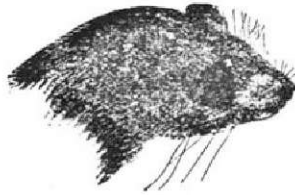


U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF BIOLOGICAL SURVEY
HENRY W. HENSHAW, *Chief*

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A SYSTEMATIC SYNOPSIS OF THE MUSKRATS

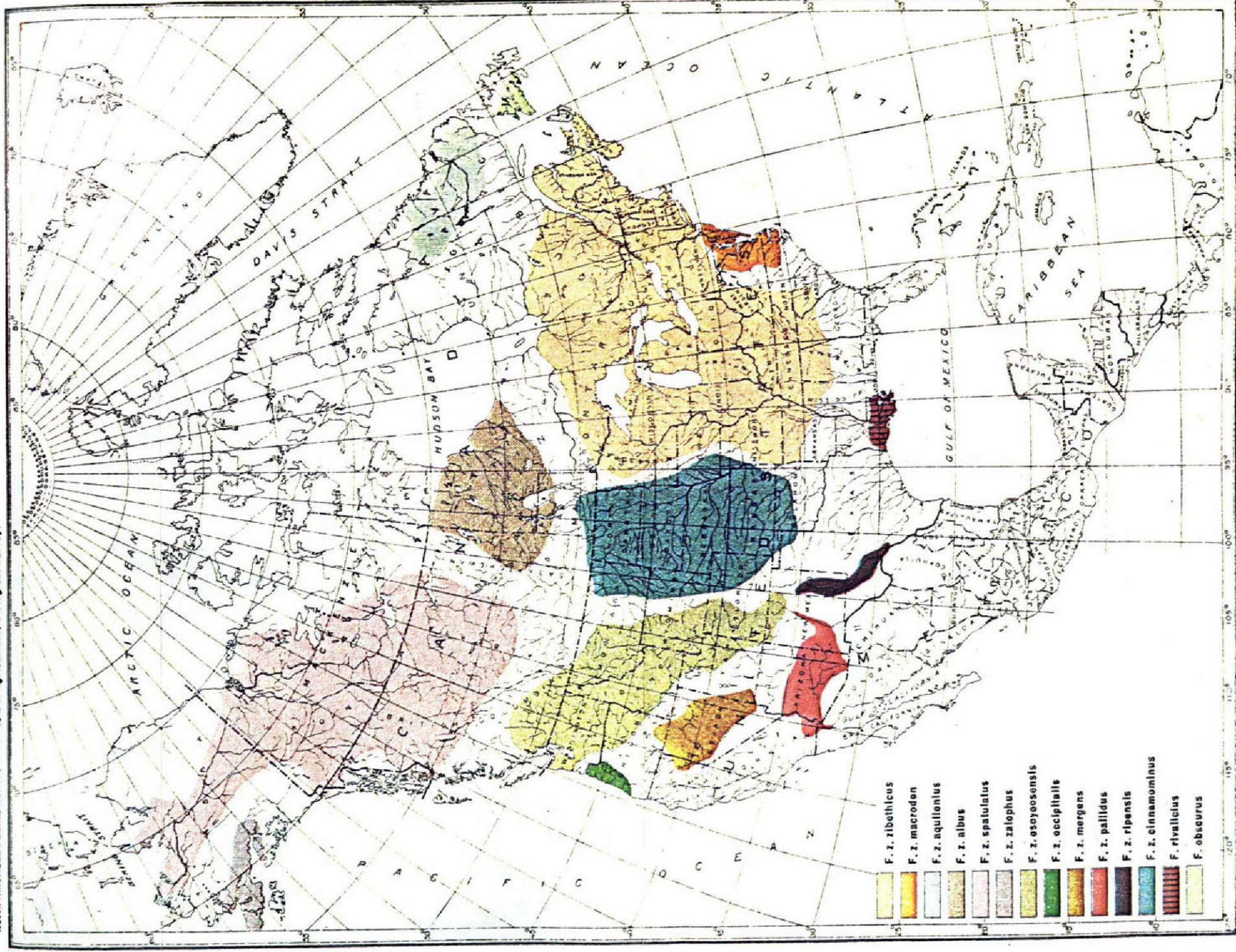
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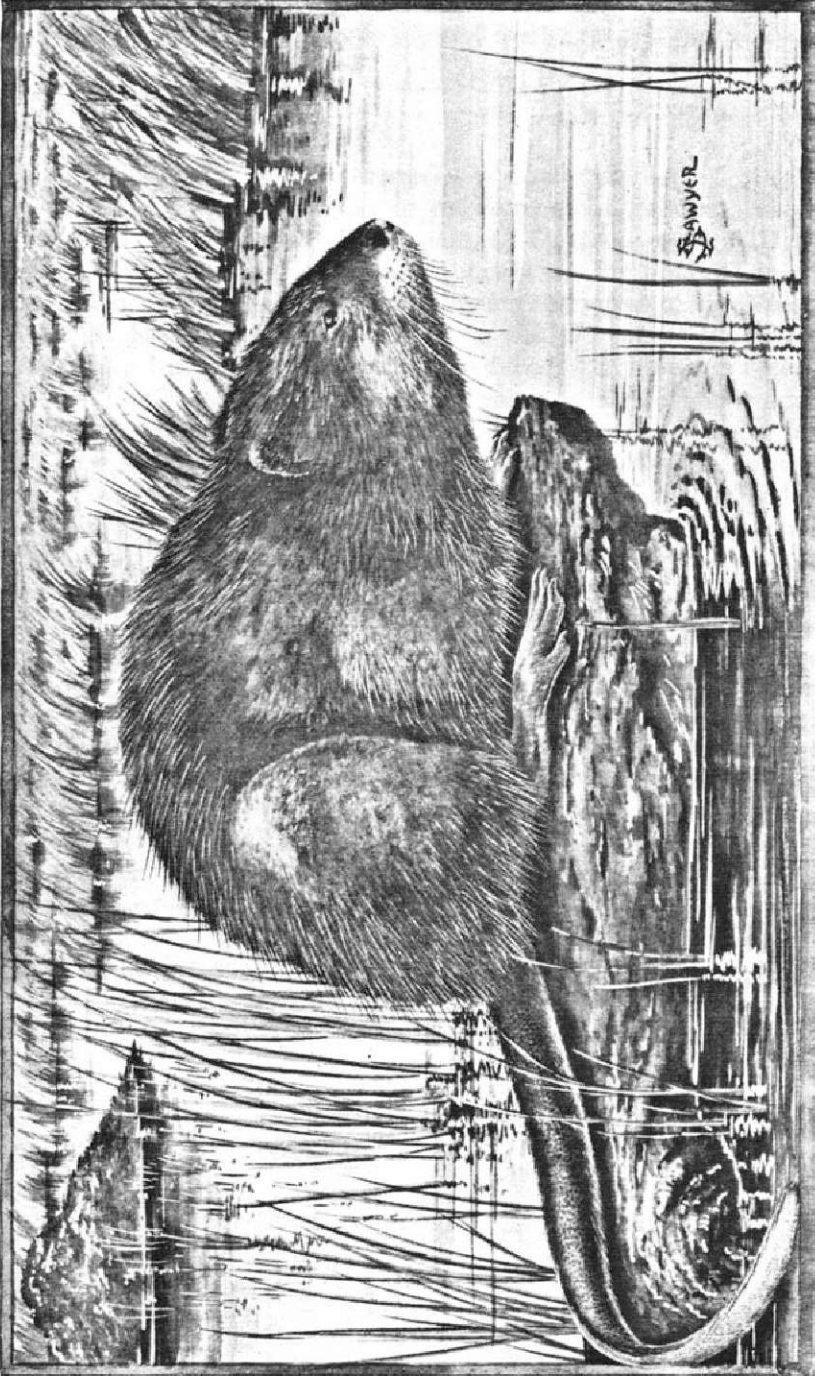
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1911





THE MUSKRAT IN ITS HAUNTS.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., January 27, 1911.

SIR: I have the honor to transmit herewith, for publication as North American Fauna No. 32, a Systematic Synopsis of the Muskrats, by N. Hollister, formerly Expert in the Bureau of Biological Survey. Our fur bearers have been so reduced in numbers in recent years that the muskrat has become of great economic importance because of the utility of its fur. In addition its flesh is valuable for food. The animals are likely to be still more important in future, especially as it has been found practicable to raise them on flooded marsh land of no agricultural value. In such areas muskrats may be protected and the supply maintained indefinitely. In other places they cause serious breaks by burrowing in embankments, and the damage done in this way is far in excess of their value as fur bearers. Because of its economic relations the muskrat has been the subject of numerous legislative enactments. The animal is widely distributed over North America, where there are several species and numerous subspecies, the interrelations and ranges of which have hitherto not been well understood. The present report is therefore timely and important, as the ranges of the several forms have been worked out and mapped and the whole subject brought up to date.

Respectfully,

HENRY W. HENSHAW,
Chief, Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

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A SYSTEMATIC SYNOPSIS OF THE MUSKRATS.

By N. HOLLISTER.

INTRODUCTION.

HISTORY.

The conspicuous North American animals which have no representatives in the Old World, including the skunk, opossum, muskrat, hummingbird, turkey, and others, early attracted the attention of explorers and accounts of them were soon taken to Europe. The first published description of the muskrat appears in Captain John Smith's Description of Virginia, 1612.¹ Smith writes: "*Mussascus* is a beast of the forme and nature of our water *Rats*, but many of them smell exceeding strong of muske." Under the name of *mussascus*, *musquash*, or *ondatra* there are numerous references to the animal in the literature of the period succeeding Smith's work. Linnæus, however, at first confounded the American muskrat with his *Castor moschatus* (= *Desmana moschata*) of Asia, and it was not until 1766 that he gave it an independent place in his *Systema Naturæ*, placing it in the same genus with the beaver and naming it *Castor zibethicus*. The specific name *zibethicus* has been used for the form from eastern Canada and the northern United States by most systematists to the present day. Tiedemann, in 1808, renamed it *Ondatra americana*,² and Oken, 1816, used the same specific name. The Linnæan specific name has, however, been associated between 1788 and 1840 with no less than eight generic names.

From time to time various mammalogists have described forms of muskrats from many parts of North America, giving them specific or subspecific rank as the limited material before them seemed to justify. Seventeen names have been thus proposed, and with the idea

¹ A Map of Virginia. With a Description of the Countrey, the Commodities, People, Government, and Religion. Written by Captaine Smith, sometimes Governour of the Countrey, p. 14, 1612.

² Zoologie, I, 481, 1808. .

of determining their respective validity and importance and of mapping the ranges of the recognizable forms, a study of the large collection of skins and skulls of muskrats in the United States National Museum was undertaken.

Sabine, in the Zoological Appendix to Franklin's Narrative, in 1823, describes a light-colored specimen from Cumberland House, Saskatchewan, as *Fiber zibethicus albus*; and Richardson, in the Fauna Boreali-Americana, in 1829, has three varieties, B, C, and D, also based upon abnormally colored examples, which he designates as *nigra*, *maculosa*, and *alba*. The names *nigra* and *maculosa* of Richardson are easily disposed of as synonyms of *Fiber zibethicus* or *Fiber z. albus*, but Sabine's *albus* itself, with a perfect diagnosis and definite type locality, must unfortunately, according to present rules of nomenclature, be used for the recognizable geographic race found in that region. In 1863, Lord, in the Proceedings of the Zoological Society of London, described a species of muskrat from southern British Columbia as *Fiber osoyoosensis*, but this form seems to have been lightly considered and his name usually placed in synonymy.

The genus was generally considered monotypic up to 1890, when Mearns described a form from Camp Verde, Arizona, as *Fiber zibethicus pallidus*.¹ During the next thirteen years eight new muskrats were named. Bangs described *Fiber obscurus* from Newfoundland in 1894² and *Fiber z. rivalicius* from Louisiana the following year.³ Merriam described *Fiber macrodon* from the Dismal Swamp of Virginia in 1897.⁴ Bangs, in 1899, proposed the name *aquilonius* for the Labrador muskrat,⁵ and Osgood, in 1900, named the animal from northwest America *Fiber spatulatus*.⁶ In 1902 Bailey described a new muskrat from the Pecos River, *Fiber z. ripensis*,⁷ and Preble proposed the name *hudsonius* for the Keewatin race.⁸ The following year Elliot described *Fiber occipitalis* from the coast of Oregon.⁹ No more names were proposed for existing species until 1910, when, as a result of the systematic revision in progress by the present writer, three recognizable forms found to be still unnamed were described, *zalophus* from the Alaska Peninsula,¹⁰ *mergens* from Nevada,¹⁰ and *cinnamominus* from Kansas.¹¹

¹ Bull. Amer. Mus. Nat. Hist., II, 280, 1890.

² Proc. Biol. Soc. Wash., IX, 133, 1894.

³ Proc. Boston Soc. Nat. Hist., XXVI, 541, 1895.

⁴ Proc. Biol. Soc. Wash., XI, 143, 1897.

⁵ Proc. New England Zool. Club, I, 11, 1899.

⁶ North Amer. Fauna, No. 19, p. 36, 1900.

⁷ Proc. Biol. Soc. Wash., XV, 119, 1902.

⁸ North Amer. Fauna, No. 22, p. 53, 1902.

⁹ Publ. Field. Col. Mus., Zool. Ser., III, 162, 1903.

¹⁰ Proc. Biol. Soc. Wash., XXIII, 1, 1910.

¹¹ Proc. Biol. Soc. Wash., XXIII, 125, 1910.

DISTRIBUTION AND HABITS.

Muskrats occur over the greater part of North America from the northern limit of trees south to the Mexican border. They are not found along the lower Atlantic seaboard, nor, except in southern Louisiana, over the entire Gulf region. They are unknown also on the Pacific slope south of central Oregon.

As might be expected from the muskrat's extensive distribution, its habits vary considerably with local conditions. Over the greater part of its range it is noted as a builder of marsh houses, and these heaps of aquatic vegetation are a characteristic feature of the marsh landscape. The houses, chiefly for winter shelter, are sometimes of great size, though commonly the home of a single family. The nest chamber is in the center of the heap, above water line, with tunnels for entrance and exit running out below the surface. Not all muskrats, however, build houses. Where abrupt banks take the place of low, marshy shores, many of the animals seem to prefer holes in these banks. In this case the burrows extend from an underwater entrance through the bank to a dry nest chamber, near the surface, above high-water mark. In many places muskrat houses are unknown, all the animals living in these bank homes.

By far the greatest part of the muskrat's food is vegetable matter, and many kinds of aquatic and shore-growing plants help make up its bill of fare. It often travels a considerable distance from water at night to feed on some especially favorite food. There is good evidence that the muskrat sometimes eats animal matter, fresh-water mussels especially, and occasionally fish, dead birds, and other animals. Doctor Mearns observed a muskrat fishing in the Verde River, Arizona, and notes it "occasionally coming out upon a log to eat the fish it caught."¹ Mr. E. R. Warren, in his recently published *Mammals of Colorado*, records the following:

One [muskrat] was seen in a lake near Crested Butte chasing under water a "water dog," *Amblystoma tigrinum*, which it finally captured by making a sudden dash forward and seizing it with its teeth. The rat then came to the surface with its prey in its mouth, and not until then was it seen to be a muskrat, for while the chase was in progress the observers supposed it to be a mink.

Breeding habits doubtless vary somewhat with climatic conditions. Prof. D. E. Lantz, after calling attention to the wide variance in the published accounts of the breeding habits of the muskrat, gives his information from the best-informed trappers in Maryland. The most reliable evidence shows that in this region from 3 to 5 litters (normally 3) are produced annually, and that the number of young in a litter varies from 3 to 12, or even more, the average

¹ Bull. U. S. Nat. Mus., No. 56, p. 496, 1907.

being probably 6 or 8. The young of early spring litters are said to breed the fall of the same year. Professor Lantz further summarizes:

Normally the animals mate in March and the first litter is born in April; a second litter is due in June or early July, and a third in August or September. In favorable seasons a fourth or even a fifth litter may be produced. The period of gestation is possibly no longer than twenty-one days, as with the common rat and probably with the field mouse. The young are blind and naked when born, but develop rapidly. Outside of low marshes, muskrats are usually born in the underground burrows.¹

Where the muskrats are not able to find suitable banks for nesting burrows, the young are usually born in open nests, made for the purpose in the drier parts of the marsh home.

Actual breeding records noted on labels of female specimens are as follows: Summit, Mont., June 18, 1895, 13 large fetuses (V. Bailey); Ward, Colo., June 8, 1893, 8 fetuses (J. A. Loring); Newport, R. I., April 18, 1900, 6 small fetuses (Dr. E. A. Mearns). E. R. Warren, in *The Mammals of Colorado*, gives breeding records from that State as follows: Grand County, May 12, eight good-sized embryos; Lily, Routt County, June 1, young 2 or 3 weeks old; Barr, Adams County, May 30, very small young, not much larger than adult *Microtus modestus*; Medano Ranch, Costilla County, June 24, seven embryos, second litter.

ECONOMIC RELATIONS.

• The great and ever-increasing demand from the furrier and the consequent rise in the price of muskrat skins make the animal one of great economic importance. During the past few years especially, the price of the fur has steadily increased, until during the season of 1909-10 the choicest dark skins in prime condition netted the trapper close to \$1 each. Though this exceptionally high price may not be maintained, the proper recognition of the beauty of this fur will insure its steady favor. With the rapid extermination of the rarer fur bearers, especially those species which can not adapt themselves to the changes wrought by the settlement of the country, the muskrat will soon become the most important fur-bearing animal of North America. With proper protection it should furnish a constant supply of choice fur and add to the wealth of the country for generations to come. Its well-known adaptability to changed conditions is a strong point in its favor.

While the damage the rodent inflicts on crops is not severe, it sometimes destroys grain and vegetables for a limited distance from the water's edge. The chief complaint against it, however, is on account of the injury it does by burrowing into dams and embankments of ditches and levees. Instances of serious loss to property from this source are numerous, and in certain places unceasing war-

¹ U. S. Dept. Agr., Farmers' Bulletin No. 396, p. 15, 1910.

fare against the burrowers is necessary. In most localities, however, the animal's value as a fur bearer justifies its protection throughout the breeding season and the months when the pelage is not at its very best.

Of late years the flesh of the muskrat has been extensively sold in eastern markets, and during the open season many thousands are used as food in the larger cities. In fur farming the chances of success with the muskrat are much greater than with any of the other fur bearers, and many reserves are now paying handsome profits to owners and trappers.

CHARACTERS AND PELAGE.

All existing forms of muskrats are closely related. The majority are geographic races of one species, and blend in characters from one to another. As a rule the recognized forms are well characterized and over a considerable definite area are constant in color, size, and salient cranial characters. It is sometimes difficult to identify with a particular race specimens from intermediate areas, especially if they are immature, or of pelage not comparable with the specimens it becomes desirable to study in that connection. In most cases the material has been sufficient to settle the boundaries of subspecies with considerable accuracy, though many additional specimens will be necessary to fill in the numerous gaps in ranges, as shown by the colored map.

The pelage of the muskrat is made up of a thick underfur, the main coat, and long overlying darker hairs, which come in slowly as the season advances. The great number of specimens examined from all parts of the range show that all but one form have only one molt, and this occurs during the warm summer months. *Fiber rivalicicus*, of the coast region of Louisiana, apparently molts twice a year, approximately spring and fall.

Aside from conspicuous cases of dichromatism, the color of all specimens in comparable pelage from any given locality is remarkably uniform. The great variation frequently noticed in a large series from one region is due mainly to age and season and the degree to which the black overlying hairs have appeared. Sexual variation is so absolutely wanting that it was found useless to distinguish between the sexes in tables of skin or cranial measurements. Skulls in a large series from any particular water are remarkably alike in shape and size, but a slight variation between series from near-by localities is frequently noted. In the discrimination of forms I have endeavored to confine the named subspecies to what appear well-characterized geographic races, that combine the essential characters of all the individuals over a definite area and differ from the individuals of all other recognized subspecies in some general and common characters. Long and painstaking study of large series of

skulls is necessary to distinguish subspecific characters of real value from minor local variations.

Since no two forms occur in the same locality and the characters separating the geographic races are frequently relative, it is obvious that an artificial key to the subspecies is of little value in identifying specimens. As such a key has important uses, however, as a means of ready reference to characters, and in other ways, the following is presented:

KEY TO ADULT MUSKRATS IN FRESH PELAGE.

Size large; hind foot averaging over 80 mm.

Coloration darker; blackish or blackish brown.

Skull with high, sharp interorbital ridge; nasals broadly spatulate anteriorly (Puget Sound region and Rocky Mts.)..... *osoyoosensis* (p. 24).

Skull without specially developed interorbital ridge.

Largest in the genus; tooth row averaging over 17 mm.; coloration blackish (Atlantic coast, Delaware Bay to N. C.). Black phase of..... *macrodon* (p. 18).

Size less; tooth row averaging under 17 mm.; coloration dark brown (S. E. Canada and N. E. United States)..... *zibethicus* (p. 16).

Coloration lighter; reddish brown or grayish brown.

Interpterygoid fossa narrow, with borders nearly parallel (western Oregon)..... *occipitalis* (p. 26).

Interpterygoid fossa much widened posteriorly.

Upperparts grayish brown, with darker dorsal area (Great Basin region).
mergens (p. 27).

Upperparts bright reddish brown; size very large (Atlantic coast, Delaware Bay to N. C.). Normal phase of..... *macrodon* (p. 18).

Size small; hind foot averaging less than 80 mm.

Coloration dark; black or blackish brown.

Skull with high, sharp interorbital ridge.

Zygomata broadly spreading anteriorly (Alaska and N. W. British America)..... *spatulatus* (p. 22).

Zygomata not broadly spreading anteriorly.

Hind foot averaging 75 mm.; colors darker with more rusty tinge (Keewatin and eastern Saskatchewan)..... *albus* (p. 20).

Hind foot averaging less than 70 mm.; colors lighter with little rusty tinge (Alaska Peninsula)..... *zalophus* (p. 23).

Skull without distinct interorbital ridge.

Coloration glossy blackish.

Tail long (averaging over 260 mm.); skull large (Labrador and Ungava)..... *aquilonius* (p. 19).

Tail short (averaging less than 230 mm.); skull small and weak (Newfoundland)..... *obscurus* (p. 15).

Coloration dull blackish brown; underparts dark (coast region of Louisiana)..... *rivalicicus* (p. 31).

Coloration pale; reddish or pale brown.

Larger (tail averaging 240 mm.; hind foot over 73 mm.) (Great Plains region),
cinnamominus (p. 30).

Smaller (tail averaging less than 205 mm.); hind foot less than 70 mm.
Upperparts cinnamon rufous (Colorado River east to the Rio Grande in New Mexico)..... *pallidus* (p. 28).

Upperparts Vandyke brown (Pecos Valley, Texas and New Mexico),
ripensis (p. 29).

FOSSIL MUSKRATS.

Fossil remains of muskrats have been found in Pleistocene deposits in various parts of the United States. As might be expected, these bones, chiefly fragments of skulls and jaws, indicate species identical with existing forms or closely related to them. Three species known only as fossils are recognizable, two of which are remarkable for their very small size, considerably less than that of any species now living; about the size of *Neofiber alleni*. Through the kindness of Mr. J. W. Gidley, of the United States National Museum, and Dr. W. D. Matthew, of the American Museum of Natural History, I have been able to study these fossil muskrats in connection with the living species. One species, *Fiber annectens*, from the Middle Pleistocene of the Ozark Mountains, has already been described by Mr. Barnum Brown,¹ and in this paper two species, from the Lower Pleistocene of Nebraska and Oregon, are named.

MATERIAL AND ACKNOWLEDGMENTS.

In the preparation of the following systematic account of the genus *Fiber*, over 1,000 specimens have been studied. These were chiefly well-prepared skins, accompanied by skulls, together with many odd skulls and skeletons. The type specimens, or virtual topotypes, of all described forms have been examined. The range of the animal has been well covered and, on the whole, the material has been sufficient to work out satisfactorily the characters and ranges of the forms.

While the conclusions herein presented are based largely upon a study of the specimens in the United States National Museum (the collection of the Biological Survey alone contains over 500 specimens), I have been greatly aided by the use of various other collections. For the loan of material and for greatly appreciated assistance in other ways, it is a pleasure to acknowledge my indebtedness to Dr. C. Hart Merriam, to whose private collection I have had free access; to Mr. Charles B. Cory and Mr. W. H. Osgood, Field Museum of Natural History; to Dr. Joseph Grinnell and Mr. H. S. Swarth, Museum of Vertebrate Zoology, University of California; to Mr. Outram Bangs and Dr. Glover M. Allen, Museum of Comparative Zoology; to Dr. W. D. Matthew, American Museum of Natural History; to Mr. Gerrit S. Miller, jr., and Mr. J. W. Gidley, United States National Museum; and others, particularly various members of the Biological Survey.

¹ Mem. Amer. Mus. Nat. Hist., IX, pt. 4, p. 197, 1908.

Genus FIBER Cuvier.

Ondatra Lacépède, Tabl. Mamm., p. 9, 1799. Not *Ondatra* Link, 1795.

Fiber Cuvier, Leçons d'Anat. Comp., I, tabl. I, 1800.

Mussascus Oken, Lehrbuch Naturgesch., 3 ter Theil, 2 te Abth., p. 886, 1816.

Simotes Fischer, Mem. Soc. Imp. Nat. Moscow, V, 444, 1817.

Moschomys Billberg, Syn. Faun. Scandinaviæ, ed. 1, I, Mamm., Conspectus A, 1827.

Type species.—*Castor zibethicus* Linnæus.

Geographic distribution.—Hudsonian, Canadian, Transition, and Austral Zones of North America, from the northern limit of trees south to the Mexican border of the United States; excepting the southern Atlantic seaboard, most of the Gulf States, and the Pacific coast south of middle Oregon.

General characters.—Form robust; legs short, feet large, both modified for swimming; feet and toes fringed by short, stiff hairs, and toes of hind feet partly webbed; tail long, compressed laterally, covered by small scales, and thinly haired. External ear small, scarcely extending beyond fur. Fur dense and waterproof; pelage supplemented by longer glossy overlying hairs. Strongly developed perineal glands secreting a powerful musk; mammæ six; plantar tubercles five.

Skull and teeth.—Skull resembling that of *Microtus* and other related genera, but comparatively large and massive; angular, with heavy zygomata and long rostrum; posterior border of palate not bridged, but with small median spine projecting into the interpterygoid fossa. Audital bullæ large. Upper incisors without grooves; lower incisor passes under $\overline{m2}$ and outside of $\overline{m3}$ with extremity of root at base of condylar process. All molars rooted; $\overline{m1}$ with anterior loop and four closed triangles; $\overline{m2}$ with anterior loop and three closed triangles; $\overline{m3}$ with anterior and posterior loops and two or three closed triangles; $\overline{m1}$ normally with large anterior loop deeply cut by two reentrant angles, five closed triangles, and posterior loop; $\overline{m2}$ with four closed triangles and posterior loop; $\overline{m3}$ with three or four closed triangles and posterior loop.

List of Species and Subspecies, with Type Localities.

EXISTING SPECIES.

<i>Fiber obscurus</i> Bangs.....	Codroy, Newfoundland.
<i>zibethicus</i> (Linnæus).....	Eastern Canada.
<i>zibethicus macrodon</i> Merriam.....	Dismal Swamp, Virginia.
<i>zibethicus aquilonius</i> Bangs.....	Rigoulette, Labrador.
<i>zibethicus albus</i> Sabine.....	Cumberland House, Saskatchewan.
<i>zibethicus spatulatus</i> Osgood.....	Lake Marsh, Yukon.
<i>zibethicus zalophus</i> Hollister.....	Becharof Lake, Alaska.
<i>zibethicus osoyoosensis</i> Lord.....	Lake Osoyoos, British Columbia.
<i>zibethicus occipitalis</i> Elliot.....	Florence, Oreg.
<i>zibethicus mergens</i> Hollister.....	Fallon, Nev.

<i>Fiber zibethicus pallidus</i> Mearns.....	Old Fort Verde, Ariz.
<i>zibethicus ripensis</i> Bailey.....	Carlsbad, N. Mex.
<i>zibethicus cinnamominus</i> Hollister.....	Wakeeney, Kans.
<i>rivalicicus</i> Bangs.....	Burbridge, La.

FOSSIL SPECIES.

<i>Fiber nebracensis</i> nobis....	Lower Pleistocene, Niobrara River, Sheridan County, Nebr.
<i>oregonus</i> nobis.....	Lower Pleistocene, Fossil Lake, Oreg.
<i>annectens</i> Brown.....	Middle Pleistocene, Newton County, Ark.

EXISTING SPECIES.

FIBER OBSCURUS BANGS.

NEWFOUNDLAND MUSKRAT.

Fiber obscurus Bangs, Proc. Biol. Soc. Wash., IX, 133, September 15, 1894.

Type locality.—Codroy, Newfoundland.

Geographic distribution.—Newfoundland.

General characters.—Size small; hind foot proportionally large; color very dark; skull small and weak; parietals large.

Color.—*Fresh pelage*: Upperparts dark mummy brown, varying to almost black, darkened on back by brownish black overlying hairs; sides chestnut; underparts chestnut, brighter than in *F. zibethicus*; small spot on chin blackish brown; underfur slate gray; lips pale straw yellow or white; nasal pad and tail black; feet brown; nails yellow to brown. *Worn pelage*: Upperparts paler, without overlying black hairs; sides lacking the brightness of the winter pelage. *Young*: Above uniform dusky; below paler.

Skull and teeth.—Skull very small, weak, and smooth; interorbital constriction relatively broad; parietals large; nasals narrow; teeth small.

Measurements.—Average of seven adults from Codroy and Bay St. George, Newfoundland: Total length, 500;¹ tail vertebræ, 226; hind foot, 76.

Skull.—Average of 11 specimens from Codroy and Bay St. George, Newfoundland: Basal length, 53.2; zygomatic breadth, 34.7; palatal length, 34; length of nasals, 19.8; breadth of nasals, 7.4; alveolar length of upper molar series, 14.2.

Type specimen.—No. 1155, Museum of Comparative Zoology (Bangs collection). Skin and skull, ♀. Collected by Ernest Doane, May 14, 1894.

Remarks.—Though some winter specimens of *Fiber zibethicus* are as black as some skins of *obscurus*, the color of the Newfoundland animal averages darker at all seasons. It is apparently a well-established species.

Specimens examined.—Total number 17, from localities as follows:

Newfoundland: Balena, 1; Bay St. George, 12; Codroy, 3; Newfoundland, 1.

¹ All measurements are given in millimeters.

FIBER ZIBETHICUS ZIBETHICUS (LINNÆUS).

COMMON MUSKRAT.

Castor zibethicus Linnæus, Syst. Nat., ed. 12, I, 79, 1766.

Castor zibethus Severinus, Tent. Zool. Hung., p. 107, 1779.

Mus zibethicus Gmelin, Syst. Nat., I, 125, 1788.

Myocastor zibethicus Kerr, Anim. Kingd. syst. cat., bet. pp. 32 and 33, 1792.

Mus Myocastor zibethicus Kerr, Anim. Kingd., p. 225, 1792.

Ondatra zibethicus Link, Beytr. Nat., I, pt. 2, p. 76, 1795.

Ondatra americana Tiedemann, Zoologie, I, 481, 1808.

[*Fiber*] *zibethicus* Illiger, Prodr. Syst. Mamm., p. 88, 1811.

[*Mussascus*] *americana* Oken, Lehrb. Nat., 3 ter Theil., 2 te Abth., p. 886, 1816.

[*Simotes*] *zibethicus* Fischer, Mem. Soc. Imp. Nat. Moscou, V, 444, 1817.

Mus (Fiber) zibeticus Cuvier, Règne Anim., I, 192, 1817.

Fiber zibethicus, var B, *nigra* Richardson, Fauna Boreali-Amer., I, 119, 1829 (no definite locality).

Fiber zibethicus, var C, *maculosa* Richardson, Fauna Boreali-Amer., I, 119, 1829 (no definite locality).

Lemmus zibethicus Fischer, Synops. Mamm., p. 289, 1829.

Fiber zibethicus varius Fitzinger, Sitz.-Ber. Kais. Akad. Wiss., LVI, 103, 1867 (new name for *F. z. maculosa* Richardson).

Fiber zibethicus niger Fitzinger, Sitz.-Ber. Kais. Akad. Wiss., LVI, 103, 1867 (new name for *F. z. nigra* Richardson).

Type locality.—Eastern Canada; specimens from New Brunswick assumed to be typical.

Geographic distribution.—Southeastern Canada, northeastern and east central United States; from New Brunswick and Quebec west to Minnesota, and south to northern Georgia and Arkansas, except along the Atlantic seaboard south of Delaware Bay.

General characters.—Size large; tail long; color dark; skull large, with zygomata not broadly spreading anteriorly; molars of medium size.

Color.—*Fresh pelage*: Upperparts mummy brown, darkest on head; back glossy; sides chestnut to hazel. The darker color on back is due to the blackish overlying hairs, the color of the fur being much like that of sides. Underparts like sides but paler, approaching tawny, shading to whitish on throat and belly; a small spot on chin and hair of wrist and heel blackish; lips straw yellow; underfur light slate gray; nasal pad and tail black; feet dark brown; nails pale straw to brown. *Worn pelage*: Paler and duller throughout; upperparts and sides uniform grayish brown, or with a faded reddish mixture; back and head with little or no black. *Black phase*: Upperparts uniformly black; cheeks and long hair at base of tail chestnut; underparts dark. *Young*: Back uniform dusky; sides and belly paler; cheeks rusty.

Skull and teeth.—Skull large; zygomata not broadly spreading anteriorly; interorbital ridge not especially developed, except in extreme old age; parietals large; audital bullæ rounded; molars of medium size.

Measurements.—Average of 7 adults from Lake George and Peterboro, N. Y.: Total length, 563; tail vertebræ, 254; hind foot, 81. *Skull.*—Average of 10 adults from New Brunswick: Basal length, 60.4; zygomatic breadth, 38.8; palatal length, 38; length of nasals, 21.2; breadth of nasals, 9.1; alveolar length of upper molar series, 16.3.

Remarks.—This form, the common muskrat of the Northern and Middle States, is a dark-colored animal; much darker than *F. z. macrodon* in ordinary color phase, and only slightly lighter than *obscurus* from Newfoundland. Specimens from the coast region of Massachusetts and Rhode Island average especially black in full winter pelage. Specimens from Conanicut Island, Rhode Island, have long tails, but occasional specimens from some mainland localities match them in this character, and the very slight insular variety perhaps developing here is hardly worthy of recognition by name. Prince Edward Island specimens show no approach toward *obscurus* and are apparently typical of *zibethicus*. Specimens from Middle and Southern States average less black than New England specimens, approaching some of the less pronounced examples of normally colored *macrodon*, and have more red than most specimens from the Northeast. I have as yet, however, failed to find a single specimen from any inland southern or western locality, east of the Great Plains, that can not be matched by some strictly comparable specimen or specimens in the large series of true *zibethicus* from northeastern United States. Specimens from the lower Hudson Valley and Long Island show a decided approach toward *macrodon*, and these two forms probably blend throughout New Jersey and Delaware. Specimens from upper Delaware Bay have been referred to *macrodon*, though the discrimination at this point is difficult, and the animals could be placed with either form without much violence.

The black phase appears to be of rare occurrence in typical *zibethicus*. I have seen it only from Lake George, New York, and Conanicut Island, Rhode Island. Several albinos and partial albinos have been examined.

Remains of *Fiber zibethicus* are recorded by Leidy¹ and Holmes² from Pleistocene deposits of New Jersey, Pennsylvania, and South Carolina.

Specimens examined.—Total number 468, from localities as follows:

- Prince Edward Island: Mount Stewart, 2.
- New Brunswick: "New Brunswick," 14.
- Quebec: Lake St. John, 1; Ottawa River, 1.
- Maine: Naskeag, 1.

¹ Synops. Extinct Mamm. N. Amer., p. 407, 1869; Ann. Report Geol. Survey Pennsylvania for 1887, pp. 5 and 19, 1889.

² Proc. Amer. Ass. Adv. Science, Third meeting, pp. 201-204, 1850.

- New Hampshire:** Charlestown, 2.
Massachusetts: Belmont, 16; Middleboro, 2; Wilmington, 7; Woburn, 2.
Connecticut: East Hartford, 2.
Rhode Island: Conanicut Island, 25; Fort Adams, 1; Newport, 14.
New York: Adirondacks, 2; Essex County, 68;¹ Fort Totten, 5; Hastings, 1; Highland Falls, 5; Lake George, 14; Locust Grove, 1; Montauk Point, 1; Peterboro, 3; Piseco, 2; Saranac Lake, 1; Schroon Lake, 2; Severance, 22;¹ Sing Sing, 3; Trousers Lake, 2; Troy, 1.
Pennsylvania: Allegheny County, 3; Carlisle, 6; Conestoga Creek, 1; Sayre, 1.
Michigan: Ann Arbor, 1; Isle Royale, 2; New Richmond, 1; Taquahmenaw River, 1.
Wisconsin: Beaver Dam, 2; Conover, 1; Crab Lake, 1; Delavan, 14; Eagle River, 4; Green Bay, 2; Lake Koshkonong, 1.
Minnesota: Elk River, 150;² Fort Snelling, 5.
Iowa: Burlington, 1.
Illinois: Chicago, 1; Fox Lake, 7; Libertyville, 1; Olive Branch, 7.
Indiana: Effner, 3; Hebron, 2; La Porte, 1; Wheatland, 5.
Kentucky: Eubanks, 1.
Tennessee: Highcliff, 5; Roan Mountain Station, 1; Watauga Valley, 1.
West Virginia: White Sulphur Springs, 4.
North Carolina: Magnetic City, 1.
South Carolina: Greenville, 1.
Georgia: "Georgia," 1; Hogansville, 1.
Alabama: Reform, 1.
Arkansas: Mammoth Spring, 4.

FIBER ZIBETHICUS MACRODON MERRIAM.

VIRGINIA MUSKRAT.

Fiber macrodon Merriam, Proc. Biol. Soc. Wash., XI, 143, 1897.

Fiber zibethicus macrodon Stone and Cram, Amer. Anim., 126, 1902.

Type locality.—Lake Drummond, Dismal Swamp, Virginia.

Geographic distribution.—Middle Atlantic coast region of the United States, from Delaware Bay to Pamlico Sound; inland to Washington, Virginia, and Raleigh, N. C.

General characters.—Size largest in the genus; colors rich and bright; normal pelage with much red in fresh and worn state (there is a large proportion of specimens in the black phase from some localities). Skull large and massive; teeth large.

Color.—*Fresh pelage:* Like *zibethicus*, but lighter and brighter, with less black. Upperparts Prout's brown, darker on nose, head, and back; sides varying from grayish brown to russet; underparts from broccoli brown or drab to bright cinnamon rufous. Specimens in perfectly fresh pelage have very little of the bright russet tinge which appears in specimens taken later in the winter and spring, the hairs of this color coming in as the season advances. Spring specimens, before the summer molt has commenced, are often especially bright and rich colored above and below. *Worn pelage:* Upperparts dull russet; underparts pale cinnamon rufous. *Young:* Like young

¹ Skulls.

² 122 odd skulls.

of *zibethicus*. *Black phase*: Entire upperparts, sides, and middle area of underparts uniform brownish black; flanks with a few hairs of rusty brown; cheeks rusty; throat and ventral region whitish, drab, or Isabella color; usual small spot on chin black. Between this phase and the normal color before described is every degree of variance. Some specimens have the back black and the belly gray or rusty, some have the belly dark and upperparts nearly normal or partly melanistic, while a few are of an intermediate slate color.

Skull and teeth.—Skull large, with heavy rostrum, posteriorly elongated brain case, and elevated frontal; jugal massive, high, and rounded above; molar teeth large.

Measurements.—Average of four adults from the Dismal Swamp, Virginia: Total length, 620; tail vertebræ, 274; hind foot, 88.

Skull.—Average of four adults from Dismal Swamp: Basal length, 65.1; zygomatic breadth, 41.7; palatal length, 41; length of nasals, 22.9; breadth of nasals, 9.9; alveolar length of upper molar series, 17.7.

Type specimen.—No. 75940, United States National Museum, Biological Survey Collection. ♀ adult, skin (black phase) and skull. Collected by Dr. A. K. Fisher, October 9, 1895.

Remarks.—The most remarkable thing about this form is the large per cent from certain localities of specimens in the black phase. In some marshes on the eastern shore of Maryland over half of the muskrats are black. From no locality, however, from which more than two specimens are at hand, is the normal phase unknown. Specimens from interior localities in Maryland, though retaining the color of *macrodon*, have skulls closely approaching in character those of *zibethicus* from farther north. No specimens from New Jersey have been examined, but it seems probable that they will prove somewhat intermediate between the two subspecies.

Specimens examined.—Total number 83, from localities as follows:

Pennsylvania: Chester County, 2.

Maryland: Branchville, 1; Broadwater, 1; Cambridge, 1; Forest Glen, 1; Jefferson, 1; Kensington, 1; Laurel, 10.

District of Columbia: Washington, 11.

Virginia: Arlington, 1; Dunn Loring, 4; Fredericksburg, 1; Lake Drummond, Dismal Swamp, 5; Pope Creek, 5; Quantico, 5; Suffolk, 6; Wallaceton, Dismal Swamp, 2; Warwick, 8; Washington, 6.

North Carolina: Currituck, 2; Poplar Branch, 2; Raleigh, 7.

FIBER ZIBETHICUS AQUILONIUS BANGS.

LABRADOR MUSKRAT.

Fiber zibethicus aquilonius Bangs, Proc. New England Zool. Club., I, 11, February 28, 1899.

Type locality.—Rigoulette, Hamilton Inlet, Labrador.

Geographic distribution.—Labrador and Ungava.

General characters.—Like *zibethicus*, but slightly smaller, with hind foot actually and relatively smaller, color averaging more blackish in summer.

Color.—*Fresh pelage:* Almost exactly like *Fiber z. zibethicus*, but slightly brighter and richer colored, especially on sides and underparts. *Worn pelage:* Averaging darker, with more black, than the corresponding pelage of *F. z. zibethicus*; underparts averaging more heavily colored, the overlying hairs of a darker shade.

Skull and teeth.—Skull almost precisely like that of *F. z. zibethicus*, but averaging a little lighter, with slightly lighter rostrum and very slightly smaller teeth.

Measurements.—Average of four specimens from Hamilton Inlet and Lance au Loup, Labrador: Total length, 551; tail vertebræ, 262; hind foot, 74. *Skulls.*—Basal length, 60.3; zygomatic breadth, 40.1; palatal length, 37.5; length of nasals, 22.3; breadth of nasals, 9.2; alveolar length of upper molar series, 15.3.

Type specimen.—No. 3957, Museum of Comparative Zoology (Bangs Collection). Skin and skull, immature ♂. Collected by C. H. Goldthwaite, August 15, 1895.

Remarks.—The series of specimens representing this form is far from satisfactory. In the available series of 16 skins and skulls there is only 1 good adult specimen,¹ and 3 or 4 more which may be called subadult. These specimens, together with the remaining series of young, indicate a slight form which seems to show enough average difference from *zibethicus* to merit recognition. It approaches the Hudson Bay form slightly but is much blacker and the skull is more like that of *zibethicus*. In no important character does it seem to resemble the very different *F. obscurus* from Newfoundland. A large series of adult skulls and more skins in full winter pelage are much needed, and until these are available the validity of the form can not be considered as satisfactorily established.

Specimens examined.—Total number 16, from localities as follows:

Labrador: Black Bay, 1; Hamilton Inlet, 1; Lance au Loup, 10.

Ungava: Forks, 2; Fort Chimo, 2.

FIBER ZIBETHICUS ALBUS SABINE.

HUDSON BAY MUSKRAT.

Fiber zibethicus—albus Sabine, Zool. App. Franklin's Narr., p. 660, 1823.

Fiber zibethicus, var. D, *alba*, Richardson, Fauna Boreali-Amer., I, 119, 1829.

Fiber zibethicus hudsonius Preble, North Amer. Fauna, No. 22, p. 53, October 31, 1902. Fort Churchill, Keewatin.

Type locality.—Cumberland House, Saskatchewan.

Geographic distribution.—Waters draining into Hudson Bay from the west, in eastern Saskatchewan and Keewatin; north to the Barren Grounds.

¹ Museum of Comparative Zoology (Bangs Collection), No. 8947.

General characters.—Like *Fiber z. zibethicus*, but smaller, with shorter tail and smaller hind foot; faded summer pelage with much more rusty; skull with zygomata as in *zibethicus*, interorbital ridge and teeth as in *spatulatus*.

Color.—*Fresh pelage:* Upperparts like *zibethicus* but paler; back and sides uniform Vandyke brown to Prout's brown; muzzle darker; sides russet; underparts like sides but paler, shading to whitish on throat and belly; small spot on chin and hair of wrist and heel brown; lips pale straw yellow; feet grayish brown; tail blackish. *Worn pelage:* Like *zibethicus*, but with more red; sides lighter. *Young:* Like corresponding age of *zibethicus*.

Skull and teeth.—Skull averaging smaller than in *Fiber z. zibethicus*; interorbital crest higher; molars small. Differs from skull of *spatulatus* in the shape of the zygomata, which are not so squarely spreading anteriorly; bullæ more inflated; nasals narrower.

Measurements.—Average of eight adults from Keewatin: Total length, 541; tail vertebræ, 239; hind foot, 75. *Skull.*—Average of five adults from Fort Churchill and Echimamish River, Keewatin: Basal length, 58.8; zygomatic breadth, 38.1; palatal length, 37.1; length of nasals, 21; breadth of nasals, 9.1; alveolar length of upper molar series, 15.3.

Type specimen.—The original specimen of *albus*, collected at Cumberland House by a Mr. Holmes, was taken to Europe by Franklin's First Expedition, and was described by Sabine. Mr. Gerrit S. Miller, jr., has searched the records at the British Museum and informs me that no such specimen is catalogued in that institution. The "type" of this form is probably not in existence.

Remarks.—This is a slight form, but one apparently worthy of recognition. To a certain degree it combines the characters of true *zibethicus* with those of *spatulatus*, but it occupies a definite area of some extent and is not exactly an intermediate in the ordinary sense of the term. To the northwest the intergradation with *spatulatus* is very clear, and specimens from the Athabaska and the Mackenzie regions, though unquestionably referable to *spatulatus*, are certainly intermediate. Specimens from near The Pas, Saskatchewan River, virtually topotypes, have been recently received at the Biological Survey, through the efforts of Mr. E. A. Preble and Mr. R. MacFarlane, and the question as to what form occurs at Sabine's type locality is thus definitely settled. Sabine's description, based upon an abnormal specimen, agrees with this form in everything except color, and his name unfortunately must be used.

Specimens examined.—Total number 14, from localities as follows:

Keewatin: Echimamish River, 5; Fort Churchill, 1; Hairy Lake, 1; Nelson River 1; Robinson Portage, 1; The Pas, 2; York Factory, 3.

FIBER ZIBETHICUS SPATULATUS Osgood.

NORTHWESTERN MUSKRAT.

Fiber spatulatus Osgood, North Amer. Fauna, No. 19, p. 36, 1900.

Fiber zibethicus spatulatus Preble, North Amer. Fauna, No. 27, p. 191, 1908.

Type locality.—Lake Marsh, Yukon.

Geographic distribution.—Northwestern North America, from the Kowak River and Yukon Valley, Alaska, east to the Anderson River and south into British Columbia and Alberta.

General characters.—Size small; hind foot small; color dark, with minimum amount of rusty. Skull angular, zygomata broadly spreading anteriorly; interorbital crest high; parietals small; nasals broad; molars small.

Color.—*Fresh pelage*: Upperparts glossy mummy brown; nose and hips blackish; sides russet; underparts dull whitish with a cinnamon wash; lips, throat, and belly whitish; small spot on chin brown; feet grayish brown; tail black. *Worn pelage*: Varying from dingy yellowish brown to dark grayish brown; underparts with less coloring from overlying hairs than in the fresher coat. *Young*: Dull grayish brown, lighter than in corresponding age of *zibethicus* or *albus*; underparts grayish white.

Skull and teeth.—Skull angular; zygomata broadly spreading anteriorly; interorbital ridge developed to a high, sharp crest, even in comparatively young individuals; bullæ small and flattened diagonally; jugals small, not rising high above plane of the zygomatic arch; parietals small; nasals broad at curve and constricted posteriorly; molars small.

Measurements.—Average of four adults from northern British Columbia and Alberta: Total length, 530; tail vertebræ, 232; hind foot, 74.5. *Skull*.—Average of five adults from type region: Basal length, 58.2; zygomatic breadth, 38.4; palatal length, 37; length of nasals, 20.4; breadth of nasals, 10; alveolar length of upper molar series, 14.7.

Type specimen.—No. 98567, United States National Museum, Biological Survey Collection. Skin and skull, ♀. Collected by Wilfred H. Osgood, July 3, 1899.

Remarks.—The northwestern muskrat is a well-defined subspecies occupying a large area, over the greater part of which it remains remarkably constant in characters. Specimens from the entire Yukon Valley and northwestern Alaska, Yukon, northern British Columbia, and Alberta are typical, but those from the northeastern parts of its range, from the mouth of the Mackenzie River along the northern tree limit, are obviously approaching the Hudson Bay form.

Specimens from the north of Great Bear Lake and from the Lower Mackenzie Valley have slightly larger teeth and less broadly spreading

zygomata. There is also a marked tendency toward the Hudson Bay form in the increase of the rusty, throughout the pelage, in all the most eastern specimens. Five specimens from Revillagigedo Island, Alaska,¹ while typical of *spatulatus* in size and color, show a slight approach toward *osoyoosensis* in the shape of the audital bullæ and in the high, rounded jugals.

Specimens examined.—Total number 67, from localities as follows:

Alaska: Anklin River, Yakutat Bay, 2; Dangerous River, Yakutat Bay, 1; Eagle, 1; Fort Hamlin, 3; Kowak River, 150 miles from mouth, near Jade Mountains, 1; Nome, 1; Norton Bay, 1; Nulato, 1; Portage Cove, Revillagigedo Island, 5; Russian Mission, Yukon River, 2; St. Michaels, 3; Yukon, 4.

Yukon: Lake Marsh, 2.

Mackenzie: Fort Anderson, 1; Fort Franklin, 7; Fort Liard, 1; Fort McPherson, 7; Fort Resolution, 3; Fort Simpson, 5; Great Slave Lake, 1; Willow River, 1.

British Columbia: Bennett, 1; Tagish Lake, 1.

Alberta: Athabaska Lake, 1; Blindman River, 1; Edmonton, 2; Fort Chipe wayan, 4; Henry House, 1; Slave River, 2; Swan Lake, 1.

FIBER ZIBETHICUS ZALOPHUS HOLLISTER.

ALASKA PENINSULA MUSKRAT.

Fiber zibethicus zalophus Hollister, Proc. Biol. Soc. Wash., XXIII, 1, February 2, 1910.

Type locality.—Becharof Lake, Alaska.

Geographic distribution.—Alaska Peninsula, north to Nushagak and east to the head of Cook Inlet.

General characters.—Size small; tail short; hind foot very small. Skull with zygomata not broadly spreading anteriorly; parietals very small, even in young animals; interorbital ridge extreme in development into a blade-like crest; molars small.

Color.—General tone of upperparts bister, darkest on back and hips, with little or no rusty coloring; sides like back, but with a slight russet tinge; brown spot on chin reduced to a mere streak. Underparts creamy white with a cinnamon wash, varying in intensity and shading to white on throat and hind legs; lips whitish; feet grayish brown, fringed with pale buffy hairs; tail black. *Worn pelage:* Upperparts russet to cinnamon, varying greatly in the specimens at hand, but usually with much more red than in fresh coat, or in any pelage of *F. z. spatulatus*. *Young:* Like young of *spatulatus*.

Skull and teeth.—Skull with zygomata not broadly spreading anteriorly as in *spatulatus*; rostrum and nasals longer; parietals very small, squamosal covering most of area of brain case, even in young animals; interorbital ridge extreme in development into a blade-like crest; teeth small.

¹ Collection Museum of Vertebrate Zoology, University of California.

Measurements.—Average of four adults from Lake Clark and Cook Inlet, Alaska: Total length, 533; tail vertebræ, 228; hind foot, 69.7. *Skull.*—Average of five adults from Becharof Lake, Tyonek, and Lake Clark, Alaska: Basal length, 60.1; zygomatic breadth, 38.8; palatal length, 38.4; length of nasals, 21.3; breadth of nasals, 9.7; alveolar length of upper molar series, 14.7.

Type specimen.—No. 131488, United States National Museum, Biological Survey Collection. Skin and skull, not sexed. Collected by A. G. Maddren, October, 1903.

Remarks.—This is a very well-marked form, all the specimens agreeing in the uniformity of the characters which separate it from its geographical neighbor, *F. z. spatulatus*. It is completely cut off from *spatulatus* on the east, but on the north it probably intergrades somewhere between Nushagak and the mouth of the Yukon River. In many ways it is the extreme type of the *spatulatus* style, but it has a longer skull with the zygomata shaped more like true *zibethicus* from the East. Compared in color with *spatulatus* it is grayer in fresh pelage and with more red in the worn or washed-out coat.

Specimens examined.—Total number 21, from localities as follows:

Alaska: Becharof Lake, 13; Fort Kenai, 2; Lake Clark, 3; Nushagak, 1; Tyonek, 1; Ugashik, 1.

FIBER ZIBETHICUS OSOYOOSSENSIS LORD.

ROCKY MOUNTAIN MUSKRAT.

Fiber osoyoosensis Lord, Proc. Zool. Soc. London, 1863, p. 97, 1863.

Fiber zibethicus osoyoosensis Hollister, Proc. Biol. Soc. Wash., XXIII, 1, 1910.

Type locality.—Lake Osoyoos, British Columbia.

Geographic distribution.—Puget Sound region and Rocky Mountains, from southern British Columbia, Washington, Idaho, and western Montana, south in the mountains to northern New Mexico.

General characters.—Nearest to *spatulatus* but decidedly larger; colors darker than in *spatulatus*, *mergens*, or *cinnamominus*. Skull much like that of *spatulatus* but larger, with much larger teeth.

Color.—*Fresh pelage:* Upperparts varying from uniform glossy mummy brown to black; slightly darker than in *spatulatus*; sides russet; underparts usually heavily colored with cinnamon and dark russet or brown hairs; throat and ventral region lighter; hips black. *Worn pelage:* Upperparts dull sooty brown, sides and underparts paler, usually with few rusty overlying hairs. *Young:* Seal brown, paler beneath.

Skull and teeth.—Skull large, resembling that of *spatulatus* in the development of the high interorbital ridge and broad nasals, but much larger and relatively narrower; molars larger; interorbital constriction great; bullæ small, with lateral inflation; rostrum and nasals long.

Measurements.—Average of ten adults from Oroville, Washington: Total length, 589; tail vertebræ, 271; hind foot, 83. *Skull:* Basal length, 64.1; zygomatic breadth, 40.5; palatal length, 41.3; length of nasals, 23.6; breadth of nasals, 10.1; alveolar length of upper molar series, 15.9.

Type specimen.—No. 62.12.30.6, British Museum (Natural History). Skin and skull, barely adult, not sexed. Collected by J. K. Lord, no date. As this is the only muskrat type not preserved in an American museum, the following notes, kindly made for me by Mr. Gerrit S. Miller, jr., at the British Museum, August, 1910, are of considerable importance and should be placed on permanent record:

Skin in moderately good condition; recently made over; somewhat shrunken. Head and body, 270; tail, 220 (from skin in present condition); hind foot, 72 (by taxidermist); hind foot (now), 69; with claw, 76; ear (by taxidermist), 19. Color rather dark but not at all peculiar, belly of the ordinary style, not dusky. Skull barely adult; brain case smooth; ridges in temporal region low, not quite joined. Condylbasal length, 58 (estimated, condyles cut away); upper length (to front of nasals), 57.4; zygomatic breadth, 35; mastoid breadth, 25.4; interorbital breadth, 6.2; nasals, 19.0; greatest breadth, both nasals together, 9.0; diastema, 20.6; mandible, 40.2; maxillary tooth row (alveoli), 14.6; (crowns), 13.2; mandibular tooth row (alveoli), 15; (crowns), 13.6.

Remarks.—This large, dark-furred muskrat of the *spatulatus* type is readily distinguishable from its neighboring subspecies. From *spatulatus* on the north, with which it clearly intergrades in British Columbia, it is distinguished by its larger size and darker colors, as well as by the great cranial differences. Specimens from Ashcroft, British Columbia, are slightly approaching *spatulatus* in skull characters. From its neighbor on the great Nevada desert, *mergens*, it differs especially in its darker color. At Twelvemile Creek, Oregon, and at points along the western range in the Rockies it shows a decided tendency toward *mergens* in color and skull. To the east it blends into *cinnamominus*, as shown wherever specimens are available from along the border of the Great Plains. I can find no satisfactory characters to separate the animals from the southern Rockies, in Colorado and New Mexico, from typical *osoyoosensis*. The specimens from southern localities average slightly smaller, with smaller hind foot, and the skulls have shorter rostra, but some specimens can be exactly matched in the series from northern localities, and the per cent of specimens exhibiting the slight differences does not seem large enough to warrant naming the form. Some skulls from Farmington, N. Mex., are almost exactly matched in the toptype series from Lake Osoyoos (Oroville, Wash.), and the skins are equally black above, with the black hips and other characteristics of *osoyoosensis*. Specimens from Rinconada and Costilla River, New Mexico, though clearly referable to this form, show a slight approach toward *ripensis* of the Pecos Valley.

Specimens examined.—Total number 131, from localities as follows:

British Columbia: Ashcroft, 2; Kettle River, 1; Port Moody, 5.

Washington: Aberdeen, 1; Almota, 1; Chehalis County, 2; Easton, 1; Fort Steilacoom, 1; Lake Cushman, 29; Lake Washington, 2; Mabton, 2; Marshall, 2; Mount Vernon, 3; Oroville, 12; Rockland, 1; Seattle, 6; Touchet, 7; Walla Walla, 1.

Oregon: The Dalles, 1; Twelvemile Creek, 1.

Idaho: Fort Sherman, 1; Lemhi, 1; Packer Meadow, 2; Sawtooth Lake, 5.

Montana: Corvallis, 8; Florence, 1; Highwood Mountains, 1; Summit, 1.

Wyoming: Opal, 2; Pass Creek, 1; Rock Creek, 1; Valley, 1.

Utah: Laketown, 2; Ogden, 2; Utah Lake, 1.

Colorado: Cochetope Pass, 5; Coventry, 2; Crested Butte, 1; Hebron, 2; Hot Sulphur Springs, 3.

New Mexico: Costillo River, 1; Farmington, 4; Rinconada, 2.

FIBER ZIBETHICUS OCCIPITALIS ELLIOT.

OREGON COAST MUSKRAT.

Fiber occipitalis Elliot, Publ. Field Col. Mus., Zool. Ser., III, 162, April, 1903.

Type locality.—Florence, Oreg.

Geographic distribution.—Northern Willamette Valley and coast of Oregon.

General characters.—Size and general characters of *F. z. osoyoosensis*, but averaging slightly paler or more reddish; skull with extremely narrow interpterygoid space.

Color.—*Fresh pelage*: Like *F. z. osoyoosensis*, but with less black; color above a uniform chestnut brown; head darker; nose and outer sides of legs blackish; sides like back but slightly brighter; underparts heavily washed with bright cinnamon rufous. *Worn pelage*: Duller and darker, showing much more black.

Skull and teeth.—Skull like that of *osoyoosensis* but with less highly developed interorbital ridge; interpterygoid space very narrow, the borders nearly parallel.

Measurements.—Average of four specimens from the type locality: Total length, 589; tail vertebræ, 271; hind foot, 83.5. *Skull of type*: Basal length, 64.1; zygomatic breadth, 44; palatal length, 42.5; length of nasals, 24.5; breadth of nasals, 10; alveolar length of upper molar series, 16.

Type specimen.—No. 9260, Field Museum of Natural History, Chicago. ♀, old adult, skin and skull. Collected by Edmund Heller, December 16, 1901.

Remarks.—This form is known from only three localities, and the material representing it is rather unsatisfactory. It seems to be a well-marked form, but with a limited range. The specimens from the upper Willamette Valley are mostly rather immature but clearly belong with this form rather than with *osoyoosensis*. Some of the specimens from south of Puget Sound, in Washington, show a slight

approach toward this form in a narrowing of the interpterygoid fossa; but otherwise distinctly belong with *osoyoosensis*, which remains typical south along the Sound to and below Seattle. Additional specimens from the coast region of Washington and Oregon are greatly needed to work out thoroughly the interrelations of these forms.

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

Oregon: Beaverton, 1; Florence, 4; Portland, 5.

FIBER ZIBETHICUS MERGENS HOLLISTER.

NEVADA MUSKRAT.

Fiber zibethicus mergens Hollister, Proc. Biol. Soc. Wash., XXIII, 1, February 2, 1910.

Type locality.—Fallon, Nev.

Geographic distribution.—Northern part of the Great Basin; southeastern Oregon, northeastern California, Nevada, and western Utah.

General characters.—Size large, colors pale. Differs from *F. z. osoyoosensis* in its much paler color, and from *F. z. pallidus* in its large size and darker colors.

Color.—*Fresh pelage:* Above, grayish brown; head and dorsal area blackish; cheeks, shoulders, and sides rusty; underparts creamy white with central area pale cinnamon or russet; usual spot on chin blackish brown. Fall specimens, before the black hairs have come in, are sometimes quite rusty above. *Worn pelage:* Above, uniform pale yellowish brown; sides and underparts with little rusty.

Skull and teeth.—Skull slightly smaller than that of *osoyoosensis*, with shorter rostrum, more broadly spreading zygomata, and heavier jugals; much larger than that of *pallidus*.

Measurements.—Average of six adults from Fallon and Lovelocks, Nev.: Total length, 554; tail vertebræ, 253; hind foot, 80. *Skull.*—Average of four adults from Fallon and Lovelocks, Nev.: Basal length, 62.1; zygomatic breadth, 40.2; palatal length, 39.9; length of nasals, 21.4; breadth of nasals, 9.9; alveolar length of upper molar series, 15.5.

Type specimen.—No. 156880, United States National Museum, Biological Survey Collection. ♀ adult, skin and skull. Collected by Stanley E. Piper, April 3, 1908.

Remarks.—This is a pale desert form of the *osoyoosensis* type, occupying the northern part of the Great Basin. It grades directly into *osoyoosensis* on the north and east, but the material from southern Nevada and Utah is too scanty to give a good idea of its direct relationship with *pallidus*. At the time of publishing the original description of *mergens*, I stated that no intergradation with *pallidus* was

known. Since that time two specimens have been received from St. George, Utah, which show almost intermediate characters. For the present these, on account of their large size, have been placed under *mergens*, though a larger series from the same locality and intermediate points may change this view.

Specimens examined.—Total number 20, from localities as follows:

Oregon: Shirk, 1.

California: Eagle Lake, 1;¹ Susanville, 1.²

Nevada: Fallon, 6; Lovelocks, 4; Paradise, 1; Ruby Lake, 4.

Utah: St. George, 2.

FIBER ZIBETHICUS PALLIDUS MEARN'S.

ARIZONA MUSKRAT.

Fiber zibethicus pallidus Mearns, Bull. Amer. Mus. Nat. Hist., II, 280, 1890.

Type locality.—Old Fort Verde (Camp Verde), Yavapai County, Ariz.

Geographic distribution.—Colorado River valley (California, Lower California, and Arizona), east to the Rio Grande Valley in New Mexico.

General characters.—Size small, color uniform rusty red, with no overlying black hairs; skull small.

Color.—*Fresh pelage*: Back and sides bright rusty red, nearest to the cinnamon rufous of Ridgway, with no black in the overlying hairs; between eyes and nose Prout's brown; whiskers blackish brown. Underparts like back and sides, but paler; a small brown spot on chin; edges of lips yellow; nose pad black; tail brownish; feet pinkish gray, fringed with buffy hair; nails straw to chrome. *Worn pelage*: Similar, but paler and duller throughout; underparts pale drab with little of the rusty tint; throat and ventral region whitish; brown spot on chin nearly obsolete. *Young*: Like adult in summer but still paler; very different from the dark young of all the other forms.

Skull and teeth.—Skull very small; except in size it resembles that of *F. z. zibethicus* in nearly every particular. Skulls of *pallidus* are easily separated from skulls of *mergens* by their small size, but it is difficult to distinguish them from skulls of *ripensis*, which are also small. Skulls of *pallidus* average slightly larger than those of *ripensis*, with heavier rostrum, wider nasals, and smaller, less inflated audital bullæ.

Measurements.—Average of five specimens from the Arizona and California banks of the Colorado River: Total length, 431; tail vertebrae, 191; hind foot, 66.5. Doctor Mearns's type series of nine specimens from the Verde River average: Total length, 482; tail, 204.³

Skull.—Average of five specimens from the Colorado River: Basal length, 54.7; zygomatic breadth, 36.8; palatal length, 34.7; length of

¹ Foot only.

² Skull only.

³ Bull. Amer. Mus. Nat. Hist., II, 282, 1890.

nasals, 19.2; breadth of nasals, 8.6; alveolar length of upper molar series, 14.5.

Type specimens.—There are two cotypes, both in the American Museum of Natural History, New York City—No. 2346, ♂, September 17, 1885, and No. 2348, ♀, August 28, 1886; collected by Dr. E. A. Mearns.

Remarks.—This is one of the best of the described forms of the muskrat, and it is readily distinguishable at all seasons by its small size and peculiar coloration. Its range is restricted and it does not seem to be abundant in many localities. New Mexican specimens seem to be grading toward the Rocky Mountain form, but the scarcity of material from this region and from eastern Arizona is a great handicap in working out its relationships.

Specimens examined.—Total number 14, from localities as follows:

- California:** Colorado River, 15 miles southwest of Ehrenberg, Ariz., 4.
Arizona: Camp Grant, 2; Fort Verde, 2; Robert's Ranch, opposite Needles, Cal., 1; Springerville, 1.
New Mexico: Albuquerque, 1; Upper Tularosa River, 3.

FIBER ZIBETHICUS RIPENSIS BAILEY.

PECOS MUSKRAT.

Fiber zibethicus ripensis Bailey, Proc. Biol. Soc. Wash., XV, 119, June 2, 1902.

Type locality.—Carlsbad (Eddy), N. Mex.

Geographic distribution.—Pecos Valley, in Texas and New Mexico.

General characters.—About the size of *F. z. pallidus*, with shorter tail; color much darker. Skull slightly smaller, with larger bullæ.

Color.—*Fresh pelage:* Upperparts Vandyke brown; a few black hairs on back; top of head blackish; muzzle whitish; sides russet, brightest on neck and cheeks; underparts much paler; throat and ventral regions whitish. *Worn pelage:* Similar, but much paler and with no gloss. Back and sides light brown; underparts dirty white, with a faint cinnamon wash over central area. *Young:* Blackish above, drab below; sides and cheeks with a faint rusty tinge.

Skull and teeth.—Skull very small; differs from that of *pallidus* in the slightly lighter rostrum, narrower nasals, and larger, more inflated, bullæ.

Measurements.—Average of six specimens from the type locality: Total length, 463; tail vertebræ, 204; hind foot, 68. *Skull:* Basal length, 53.6; zygomatic breadth, 34.6; palatal length, 34.3; length of nasals, 18.3; breadth of nasals, 7.7; alveolar length of upper molar series, 14.9.

Type specimen.—No. 109012, United States National Museum, Biological Survey Collection. ♂ adult, skin and skull. Collected by Vernon Bailey, July 25, 1901.

Remarks.—This well-marked form, easily distinguished from all others, is confined to a small area in New Mexico and Texas, the immediate vicinity of the Pecos River, and neighboring streams and springs. Specimens from Santa Rosa, N. Mex., in the upper Pecos Valley, have more black in the pelage and are slightly larger than typical specimens. They apparently show a tendency toward the darker form of the Rocky Mountains.

Specimens examined.—Total number 28, from localities as follows:

New Mexico: Carlsbad, 6; Santa Rosa, 7.

Texas: Fort Stockton, 15.

FIBER ZIBETHICUS CINNAMOMINUS HOLLISTER.

GREAT PLAINS MUSKRAT.

Fiber zibethicus cinnamominus Hollister, Proc. Biol. Soc. Wash., XXIII, p. 125, September 2, 1910.

Type locality.—Wakeeney, Trego County, Kan.

Geographic distribution.—Great central plains region of western United States and Canada; from Manitoba south to northern Texas; east to central Iowa and west to the Rocky Mountains.

General characters.—Smaller than *F. z. zibethicus* or *osoyoosensis*; larger than *ripensis*. Coloration pale, with much red in both fresh and worn pelages. Skull smaller than in *zibethicus*, with smaller teeth.

Color.—*Fresh pelage:* Upperparts and sides cinnamon brown, dorsal area only slightly darker, with few black hairs. Nose to forehead and eyes seal brown. Cheeks and underparts creamy clay color, lighter on neck, throat, and inner sides of legs. A very small brown spot on chin. Feet drab; nails yellowish. Tail dark brown. *Worn pelage:* Varying from wood brown to russet, depending upon the state of wear or renewal. Specimens in the short-haired early fall pelage are the darkest, and those in extreme faded or washed out early summer coat are the lightest.

Skull and teeth.—Skull smaller than in *zibethicus* or *osoyoosensis* with smaller teeth; larger than that of *ripensis*. Compared with skulls of *zibethicus* it has a proportionally shorter and heavier rostrum, accompanied by a shortening and widening of the nasals.

Measurements.—Average of two specimens from the type locality: Total length, 496; tail vertebræ, 240. Average of hind foot in twenty-one specimens from various localities, 73.5. *Skull.*—Average of five specimens from the type locality: Basal length, 56.3; zygomatic breadth, 35.5; palatal length, 35.5; length of nasals, 19.5; breadth of nasals, 8.9; alveolar length of upper molar series, 15.

Type specimen.—No. $\frac{3}{4}$ $\frac{3}{4}$, Merriam Collection (in United States National Museum). ♂ adult, skin and skull. Collected by A. B. Baker, January 14, 1887.

Remarks.—This is the muskrat of the prairie sloughs and streams of the interior Great Plains region. In color it most resembles *Fiber z. pallidus* of Arizona, and is thus very different from its nearest geographical neighbors. It apparently intergrades with *albus* on the north and with *zibethicus* and *osoyoosensis* on the eastern and western borders of the Great Plains. Specimens from Carberry, Manitoba, though apparently referable to *cinnamominus*, are somewhat intermediate between three forms, *zibethicus*, *cinnamominus*, and *albus*.

Specimens examined.—Total number 84, from the following localities:

- Manitoba: Carberry, 4.
- North Dakota: Buford, 1; Oaks, 1.
- Montana: Glasgow, 1; Little Dry Creek, 3.
- Wyoming: Bear Creek, 1; Sun, 3.
- South Dakota: Custer, 1; Savoy, 4; Tigerville, 1.
- Nebraska: Beemer, 10; Johnstown, 27.¹
- Colorado: Boulder, 5; Ward, 1; Wray, 2.
- Kansas: Garnett, 1; Manhattan, 1; Wakeeney, 8.
- Iowa: Knoxville, 1.
- Oklahoma: Red Fork, 1.
- Texas: Canadian, 4; Lipscomb, 8.

FIBER RIVALICIOUS BANGS.

LOUISIANA MUSKRAT.

Fiber zibethicus rivalicicus Bangs, Proc. Boston Soc. Nat. Hist., XXVI, 541, July 31, 1895.

Type locality.—Burbridge Plantation, near Belair, Plaquemines Parish, La.

Geographic distribution.—Coast region of Louisiana, north to northern Calcasieu, Pointe Coupee, and Tangipahoa parishes.

General characters.—Like *Fiber zibethicus*, but averaging slightly smaller; colors duller; underparts darker.

Color.—*Fresh pelage:* Upperparts uniform dark brownish black, with little of the reddish tints of other forms; sides like back, but without the overlying hairs. Underparts pale drab to sepia or Prout's brown, the color depending on the number and shade of the longer dark-colored hairs; underfur light plumbeous. *Worn pelage:* Paler and duller throughout, usually showing more of the rusty tint than the fresh pelage.

Skull and teeth.—Skull almost precisely like that of *Fiber z. zibethicus*, but averaging slightly smaller.

Measurements.—Average of 10 adults from Belair, La.: Total length, 547; tail vertebrae, 233; hind foot, 78. *Skull:* Basal length, 60.1; zygomatic breadth, 38.7; palatal length, 38; length of nasals, 20.3; breadth of nasals, 8.4; alveolar length of upper molar series, 15.7.

¹ Skulls.

Type specimen.—No. 2719, Museum of Comparative Zoology (Bangs Collection). ♂ adult, skin and skull. Collected by F. L. Small, January 31, 1895.

Remarks.—This form has a very limited range and is known only from the southern parishes of Louisiana. In a letter to Dr. C. Hart Merriam, Mr. Frank M. Miller, of New Orleans, writes that the muskrat is confined strictly to the area south of a line running along the northern boundaries of Calcasieu, Acadia, Lafayette, St. Martin, Pointe Coupee, Baton Rouge, Livingston, Tangipahoa, and St. Tammany parishes. The animal is thus completely isolated from other forms. The colony doubtless originated from stock from farther up the river. The most southern localities from which muskrats are known are included within the range of *Fiber rivalicicus*, though they are only slightly farther south than the known southern limit of *Fiber z. ripensis*, at Del Rio, on the Rio Grande. This is the only form of which the specimens examined show anything like conclusive evidence of two annual molts. The Louisiana muskrat apparently molts in spring and fall, approximately in May and October.

Specimens examined.—Total number 36, from localities as follows:

Louisiana: Abbeville, 5; Belair, 20; Chef Menteur, 1; Gum Cove, 1; Houma, 4; Iowa, 2; Octave Pass, 2; Slidell, 1.

FOSSIL SPECIES.

FIBER NEBRACENSIS sp. nov.

Type from Lower Pleistocene ("Equus Beds"), quarry on Niobrara River, near Hay Springs, Sheridan County, Nebr. No. 2702, American Museum of Natural History, Department of Vertebrate Palæontology. Skull, adult; parts of rostrum, palate, zygomata, brain case, and occiput; incisors and left row of cheek teeth *in situ*. Missing parts restored. American Museum Expedition of 1897.

Characters.—Size medium, about that of *Fiber z. cinnamominus*, the existing form in same region. Teeth as in living species. Rostrum short; audital bullæ peculiar, small and much flattened, without angular surface on basioccipital side; interorbital crest high and sharp, as in the boreal forms; parietals and interparietal small and much flattened. Jaw not peculiar.

Measurements.—Upper molar series, crowns, in three specimens: 12.7 (type); 12.8; 12.7. Lower molar series, crowns, five specimens: 12.7; 13.2; 12.5; 13.5; 12.7. First lower molar, crown, seven specimens: 6.3; 6.5; 6.4; 6.5; 6.4; 6.9; 7.0. Front of crown of $\overline{m1}$ to inferior notch of mandible, five specimens: 21.4; 22.2; 23.2; 23.3; 23.5.

Remarks.—The skull of this fossil species, while greatly resembling that of some of the living forms of *Fiber*, possesses a combination of characters not found in any other known form. In size it agrees

with living forms, thus differing widely in that respect from the other described fossil species.

Material examined.—Parts of three skulls and seven lower jaws, all with teeth *in situ*, from the type locality.

FIBER OREGONUS SP. NOV.

Type from Lower Pleistocene ("Equus Beds"), Fossil Lake (Christmas Lake), 20 miles from Silver Lake, Lake County, Oregon. No. 8594, American Museum of Natural History, Department of Vertebrate Palæontology. Young adult, right mandibular ramus; coronoid process, condyle, and angle broken; $\overline{m3}$ missing; incisor broken at alveolus. Cope Collection.

Characters.—Size very small, about the size of *Fiber annectens* Brown, from Arkansas in Mid-Pleistocene, and much smaller than any existing species of *Fiber*. Anterior loop of $\overline{m1}$ with deeper reentrant angles than in any living species; triangles not completely closed in any case. From the type specimen of *F. annectens*, a right mandibular ramus also, it differs in its much more robust build (the type of *F. annectens* is rather immature, however); teeth distinctly larger, especially broader across crowns; triangles less nearly closed. The inferior notch is rounded, while in *F. annectens* it is sharply square. The root of the lower incisor extends much farther back, passing beyond the inferior dental foramen.

Comparative measurements of mandibles of fossil and recent muskrats.

	<i>oregonus.</i>	<i>annectens.</i>	<i>osoyno- ensis.</i>	<i>obscurus.</i>
From anterior edge of crown of $\overline{m1}$ to inferior notch.....	19.5	19	25.7	23
Length of first two lower molars, crowns.....	9.0	8.2	11.3	11
Length of $\overline{m1}$, crown.....	6.0	5.7	7.1	7.5

Remarks.—Except in size, the fragment representing *F. oregonus* is almost identical with the corresponding bone in living species. It differs from the jaw of *Fiber annectens* in only a few slight characters.

Material examined.—One right mandibular ramus, the type.

FIBER ANNECTENS BROWN.

Fiber annectens Brown, Mem. Amer. Mus. Nat. Hist., IX, pt. 4, p. 197, February, 1908.

Type locality.—Conard Fissure, Newton County, Ark. Middle Pleistocene.

Characters.—Size very small; smallest muskrat known. The species is based upon one right mandibular ramus and an upper molar, which indicate a species close to existing forms in everything except size. The sharply squared inferior notch is the most striking

difference; in all other species this notch is well rounded. The anterior loop of first lower molar is more deeply cut by the reentrant angles than in any specimen of an existing species examined. In the original description the statement is made that this loop is not cut by reentrant angles, the deep cuts apparently leading the describer to believe that the loop included only that part of the pattern anterior to these reentrant angles. The reduction of the anteroexternal column of $\overline{m3}$, a character used in his argument of intermediate relationship between *Fiber* and *Neofiber*, is of little consequence; this column is indifferently present or absent in *Fiber*, this particular tooth showing more variation in pattern than any other.

Measurements.—Length of jaw, condyle to anterior surface of symphysis, 30; from anterior edge of crown of $\overline{m1}$ to inferior notch, 19; alveolar length of lower molar series, 12; length of first two lower molars, crowns, 8.2; length of first lower molar, crown, 5.7.

Type specimen.—No. 12424, American Museum of Natural History, Department of Vertebrate Palæontology. Right mandibular ramus, somewhat immature. Nearly complete; coronoid process broken; incisor broken at alveolus. Collected by Barnum Brown, 1903.

Remarks.—This is the smallest muskrat known, living or fossil. In size the jaw almost matches that of *Neofiber alleni*. It appears to be a true *Fiber*, in no important character connecting *Fiber* with *Neofiber*. The molars are all rooted.

Material examined.—One right mandibular ramus (the type) and one right upper first molar, from the same deposit.

TABLE OF AVERAGE CRANIAL MEASUREMENTS OF MUSKRATS.

Form.	Number averaged.	Locality.	Basal length.	Zygomatic breadth.	Palatal length.	Length of nasals.	Breadth of nasals.	Alveolar length of upper molar series.
<i>F. obscurus</i>	11	Newfoundland: Codroy and Bay St. George.	53.2	34.7	34	19.8	7.4	14.2
<i>F. zibethicus</i>	10	New Brunswick.....	60.4	38.8	38	21.2	9.1	16.3
<i>F. z. macrodon</i>	4	Virginia: Dismal Swamp.....	65.1	41.7	41	22.9	9.9	17.7
<i>F. z. aquilonius</i>	4	Labrador: Hamilton Inlet and Lance au Loup.	60.3	40.1	37.5	22.3	9.2	15.3
<i>F. z. albus</i>	5	Keewatin: Fort Churchill and Echinamish River.	58.8	38.1	37.1	21	9.1	15.3
<i>F. z. spatulatus</i>	5	Alaska: Eagle; Yukon: Lake Marsh; British Columbia: Bennett and Tagish Lake.	58.2	38.4	37	20.4	10	14.7
<i>F. z. zalophus</i>	5	Alaska: Becharof Lake, Tyoonok and Lake Clark.	60.1	38.8	38.4	21.3	9.7	14.7
<i>F. z. osyoosensis</i>	10	Washington: Oroville.....	64.1	40.5	41.3	23.6	10.1	15.9
<i>F. z. occipitalis</i>	1	Oregon: Florence.....	64.1	44	42.5	24.5	10	16
<i>F. z. mergens</i>	4	Nevada: Fallon and Lovelocks.....	62.1	40.2	39.9	21.4	9.9	15.5
<i>F. z. pallidus</i>	5	Colorado River, in Arizona and California.	54.7	36.8	34.7	19.2	8.6	14.5
<i>F. z. ripensis</i>	6	New Mexico: Carlsbad.....	53.6	34.6	34.3	18.3	7.7	14.9
<i>F. z. cinnamominus</i>	5	Kansas: Trego County.....	56.3	35.5	35.5	19.5	8.9	15
<i>F. rivalicinus</i>	10	Louisiana: Belair.....	60.1	38.7	38	20.3	8.4	15.7

TABLE OF AVERAGE FLESH MEASUREMENTS OF MUSKRATS.

Form.	Number averaged.	Locality.	Total length.	Tail.	Hind foot.
<i>F. obscurus</i>	7	Newfoundland: Codroy and Bay St. George....	500	226	76.0
<i>F. zibethicus</i>	7	New York: Lake George and Peterboro.....	563	254	81.0
<i>F. z. macrodon</i>	4	Virginia: Dismal Swamp.....	620	274	88.0
<i>F. z. aquilonius</i>	4	Labrador: Hamilton Inlet and Lance au Loup.....	551	262	74.0
<i>F. z. albus</i>	8	Keewatin.....	541	239	75.0
<i>F. z. spatulatus</i>	4	Northern British Columbia and Alberta.....	530	232	74.5
<i>F. z. zalophus</i>	4	Alaska: Lake Clark and Cook Inlet.....	533	228	69.7
<i>F. z. osoyoosensis</i>	10	Washington: Oroville.....	589	271	83.0
<i>F. z. occipitalis</i>	4	Oregon: Florence.....	589	271	83.5
<i>F. z. mergens</i>	6	Nevada: Fallon and Lovelocks.....	554	253	80.0
<i>F. z. pallidus</i>	5	Colorado River, in Arizona and California.....	431	191	66.5
<i>F. z. ripensis</i>	6	New Mexico: Carlsbad.....	463	204	68.0
<i>F. z. cinnamominus</i>	6	Kansas and South Dakota ¹	497	230	71.3
<i>F. rivalicicus</i>	10	Louisiana: Belair.....	547	233	78.0

¹ Kansas specimens without flesh measurements of foot. Foot average from 4 specimens from South Dakota.

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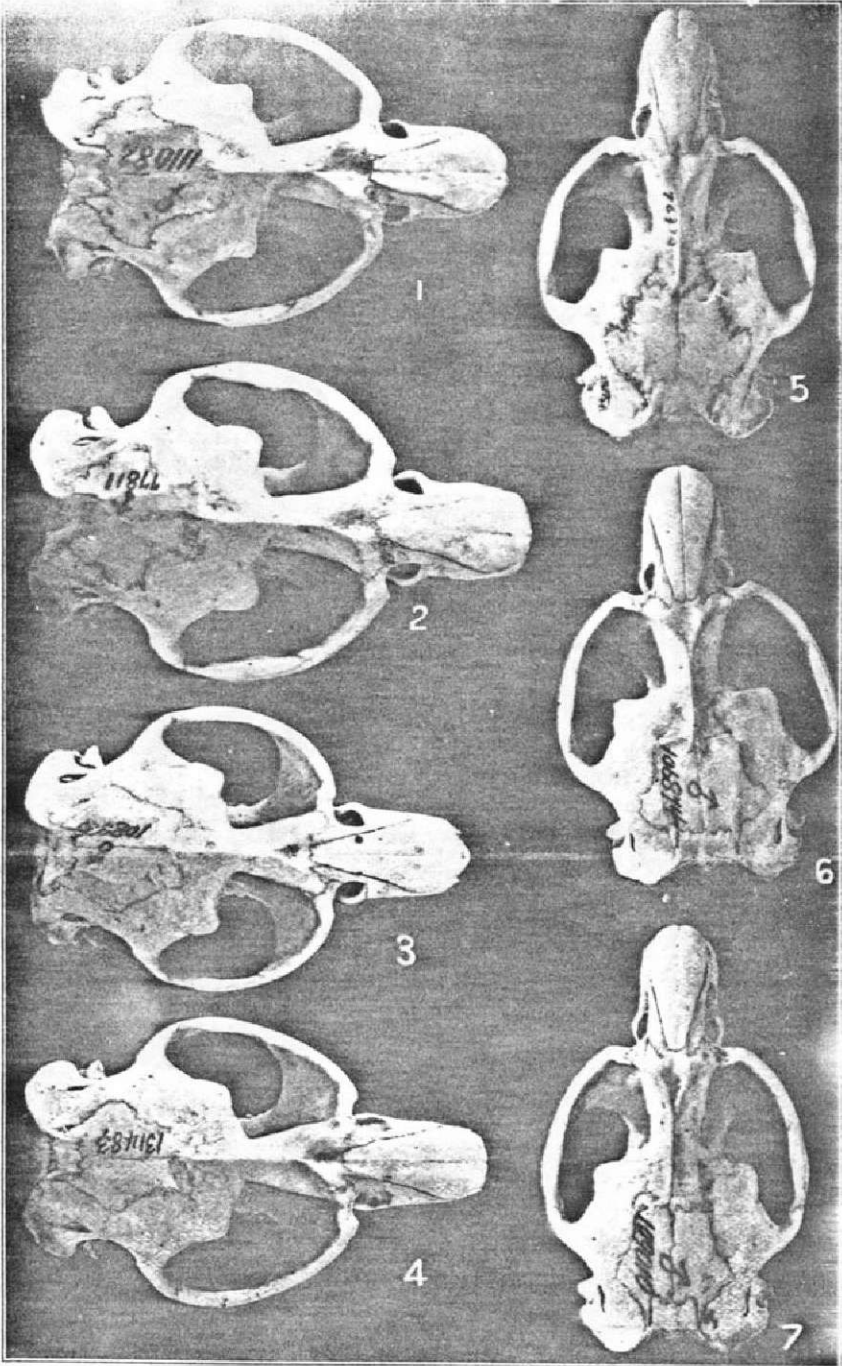
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PLATE III.

SKULLS (DORSAL VIEWS, NATURAL SIZE).

1. *Fiber zibethicus* (Linn.). ♀ ad. Peterboro, New York. (No. 111082, U. S. Nat. Mus.)
2. *F. z. macrodon* Merriam. ♂ ad. Wallaceton, Virginia. (No. 77811, U. S. Nat. Mus., Biol. Surv. Coll.)
3. *F. z. spatulatus* Osgood. ♂ ad. Tagish Lake, British Columbia. (No. 108335, U. S. Nat. Mus., Biol. Surv. Coll.)
4. *F. z. zalophus* Hollister. Ad. Becharof Lake, Alaska. (No. 131483, U. S. Nat. Mus., Biol. Surv. Coll.)
5. *Fiber obscurus* Bangs. Ad. Bay St. George, Newfoundland. (No. 76370, U. S. Nat. Mus., Biol. Surv. Coll.)
6. *Fiber z. albus* Sabine. ♂ ad. Echimamish River, Keewatin. (No. 106874, U. S. Nat. Mus., Biol. Surv. Coll.)
7. *Fiber z. ripensis* Bailey. ♂ ad. Carlsbad, New Mexico. (No. 109010, U. S. Nat. Mus., Biol. Surv. Coll.)



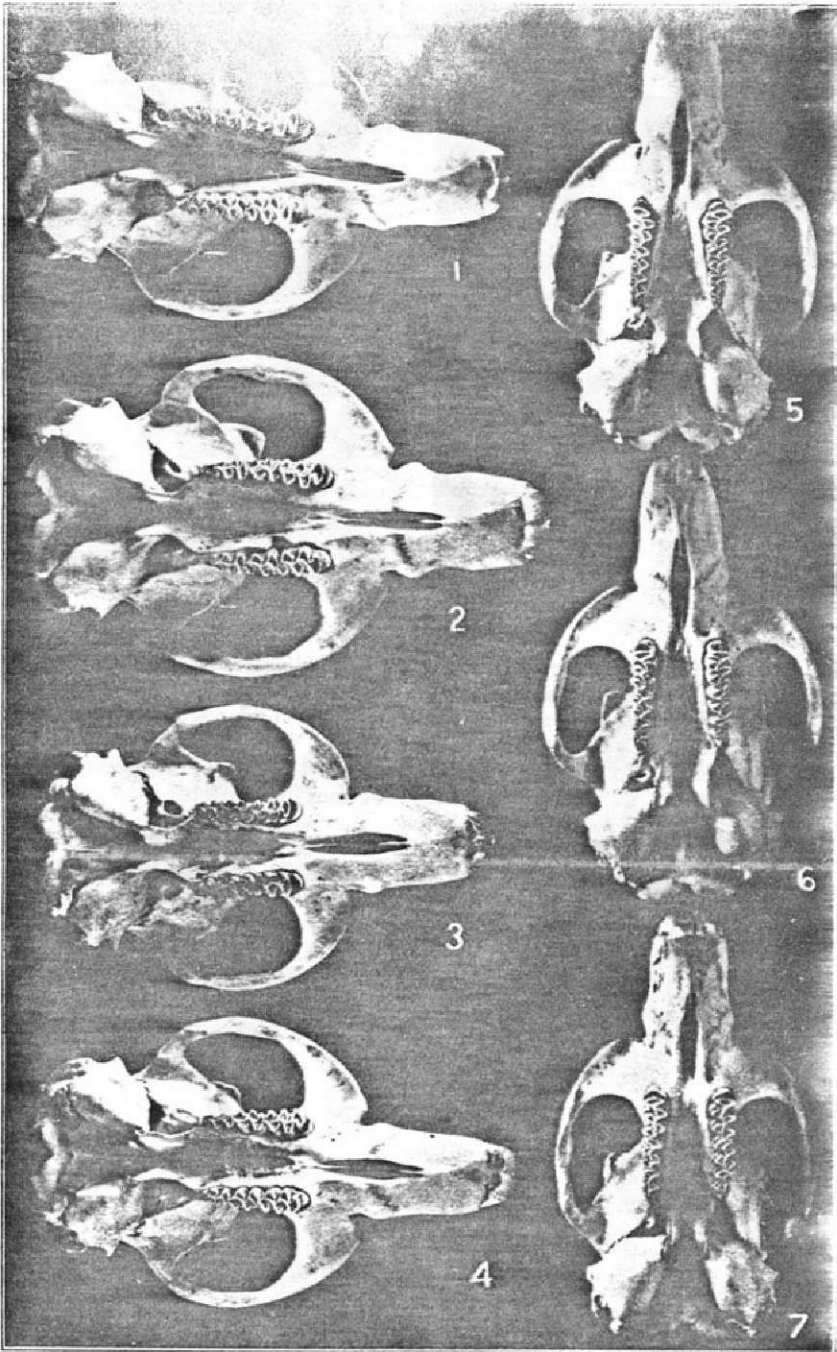
SKULLS OF FIBER.

- | | |
|------------------------------|----------------------------|
| 1. <i>F. zibethicus</i> . | 4. <i>F. z. zalophus</i> . |
| 2. <i>F. z. macrodon</i> . | 5. <i>F. obscurus</i> . |
| 3. <i>F. z. spatulatus</i> . | 6. <i>F. z. albus</i> . |
| 7. <i>F. z. ripensis</i> . | |

PLATE IV.

SKULLS (VENTRAL VIEWS, NATURAL SIZE).

- FIG. 1. *Fiber zibethicus* (Linn.) ♀ ad. Peterboro, New York. (No. 111082, U. S. Nat. Mus.)
2. *F. z. macrodon* Merriam. ♂ ad. Wallaceton, Virginia. (No. 77811, U. S. Nat. Mus., Biol. Surv. Coll.)
3. *F. z. spatulatus* Osgood. ♂ ad. Tagish Lake, British Columbia. (No. 108335, U. S. Nat. Mus., Biol. Surv. Coll.)
4. *F. z. zalophus* Hollister. Ad. Becharof Lake, Alaska. (No. 131483, U. S. Nat. Mus., Biol. Surv. Coll.)
5. *F. obscurus* Bangs. Ad. Bay St. George, Newfoundland. (No. 76370, U. S. Nat. Mus., Biol. Surv. Coll.)
6. *Fiber z. albus* Sabine. ♂ ad. Echimamish River, Keewatin. (No. 106874, U. S. Nat. Mus., Biol. Surv. Coll.)
7. *F. z. ripensis* Bailey. ♂ ad. Carlsbad, New Mexico. (No. 109010, U. S. Nat. Mus., Biol. Surv. Coll.)

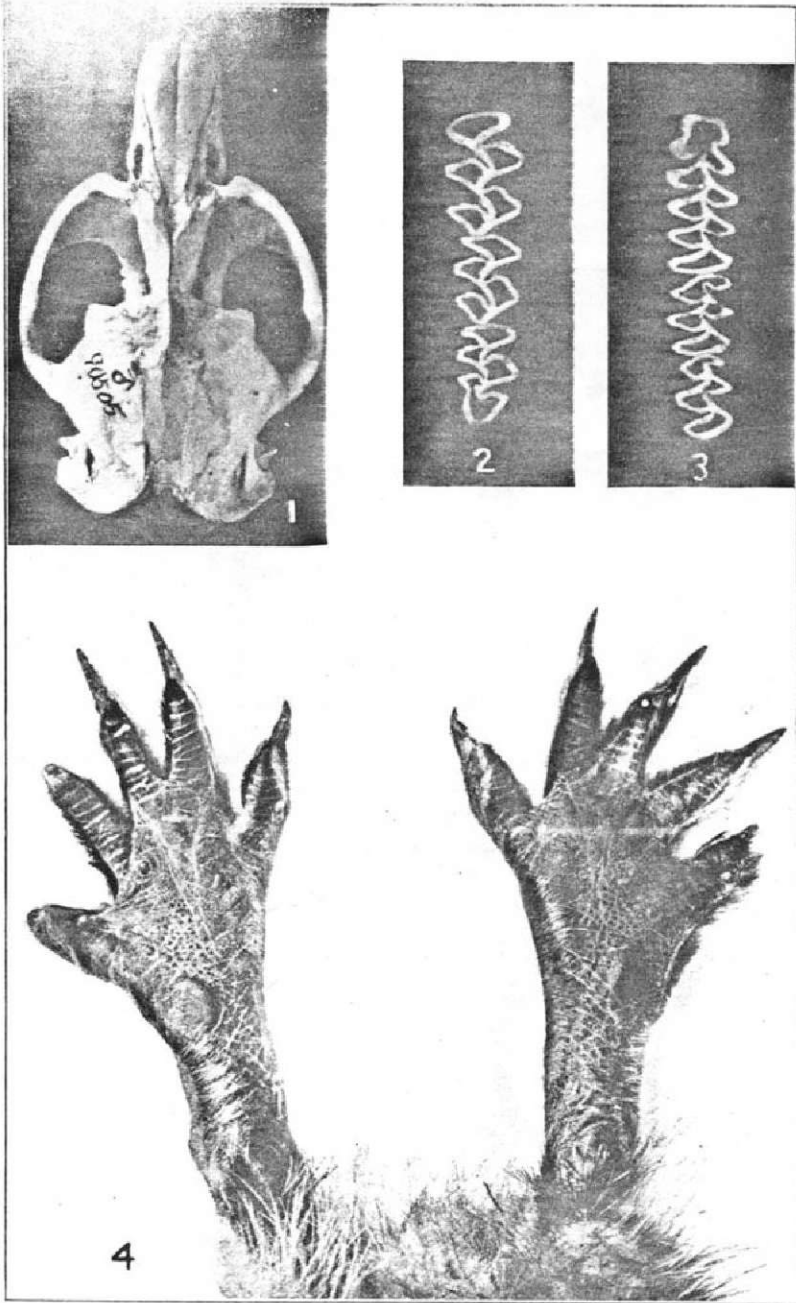


SKULLS OF FIBER.

- | | |
|------------------------------|--------------------------|
| 1. <i>F. zibethicus</i> . | 4. <i>F. z. zalophus</i> |
| 2. <i>F. z. macrodon</i> . | 5. <i>F. obscurus</i> . |
| 3. <i>F. z. spatulatus</i> . | 6. <i>F. z. albus</i> . |
| 7. <i>F. z. ripensis</i> . | |

PLATE V.

- FIG. 1. Skull of *F. z. osoyoosensis* Lord. ♂ ad. Oroville, Washington. (No. 90505, U. S. Nat. Mus., Biol. Surv. Coll.) Natural size.
2. Enamel pattern of upper molar teeth of *Fiber*. (*Fiber z. osoyoosensis* Lord. No. 99941, U. S. Nat. Mus. Lake Cushman, Washington.) × 3.
3. Enamel pattern of lower molar teeth of *Fiber*. (*Fiber z. osoyoosensis* Lord. No. 99941, U. S. Nat. Mus. Lake Cushman, Washington.) × 3.
4. Hind feet of *Fiber*. (*Fiber z. macrodon* Merriam. From fresh specimen collected at Cambridge, Maryland, March 16, 1909.) Natural size.



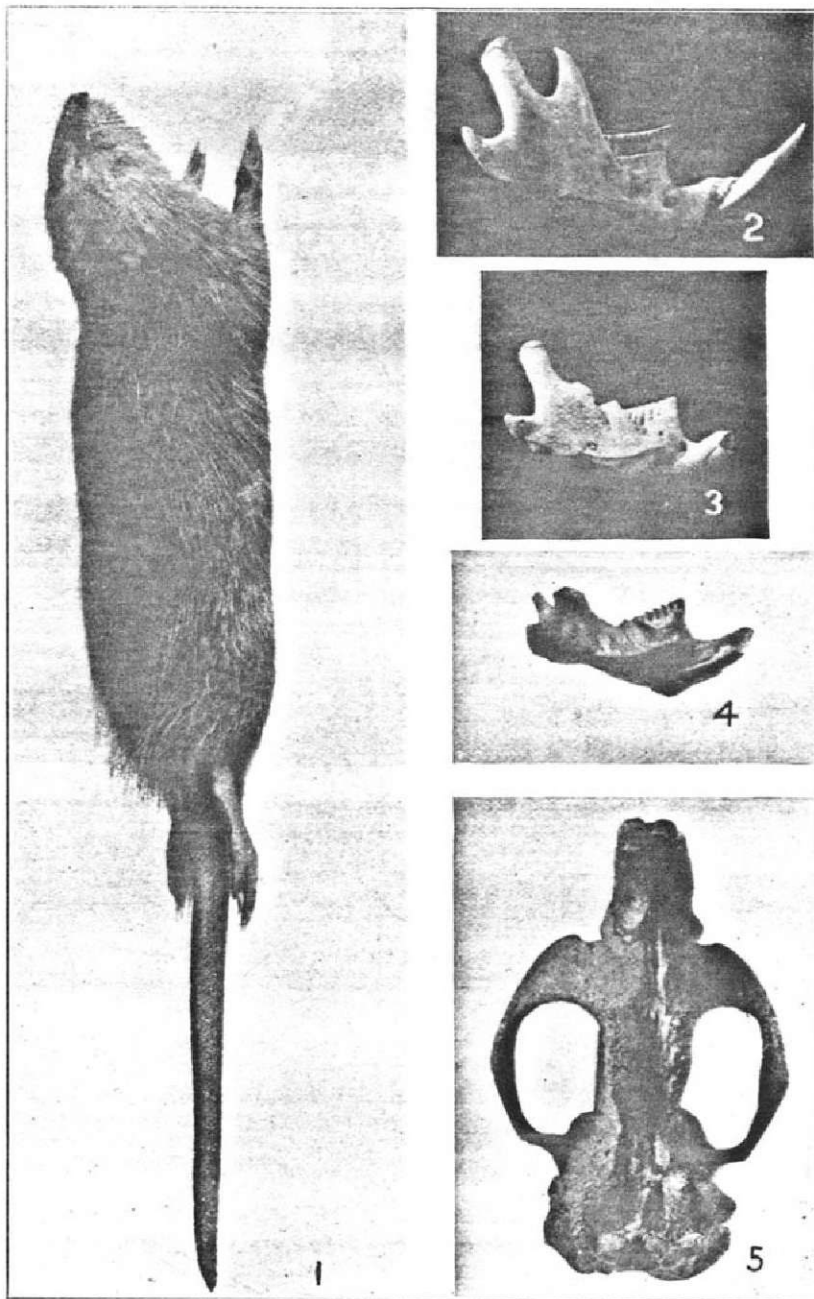
SKULL, TOOTH ENAMEL PATTERN, AND FEET OF FIBER.

1, 2, 3. *F. z. osyoosensis*,

4. *F. z. macrodon*.

PLATE VI.

- FIG. 1. *Fiber z. macrodon* Merriam. From fresh specimen collected at Cambridge, Maryland, March 16, 1909. Reduced.
2. *Fiber z. cinnamominus* Hollister. Right mandibular ramus of type. No. 3724, Merriam Coll. Trego County, Kansas. Natural size.
3. Type of *Fiber annectens* Brown. Middle Pleistocene, Newton County, Arkansas. No. 12424, Am. Mus. Nat. Hist., Dept. Vert. Palæontology. Natural size.
4. Type of *Fiber oregonus* Hollister. Lower Pleistocene, Fossil Lake, Oregon. No. 8594, Am. Mus. Nat. Hist., Dept. of Vert. Palæontology. Natural size.
5. Type of *Fiber nebracensis* Hollister. Lower Pleistocene, Niobrara River, Sheridan County, Nebraska. No. 2702, Am. Mus. Nat. Hist., Dept. of Vert. Palæontology. Most of right side restored. Natural size.



1. *F. z. macrodon*.
2. *F. z. cinnamominus*. Type.
3. *F. annectens*. Type.
4. *F. oregonus*. Type.
5. *F. nebracensis*. Type.

INDEX.

[New names in **bold-faced type**; synonyms in *italics*.]

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