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### THE SUBSPECIES OF THE AMERICAN PERCID FISH, *POECILICHTHYS WHIPPLII*

BY CARL L. HUBBS AND JOHN D. BLACK

IN the course of an ichthyological survey of Arkansas, the junior author has disclosed the existence of two unnamed forms of the redbfin darter, *Poecilichthys whipplii*. Although they are only weakly characterized by average differences, these forms are here described as new subspecies. One of them, a very fine-scaled, small-eyed mountain form, is named *P. w. montanus*. It abounds in an Arkansas River tributary variously known and mapped as Clear Creek, Frog Bayou, and Jones Creek, and situated in Washington and Crawford counties, Arkansas. Here it replaces the typical subspecies, which inhabits other Arkansas River tributaries in Arkansas, north-eastern Oklahoma, southeastern Kansas, and southwestern Missouri, and the White River system of Arkansas. The Red River drainage basin of Arkansas, Oklahoma, and Texas, and the coastal streams of eastern Texas, are occupied by the new subspecies, *P. w. radiosus*. The coarser scales of *radiosus* were indicated by the data given by Meek (1891: 139) and by the count of an especially large-scaled specimen that has been cited as a troublesome variant (Gilbert, 1887: 62; Jordan and Evermann, 1896: 1095). In the size of the scales *P. w. radiosus* bridges over the distinction between typical *whiplii* and its eastern representative *Poecilichthys artesiaae*, which is there-

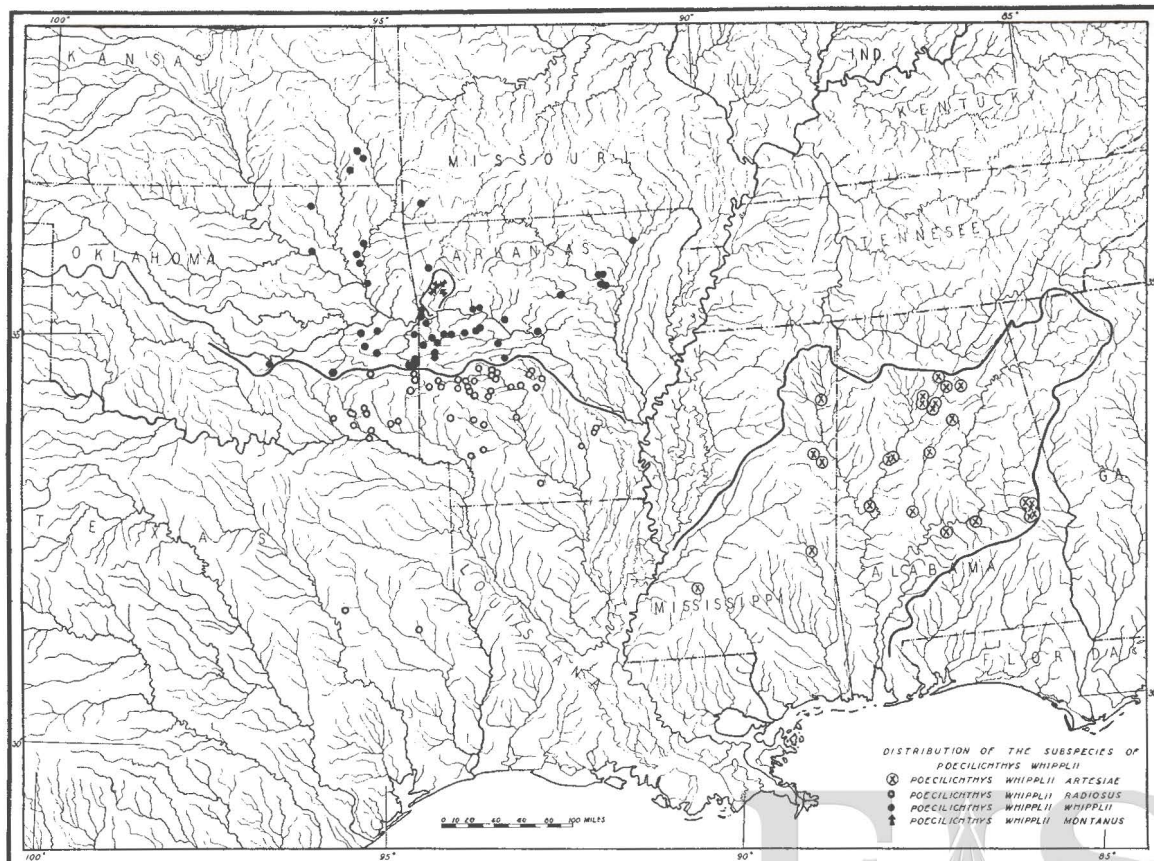
fore also regarded as a subspecies of *P. whipplii*. Were it not for the higher average number of dorsal soft-rays in the Red River form, it would not be practicable to distinguish *radiosus* from *artesiae*. We find no reason to maintain the nominal form *alabamae* as distinct from *P. w. artesiae*. With the exception of two new records (the Pascagoula River system near Enterprise, and a tributary of the Mississippi River near Hazelhurst, both in Mississippi) *artesiae* is known only from the drainage basin of the Alabama River.

The interesting distribution of the subspecies of *Poeciliichthys whipplii* is shown on Map 1. All available record stations are indicated, since almost all of the literature records have been confirmed by a re-examination of the original material. We have studied all specimens of the species in the United States National Museum (U.S.N.M.), the University of Michigan Museum of Zoology (U.M.M.Z.), the Museum of Comparative Zoology (M.C.Z.), and the Iowa State College (I.S.C.). For the privilege of so doing we are very grateful to the authorities of these institutions. We are also indebted to Professor Frank E. Guyton and Dr. Reeve M. Bailey, for making available most of the specimens of *P. w. artesiae* which we have examined. In addition, Professor Guyton took particular pains in preserving and promptly sending a high nuptial male, for a description of the life colors, and Dr. Bailey furnished one of two specimens of *P. w. radiosus* from Texas.

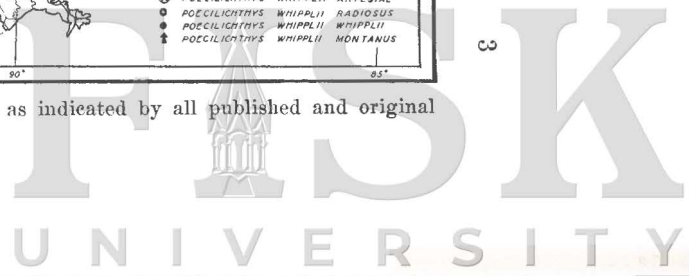
#### THE GENERIC REFERENCE

The vagueness and impracticability of the separation of *Poeciliichthys* into small genera is exemplified by the recent reference of the synonyms, *artesiae* and *alabamae*, to different genera (Jordan, Evermann, and Clark, 1930: 292). The status of *Poeciliichthys* is treated in another paper (Hubbs and Black, 1940).

The four forms here regarded as subspecies of *Poeciliichthys whipplii* agree with one another in essential respects and almost certainly comprise a single *Formenkreis*. The group as a whole differs from every other species of darter in some items of the following description.



MAP 1. Distribution of the subspecies of *Poeciliichthys whipplei*, as indicated by all published and original record stations.



COMMON CHARACTERS OF THE SUBSPECIES OF  
*Poeciliichthys whipplii*

The body is compressed and moderately slender (depth 4.4 to 6.2 in standard length). The parietal region of the cranium is strongly convex; the interorbital region is of moderate width. The rather sharply pointed snout measures 4.1 to 5.7 times in the slender head. Even when shortened the snout never has an abruptly decurved contour. The well-developed frenum shows no tendency toward obliteration when the mouth is tightly closed. The upper lip projects beyond the snout and slightly beyond the tip of the lower jaw (the mandible is more strongly included in *P. w. montanus* than in the other forms). The mouth is rather large (for a darter): the upper jaw extends to below the pupil. The gape is rather narrow and V-shaped as seen from below. The curved-conic teeth, forming rather broad villiform bands on the jaws, vomer, and palatines, are considerably enlarged only in the outer row of the premaxillary band. The gill-membranes are rather broadly united but retain a V-shaped outline. The distance from the union of the gill-membranes to the tip of the mandible measures 1.6 to 2.0 times in the head.

The genital papilla is typically a squarish flap, rarely subtriangular. It is usually about as broad as long (measured from the anus), but varies considerably in width. The posterior margin is rarely entire, usually with a median incision or emargination, sometimes with one to several flaps between creases on the surface of the papilla. In the adult female the papilla overlaps the front of the first anal ray. In the male it is similar but somewhat smaller. Radiating ridges (rarely papillae) occur about the anus.

The 8 pores of the lateral canal of the head are at the end of short branches extending downward and backward. The supratemporal commissure is complete; the median pore and the lateral pore are each at the end of a short tube. The interorbital pores are present. The anterior and posterior nasals lie a short distance anterior and mesial to the corresponding nostril. The coronal pore is at the end of a tube. The com-

plete infraorbital canal opens in 8, occasionally 9 pores (rarely 7 in *P. w. radiosus*), of which the second and third, rarely the second to fourth, lie near the edge of the suborbital; the following pores usually open at the end of short downward projecting tubes, though the fourth pore is often on the canal. There are 10 operculomandibular pores. (See Hubbs and Cannon, 1935: 10.)

The submedian and nearly straight lateral line is typically about three-fourths complete, leaving 2 to 21 unpored scales (occasionally none in *P. w. artesiæ*). The scales of the mid-ventral line are not modified. Except for a small temporal patch on each side, the top of the head is devoid of scales. The nape is usually but not always well covered with more or less embedded scales. The squamation of the sides of the head is highly variable: the opercles are usually well covered with scales which are commonly embedded (and rarely lacking in *P. w. radiosus*); the cheek scales are often absent, or developed only near the eye, and when present they are usually cycloid and embedded. The breast is scaleless. In size the body scales vary from moderate to small, numbering from 43 to 75 (Table I).<sup>1</sup>

Typically, the dorsal fins are neither markedly conjoined nor separated, and are neither low nor notably elevated. The dorsal rays number IX to XII, 11 to 16 (Table IV). In the breeding males the dorsal spines do not bear terminal knobs, and the soft rays are not exerted. The 2 (very rarely 3) anal spines are stiff and pungent. The soft portion of the anal, with 7 to 9 (very rarely 5 or 6) rays, is much smaller than the second dorsal. The anal fin is not greatly expanded and is not tuberculate in the breeding males. The caudal fin is truncate. The pelvics are closely approximated and short, usually extending not much more than halfway to the anal origin. The short and rounded pectoral extends only to above the end of the pelvic (with some variation).

The adults as a rule are irregularly spotted with red, and

<sup>1</sup> The scales in *artesiæ* vary from 43 to 58 according to the counts by Gilbert and Swain (in Gilbert, 1887: 62).

the high males are largely crimson. The color pattern of the body is rather vague and extremely variable, but neither bars nor stripes are ever very conspicuous. The black humeral mark is rather well developed. The sides of the head are typically punctulate and often mottled and are marked with a long, narrow subocular bar, a streak across the snout, a short dash behind the eye, and usually a similar short opercular dash on the same horizontal line. The entire length of the spinous dorsal is normally marked in both sexes by a submarginal red band with clear borders and by a dark margin. The second dorsal and caudal fins are similarly colored in the adult males, but in the females these fins are barred. On the second dorsal the bars are almost wholly confined to the membranes, but on the caudal the markings extend across the rays as well. Of the 3 dark spots in a vertical line on the caudal base, the uppermost is the least developed.

The forms of *Poecilichthys whipplii* are large (for darters). The maximum standard lengths of the specimens at hand are: *P. w. artesiaae*, 70 mm.; *P. w. radiosus*, 60 mm. (but commonly mature at a much smaller size); *P. w. whipplii*, 66 mm.; *P. w. montanus*, 75 mm.

#### COMPARISON OF SUBSPECIES

The main character by which *artesiaae* has been distinguished from *whiplii* is the size of the scales. The distinction does not hold as sharply as generally indicated, but is still of value. Each of the four subspecies has a distinctive average number of scales, and the difference between the extreme forms, *artesiaae* and *montanus*, is well marked (Table I). The two other subspecies bridge over the gap, though *radiosus* is close to *artesiaae* and typical *whiplii* is almost as extreme in the other direction as *montanus*. The differences, however, appear on statistical grounds to be reasonably reliable (Table VI). The counts for *montanus* are consistently high (Table I), and those for *whiplii* average less than 65 for all 16 localities for which there are more than 2 counts, with 1 exception: 5 counts for Lees Creek, Van Buren County, Arkansas, average 65.6 (it

is possible that this series should be referred to *montanus*). The difference between *radiosus* of the Red River drainage and *whipplei* of the Arkansas and White river drainages is rather sharp: on the sole basis of the scale counts as represented in Table I, 86 per cent of the specimens of the two forms, when examined in equal numbers, are identifiable if the break in the count is assumed to lie between 59 and 60. In the scale counts of *radiosus* there is some local variation, without any definite geographic trend.

The Red River form, *radiosus*, has only a slightly higher average number of scales than the Alabama River subspecies, *artesiaae*. Were it not for a higher average number of unpored scales in the lateral line series (Table III) and of dorsal soft rays (Table IV), it would not be feasible to separate *radiosus* from *artesiaae*, despite the fact that no representatives of the species are known from a rather wide band of intervening waters. On the bases of the available counts for these respective characters, 71 and 82 per cent of the specimens may be regarded as identifiable (in these computations the specimens of *artesiaae* from the Mississippi River system have been disregarded, though they are essentially typical). In the number of unpored scales and of soft dorsal rays *radiosus* agrees rather closely with the two other western subspecies. *P. w. radiosus* seems to be the smallest form.

The two subspecies of the Arkansas River basin, *P. w. whipplei* and *P. w. montanus*, would probably not have been separated on the sole basis of the average difference in number of scale rows. There are, however, a number of other average discrepancies. The difference in the scale counts appears much more definite when the numbers of pored scales are compared (Table II): on that basis 84 per cent of all specimens of the two forms when represented by equal numbers may be identified, if we assume that the pored scale count of *whipplei* should be 36 to 54, and that of *montanus*, 55 to 68. As a rule the eye is smaller and the snout longer in *montanus*, at comparable sizes (Table V). *P. w. montanus* seems to average somewhat larger and usually to have a slightly different

physiognomy: the snout is not only longer but is also somewhat more hooked downward, so that the mouth is more nearly horizontal, and the lower jaw is more definitely included.

1. *Poeciliichthys whipplii artesiae* Hay

Eastern Redfin Darter

*Poeciliichthys artesiae*.—Hay, 1881: 494, 515 (original description; tributary of Catawba River, Mississippi). Jordan and Gilbert, 1883: 516–17 (description; after Hay).

*Etheostoma artesiae*.—Jordan, 1885: 868. Jordan and Evermann, 1896: 1094 (description; range).

*Nivicola artesiae*.—Jordan, Evermann, and Clark, 1930: 292 (after Jordan and Evermann).

*Catonotus artesiae*.—Schrenkeisen, 1938: 232 (characters; Georgia to Texas).

*Etheostoma whipplei alabamiae*.—Gilbert and Swain, in Gilbert, 1887: 62 (diagnosis and comparisons; Black Warrior River, near Morris and Tuscaloosa, Alabama). Gilbert, 1891: 156–57 (records, Alabama).

*Etheostoma alabamiae*.—Jordan and Evermann, 1896: 1095 (description and comparisons; range).

*Claricola alabamiae*.—Jordan, Evermann, and Clark, 1930: 292 (range and synonymy, after Jordan and Evermann).

*Catonotus alabamiae*.—Schrenkeisen, 1938: 232 (characters).

*Etheostoma whipplii* (identification to species only).—Boulenger, 1895: 84–85 (description, synonymy, and range, in part).

In 20 specimens from 19 to 65 mm. in standard length the head enters the standard length 2.9 to 3.4 times; the depth, 4.4 to 5.5 times; the eye enters the head 3.8 to 5.8 times; the snout, 4.3 to 5.7 times. The distance from the union of the gill-membranes to the tip of the mandible measures 1.6 to 2.0 times in the head. The nape is usually completely covered with more or less embedded scales. The opercles are well scaled in nearly all specimens, and generally are not embedded. The cheeks vary from scaleless to about one-fourth covered with embedded scales.

When fresh in formaldehyde, a high male collected by F. E. Guyton at Auburn, Alabama, on April 18, showed the following colors: The background is pale yellowish above, whitish below, becoming blue-gray on the breast. The lower side of

the head is pale. The mid-sides are irregularly splashed with deep, brilliant red. The red spots composing the splashes decrease in size toward the back, becoming faint near the dorsal fin; on the lower side they become larger and are more joined in groups. Almost to the mid-line the sides of the abdomen are red; this color is strongest on the scale borders. There is a ring of gold around the pupil. Throughout its length the spinous dorsal bears an even, brilliant, deep red band, bounded with pale, and the fin is edged with dusky green (no doubt blue in life). There is a deep red spot near the base of each interspinous membrane. The soft dorsal has a submarginal, deep red band, with tongues extending basally on the membranes, just in advance of each ray, and breaking up ventrally into spots; there is a yellowish streak just beyond the red band and within the dark margin (blue in life). The caudal fin has a broad, submarginal band of deep red, separated from the dark margin by a yellowish streak; the red band sends streamers about one-third the distance to the base of the membranes. On the caudal base there is a band of orange blotches. Except for a wide margin of bright green (blue in life), the anal fin is a bright, deep red, becoming yellow only at the extreme base. The pectoral fin is pale lemon with some red on the rays. The pelvics are deep green (blue in life).

The range of *P. w. artesia*e is commonly given as "Georgia to Central Texas (Palestine)," following Jordan and Evermann (1896: 1094). The only Georgia record, however, is that of a specimen (M.C.Z. No. 24524) in the Museum of Comparative Zoology with no further data; it perhaps came from the Alabama River system in Georgia. The record from Palestine, Texas, is here referred to *P. w. radiosus*. The specimen (M.C.Z. No. 24563) from "an artesian well in Alabama," mentioned by Jordan and Evermann (1896: 1094), proves on re-examination to be referable to *P. parvipinnis* Gilbert and Swain (in Gilbert, 1887: 59-60), a valid species which was wrongly synonymized with *Etheostoma squamiceps* by Jordan and Evermann (1896: 1096).

2. *Poecilichthys whipplii radiosus*, new subspecies

## Southern Redfin Darter

(Pl. I, Fig. 1)

- Etheostoma whipplei* (identification to species only).—Jordan and Gilbert, 1886: 13 (color; "Washita" and Saline rivers, Arkansas). Gilbert, 1887: 61-62 (records only; "Saline River at Benton, and Washita River at Arkadelphia, Ark."); including supposedly aberrant specimen, with 48 lateral line scales). Jordan, 1888: 131-32 (range, in part). Meek, 1891: 139 (scales 50 to 60; Ouachita River, Arkansas); 1894a: 272 (records, in part); 1894b: 91, 93 (records, Arkansas). Jordan, 1899: 131-32, 357 (range, in part).
- Etheostoma whipplii*.—Boulenger, 1895: 84-85 (description, synonymy and range, in part). Meek, 1896: 343 (records, Red River system, Oklahoma and Texas). Jordan and Evermann, 1896: 1095-96 (range in part; including aberrant specimen, with 48 lateral line scales, from "Washita River at Arkadelphia, Arkansas"). Fowler, 1904: 248-49 (color note; Limestone Gap, Indian Territory). Cockerell, 1913: 156 (scale; "Kaimishi, I. T.").
- Poecilichthys whipplii*.—Cockerell, 1927: 18 (scale). Ortenburger and Hubbs, 1927: 136-37 (records, Oklahoma). Hubbs and Ortenburger, 1929: 104 (records, Oklahoma and Arkansas).
- Claricola whipplii*.—Jordan, 1929: 168 (range, in part). Jordan, Evermann, and Clark, 1930: 292 (range, in part).

The holotype, an adult male 50 mm. in standard length, was collected by John D. and Ruby Y. Black on June 19, 1938, in Sugar Loaf Creek, tributary of Caddo River, Ouachita River system, on U. S. highway 70, in Township 4 S., Range 22 W., Hot Spring County, Arkansas; U.M.M.Z. No. 123080. Numerous other specimens from the Red River drainage are designated as paratypes. The localities are indicated on Map 1.

The distinctive characters of this form, as contrasted with its near relatives *P. w. artesia* and *P. w. whipplii* are given on pp. 6-7 and in Tables I to V. In most respects *radiosus* agrees with the other subspecies of *P. whipplii*; the common characters of the species, as given on pp. 4-6, apply completely to this subspecies.

In 13 specimens from 22 to 60 mm. in standard length the head enters the standard length 2.9 to 3.5 times; the depth, 4.5 to 5.5 times; the eye enters the head 4.1 to 5.5 times; the

snout, 4.6 to 5.3 times. The distance from the union of the gill-membranes to the tip of the mandible measures 1.6 to 1.9, usually about 1.7 times in the head.

The nape is well covered with embedded scales, of which some are exposed in a few specimens. The cheeks and opercles vary from scaleless to well scaled. When the cheeks are well covered, the scales are embedded.

The color pattern of the body is extremely variable. In many specimens the bars are completely disrupted into mottlings. In others they are moderately sharp and either narrow and solid or broader and hollow-centered. Some have a row of small dusky or blackish blotches along the mid-line. These blotches are most distinct and most frequently developed in the upper tributaries of the Ouachita River, where the sides of the head are clearer than usual; but even here large series show the whole range of variation. Some examples are marked with narrow, moderately intense lengthwise stripes.

The life colors are probably similar to those of the other subspecies, but may also show local and individual variation (Jordan and Gilbert, 1886: 13). Fowler's description (1904: 248) is in the main correct, though his account of the fin colors is misleading, if not actually incorrect.

Contrary to the indication of Jordan and Gilbert (1886: 13), this form, like the other subspecies, develops red pigment in the adults. Specimens from Gulpha Creek, tributary to the Ouachita River, near Hot Springs, Arkansas, were described as follows from preserved specimens which still retained some of the life colors: The body is marked with small blackish flecks on a background of olive tan. Similar flecks are especially conspicuous on the otherwise immaculate lower side of the head and breast, and on the cheeks and pectoral base. Small red blotches, covering about 1 to 3 scales, occur both above and below the lateral line. Just below the lateral line a row of 10 to 12 black blotches forms an interrupted lateral band. The back is tessellated with similar blotches. On the lower side the blotches are more scattered and smaller, covering 1 to 3 scales. In both sexes the first dorsal is blue

on the basal two-thirds, then shows a narrow creamy-clear band, a stripe of red, another and stronger clear band, and a border of blue; the red and clear stripes fade out posteriorly in some fish. In males the soft dorsal is dusky (presumably blue in life) on the basal two-thirds, grading into orange, inside a sharp subterminal clear stripe and strong blue border. In females the second dorsal has the same general pattern, but is checkered with light and dusky, obscuring the striped pattern. The caudal in the males is clear, grading backward through pale orange into red, followed by a narrow clear band, a broad subterminal blue bar, and a narrow clear margin. In females the caudal is finely checkered with dark and light, with terminal bands as in the males. The anal is similar to the soft dorsal, but not checkered, and basally paler, and with the orange band much stronger and much wider, covering about one-half of the fin. The pectoral is faintly washed with orange and has minute dusky flecks along the edges of the rays. The pelvic shows no orange, but is dusky on the membranes.

In life a highly colored female from Wolf Creek at Delight, Arkansas, showed the following colors: Numerous light spots on the sides vary from lemon to red. There is a prominent wash of chestnut on each side of the belly. The orange bars between the dark blotches on the posterior part of the body do not encircle the caudal peduncle below. Longitudinal striping is rather conspicuous. In the spinous dorsal the spines are clear and the membranes bluish basally, then clear, then blue, then orange red in a prominent stripe widest posteriorly, then clear, and finally bordered with a band of slaty blue. The soft dorsal and caudal fins are checkered with black and reddish orange, with a bluish black terminal band. The anal is similar, but has the orange area more extensive and brighter, with a narrow bluish subterminal band within a clear margin. The pectoral, which is tinged with lemon, and the pelvic are flecked with black along the rays.

The holotype agrees in all respects with the description of the species. Its special features are as follows: Scales,

8—(40 + 15 = 55)—10. Opercles with a few scales; breast and cheeks scaleless; nape covered with embedded scales. Dorsal rays, XI, 14; anal rays, II, 8; branched caudal rays, 15; pectoral rays, 12–12.

Depth, 5.2. Greatest width, 1.5 into projection of greatest depth. Head length, 3.2. Least suborbital width, 14.0 in head. Least interorbital width, 2.7 in eye. Eye, 4.8 in head, 1.1 in snout. Snout, 4.6 in head. Upper jaw, 3.4 in head. Angle of muzzle (not including the truncated lips),  $57^\circ$ ; of mouth,  $37^\circ$  with the horizontal; of gill-membranes,  $52^\circ$ . Eye, 2.9 in distance from tip of mandible to union of gill-membranes; latter distance, 1.8 in head and 0.8 times interspace between union of membranes and insertion of pelvic fin. Highest dorsal spine, 2.7 in head, 2.6 in first dorsal base, and 1.4 in the highest dorsal soft ray, which enters the head 2.1 times and the second dorsal base 1.6 times. Length of caudal fin, 1.5 in head. Highest anal ray, 2.0 in head and 0.8 in the anal base, which enters the head 2.4 times, and the second dorsal base 1.8 times. Longest pectoral ray 1.3 in head; length of pelvic fin, 1.3. Interspace between pelvic fins, 2.0 in pelvic base.

The record of Palestine, Texas, first given by Jordan and Evermann (1896: 1094), was based on a specimen (U.S.N.M. No. 34712) of *P. whipplei radiosus* sent to the National Museum by E. L. Yoakum of that city, without a definite statement that it was caught in the vicinity of Palestine, Texas. It was probably obtained locally, and the record has recently been verified by the collection of another specimen in the Neches River system, 6.3 miles southeast of Nacogdoches, Texas. The Palestine specimen has the following characters: standard length, 54 mm.; eye in snout, 1.1; dorsal, XI, 13; anal, II, 8; scales,  $52 + 7 = 59$ . The one from near Nacogdoches has: standard length, 28 mm.; eye in snout, 1.0; dorsal, XI, 14; anal, II, 8; scales,  $45 + 12 = 57$  (the counts for this specimen are not included in Tables I–VI). The species *whipplei* is not listed by Evermann and Kendall (1894) in their review of the fishes of Texas, although Jordan and Gilbert gave the range of *Poecil-*

*ichthys punctulatus* (which name they wrongly used for *P. whipplii*) as "Missouri to Texas." Without doubt the Missouri record referred to true *punctulatus*. The reason for including Texas in the range was obviously the unpublished identification, as "*Etheostoma whipplei* (Texas variety)," of a specimen of *Poecilichthys jessiae* collected by Jordan and Gilbert in Sabine River at Longview, Texas (examined in the National Museum).

A highly successful darter with a wide range of habitat tolerance, this subspecies ascends headwaters even above the limit of *Semotilus* and *Campostoma* in the colder, more torrential streams of the Ouachita region, and at the same time is a common form in the muddy lowland bayous along with *Holepis* and *Gambusia*.

The name *radiosus* refers to the large number of soft dorsal rays.

### 3. *Poecilichthys whipplii whipplii* (Girard)

#### Western Redfin Darter

*Boleichthys whipplii*.—Girard, 1859: 103 (original description; "Coal creek, Arkansas" [= Coal Creek, a southern tributary of the Arkansas River in eastern Oklahoma]).

*Boleosoma whipplii*.—Vaillant, 1873: 96-97 (after Girard).

*Etheostoma whipplei*.—Jordan, 1885: 869 (compared with and removed from synonymy of *Poecilichthys punctulatus*). Jordan and Eigenmann, 1885: 71 (skeleton; pyloric caeca). Jordan and Gilbert, 1886: 9 (color; type examined; removed from synonymy of *P. punctulatus*). Gilbert, 1887: 61 (description; compared with *E. punctulatum*; Poteau River record only). Jordan, 1888: 131-32 (range, in part; description). Gilbert, 1889: 610 (tributary, Poteau River, Arkansas). Meek, 1891: 131 (North Fork, White River, south of Cabool, Missouri); 1894a: 272 (records, in part); 1894b: 80, 83, 86, 90, 91, 93, and 94 (records and distribution, Arkansas; McAlester, Oklahoma). Evermann and Kendall, 1895: 471 (description; Indian Creek, near Neosho, Missouri; Sallisaw River, at Mackey, Indian Territory). Jordan, 1899: 131-32, 357 (range, in part; description).

*Etheostoma whipplii*.—Boulenger, 1895: 84-85 (description, synonymy, and range, in part). Meek, 1896: 343 (records, Arkansas River system, Oklahoma and Arkansas). Jordan and Evermann, 1896:

1095-96 (synonymy, description, and range, in part). Fowler, 1904: 248-49 (color note; Hartford, Arkansas).

*Clariicola whiplii*.—Jordan, 1929: 168 (range, in part; description), Jordan, Evermann, and Clark, 1930: 292 (range, in part). Pratt, 1935: 127 (description; lower Arkansas basin).

*Catonotus whiplii*.—Schrenkeisen, 1938: 232 (description; lower Arkansas basin).

*Poecilichthys punctulatus* (erroneous synonymizing).—Jordan and Gilbert, 1883: 516 (range, in part; description).

In 17 specimens from 20 to 61 mm. in standard length the head enters the standard length 2.8 to 3.5 times; the depth, 4.7 to 6.2 times; the eye enters the head 4.4 to 6.0 times; the snout, 4.2 to 5.2 times. The distance from the union of the gill-membranes measures 1.6 to 1.9, usually about 1.8 times in the head. The nape consistently is completely scaled, but about half the scales are embedded. The scales on the cheeks and on the opercles vary from a few embedded ones to a complete set of exposed ones.

Observations on live and freshly preserved material show that the life colors of this subspecies are essentially like those described for *radiosus* and *montanus*. Pilsbry's notes on the life colors of this subspecies (Fowler, 1904: 249) are incorrect, since the fins of no form of *P. whiplii* are ever bordered with red, and since no specimen that we have examined shows "green spines and rays." The anal border is blue, not green.

Apparently this form is not so well adapted to the lowland habitat as is *P. w. radiosus*, but it is common in most small tributary creeks of the Arkansas River within its range and likewise ascends the headwaters into the smallest of mountain brooks.

#### 4. *Poecilichthys whiplii montanus*, new subspecies Mountain Redfin Darter

(Pl. I, Fig. 2)

The holotype is an adult male 75 mm. in standard length, collected by John D. Black and Jack Yerton on June 17, 1939, near the head of Blue Hole Creek, a tributary of Clear Creek, one mile south of Winslow, Washington County, Arkansas; U.M.M.Z. No. 127777.

There are 499 paratypes, as follows: 7 with the holotype; 227 from East Branch of Blue Hole Creek; 100 from the lower part of Blue Hole Creek; 107 from Railroad Creek just below the mouth of Blue Hole Creek; 53 from 1 mile below the junction of these streams; 4 from Schaberg Creek (of which Railroad Creek is the main tributary) at Schaberg, Crawford County; and 1 from Jones Fork of Clear Creek, near Winfrey, Crawford County. The other headwaters of Clear Creek have not been explored, nor have those of adjacent tributaries of the Arkansas River. Map 1 shows the location of these collections.

The principal characteristics by which *P. w. montanus* is separated from *P. w. whipplii*, its nearest relative, have been given on pp. 6-8, in Tables I-V, and on Plate I. The characters common to this and the other subspecies of *P. whipplii* are given on pp. 4-6. In 50 specimens from 22 to 75 mm. in standard length the head enters the standard length 3.2 to 3.6 times; the depth, 4.9 to 5.5 times; the eye enters the head 4.3 to 6.8 times; the snout, 4.1 to 5.1 times. The distance from the union of the gill-membranes to the tip of the mandible measures 1.7 to 2.0, usually 1.8 to 1.9 times in the head.

The nape is always well covered with small, embedded scales. The opercles vary from one-half to well scaled, and most of the scales are embedded. The invariably embedded cheek scales vary from a few to a complete investment and are often limited to two or three rows just back of the eye.

The color pattern of the body, as in the other subspecies of *P. whipplii*, is extremely variable. The remarks on this subject given above in the account of *P. w. radiosus* apply almost as well to *P. w. montanus*, except that the tendency toward the transformation of the main row of blotches into an interrupted lateral band, often evident in *radiosus*, is not seen in *montanus*. The principal patterns are (1) a rather uniform mottling, most characteristic of the larger individuals, and (2) a series of about 12 dark but hollow-centered crossbars, typical of the young. These bars tend to disappear in larger specimens, the transition from the barred to the mottled pattern progressing

from the head backward, with much variation in the rate and completeness of the change. The general ground color appears lighter than in any of the other subspecies; the dark mottlings tend to be brown rather than blackish, and the body is less intensely dusted with melanophores than in the other subspecies.

On the basis of a color photograph of the holotype, taken when captured, and of other color notes made on live and freshly preserved material, the life colors of the adult males of this form are described as follows: The general body color is mottled, as described above for adults. The brilliant crimson spots become more numerous posteriorly, to form irregular vertical bands, 2 to 4 scales wide, behind the origin of the soft dorsal fin. There are more red spots below than above the lateral line. A very high male is almost solid red along the sides. The abdomen and the lower side of the caudal peduncle appear to be suffused with orange-red, but this color is largely confined to the scale margins. The middle of the opercle, the top of the head, and the sides of the snout are bluish. The branchiostegals are margined with dusky blue, and there are blue specks on the breast. The spinous dorsal is marked with a row of irregular blocks of crimson, one at the base of each membrane; then a wide clear band; a strong band of crimson; a submarginal clear band; and a dusky blue marginal stripe. The soft dorsal is dusky cream, with 3 to 4 rows of crimson spots on the membranes, running into a band of crimson, bordered distally with a clear band and then margined by a narrow blue band. The caudal has a crimson basal bar, followed successively by a wide band of dusky cream, a wide crimson bar, and a narrow band of bright caerulean to royal blue. The anal is brilliant, opaque crimson on the basal three-fourths, and is bordered by blue (rarely by cream). The pectoral and pelvic rays are orange-red on their basal three-fourths; otherwise these fins are clear, save for minute dusky flecks along the edges of the rays. There is a faint dusky blue bar at the base of each pectoral and pelvic fin, visible only when the fish is dry.

The females have the soft dorsal and caudal checkered with red and dusky, as in the other subspecies. They show less red than the males (often none on the body), and the blue borders on the fins are faint or lacking.

The holotype agrees with the species description already given and has the following special features: Scales 11—(60 + 10 = 70)—13. Opercles with partially embedded scales on posterior half; cheeks with embedded scales anteriorly; nape well covered with embedded scales. Dorsal rays, XII, 14; anal rays, II, 9; branched caudal rays, 15; pectoral rays, 13–13.

Depth, 4.9. Greatest width, 1.6 into projection of greatest depth. Head length, 3.6. Least suborbital width, 14.0 in head. Least interorbital width, 1.9 in eye. Eye, 6.6 in head; 1.5 in snout. Snout, 4.6 in head. Upper jaw, 3.4 in head. Angle of muzzle, 68°; of mouth, 25° with the horizontal; of gill-membranes, 68°. Eye, 3.7 in distance from tip of mandible to union of gill-membranes; latter distance, 1.9 in head and 0.9 times interspace between union of membranes and insertion of pelvic fin. Highest dorsal spine, 2.5 in head, 3.2 in first dorsal base, and 1.4 in the highest dorsal soft ray, which enters the head 2.3 times and the second dorsal base 1.7 times. Length of caudal fin, 1.7 in head. Highest anal ray, 2.2 in head and 1.2 in the anal base, which enters the head 1.7 times, and the second dorsal base 1.5 times. Longest pectoral ray, 1.4 in head; length of pelvic fin, 1.6. Interspace between pelvic fins, 1.6 in pelvic base.

This subspecies is not unlike *P. w. whipplii* in its habitat preferences, except that it becomes relatively more abundant in headwater brooks. It is the only species of fish which penetrates to the extreme source of certain tributaries of Clear Creek. It is particularly abundant in small streams. In a single dip with a 3-foot seine, 26 adults were caught in a pool only 3 feet in diameter. The headwater brooks commonly inhabited by this darter dry up completely every few summers, but seem to be repopulated quickly by migrants from farther downstream, where the form is also common.

This subspecies is named *montanus* as it inhabits mountain streams.

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TABLE I  
LATERAL LINE SCALE COUNTS IN SUBSPECIES OF *Poeciliichthys whipplii*

Scales	<i>artesia</i> Alabama System*	<i>artesia</i> Miss. R. System	<i>radius</i> Total	<i>whiplii</i> Total	<i>montanus</i> Total	<i>montanus</i> Railroad Cr.	<i>montanus</i> Blue Hole Cr.	<i>montanus</i> Jones Cr.	<i>montanus</i> Schaberg Cr.
45	3	...	...	...	...	...	...	...	...
46	...	...	1	...	...	...	...	...	...
47	2	...	1	...	...	...	...	...	...
48	3	2	4	...	...	...	...	...	...
49	8	1	3	...	...	...	...	...	...
50	10	3	18	...	...	...	...	...	...
51	8	...	13	1	...	...	...	...	...
52	7	2	11	1	...	...	...	...	...
53	3	1	12	...	...	...	...	...	...
54	2	4	12	...	...	...	...	...	...
55	6	1	8	3	...	...	...	...	...
56	2	1	12	1	1	1	...	...	...
57	4	...	13	6	...	...	...	...	...
58	2	...	8	2	...	...	...	...	...
59	1	...	8	6	...	...	...	...	...
60	...	1	3	11	...	...	...	...	...
61	...	...	5	10	1	...	1	...	...
62	...	...	1	14	1	...	1	...	...
63	1	...	3	22	6	3	3	...	...
64	...	...	1	14	7	3	4	...	...
65	...	...	...	5	4	...	3	1	...
66	...	...	...	5	6	3	3	...	...
67	...	...	...	5	11	...	10	...	1
68	...	...	1	5	9	3	6	...	...
69	...	...	1	2	8	1	6	...	1
70	...	...	...	...	11	3	8	...	...
71	...	...	...	1	8	3	5	...	...
72	...	...	...	...	2	...	2	...	...
73	...	...	...	...	2	...	1	...	1
74	...	...	...	...	2	...	2	...	...
75	...	...	...	...	1	...	1	...	...
Number	62	16	139	114	80	20	56	1	3
Average	51.81	52.44	54.51	62.24	67.66	66.55	68.00	65.00	69.67
Standard error	± 0.46	.....	± 0.35	± 0.32	± 0.37	± 0.81	± 0.41	.....	.....

\* Including one specimen, from the Pascagoula River system, with 49 scales.

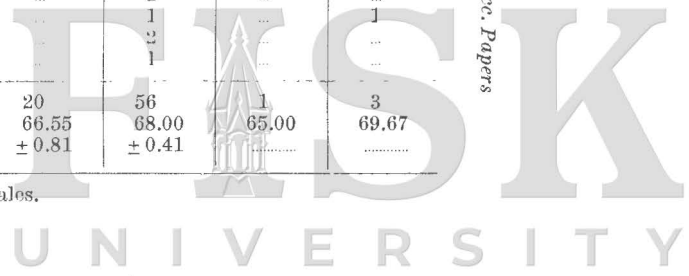


TABLE II  
 COUNTS OF PORED SCALES IN LATERAL LINE IN SUBSPECIES OF  
*Poecilichthys whipplei*

Pored Scales	<i>artesia</i> Alabama R. Sys- tem*	<i>artesia</i> Miss. R. System	<i>radiusus</i>	<i>whipplei</i>	<i>montanus</i>
30	.....	...	1	.....	.....
31	.....	...	.....	.....	.....
32	.....	...	.....	.....	.....
33	.....	...	2	.....	.....
34	1	...	1	.....	.....
35	.....	...	8	.....	.....
36	1	...	6	1	.....
37	.....	...	9	.....	.....
38	4	...	11	1	.....
39	14	.....	11	.....	.....
40	3	2	15	1	.....
41	8	3	11	3	.....
42	6	1	11	1	1
43	2	1	8	4	.....
44	4	3	7	5	.....
45	8	2	5	8	.....
46	4	2	5	7	2
47	3	2	5	4	.....
48	1	.....	1	8	.....
49	2	.....	5	8	1
50	.....	.....	.....	19	.....
51	.....	.....	2	9	1
52	.....	.....	2	5	4
53	1	.....	1	7	3
54	.....	.....	1	7	3
55	.....	.....	.....	2	7
56	.....	.....	.....	3	7
57	.....	.....	.....	6	10
58	.....	.....	.....	2	9
59	.....	.....	.....	.....	8
60	.....	.....	.....	1	4
61	.....	.....	.....	.....	3
62	.....	.....	.....	.....	1
63	.....	.....	.....	.....	5
64	.....	.....	.....	.....	5
65	.....	.....	.....	.....	2
66	.....	.....	.....	.....	3
67	.....	.....	.....	.....	.....
68	.....	.....	.....	.....	1
Number .....	62	16	128	112	80
Average .....	42.16	43.50	41.15	49.38	57.75
Standard error ...	± 0.45	.....	± 0.40	± 0.43	± 0.53

\* Including one specimen, from the Pascagoula River system, with 39 pored scales.

TABLE III  
 COUNTS OF UNPORED SCALES IN THE LATERAL LINE SERIES IN  
 SUBSPECIES OF *Poeciliichthys whippilii*

Unpored Scales	<i>artesia</i> Alabama R. Sys- tem*	<i>artesia</i> Miss. R. System	<i>radius</i>	<i>whippilii</i>	<i>montanus</i>
0 .....	2	...	.....	.....	.....
1 .....	.....	.....	.....	.....	.....
2 .....	.....	.....	.....	.....	1
3 .....	2	.....	.....	.....	1
4 .....	.....	.....	.....	.....	.....
5 .....	1	1	2	.....	3
6 .....	4	.....	.....	6	3
7 .....	6	4	3	4	11
8 .....	11	1	2	8	8
9 .....	4	3	9	3	12
10 .....	7	5	9	8	11
11 .....	6	.....	10	12	9
12 .....	6	1	14	6	7
13 .....	5	1	16	13	3
14 .....	3	.....	17	20	4
15 .....	.....	.....	15	7	4
16 .....	3	.....	16	7	.....
17 .....	2	.....	10	7	1
18 .....	.....	.....	.....	6	1
19 .....	.....	.....	2	2	.....
20 .....	.....	.....	2	2	.....
21 .....	.....	.....	1	1	1
22 .....	.....	.....	1	.....	.....
Number .....	62	16	129	112	80
Average .....	9.65	8.94	13.29	12.78	9.89
Standard error ...	± 0.46	.....	± 0.29	± 0.34	± 0.39

\* Including one specimen, from the Pascagoula River system, with 10 unpored scales.

TABLE IV  
FIN-RAY COUNTS IN SUBSPECIES OF *Poeciliichthys whipplei*

	<i>artesia</i> Alabama R. Sys- tem*	<i>artesia</i> Miss. R. System	<i>radiosus</i>	<i>whipplei</i>	<i>montanus</i>
Dorsal spines					
9 .....	1	.....	.....	.....	.....
10 .....	27	.....	20	9	5
11 .....	31	16	46	35	33
12 .....	3	.....	6	17	12
Number .....	62	16	72	61	50
Average .....	10.58	11.00	10.81	11.13	11.14
Standard error	± 0.08	.....	± 0.07	± 0.08	± 0.08
Dorsal soft rays					
11 .....	3	.....	.....	.....	.....
12 .....	31	9	4	.....	.....
13 .....	24	7	18	24	14
14 .....	1	.....	38	33	27
15 .....	.....	.....	4	5	8
16 .....	.....	.....	1	.....	1
Number .....	59	16	65	62	50
Average .....	12.39	12.44	13.69	13.69	13.92
Standard error	± 0.08	.....	± 0.09	± 0.08	± 0.10
Anal spines					
2 .....	49	16	68	60	50
3 .....	.....	.....	.....	1	.....
Anal soft rays					
5 .....	.....	.....	1	.....	.....
6 .....	1	.....	1	.....	.....
7 .....	28	11	35	14	7
8 .....	29	5	29	43	38
9 .....	4	.....	2	4	5
Number .....	62	16	68	61	50
Average .....	7.58	7.31	7.44	7.84	7.96
Standard error	± 0.08	.....	± 0.08	± 0.07	± 0.07

\* Including one specimen, from the Pascagoula River system, with XI, 13 dorsal rays and II, 9 anal rays.

TABLE V  
MEASUREMENTS OF EYE INTO SNOUT IN SUBSPECIES OF  
*Poeciliichthys whippelii*

Size Group	<i>artesia</i> Alabama R. Sys- tem*	<i>artesia</i> Miss. R. System	<i>radius</i>	<i>whippelii</i>	<i>montanus</i>
19 to 29 mm.					
0.7 .....	5	...	4	2	...
0.8 .....	10	1	4	4	...
0.9 .....	5	...	8	1	...
1.0 .....	2	...	2	.....	2
1.1 .....	.....	.....	.....	.....	1
30 to 39 mm.					
0.8 .....	1	1	2	.....	.....
0.9 .....	7	4	3	.....	.....
1.0 .....	17	6	5	8	1
1.1 .....	3	.....	3	3	5
1.2 .....	.....	.....	.....	1	1
1.3 .....	.....	.....	.....	.....	2
1.4 .....	.....	.....	.....	.....	.....
1.5 .....	.....	.....	.....	.....	1
40 to 49 mm.					
0.9 .....	1	.....	3	1	.....
1.0 .....	12	1	7	10	.....
1.1 .....	.....	1	2	11	3
1.2 .....	9	.....	.....	9	5
1.3 .....	.....	.....	.....	2	8
1.4 .....	.....	.....	.....	1	3
1.5 .....	.....	.....	.....	.....	1
50 to 59 mm.					
1.0 .....	1	.....	.....	.....	.....
1.1 .....	7	.....	1	1	.....
1.2 .....	.....	.....	.....	3	3
1.3 .....	3	.....	.....	2	1
1.4 .....	.....	.....	.....	.....	4
1.5 .....	.....	.....	.....	.....	3
60 to 74 mm.					
1.0 .....	.....	.....	.....	1	.....
1.1 .....	1	.....	1	.....	.....
1.2 .....	.....	.....	.....	.....	.....
1.3 .....	1	.....	.....	.....	.....
1.4 .....	.....	.....	.....	.....	2
1.5 .....	.....	.....	.....	.....	4

\* Including one specimen, from the Pascagoula River system, 58 mm. long, with eye 1.3 in snout.

TABLE VI

DIFFERENCES BETWEEN MEANS FOR SCALE AND FIN-RAY COUNTS OF THE FOUR SUBSPECIES OF *Poecilichthys whipplii*, COMPARED WITH THE STANDARD ERROR OF THE DIFFERENCES

In these computations we have used the formulas stated by Hubbs and Kuhne (1937: 7).

	<i>artesiae*</i> and <i>radiosus</i>	<i>artesiae*</i> and <i>whiplii</i>	<i>artesiae*</i> and <i>montanus</i>	<i>radiosus</i> and <i>whiplii</i>	<i>radiosus</i> and <i>montanus</i>	<i>whiplii</i> and <i>montanus</i>
Lateral line scales						
$\Delta$	2.70	10.43	15.85	7.73	13.15	5.42
$SE_{\Delta}$	0.58	0.56	0.59	0.47	0.50	0.49
$\Delta \div SE_{\Delta}$	4.7	18.6	26.9	16.4	26.3	11.1
Pored scales						
$\Delta$	1.01	7.22	15.59	8.23	16.60	8.37
$SE_{\Delta}$	0.60	0.62	0.70	0.59	0.66	0.68
$\Delta \div SE_{\Delta}$	1.7	11.6	22.3	13.9	25.2	12.3
Unpored scales						
$\Delta$	3.64	3.13	0.24	0.51	3.40	2.89
$SE_{\Delta}$	0.54	0.57	0.60	0.45	0.49	0.52
$\Delta \div SE_{\Delta}$	6.7	5.5	0.4	1.1	6.9	5.6
Dorsal spines						
$\Delta$	0.23	0.55	0.56	0.32	0.33	0.01
$SE_{\Delta}$	0.11	0.11	0.11	0.11	0.11	0.11
$\Delta \div SE_{\Delta}$	2.1	5.0	5.1	2.9	3.0	0.1
Dorsal soft rays						
$\Delta$	1.30	1.30	1.53	0.00	0.23	0.23
$SE_{\Delta}$	0.12	0.11	0.13	0.12	0.13	0.13
$\Delta \div SE_{\Delta}$	10.8	11.8	11.8	0.0	1.8	1.8
Anal soft rays						
$\Delta$	0.14	0.26	0.38	0.40	0.52	0.12
$SE_{\Delta}$	0.11	0.11	0.11	0.11	0.11	0.10
$\Delta \div SE_{\Delta}$	1.3	2.4	3.5	3.6	4.7	1.2

\* The data for *P. w. artesiae* apply only to the specimens from the Alabama River system plus one from the Pascagoula River system.

*Carl L. Hubbs and John D. Black*

PLATE I

Subspecies of *Poeciliichthys whipplii*

FIG. 1. *Poeciliichthys whipplii radiosus*.

From the holotype, an adult male 50 mm. in standard length, from Sugar Loaf Creek, Hot Spring County, Arkansas.

FIG. 2. *Poeciliichthys whipplii montanus*.

From the holotype, an adult male 75 mm. in standard length, from Blue Hole Creek, Washington County, Arkansas.



FIG. 1



FIG. 2

Reprinted from COPEIA, 1940, No. 4, December 27

## Status of the Catostomid Fish, *Carpiodes carpio* *elongatus* Meek

By CARL L. HUBBS and JOHN D. BLACK

IN the course of our respective researches on the fishes of northeastern Mexico and of Arkansas, we have had occasion to investigate the status of the southwestern representative of the carp-sucker, *Carpiodes carpio* (Rafinesque). During the preparation of the paper we have examined all of the specimens of this species in the University of Michigan Museum of Zoology (U.M.M.Z.) and some critical material in the United States National Museum (U.S.N.M.). Earlier the senior author studied pertinent material in the Museum of Comparative Zoology and Field Museum of Natural History. Our thanks are due the authorities of these institutions.

It is concluded that *Carpiodes carpio* is represented in the Río Grande system, and in other Gulf tributaries from the Río Soto la Marina in northeastern Mexico northeastward through Texas, and probably to the lower Mississippi, by a form which seems to be only subspecifically differentiated. This subspecies is here designated *Carpiodes carpio elongatus* Meek, the slender carpsucker. The wide-spread northern and western form, which may be called the common carp-sucker, will therefore take the name *Carpiodes carpio carpio* (Rafinesque).

The status and distinctive characters of *Carpiodes carpio* proper have been satisfactorily treated by Forbes and Richardson (1909 and 1920: 75-77, Fig. 17) and Hubbs (1930: 14-15), and need not be reviewed. The published treatments of the southwestern form, however, are replete with confusion, as indicated in the following synonymy.

### *Carpiodes carpio elongatus* Meek

- Carpiodes tumidus* (misidentification).—Jordan, 1878: 405 (in part; *C. grayi* confounded).
- Carpiodes velifer tumidus*.—Evermann and Kendall, 1894: 77, 80, 82, 85, 89, 91, 97 (in part; *C. grayi* confused; Cope's San Ildefonso specimens of "*C. grayi*," collected between 1871 to 1874, wrongly stated to be the types of *C. grayi* Cope, 1870: 482-483, and 1877: 482-483, with supplementary "Notes to Second Edition"; Río Lampasas at Belton and Río Colorado at Austin, Texas).
- Carpiodes cyprinus* (misidentification).—Jordan, 1878: 666 (in part; *C. grayi* confounded).
- Carpiodes grayi* (presumed misidentification, since the original *C. grayi* appears to be a synonym of *C. carpio carpio*).—Cope, in Cope and Yarrow, 1875: 681 (San Ildefonso, on Río Grande, New Mexico). Fowler, 1904: 242-243 (Del Río, Texas).
- Ichtiobus velifer* (misidentification).—Jordan and Gilbert, 1886: 18, 20 (characters; Río Lampasas at Belton and Río Colorado at Austin, Texas).
- Ichtiobus carpio* (misidentification as to subspecies).—Jordan and Gilbert, 1886: 20 (characters; Río Colorado at Austin, Texas).
- Carpiodes carpio*.—Evermann and Kendall, 1894: 80, 82, 91, 97 (Río Colorado at Austin and Long Lake near Magnolia Point, Texas).

*Carpiodes elongatus*.—Meek, 1904: xxxi, xxxiv–xxxv, 26, 28–29, fig. 5 (original description; San Juan, Montemorelos, Linares, and La Cruz, Mexico). Fowler, 1913: 47 (reidentification of specimens from Del Rio Texas, previously reported as *C. grayi*).

*Ictiobus elongatus*.—Regan, 1907: 144 (characters; range).

*Carpiodes microstomus*.—Meek, 1904: xxxi, 26–28, fig. 4 (original description; Santa Rosalia and Jimenez, Mexico).

*Ictiobus microstomus*.—Regan, 1907: 144 (characters; range).

As indicated above in the synonymy, this *Carpiodes* has been confused with *Carpiodes tumidus* Girard, which, as stated by Hubbs (1930: 12–13), is a synonym of *Ictiobus bubalus*. It will be shown by Hubbs and Gordon that the Mexican specimens reported by several authors as *Carpiodes* or *Ictiobus tumidus* are also referable to *Ictiobus*.

Two available names, *Carpiodes elongatus* and *C. microstomus*, have been applied to this form. An examination of type specimens of these nominal species (Table 1) fails to verify the alleged distinctions in depth of body and length of head, pointed out by Meek (1904: 26), or to indicate other characters by which two forms might be distinguished. The specimens from Santa Rosalia have the head a little more tumid and wider and the eye slightly smaller than in the other types, but the systematic significance of this difference is very doubtful. We regard *C. elongatus* and *C. microstomus* as synonymous, and since the names are of identical date, select one name (*elongatus*) as the valid appellation for the combined unit.

TABLE 1  
CHARACTERS TAKEN FROM TYPES OF *Carpiodes elongatus* AND *C. microstomus*

Nominal species	Type	Locality	Head	Depth	Inter-orbital	Dorsal rays	Scales
<i>C. elongatus</i> . . . .	Holotype	Linares	4.15	3.3	2.5	24	35
<i>C. elongatus</i> . . . .	Paratype	Linares	3.95	3.1	2.5	25	37
<i>C. elongatus</i> . . . .	Paratype	Linares	3.95	3.0	2.4	25	35
<i>C. elongatus</i> . . . .	Paratype	San Juan	4.0	3.0	2.4	22	37
<i>C. microstomus</i> . . .	Paratype	Sta. Rosalia	4.15	3.3	2.3	24	37
<i>C. microstomus</i> . . .	Paratype	Sta. Rosalia	4.15	3.0	2.3	24	37

Meek's type figure of *Carpiodes elongatus* is a fairly good representation of this sucker, but his illustration for *C. microstomus* is very poor.

As in *Carpiodes carpio carpio* the mouth of *C. c. elongatus* is usually located far backward, so that more than half its length lies behind the vertical from the internarial flap. The opercle is strongly striate. The scales are not very closely imbricated. The body is slender. The sharp but low anterior lobe of the dorsal fin is much shorter than the dorsal base. These resemblances are fundamental ones in the taxonomy of *Carpiodes*.

The southwestern form differs rather consistently from typical *carpio* in the following respects: The semitubercular process at the tip of the lower jaw, moderately diagnostic of northern *carpio*, is lacking or weakly developed. The gape tends to be more semi-circular, less four-sided. Typically the anterior part of the back is more arched. The cross-hatching

that outlines the scale pockets is usually more conspicuous, providing a means for the identification of most adult specimens. Perhaps the most striking and certainly the most easily measured differences involve the depth of the body, the length of the caudal peduncle and the length of the dorsal base. *C. c. elongatus* is the more attenuate, especially toward the caudal fin, and the dorsal fin on the average is shorter. The length of the dorsal base when projected forward usually falls far back of the eye in *elongatus* but reaches almost to or even beyond the back edge of the eye in *C. c. carpio*. However, the individual variation in this measurement is so great that no statistical analysis is attempted.

The differences in the form of the body and in the length of the dorsal fin are well indicated by two ratios: the distance between the end of the dorsal base and the middle of the caudal base, measured into the basal length of the dorsal fin (Table 2A); and the length of the dorsal base, stepped into the standard length (Table 2B). Except for certain small groups purposefully kept separate, the overlap in the measurements of Table 2 is due much more to individual than to regional variation. Although referable to *C. c. carpio* the fish from the Arkansas and Red rivers seem to approach *C. c. elongatus*, not only in the ratios given in Table 2 but also in other characters. Similarly the material of *elongatus* from the coastal streams of Texas appears to grade toward typical *carpio*. Complete intergradation will probably be demonstrated when adequate material is available from Louisiana and the adjacent parts of the bordering states.

Two cotypes (U.S.N.M. 178) of *Carpionodes damalis* Girard, from Milk River, Montana, are included among the specimens of *Carpionodes c. carpio* measured for Table 2. In these types the distance between the dorsal and caudal bases enters the dorsal base 2.5 times, and the dorsal base measures 2.3 to 2.4 times in the standard length.

*Carpionodes carpio elongatus* is probably wide-spread through the Soto la Marina, San Fernando, San Juan, and Sabinas river systems of north-eastern Mexico (as will be shown in a forthcoming report by Carl L. Hubbs and Myron Gordon). It proves to be common in the coastal streams of Texas as well as in the Río Grande system of Texas and New Mexico. The northernmost records are for 2 half-grown (U.M.M.Z. 66183) collected by T. D. A. Cockerell at Hondo in the Pecos River system of New Mexico, and for 2 young (U.M.M.Z. 109496) seined by Joseph R. Bailey in the Mississippi River near the Louisiana-Arkansas state line (some doubt pertains to the identification of these young specimens and hence to the inclusion of the lower Mississippi in the range of *elongatus*). Measurements for these 2 series are given separately in Table 2.

In the fish collection of the University of Michigan there are many specimens of *Carpionodes carpio elongatus* from several stream systems in Texas and from the Río Grande and its tributaries in New Mexico. Some of these were collected by R. T. Richey in Little Brazos River 10 miles west of Bryan, and in a borrow pit 4 miles west of Bryan, Texas. Kelshaw Bonham and students recently collected specimens in Eagle Lake, Colorado County, and in Clear Creek, a tributary of Navasota River east of Kurten, Texas. Others were seined by Carl L. Hubbs and family in the following streams in Texas: South Bosque River 10 miles south-

TABLE 2  
 PROPORTIONATE MEASUREMENTS IN *Carpiodes carpio*  
 A.—Distance between End of Dorsal Base and Middle of Caudal Base, Measured into Basal Length of Dorsal Fin

	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	No.	Ave.
<i>Carpiodes carpio carpio</i>																					
Tennessee and Ohio river systems.....									2			4	1		2	1	1	1		12	2.41
Missouri River system.....										2	5	12	4	3	3	3	2	1	1	36	2.43
Mississippi River and minor tributaries, northern Arkansas to Wisconsin.....						1	1			1	3	5	8	6	2	2	4	1	2	36	2.46
Arkansas and Red river systems.....						1	8	4	6	9	12	15	11	8	7	3	3			87	2.26
<i>Carpiodes carpio elongatus</i>																					
Mississippi River, near Arkansas-Louisiana line.....						2														2	1.70
Coastal streams of Texas.....						4	10		3											17	1.81
Tributaries of Rio Grande, Texas.....	1	1	14	10	10	3	2													41	1.41
Pecos River system, New Mexico.....								2												2	1.90
Rio Grande and tributaries, New Mexico.....				2	8	5														15	1.62
Rio Salado, near Músquiz, Mexico.....					1															1	1.60
Totals: <i>Carpiodes c. carpio</i> .....						2	9	4	8	12	20	36	24	17	14	9	10	3	3	171	2.35
<i>Carpiodes c. elongatus</i> .....	1	1	14	12	19	14	12	2	3											78	1.61

B.—Length of Dorsal Base, Stepped into the Standard Length

	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	No.	Ave.
<i>Carpiodes carpio carpio</i>															
Tennessee and Ohio river systems.....		1	3	4	1	1	2							12	2.63
Missouri River system.....	1	9	14	7	2	2		1						36	2.53
Mississippi River and minor tributaries, northern Arkansas to Wisconsin.....		2	14	8	9	3								36	2.49
Arkansas and Red river systems.....		10	17	28	25	3	3	1						87	2.61
<i>Carpiodes carpio elongatus</i>															
Mississippi River, near Arkansas-Louisiana line.....								2						2	3.00
Coastal streams of Texas.....				1	3	5	6	1	1					17	2.83
Tributaries of Rio Grande, Texas.....					1	1	8	11	2	6	8	3	1	41	3.10
Pecos River system, New Mexico.....						1	1							2	2.75
Rio Grande and tributaries, New Mexico.....					1			5	1	2	4	1	1	15	3.15
Rio Salado, near Músquiz, Mexico.....					1									1	2.70
Totals: <i>Carpiodes c. carpio</i> .....	3	34	42	48	31	6	5	2						171	2.57
<i>Carpiodes c. elongatus</i> .....				1	7	7	14	19	4	8	12	4	2	78	3.04



west of Waco, Hog Creek west and south of Waco, Waco Creek on Baylor University campus at Waco, Pinto Creek west of Brackettville, and Devil River on U. S. Highway 90 in Val Verde County. Two young (only 15 and 16 mm. in standard length), showing to exaggeration the slender form, short head, snubby snout, and small eye of *elongatus*, were taken by E. P. Creaser and Myron Gordon in Arroyo Chacón at Laredo, Texas. Numerous large to small young were obtained by Leo T. Murray of Baylor University in Tornillo and Terlingua creeks, Brewster County, Texas. Still other examples are at hand, from Río Grande near Las Cruces, and from a borrow pit near this river, 2 miles south of Alameda, both in New Mexico. Samples of almost all of these series were measured for Table 2.

## SUMMARY

*Carpiodes elongatus* and *C. microstomus* Meek are synonymized. *Carpiodes carpio elongatus* is the southwestern representative of *C. c. carpio*. It ranges from northeastern México through the Río Grande system of New Mexico and Texas to the coastal streams of eastern Texas, probably to the lower Mississippi River.

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PERCID FISHES RELATED TO *POECILICHTHYS*  
*VARIATUS*, WITH DESCRIPTIONS OF  
THREE NEW FORMS

BY CARL L. HUBBS AND JOHN D. BLACK

IN 1931 J. Clark Salyer, II, secured for the University of Michigan Museum of Zoology two immature darters from the Big Niangua River, near Buffalo, Missouri. These were tentatively referred to *Poecilichthys variatus* by Hubbs and Trautman (1932: 33), but now, after having been carefully compared with more abundant material, seem to represent a distinct and hitherto unnamed form, herein called *P. tetrazonus*. Later, 1 young and 1 adult of the same species, from the Gasconade River system in Missouri, were found in the United States National Museum.

During the summer of 1938, in the course of field work leading to a general survey of Arkansas fishes, the junior author and Mrs. Black obtained in the White River system several specimens of another new darter closely related to *Poecilichthys variatus*. It differs from that species in several respects, and on available evidence appears to be specifically distinct. It is herein named *Poecilichthys euzonus euzonus*.

At the same time A. Hugh Denney, while collecting fishes in connection with a fish-management project of the United States Forest Service in southeastern Missouri, in another section of the White River system, seined several specimens of a very

similar darter, which we regard as subspecifically distinct from the Arkansas form. It is designated *Poecilichthys euzonus erizonus*.

Specimens which may be regarded as *Poecilichthys euzonus euzonus*, approaching *P. euzonus erizonus*, were located in the National Museum. They came from Black and Spring rivers at Black Rock and from the White River at Batesville, Arkansas. These darters, as well as 2 examples of *P. tetrazonus* mentioned above, were incorrectly referred by Meek to *Etheostoma uranidea* Jordan and Gilbert (in Gilbert, 1887: 48-49). The true *Imostoma uranidea* (Jordan and Gilbert), although often showing a color pattern much like that of *Poecilichthys variatus*, is a very different species. After comparing the types and other material, we regard *Etheostoma (Hadrop-terus) ouachitae* Jordan and Gilbert (in Gilbert, 1887: 49-50) as a synonym of *Imostoma uranidea*.

We are much indebted to Alexander Wetmore and Leonard P. Schultz for the privilege of examining and reporting on specimens in the United States National Museum.

The material of these 3 new forms, together with additional specimens of 3 related species already named, enables us to present this review of the *Poecilichthys variatus* group, in which we include:

1. *Poecilichthys osburni* Hubbs and Trautman, 1932
2. *Poecilichthys tetrazonus*, new species
3. *Poecilichthys variatus* (Kirtland, 1838)
4. *Poecilichthys euzonus*, new species
  - 4a. *Poecilichthys euzonus erizonus*, new subspecies
  - 4b. *Poecilichthys euzonus euzonus*, new subspecies
5. *Poecilichthys blennius* (Gilbert and Swain, 1887)

The 5 species of the *Poecilichthys variatus* group, as here defined, may be recognized by the 4 conspicuous dark crossbars (5 in *P. osburni*), laid down over a pale and more or less uniform ground color above the lateral line. Other common characters—each shared, however, with some other species of the genus—are given as item 1a in the key.

It has just been discovered that 1 other species of *Poecilichthys* bears the 4 or 5 conspicuous oblique saddles characteristic of the *P. variatus* group. As Reeve M. Bailey has pointed out to us, the species described by Radcliffe and Welch (1913: 31-32, Pl. 18) as *Hadropterus sellaris* is not referable to *Hadropterus*, for it lacks all traces of the enlarged, spiny scales along the mid-ventral line, even between the pelvic fins where a very spiny plate is always evident in *Hadropterus* and other genera defined on this squamational character. *Poecilichthys sellaris*, known only from the two types collected in Swan Creek near Havre de Grace, Maryland, close to the head of Chesapeake Bay, may well bear no immediate relationship with the species of the Mississippi Valley having similar coloration. That the agreement in color pattern may have resulted from parallel evolution seems more plausible when we recall that very similar markings are developed in certain totally unrelated fishes of the riffles, for example in species of *Hypentelium* and *Cottus*. *P. sellaris* differs trenchantly from the species of the *P. variatus* group, including *P. blennius*, in the V-shaped border of the gill-membranes and in the scaleless belly. The distinctive genital papilla of the adult male of *P. sellaris* is a subspherical process, preceded and partly covered by a complex flap consisting of a subtriangular shelf, on either side of which there is a large flat lobe turned under and back at the outer side to produce a small, thickened flap which is nearly hidden in ventral aspect. Other characters suggest relationship with *P. variatus*: (1) the saddles rival those of *P. blennius* in boldness and are similarly set off by light borders; (2) the anal fin is almost as expansive as the second dorsal; (3) the pelvics are separated by an interspace about two-thirds as wide as the base of either fin.

Some doubt is involved in the reference of *Poecilichthys blennius* to the *P. variatus* group. As indicated in the key, it is sharply set off from the 4 other species, which seem to constitute a well-circumscribed *Formenkreis*. No other characters than those of coloration seem to align *P. blennius* definitively with this group.

Generic or subgeneric classification among the darters is extraordinarily difficult. The only respect in which this group of species provides an exception to the statement arises from the circumstance that *variatus* is the genotype of *Poeciliichthys* Agassiz (1854: 304–6).<sup>1</sup> Consequently, *variatus* and its immediate relatives will remain in *Poeciliichthys*, whether or not that genus is disrupted. We see no valid occasion for either the subgeneric or generic separation of any of the 4 other species here treated. Jordan and Evermann (1896: 1067) referred *Etheostoma variatum* to the subgenus *Poeciliichthys* and *E. blennius* to *Nanostoma*, but the criteria used by these authors to distinguish the 2 subgenera (“anal fin nearly as large as soft dorsal,” instead of much smaller; “spinous dorsal with about 13 spines,” rather than 9 to 12) fail completely, in the light of the data presented in this paper. Nor is there anything distinctive in the supplementary characters assigned to *Poeciliichthys* (“head almost naked; fins very large; colors brilliant”). We therefore interpret *Nanostoma* as subgenerically synonymous with *Poeciliichthys*. There is certainly no trace of justification for the generic separation of *Nanostoma* from *Poeciliichthys*, as advised by Jordan (1916: 26) and as recently practiced by Jordan (1929: 163), and by Jordan, Evermann, and Clark (1930: 289).

The same authors—Jordan (1929: 157), Jordan, Evermann, and Clark (1930: 287)—and some others following their lead, have referred *Poeciliichthys blennius* to the genus *Ulocentra*. It is possible that this reference has a natural basis, since *blennius* does strongly resemble the species of *Ulocentra*. It has, however, a definite though narrow frenum, and is therefore retained by us in *Poeciliichthys*.

Since all 5 species under discussion seem referable to *Poeciliichthys* in subgeneric as well as generic sense, there is no present reason for considering here whether *Poeciliichthys* should be divided into subgenera or into genera. The consid-

<sup>1</sup> On the use of this name for all or part of the group called *Etheostoma* by Jordan and Evermann (1896: 1066–99), see Jordan (1916: 25) and Hubbs (1926: 63).

erable diversity in the species here treated, in the degree of union of the gill-membranes, lessens the taxonomic significance of this rather intangible character, which, with the equally tenuous character of the completeness of the lateral line, has been used in the primary division of the whole group.

In the species group as here established, the lateral-line system of the head (Hubbs and Cannon, 1935: 10-11, Pl. 2) is remarkably uniform. The lateral canal of the head gives off 5 pores, each of which, except the hindmost, opens at the end of a narrow tube directed, and commonly curved, downward and slightly backward. The supratemporal commissure is complete, with the median pore at the end of a short, backward-extending canal. The lateral pore on either side lies directly on the canal. In some individuals a small sense organ, superficially resembling a pore, is developed on either side of the supratemporal canal, between the lateral pore and the median line. The interorbital pores are present, as is the coronal, which terminates a backward-extending tube. The two nasals are widely separated, for the anterior one lies slightly in advance of the anterior nostril, whereas the posterior one is near the posterior nostril. The infraorbital canal is complete with 8 pores, but presents a peculiarity: although each of the 4 posterior pores lies at the end of a downward-projecting tube, the posteriormost or fourth of the anterior set is frequently, in some forms almost invariably, at the end of a short tube which extends upward to near the eye. In *P. blennioides* and *P. tetrazonus*, however, this pore typically opens out directly on the canal, or even at the end of ventral tubes (see descriptions of these species). There is some variation in this character, even on the two sides of an individual. The operculomandibular series comprises 10 pores, of which those on the opercle open at the end of short, downward-projecting tubes.

Due to the previous association of *P. blennioides* with the subgenus or genus *Nanostoma*, a check was made on the pores of the head in the various species referred to that group. *P. swannanoa* alone showed the upward-projecting fourth pore, and only as a variation from the more usual condition, in

which the pore lies below or on the canal. In *P. zonalis zonalis*, *P. zonalis arcansanus*, *P. lynceus* (= *P. elegans*), and *P. rupestris*, this pore opens on the lower side of the canal, as in most other darters, with a complete canal, which we have examined.

ANALYSIS OF THE SPECIES AND SUBSPECIES OF THE  
*POECILICHTHYS VARIATUS* GROUP

- 1a (common characters).—Lateral line complete (occasionally with 1 or 2 pores missing). Gill-membranes more or less broadly connected. Form robust. Dorsal rays XI to XIV (X to XII in *P. tetrazonus*)—11 to 16; anal with 2 stiff spines and 8 to 11, commonly 9 or 10, soft rays. *Body above lateral line crossed by 4 conspicuous dark bars (5 in P. osburni), on a pale and more or less uniform ground color.*
- 2a.—Snout more or less produced (angle of muzzle 44° to 70°). Gill-membranes moderately to rather broadly connected, forming an angle of 50° to 90°. Scales 6 to 9—50 to 73—7 to 11 (5 or 6—47 to 54—7 or 8 in *P. tetrazonus*). Soft rays 12 to 15 in dorsal fin, 9 to 11 in anal, and 14 to 16 in pectoral. Least bony interorbital width 2.2 to 3.8 in eye. Least suborbital width 5.8 to 12.0 in head. Upper jaw 3.3 to 3.7 in head (3.5 to 4.0 in *P. euzonus erizonus*). Highest dorsal spine 2.2 to 2.8 in head; longest pectoral ray 0.8 to 1.2; length of pelvic fin 1.0 to 1.5. Dorsal saddles not set off by a light posterior border. Lateral blotches not fused into a zigzag line.
- 3a.—Five blackish saddles. Head 3.6 to 4.0. Eye 1.3 to 2.0 in snout, 4.4 to 5.6 in head. Snout 2.8 to 3.4. Least suborbital width 5.8 to 7.3.
- 4a.—Scales 7 to 9—59 to 69 (53 to 57 in a variant form)—8 to 11. Dorsal spines 11 to 14. Saddles and lateral markings fairly well developed in young, becoming obsolescent in adult females but intensified in breeding males; lateral blotches in adults forming 9 to 11 rather regular bars, almost encircling body posteriorly; 11 or 12 orange bars in breeding males. Body moderately compressed (width 1.5 in projection of depth). Least bony interorbital width 2.3 to 2.5 in eye. Vertical soft fins high (highest dorsal ray 1.4 to 1.7, and highest anal ray 1.7 to 1.8 in head). Interspace between pelvic fin and union of gill-membranes 1.2 to 1.4 in distance thence to tip of mandible. Breast scaleless (rarely with a few scales near pelvic fins); angle between supra-temporal and lateral head canals and the opercle and cheeks

scaless. *Upper Kanawha River system, Virginia and West Virginia:*

1. *P. osburni*

3b.—Four blackish saddles. Head 3.3 to 3.7. Eye 0.8 to 1.5 in snout, 3.7 to 4.7 in head. Snout 3.0 to 4.3. Least suborbital width 6.5 to 12.0 (usually more than 7.2).

4b.—Scales 5 or 6—47 to 51—7 or 8 (4 specimens known). Dorsal spines 10 to 12. Saddles and lateral markings moderately prominent; lateral blotches in adults forming about 10 rather regular bars on lower part of body, with weak extensions dorsally. Body moderately compressed (greatest width 1.4 to 1.7 in projection of depth). Least bony interorbital width 2.2 to 3.0 in eye. Vertical soft fins little elevated (highest dorsal ray 1.8 to 2.1, and highest anal ray 2.0 to 2.3, in head). Interspace between pelvic fin and union of gill-membranes 1.5 to 1.6 in distance thence to tip of mandible. Breast more or less scaled; angle between supratemporal and lateral head canals scaled or scaless; opercle with 1 to 6 scales; cheeks with none. *Big Niangua and Gasconade River systems (Missouri River drainage basin), Missouri:*

2. *P. tetrazonus*

4c.—Scales 6 or 7—50 to 58—7 to 9. Dorsal spines 11 to 13, most frequently 13. Saddles and lateral bars very distinct in young, but becoming obscure in adults, particularly in breeding males; lateral blotches 9 to 11, not forming regular bars, those in the breeding males indistinct and not forming orange bars; the orange bars therefore few (5 or 6). Body more compressed (width 1.5 to 1.7 in projection of depth). Least interorbital width 2.5 to 2.7 in eye. Vertical soft fins high (highest dorsal ray 1.4 to 1.9, and highest anal ray 1.6 to 2.0, in head). Interspace between pelvic fin and union of gill-membranes 1.5 to 1.7 in distance thence to tip of mandible. Breast almost always scaless, except near pelvic fins; angle between supratemporal and lateral head canals scaless, or with 1 to 3 embedded scales; opercle ordinarily without scales, rarely with a few; cheeks always naked. *Ohio River drainage basin in New York, Pennsylvania, West Virginia, Ohio, Indiana, and Kentucky, exclusive of the Upper Kanawha, Wabash, Kentucky, and Tennessee River systems:*<sup>2</sup>

3. *P. variatus*

<sup>2</sup> A single record for the Cumberland River system, in Tennessee, has been doubted (Hubbs and Trautman, 1932: 33).

4d.—Scales 7 to 9—57 to 73—8 to 11 (6—54—9 in 1 specimen from Spring River with unusually large anterior scales). Dorsal spines 12 to 14, most frequently 13. Saddles and lateral markings very prominent in both sexes, at all ages and seasons. Body more terete (greatest width 1.2 to 1.5 in projection of depth). Least bony interorbital width 3.0 to 3.8 in eye (2.6 to 3.3 in young and half-grown specimens from Black Rock and Batesville, Arkansas). Vertical soft fins little elevated (highest dorsal ray 1.8 to 2.5, and highest anal ray 1.8 to 2.4, in head). Interspace between pelvic fin and union of gill-membranes 1.2 to 1.6 in distance thence to tip of mandible. Breast more or less completely scaled (with rare exceptions); angle between supratemporal and lateral head canals with a patch of ctenoid scales; cheeks with or without scales. *White River system in Missouri and Arkansas:*

4. *P. euzonus*

5a.—Cheeks with several ctenoid scales (wholly lacking in 1 of 18 specimens, and limited to 1 or 2 on each cheek in another); breast always well scaled, and the posterior scales usually somewhat ctenoid; opercle covered with ctenoid scales. Scales above lateral line 7, rarely 8. Lateral blotches 8 to 10, usually 8 or 9, less definitely connected with the saddles, more triangular, and becoming more disrupted with age; saddles in adult also less regular and straight-edged; light areas considerably tessellated with dark in adult; stippling of anterior lower surfaces restricted to the cheeks (usually leaving below the eye a clear patch transversed by a faint subocular bar) and to mottlings on the chin. Gill-membranes usually more broadly connected, forming an angle of 52° to 81° (typically 65° to 75° in adults). Snout more constricted and produced (angle of muzzle 40° to 50°), 3.0 to 3.5 in head. Eye smaller, 1.3 to 1.5 in snout, and 3.7 to 4.7, usually 4.0 to 4.5, in head. Highest dorsal ray 1.8 to 2.1 in head. Head 3.4 to 3.7, usually 3.5 to 3.6. *Current River (White River system), southeastern Missouri:*

4a. *P. euzonus erizonus*

5b.—Cheeks scaleless; breast scaleless anteriorly, with embedded scales posteriorly (wholly scaleless in 1 of 9 specimens); opercle not quite fully scaled. Scales above lateral line 8, rarely 9. Lateral blotches 5 to 8, usually 7 or 8, more definitely connected with the saddles, mostly squarish (somewhat triangular in young), and little disrupted with

age; saddles in adult also more regular and straight-edged; light areas scarcely tessellated with dark in adult; stippling of anterior lower surfaces densely extended over cheeks, throat, branchiostegal membranes, and fore part of breast (less developed in young, but always better developed at comparable sizes). Gill-membranes usually less broadly connected, forming an angle of  $50^{\circ}$  to  $62^{\circ}$ . Snout heavier and more declivous (angle of muzzle  $44^{\circ}$  to  $57^{\circ}$ ), 3.3 to 4.0 in head. Eye larger, 0.9 to 1.2, usually 1.1 to 1.2, in snout, and 3.7 to 3.9 in head. Highest dorsal ray 2.0 to 2.3 in head. Head 3.0 to 3.4. *White River system, in typical form above Batesville, Arkansas:*

4b. *P. euzonus euzonus*

2b.—Snout more declivous (angle of muzzle  $69^{\circ}$  to  $75^{\circ}$ ). Gill-membranes very broadly connected, forming an angle of  $89^{\circ}$  to  $110^{\circ}$ . Scales 4 or 5—42 to 45—6 or 7. Soft rays 11 to 13 in dorsal fin, 8 or 9 in anal, and 16 or 17 in pectoral. Least bony interorbital width 1.8 to 2.0 in eye. Least suborbital width 4.8 to 6.8 in head. Upper jaw 3.7 to 4.2 in head. Highest dorsal spine 1.9 to 2.0 in head; longest pectoral ray 0.7 to 0.8; length of pelvic fin 0.9 to 1.0. Dorsal saddles set off by a creamy white posterior border. Lateral blotches fused into a zigzag line.

3c.—Four green-black saddles. Head 3.6 to 4.0. Eye 1.2 to 1.8 in snout, 4.0 to 4.9 in head. Snout 2.7 to 3.4. *Tennessee River system, in Alabama and Tennessee:*

5. *P. blennioides*

EXPLANATION OF MEASUREMENTS AND COUNTS.—The measurements of the head include the opercular membrane. The eye (rather than the orbit) is measured between the margins of the cornea on the longest dimension. Scales above the lateral line are counted from the origin of the dorsal fin downward and backward to the lateral line, beginning with the one beside the first dorsal spine and ending with the scale row above the lateral line. Scales below the lateral line are enumerated diagonally upward and forward from beside the first anal spine to the lateral line, again excluding the lateral-line scale row, but including the very small row of scales often present next to the anal fin. The lateral-line count begins with the last scale which is in contact with the shoulder girdle and ends at the structural base of the caudal fin. The last ray of the

dorsal and anal fins is always counted as a divided ray—a criterion at times requiring careful examination.

1. *Poeciliichthys osburni* Hubbs and Trautman

*Poeciliichthys osburni*.—Hubbs and Trautman, 1932: 31–38, Figs. 1–2 (original description; records). Morgan, 1937: 150 (no air bladder).

This well-marked, isolated species shows direct relationship only with *P. variatus*. Its distinguishing characters are indicated in the original account, and as items 1*a*, 2*a*, 3*a*, and 4*a* of our key. The material in the University of Michigan Museum of Zoology has been examined. Some collections have been received since the type description was published. All are from the Kanawha (New) River system above Kanawha Falls. Series from the Kanawha system below these falls prove referable to *P. variatus*. Since certain errors in the original description have been discovered, we give here the counts and measurements of the holotype, and, in parentheses, of 6 adult paratypes.

Scales 8—64—9 (7 to 9—59 to 66—9 or 10). Dorsal rays XIII–13 (XII to XIII–13 to 15); anal rays, II, 9 (II, 9 or 10, usually 10); pectoral rays 15–15 (14 to 15, generally 15). Lateral markings 11 (9 to 11), not counting the blotch at the caudal base nor the continuation of the nuchal saddle. These markings form more definite bars than do those in other species. The posterior bars in the adult male almost encircle the body.

Depth 5.0 (4.8 to 5.4). Greatest width 1.5 (1.5) in projection of greatest depth. Head length 3.9 (3.6 to 3.9). Least suborbital width 6.5 (5.8 to 7.3) in head. Least interorbital width 2.3 (2.3 to 2.5) in eye. Eye 5.5 (4.8 to 5.6) in head; 1.8 (1.5 to 2.0) in snout. Snout 3.2 (2.8 to 3.4) in head. Upper jaw 3.6 (3.3 to 3.6). Angle of muzzle 55° (49° to 58°); of gill-membranes 61° (61° to 78°). Eye 2.7 (2.4 to 2.8) in distance from tip of mandible to union of gill-membranes; latter distance 1.8 (1.7 to 2.0) in head, and 1.2 (1.1 to 1.4) times interspace between union of membranes and insertion of pelvic fin. Highest dorsal spine 2.2 (2.2 to 2.5) in head,

2.5 (2.2 to 2.9) in first dorsal base, and 1.4 (1.4 to 1.5) in the highest dorsal soft ray, which enters the head 1.4 (1.4 to 1.7) times and the second dorsal base 1.1 (1.1 to 1.2) times. Length of caudal fin 1.5 (1.4 to 1.5) in head. Highest anal ray 1.7 (1.7 to 1.8) in head, and 1.2 (0.8 to 1.2) in the anal base, which enters the head 1.7 (1.5 to 2.3) times and the second dorsal base 1.3 (1.3 to 1.4) times. Longest pectoral ray 0.9 (0.8 to 1.0) in head; length of pelvic fin 1.2 (1.2 to 1.3). Interspace between pelvic fins 1.6 (1.4 to 1.7) in pelvic base.

In the original description a large-scaled variant of this form was mentioned. Three similar specimens, in the National Museum, were collected by Leonard P. Schultz and Earl D. Reid in Crooked Creek, 4 miles east of Galax, Virginia, July 13, 1938. They show the following characters: Scales 7—53—9 (1) or 10 (2); dorsal, XI (1) or XIII (2), 12 (1) or 13 (2); depth 5.1 to 5.6; eye 1.3 in snout, 4.4 to 5.2 in head; head 3.8 to 4.0; dorsal saddles 5; male with numerous light bars.

## 2. *Poecilichthys tetrazonus*, new species

(Pl. I, Fig. 1)

*Etheostoma uranidea* (misidentification).—Meek, 1891: 123 (Gasconade River at Arlington, and Little Piney River at Newburg, Missouri).  
*Poecilichthys variatus* (misidentification).—Hubbs and Trautman, 1932: 33 (Missouri record only).

The holotype, University of Michigan Museum of Zoology No. 111330, is a half-grown specimen 33 mm. in standard length. It was seined in Big Niangua River, at mouth of Greasy Creek, 6 miles southeast of Buffalo, Dallas County, Missouri, by J. Clark Salyer, II, on August 28, 1931. One paratype, a young fish 22 mm. long, was taken with the holotype.

The two type specimens of this species were recorded by Hubbs and Trautman as *Poecilichthys variatus*, but on more detailed study appear to represent a distinct species. The two darters from the Gasconade River system of Missouri, referred by Meek to *Etheostoma uranidea*, seem to represent the same form. The contrasting characters of *P. variatus* and *P. tetra-*

*zonus* are given as items 4*b* and 4*c* in our key. When compared with the two subspecies of *P. euzonus*, *P. tetrazonus* is seen to differ sharply in the size of the scales and in numerous other characters, as stated in items 4*b* and 4*d* of the key. The available evidence indicates the full specific separation of *tetrazonus* from *variatus* and *euzonus*, but the relationships between these forms seem rather close. Further material may indicate subspecific intergradation.

In the following description the counts and measurements are given first for the holotype, followed, in parentheses, by determinations for (1) the paratype; (2) the young specimen, 28 mm. long, from Gasconade River; and (3) the adult, 57 mm. long, from Little Piney River.

Scales 5—51—7 (5—47—7; 6—52—8; 6—54—8). Breast with several ctenoid scales (with several cycloid scales in paratype; posterior half of breast well covered with ctenoid scales and anterior half with some embedded scales, in the 2 other specimens). Angle between supratemporal and lateral head canals with 1 large, ctenoid scale on one side but none on the other side (with none on either side in paratype; with several large ctenoid scales in the other specimens). Opercle of each side with 1 large ctenoid scale in the holotype (with a few ctenoid scales in the 3 others). Cheeks scaleless (in all specimens).

Dorsal rays XII—14 (X—14; XII—13; XII—13); anal rays II, 9 (II, 10; II, 9; II, 10); pectoral rays 15—15 (14—15; 14—?; 15—16). The dorsal fins are well separated.

The canals and pores of the head correspond with the description given on p. 5. The posteriormost of the anterior group of 4 infraorbital pores opens directly from the canal at its upper edge on one side and at its lower edge on the other side (at mid-line of canal on both sides; on lower edge of canal; at ends of short, downward-projecting tubes).

The body is shaped about as in specimens of like size of *P. variatus*; depth 5.3 (5.1; 4.6; 4.8). The body is moderately compressed; width 1.6 (1.4; 1.7; 1.7) in projection of depth.

The head is rather large, 3.3 (3.3; 3.7; 3.7) in standard length. Least suborbital width 9.6 (9.0; 10.0; 8.0) in head. Least interorbital width 3.0 (3.0; 2.5; 2.2) in eye. The eye is rather large: 4.2 (4.2; 4.5; 4.7) in head, 1.3 (1.0; 1.1; 1.5) in snout. The snout is rather short, 3.8 (4.2; 4.3; 3.6) in head, but rather pointed: angle of muzzle  $55^\circ$  ( $52^\circ$ ;  $51^\circ$ ;  $57^\circ$ ). Upper jaw 3.6 (3.5; 3.7; 3.6) in head. Angle of gill-membranes  $66^\circ$  ( $55^\circ$ ;  $74^\circ$ ;  $77^\circ$ ). Eye 2.4 (2.7; 2.5; 2.7) in distance from tip of mandible to union of gill-membranes; latter distance 1.6 (1.6; 1.6; 1.7) in head, and 1.6 (1.5; 1.4; 1.3) times interspace between union of gill-membranes and insertion of pelvic fin. Highest dorsal spine 2.7 (2.4; 2.3; 2.4) in head, 2.4 (2.0; 2.4; 2.8) in first dorsal base, and 1.3 (1.3; 1.3; 1.4) in the highest dorsal soft ray, which enters the head 2.1 (2.0; 1.8; 1.9) times and the second dorsal base 1.4 (1.4; 1.3; 1.4) times. Length of caudal fin 1.3 ( — ; 1.5; 1.4) in head. Highest anal ray 2.3 (2.0; 2.0; 2.0) in head, and 1.0 (1.0; 1.0; 0.9) in the anal base, which enters the head 2.3 (2.0; 2.0; 1.8) times and the second dorsal base 1.4 (1.4; 1.3; 1.3) times. Longest pectoral ray 1.0 (0.9; 1.0; 1.0) in head; length of pelvic fin 1.4 (1.5; 1.2; 1.3). Interspace between pelvic fins 2.0 (1.5; 1.6; 1.5) in pelvic base.

The coloration of the holotype is as follows: The back is crossed by 4 regular dark saddles, about as in the related species. These crossbars are less blackened than in *P. euzonus*. As in *P. euzonus erizonus*, the anteriormost saddle is expanded backward to include the extreme front of the dorsal fin. This band splits at the pectoral insertion to form 2 narrow lines, 1 on either side of the fin (the anterior fork is under the gill-cover). The second and third saddles, descending from the rear of the spinous and soft dorsal fins, respectively, fail by 1 scale row to reach the lateral line. The fourth saddle, on the caudal peduncle, is continued to near the mid-ventral line. In addition there is a faint spot at the base of the caudal fin. There are about 9 lateral blotches (10 in the paratype). Of these the first 2 are rectangular, the others more or less triangular. The general ground color of the upper surfaces in alco-

hol is olivaceous tan, lighter than in *P. euzonus* because the melanophores on the scales are less dense. The bars radiating from the eye (1 downward and forward, 1 downward, and 1 backward) are short. The opercle and the angle of the preopercle are stippled, and there are melanophores near the radiating bars and at the tip of the chin. Otherwise, the lower sides of the head are nearly clear of pigment.

The young paratype, perhaps largely on account of its size, is unusually pale, resembling *Boleosoma*.

The Gasconade River specimen is colored much like the holotype, though the second and third bars show a tendency, with bilateral variation, to connect with lateral bars. The basal caudal spot is conspicuous. There are 10 lateral blotches, mostly squarish. The scale centers tend to be lighter, the crosshatching more conspicuous. A dusky blotch on the upper anterior sides represents a trace of the second saddle of *Poecilichthys osburni*.

The single adult specimen (from Little Piney River) approaches *P. osburni* in that the lateral blotches, 9 on one side and 10 on the other, form rather definite bars on the lower sides, with weak extensions above the lateral line. There is no definite trace of the second saddle of *P. osburni*. The first saddle is truncated at the base of the first dorsal spine. There are faint connections between the second and third dark saddles and the lateral blotches below them. The basal caudal spot is inconspicuous. The cheeks and the lower side of the head are evenly and densely stippled.

The name *tetrazonus*, derived from *τετράς*, four, and *ζώνη*, zone, refers to the 4 prominent dark saddles characteristic of this and related species.

### 3. *Poecilichthys variatus* (Kirtland)

(Pl. II, Fig. 1)

*Etheostoma variata*.—Kirtland, 1838: 168 and 192 (virtual *nomen nudum*; Mahoning River, Ohio; Cuyahoga River record probably based on *P. caeruleus*); 1841: 274-76, Pl. 2, Fig. 2 (original description; Mahoning River).

*Etheostomata variatum*.—Agassiz, 1850: 299 (type of genus *Poecilo-*

*soma*); 1854: 306 (type of *Poecilichthys*). Jordan and Eigenmann, 1885: 71 (skeleton). Woolman, 1892: 280, 286 (Kentucky records; characters). Boulenger, 1895: 81 (synonymy; description; Big Creek, Hyden, Kentucky). Jordan and Evermann, 1896: 1069-70 (description; range; synonymy).

*Hadropterus variatus*.—Putnam, 1863: 4 (synonymy). Jordan, 1885: 163-65 (rediscovery; synonymy; description).

*Poecilichthys variatus*.—Fowler, 1919: 70 (Pennsylvania records). Fowler and Carlson, 1927: 72 (color; Pennsylvania records). Jordan, 1929: 163 (description; range, Arkansas excepted). Jordan, Evermann, and Clark, 1930: 289 (range; synonymy). Hubbs and Trautman, 1932: 31-38, Fig. 1 (records and comparisons; Arkansas and Missouri records excepted). Morgan, 1937: 150 (no air bladder). Greeley, 1938: 72 (New York records). Fowler, 1938: 106 (Pennsylvania records).

*Ethcostoma notatum*.—Agassiz, 1850: 299 (*nomen nudum*). Putnam, 1863: 4 (in synonymy of *H. variatus*).

?*Hadropterus tessellatus*.—Jordan, 1877: 7 (original description; synonymy excepted; Foxburg, Pennsylvania).

As Jordan (1885: 163) noted, the name *variatum* was transferred by himself and others for a time to *Poecilichthys caeruleus*. Vaillant (1873: 84-87) used the name *Boleosoma variatum*, and Jordan and Gilbert (1883: 503) that of *Alvordius variatus*, in describing species of *Hadropterus*.

This species, as here delimited, has been characterized by the authors cited in the synonymy. In our analysis of the species, it is compared in detail with the other forms of the group now recognized. Items 1*a*, 2*a*, 3*b*, and 4*c* of the key constitute a description. Additional characters are given below. The determinations were mostly made on 7 Ohio specimens 31 to 73 mm. in standard length.

Dorsal rays XI to XIII-12 to 16; anal rays II, 9 or 10, usually 9; pectoral rays 14 to 16, usually 15. Lateral markings 9 to 11.

Depth 4.6 to 5.4. Head length 3.5 to 3.7. Least suborbital width 8.0 to 9.5 in head. Eye 3.8 to 4.0 in head, 0.8 to 1.0 in snout. Snout 3.3 to 4.0 in head. Upper jaw 3.4 to 3.7. Angle of muzzle 55° to 70°; of gill-membranes 61° to 90°, increasing with age. Eye 2.2 to 2.5 in distance from tip of mandible to union of gill-membranes; latter distance 1.5 to 1.7 in head.

Highest dorsal spine 2.4 to 2.6 in head, 2.2 to 2.5 in first dorsal base, and 1.3 to 1.7 in highest dorsal soft ray, which enters the second dorsal base 1.0 to 1.4 times. Length of caudal fin 1.4 to 1.5. Highest anal ray 0.9 to 1.0, usually 1.0, in the anal base, which enters the head 1.6 to 2.0 times and the second dorsal base 1.3 to 1.4 times. Longest pectoral ray 0.8 to 0.9 in head; length of pelvic fin 1.1 to 1.3. Interspace between pelvic fins 1.5 to 2.0, usually 1.5, in pelvic base.

#### 4. *Poecilichthys euzonus*, new species

This species is characterized by the very decided contrast between the dorsal saddles and the ground color; the smaller fins, as compared with those of *P. variatus* and *P. osburni*; and the more cylindrical body (the body form, especially in *P. euzonus erizonus*, approaches that of *Hadropterus*). The scales, about as in typical *P. osburni*, are somewhat smaller than in *variatus*. From *osburni*, the new species differs in the size of the fins, the general body shape, the number of bands, other features of coloration, and in various other characters. The squamation of the head and breast, too, separates this species distinctly from others of the group, though there is considerable difference in this respect between the 2 subspecies of *P. euzonus*. The details of the specific description are presented in the accounts of the 2 subspecies. Common specific characters are stated as items 1a, 2a, 3b, and 4d.

*Poecilichthys euzonus*, as here constituted, is a complex of 2 rather distinct subspecies, which are contrasted in items 5a and 5b of the key (p. 8). *P. e. euzonus* occurs in the White River system of Arkansas, above Batesville, and *P. e. erizonus* in the Current River of Missouri, which is also in the White River system.

Specimens from Spring River and Black River, at Black Rock, and from White River at Batesville, Arkansas, misidentified as *Etheostoma uranidea* by Meek (1894a: 268; and 1894b: 80), appear more like typical *P. euzonus*, but approach *erizonus* in distribution and in some characters. The Spring River specimens have been referred to *Poecilichthys variatus* by

Hubbs and Ortenburger (1929: 48) and by Hubbs and Trautman (1932: 33). It is possible that these fish should be interpreted as intergrades, but their small size and long preservation preclude a precise subspecific determination. In the Spring and White River series the breast is rather more scaled than in typical *euzonus*, but less so than in *erizonus*, and the cheeks bear no scales except for a few in 1 specimen from Spring River. The individual from Black River has the breast densely scaled and the cheeks about as well scaled as in *erizonus*. In general physiognomy all 3 lots are more like *euzonus* than *erizonus*. The saddles are more like those of *euzonus*; the lateral blotches, rather intermediate. In counts and measurements (Table I) the resemblances are diverse. As would be expected, the specimens from White River at Batesville seem somewhat closer to *euzonus* than do those from Black Rock.

4a. *Poecilichthys euzonus erizonus*, new subspecies

(Pl. I, Fig. 2)

The holotype, University of Michigan Museum of Zoology No. 124597, is an adult male 66 mm. in standard length. It was collected by A. Hugh Denney on August 10, 1938, in Current River, at "The Nook," T. 23 N., R. 2 E., Sec. 9, Ripley County, Missouri. The paratypes were all collected by Denney in Current River in Missouri: 5 with the holotype; 8 from near the Carter County Hunting and Fishing Club, T. 26 N., R. 1 E., Sec. 11 and 12, Carter County, July 25, 1938; 2 from the Doniphan Boat Landing, T. 23 N., R. 2 E., Sec. 27, Ripley County, July 26, 1938; 2 from the river just above the mouth of Pike Creek, T. 27 N., R. 1 W., Sec. 23, Carter County, August 18, 1938. The 18 available specimens of this form range in size from 34 to 70 mm.; 15 are 58 to 70 mm. long.

The diagnostic characters are given as items 1a, 2a, 3b, 4d, and 5a in the key. Probably the most obvious difference between this subspecies and typical *euzonus* is the more extensive squamation of the breast and the scaled cheeks. The blotches on the side and the scale rows above the lateral line each aver-

TABLE I

COUNTS AND MEASUREMENTS OF *POECILICHTHYS EUZONUS*

Extreme counts and measurements, representing only 1 or 2 specimens, are indicated in parentheses for some of the items.

	<i>P. e. erizonus</i>		<i>P. e. euzonus</i> approaching <i>erizonus</i>			<i>P. e. euzonus</i>	
	Holotype	Paratypes	Black River	Spring River	White River	Paratypes	Holotype
Number of specimens .....	1	17	1	12	8	8	1
Standard length (in mm.)	66	34-70	30.5	28.5-38.5	36-45	28-49	60.5
Scales above lateral line...	7	7-8	7	(6)7-8	8-9	8(9)	8
Scales in lateral line .....	67	62-68(73)	62	(54)60-66	57-65	63-67	65
Scales below lateral line...	9	9-11	9	(8)9-10	10-11	9-10	9
Dorsal spines .....	13	(12)13(14)	13	(12)13	12-13	13(14)	13
Dorsal soft rays .....	14	14-15	14	14(15)	13-14	(13)14	14
Anal rays .....	10	(9)10-11	10	10(11)	9-11	(9)10	10
Pectoral rays .....	16-16	(14)15-16	15-15	15-16	15-16	15-16	15-16
Lateral blotches below lateral line .....	8	8-10	8	7-10	7-8(9)	5-8	6
Depth in length .....	5.1	4.9-5.5(5.8)	4.7	(4.7)4.8- 5.0	(5.0)5.1- 5.3(5.6)	5.5-5.6(5.8)	5.2
Greatest width in projec- tion of depth .....	1.4	1.3-1.4(1.5)	1.5	1.5	(1.4)1.5	(1.2)1.3-1.4	1.3
Head in length .....	3.6	3.4-3.7	3.5	3.2-3.4	3.3-3.6	(3.0, 3.1) 3.2-3.4	3.4
Least suborbital width in head .....	7.2	(6.5)7.2- 8.0(8.5)	9.3	(8.7)9.0- 9.5(10.0)	10.0-12.0	(9.1)9.3- 9.5(10.0)	8.8
Least interorbital width in eye .....	3.0	3.0-3.5	3.2	(2.6)3.0- 3.2(3.3)	2.6-2.7(2.8)	3.5-3.6(3.8)	3.5

TABLE I—(Continued)

	<i>P. e. erizonus</i>		<i>P. e. euzonus</i> approaching <i>erizonus</i>			<i>P. e. euzonus</i>	
	Holotype	Paratypes	Black River	Spring River	White River	Paratypes	Holotype
Eye in head .....	4.5	(3.7)3.9– 4.5(4.7)	3.8	3.9–4.6(5.0)	4.3–4.6	3.7–3.9	3.9
Eye in snout .....	1.5	1.3–1.5	1.1	(1.0)1.2– 1.5(1.6)	1.1–1.3	(0.9)1.1–1.2	1.2
Snout in head .....	3.3	3.0–3.5	3.6	(3.1)3.3– 3.7(3.9)	(3.6)3.9–4.1	3.3–3.6(4.0)	3.6
Upper jaw in head .....	3.6	3.5–3.7(4.0)	3.5	3.5–3.6(3.7)	(3.5)3.6–3.7	3.4–3.6	3.5
Angle of muzzle .....	45°	40–50°	41°	(39)44–48 (55)°	(48)50–55°	44–57°	53°
Angle of gill-membranes	68°	(52)62–78 (81)°	52°	55–68°	62–67°	(50)53–62°	62°
Eye into distance from tip of mandible to union of gill-membranes .....	2.5	(2.1)2.3–2.5	2.3	(2.3)2.5– 2.7(2.8)	2.5–2.6	2.0–2.3(2.4)	2.1
Latter distance into head	1.7	(1.6)1.7–1.9	2.0	1.7–1.9	1.7–1.8	(1.7)1.8–2.0	2.0
Interspace between inser- tion of pelvic fin and union of gill-membranes in distance thence to tip of mandible .....	1.3	1.2–1.5	1.3	1.4–1.6	(1.2)1.3–1.5	1.3–1.4	1.3
Highest dorsal spine in head .....	2.6	2.4–2.6(2.8)	2.7	2.5–2.7(2.8)	2.4–2.7	2.3–2.6	2.7
Highest dorsal spine in first dorsal base .....	2.5	2.4–2.8	2.5	2.4–2.6(2.7)	2.2–2.5	(2.1)2.2–2.3	2.5

TABLE I—(Continued)

	<i>P. e. erizonus</i>		<i>P. e. euzonus</i> approaching <i>erizonus</i>			<i>P. e. euzonus</i>	
	Holotype	Paratypes	Black River	Spring River	White River	Paratypes	Holotype
Highest dorsal spine in highest dorsal ray .....	1.3	1.3-1.5	1.3	1.2-1.3	1.0-1.1	(1.1)1.3-1.4	1.4
Highest dorsal soft ray in head .....	2.0	1.8-2.1	2.2	2.1-2.2(2.5)	2.3-2.4	2.0-2.3	2.1
Highest dorsal soft ray in second dorsal base.....	1.5	1.4-1.6	1.5	(1.2)1.3-1.4(1.5)	1.6	1.3-1.5	1.4
Length of caudal fin in head .....	1.4	1.4-1.6	1.5	1.4-1.5	(1.4)1.5	1.5-1.7(1.8)	1.5
Highest anal ray in head .....	2.0	1.8-2.3	2.4	(2.1)2.2-2.3(2.4)	1.9-2.3	(2.0)2.1-2.3	2.1
Highest anal ray in anal base .....	1.0	1.0-1.1(1.2)	1.0	(0.9)1.0	0.9-1.0	(0.9)1.0-1.1	1.1
Anal base in head .....	2.0	(1.5, 1.7) 1.8-2.1	2.4	(2.1)2.2-2.4(2.6)	2.0-2.3	(1.9)2.1-2.3(2.4)	2.0
Anal base in soft dorsal base .....	1.5	1.3-1.6	1.2	1.2-1.3(1.6)	1.4-1.5	1.2-1.4	1.3
Longest pectoral ray in head .....	0.85	0.9-1.0(1.2)	1.1	(1.0)1.1(1.2)	1.1-1.2	1.1-1.2	1.1
Length of pelvic fin in head .....	1.0	1.1-1.2(1.4)	1.3	1.3-1.4	(1.3)1.4	1.2-1.4	1.2
Interspace between pelvic fins in pelvic base .....	1.5	1.4-1.6(1.9)	1.3	1.5-1.7(1.8)	1.3-1.6	(1.4)1.5	1.5

age about 1 fewer than in *euzonus*. In *erizonus* the eye averages smaller and the snout longer, so that the eye-snout ratio is quite distinct (1.3 to 1.5 in *erizonus*, 0.9 to 1.2 in *euzonus*). The fins, notably the pectoral, tend to be somewhat larger in *erizonus* than *euzonus*, though smaller than in *osburni* and *variatus*. Distinctions in coloration are evident, and there are several other minor differences. The 2 subspecies are compared as items 5a and 5b of the key, and in Table I.

The dorsal fins are separated in all the types.

In preserved specimens the ground color between the saddles of the back is olivaceous tan. Each scale of these regions is finely and closely speckled with black, except at the center, which is clear. Some scales, in irregular patches in the light areas, are much more densely speckled than others and produce a slightly tessellated effect. The back is crossed by the 4 strong fuscous bands characteristic of the *P. variatus* group. The margins of these dorsal saddles are not as sharply defined as in *P. e. euzonus*. The first saddle, extending over the posterior part of the nape, has its posterior margin somewhat extended backward along the sides of the first 1 or 2 spines of the dorsal fin. This mark extends solidly down to the insertion of the pectorals, where it divides, sending one line down behind the fin and another in front of the fin under the gill-cover. The second dorsal saddle begins at the back of the spinous dorsal and slopes more sharply forward than the first saddle. It widens at the lateral line and forks to form, below the lateral line, 2 less blackened lateral blotches, which are more distinctly separated from the dorsal saddles than in *euzonus*. The third saddle, located at the back of the soft dorsal, is quite similar, likewise giving off blotches below the lateral line. The fourth saddle, well back on the caudal peduncle, is not forked, but becomes markedly widened below the lateral line. There is a poorly defined dark spot on the peduncle near the base of the caudal fin.

The blotches below the lateral line, usually numbering 8, occasionally 9, in 1 fish 10, are all decidedly more triangular than in specimens of *euzonus* of similar size, never forming

squarish blocks or bars. With age this triangular pattern breaks down to produce a more irregular pattern, vaguely suggesting right triangles joined by their apices. The lateral markings are definitely more separated from the dorsal saddles than in *euzonus*, usually showing at most a slight connection.

The cheeks are lightly speckled with melanophores. The suborbital region ordinarily remains clear, except for a narrow rim below the eye and a narrow blackish bar extending downward from the middle of the eye. Otherwise the under side of the head and breast is usually immaculate at all ages, except for several black specks on the chin. Some adults show a tendency toward speckling on the under side of the head, but the degree of pigmentation characteristic of adult *euzonus* is never approached.

After 3 months in formalin the holotype and other breeding males retained some of the nuptial colors. A longitudinal band of yellow-orange extends along the lower side of the trunk, above and to slightly behind the depressed pelvic fin. Irregular red dots on the sides tend to be more or less centered, one on each pale area below the lateral line. Above the lateral line red dots begin behind the second blackish saddle, are arranged in groups of 3 or 4 before the third saddle, and become larger and more numerous toward the caudal fin. The light interspaces between the dark lateral blotches are tinted with lemon-orange. The spinous dorsal shows a basal stripe containing blocks of brown, then a clear streak followed by a band of black; then an orange-red submarginal stripe within the clear border. The basal half of the soft dorsal is colored like the caudal; the distal half is clear or nearly so. The caudal fin is marked by wavy vertical lines, alternately dusky and red; the red is intensified toward the base of the fin. The anal and pelvic fins are whitish. The pectoral, reddish orange on the base, is elsewhere marked by alternating blocks of red and dusky. The life colors correspond rather closely with those described for *P. variatus* and *P. osburni*, but the breeding males apparently do not become so intensely pigmented as in *variatus*, since a very strong contrast between the saddles and the ground color is retained.

The name *erizonus* is taken from the Greek:  $\epsilon\rho\iota$ , intensive prefix, and  $\zeta\acute{\omega}\nu\eta$ , zone.

4b. *Poecilichthys euzonus euzonus*, new subspecies

(Pl. I, Fig. 3)

*Etheostoma uranidea* (presumed identification).—Meek, 1894a: 268  
(record for White River at Oxford Bend, which is 9 miles northeast of Fayetteville, Washington County, Arkansas).

The holotype, University of Michigan Museum of Zoology No. 123548, is an adult male, 60.5 mm. in standard length. It was collected July 8, 1938, in Buffalo River, 4 miles southeast of St. Joe, Searcy County, Arkansas, by John D. and Ruby Y. Black. The 8 paratypes, all taken by the same collectors in the White River system of Arkansas, comprise 5 specimens collected with the holotype; 2 from King's River, 3 miles east of Alabam, at Denney Cave, Madison County, June 30, 1938; 1 from White River near Busch, Carroll County, July 8, 1938. The 9 types range in standard length from 28 to 60.5 mm.

The distinctive features of this form are mostly given in the key and in Table I.

The dorsal fins are separated in 7 specimens, united in 2.

The ground color of preserved specimens is a clear tan, apparently lacking the olivaceous tinge of *erizonus*. The side and back are finely and evenly speckled with fine black dots, except at the clear center of each scale. Since very few, usually none, of the scales on the back between the saddles are conspicuously darkened, the tessellated effect of *erizonus* is lacking. The saddles are all fuscous, possibly a little more brownish than in the other members of the group. The first saddle, crossing the nape just before the dorsal fin, is usually sharp-edged behind, extending just to the first dorsal spine, but in some specimens is extended backward as in *erizonus*, so that the saddle surrounds the first 2 spines. This saddle shows considerable variation, but its margins are sharper and straighter than in *erizonus*. The first saddle is continued down to the insertion of the pectoral fin where it divides into 2 rather narrow lines, one running down the side behind the

pectoral, the other extending along the fin base just under the edge of the gill-cover. The second dorsal saddle, extending downward and somewhat forward from the posterior part of the first dorsal base, splits at the lateral line to form an inverted Y. The resulting blotches on the sides below the lateral line are definitely block-shaped in the holotype and other adults, and are connected by at least a corner with a dorsal saddle. The similar third saddle, located at the back of the soft dorsal, shows no offset in the front margin, as the anterior of the 2 associated lateral blotches is continuous with the front half of this saddle. The fourth saddle, well back on the caudal peduncle, is undivided but expanded below the lateral line. There is also a poorly defined caudal spot. As in *erizonus*, the black speckling fades out rapidly below the lateral line. The sides below the blackish blotches are virtually immaculate.

The blotches along the sides are fewer than in any other species of the group, numbering 5 to 8, usually 7 or 8. In the adults they are clean-cut blocks, losing the more triangular shape which seems characteristic of the younger fish.

The sides and lower surfaces of the head, as well as the anterior half of the breast, are closely and finely speckled with black, particularly in the adults. In this respect the adults of *erizonus* and *euzonus* are surprisingly unlike, though immature individuals are not so distinct. The young of *euzonus* lack most of the speckling, but at comparable sizes are more pigmented than those of *erizonus*.

Almost nothing is known of the breeding colors of the male. However, the checkered pattern on the pectorals, caudal, and soft dorsal, and some color remaining on the spinous dorsal, indicate that the colors of the fins as a whole are similar to those of *erizonus*. As in that form, the pelvics and anal are apparently devoid of color.

The name *euzonus* is from  $\epsilon\tilde{\upsilon}$ , well or beautifully, and  $\zeta\acute{\omega}\nu\eta$ , zone.

##### 5. *Poecilichthys blennius* (Gilbert and Swain)

(Pl. II, Fig. 2)

*Etheostoma (Rhothoeca) blennius*.—Gilbert and Swain, *in*: Gilbert, 1887: 55-56 (original description; near Florence, Alabama).

*Etheostoma blennioides*.—Jordan and Evermann, 1896: 1073 (description).

*Ulocentra blennioides*.—Jordan, 1929: 157 (description). Jordan, Evermann, and Clark, 1930: 287.

*Poeciliichthys blennioides*.—Kuhne, 1939: 92.

*Etheostoma thalassinum* (misidentification).—Boulenger, 1895: 83 (in part).

This very distinct species was well described by Gilbert and Swain. It is contrasted in our key with the other and more typical species referred to the *Poeciliichthys variatus* group. Its pertinence to the genus *Poeciliichthys* is discussed on p. 3.

Apparently the types are the only previously recorded specimens. Additional material has lately been collected by L. F. Miller, working under A. R. Cahn of the Tennessee Valley Authority: 1 adult 47 mm. long from Greene River, Duck River system, Wayne County, Tennessee, May 16, 1937; 1 small adult, 43.5 mm. long, from Brush Creek, Duck River system, Perry County, Tennessee, May 17, 1937; 1 adult male, 49 mm. long, from Bumpass Creek, Tennessee River system, Lauderdale County, Alabama, February 16, 1938; 13 half-grown, 25 to 27 mm. long, from Second Creek, Tennessee River system, Lauderdale County, Alabama, November 4, 1937.

The scales are relatively large. In the 3 adults and 6 young specimens the counts are: 4 or 5, usually 5—42 to 45—6 or 7. The head and breast are completely naked.

Dorsal rays XI to XIII—11 to 13. Anal rays II, 8 or 9. Pectoral rays 16 or 17, usually 16. The dorsals are well separated in all the specimens.

The lateral-line canals and pores of the head agree with the description for the group (p. 5), except that there is considerable variation in the posteriormost of the anterior set of 4 pores of the infraorbital series. In the Greene River specimen, the pore of one side opens by a short upward-projecting tube; on the other side, by a short downward tube. In all other examples examined, this pore opens into the canal, or just below it.

This is one of the most heavily set of all the darters. It is almost cylindrical, though relatively deep through the shoulders. The contours taper rapidly behind the spinous dorsal.

The abruptly declivous snout accentuates the appearance of robustness.

Considerable differences in proportionate measurements appear when the 2 adult specimens from the Duck River system are compared with the half-grown fish from nearer the type locality, in Alabama. Since the differences may reflect some local variation, as well as age changes, the measurements of the 2 lots are presented separately: those for the Duck River specimens first; those for the Alabama material in parentheses, and separately for the 1 adult and for 6 half-grown. Depth 4.4 to 4.7 (5.0; 4.7 to 5.0). Greatest width 1.3 (1.3; 1.4 to 1.5) in projection of greatest depth. Head length 3.9 to 4.0 (4.1; 3.6 to 3.8). Least suborbital width 5.3 to 5.5 (4.8; 6.0 to 6.7) in head. Least interorbital width 1.9 to 2.0 (1.9; 1.7 to 2.0) in eye. Eye 4.9 (4.6; 4.0 to 4.3) in head; 1.8 (1.6; 1.2 to 1.5) in snout. Snout 2.7 to 2.8 (2.9; 3.1 to 3.6) in head. Upper jaw 4.0 to 4.2 (3.7; 3.8 to 4.1). Angle of muzzle  $72^{\circ}$  to  $73^{\circ}$  ( $70^{\circ}$ ;  $68^{\circ}$  to  $75^{\circ}$ ); of gill-membranes  $97^{\circ}$  to  $98^{\circ}$  ( $110^{\circ}$ ;  $89^{\circ}$  to  $95^{\circ}$ ). Eye 2.7 (2.4; 2.3 to 2.6) in distance from tip of mandible to union of gill-membranes; latter distance 1.6 to 1.7 (1.9; 1.6 to 1.9) in head; and 1.3 to 1.4 (1.2; 1.4 to 1.6) times interspace between union of membranes and insertion of pelvic fin. Highest dorsal spine 1.9 to 2.0 (1.95; 2.0 to 2.2) in head, 2.2 to 2.3 (2.6; 2.0 to 2.1) in first dorsal base, and 1.2 to 1.3 (1.2; 1.2 to 1.3) in highest dorsal soft ray, which enters the head 1.6 to 1.8 (1.6; 1.7 to 1.8) times, and the second dorsal base 1.2 to 1.4 (1.3; 1.1 to 1.2) times. Length of caudal fin 1.3 (1.2; 1.3 to 1.4) in head. Highest anal ray 1.6 to 1.7 (1.7; 1.7 to 1.8) in head, and 0.8 (1.0; 0.7 to 0.8) in the anal base, which enters the head 1.8 to 2.2 (1.7; 2.1 to 2.4) times, and the second dorsal base 1.4 to 1.6 (1.3; 1.3 to 1.4) times. Longest pectoral ray 0.7 (0.8; 0.7) and length of pelvic fin 0.9 (1.0; 0.9) in head. Interspace between pelvic fins 1.1 to 1.2 (1.3; 1.4 to 1.5) in pelvic base.

The following color notes were made after the specimens had been in formalin about two weeks. In the adult from Greene River, the whole color tone was pinkish, owing to the light

brownish red spot on the center of each scale from the dorsal fins to the side of the belly. These spots became weak and tan colored on the lower sides of the caudal peduncle, but deeper and brighter under the pectorals. The lower sides, especially between and near the lateral blotches, were bright golden. The belly was white. The breast was bright silvery with strong mottlings of ivory before and behind the pectoral fins. The dark bars of the body were blackish green. The head was mottled with light and dark olive. The margin of the first dorsal fin was narrow and blood-red forward, still narrower and yellower posteriorly, but broad and red-brown near the end of the fin. There was a dusky reddish brown stripe on each interspinal membrane from the base well toward the tip, and a somewhat similar, but less reddish mark on each membrane of the second dorsal. The greenish caudal rays were very indefinitely banded with dusky. The anal and pelvic rays were mostly yellow, becoming a little orange forward and outward. The pectoral fin was mostly yellowish on the rays, but the median part of the fin was banded with pink and green.

The specimen from Brush Creek was brighter, although the red spots on the scales were fainter (hardly evident on the white underparts). The blackish green oblique saddles were abruptly set off on the posterior edge by bright cream, as in the other specimen, and there was a tannish semicircle on the nape in front of the first saddle. The red border on the spinous dorsal was developed only anteriorly. The dorsal spines and soft rays were individually barred with deep green and amber, and the membranes were only slightly blotched. The greenish caudal was barred with darker and lighter. The pectoral showed 2 pink crescents near the base, and bars of yellowish and greenish outward. The pelvic fin was definitely dappled with pink.

The adult male from Bumpass Creek was described as richly though not brilliantly colored. The light areas covering most of the sides and back were enriched by a strong rosy wash, mostly concentrated toward the centers of the scales. The dorsal spines were set off in translucent streaks, between which

the membranes were deep red-brown. The first dorsal became pinkish brown just within a fine, pale edge. The second dorsal was mostly red-brown on the membranes, becoming sooty outward and pale brown along the rays. The caudal and pectoral fins were dusky green and yellowish; the pelvic, dusky with a cream edge; the anal, pale.

In the small specimens from Alabama the light areas were a rich tan. The base of the pectoral was marked with a conspicuous watery orange crescent.

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PLATE I

FIG. 1. Holotype of *Poeciliichthys tetrazonus*, a half-grown specimen 33 mm. in standard length, from Big Niangua River, Missouri.

FIG. 2. Holotype of *Poeciliichthys euzonus crizonus*, an adult male 66 mm. in standard length, from Current River, Missouri.

FIG. 3. Holotype of *Poeciliichthys euzonus euzonus*, an adult male 60.5 mm. in standard length, from Buffalo River, Arkansas.

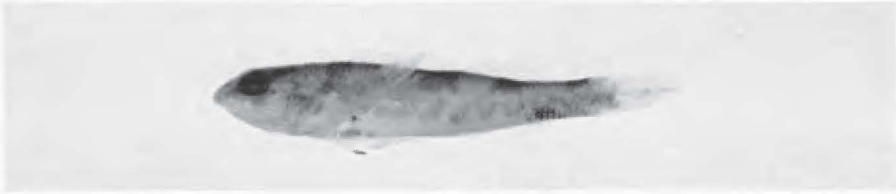


FIG. 1



FIG. 2

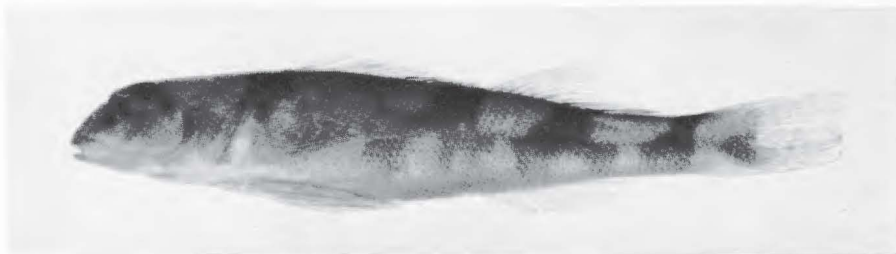


FIG. 3

Photographs by F. W. Ouradnik.

*Carl L. Hubbs and John D. Black*

PLATE II

FIG. 1. Breeding male of *Poeciliichthys variatus*, 73 mm. in standard length, from Columbiana County, Ohio.

FIG. 2. Adult of *Poeciliichthys blennius*, 43.5 mm. in standard length, from Brush Creek, Duck River system, Tennessee.

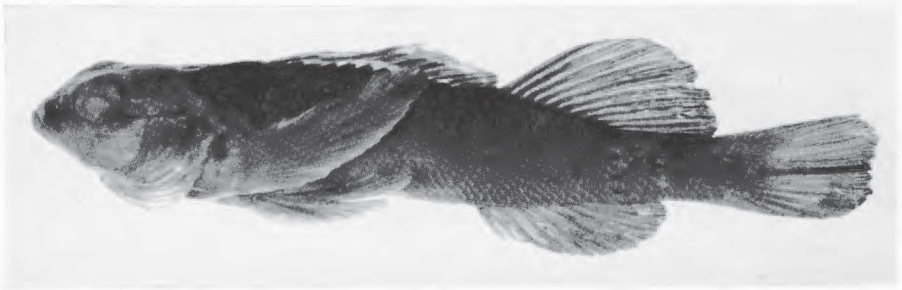


FIG. 1

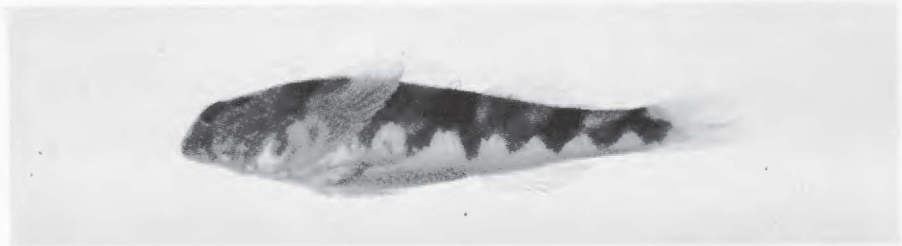


FIG. 2

Photographs by F. W. Ouradnik.

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## FOREWORD

The University of Arkansas Museum has accumulated considerable material in the fields of zoology and archaeology, the data from which should be made available to scientists. Since our journals are already badly crowded we believe that the interests of workers in the field would best be furthered by initiating our own series. These publications, Occasional Papers of the University of Arkansas Museum, will appear from time to time.

As a preliminary to further work in herpetology, we present herewith Occasional Paper Number One on the "Reptiles of Arkansas." Number Two on the "Amphibia of Arkansas" is now ready for press. Publications on the mammals and fishes may be expected to appear in the near future, as well as other papers dealing with the various aspects of the vertebrate fauna of the state.

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## INTRODUCTION

Both authors have long been interested in the vertebrate fauna of Arkansas. One has kept records for the entire state in the files of the University Museum for the past eighteen years. The other has made considerable collections of various vertebrates of the northwestern portion of the state for the past eight years. The present paper is the result of a survey made to determine the extent of the distributional data available on the reptiles and amphibians of Arkansas before we entered into any intensive field activities. We were under the impression, apparently shared by nearly everyone, that Arkansas had been neglected, save for occasional sporadic collections. It is true that the material from this state is badly scattered, but the total data as here collected presents a very representative cross section of the reptiles and amphibians living within the state.

We are acutely aware that many of the identifications as given in this paper are in error, but the problem of the correct naming of these animals comes within the province of the taxonomist who specializes on a single genus. We have made every reasonable effort to classify the animals according to present nomenclature. This, although desirable, is relatively unimportant in a paper of the type we have prepared. Our purpose has been to make available for such specialists as well as for students of a more general nature the data concerning the published records and the whereabouts of as many specimens of each species from this state as we have been able to locate.

Inasmuch as Cope (1889 and 1900) covers the same ground as the previous reports, insofar as Arkansas is concerned, we have not, with a few exceptions, referred to papers of earlier dates. It should be pointed out that many of the localities given in the older reports, including those of Cope from "Arkansas" are not in Arkansas according to present bound-

aries. Some of them are far west of Arkansas as the state is now constituted. Oklahoma localities included are Fort Towson (sometimes given as Fort Townson), Fort George, Fort Mason, Red River, Canadian River and Creek Boundary. Fort Scott, Kansas, is also given in the Cope papers as "Arkansas." With few exceptions these are not further referred to in the present paper.

The most surprising part of the whole study has been the remarkable proportion of the previously reported specimens that cannot now be located. In the case of the specimens reported in the papers of Burt, especially that of 1935, many of these are now in the larger museums and have not found their way into the catalog, while still others are in the Burt collection. The material collected by Seth E. Meek, as reported by Hurter and Strecker (1909) and not otherwise accounted for in this paper may be assumed to be in the collection of the Field Museum of Natural History. Dr. Karl P. Schmidt in sending us the records from that institution stated that he was including a list of all Arkansas material in the institution "other than that collected by Meek."

In making these studies we are indebted to many persons, but particularly to the following: Col. T. H. Barton, El Dorado, Arkansas, whose generous financial assistance has made these studies possible; H. K. Gloyd and Hobart M. Smith, Chicago Academy of Sciences; E. R. Dunn, Haverford College and the Philadelphia Academy of Natural Sciences; M. Graham Netting, Carnegie Museum; E. H. Taylor and C. D. Bunker, University of Kansas; Charles E. Burt, Southwestern College; Karl P. Schmidt, Field Museum of Natural History; G. K. Noble, American Museum of Natural History; Doris M. Cochran, United States National Museum; Albert H. Trowbridge, Bureau of Biological Survey; Joseph Slevin, California Academy of

Sciences; E. Raymond Hall and T. L. Rodgers, University of California; L. M. Klauber, San Diego Natural History Museum; R. Marlin Perkins, Missouri Botanical Gardens; Leo T. Murray, Baylor University; A. I. Ortenburger and A. O. Weese, University of Oklahoma; Mrs. Helen T. Gaige, University of Michigan; Geo. T. Meyers and Albert W. Herre, Stanford University; William M. Clay, University of Louisville; Byron C. Marshall, Imboden, Arkansas, Hoyt Pyle, Marked Tree, Arkansas, and Percy Viosca, Jr., Southern Biological Supply Company.

We have been fortunate enough to secure the complete records from practically every collection in the custody of these scientists. Mr. Marshall has been occupied with various important matters that made it impossible for him to supply us with all his records. The same has been true with Mr. Perkins, but both of these men have cooperated as heartily as circumstances permitted.

We present in this paper records for 83 reptiles and in part two for 47 amphibians. Some of these have been previously unreported from Arkansas.

Since some of the institutions listed are not widely known for their herpetological collections it was thought best to explain the abbreviations employed in listing specimens now available. These follow:

- AMNH—American Museum of Natural History.
- ANS—Philadelphia Academy of Natural Science.
- AU—University of Arkansas Museum.
- BC—Charles E. Burt collection.
- BU—Baylor University Museum.
- CAS—California Academy of Sciences.
- ChA—Chicago Academy of Sciences.
- CU—Cornell University.
- CMZ—Carnegie Museum of Zoology.
- EHT—E. H. Taylor collection.
- FMNH—Field Museum of Natural History.

KU—University of Kansas Museum of Natural History.

MBG—Missouri Botanical Gardens.

MU—Michigan University Museum of Zoology.

MCZ—Museum of Comparative Zoology, Harvard University.

MVZ—Museum of Vertebrate Zoology, University of California.

OU—Oklahoma University Museum of Zoology.

SDNHM—San Diego Natural History Museum.

SU—Stanford University Museum.

USNM—United States National Museum.

The bibliography for part one and part two will appear with part two.

## CLASS REPTILIA

ORDER LORICATA. CROCODILES and  
ALLIGATORS

*Alligator mississippiensis* (Daudin). Mississippi Alligator.

There is a skull of an alligator in the University of Arkansas Museum from Stamps, Lafayette County. This animal was collected by Richard Davis, December 25, 1923.

Alligators occur in considerable numbers in the Red River area. Doctor P. B. Carrigan, in a letter of May 12, 1938, informs us that Grassy Lake, near McNab, Hempstead County, is well populated, and "contains the largest alligators in the south." There are specimens from this locality on the Hot Springs Alligator Farm, and in the Little Rock Zoological Gardens.

ORDER SQUAMATA. SUB-ORDER LACERTINA  
THE LIZARDS

*Anolis carolinensis* (Voigt). American Chameleon.

PREVIOUSLY REPORTED—*South Arkansas*: (Taylor, 1935). *Cleveland*: N. Fordyce, (Burt, 1935). *Columbia*: Taylor, (Burt, 1935). *Garland*: Hot Springs, (Hurter and Strecker, 1909; Strecker, 1924 and 1928). *Lafayette*: Lewisville, (Taylor, 1935). *Perry*: 3 mi. N. W. Applin, (Perkins, 1928). *Saline*: N. E. Saline (Perkins and Lentz, 1934).

SPECIMENS KNOWN—*South Arkansas*: 2 KU. *Clark*: 6 mi. W. Arkadelphia, 1 AU. *Cleveland*: N. Fordyce, 1 USNM. *Columbia*: 6 mi. N. Taylor, 1 USNM. *Garland: Hot Springs*, 3 USNM, 1 CAS, 2 BU, 1 AU. *Lafayette*: Lewisville, 1 KU. *Perry*: 3 mi. N. W. Applin, 2 MBG. *Saline*: N. E. Saline, 3 MBG.

*Crotaphytus collaris collaris* (Say). Collared Lizard;  
Mountain Boomer.

PREVIOUSLY REPORTED—*Benton*: 4 mi. N. E. Gateway, (Burt, 1935). *Carroll*: Eureka Springs, (Hurter and Strecker, 1909); N. Busch, (Burt, 1935). *Faulkner*: 12 mi. N. Conway, (Perkins, 1928). *Independence*: (Burt, 1928). *Logan*: Mt. Magazine, (Hurter, 1911). *Pulaski*: Little Rock, (McLain, 1899; Hurter and Strecker, 1909). *Sebastian*: Fort Smith, (McLain, 1899; Cope, 1900; Hurter and Strecker, 1909). *Washington*: Fayetteville, (Hurter and Strecker, 1909).

SPECIMENS KNOWN—"Arkansas": 1 CMZ, 1 MU, 6 AMNH. *Carroll*: Busch, 1 USNM, cataloged as "*Benton*", 1 AU. Eureka Springs, 1 USNM; Berryville, 1 AU. *Crawford*: Beaver Dam, 1 AU. *Faulkner*: 12 mi. N. Conway, "several" MBG. *Independence*: 1 USNM. *Johnson*: Clarksville, 2 USNM. *Lawrence*: 1 FMNH, 1 MU; Imboden, 19 AMNH, 2 FMNH, 1 CU, 1 and eggs AU; 1 mi. N. W. Black Rock, 1 MU. *Polk*: Mena, 1 AU; Eagletown, 1 FMNH. *Pulaski*: near Little Rock, 6 SU. *Sebastian*: Fort Smith, 1 USNM, 1 SU.

*Sceloporus undulatus fasciatus* (Green). Swift; Fence Lizard.

We have followed Hobart M. Smith in assigning all Arkansas *Sceloporus* to this sub-species as revived by Smith. Material from Dardanelle, Morrilton, and the Ouachitas in general is not typical of this form, but at present there seems no other disposition that can be made of these specimens. Doctor Smith expects to go over this material carefully in the very near future and no doubt will be able to satisfactorily classify these particular specimens. They have been referred to *thayeri* and *consobrinus* by such authorities as Stejneger, Cope, Strecker and Hurter, but on the basis of

present knowledge cannot be included in these subspecies.

PREVIOUSLY REPORTED—*Carroll*: 4 mi. S. E. Green Forest, (Burt, 1935). *Clark*: 2 mi. N. E. Curtis, (Burt, 1935). *Clay*: Greenway, (Hurter and Strecker, 1909). *Cleveland*: 12 mi. N. Fordyce, (Burt, 1935). *Columbia*: 6 mi. N. Taylor, and 6 mi. S. E. Waldo, (Burt, 1935). *Crawford*: Van Buren, (Taylor, 1935). *Dallas*: 6 mi. N. Fordyce, (Burt, 1935). *Green*: Paragould, (Hurter and Strecker, 1909). *Hot Spring*: 3 mi. N. Malvern, (Burt, 1935). *Lawrence*: Lewisville, (Taylor, 1935). *Monroe*: 3 mi. S. W. Clarendon, (Burt, 1935). *Montgomery*: 6 mi. E. Mt. Ida; 1 mi. E. Oden; 3 mi. W. Oden; Crystal Springs (listed as *Garland*), (Burt, 1935). *Newton*: Ponca, (Burt, 1935). *Pike*: 3 mi. E. New Hope, (Ortenburger, 1929). *Polk*: 4 mi. E. State Line, 8 mi. E. State Line, 3 mi. S. Mena; 1 mi. N. E. Mena, 7 mi. W. Norman, (Ortenburger, 1929). *Pope*: 15 mi. N. Dover, (Burt, 1935). *Pulaski*: 2 mi. N. Olmstead, (Burt, 1935); Little Rock, and Pulaski, (Hurter and Strecker 1909). *Scott*: 8 mi. N. Waldron, (Ortenburger, 1929). *Sebastian*: Fort Smith (McLain, 1899; Cope, 1900; Hurter and Strecker, 1909). *Washington*: Winslow (Taylor, 1935). *Yell*: 6 mi. S. E. Ola, (Burt, 1935).

Also under the name *S. thayeri consobrinus* from: *Faulkner*: "Monilton" which undoubtedly refers to Morrilton, (Cope 1900; Hurter and Strecker, 1909). *Garland*: Hot Springs, (Hurter and Strecker, 1909; Strecker 1924). *Logan*: Mt. Magazine, and Petit Jean, (Stone 1904). *Sebastian*: Poteau Mt., (Stone, 1904).

SPECIMENS KNOWN—Those reported by Ortenburger in 1929 are in OU. "Arkansas": 3 AMNH. *Benton*: 2 mi. N. E. Sulphur Springs, 5 MU; 2 mi. S. Gentry, 4 MU. *Carroll*: near Eureka Springs, 2 MU; 10 mi. S. W. Eureka Springs, 5 MU; Lake Lucerne, 4 MU. *Clark*: Curtis, 1 USNM. *Cleveland*: 10 mi. N. Fordyce,

5 USNM. *Columbia*: Taylor, 3 USNM; Waldo 2 USNM. *Conway*: Morrilton, 3 USNM. *Crawford*: Van Buren, 2 KU; Mountainburg, 1 KU. *Dallas*: 6 mi. N. Fordyce, 2 USNM. *Franklin*: Ozark, 2 KU. *Fulton*: Viola, 2 MU. *Garland*: Hot Springs, 3 FMNH, 19 BU, 4 CAS. *Hot Spring*: Malvern, 1 USNM. *Jefferson*: 7 mi. N. Pine Bluff, 1 USNM. *Lafayette*: Lewisville, 56 KU, 1 AMNH. *Lawrence*: Imboden, 14 AMNH, 12 FMNH, 2 and eggs AU. *Logan*: Petit Jean Mt., 1 ANS; Mt. Magazine, 1 ANS, 5 FMNH. *Lonoke*: 25 mi. E. Little Rock, 3 MU. *Madison*: Huntsville, 1 USNM. *Miller*: 4 mi. N. Texarkana, 2 AMNH. *Montgomery*: 6 mi. E. Mt. Ida, 2 USNM; Oden, 2 USNM; Crystal Springs, 1 USNM, 1 MU; near Waters (Pine Ridge), 1 MU. *Newton*: Ponca, 1 USNM. *Perry*: Hollis, 1 FMNH. *Polk*: Big Fork, 1 USNM; Rich Mt., 1 USNM, 1 MU, 1 FMNH; Mena, 1 USNM; 5 mi. N. Mena, 1 AMNH. *Pope*: Dover, 1 USNM. *Monroe*: Clarendon, 1 USNM. *Pulaski*: 3 KU; Olmstead, 2 USNM; 11 mi. S. E. Maumelle, 1 MU; Cross Roads, 2 MU; Little Rock, 1 CMZ. *Saline*: Hensley, 1 USNM. *Sharp*: near Ravenden, 2 MU. *Washington*: Fayetteville, 5 AU; 1 mi. W. Farmington, 1 AU; 6 mi. E. Springdale, 1 BC; 2 mi W. West Fork, 1 AU; 2 mi. S. W. Winslow, 1 KU; Winslow, 22 KU. *Yell*: Dardanelle, 5 USNM; Ola, 1 USNM.

*Sceloporus olivaceous* Smith. Florida Swift.

There is a single specimen in the United States National Museum from Fort Smith. This species has been previously known as *spinosus floridanus*. We agree completely with Smith, who under date of April 17, 1938, writes: "I am strongly inclined to doubt the validity of this record." There is, however, the possibility that the animal has been carried in from elsewhere and escaped.

*Phrynosoma cornutum* (Harlan). Horned Toad.

PREVIOUSLY REPORTED—*Sebastian*: Fort Smith, (Cope, 1900; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Union*: El Dorado, 1 MU. *Washington*: Winslow, 1 in Winslow High School; Fayetteville, 7 AU.

The Winslow colony is known to be the result of releasing pets. The same is probably true of the thriving colony at Fayetteville, and has been suggested to explain the El Dorado record. They are known to occur frequently around Fort Smith; this seems to be within the natural range of the species.

*Ophisaurus ventralis* (Linne'). Glass Snake; Joint Snake.

PREVIOUSLY REPORTED — “*Arkansas*”: (Cope, 1900). *Saline*: N. E. Saline, (Perkins and Lentz, 1934). *Sebastian*: Fort Smith, (McLain, 1899; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Clark*: Arkadelphia, 1 AU. *Lawrence*: Imboden, 3 FMNH. *Saline*: N. E. Saline, 1 MBG. *Sebastian*: Fort Smith, 3 SU. *Washington*: 10 mi. E. Fayetteville, 1 AU; Fayetteville, 3 AU, 1 in Winslow High School.

*Heloderma suspectum* (Cope). Gila Monster. Beaded Lizard.

There is a mounted specimen of this poison lizard in the University of Arkansas Museum that was collected 2 mi. N. Texarkana, Miller County. It probably is an escaped pet.

*Cnemidophorus sexlineatus* (Linne'). Sand Lizard; Six-lined Lizard; “Scorpion.”

Specimens from Hot Springs now in the United States National Museum, California Academy of Sciences, and Baylor Museum are classified as “typi-

cal *gularis*." Hurter and Strecker (1909) and Strecker (1924) went to great lengths in explaining the differences between these specimens, and typical *sexlineatus*. They consider these "typical *gularis*". Burt (1931) refers these specimens to *sexlineatus* without comment. This case parallels that of *Sceloporus* from the same locality, and it is highly probable that these animals are distinct. We here include them with *sexlineatus*.

PREVIOUSLY REPORTED—*Benton*: 6 mi. W. Center-ton; 1 mi. W. Garfield, (Burt, 1935). *Boone*: 3 mi. N. E. Alpena Pass, (Burt, 1935). *Carroll*: S. E. Berryville, (Burt, 1935). *Clark*: 5 mi. S. Arkadelphia; 2 mi. N. E. Curtis, (Burt 1935). *Columbia*: 6 mi. N. Taylor; 6 mi S. E. Waldo, (Burt, 1935). *Crawford*: Mulberry, (Taylor, 1935). *Faulkner*: 2 mi. S. E. Meniffee, (Burt, 1935); 7 mi. W. Conway, (Perkins, 1928). *Garland*: 2 mi. N. Mt. Valley (Burt, 1935); Hot Springs, (Burt, 1931; Cope, 1900; Hurter and Strecker, 1909; Strecker, 1924). *Hot Spring*: 3 mi. N. Malvern (Burt, 1935). *Independence*: N. E. Olyphant, (Burt, 1935). *Jefferson*: Pine Bluff, (Hurter and Strecker, 1909). *Lafayette*: Lewisville, (Burt, 1931; Taylor, 1935). *Lawrence*: Imboden, (Burt, 1931). *Little River*: 2 mi. N. Ashdown, (Burt, 1931). *Logan*: W. Booneville, (Burt, 1935). *Montgomery*: 6 mi. E. Mt. Ida; 1 mi. E. Oden; 3 mi W. Oden, (Burt, 1935). *Nevada*: 5 mi. S. W. Prescott, (Burt, 1935). *Perry*: 8 mi. S. E. Ola, (Burt, 1935). *Polk*: 4 mi. E. State Line; 8 mi. E. State Line; 3 mi. S. Mena; 4 mi. W. Board Camp, (Ortenburger, 1929; Burt, 1931). *Pike*: 3 mi. E. New Hope, (Ortenburger, 1929; Burt, 1931). *Pope*: 15 mi. N. Dover, (Burt, 1935). *Prairie*: DeValls Bluff, (Burt, 1931; Taylor, 1935). *Pulaski*: 1 mi. S. Palarm; 4 mi. S. Palarm, (Burt, 1935). *Sebastian*: 5 mi. S. Fort Smith; Fort Smith, (Yarrow, 1882; McLain, 1899; Burt, 1931). *Washington*: Winslow, (Tay-

lor, 1935); Fayetteville, (Hurter and Strecker, 1909). *White*: 1 mi. N. W. Russell, (Burt, 1935). *Yell*: W. Havana, (Burt, 1935).

SPECIMENS KNOWN—*Benton*: Garfield, 1 USNM; Centerton, 1 USNM. *Carroll*: Berryville, (Catalogued as “*Crawford*”) 1 USNM. *Clark*: Arkadelphia, 1 USNM; Curtis, 3 USNM. *Columbia*: Waldo, 1 USNM. Taylor, 1 USNM. *Conway*: Menifee, 1 USNM. *Crawford*: Mulberry, 4 KU. *Faulkner*: 7 mi. W. Conway, “several” in MBG. *Franklin*: Ozark, 2 KU. *Garland*: Mt. Valley, 1 USNM; Hot Springs, 3 USNM, 2 CAS, 2 USNM, 3 BU. *Green*: 6½ mi. N. W. Paragould, 1 MU. *Hot Springs*: Malvern, 1 USNM. *Jackson*: Olyphant, 1 USNM. (Catalogued as “*Independence*”). *Jefferson*: 1 KU; Pine Bluff, 1 USNM; 4 mi. N. E. Pine Bluff, 1 USNM. *Lafayette*: Lewisville, 4 KU. *Lawrence*: Imboden, 12 FMNH, 1 CU. *Little River*: 2 mi. N. Ashdown, 3 AMNH. *Logan*: Booneville, 1 USNM. *Lonoke*: 25 mi. E. Little Rock, 1 MU. *Madison*: 2 mi. N. Crosses, 1 MU. *Montgomery*: Mt. Ida, 1 USNM; Oden, 1 USNM. *Nevada*: Prescott, 3 USNM. *Prairie*: DeValls Bluff, 47 KU. *Polk*: 3 mi. S. Mena, 1 OU; 4 mi. W. Board Camp, 1 OU. *Pope*: Dover, 1 USNM. *Pulaski*: 1 USNM; Palarm, 1 USNM; Little Rock, 11 MU, 1 CMZ; 4 mi. S. E. of Maumelle, 1 USNM. *Sebastian*: Fort Smith, 11 SU, 1 USNM. *Washington*: 1 mi. W. Farmington, 1 AU; Fayetteville, 2 AU; Winslow, 23 KU. *Yell*: Ola (Catalogued as “*Perry*”) 1 USNM; Havana, 1 USNM.

*Leiolopisma unicolor* (Harlan). Brown Skink.

PREVIOUSLY REPORTED—*Clark*: 2 mi. N. E. Curtis, (Burt, 1935). *Cleveland*: 21 mi. N. E. Fordyce, (Burt, 1935). *Columbia*: 6 mi. N. Taylor; 6 mi. S. E. Waldo, (Burt, 1935). *Crawford*: Mulberry, (Taylor, 1935). *Dallas*: 1 mi. N. Fordyce, (Burt, 1935). *Franklin*: Altus, (Hurter and Strecker, 1909). *Faulkner*: 7 mi. W.

Conway; 12 mi. N. Conway, (Perkins, 1928). *Garland*: Hot Springs, (Strecker, 1924). *Grant*: N. Sheridan, (Burt, 1935). *Green*: Paragould, (Hurter and Strecker, 1909); 10 mi. S. E. Paragould, (Burt, 1935). *Hot Spring*: 3 mi. N. Malvern, (Burt, 1935). *Independence*: N. E. Olyphant, (Burt, 1935). *Lafayette*: Lewisville, (Taylor, 1935). *Logan*: Petit Jean Mt., (Stone, 1904). *Miller*: (Strecker and Williams, 1928). *Montgomery*: 6 mi. E. Mt. Ida; 9 mi. E. Mt. Ida; 3 mi. W. Oden, (Burt, 1935). *Nevada*: 1 mi. S. Rosston, (Burt, 1935). *Pike*: 3 mi. E. New Hope, (Ortenburger, 1929). *Polk*: 1 mi. W. Wicks, (Ortenburger, 1929). *Pulaski*: (Taylor, 1935); Little Rock (Hurter and Strecker, 1909); 2 mi. N. Olmstead, 4 mi. S. Palarm, (Burt, 1935). *Sebastian*: Poteau Mt., (Stone, 1904).

SPECIMENS KNOWN—"Arkansas": 6 AMNH. *Benton*: 1 mi. S. Sulphur Springs, 1 MU; 2½ mi. N. E. Sulphur Springs, 1 MU. *Carroll*: 1 USNM; Lake Lucerne, 1 MU; 10 mi. W. Eureka Springs, 1 MU. *Clark*: Curtis, 1 USNM. *Clay*: Corning, 1 MU. *Columbia*: Taylor, 1 USNM; Waldo, 2 USNM. *Crittenden*: 6 mi. W. West Memphis, 1 BC. *Crawford*: Mulberry, 1 KU. *Dallas*: Fordyce, 5 USNM. *Faulkner*: Palarm, 1 USNM; 7 mi. W. Conway, "several" MBG; 12 mi. N. Conway "few" MBG. *Franklin*: Altus, 1 USNM. *Fulton*: Viola, 1 MU. *Garland*: 9 FMNH; Hot Springs, 10 BU; 1 CAS; 1 USNM, 3 FMNH. *Green*: Paragould, 1 USNM. *Howard*: Dora, 1 USNM. *Jackson*: Olyphant, 1 USNM. *Lafayette*: 1 MU; Lewisville, 30 KU. *Lawrence*: Imboden, 2 and eggs AU, 17 FMNH. *Logan*: Petit Jean Mt., 1 ANS; Mt. Magazine, 1 FMNH. *Lonoke*: 25 mi. E. Little Rock, 2 MU. *Miller*: 6 BU; 4 mi. N. Texarkana, 3 FMNH. *Montgomery*: Oden, 3 USNM; Mt. Ida, 4 USNM. *Monroe*: 6 mi. S. W. Clarendon, 6 MU; Brinkley, 1 MU. *Pike*: 3 mi. E. New Hope, 1 OU. *Polk*: 1 mi. W. Wickes, 1 OU. *Prairie*: DeValls Bluff, 6 KU. *Pulaski*: 2 KU; Little Rock, 1

MU, 3 USNM. *Sebastian*: Poteau Mt., 1 ANS. *Sevier*: 12 mi. S. Lockesburg, 2 AMNH. *Washington*: near Fayetteville, 1 AU; 6 mi. E. Springdale, 1 BC; Winslow, 1 KU.

*Eumeces anthracinus* (Baird). Coal Skink.

PREVIOUSLY REPORTED—"Arkansas River": (May not be Arkansas material). (Hurter and Strecker, 1909). *Faulkner*: 7 mi. W. Conway, (Perkins, 1928). *Garland*: Hot Springs, (Strecker, 1924). *Lafayette*: Lewisville, (Taylor, 1935). *Lawrence*: (Taylor, 1935). *Montgomery*: 3 mi. W. Oden, (Burt, 1935). *Pulaski*: near Little Rock, (Perkins, 1928).

SPECIMENS KNOWN—"Arkansas": 1 ANS. *Faulkner*: 7 mi. W. Conway, "several" MBG. *Garland*: Hot Springs, 2 CAS. *Lafayette*: Lewisville, 6 KU. *Lawrence*: Imboden, 17 KU, 1 CMZ, 2 CU, 2 and eggs AU, 1 FMNH. *Montgomery*: 3 mi. W. Oden, 5 USNM. *Pulaski*: 1 USNM; near Little Rock, 3 MBG.

*Eumeces fasciatus* (Linne). Blue Tailed Skink.

PREVIOUSLY REPORTED—Benton: 2½ mi. N. E. Sulphur Springs; ½ mi. S. Sulphur Springs, (Taylor, 1935b); 3 mi. N. W. Bentonville, (Burt, 1935). *Carroll*: Lake Lucerne, (Taylor, 1935b). *Clark*: 2 mi. N. E. Curtis, (Burt, 1935). *Cleveland*: 12 mi. N. Fordyce, (Burt, 1935). *Clay*: Greenway, (Hurter and Strecker, 1909). *Columbia*: 6 mi. S. E. Waldo; 6 mi. N. Taylor, (Burt, 1935). *Dallas*: 6 mi. N. Fordyce, (Burt, 1935). *Faulkner*: 7 mi. W. Conway; 12 mi. N. Conway, (Perkins, 1928). *Garland*: Hot Springs, (Cope, 1900; Hurter and Strecker, 1909; Strecker, 1924; Taylor, 1935b). *Green*: 10 mi. S. E. Paragould, (Burt, 1935). *Independence*: Olyphant, (Burt, 1935). *Lafayette*: Lewisville, (Taylor, 1935, 1935b). *Lawrence*: Imboden, (Taylor, 1935, 1935b). *Logan*: Blue Mt., (Stone, 1904;

Taylor, 1935b); Mt. Magazine, (Stone, 1904, Taylor, 1935b). *Miller*: (Strecker and Williams, 1928; Taylor, 1935b). *Monroe*: 7 mi. S. W. Clarendon, (Burt, 1935). *Montgomery*: 3 mi. W. Oden, (Burt, 1935). *Nevada*: 1 mi. S. Rosston, (Burt, 1935). *Pike*: 2 mi. E. Dierks, (Ortenburger, 1929). *Polk*: 3 mi. E. Cherry Hill, (Burt, 1935). *Prairie*: DeValls Bluff, (Taylor, 1935; 1935b). *Pulaski*: Little Rock, (Hurter and Strecker, 1909; Perkins, 1928). *Saline*: (Taylor, 1935b). *Sebastian*: Fort Smith, (McLain, 1899; Cope, 1900; Hurter and Strecker, 1909). *Union*: (Taylor, 1935b). *Washington*: Winslow, (Taylor, 1935, 1935b); Fayetteville, (Burt, 1935); 6 mi. E. Springdale, (Burt, 1935).

SPECIMENS KNOWN—*Benton*: 2½ mi. N. E. Sulphur Springs, 6 MU; ½ mi. S. Sulphur Springs, 1 MU; 3 mi. N. W. Bentonville, 1 BC. *Carroll*: Lake Lucerne, 1 MU; Busch, 1 USNM. *Clark*: Curtis, 1 USNM; Okalona, 1 USNM. *Columbia*: Waldo, 1 USNM; Taylor, 1 USNM. *Dallas*: Fordyce, 3 USNM. *Faulkner*: 7 mi. W. Conway, "several" in MBG; 12 mi. N. Conway, "few" in MBG. *Franklin*: Ozark, 1 KU. *Fulton*: Viola, 2 MU. *Garland*: Hot Springs, 5 BU; 3 CAS; 1 USNM. 6 FMNH. *Green*: Paragould, 3 USNM. *Jackson*: Olyphant (Catalogued as "Independence") 1 USNM. *Lafayette*: Lewisville, 34 KU. *Lawrence*: Imboden, 2 AMNH; 10 FMNH, 179 KU. *Logan*: Blue Mt., 3 ANS; Mt. Magazine, 4 ANS, 16 FMNH. *Madison*: Huntsville, 1 USNM. *Miller*: 7 BU. *Monroe*: Clarendon, 1 USNM; Brinkley, 1 MU. *Nevada*: Rosston, 2 USNM. *Pike*: 2 mi. E. Dierks, 1 OU. *Polk*: Cherry Hill, 1 USNM; Rich Mt., 1 MU, 3 FMNH. *Prairie*: DeValls Bluff, 11 KU. *Pulaski*: Little Rock, 1 MBG. *Saline*: 3 EHT. *Sebastian*: Fort Smith, 15 SU. *Sevier*: 12 mi. S. Lockesburg, 2 AMNH. *Union*: 1 USNM. *Washington*: Prairie Grove, 1 KU; 6 mi. E. Springdale, 1 BC; Fayetteville, 5 AU; Winslow, 8 KU.

*Eumeces laticeps* (Schneider) Red-headed Skink.

PREVIOUSLY REPORTED—*Ashley*: Wilmot, (Taylor, 1935b). *Garland*: Hot Springs, (Taylor, 1935b). *Jefferson*: New Gascony, (Taylor, 1935b). *Lawrence*: Imboden, (Taylor, 1935b). *Logan*: Petit Jean Mt., (Stone, 1904; Taylor, 1935b). *Miller*: (Strecker and Williams, 1928; Taylor, 1935b). *Sebastian*: Fort Smith, (Taylor, 1935b). *Sevier*: Lockesburg, (Taylor, 1935b).

SPECIMENS KNOWN—*Ashley*: Wilmot, 1 USNM. *Clay*: Corning, 1 MU. *Crawford*: Mulberry, 1 AU. *Garland*: Hot Springs, 1 USNM, 1 BU. *Jefferson*: New Gascony, 2 ANS. *Lawrence*: Imboden, 5 KU, 2 FMNH, 1 and eggs AU. *Logan*: Petit Jean Mt., 1 ANS. *Miller*: 2 BU. *Pulaski*: Little Rock, 1 MU. *Sebastian*: Fort Smith, 1 USNM. *Sevier*: Lockesburg, 2 AMNH.

*Eumeces brevilineatus* (Cope). Short-lined Skink.

Apparently the only specimen known from Arkansas is in Cornell University Museum, No. 1128, collected by Byron C. Marshall, Lawrence County, near Imboden, May 31, 1929.

## SUB-ORDER SERPENTES. SNAKES.

*Leptotyphlops dulcis* (Baird and Girard). Florida Worm Snake.

The only record for this rare snake, so far as we know, is that of two specimens in the American Museum of Natural History, collected at Imboden by Byron C. Marshall.

*Carphophis amoena vermis* (Kennicott). Worm Snake.

PREVIOUSLY REPORTED—*Benton*: Rogers, (Stone, 1904). *Faulkner*: 7 mi. W. Conway; 12 mi. N. Conway, (Perkins, 1928). *Garland*: Hot Springs, (Strecker, 1924). *Logan*: Mt. Magazine, Blue Mt. Station, (Stone, 1904). *Pulaski*: Little Rock, (McLain, 1899; Hurter and Strecker, 1909). *Washington*: Winslow, (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 1 AMNH, 1 ANS. *Benton*: Rogers, 1 ANS; Sulphur Springs, 1 MU. *Boone*: Mystic Cavens, S. Harrison, 1 KU. *Carroll*: 1 USNM; Eureka Springs, 2 MU. *Faulkner*: 7 mi. W. Conway, "several" MBG; 12 mi. N. Conway, "several" MBG. *Garland*: 1 FMNH; Hot Springs, 1 BU. *Logan*: Blue Mt. Station, 2 ANS; Mt. Magazine, 13 FMNH, 1 ANS. *Lawrence*: Imboden, 20 AMNH, 1 CU, 9 FMNH. *Madison*: Hindsville, 1 AU. *Polk*: Rich Mt., 1 MU, 1 FMNH. *Pulaski*: Little Rock, 1 USNM, 1 BU, 1 MBG. *Sebastian*: Poteau Mt., 1 ANS; Fort Smith, 2 SU. *Washington*: Fayetteville, 1 MU, 4 AU.; 6 mi. E. of Springdale, 1 BC; Winslow, 3 KU, 1 AU.

*Farancia abacura* (Holbrook). Mud Snake; Horn Snake.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Green*: 10 mi. S. E. Paragould (Burt, 1935). *Lafayette*: Bradley (Strecker, 1926); Lewisville (Taylor, 1935).

SPECIMENS KNOWN—*Clay*: Rector, 1 USNM. *Crittenden*: near Hughes, 1 AU. *Drew*: 3 mi. E. Monticello, 1 AU. *Green*: 2½ mi. S. E. Paragould, 1 MU; 22 mi. N. Paragould, 1 MU. *Lafayette*: Lewisville, 1 KU. *Mississippi*: Frenchman's Bayou, 1 AU.

*Diadophis punctatus arnyi* (Kennicott). Army's Ringed-neck Snake.

PREVIOUSLY REPORTED—*Carroll*: Eureka Springs (Hurter and Strecker, 1909; Burt, 1935). *Faulkner*: 7 mi. W. Conway; 12 mi. N. Conway (Perkins, 1928). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Logan*: Mt. Magazine (Stone, 1904). *Madison*: Forum (Burt, 1935).

SPECIMENS KNOWN—*Benton*: 1 MU. *Carroll*: 1 MU; Eureka Springs, 1 USNM. *Faulkner*: 7 mi. W. Conway, "several" MBG; 12 mi. N. Conway, "several" MBG. *Logan*: Mt. Magazine, 6 ANS, 1 FMNH, 2 AU. *Garland*: Hot Springs, 2 USNM. *Lawrence*: 5 mi. S. W. Imboden, 2 AMNH, 1 CU, 1 AU. *Madison*: Forum, 1 USNM. *Polk*: Rich Mt., 3 FMNH. *Washington*: 6 mi. E. Springdale, 1 BC.

*Diadophis punctatus stictogenys* (Cope). Southern Ringed-neck Snake.

Marshall considers his Imboden specimens mainly intermediate between *stictogenys* and *arnyi*, referring some specimens to one race, some to the other and still others he marks clearly intermediate. The area of intergradation extends diagonally across the state roughly following the boundary between the Interior Highland and the Costal Plain as defined by Fennemans (1932). This line delimits two distinct physical areas and is a useful guide in zoogeographic studies.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Montgomery*: 3 mi. W. Oden (Burt, 1935).

SPECIMENS KNOWN—*Lawrence*: 5 mi. N. Imboden, 1 AMNH; Imboden, 4 AU (three marked intermediate), 3 FMNH, 1 CU. *Montgomery*: 3 mi. W. Oden, 1 USNM.

*Heterodon contortrix* Linne'. Spreading Adder; Puff Adder.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Faulkner*: 12 mi. N. Conway (Perkins, 1928). *Franklin*: Altus (Hurter and Strecker, 1909). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Grant*: 2 mi. N. Ico (Burt, 1935). *Lafayette*: Lewisville (Taylor, 1935). *Madison*: N. E. Clifty (Burt, 1935). *Polk*: 3 mi. N. E. Cherry Hill (Burt, 1935). *Saline*: N. E. Saline (Perkins and Lentz, 1934). *Sebastian*: Fort Smith (McLain, 1899; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Clay*: Greenway, 1 CAS. *Crawford*: Near Winfrey, 1 KU. *Franklin*: Altus, 1 USNM. *Faulkner*: 2 mi. N. Conway, 4 MBG; Conway, 1 AU. *Garland*: Hot Springs, 1 ANS. *Lawrence*: Imboden, 2 AMNH, 4 FMNH, 1 CU. *Lafayette*: Lewisville, 2 KU. *Logan*: 20 mi. W. Russellville, 1 MU. *Montgomery*: Pine Ridge, 1 FMNH. *Polk*: Cherry Hill, 1 USNM; Eagletown, 1 FMNH. *Pulaski*: Little Rock, 1 CMZ. *Saline*: N. E. Saline, 1 MBG. *Sebastian*: Fort Smith, 2 SU. *Washington*: Fayetteville Junction, 1 AU; West Fork, 1 AU; Winslow, 1 KU, 3 Winslow High School.

*Liopeltis vernalis* (Harlan). Smooth Green Snake.

There is but one authentic record for this species, and that is from Clark County, Arkadelphia, collected by Meek, as reported by Hurter and Strecker, (1909).

*Opheodrys aestivus* (Linnaeus). Rough Green Snake.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Garland*: Hot Springs, (Hurter

SPECIMENS KNOWN—*Lawrence*: 5 mi. N. Imboden, 1 AMNH; Imboden, 4 AU (three marked intermediate), 3 FMNH, 1 CU. *Montgomery*: 3 mi. W. Oden, 1 USNM.

*Heterodon contortrix* Linne'. Spreading Adder; Puff Adder.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Faulkner*: 12 mi. N. Conway (Perkins, 1928). *Franklin*: Altus (Hurter and Strecker, 1909). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Grant*: 2 mi. N. Ico (Burt, 1935). *Lafayette*: Lewisville (Taylor, 1935). *Madison*: N. E. Clifty (Burt, 1935). *Polk*: 3 mi. N. E. Cherry Hill (Burt, 1935). *Saline*: N. E. Saline (Perkins and Lentz, 1934). *Sebastian*: Fort Smith (McLain, 1899; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Clay*: Greenway, 1 CAS. *Crawford*: Near Winfrey, 1 KU. *Franklin*: Altus, 1 USNM. *Faulkner*: 2 mi. N. Conway, 4 MBG; Conway, 1 AU. *Garland*: Hot Springs, 1 ANS. *Lawrence*: Imboden, 2 AMNH, 4 FMNH, 1 CU. *Lafayette*: Lewisville, 2 KU. *Logan*: 20 mi. W. Russellville, 1 MU. *Montgomery*: Pine Ridge, 1 FMNH. *Polk*: Cherry Hill, 1 USNM; Eagletown, 1 FMNH. *Pulaski*: Little Rock, 1 CMZ. *Saline*: N. E. Saline, 1 MBG. *Sebastian*: Fort Smith, 2 SU. *Washington*: Fayetteville Junction, 1 AU; West Fork, 1 AU; Winslow, 1 KU, 3 Winslow High School.

*Liopeltis vernalis* (Harlan). Smooth Green Snake.

There is but one authentic record for this species, and that is from Clark County, Arkadelphia, collected by Meek, as reported by Hurter and Strecker, (1909).

*Opheodrys aestivus* (Linnaeus). Rough Green Snake.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Garland*: Hot Springs, (Hurter

and Strecker, 1909; Strecker, 1924). *Pulaski*: Little Rock, (Hurter and Strecker, 1909; Burt, 1935). *Sebastian*: Fort Smith (McLain, 1899; Cope, 1900; Hurter and Strecker, 1909). *Washington*: Winslow (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": I ANS. *Benton*: Eden's Bluff, near War Eagle, 1 AU. *Carroll*: 1 MU. *Green*: Paragould, 5 MU. *Lawrence*: Imboden, 4 FMNH, 1 CU. *Sebastian*: Fort Smith, 1 USNM, 2 SU, 1 MU. *Washington*: Fayetteville, 1 MU, 2 AU; near Farmington, 1 AU; Winslow, 6 KU, 1 AU.

*Coluber constrictor constrictor* (Linne'). Black Snake.

Ortenburger (1928) excludes all but extreme southeastern Arkansas from the range of this subspecies. Most students believe there is a great deal of intergradation between the two subspecies of *constrictor* found in Arkansas, and that the ranges of both forms overlap to a considerable extent. For the most part *flaviventris* is found in the hills and *constrictor* in the lowlands, according to prevalent opinion, but the separation is far from distinct. The original identifications are followed here, although we believe the disposition of these forms as made by Ortenburger is preferable.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Faulkner*: 12 mi. N. Conway (Perkins, 1928). *Lafayette*: Lewisville (Taylor, 1935). *Lawrence*: Imboden, (Taylor, 1935). *Mississippi*: 3 mi. N. Manila, (Burt, 1935). *Newton*: 1 mi. W. Lurton (Burt, 1935). *Pulaski*: Little Rock, (Hurter and Strecker, 1909); S. Little Rock, (Perkins, 1928). *Saline*: N. E. Saline (Perkins and Lentz, 1934). *Sebastian*: Fort Smith, (McLain, 1899; Cope, 1900; Hurter and Strecker, 1909). *Washington*: Winslow (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 1 AMNH. *Baxter*: S. Norfolk, 1 AU. *Carroll*: Berryville, 1 USNM. *Clark*: Caddo River, 3 mi. N. Arkadelphia, 1 AU. *Faulkner*: 12 mi. N. Conway, 2 MBG. *Green*: Paragould, 1 MU; 2 mi. N. W. Paragould, 2 MU; 9½ mi. W. Paragould, 1 MU. *Lafayette*: Lewisville, 2 KU. *Lawrence*: Imboden, 2 KU. *Pulaski*: Little Rock, 2 MBG; near Cross Roads, 1 MU. *Sebastian*: Fort Smith, 1 SU. *Washington*: Fayetteville, 1 AU; near Prairie Grove, 1 AU; Winslow, 1 KU.

*Coluber constrictor flaviventris* (Say). Blue Racer.

PREVIOUSLY REPORTED—*Benton*: Gravette (Taylor, 1935). *Boone*: 2 mi. E. Alpena Pass (Burt, 1935). *Carroll*: S. E. Berryville (Burt, 1935). *Cleveland*: 17 mi. N. Fordyce (Burt, 1935). *Garland*: Hot Springs, (Hurter and Strecker, 1909; Ortenburger, 1928). *Madison*: 3 mi. N. Forum (Burt, 1935). *Pope*: 6 mi. S. Simpson (Burt, 1935). *Pulaski*: Little Rock (Ortenburger, 1928). *Saline*: 5 mi. N. Ico (Burt, 1935). *Sebastian*: Fort Smith (Ortenburger, 1928); 9 mi. S. Fort Smith, given as Crawford County, (Burt, 1935). *Washington*: E. Summers (Burt, 1935); Winslow (Taylor, 1935).

SPECIMENS KNOWN—*Benton*: 3 mi. N. W. Bentonville, 1 BC; Gravette, 2 KU. *Green*: Paragould, 1 MU. *Garland*: Hot Springs, 1 MU, 1 FMNH. *Lawrence*: Imboden, 8 AMNH, 10 FMNH. *Polk*: Ink, 1 FMNH. *Saline*: N. E. Saline, 4 MBG. *Washington*: Fayetteville, 1 MU, 4 AU; Winslow, 8 KU.

*Masticophis flagellum flagellum* (Shaw). Coach Whip.

PREVIOUSLY REPORTED—*Crawford*: 5 mi. S. Fort Smith (Burt, 1935). *Faulkner*: 12 mi. N. Conway (Perkins, 1928). *Madison*: 2 mi. E. Alabam (Taylor, 1935). *Perry*: 3 mi. N. W. Applin (Perkins, 1928). *Pulaski*: S. Little Rock (Perkins, 1928). *Saline*: N. E. Saline (Perkins and Lentz, 1934); 11 mi. S. Little

Rock (Burt, 1935); 2 mi. E. Whittington (Burt, 1935). *Scott*: 11 mi. S. Waldron (Ortenburger, 1929). *Sebastian*: Fort Smith (McLain, 1899; Cope, 1900; Hurter and Strecker, 1909; Ortenburger, 1928). *Washington*: Winslow (Taylor, 1935).

SPECIMENS KNOWN—*Faulkner*: 12 mi. N. Conway, "several" MBG; Cadron Creek, near Conway, 1 AU; 1½ mi. N. Conway, 1 AU. *Franklin*: 3 mi. E. Altus, 1 BC. *Lawrence*: Imboden, 2 FMNH, 1 CU. *Madison*: 2 mi. E. Alabam, 1 KU. *Marion*: 7 mi. W. Yellville, 1 MU. *Montgomery*: Pine Ridge, 1 FMNH. *Perry*: 3 mi. N. W. Applin, 1 MBG. *Sebastian*: Fort Smith, 1 SU. *Scott*: 11 mi. S. Waldron, 1 OU. *Washington*: Fayetteville, 2 MU, 1 AU; West Fork, 1 AU; Winslow, 2 KU. *Yell*: Havana, 1 FMNH.

*Elaphe guttata* (Linne'). Corn Snake.

There are two published records, one from Greenway, Clay County, collected by Meek as reported by Hurter and Strecker (1909), and one from "Arkansas" now in the United States National Museum, as reported by Cope (1900). Marshall occasionally gets a specimen in the region of Imboden, Lawrence County.

*Elaphe laeta* (Baird and Girard). Milk Snake.

PREVIOUSLY REPORTED—"Arkansas": (Cope, 1900; Hurter and Strecker, 1909). *Carroll*: 4 mi. W. Green Forest (Burt, 1935). *Saline*: N. E. Saline (Perkins and Lentz, 1934). *Sebastian*: Fort Smith (Cope, 1900). *Washington*: Winslow (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 1 USNM. *Benton*: Near Rogers, 1 AU. *Garland*: Hot Springs, 1 FMNH. *Lawrence*: Imboden, 1 MU. *Polk*: Eagletown, 1 FMNH. *Saline*: N. E. Saline, 1 MBG. *Washington*: Fayetteville, 3 AU; Winslow, 1 KU.

*Elaphe obsoleta obsoleta* (Say). Pilot Black Snake.

The condition here parallels that of *Coluber con-*

*strictor* in that the area of intergradation between *obsoleta* and *confinis* is rather extensive, and many intermediates occur, as well as much overlapping. We give here the original determinations. Dr. Burt (1935) does not recognize the subspecies *confinis* as valid.

PREVIOUSLY REPORTED—*Benton*: 3 mi. E. Decatur (Burt, 1935); 3 mi. N. E. Gateway (Burt, 1935); Gravette (Taylor, 1935). *Carroll*: S. Busch (Burt, 1935); Eureka Springs (Hurter and Strecker, 1909). *Conway*: W. Morrilton (Burt, 1935). *Garland*: Hot Springs (Strecker, 1924). *Madison*: 2 mi. S. Forum (Burt, 1935). *Montgomery*: 5 mi. E. Mt. Ida (Burt, 1935). *Newton*: 4 mi. N. Jasper (Burt, 1935). *Saline*: N. E. Saline (Perkins and Lentz, 1934); 11 mi. S. Little Rock, (Burt, 1935). *Sebastian*: Fort Smith (McLain, 1899; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Benton*: Gravette, 1 KU. *Carroll*: Eureka Springs, 2 USNM. *Fulton*: Mammoth Spring, 2 AMNH. *Green*: 5 mi. N. E. Paragould, 1 MU; 8 mi. S. Paragould, 2 MU; 16 mi. N. W. Paragould, 1 MU. *Lawrence*: Imboden, 9 FMNH, 1 CU. *Newton*: Jasper, 1 USNM. *Saline*: N. E. Saline, 8 MBG. *Sebastian*: Fort Smith, 1 USNM, 2 SU. *Washington*: Fayetteville, 1 AU; 1 USNM; 1 mi. W. Prairie Grove, 1 AU; 6 mi. E. Springdale, 1 BC; Winslow, 6 KU.

*Elaphe obsoleta confinis* (Baird and Girard). Southern Pilot Black Snake; Spotted Black Snake; Chicken Snake.

PREVIOUSLY REPORTED — *Prairie*: DeValls Bluff (Taylor, 1935). *Sebastian*: Fort Smith (Hurter and Strecker, 1909).

SPECIMENS KNOWN — *Green*: Paragould, 1 MU. *Monroe*: Brinkley, 1 MU. *Prairie*: DeValls Bluff, 1 KU. *Washington*: Fayetteville, 1 AU, 2 MU.

*Pituophis sayi sayi* (Schlegel). Bull Snake.

Hurter and Strecker (1909) report a single individual taken near Mena, Polk County, by Strecker. We have not been able to locate this specimen. Perkins and Lentz have taken this animal in Arkansas, according to a letter we have from Perkins under date of April 6, 1938, but he does not give the locality.

*Lampropeltis calligaster* (Harlan). Brown King Snake.

PREVIOUSLY REPORTED—*Benton*: 2 mi. N. E. Siloam Springs, (Burt, 1935). *Clay*: Greenway (Hurter and Strecker, 1909; Blanchard, 1921). *Lafayette*: Lewisville (Taylor, 1935). *Perry*: 3 mi. N. W. Applin (Perkins, 1928). *Saline*: N. E. Saline (Perkins and Lentz, 1934). *White*: McRae (Burt, 1935).

SPECIMENS KNOWN—"Arkansas": 1 CU. *Lafayette*: Lewisville, 1 KU. *Lawrence*: Imboden, 1 CU. *Montgomery*: Pine Ridge, 1 FMNH. *Perry*: 3 mi. N. W. Applin, 1 MBG. *Pope*: Near London, 1 MU. *Pulaski*: Near Cross Roads, 1 MU. *Saline*: N. E. Saline, 1 MBG. *Washington*: Fayetteville, 2 AU. *White*: McRae, 1 USNM.

*Lampropeltis getulus holbrooki* (Stejneger). Say's King Snake; Salt and Pepper King Snake.

PREVIOUSLY REPORTED — "Arkansas": (Cope, 1900). *Clark*: Arkadelphia (Blanchard, 1921). *Clay*: Greenway (Blanchard, 1921). *Crawford*: Mulberry (Taylor, 1935). *Faulkner*: 7 mi. W. Conway (Perkins, 1928). *Garland*: Hot Springs (Hurter and Strecker, 1909; Blanchard, 1921; Strecker, 1924). *Hot Spring*: Donaldson (Blanchard, 1921). *Jefferson*: Pine Bluff (Hurter and Strecker, 1909; Blanchard, 1921). *Lafayette*: Lewisville (Taylor, 1935). *Montgomery*: 7 mi. W. Norman (Ortenburger, 1929); 7 mi. N. W. Mauldin (Burt, 1935); 3 mi. W. Oden (Burt, 1935). *Polk*: 1 mi. W. Board Camp (Ortenburger, 1929). *Prairie*:

DeValls Bluff (Taylor, 1935). *Pulaski*: Palarm (Burt, 1935). *Saline*: N. E. Saline (Perkins and Lentz, 1934). *Washington*: Fayetteville, (Blanchard, 1921); Winslow (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 1 USNM. *Benton*: 3 mi. W. Bentonville, 1 BC. *Carroll*: 1 MU. *Crawford*: Mulberry, 1 KU. *Fulton*: Mammoth Spring, 1 AMNH. *Garland*: Near Montgomery County line, 1 MU; Hot Springs, 1 USNM; 1 CMZ, 3 FMNH. *Green*: Near Paragould, 5 MU; 16 mi. N. W. Paragould, 1 MU. *Lafayette*: Lewisville, 2 KU. *Lawrence*: Imboden, 2 SDNHM, 17 FMNH, 9 AMNH. *Lonoke*: 25 mi. E. Little Rock, 1 MU. *Montgomery*: 1 MU; 3 mi. W. Oden, 1 USNM; 7 mi. N. W. Mauldin, 1 USNM; 7 mi. W. Norman, 1 OU. *Perry*: Hollis, 1 FMNH. *Polk*: Eagleton, 1 MU; 1 mi. W. Board Camp, 1 OU; Rich Mt., 1 FMNH. *Prairie*: DeValls Bluff, 3 KU. *Pulaski*: 2 mi. N. Little Rock, 1 CMZ; Little Rock, 1 CU. *Saline*: N. E. Saline, 2 MBG. *Washington*: Fayetteville, 2 AU; Lincoln, 1 AU; Weddington Gap, 16 mi. W. Fayetteville, 1 AU; Winslow, 2 KU.

*Lampropeltis triangulum amaura* (Cope). Southern Coral King Snake.

PREVIOUSLY REPORTED—"Arkansas": (Blanchard, 1921). *Clark*: Arkadelphia (Blanchard, 1921). *Garland*: Hot Springs (Strecker, 1924).

SPECIMENS KNOWN—"Arkansas": 1 USNM (there is a strong possibility that this is not an Arkansas specimen). *Clark*: Arkadelphia, 1 Alabama Museum. *Logan*: Mt. Magazine, 1 FMNH.

*Lampropeltis triangulum sypila* (Cope). Coral King Snake.

PREVIOUSLY REPORTED — "Arkansas": (Cope, 1900). *Garland*: Hot Springs (Hurter and Strecker, 1909; Blanchard, 1921). *Logan*: Petit Jean Mt. (Stone,

1904; Blanchard, 1921). *Polk*: Rich Mt. (Blanchard, 1921). *Sebastian*: Fort Smith (McLain, 1899; Hurter and Strecker, 1909; Blanchard, 1921).

SPECIMENS KNOWN—*Green*: Near Paragould, 1 MU. *Lawrence*: Imboden, 1 AU; 1 CU. *Logan*: Petit Jean Mt., 1 ANS; Mt. Magazine, 1 AU. *Polk*: Rich Mt., 1 USNM. *Sebastian*: Fort Smith, 3 SU. *Washington*: West Fork, 1 AU; Winslow, 2 Winslow High School. *White*: Griffithville, 1 USNM.

*Cemophora coccinea* (Blumenbach). False Coral Snake.

There is a specimen in the Michigan University Museum from 3½ mi. S. E. Paragould, and one in the Arkansas University Museum from Fort Smith. The species is reported not rare at Fort Smith and we have seen several live specimens from there, where they are known as Coral Snakes.

#### Genus *Natrix*

The genus *Natrix* has long offered many peculiar problems which have rendered a satisfactory disposition of the various species and subspecies virtually impossible. Arkansas, being well within the middle of the range of the genus and blessed with especially varied topography, climate and drainage regions has been especially effected. We have, in the following paragraphs, listed the various species according to their present identifications, partly to avoid confusion and partly due to the impossibility of examining all this material ourselves critically enough to justify a reclassification of the material in question.

We have received a letter from Dr. William M. Clay, after the manuscript was otherwise completed, (June 11, 1938) which sheds a great deal of light on the problem of the subspecific identification of certain species within the genus. We have extracted the following pertinent information from that letter, relative to Arkansas specimens.

The subspecies *pleuralis* of the *Natrix sipedon* complex has been restored and includes all the *sipedon* from Arkansas, except possibly a few which should be referred to *sipedon sipedon*, and those specimens which can be classified under the subspecies *confluens*. As we interpret this *confluens* stands as before, but most of the material previously called *sipedon sipedon* from Arkansas should be classified as *sipedon pleuralis*. The subspecies *fasciata*, according to Clay, does not occur in Arkansas, hence the material listed under that name should be assigned to *pleuralis* with which *fasciata* intergrades further south.

Concerning the *erythrogaster-transversa* complex Clay has concluded that all Arkansas specimens are somewhat intermediate in that their ventral color is usually yellow as in *transversa*, but that the dorsal color pattern is much closer to *erythrogaster*. Our observations on a large number of specimens from the state agree with this. A few specimens tend to show the dorsal coloration of *transversa*, but on the whole the material from any given locality seems best referred to *erythrogaster*.

Dr. Clay has not studied the other species of the genus; hence we retain, without comment, their original identifications.

*Natrix cyclopion* (Dumeril and Bibron). Green Water Snake.

PREVIOUSLY REPORTED—*Green*: Paragould, (Hurt-er and Strecker, 1909). *Prairie*: 10 mi. S. Hazen, (Perkins, 1928). *Pulaski*: Near Little Rock, (Perkins, 1928).

SPECIMENS KNOWN—*Jefferson*: Pine Bluff, 1 AU. *Prairie*: 10 mi. S. Hazen, "several" MBG. *Pulaski*: near Little Rock, 2 MBG, 1 USNM. *Poinsett*: near Waldenburg, 1 MU. *Washington*: Greathouse Spring, 6 mi. N. W. Fayetteville, 1 AU.

*Natrix grahamii* (Baird and Girard). Graham's Water Snake.

PREVIOUSLY REPORTED—*Green*: Paragould, (Hurter and Strecker, 1909). *Saline*: N. E. Saline, (Perkins and Lentz, 1934).

SPECIMENS KNOWN—*Jefferson*: Pine Bluff, 1 AU. *Poinsett*: near Weiner, 1 MU. *Saline*: N. E. Saline, 1 MBG.

*Natrix rhombifera* (Hallowell). Diamond-backed Water Snake.

PREVIOUSLY REPORTED—*Green*: Paragould, (Hurter and Strecker, 1909). *Garland*: Hot Springs (Strecker, 1924). *Lafayette*: Lewisville, (Taylor, 1935). *Prairie*: DeValls Bluff, (Taylor, 1935); 10 mi. S. Hazen, (Perkins and Lentz, 1934). *Sebastian*: Fort Smith, (McLain, 1899; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Clay*: near Corning, 1 MU. *Crittenden*: Turrell, 1 MU. *Faulkner*: Conway, 1 AU. *Garland*: Hot Springs, 1 USNM. *Green*: near Paragould, 7 MU. *Jefferson*: Pine Bluff, 1 AU. *Lafayette*: Lewisville, 1 KU. *Phillips*: Helena, 1 MU. *Prairie*: DeValls Bluff, 16 KU; 10 mi. S. Hazen, "several" MBG. *Poinsett*: near Waldenburg, 11 MU; near Weiner, 3 MU. *Saint Francis*: Wheatley, 1 USNM; 1 mi. E. Goodwin, 1 BC. *Saline*: N. E. Saline, 3 MBG. *Sebastian*: Fort Smith, 3 SU; Barling, 1 AU. *Washington*: Fayetteville, 4 AU; West Fork, 1 AU.

*Natrix rigida* (Say). Striped Water Snake.

Previously reported from "Southwestern Arkansas", presumably Miller County, near the Red River, by Strecker and Williams (1928). Marshall has recently collected a specimen at Pine Bluff, now in the University of Arkansas Museum.

*Natrix septemvittata* (Say). Brown Queen Snake.

PREVIOUSLY REPORTED—*Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924).

SPECIMENS KNOWN—*Garland*: Hot Springs, 3 USNM, 1 BU. *Washington*: S. E. Greenland, White River, 1 AU.

*Natrix sipedon sipedon* (Linne'). Common Water Snake.

PREVIOUSLY REPORTED—*Clay*: Greenway, (Hurter and Strecker, 1909). *Crittenden*: 2 mi. S. Turrell, (Burt, 1935). *Crawford*: Mulberry, (Taylor, 1935). *Lawrence*: Imboden, (Taylor, 1935); Black Rock (Burt, 1935). *Madison*: 2 mi. S. Forum, (Burt, 1935). *Polk*: 4 mi. E. State Line; 3 mi. S. Potter, (Ortenburger, 1929). *Pope*: 15 mi. N. Dover, (Burt, 1935). *Sevier*: 20 mi. E. DeQueen, (Ortenburger, 1929).

SPECIMENS KNOWN—*Crawford*: Mulberry, 2 KU; near Winfrey, 2 KU. *Franklin*: Ozark, 1 MVZ; 6 mi. N. Ozark, 2 KU. *Garland*: Hot Springs, 1 USNM. *Lawrence*: Black Rock, 1 USNM; Imboden, 2 KU, 1 MU. *Madison*: Delaney, 2 MU; 3 mi. S. Delaney, 2 USNM; 2 mi. S. Forum, 1 USNM. *Newton*: 1 mi. S. Ponca, 1 USNM. *Polk*: 4 mi. E. state line, 1 OU; 3 mi. S. Potter, 1 OU. *Sevier*: 20 mi. E. DeQueen, 1 OU. *Washington*: Fayetteville, 2 AU; 6 mi. N. W. Fayetteville, 1 AU; Prairie Grove, 1 AU; West Fork, 1 AU; Winslow, 1 KU.

*Natrix sipedon confluens* (Blanchard). Blanchard's Water Snake.

PREVIOUSLY REPORTED—*Dallas*: 2 mi. N. Estes, (Burt, 1935). *Garland*: Hot Springs, (Strecker, 1924). *Green*: 10 mi. S. E. Paragould, (Burt, 1935). *Lafayette*: Lewisville, (Taylor, 1935). *Prairie*: DeValls Bluff, (Taylor, 1935).

SPECIMENS KNOWN—*Dallas*: 2 mi. N. Estes, 1

USNM. *Garland*: Hot Springs, 2 BU. *Green*: 10 mi. S. E. Paragould, 1 USNM; Paragould, 3 MU. *Jefferson*: Pine Bluff; 1 AU. *Lafayette*: Lewisville, 1 KU. *Phillips*: Helena, 1 MU. *Poinsett*: Weiner, 3 MU. *Prairie*: DeValls Bluff, 16 KU.

*Natrix sipedon fasciata* (Linne'). Banded Water Snake.

PREVIOUSLY REPORTED—*Garland*: Hot Springs, (Hurter and Strecker, 1909). *Miller*: Texarkana, (Hurter and Strecker, 1909). *Prairie*: 10 mi. S. Hazen, (Perkins, 1928). *Pulaski*: near Little Rock, (Perkins, 1928). *Sebastian*: Fort Smith, (Hurter and Strecker, 1909, referring here the specimen given under the name *pleuralis* by McLain, 1899).

SPECIMENS KNOWN—*Faulkner*: Cadron Creek, 1 mi. N. W. Conway, 1 AU. *Jefferson*: 1 USNM; Pine Bluff, 1 AU. *Miller*: Texarkana, 1 USNM. *Prairie*: 10 mi. S. Hazen, "several" MBG. *Pulaski*: near Little Rock, 2 MBG. *Saint Francis*: Wheatley, 2 USNM.

*Natrix sipedon pleuralis* (Cope). Cope's Water Snake.

PREVIOUSLY REPORTED—*Sebastian*: Fort Smith, (McLain, 1899; the same specimen referred to *fasciata* by Hurter and Strecker, 1909).

SPECIMENS KNOWN (see introductory paragraph on *Natrix*)—*Carroll*: Eureka Springs, 6 MU. *Pike*: Murfreesboro, 1 FMNH. *Sebastian*: Fort Smith, 1 SU.

*Natrix erythrogaster erythrogaster* (Forster). Copper-bellied Water Snake.

PREVIOUSLY REPORTED—*Green*: 10 mi. S. E. Paragould, (Burt, 1935). *Lawrence*: Imboden, (Taylor, 1935).

SPECIMENS KNOWN—*Clay*: Corning, 3 MU. *Garland*: 1 USNM. *Green*: Paragould, 28 MU; 10 mi. S. E. Paragould, 1 USNM; 22 mi. N. Paragould, 1 MU; S. Marmaduke, 1 MU. *Lawrence*: Imboden, 34 KU, 1

CMZ, 2 AU, 2 CU. *Madison*: Delaney, 1 MU. *Monroe*: Clarendon, 1 MU. *Pulaski*: 1 USNM. *Yell*: Havana, 1 AU.

*Natrix erythrogaster transversa* (Hallowell). Blotched Water Snake.

Hallowell (Proc. Acad. Nat. Sci., Phila. 1852, p. 177) in his original description of this subspecies gives the type locality as "Creek Boundary, Arkansas River and its tributaries, Arkansas." There persists the misconception that this is an Arkansas locality, as the state is now delimited. Actually this locality, according to a letter we have from Dr. A. O. Weese, is west of Tulsa, Oklahoma, since the Creek Boundary extends from Tulsa westward, and would intersect the Arkansas River about the junction of the Arkansas and Cimmaron rivers.

PREVIOUSLY REPORTED—*Garland*: Hot Springs, (Cope, 1900; Hurter and Strecker, 1909; Strecker, 1924). *Lafayette*: Lewisville, (Taylor, 1935). *Polk*: 3 mi. E. Cherry Hill, (Burt, 1935). *Miller*: Texarkana, (Hurter and Strecker, 1909). *Pulaski*: Little Rock, (Hurter and Strecker, 1909). *Saline*: N. E. Saline, (Perkins and Lentz, 1934). *Sebastian*: Fort Smith, (McLain, 1899; Cope, 1900; Hurter and Strecker, 1909). *Washington*: Winslow, (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 1 AMNH. *Carroll*: Eureka Springs, 1 USNM. *Fulton*: Mammoth Spring, 1 AMNH. *Garland*: Hot Springs, 7 USNM, 1 CAS. *Lafayette*: Lewisville, 3 KU. *Lawrence*: Imboden, 1 AMNH, 19 FMNH. *Madison*: 8 mi. S. E. Huntsville, 1 KU. *Saline*: N. E. Saline, 5 MBG. *Sebastian*: Fort Smith, 1 USNM, 2 SU. *Washington*: Winslow, 1 KU.

*Storeria dekayi* (Holbrook). DeKay's Snake.

PREVIOUSLY REPORTED—*Carroll*: (Hurter and Strecker, 1909). *Crawford*: Van Buren, (Taylor,

1935). *Garland*: Hot Springs, (Strecker, 1924). *Lafayette*: Lewisville, (Taylor, 1935). *Pulaski*: Little Rock, (Hurter and Strecker, 1909). *Saline*: N. E. Saline, (Perkins and Lentz, 1934). *Washington*: Winslow, (Taylor, 1935).

SPECIMENS KNOWN—*Benton*: Sulphur Springs, 1 MU. *Carroll*: 1 USNM. *Crawford*: Van Buren, 1 KU. *Garland*: Hot Springs, 1 USNM. *Green*: Paragould, 1 MU. *Lafayette*: Lewisville, 1 KU. *Lawrence*: Imboden, 2 AMNH, 1 AU. *Pulaski*: Little Rock, 1 USNM. *Saline*: N. E. Saline, 1 MBG. *Washington*: near Springdale, 1 ChA; Winslow, 2 KU.

*Storeria occipito - maculata* (Storer). Red - bellied Snake; Storer's Snake.

PREVIOUSLY REPORTED — *Lafayette*: Lewisville, (Taylor, 1935). *Pulaski*: (Taylor, 1935).

SPECIMENS KNOWN—*Benton*: near Bat Cave, 2 mi. N. W. War Eagle, 1 AU. *Lafayette*: Lewisville, 1 KU. *Lawrence*: Imboden, 2 AU, 7 FMNH. *Pulaski*: 1 KU. *Washington*: 10 mi. E. Winslow, 1 AU.

*Virginia valeriae valeriae* (Baird and Girard). Valeria's Snake.

The only record is of a specimen labelled "Arkansas" in the collection of the Philadelphia Academy of Natural Science. Dr. Dunn has reexamined this specimen and reports that it is typical of this subspecies. He further suggests that this form as a variant within the normal range of the subspecies *elegans* is to be expected. Since the confusion regarding material labelled "Arkansas" comes from the west instead of the east, and since this subspecies is the eastern form there seems no good reason to doubt the validity of the record, even though the one word "Arkansas" is disconcerting.

*Virginia valerie elegans* (Kennicott). Virginia's Snake.

In addition to the specimens listed here we have recently examined a specimen, alive, from Cane Hill, Washington County, belonging to, and collected by, Miss Clara Waite of Cane Hill.

PREVIOUSLY REPORTED—*Benton*: Rogers, (Stone, 1904). *Garland*: Hot Springs, (Strecker, 1924). *Lawrence*: Imboden, (Taylor, 1935).

SPECIMENS KNOWN—*Benton*: Rogers, 1 ANS. *Lawrence*: Imboden, 1 KU, 1 AU, 1 CU. "Ozark Mts.", 2 CU.

*Potamophis striatulus* (Linne'). Ground Snake.

PREVIOUSLY REPORTED — "Arkansas": (Cope, 1900). *Garland*: Hot Springs, (Strecker, 1924). *Sebastian*: Fort Smith, (Hurter and Strecker, 1909).

SPECIMENS KNOWN—"Arkansas": 1 USNM, 1 CU. *Green*: near Paragould, 1 MU. *Lawrence*: Imboden, 9 AMNH, 1 CU, 2 AU. *Miller*: Texarkana, 1 USNM. *Pulaski*: 12 mi. S. W. Little Rock, 1 MU. *Washington*: 6 mi. E. Springdale, 1 BC.

*Tropidoclonion lineatum* (Hallowell). Line Snake.

The only specimen known to us is one from Imboden in the Cornell University collection.

*Thamnophis radix* (Baird and Girard). Western Ribbon Snake.

PREVIOUSLY REPORTED — "Arkansas": Hurter, 1911, so mentions this species in discussing its range. No details are given.

SPECIMENS KNOWN—*Washington*: Farmington, 1 AU; Fayetteville, 1 AU; Winslow, 1 AU.

*Thamnophis sauritus proximus* (Say). Southern Ribbon Snake.

We include under this subspecies the two speci-

mens from Fort Smith which McLain (1899) reported under the subspecific name of *sackenii*.

PREVIOUSLY REPORTED—*Clay*: Greenway, (Hurter and Strecker, 1909). *Crawford*: Mulberry, (Taylor, 1935). *Garland*: Hot Springs, (Hurter and Strecker, 1909; Strecker, 1924). *Lafayette*: Lewisville, (Taylor, 1935). *Pulaski*: Little Rock, (McLain, 1899; Hurter and Strecker, 1909). *Saline*: N. E. Saline, (Perkins and Lentz, 1934); 4 mi. N. Ico, (Burt, 1935). *Sebastian*: Fort Smith, (McLain, 1899; Hurter and Strecker, 1909). *Washington*: Winslow, (Taylor, 1935).

SPECIMENS KNOWN — “Arkansas”: 1 AMNH. *Clay*: Corning, 1 MU. *Crawford*: Mulberry, 1 KU. *Crittenden*: West Memphis, 1 BC. *Drew*: Winchester, 1 USNM. *Green*: Paragould, 2 MU; 22 mi. N. Paragould, 1 MU. *Lafayette*: Lewisville, 3 KU. *Lawrence*: Imboden, 5 FMNH, 1 AU, 1 CU. *Poinsett*: 2 MU. *Pulaski*: 1 USNM; Little Rock, 1 SU. *Saline*: N. E. Saline, 1 MBG. *Sebastian*: Fort Smith, 2 SU. *Washington*: Fayetteville, 2 AU; West Fork, 1 AU; Winslow, 3 KU.

*Thamnophis sirtalis sirtalis* (Linne'). Garter Snake.

Most of the *sirtalis* from Arkansas seem referable to this subspecies, although the Ozarks seem to be in an area of intergradation. We have examined all the *Thamnophis* from Arkansas in the collections of Michigan University and Kansas University in addition to our material, and are satisfied that the present disposition as here given is reasonably accurate.

PREVIOUSLY REPORTED — *Garland*: Hot Springs, (Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Benton*: Sulphur Springs, 1 MU. *Carroll*: 1 USNM. *Garland*: 1 USNM. *Jefferson*: 1 USNM. *Lawrence*: Imboden, 1 FMNH, 1 AU. *Mississippi*: Helena, 1 MU. (This is a most unusual young specimen, with wavy cross lines of black on a

green field, and without dorsal stripe. We follow here the original determination, although it is likely that some other disposition will eventually be made of this specimen). *Polk*: Acorn, 1 MU; Rich Mt., 1 FMNH. *Perry*: Hollis, 1 FMNH. *Washington*: Fayetteville, 2 MU; near Woolsey, 1 AU.

*Thamnophis sirtalis parietalis* (Say). Red-sided Garter Snake.

Taylor (1935) reported four of these from Winslow. There is now a fifth in the Kansas University Museum. All five of these specimens have the bright red blocks on the sides typical of this subspecies and are undoubtedly *parietalis*.

*Tantilla gracilis* (Baird and Girard). Graceful Tantilla.

PREVIOUSLY REPORTED—*Faulkner*: 12 mi. N. Conway; 7 mi. W. Conway, (Perkins, 1928). *Garland*: Hot Springs, (Hurter and Strecker, 1909; Strecker, 1924). *Lawrence*: (Force, 1935). *Logan*: Blue Mt. Station, (Stone, 1904). *Montgomery*: 3 mi. W. Oden, (Burt, 1935). *Pulaski*: Little Rock, (Hurter and Strecker, 1909; Force, 1935). *Saline*: N. E. Saline, (Perkins and Lentz, 1934). *Sebastian*: Fort Smith, (McLain, 1899; Hurter and Strecker, 1909); Hartford, (Stone, 1904).

SPECIMENS KNOWN—"Arkansas": 1 CU. *Benton*: 3 mi. N. E. Bentonville, 1 BC. *Faulkner*: "several" MBG. *Garland*: Hot Springs, 1 USNM. *Lawrence*: Imboden, 13 AMNH, 1 MU, 2 AU, 2 CU. *Logan*: Blue Mt. Station, 1 ANS. *Montgomery*: 3 mi. N. Oden, 1 USNM. *Saline*: N. E. Saline, 27 MBG. *Sebastian*: Fort Smith, 3 SU, 1 USNM.

*Micrurus fulvius fulvius* (Linne'). Coral Snake.

There is a specimen in the United States National Museum labelled "Arkansas" and collected by Col.

Kearney. Dr. A. O. Weese, of the University of Oklahoma, informs us under date of June 2, 1938, that "As far as I know Colonel Kearney did not collect within the bounds of the present state of Arkansas." He was at several Oklahoma points, including Fort Towson, as Dr. Weese further states, and it is probable that this snake came from around Fort Towson.

We have, however, one good Arkansas record, that of a specimen taken in Miller County, and now in the University of Arkansas collection. There are many sight records from the southern part of the state that no doubt refer to this species.

*Agkistrodon mokasen* (Beauvois.) Copperhead.

PREVIOUSLY REPORTED — "Arkansas": (Cope, 1900). *Benton*: Gravette, (Taylor, 1935). *Clay*: Greenway, (Hurter and Strecker, 1909). *Garland*: Hot Springs, (Hurter and Strecker, 1909). *Lafayette*: Lewisville, (Taylor, 1935). *Saline*: N. E. Saline, (Perkins and Lentz, 1934). *Sebastian*: Fort Smith, (McLain, 1899; Hurter and Strecker, 1909). *Washington*: Winslow, (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 1 USNM. *Benton*: Gravette, 1 KU. *Clark*: 6 mi. W. Arkadelphia, 1 AU. *Clay*: Greenway, 1 FMNH. *Garland*: Hot Springs, 1 USNM. *Green*: Paragould, 1 MU. *Jefferson*: Rob Roy, 1 M. V. Parker coll. *Lafayette*: Lewisville, 1 KU. *Lawrence*: Imboden, 6 SDNHM, 1 CU. *Madison*: Huntsville, 1 KU. *Monroe*: Roe, 1 M. V. Parker coll. *Prairie*: 10 mi. S. Hazen, 1 MBG. *Pulaski*: S. Little Rock, 1 MBG. *Saline*: N. E. Saline, 6 MBG. *Sebastian*: Fort Smith, 1 SU. *Washington*: Winslow, 1 KU; Fayetteville, 1 AU; 5 mi. N. Fayetteville, 3 AU; West Fork, 1 AU.

*Agkistrodon piscivorus* (Lacepede). Water Moccasin; Cottonmouth.

PREVIOUSLY REPORTED—*Garland*: Hot Springs,

(Hurter and Strecker, 1909; Strecker, 1924). *Green*: Paragould, (Hurter and Strecker, 1909). *Hot Spring*: Donaldson, (Cope, 1900; Hurter and Strecker, 1909). *Lafayette*: Lewisville, (Taylor, 1935). *Monroe*: 9 mi. S. W. Clarendon, (Burt, 1935). *Prairie*: 10 mi. S. Hazen, (Perkins, 1928); DeValls Bluff, (Taylor, 1935). *Sebastian*: Fort Smith, (McLain, 1899; Cope, 1900; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Craighead*: Otwell, 1 MU. *Crawford*: Mountainburg, 1 KU; Arbuckle Island, 1 AU. *Clark*: 3 mi. N. W. Arkadelphia, 1 AU; 3 mi. W. Arkadelphia, 1 AU; Hopedale, 1 USNM. *Clay*: Corning, 1 MU. *Green*: Paragould, 1 MU; 22 mi. N. Paragould, 1 MU. *Lafayette*: Lewisville, 8 KU. *Lawrence*: Imboden, 1 FMNH. *Jefferson*: Pine Bluff, 1 SDNHM. *Monroe*: Clarendon, 1 USNM; 9 mi. S. W. Clarendon, 1 M. V. Parker coll; Roe, 1 M. V. Parker coll. *Poinsett*: Marked Tree, 1 Parker coll; Waldenburg, 1 Boyer coll.; Weiner, 1 MU. *Prairie*: 10 mi. S. Hazen, "several" MBG; DeValls Bluff, 45 KU. *Pulaski*: S. Little Rock, 12 MBG. *Saint Francis*: Round Pond, 1 Parker coll.; Wheatley, 1 USNM. *Saline*: N. E. Saline, 12 MBG. *Sebastian*: Fort Smith, 2 USNM, 2 ANS, 1 SU.

*Sistrurus miliarius streckeri* (Gloyd). Strecker's Ground Rattler.

PREVIOUSLY REPORTED—"San Bois Creek": (Hurter and Strecker, 1909). *Garland*: Hot Springs, (Strecker, 1924). *Lawrence*: Imboden, (Gloyd, 1935, the description of *streckeri* with Imboden as the type locality). *Washington*: Winslow, (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 1 USNM, 1 ANS. *Benton*: near War Eagle, 1 AU. *Craighead*: Jonesboro, 1 Memphis Zoo; Crowley's Ridge, 1 B. C. Marshall coll. *Garland*: Hot Springs, 1 BU. *Lawrence*: Imboden, 2 SDNHM; 2 H. K. Gloyd coll; 2 MU,

1 AU. *Madison*: Thompson, 1 USNM. *Sebastian*: Fort Smith, 1 USNM. *Washington*: 4 mi. N. Winslow, 1 KU.

*Crotalus cinereus* (LeConte). Diamond-backed Rattlesnake.

This animal has long been known to both authors as an inhabitant of the Ozarks and remains common in a few localities. First reported by Perkins and Lentz (1934) attention to this form has shown it to be much more abundant than thought. It still occurs in reasonable numbers around Winslow, and is abundant on Mt. Magazine. We have recently (June 8, 1938) examined two skins at Booneville of snakes of this species collected on Mt. Magazine. One, killed by Sam Nichols of Booneville, and photographed by him, was over 4 feet long. This animal was killed February 25, 1938. The other, a huge skin, was said to have been killed there a few years ago and in the flesh, without rattlers or head, was exactly six feet long! The dried skin, allowing for stretching, bears this out.

PREVIOUSLY REPORTED — “*Arkansas*”: (Cope, 1900). *Clay*: Piggott, (Perkins and Lentz, 1934). *Saline*: N. E. Saline, (Perkins and Lentz, 1934).

SPECIMENS KNOWN—*Clay*: Piggott, 1 SDNHM. *Logan*: Mt. Magazine, 1 FMNH. *Saline*: N. E. Saline, 20 mi. W. Little Rock, 2 SDNHM. *Washington*: 10 mi. E Winslow, 1 AU. *White*: Beebe, 1 SDNHM.

*Crotalus horridus horridus* (Linne'). Timber Rattlesnake.

Still common in the mountainous portions of the state and is found around Winslow and Mt. Magazine in the same habitat with the Diamond-backed, although its range is much wider than that species.

The record of *Crotalus adamanteus* Beauvois in the United State National Museum, labelled “*Arkan-*

sas'' and collected by Col. Kearney is undoubtedly an error, as stated by Hurter and Strecker (1909), and to quote M. Graham Netting "impossible." This specimen, more than any other, tends to show that all the Kearney specimens from "Arkansas" are incorrectly indexed as to location.

PREVIOUSLY REPORTED — "*Arkansas*": (Cope, 1900). *Garland*: Hot Springs, (Hurter and Strecker, 1909). *Logan*: Petit Jean Mt.; Mt. Magazine, (Stone, 1904). *Saline*: N. E. Saline, (Perkins and Lentz, 1934).

SPECIMENS KNOWN—"*Arkansas*": 1 USNM. *Benton*: 2 mi. S. Clantonville and 8 mi. E. Gateway, 1 AU. *Carroll*: 1 AU. *Crawford*: Beaver Dam, near Natural Dam, 2 AU. *Logan*: Petit Jean Mt., 1 ANS; Mt. Magazine, 1 ANS. *Polk*: Rich Mt., 1 USNM. *Saline*: N. E. Saline, 4 MBG. *Sebastian*: Fort Smith, 1 USNM. *Washington*: 1 mi. S. Winslow (examined, head preserved), 1 AU; Devil's Den State Park, 9 mi. W. Winslow, 1 AU.

*Crotalus horridus atricaudatus* (Latreille). Canebrake Rattler.

PREVIOUSLY REPORTED—*Green*: Paragould, (Hurter and Strecker, 1909). *Faulkner*: Conway, (Perkins, 1928). *Saline*: (Perkins and Lentz, 1934).

SPECIMENS KNOWN—*Crittenden*: West Memphis, 1 MCZ. *Faulkner*: 12 mi. N. Conway, 2 MBG. *Saline*: 1 MBG. *Lawrence*: Imboden, 1 MU, 1 SDNHM. *Polk*: Eagletown, 1 FMNH.

## ORDER TESTUDINATA. TURTLES.

*Sternotherus carinatus* (Gray). Keeled Musk Turtle.

PREVIOUSLY REPORTED — *Lafayette*: Lewisville, (Taylor, 1935). *Prairie*: DeValls Bluff, (Taylor, 1935); Hazen, (Perkins, 1928).

SPECIMENS KNOWN—*Lafayette*: Lewisville, 1 KU. *Prairie*: Hazen, 8 MBG.

*Sternotherus odoratus* (Latreille). Common Musk Turtle.

PREVIOUSLY REPORTED—*Prairie*: DeValls Bluff, (Taylor, 1935).

SPECIMENS KNOWN—*Clay*: Near Corning, 1 MU. *Green*: Bertig Lake, 10 mi. W. Paragould, 1 MU; 7½ mi. S. E. Paragould, 5 MU; 3 mi. W. Paragould, 1 MU. *Lawrence*: Black Rock, 1 AU. *Prairie*: DeValls Bluff, 7 KU. *Pulaski*: 1 USNM.

*Kinosternon subrubrum hippocrepis* (Gray). Louisiana Mud Turtle.

PREVIOUSLY REPORTED — *Lafayette*: Lewisville, (Taylor, 1935). *Miller*: Texarkana, (Hurter and Strecker, 1909, under the name *Cinosternum louisiana* Baur). *Prairie*: DeValls Bluff, (Taylor, 1935).

SPECIMENS KNOWN—*Ashley*: Wilmot, 1 USNM. *Green*: 3 mi. N. W. Beach Grove, 1 MU. *Lafayette*: Lewisville, 4 KU. *Lawrence*: Imboden, 1 AU. *Miller*: Texarkana, 1 USNM. *Poinsett*: 1 MU. *Prairie*: DeValls Bluff, 2 KU. *Washington*: near Robinson, 1 AU.

*Macrochelys temminckii* (Troost). Alligator Snapper.

PREVIOUSLY REPORTED—*Clay*: Greenway, (Hurter and Strecker, 1909). *Lafayette*: Lewisville, (Taylor, 1935). *Prairie*: DeValls Bluff, (Taylor, 1935). *Pulaski*: Little Rock, (Hurter and Strecker, 1909). *Se-*

*bastian*: Fort Smith, (McLain, 1899; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Chicot*: Lake Chicot, 1 AU. *Clay*: Greenway, 1 AU. *Green*: St. Francis River, near Paragould, 1 AU. Carapace and skull preserved. This animal weighed 130 pounds, and is said to be the largest individual known). *Lafayette*: Lewisville, 2 KU. *Prairie*: DeValls Bluff, 13 KU. *Pulaski*: Cache Bayou, 1 AU (weight 102 pounds). *Sebastian*: Fort Smith, 1 SU.

*Chelydra serpentina* (Linne'). Common Snapper.

PREVIOUSLY REPORTED—*Garland*: Hot Springs, (Hurter and Strecker, 1909; Strecker, 1924). *Green*: Paragould, (Hurter and Strecker, 1909). *Jefferson*: Pine Bluff, (Hurter and Strecker, 1909). *Prairie*: DeValls Bluff, (Taylor, 1935).

SPECIMENS KNOWN—*Clark*: Terre Noir Creek, 13 mi. W. Arkadelphia, 1 AU. *Craighead*: 5 mi. N. Otwell, 1 MU. *Faulkner*: Cadron Creek, near Conway, 1 AU. *Green*: 3 mi. W. Paragould, 1 MU. *Jefferson*: Pine Bluff, 1 USNM. *Lawrence*: Imboden, 10 FMNH. *Montgomery*: Pine Ridge, 1 FMNH. *Polk*: 1 MU. *Prairie*: DeValls Bluff, 7 KU. *Washington*: Fayetteville, 2 AU; 5 mi. N. Fayetteville, 2 AU; Johnson Spring, Johnson, 1 AU; White River near Goshen, 1 AU.

*Clemmys insculpta* (Le Conte). Wood Terrapin.

McLain (1899) reports one of these from Fort Smith, SU No. 3763. This specimen is in the same category as *Gopherus polyphemus* from Fort Smith, and if actually collected there it in all probability represents a released or escaped pet.

*Terrapene carolina* (Linne'). Carolina Terrapin.

PREVIOUSLY REPORTED—*Prairie*: (Taylor, 1935).

SPECIMENS KNOWN—*Garland*: Hot Springs, 1 USNM. *Washington*: Fayetteville, 1 USNM. *Yell*: 12 mi. S. Ola, 1 AU.

*Terrapene ornata* (Agassiz). Painted Terrapin;  
Painted Box Turtle.

The only known record for this species in the state is of a single specimen in the United States National Museum, from Mammoth Spring, Fulton County.

*Terrapene triunguis* (Agassiz). Three-toed Terrapin.

PREVIOUSLY REPORTED — *Columbia*: Magnolia (Hurter and Strecker, 1909). *Garland*: Hot Springs, (Strecker, 1924). *Lafayette*: Lewisville, (Taylor, 1935). *Pike*: 4 mi. N. Kirby (Ortenburger, 1929). *Prairie*: DeValls Bluff, (Taylor, 1935). *Washington*: Winslow, (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 1 USNM. "*S. W. Arkansas*": 1 USNM. *Boone*: 1 mi. E. Alpena Pass, 1 MU. *Carroll*: 2 mi. W. Alpena Pass, 2 MU. *Clark*: Near Caddo River, 3 mi. N. Arkadelphia, 1 AU. *Columbia*: Near Magnolia, 1 BU. *Garland*: 1 MU; 8 mi. E. Hot Springs, 1 MU, 7 FMNH. *Green*: Paragould, 6 MU. *Faulkner*: 2 mi S. E. Conway, 1 MU. *Franklin*: Ozark, 4 KU. *Fulton*: Mammoth Spring, 1 AMNH. *Howard*: Nashville, 1 FMNH. *Lafayette*: Lewisville, 2 KU. *Lawrence*: Imboden, 10 FMNH, 1 CU. *Logan*: Near Paragould, 1 AU. *Poinsett*: 1 mi. N. Waldenburg, 1 MU. *Perry*: Near Fourche La Fave River, 1 AU; S. Fourche La Fave River, 1 AU. *Prairie*: DeValls Bluff, 2 KU. *Pulaski*: Cross Roads, 1 MU; Little Rock, 1 MU, 1 CMZ; 2 mi. W. Little Rock, 1 CMZ. *Washington*: Fayetteville, 1 AU; Winslow, 11 KU. *White*: Searcy, 1 MU.

*Graptemys geographica* (LeSueur). Map Turtle.

PREVIOUSLY REPORTED — *Lafayette*: Lewisville, (Taylor, 1935). *Prairie*: DeValls Bluff (Taylor, 1935).

SPECIMENS KNOWN—*Lafayette*: Lewisville, 1 KU. *Lawrence*: Black Rock, 1 AU, 1 MU. *Prairie*: DeValls Bluff, 1 KU. *Saline*: Benton, 1 USNM.

*Graptemys pseudogeographica pseudogeographica* (Gray). False Map Turtle.

PREVIOUSLY REPORTED — *Jefferson*: Pine Bluff (Hurter and Strecker, 1909). *Prairie*: DeValls Bluff (Taylor, 1935).

SPECIMENS KNOWN—*Jefferson*: Pine Bluff, 1 USNM. *Lawrence*: Black Rock, 3 AU, 2 AU classified as *Graptemys p. kohnii*, which Marshall recognizes; Imboden, 1 FMNH. *Prairie*: DeValls Bluff, 118 KU. *Saline*: Benton, 4 USNM, one indexed as *Graptemys p. oculifera*.

*Chrysemys picta dorsalis* (Agassiz). Painted Turtle; Pond Turtle.

PREVIOUSLY REPORTED—*Green*: Paragould (Hurter and Strecker, 1909). *Prairie*: DeValls Bluff, (Taylor, 1935).

SPECIMENS KNOWN — *Craighead*: Monette, 1 USNM. *Poinsett*: Weiner, 2 MU. *Prairie*: DeValls Bluff, 1 KU.

*Pseudemys troostii* (Holbrook). Troost's Turtle; Elegant Turtle.

We follow Viosca (1933) in applying *troostii* to both the dimorphic male described under that name, and those turtles commonly known as *elegans*.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Garland*: Hot Springs (Strecker, 1924). *Green*: Paragould (Hurter and Strecker, 1909). *Prairie*: DeValls Bluff (Taylor, 1935).

SPECIMENS KNOWN—*Clay*: Corning, 1 USNM. *Dallas*: 1 mi. N. Faringdale, 5 USNM. *Green*: 2 mi. S.

E. Paragould, 1 MU; 8 mile Creek, near Paragould, 2 MU. *Jackson*: 2 mi. S. Newport, 1 MU. *Lawrence*: Black Rock, 2 AU; Imboden, 10 FMNH. *Mississippi*: Manila, 3 MVZ. *Poinsett*: 5 MU. *Prairie*: DeValls Bluff, 61 KU. *Pulaski*: E. of Little Rock, 1 MU, 1 USNM; 6 mi. E. of Little Rock, 1 AU. *Saline*: Benton, 1 USNM. *White*: 1½ mi. N. E. Higginson, 1 USNM.

*Pseudemys texana* (Baur). Texas Turtle.

PREVIOUSLY REPORTED — *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Lafayette*: Lewisville, (Taylor, 1935). *Prairie*: DeValls Bluff (Taylor, 1935).

SPECIMENS KNOWN—*Lafayette*: Lewisville, 1 KU. *Lawrence*: Black Rock, 1 AU. *Saline*: Benton, 1 USNM.

*Deirochelys reticularia* (Latreille). Chicken Turtle.

PREVIOUSLY REPORTED — *Prairie*: DeValls Bluff (Taylor, 1935).

SPECIMENS KNOWN—*Craighead*: Jonesboro, 1 MU. *Jackson*: Swifton, 1 USNM. *Prairie*: DeValls Bluff, 1 KU.

*Gopherus polyphemus* (Daudin). Gopher Tortoise.

McLain (1899) reported two of these turtles from Fort Smith collected by Pierson and at one time in the Stanford University Museum. Dr. Albert W. Herre in a letter under date of May 25, 1938, informs us that these specimens are no longer there and presumably were destroyed in the great earthquake, which destroyed a large amount of the scientific specimens in Stanford University at that time. Dr. Herre further suggests that these animals probably were collected at Fort Smith, but represented released or escaped pets. Certainly Fort Smith is not within the natural range of the species.

*Amyda emoryi* (Agassiz). Emory's Soft-shelled Turtle.

But one record seems available for this species within the state. This is a specimen now in the United States National Museum from the Saline River, near Benton, Saline County.

*Amyda ferox* (Schneider). Rusty Soft-shelled Turtle.

SPECIMENS KNOWN—*Clark*: 13 mi. W. Arkadelphia, Terre Noir Creek, 1 AU. *Lawrence*: Black Rock, 1 AU.

*Amyda mutica* (LeSueur). Common Soft-shelled Turtle.

PREVIOUSLY REPORTED — *Garland*: Hot Springs (Strecker, 1924). *Jefferson*: Pine Bluff (Hurter and Strecker, 1909). *Lafayette*: Lewisville (Taylor, 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Pulaski*: Little Rock, (Hurter and Strecker, 1909). *Sebastian*: Fort Smith (McLain, 1899; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Franklin*: Ozark, 3 KU. *Lafayette*: Lewisville, 3 KU. *Lawrence*: Black Rock, 1 MU, 1 AU. *Prairie*: DeValls Bluff, 38 KU. *Sebastian*: Fort Smith, 1 USNM, 1 SU.

*Amyda spinifera* (LeSueur). Spiny Soft-shelled Turtle.

PREVIOUSLY REPORTED — *Lafayette*: Lewisville, (Taylor, 1935). *Prairie*: DeValls Bluff (Taylor, 1935).

SPECIMENS KNOWN—*Chicot*: Lake Chicot, 1 AU. *Clay*: 1 MU. *Garland*: Mt. Pine, 2 FMNH. *Lafayette*: Lewisville, 72 KU. *Lawrence*: Imboden, 1 FMNH. *Prairie*: DeValls Bluff, 29 KU. *Washington*: Near Greenland, 1 AU.

## ADDENDA

Since going to press the following records have been made available:

*Sceloporus undulatus fasciatus*. Previously reported by Burt and Burt (1929) from the following localities: *Polk*: 3 mi. S. W. of Mena. *Miller*: 3 mi. N. Texarkana.

*Cnemidophorus sexlineatus*. Also reported by Burt and Burt (1929) from *Little River*: 2 mi. S. Ashdown.

*Leiopisma unicolor*. Previously reported from *Miller*: 4 mi. N. Texarkana, (Burt and Burt, 1929). *Sevier*: 12 mi. S. Lockesburg (Burt and Burt, 1929).

*Thamnophis sauritus proximus*. Previously reported.—*Clay*: Greenway (Ruthven, 1908).

*Thamnophis sirtalis*. Previously reported.—*Garland*: Hot Springs, and *Jefferson*: Ft. Jessup (Ruthven, 1908).

*Micrurus fulvius fulvius*. Dr. P. B. Carrigan reports taking this snake twice in 1938 south of Hope, Hempstead County. One of these specimens was identified by R. Marlin Perkins of the St. Louis zoo.

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Since there is no Armstead given on Arkansas maps, and since Olmstead seems to be the proper name for the locality in question, the locality "Armstead," Pulaski County, of Burt (1935) has in this and the next paper been changed to "Olmstead."

Occasional Papers of the University  
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NUMBER TWO

Herpetology of Arkansas

PART TWO

THE AMPHIBIANS

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JOHN D. BLACK AND S. C. DELLINGER

Fayetteville, Arkansas

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## HERPETOLOGY OF ARKANSAS, PART II

## AMPHIBIANS

## CLASS AMPHIBIA: AMPHIBIANS

## ORDER CAUDATA: SALAMANDERS

*Necturus maculosus maculosus* (Rafinesque). Mudpuppy, Waterdog.

Line of probable separation between *maculosus* and *beyeri* (Viosca, 1937); *beyeri* from Monroe, Louisiana (Viosca, 1937).

PREVIOUSLY REPORTED—“*Arkansas River Arkansas*”: (Hurter and Strecker, 1909). *Craighead*: (Viosca, 1937). *Sebastian*: Near Fort Smith (Cope, 1889); Fort Smith, (Viosca, 1937).

SPECIMENS KNOWN—“*Arkansas River, Arkansas*”: 1 USNM. *Crawford*: Van Buren, 1 larva AU. *Lawrence*: Spring River, Black Rock, 5 larvae in AU. *Lonoke*: Lonoke, 1 AU. *Pulaski*: N. Little Rock, 1 AU. *Washington*: West Fork White River, S. Fayetteville, 2 AU.

*Amphiuma means* Garden. Mean's Congo Eel, Small-legged Mudpuppy.

PREVIOUSLY REPORTED—*Garland*: Ouachita River valley near Hot Springs (Strecker, 1924). *Jefferson*: Fort Jessup (Cope, 1889).

SPECIMENS KNOWN—*Jefferson*: 1 USNM; Fort Jessup, 1 USNM. *Pulaski*: 2 USNM; Little Rock, 1 USNM.

*Amphiuma tridactylum* Cuvier. Congo Eel, Three-toed Mudpuppy.

PREVIOUSLY REPORTED — *Lafayette*: Lewisville (Taylor, 1935). *Pulaski*: (Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Faulkner*: Toadsuck Ferry, 1 AU. *Lawrence*: Black Rock, 1 AU; Imboden, 1

AMNH. *Lafayette*: Lewisville, 2 KU. *Pulaski*: 1 BU. *Randolph*: Lesterville, 1 CMZ.

*Cryptobranchus alleganiensis* (Daudin). Hell Bender, Giant Waterdog.

There are two in the State Fish Hatchery from Spring River near Mammoth Spring. Marshall reports them as occurring there regularly, though uncommon.

*Triturus viridescens louisianensis* (Wolterstorff). Louisiana Newt.

PREVIOUSLY REPORTED—Small streams in the vicinity of Texarkana, Miller County. (Hurter and Strecker, 1909; Strecker and Williams, 1928).

SPECIMENS KNOWN—*Benton*: 8 mi. N. W. Bentonville, 1 BC. *Lawrence*: 2 BC; Imboden, 2 MVZ, 15 MU, 4 AU, 1 USNM, 6 CMZ, 37 AMNH (Catalogued as *meridionalis*), 12 FMNH.

*Ambystoma annulatum* Cope. Cope's Salamander.

PREVIOUSLY REPORTED — *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). Of the eight known in 1924, 7 were from Hot Springs, the other was labelled "North America" and may be from the above locality (Strecker, 1924). Noble and Marshall (1929) have since reported a large colony from Stone County, Missouri.

SPECIMENS KNOWN — *Garland*: Hot Springs, 4 USNM. *Lonoke*: "May Case Creek", 1 AMNH.

*Ambystoma jeffersonianum* (Green). Jefferson's Salamander.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909).

*Ambystoma maculatum* (Shaw). Spotted Salamander.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter

and Strecker, 1909). *Lafayette*: Lewisville (Taylor, 1935).

SPECIMENS KNOWN—*Crittenden*: 6 mi. W. West Memphis, 1 BC. *Green*: 3 mi. E. of Paragould, 1 MU. *Lafayette*: Lewisville, 16 KU. *Lawrence*: Imboden, 1 USNM, 10 FMNH, 3 and eggs in AU, 2 MVZ. *Monroe*: 3 mi. W. Brinkley, 1 MU. *Polk*: Eagletown, 1 FMNH. *Pulaski*: 2 CAS. *Washington*: Walnut Grove, 1 AU; Winslow, 1 AU, 1 KU.

*Ambystoma opacum* (Gravenhorst). Marbled Salamander.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Craighead*: 6 mi. N. Jonesboro (Burt, 1935). *Green*: Paragould (Hurter and Strecker, 1909); 3 mi. E. Paragould (Burt, 1935). *Jackson*: Olyphant (Burt, 1935). *Lafayette*: Lewisville (Taylor, 1935). *Miller*: (Strecker and Williams, 1928). *Montgomery*: Oden (Burt, 1935). *Pulaski*: Near Little Rock (Perkins, 1928).

SPECIMENS KNOWN — “Arkansas”: 1 AMNH. *Craighead*: Jonesboro, 1 USNM. *Crittenden*: 6 mi. W. Memphis, 1 BC. *Faulkner*: 12 mi. N. Conway, 2 MBG. *Green*: 3 mi. E. Paragould, 4 MU; 22 mi. N. Paragould, 4 MU. *Jackson*: Olyphant, 4 USNM. *Johnson*: 3 mi. S. W. Clarksville, 1 BC. *Lafayette*: Lewisville, 87 KU. *Lawrence*: Imboden, 9 FMNH, 1 USNM, 2 MVZ, 3 CMZ, 8 larva, 1 and eggs AU. *Miller*: 9 BU. *Monroe*: 3 mi. W. Brinkley, 4 MU. *Montgomery*: Oden, 3 USNM. *Pulaski*: 1 USNM; 25 mi. E. Little Rock, 3 MU; 10 mi. E. Little Rock, 1 MU; near Little Rock, 2 MBG; Little Rock, 4 USNM. *Sebastian*: Barling, 106 larvae, AU; 6 larvae Dunn. *Washington*: Fayetteville, 1 AU.

*Ambystoma texanum* (Matthes). Texas Salamander.

PREVIOUSLY REPORTED—*Crawford*: Mulberry (Tay-

lor, 1935 as *jeffersonianum*). *Faulkner*: 7 mi. N. Conway, 12 mi. N. Conway (Perkins, 1928). *Lafayette*: Lewisville (Taylor, 1935, as *jeffersonianum*). *Miller*: (Strecker and Williams, 1928). *Pulaski*: S. Little Rock; near Little Rock (Perkins, 1928). *Sebastian*: Fort Smith (Cope, 1889; Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Crawford*: Mulberry, 1 KU. *Craighead*: 5 mi. N. of Otwell, 2 MU. *Crittenden*: 6 mi. W. West Memphis, 1 BC. *Faulkner*: 7 mi. W. Conway, "several" MBG; 12 mi. N. Conway, "several" MBG. *Green*: 3 mi. E. of Paragould, 2 MU; Powhatan, 2 AU. *Lafayette*: Lewisville, 218 KU. *Lawrence*: Imboden, 3 USNM, 10 FMNH, 1 AU; Old River, 2 MVZ. *Miller*: 7 BU. *Monroe*: 3 mi. W. of Brinkley, 19 MU. *Pulaski*: S. of Little Rock, 2 MBG; near Little Rock, "some" MBG; Sweet Home, 1 MU. *Sebastian*: Barling, larvae, 8 AU, 1 Dunn; 15 mi. S. W. Fort Smith, 1 USNM. *Washington*: Fayetteville, 1 AU.

*Ambystoma tigrinum* (Green). Tiger Salamander.

These animals properly belong in the subspecies *mavortium*, if that form should be recognized.

PREVIOUSLY REPORTED—*Washington*: Fayetteville, (Hurter and Strecker, 1909).

SPECIMENS KNOWN—*Washington*: Fayetteville, 1 AU; 1 mi. W. of Fayetteville, 1 AU.

*Hemidactylum scutatum* (Schlegel). Four-toed Salamander.

PREVIOUSLY REPORTED—*Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924; Dunn, 1926).

These reports are all based on three individuals collected by Hurter now in the U. S. National Museum. No further information, nor additional specimens, has been secured concerning this species in Arkansas.

*Plethodon cinereus* (Green). Red-striped Salamander.

PREVIOUSLY REPORTED—*Benton*: Rogers (Fowler and Dunn, 1918; Dunn, 1926). *Garland*: Hot Springs (Strecker, 1924). *Logan*: Mt. Magazine (Stone, 1904; Dunn, 1926).

SPECIMENS KNOWN—*Benton*: Rogers, 3 ANS. *Crawford*: 3 mi. S. W. Locke, 1 AU; Russell Cave, 16 mi. S. E. Winslow, 1 KU. *Garland*: Hot Springs, 3 MU. *Logan*: Mt. Magazine, 2 FMNH, 9 ANS. *Polk*: Acorn, 15 MU; Rich Mt., 5 MU, 28 FMNH. *Washington*: Woolsey Cave, 8 mi. N. Winslow, 1 KU; Winslow, 7 AU.

*Plethodon dorsalis* (Cope). Red-backed Salamander.

Charles E. Burt has one specimen in his private collection, taken 6 mi. E. of Springdale, which he has classified as *dorsalis*.

*Plethodon glutinosus* (Green). Slimy Salamander.

PREVIOUSLY REPORTED — “*Arkansas*”: (Dunn, 1926). *Baxter*: Sheridan Cave near Mt. Home (Noble and Marshall, 1929). *Benton*: Indian Cave, near Bella Vista (Noble and Marshall, 1929). *Carroll*: (Dunn, 1926). *Faulkner*: 7 mi. W. Conway (Perkins, 1928); 12 mi. N. Conway (Perkins, 1928). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924); Crystal Springs (Burt, 1935). *Logan*: Blue Mountain, Mt. Magazine, Petit Jean Mt. (Stone, 1904; Fowler and Dunn, 1918; Dunn, 1926). *Montgomery*: 9 mi. E. Mt. Ida (Burt, 1935). *Pike*: Delight (Dunn, 1926). *Polk*: 4 mi. E. State Line (Ortenburger, 1929). *Pulaski*: (Hurter and Strecker, 1909; Dunn, 1926). *Washington*: (Taylor, 1935; “see *Typhlotriton*”).

SPECIMENS KNOWN—“*Arkansas*”: 2 MCZ. *Benton*: 1 MU; 3 mi. N. W. Bentonville, 1 BC. *Baxter*: Sheridan Cave near Mt. Home, 3 AMNH. *Boone*: 9 mi. S. W. Mystic Caverns, 2 MU. *Carroll*: 1 USNM,

1 MU. *Clark*: Arkadelphia, 1 USNM. *Crawford*: Russell Cave, 16 mi. S. E. Winslow, 12 KU. *Faulkner*: 7 mi. W. Conway "several" MBG; 12 mi. N. Conway, 1 MBG. *Franklin*: Bat Cave, 12 mi. N. Ozark, 3 KU. *Garland*: 5 FMNH, 2 MU; Crystal Springs, 1 USNM; Hot Springs, 5 BU, 4 CAS. *Howard*: Dora, 1 USNM. *Independence*: Batesville, Cave Creek, 2 AMNH. *Lawrence*: Imboden, 2 MVZ, 3 MU, 9 AMNH, 1 AU; Ravenden, 1 AU. *Logan*: Petit Jean Mt., 3 ANS; Blue Mt., 3 ANS; Magazine, 3 ANS, 1 FMNH. *Madison*: Marshall Cave, 3 mi. E. Alabam, 2 KU. *Pike*: 1 USNM; Delight, 1 USNM. *Polk*: 4 mi. E. State Line, 1 OU; near Acorn, 4 MU; Rich Mt., 2 MU, 6 FMNH. *Pulaski*: 1 USNM; Little Rock, 3 CMZ. *Washington*: Delap Cave, 6 mi. W. Prairie Grove, 31 KU. (These are the specimens, in part, which were incorrectly catalogued by a student at Kansas University as *Typhlotriton spelaesus*, and are the basis for the report of that species from Washington County, by Taylor in 1935); 5 mi. N. Fayetteville, 1 AU; Stephenson Cave, near Prairie Grove, 4 KU; Watson Cave, near Prairie Grove, 21 KU; Harrigan Cave, 1 mi. W. Winslow, 3 KU; Robinson Cave, 3 mi. S. Winslow, 1 KU; 3 mi. E. Springdale, 1 BC; near Wyola, 9 mi. N. E. Winslow, 1 AU; Winslow, 6 AU; Woolsey Cave, 8 mi. N. Winslow, 2 KU.

*Plethodon ouachitae* Dunn and Heinze. Ouachita Salamander.

PREVIOUSLY REPORTED—*Polk*: Rich Mt. (Dunn and Heinze, 1933; Burt, 1935).

SPECIMENS KNOWN—*Polk*: Rich Mt., 2 USNM, including the type USNM number 92484, 30 MU, 26 FMNH.

*Typhlotriton spelaesus* Stejneger. Blind Salamander.

PREVIOUSLY REPORTED — *Lawrence*: Im b o d e n (Dunn, 1926; Taylor, 1935). *Stone*: (Taylor, 1935).

*Washington*: (Taylor, 1935; as explained above this was an incorrect identification). *White*: (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 9 AMNH. *Benton*: 7 mi. S. W. Bentonville, 1 AMNH. *Boone*: 9 mi. S. W. Mystic Caverns, 2 MU; Harrison, 1 AU. *Carroll*: Eureka Springs, 8 AMNH. *Lawrence*: "Bennett Cowe Springs", 4 AMNH; Ravenden, 2 AMNH; Imboden, 2 MU, 1 KU, 1 CMZ, 1 AU and larvae, 2 USNM, 11 AMNH. *Sharp*: Williford, 3 AU. *Stone*: 3 MU, 2 KU.

*Manculus quadridigitatus quadridigitatus* (Holbrook).  
Dwarf Salamander.

PREVIOUSLY REPORTED—*Lafayette*: (Strecker and Williams, 1928); Lewisville (Smith, 1933; Taylor, 1935). *Miller*: (Strecker and Williams, 1928).

SPECIMENS KNOWN—*Lafayette*: Lewisville, 166 KU.

*Eurycea longicauda* (Green). Long-tailed Salamander.

Burt (1935) reports a 20 mm. individual from Forum, Madison County, under the name of *Eurycea bislineata cirrigera*. We have not seen this specimen, but are inclined to believe it either *longicauda*, or *melanopleura*. This is most likely since the specimen is a larva and *bislineata cirrigera* is apparently not known west of the Mississippi.

PREVIOUSLY REPORTED -- *Lawrence*: Imboden, (Dunn, 1926).

SPECIMENS KNOWN—*Lawrence*: Imboden, 2 MVZ, 2 AU, 1 USNM, 11 FMNH, 3 MU, 3 AMNH; near Imboden, 64 AMNH.

*Eurycea lucifuga* Rafinesque. Cave Devil, Red Lizard, Red Salamander.

PREVIOUSLY REPORTED — *Carroll*: (Dunn, 1926).

*Madison*: Denney Cave, 2 mi. E. Alabam (Taylor, 1935). *Washington*: Delap Cave, 6 mi. W. Prairie Grove (Taylor, 1935).

SPECIMENS KNOWN—*Benton*: Bat Cave near War Eagle, 1 KU; Cave Springs, 12 KU; Cave, 7 mi. W. Maysville, 1 A. P. Blair Collection. *Carroll*: 1 USNM. *Crawford*: Russell Cave, 15 mi. S. E. Winslow, 4 KU. *Independence*: Batesville, 5 AMNH. *Lawrence*: Imboden, 1 MU, 20 AMNH, 1 MVZ, 2 CMZ, 1 AU, 6 FMNH; Ravenden, 2 AMNH, 3½ mi. S. Ravenden, 1 MVZ, 4 AMNH; 3 mi. S. Ravenden, 5 AMNH; N. W. Ravenden, 1, 4 larvae, and eggs in AU. *Madison*: Denney Cave, 2 mi. E. Alabam, 2 KU; Ferris Cave, 8 mi. S. E. Huntsville, 9 KU; Marshall Cave, 3 mi. E. Alabam, 5 KU. *Washington*: Delap Cave, 6 mi. W. Prairie Grove, 19 KU; Barnett Cave, near Greenland, 4 KU; Stephenson Cave near Prairie Grove, 2 KU; Watson Cave near Prairie Grove, 2 KU; Woolsey Cave, 9 mi. N. Winslow, 3 KU; Harrigan Cave, 1 mi. W. Winslow, 1 KU; Devil's Den, 9 mi. W. Winslow, 1 AU.

*Eurycea melanopleura* (Cope). Black-sided Salamander.

PREVIOUSLY REPORTED—*Carroll*: (Dunn, 1926). *Lafayette*: Lewisville (Taylor, 1935). *Lawrence*: Imboden, (Dunn, 1926). *Pulaski*: (Dunn, 1926).

SPECIMENS KNOWN—"Arkansas": 2 AMNH. *Benton*: Cave Springs, 1 KU; 7 mi. W. Maysville, "several in moist crevices along bluff", A. P. Blair Collection. *Carroll*: 1 USNM; Lake Lucerne, 13 MU. *Independence*: Near Batesville, 1 AMNH. *Lafayette*: Lewisville, 2 KU. *Lawrence*: Imboden, 2 USNM, 2 CMZ, 1 MU, 4 AU; Ravenden, 53 AMNH. *Madison*: Ferris Cave, 8 mi. S. E. Huntsville, 3 KU; Harmony Cave, 3 mi. N. E. Huntsville, 5 KU. *Newton*: Diamond Cave, 1 MU. *Pulaski*: 2 USNM; Little Rock, 2 CAS. *Washington*: Johnson, 1 CMZ; Stephenson Cave, 1

KU; 6 mi. E. Springdale, 1 BC; 20 mi. W. Fayetteville, 2 AU; 1 mi. E. Fayetteville, 1 AU.

*Eurycea multiplicata* (Cope). Many-ribbed Salamander.

Cope (1889) reports this animal from Red River, Arkansas, which he gives as the type locality. As discussed in the introduction, this is in Oklahoma.

PREVIOUSLY REPORTED — *Garland*: Hot Springs (Strecker, 1924). *Pulaski*: (Dunn, 1926); Little Rock Hurter and Strecker, 1909; Fowler and Dunn, 1918; Dunn, 1926). *Van Buren*: 2 mi. N. Damascus, 1 CU. *Washington*: Fayetteville, (Hurter and Strecker, 1909; Dunn, 1926).

SPECIMENS KNOWN—*Baxter*: Near Mt. Home, 4 larvae AU. *Benton*: Near Bat Cave, 5 AU. *Craighead*: 5 mi. N. Bono, 1 CMZ, 2 AU. *Garland*: Hot Springs, 1 FMNH. *Logan*: Mt. Magazine, 3 FMNH, 1 AU. *Pope*: 3 mi. W. London, 1 and "numerous larvae" BC. *Polk*: Acorn, 1 MU; Rich Mt., 2 MU. *Pulaski*: 6 USNM, 1 ANS, 1 CU, 1 AMNH, 5 MCZ, 2 BU, 2 CAS; Little Rock, 4 ANS, 1 MU, 3 CAS, 1 BU, 2 MCZ, 8 USNM. *Washington*: Fayetteville, 5 AU; near Winslow, 47 KU, 35 AU, 60 Buffalo Museum. *White*: 1 KU.

*Desmognathus brimleyorum* Stejneger. Brimley's Triton.

PREVIOUSLY REPORTED—"Arkansas", near the Texas line: (Strecker and Williams, 1928). *Carroll*: Eureka Springs (Burt, 1935). *Crawford*: Mulberry (Taylor, 1935). *Garland*: (Taylor, 1935); Hot Springs (Stejneger, 1895, the type description; Hurter and Strecker, 1909; Strecker, 1924; Dunn, 1926); Crystal Springs (Burt, 1935). *Hot Spring*: Estes (Burt, 1935). *Lafayette*: Lewisville (Taylor, 1935). *Polk*: Rich Mt. (Burt, 1935). *Pulaski*: Little Rock (Hurter and Strecker, 1909; Fowler and Dunn, 1918; Dunn, 1926).

“*Southwest Arkansas*”: (Hurter and Strecker, 1909; based on O. P. Hay’s report of *D. fusca*; Hay, 1892). *Yell*: Ola (Burt, 1935).

SPECIMENS KNOWN—*Crawford*: Mulberry, 4 KU. *Carroll*: Eureka Springs, 1 larva USNM. *Garland*: 17 USNM, 2 KU; 7 mi. E. Montgomery County line, 1 MU; Hot Springs, 13 BU, 5 CAS, 37 USNM, 3 MCZ, 4 AMNH, 1 CU, 1 South Carolina, 31 FMNH; Crystal Springs, 2 USNM. *Hot Spring*: Near De Roche, 8 MU; Estes, 1 USNM. *Lafayette*: Lewisville, 89 KU. *Lawrence*: 2 AMNH. *Logan*: Mt. Magazine, 26 FMNH. *Montgomery*: Oden, 4 USNM. *Pike*: Antoine, 5 USNM. *Polk*: Rich Mt., 20 FMNH, 5 USNM, 14 MU; Acorn, 31 MU. *Pulaski*: Little Rock, 10 USNM, 11 MCZ, 2 MU, 1 ANS, 8 FMNH, 3 BU, 12 CAS. *Sebastian*: Bonanza Springs, 1 Colorado University. *Yell*: Dardanelle, 4 AU; Mt. Nebo, 6 mi. W. Dardanelle, 1 CU, 3 CMZ; 8 mi. S. E. Ola, 5 USNM.

*Siren intermedia* Le Conte. Dwarf Lamprey Eel; Dwarf Two-legged Salamander.

PREVIOUSLY REPORTED—*Lawrence*: Imboden (Noble and Marshall, 1932).

SPECIMENS KNOWN—*Lawrence*: Imboden, 3, larvae, and eggs AU, 2 CMZ, 6 AMNH, 4 MU, 1 MVZ.

*Siren lacertina* Linne. Lamprey Eel; Two-legged Salamander; Mud-Eel.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Pulaski*: Little Rock (Hurter and Strecker, 1909).

SPECIMENS KNOWN — “*Arkansas*”: 3 AMNH. *Craighead*: Jonesboro, 1 AU. *Desha*: McGehee, 1 AU. *Green*: Marmaduke, 1 AU. *Lawrence*: Imboden, 6 MVZ, 9 FMNH, 6 AMNH; 6 mi. S. Imboden, 6 AMNH; York Springs near Imboden, 1 AMNH. *Lonoke*: Lonoke, 1 AU. *Pulaski*: Little Rock, 1 USNM.

## ORDER SALIENTIA      FROGS AND TOADS

*Scaphiopus holbrooki holbrooki* (Harlan). Spadefoot.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909; Hurter, 1911). *Lawrence*: Imboden (Taylor, 1935).

SPECIMENS KNOWN—*Craighead*: Caraway, 2 MVZ. *Franklin*: Ozark, 1 KU. *Lawrence*: Imboden, 3 KU, 1 AU.

*Bufo americanus americanus* Holbrook. American Toad.

PREVIOUSLY REPORTED—*Benton*: 1 mi. N. Lowell (Burt, 1932). *Clay*: Greenway (Hurter and Strecker, 1909). *Garland*: 2 mi. E. Royal (Burt, 1935); Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Lafayette*: Lewisville (Taylor, 1935). *Montgomery*: 4 mi. N. E. Waters (Pine Ridge) (Burt, 1935). *Newton*: 1 mi. S. Willcockson (Burt, 1935). *Polk*: (Burt, 1935); 8 mi. E. State line (Ortenburger, 1929); 1 mi. W. Wickes; 4 mi. W. Board Camp (Ortenburger, 1929); 3 mi. E. Cherry Hill (Burt, 1935). *Poinsett*: Near Marked Tree (Burt, 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Pulaski*: Little Rock (Hurter and Strecker, 1909; Burt, 1935). *Sebastian*: Fort Smith (Cope, 1889; Hurter and Strecker, 1909). *Scott*: 9 mi. S. Waldron (Ortenburger, 1929). *Washington*: Winslow (Taylor, 1935).

SPECIMENS KNOWN—*Boone*: 9 mi. S. W. Mystic Caverns, 1 MU. *Carroll*: 1 USNM. *Garland*: Hot Springs, 2 USNM, 1 FMNH, 2 CAS, 9 MU. *Lafayette*: Lewisville, 13 KU. *Lawrence*: Imboden, 14 MU, 11 FMNH, 18 AMNH, 1 CU, 1 AU. *Newton*: 1 mi. S. Willcockson, 1 USNM; Neosho, 2 MU. *Phillips*: Helena, 1 MU. *Polk*: 4 MU; Rich Mt., 1 MU, 1 FMNH, 1 USNM; 8 mi. E. State Line, 1 OU; 1 mi. W. Wickes,

1 OU; 4 mi. W. Board Camp, 1 OU. *Prairie*: DeValls Bluff, 219 KU. *Pulaski*: Little Rock, 2 USNM, 1 MU; McAlmont, 1 MU. *Scott*: 9 mi. S. Waldron, 1 OU. *Sebastian*: Barling, 2 AU; Fort Smith, 2 USNM. *Washington*: Fayetteville, 2 AU; Farmington, 1 AU; West Fork, 1 AU; Winslow, 7 KU, 45 Blair Collection.

*Bufo cognatus* (Say). Plain Toad.

Still in the check list (Stejneger and Barbour, 1933) as "*Arkansas To Kansas*". This has been shown by Hurter and Strecker (1909) to be based on an Oklahoma record. There is no evidence that it has ever occurred within the boundaries of the present state of Arkansas.

*Bufo fowleri* Hinckley. Fowler's Toad.

The separation of this and *americanus* has long been a problem which many consider simple, but others believe it to be impossible with certain specimens, especially females. We are inclined to believe that many of the specimens of *fowleri* and *americanus* from Arkansas have been misidentified, and will continue to be until some more reliable methods can be devised for distinguishing these forms. We cannot agree with Burt (1935) who considers *woodhousii* identical with Arkansas *fowleri*, and therefore calls all his Arkansas specimens *woodhousii*.

PREVIOUSLY REPORTED—*Clark*: 5 mi. S. Arkadelphia (Burt, 1935). *Crawford*: 8 mi. N. W. Natural Dam (Burt, 1935). *Dallas*: Fordyce (Burt, 1935). *Green*: 8 mi. E. Paragould (Burt, 1935). *Lawrence*: 3 mi. N. W. Black Rock (Burt, 1935). *Logan*: Booneville (Burt, 1935). *Madison*: 2 mi. S. Forum; Kingston (Burt, 1935). *Montgomery*: 7 mi. W. Norman (Ortenburger, 1929). *Nevada*: 5 mi. S. Prescott (Burt 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Ran-*

*dolph*: 1 mi. S. Biggers (Burt, 1935). *Sevier*: 20 mi. E. DeQueen (Ortenburger, 1929). *Washington*: Winslow (Taylor, 1935). *Yell*: 5 mi. E. Plainview; W. of Havana (Burt, 1935).

SPECIMENS KNOWN—*Clay*: Near Corning, 5 MU. *Crawford*: 5 mi. S. E. Alma, 2 AU; Mountainburg, 1 KU; 8 mi. N. W. Natural Dam, 1 USNM. *Dallas*: Fordyce, 1 USNM. *Franklin*: Ozark, 1 KU. *Garland*: Hot Springs, 3 BU, 1 FMNH. *Green*: Cache River Bottoms, 2 MVZ; Bolton, 2 MVZ; near Paragould, 1 MU; 22 mi. N. Paragould, 1 MU; 8 mi. E. Paragould, 1 USNM. *Lawrence*: Imboden, 7 MU, 14 AMNH, 1 AU; Ravenden, 3 MU. *Madison*: Kingston, 1 USNM. *Montgomery*: 7 mi. W. Norman, 1 OU. *Prairie*: DeValls Bluff, 149 KU. *Searcy*: 4 mi. W. St. Joe, 1 KU. *Sevier*: 20 mi. E. DeQueen, 1 OU. *Sebastian*: Barling, 12 AU. *Washington*: Dutch Mills, 1 USNM; Winslow, 7 KU. *White*: Near Bald Knob, 1 MU; near Searcy, 2 MU. *Yell*: Havana, 1 AU.

*Bufo punctatus* Baird and Girard. Canyon Toad.

There is a specimen of this toad in the Cornell University Museum, their number 1708, collected by Bryon C. Marshall at Imboden, Arkansas, April 19, 1929. Doctor W. J. Hamilton, Jr., has kindly re-examined this specimen for us, and under date of June 16, 1938, writes that the identification is correct. As amazing as this record appears, it is obvious that it must be accepted as valid since the identification has been well established and the collector and locality seem to be absolutely correct.

*Bufo terrestris* (Bonnaterre). Southern Toad.

Charles E. Burt appears to be the only field worker who has recognized, or secured this species in Arkansas. He has found it over a rather wide area.

PREVIOUSLY REPORTED—*Hot Spring*: Estes (Burt,

1935). *Montgomery*: Waters, "Pine Ridge" (Burt, 1935). *Newton*: Ponca (Burt, 1935). *Polk*: 5 mi. N. Mena (Burt and Burt, 1929).

SPECIMENS KNOWN—*Dallas*: Fordyce, 4 USNM; 8 mi. N. W. Meridian, 1 USNM. *Hot Spring*: Estes 3 USNM. *Montgomery*: Waters (Pine Ridge) 4 USNM. *Newton*: Ponca, 2 USNM. *Polk*: 5 mi. S. Mena, 5 AMNH. *St. Francis*: 1 mi. E. Goodwin, 1 BC.

*Acris gryllus* (Le Conte). The Cricket Frog; Peeper.

We have attempted to separate *Acris gryllus* and *crepitans* for this report, but find that such separation to be of any use would necessitate the examination not only of all Arkansas material but of large quantities of so called "typical" specimens from various other regions. This obviously has been impractical. Marshall separates the two and distinguishes both forms as well as intergrades in his Imboden material. We have here lumped all *Acris* together under the species *gryllus*. The present state of our knowledge concerning these two species, if indeed there are two, indicates that such treatment is advisable.

PREVIOUSLY REPORTED—*Benton*: 1 mi. N. Lowell (Burt, 1932); 1 mi. W. Garfield; 3 mi. N. E. Gateway; 5 mi. E. Pea Ridge (Burt, 1935). *Clark*: 5 mi. S. Arkadelphia (Burt, 1935). *Dallas*: 1 mi. S. Princeton (Burt, 1935). *Franklin*: 10 mi. N. Ozark (Burt, 1932). *Garland*: Hot Springs (Strecker, 1924); 2 mi. E. Royal (Burt, 1935). *Green*: Paragould (Hurter and Strecker, 1909). *Hot Spring*: 2 mi. N. E. Bismark (Burt, 1935). *Lafayette*: Lewisville (Taylor, 1935). *Lawrence*: 3 mi. N. W. Black Rock (Burt, 1935). *Logan*: Booneville (Burt, 1935). *Madison*: 3 mi. S. Delaney, 1 mi. W. Baldwin (Burt, 1932); 2 mi. S. Forum; Kingston (Burt, 1935). *Montgomery*: E. Oden (Burt, 1935). *Newton*: 2 mi. S. Jasper; 1 mi. N. Ponca; 5 mi. S. Ponca; 2 mi. S. Willcockson (Burt, 1935). *Poin-*

*sett*: Marked Tree; Trumann (Burt, 1935). *Polk*: 8 mi. E. Oklahoma Line (Ortenburger, 1929); 2 mi. E. Cherry Hill (Burt, 1935); 5 mi. N. Mena (Burt and Burt, 1929). *Pope*: 15 mi. N. Dover (Burt, 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Pulaski*: North Little Rock; 3 mi. N. E. Jacksonville (Burt, 1935). *Randolph*: Pocahontas (Burt, 1935). *Sebastian*: Fort Smith (Cope, 1889 as "*crepitans*"; Hurter and Strecker, 1909); Hartford (Stone, 1904). *Sevier*: 20 mi. E. DeQueen (Ortenburger, 1929); DeQueen (Burt and Burt, 1929); 12 mi. S. Lockesburg (Burt and Burt, 1929). *Washington*: Cincinnati; 4 mi. S. Summers (Burt, 1935). *White*: 2 mi. S. Judsonia (Burt, 1935).

SPECIMENS KNOWN—*Benton*: 8 mi. N. W. Bentonville, 1 BC; 1 mi. N. Lowell, 3 MU; 3 mi. N. E. Gateway, 1 USNM; 5 mi. E. Pea Ridge, 1 USNM. *Carroll*: 1 MU. *Clark*: Arkadelphia, 3 USNM. *Franklin*: 10 mi. N. Ozark, 1 MU. *Fulton*: Viola, 5 MU. *Garland*: Hot Springs, 6 "*crepitans*" FMNH. *Lafayette*: Lewisville, 27 KU. *Lawrence*: 1 USNM; Imboden, 3 AMNH, 1 "*crepitans-gryllus*" AU, 2 "*gryllus*" AU, 1 "*crepitans*" AU, 19 "*crepitans*" FMNH; Ravenden, 1 MU. *Logan*: Booneville, 3 USNM; Mt. Magazine, 2 "*crepitans*" FMNH. *Madison*: 1 mi. W. Baldwin, 1 MU; 10 mi. N. E. Huntsville, 1 KU; Kingston, 10 USNM; 3 mi. S. Delaney, 1 USNM, 1 MU. *Montgomery*: Oden, 1 USNM. *Nevada*: Prescott, 10 AU. *Newton*: Ponca, 3 USNM. *Polk*: 5 mi. N. Mena, 3 AMNH. *Prairie*: DeValls Bluff, 47 KU. *Pulaski*: 25 mi. E. Little Rock, 1 MU. *Sebastian*: Hartford, 2 ANS; Barling, 19 AU (Granular like "*crepitans*"). *St. Francis*: 1 mi. E. Goodwin, 1 BC. *Washington*: 6 mi. E. Springdale, 1 AU; Fayetteville, "many" in AU; West Fork, 1 AU; Cincinnati, 8 USNM; Summers, 2 USNM; Evansville Creek, near Evansville, 2 AU. *White*: Near Searcy, 20 MU.

*Pseudacris feriarum* (Baird). Eastern Swamp Cricket Frog.

This species is apparently known within Arkansas only from Lewisville, Lafayette County, where R. E. McEntyre secured 9 specimens for the Kansas University Museum as reported by Taylor (1935).

*Pseudacris occidentalis* (Baird and Girard). Western Chorus Frog.

PREVIOUSLY REPORTED — *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Lafayette*: Lewisville (Taylor, 1935). *White*: (Taylor, 1935).

SPECIMENS KNOWN — *Garland*: Hot Springs, 1 Brimley Collection. *Lafayette*: Lewisville, 3 KU. *White*: 1 KU.

*Pseudacris triseriatus* (Wied). Three-lined Frog.

PREVIOUSLY REPORTED—*Dallas*: 1 mi. S. Princeton (Burt, 1935). *Garland*: Hot Springs (Strecker, 1924). *Green*: 5 mi. S. W. Paragould (Burt, 1935). *Montgomery*: 4 mi. N. E. Waters (Pine Ridge), (Burt, 1935). *Pulaski*: 2 mi. S. E. Olmstead (Burt, 1935).

SPECIMENS KNOWN—*Garland*: Hot Springs, 1 MU. *Green*: Paragould, 4 USNM, 1 MU. *Lawrence*: 1 USNM, 1 MU, 2 AU; Imboden, 1 CU, 2 MVZ, 14 AMNH, 10 FMNH. *Montgomery*: Waters (Pine Ridge), 1 USNM. *Polk*: Acorn, 1 MU.

*Hyla cinerea cinerea* (Schneider). Bell Frog.

PREVIOUSLY REPORTED—*Crittenden*: 2 mi. S. Turrell (Burt, 1935). *Lonoke*: 3 mi S. W. Cabot (Burt, 1935). *Poinsett*: Marked Tree (Burt, 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Pulaski*: 3 mi. N. E. Jacksonville (Burt, 1935). *Saline*: N. E. Saline (Perkins and Lentz, 1934).

SPECIMENS KNOWN—*Clark*: Near Arkadelphia, 1 AU. *Crittenden*: 1 USNM. *Jefferson*: Pine Bluff,

1 AU. *Lafayette*: Lewisville, 1 KU. *Lonoke*: Fish Hatchery, 2 MU. *Prairie*: DeValls Bluff, 128 KU.

*Hyla crucifer* Wied. Cross Toad; Spring-peeper.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Craighead*: 2 mi. N. W. Monette Burt, 1935).

SPECIMEN KNOWN—*Craighead*: Monette, 1 USNM. *Lawrence*: 1 USNM; Imboden, 1 AU, 2 MVZ, 11 FMNH, 1 CU. *Madison*: Ferris Cave, 1 KU. *St. Francis*: 1 mi. E. Goodwin, 1 BC. *Washington*: Stephenson Cave, near Prairie Grove, 1 KU; Fayetteville, 5 AU; 1 mi. N. W. West Fork, 1 AU.

*Hyla femoralis* Laterille. Pine Tree Toad.

There are three specimens of this species in the American Museum of Natural History labelled "*Arkansas*". There appears to be no other record for the state.

*Hyla squirella* Latreille. Southern Tree Frog; Rain Frog.

Hurter and Strecker (1909) reported this species from Greenway, Clay County, collected by Meek. There are two in the American Museum of Natural History from Imboden, Lawrence County, collected by Byron C. Marshall.

*Hyla versicolor versicolor* (Le Conte). Common Tree Frog.

PREVIOUSLY REPORTED—*Cleveland*: 13 mi. W. Rison (Burt, 1935). *Dallas*: 1 mi. N. Faringdale; 1 mi. N. Fordyce; 1 mi. S. Princeton (Burt, 1935). *Hot Spring*: 2 mi. N. E. Bismark; 2 mi. N. Estes (Burt, 1935). *Jackson*: Near Newport (Burt, 1932). *Lafayette*: Lewisville (Taylor, 1935). *Lonoke*: 3 mi. S. Cabot (Burt, 1935). *Madison*: Kingston (Burt, 1935). *Montgomery*: 4 mi. N. E. Waters (Pine Ridge), (Burt, 1935).

*Newton*: 2 mi S. Jasper; 1 mi. N. Ponca; 2 mi. S. Willcoxon (Burt, 1935). *Polk*: 1 mi. W. Wickes (Ortenburger, 1929); 2 mi. E. Cherry Hill; 6 mi. N. W. Rich Mt. Station (Burt, 1935); 5 mi. N. Mena (Burt and Burt, 1929). *Pope*: 2 mi. S. E. London (Burt, 1932). *Prairie*: DeValls Bluff (Taylor, 1935). *Pulaski*: 3 mi. N. E. Jacksonville; 1 mi. N. Little Rock (Burt, 1935). *Randolph*: Pocohantas (Burt, 1935). *Washington*: Winslow (Taylor, 1935); 4 mi. S. Summers (Burt, 1935).

SPECIMENS KNOWN—*Cleveland*: Near Fordyce, 1 USNM. *Dallas*: Estes, 1 USNM; Fordyce, 1 USNM. *Garland*: 3 USNM; near Hot Springs, 1 MU. *Hot Spring*: 2 USNM; Bismark, 1 USNM. *Jackson*: Near Newport, 2 MU. *Lafayette*: Lewisville, 1 KU. *Lawrence*: 2 USNM; Imboden, 9 AMNH, 1 AU, 2 MVZ, 7 FMNH, 1 CU. *Madison*: Kingston, 3 USNM. *Monroe*: 3 mi. W. Brinkley, 1 AU. *Montgomery*: Waters (Pine Ridge) 10 USNM. *Newton*: Ponca, 2 USNM; Willcoxon, 1 USNM. *Polk*: 5 mi. S. Mena, 1 CMZ. *Pope*: 2 mi. S. E. London, 1 MU. *Prairie*: DeValls Bluff, 6 KU. *Pulaski*: Jacksonville, 2 USNM. *Washington*: Winslow, 1 AU, 7 KU; 1 mi. N. Winslow, 2 KU; Fayetteville, 1 AU; 5 mi. N. Fayetteville, 1 AU.

*Hyla versicolor chrysocelis* (Cope). Southern Tree Frog.

PREVIOUSLY REPORTED — *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Lafayette*: Lewisville (Taylor, 1935).

SPECIMENS KNOWN—*Lafayette*: Lewisville, 6 KU.

*Rana areolata* Baird and Girard. Gopher Frog.

Taylor (1935) has reported one specimen from Lewisville, Lawrence County, collected by R. E. McEntyre. This seems to be the only valid Arkansas record.

*Rana catesbeiana* Shaw. Bull Frog.

PREVIOUSLY REPORTED — *Benton*: 5 mi. E. Pea Ridge, (Burt, 1935). *Columbia*: 6 mi. S. E. Waldo (Burt, 1935). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Grant*: Near Sheridan (Burt, 1935). *Hot Spring*: 2 mi. N. E. Bismark (Burt, 1935). *Lawrence*: 3 mi. N. W. Black Rock (Burt, 1935). *Logan*: W. Booneville (Burt, 1935). *Miller*: Texarkana (Hurter and Strecker, 1909 as *clamitans*; Strecker, 1915). *Nevada*: 5 mi. S. Prescott (Burt, 1935). *Polk*: 3 mi. E. Cherry Hill (Burt, 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Sebastian*: Fort Smith (Cope, 1889; Hurter and Strecker, 1909). *Washington*: 4 mi. S. Summers (Burt, 1935). *White*: 2 mi. S. E. Judsonia (Burt, 1935). *Yell*: 1 mi. N. Ola (Burt, 1932); 3 mi. N. E. Rover (Burt, 1935).

SPECIMENS KNOWN—*Carroll*: 1 MU. *Chicot*: Lake Village 1 AU. *Clark*: Gurdon, 1 AU; Terre Noir Creek, 13 mi. W. Arkadelphia, near highway 51, 1 AU. *Clay*: Corning, 1 MU. *Garland*: Hot Springs, 1 MU; i FMNH. *Green*: Paragould, 1 MU; Cache River, 1 USNM. *Johnson*: 8 mi. W. Clarksville, 1 MU. *Lawrence*: Imboden, 1 AMNH; Ravenden, 3 MU. *Madison*: Huntsville, 1 KU; 8 mi. S. W. Huntsville, 2 KU. *Prairie*: DeValls Bluff, 19 KU. *Pulaski*: Jacksonville, 1 MU. *Sharp*: 4 mi. N. Williford, 1 MU. *St. Francis*: 1 mi. E. Goodwin, 1 BC. *Washington*: Fayetteville, 3 KU; Clear Creek, 5 mi. N. Fayetteville, 1 AU; Great-house Springs, 6 mi. N. W. Fayetteville, 1 AU; War Eagle River, 12 mi. E. Springdale, 1 AU. *White*: Searcy, 4 MU. *Yell*: 1 mi. N. Ola, 1 MU.

*Rana clamitans* Latreille. Green; Black; Bronze Frog.

PREVIOUSLY REPORTED—*Columbia*: 6 mi. N. Taylor; 6 mi. S. E. Waldo (Burt, 1935). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Green*:

Paragould (Hurter and Strecker, 1909). *Hot Spring*: 2 mi. N. E. Bismark (Burt, 1935). *Independence*: N. E. Olyphant (Burt, 1935). *Lafayette*: Lewisville (Taylor, 1935). *Madison*: 2 mi. S. Forum (Burt, 1935). *Miller*: Texarkana (Hurter and Strecker, 1909). *Nevada*: 5 mi. S. Prescott (Burt, 1935). *Newton*: 1 mi. N. Ponca (Burt, 1935). *Polk*: 2 mi. E. Cherry Hill (Burt, 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Pulaski*: Little Rock (Hurter and Strecker, 1909). *Scott*: 1 mi. W. Waldron (Ortenburger, 1929). *Washington*: Winslow (Taylor, 1935).

SPECIMENS KNOWN—*Carroll*: 1 MU. *Clay*: Corning, 1 MU. *Craighead*: Otwell, 1 MU. *Crawford*: Mulberry, 2 KU. *Green*: Paragould, 1 MU. *Lafayette*: Lewisville, 12 KU. *Lawrence*: 1 USNM; Imboden, 2 AU, 2 USNM, 1 FMNH. *Miller*: Texarkana, 4 USNM. *Polk*: Rich Mt., 1 MU; Acorn, 1 MU. *Prairie*: DeValls Bluff, 76 KU. *Scott*: 1 mi. W. Waldron, 1 OU. *Washington*: Fayetteville, 1 AU; Illinois River, 9 mi. W. Fayetteville, 1 AU; Winslow, 18 KU; 1 AU. *White*: Searcy, 1 MU.

*Rana palustris* Le Conte. Pickerel Frog.

SPECIMENS KNOWN—*Lawrence*: Imboden, 2 MVZ; 2 USNM; 4 MU; 2 AMNH; 1 AU; 12 FMNH. *Monroe*: Brinkley, 1 MU. *Pope*: Rich Mt., 1 FMNH.

*Rana sphenocephala* (Cope). Southern Spotted Green Frog. Water Frog.

PREVIOUSLY REPORTED — *Lafayette*: Lewisville (Taylor, 1935). *Prairie*: DeValls Bluff (Taylor, 1935).

SPECIMENS KNOWN—*Clay*: Near Corning, 10 MU. *Craighead*: Near Otwell, 4 MU. *Fulton*: Viola, 3 MU. *Garland*: Near Hot Springs, 1 MU. *Green*: Near Paragould, 9 MU. *Jackson*: Near Newport, 11 MU. *Lafayette*: Lewisville, 4 KU. *Lawrence*: Imboden, 1 CU,

4 AMNH; Ravenden, 1 MU. *Polk*: Near Acorn, 5 MU. *Prairie*: DeValls Bluff, 1 KU. *Pulaski*: McAlmont, 1 MU. *Sebastian*: Barling, 6 AU.

*Rana sylvatica* Le Conte. Wood Frog.

This northern species has recently been found to occur over a wide area in northwestern Arkansas as reported by Black (1938). We add herewith two additional records. The first specimen, from Winslow, was reported by Black (1933-1938) and Taylor (1935). Other specimens reported in 1938 (Black) are from 2 miles southeast of Winslow, 1 mile west of Winslow (2); Watson Cave, near Prairie Grove, (2); and Ozark (1). All of these are in the KU collection. There is another in the AU collection taken two miles south of Ponca, Newton County, from Cob Cave in 1929 by Eugene Cypert, and one taken by Marshall in July, 1928, in the American Museum of Natural History.

*Rana pipiens* Schreber. Common Frog; Spotted Green Frog.

PREVIOUSLY REPORTED—*Benton*: 1 mi. N. Lowell (Burt, 1932); 1 mi. W. Garfield (Burt, 1935). *Boone*: 2 mi. N. Willcockson (Burt, 1935). *Clark*: 5 mi. S. Arkadelphia (Burt, 1935). *Clay*: 1 mi. N. E. Datto; 4 mi. W. McDougal (Burt, 1935). *Columbia*: 6 mi. N. Taylor; 4 mi. S. E. Waldo (Burt, 1935). *Craighead*: 4 mi. E. Jonesboro (Burt, 1935). *Crittenden*: 2 mi. S. Turrell (Burt, 1935). *Dallas*: 6 mi. N. Fordyce (Burt, 1935). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Green*: 10 mi. S. E. Paragould (Burt, 1935). *Hot Spring*: 6 mi. N. Malvern (Burt, 1935). *Independence*: N. E. Olyphant (Burt, 1935). *Jackson*: 3 mi. S. Swifton (Burt, 1935). *Lawrence*: Greenway (Hurter and Strecker, 1909); 3 mi. N. W. Blackwell (Burt, 1935). *Logan*: W. Booneville (Burt, 1935). *Madison*: 2 mi. S. Forum (Burt, 1935). *Miller*: 4 mi. N. Texarkana (Burt and Burt, 1929). *Montgom-*

*ery*: E. Oden; 4 mi. N. E. Waters (Pine Ridge), (Burt, 1935). *Nevada*: 5 mi. S. Prescott (Burt, 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Pulaski*: Little Rock (Hurter and Strecker, 1909); 11 mi. S. E. Maumelle (Burt, 1932); 2 mi. N. E. McAlmont (Burt, 1935). *Sebastian*: Fort Smith (Cope, 1889; Hurter and Strecker, 1909). *Washington*: Winslow (Taylor, 1935); 4 mi. S. Summers (Burt, 1935). *Yell*: 3 mi. N. E. Rover (Burt, 1935).

SPECIMENS KNOWN—*Benton*: 1 MU; 8 mi. N. W. Bentonville, 1 BC. *Boone*: N. Mystic Caverns, 1 MU. *Carroll*: 1 MU, 1 USNM. *Garland*: Hot Springs, 2 FMNH. *Green*: Cache River, 2 USNM. *Lafayette*: Lewisville, 14 KU. *Lawrence*: (Tadpoles) 3 USNM; Imboden, 10 FMNH, 50 AMNH including eggs and small tadpoles, 2 AU, 2 MU. *Logan*: Booneville, 1 USNM. *Miller*: 4 mi. N. Texarkana, 1 AMNH. *Montgomery*: Oden, 1 USNM. *Pope*: Acorn, 1 MU. *Prairie*: DeValls Bluff, 12 KU. *Pulaski*: 1 USNM. *St. Francis*: 1 mi. E. Goodwin, 1 BC. *Washington*: Fayetteville, 3 AU; Greathouse Springs, N. W. Fayetteville, 1 AU; 1 mi. E. Elm Springs, 1 AU; Winslow, 6 KU, 3 AU.

*Microhyla carolinensis* (Holbrook). Narrow-mouthed Toad.

PREVIOUSLY REPORTED—*Clay*: Greenway (Hurter and Strecker, 1909). *Craighead*: 4 mi. E. Jonesboro (Burt, 1935). *Dallas*: 1 mi. N. Faringdale; 1 mi. N. Fordyce (Burt, 1935). *Garland*: Hot Springs (Hurter and Strecker, 1909; Strecker, 1924). *Grant*: 2 mi. N. Ico; 4 mi. N. Sheridan (Burt, 1935). *Howard*: 20½ mi. N. E. DeQueen (Ortenburger, 1929). *Montgomery*: 4 mi. N. E. Waters (Pine Ridge), (Burt, 1935). *Nevada*: 5 mi. S. Prescott (Burt, 1935). *Prairie*: DeValls Bluff (Taylor, 1935). *Pulaski*: Near Little Rock, (Perkins, 1928); North Little Rock (Burt, 1935). *Wash-*

ington: 4 mi. N. Cincinnati; 4 mi. S. Summers (Burt, 1935). *White*: (Taylor, 1935).

SPECIMENS KNOWN—"Arkansas": 2 AMNH. *Clay*: Corning, 1 MU; Greenway, 1 CAS. *Garland*: 2 BU. *Green*: 22 mi. N. Paragould, 1 MU; 3½ mi. S. E. Paragould, 2 MU. *Lafayette*: Lewisville, 5 KU. *Lawrence*: 1 USNM; Imboden, 2 MVZ, 5 AMNH, 1 AU, 10 FMNH. *Monroe*: Brinkley, 4 MU; 6 mi. S. Clarendon, 5 MU. *Montgomery*: Waters (Pine Ridge) 4 USNM. *Prairie*: DeValls Bluff, 16 KU. *Pulaski*: 1 USNM; near Little Rock, 1 MBG; 25 mi. E. Little Rock, 1 MU. *White*: 5 KU.

#### ADDENDA

Since going to press we have received a small collection of salamanders from King's River Cave, 14 miles S. E. of Huntsville, Madison County, which appear of sufficient interest to be added to the present paper. These include the following: *Eurycea lucifuga*, 3; *Eurycea melanopleura*, 13; *Plethodon glutinosus*, 1.

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# Birds of the Winslow, Arkansas, Region



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### Introduction

In the original conception of this paper it was intended merely to give a list of my own observations of bird life within the Winslow area. Since the actual beginning of the work it has become quite evident that the value of this study would be considerably enhanced if a direct comparison was made with the study of Austin Paul Smith over the same area several years earlier. Smith's paper (1915) has therefore been freely drawn upon in the preparation of the present work, and comparisons have been made throughout between his findings and those of the present writer. Both papers are limited to an area within a ten mile radius of Winslow. Notwithstanding this remarkable differences are to be found in the distribution of species, as well as in the actual species present. These variations are to be explained by a number of significant facts.

The survey made by Smith in 1913 and 1914 was the result of rather intense collecting over an exceptionally favorable territory so that what was lost to his study through the limited time allowed for it was made up for in a great measure by the thoroughness of the work over the period in question. Having lived most of my life within the Winslow area I have carried on eleven years of continuous work there and have within the three years since that time made four field trips back into the area. I have enjoyed many advantages which come from long study in a given locality.

Consideration, too, must be given to the ever changing status of bird life, a factor which will be introduced at greater length within the body of this paper. It has been a very important element in an effort to account for the different findings of the two studies. Important as these two elements are, however, the decided variations in the final results of the two studies cannot be completely explained by them. A very fundamental difference is to be found in the actual area studied. Although the limits of range of study as given in each paper are the same, the region is so varied in topography that it is quite possible for two students to work the same territory and yet specialize in far different faunal areas. Although the combined work of Smith and myself probably gives the Winslow section the most complete record of any like territory within the state, the task is far from complete.

The work of Smith, according to information he has kindly furnished in various letters, was intensified on the high plateau somewhat south of Winslow, and in the ravines immediately adjacent to that region. He gives the elevations of his work as from 1800 to 2200 feet; this would practically confine his study to the plateau and the nearby ravines. On the other

hand the additions and notes given herewith have been compiled for the most part from the territory immediately north of and adjacent to the village of Winslow, at elevations ranging from 1400 to 2000 feet. The differences in bird life between these two areas is not so evident in ordinary field experience, but becomes so when a comparison of the distribution of certain forms is made on the basis of the two studies.

The village of Winslow is situated at the head of a rather large valley, with arms of the Boston Mountain plateau extending down on the east and west sides, the south end of the valley being closed by the main body of the highland, sometimes known as the "Ozark divide." Water draining into the Winslow valley and to the east flows north into the White River, while most of that falling to the south and west of the village flows southward through Clear Creek, Lee's Creek and Blackburn Creek into the Arkansas River. The valleys in the south half of the region are somewhat more sharp in descent and decidedly more rugged in character than those to the north. The village has an officially recorded elevation of 1734 feet at the Frisco railroad station. The surrounding hills range from 1850 to 2000 feet in height, attaining an elevation of perhaps 2250 feet at Signal Mountain and one or two other points.<sup>1</sup> The mean annual temperature at Winslow is 56.2 degrees F. The total average annual rainfall is 51.29 inches. Rainfall is well divided throughout the year, with a minimum monthly average of 2.30 inches in February and a maximum monthly average of 6.95 in May. Mid-summer droughts, however, are not uncommon, the fluctuation each year being considerable as to the periods of drought and rain so that the averages are not clearly indicative of the actual situation. The temperature extremes are represented by a mean average of approximately 35 degrees in January and of 76 degrees during the last two weeks of July and the first two weeks of August.<sup>2</sup>

The plant life of the zone is typical of the southern deciduous forest. The various oaks, (*Quercus alba*, *Q. velutina*, *Q. rubra*, *Q. coccinea* and others) are the dominant trees. The hickories (especially *Carya ovata*, *C. alba* and *C. glabra*) are also quite common. Other trees characteristic of the area include the black walnut (*Juglans nigra*), the chinquapin (*Castanea pumila*), the black gum (*Nyssa sylvatica*), and several of the maples. The most characteristic of the trees along the streams are the sycamore (*Platanus occidentalis*), and the sweet gum (*Liquidamber styraciflua*). Along the smaller streams the witch-hazel (*Hamamelis virginiana*) is especially abundant, as is the hawthorn group (*Crataegus* sp.), several species of which are represented. The most common of the undergrowth plants is the Indian currant (*Symphoricarpos orbiculatus*), although the wild blackberry (*Eubatus* sp.) is extremely common

<sup>1</sup> The elevations given here are estimates, made as carefully as possible and considered conservative, based on work by the United States Geological Survey (U.S.G.S., 1916). In a previous paper (1932a) I gave the elevation as upward to 2500 feet. Further careful work in the area convinces me this is too liberal, although elevations of as great as 2750 feet are claimed.

<sup>2</sup> Meteorological data concerning Winslow have been supplied by the Little Rock, Arkansas, office of the United States Weather Bureau.

and very important with relation to bird life. Only one small group of pine trees is known, the specific identity of which I have never attempted to determine. This is a cluster of transplanted trees, some now quite large, on Signal Mountain. The red cedar (*Juniperus virginiana*) occurs quite rarely through the area except in tracts of underbrush that have been occupied in recent years by robins in their winter roosts. In such places the young cedars have sprouted up in countless numbers, but are not at this time large enough to be of ecological significance. About 90 percent of the area is forested or given over to underbrush, settlement in the area since Smith's study being offset by the abandonment of land in the southern portion of the region.

Smith (1915) lists 143 forms in his paper; the present work lists 175. Of those reported by Smith only one, *Ammodramus bairdi*, is here omitted. In a letter from Smith under date of August 4, 1933, he asks that this species be removed from the list as the specimen on which it was based proved to be an abnormal specimen of *Ammodramus savannarum australis*. The Arkansas record being based on this specimen alone, will, therefore, necessitate the removal of *A. bairdi* from the list of Arkansas birds. Of the remaining 142 forms on Smith's report, two, *Elanoides forficatus forficatus* and *Meleagris gallopavo silvestris*, are almost certain to be now extinct within the limits covered by this study. Two additional extinct species are added in the present paper, as they are known to have occurred within comparatively recent years. Thirty-one others which Smith did not find are also added.

It may be readily understood from the preceding paragraphs that no necessity has appeared to question any of Smith's records. It is apparent that his compilation was carefully made, with all questionable records based on specimens. In making the present list I have tried to follow the same plan. Where previous records based on specimens stood as precedent it was not felt that actual specimens were necessary. In all other cases, with the two exception of *Bombycilla garrula pallidiceps* and *Prothonotaria citrea*, both birds of unmistakable characteristics and both known to occur within the state, the records given here are based on specimens collected. Such a plan, of course, eliminates quite a large number of sight records, most of which are undoubtedly correct, but I feel that far too many records from Arkansas (as well as many other places) are poorly substantiated. It appears better to have a small list based on actual specimens than a more extended list which cannot be substantiated by museum material.

The three published works on the birds of Arkansas (Howell, 1911; Wheeler, 1924; Baerg, 1931) have been consulted frequently during the present study, but inasmuch as Howell did not visit the Winslow area and the records of the latter two authors appear to be based almost solely upon Smith's paper they have not had any direct bearing on the present work. The specimens on which additions to the Winslow fauna given here are based are for the most part now either in the collection of Dr. Louis B. Bishop, of Pasadena, California, or the Museum of Birds and Mammals, University of Kansas. A few are in the collection of J. A. Munro, of Okanagan Landing, British Columbia. All specimens of doubtful identity have, except where

otherwise noted, been identified either by the Bureau of Biological Survey or by members of the staff of the United States National Museum. Dr. Louis B. Bishop has rendered many favors which has made possible a more complete and accurate listing of the Winslow avifauna, as has Austin Paul Smith, both placing all their valuable data at my disposal. The list which follows has been arranged to conform with the fourth edition of the Check-List of North American Birds, of the American Ornithologists Union, and the names used herein are the same as employed in that publication.

#### Annotated List

*Podilymbus podiceps podiceps* (Linnaeus). Pied-billed Grebe. Three records, all specimens having been collected by myself. Dates are April 28, 1926; April 10, 1929; and April 29, 1931. Although not known to occur in the fall it is highly probable that it is a fall migrant in limited numbers. The nature of the area around Winslow is such that records for water birds of this type are difficult to secure. Fall specimens have been taken at Fayetteville.

*Pelecanus erythrorhynchos* Gmelin. White Pelican. Known as a rare migrant. One bird kept captive for several months by a farmer on Blackburn Creek, about 6 miles southwest of Winslow. The bird had suffered a broken wing, and was released when finally able to fly again.

*Ardea herodias herodias* Linnaeus. Great Blue Heron. Not uncommon on the larger streams in the late summer. One specimen in my collection was killed July 16, 1931, six miles east of Winslow.

*Casmerodius albus egretta* (Gmelin). American Egret. The bird appears to be not uncommon along Clear Creek (the Frog Creek of Smith's list) in Crawford County, as well as along the streams north and west of Winslow. I have observed it several times in late July on Clear Creek. Two specimens in my collection, both taken five miles north of Winslow, are dated July 8, and August 6.

*Florida caerulea caerulea* (Linnaeus). Little Blue Heron. A common summer visitor on the streams around Winslow, appearing early in August and remaining until about the middle of September. There is one spring record, April 21, 1929.

*Butorides virescens virescens* (Linnaeus). Eastern Green Heron. A rather common summer visitor. There are no nesting records, although the bird is frequently observed throughout the summer.

*Cygnus columbianus* (Ord). Whistling Swan. "A solitary bird killed during the winter of 1912-13 on Frog Creek, near Porter, Crawford County, was probably of this species." (Smith, 1915). Nothing can be added to this report. Porter is about nine miles south of Winslow.

*Branta canadensis canadensis* (Linnaeus). Common Canada Goose. A common migrant. Hunters secure one or two birds each fall, but as a rule it does not stop within this area. The earliest spring record is Feb. 8, 1928, when over 600 were seen.

*Anas platyrhynchos platyrhynchos* Linnaeus. Common Mallard. A com-

mon migrant, often stopping on the small streams near here, and on Nelson Pond, west of Winslow.

*Querquedula discors* (Linnaeus). Blue-winged Teal. Fairly common migrant. My earliest record is April 1, 1928, April 11 and 12 being the usual early dates. I have one mounted specimen shot on Nelson Pond in the latter part of August, 1925, the exact date being unknown.

*Nyroca affinis* (Eyton). Lesser Scaup Duck. Only two records. One bird was found dead April 13, 1929 and another found wounded April 21 of the same year, the latter specimen dying May 5th.

*Cathartes aura septentrionalis* Wied. Turkey Vulture. "Present most of the year, retiring about December 1 to below 1500 feet; but reascending toward the end of February. A few could be noted almost daily but to find any number in company was unusual." (Smith, 1915). This has continued to be the condition until this past summer when the extreme shortage of all wild life was reflected in the almost total absence of vultures from the area.

*Coragyps atratus atratus* (Meyer). Black Vulture. Although not nearly so common as the preceding it is always to be found from April until November. My earliest record is April 10. I am of the opinion that it is more common in the Clear Creek region than elsewhere; it is rarely observed above 1700 feet.

*Elanoides forficatus forficatus* (Linnaeus). Swallow-tailed Kite. Smith (1915) reports a sight record by a farmer near Winslow, Oct. 8, 1913. I have heard of no later record. Once apparently common here as a transient.

*Astur atricapillus atricapillus* (Wilson). Eastern Goshawk. A single specimen was shot at Winslow, Nov. 5, 1926. It was a large adult female. Baerg (1931) reports that a single specimen was killed "not far from Fayetteville during the winter of 1928-29." There appears to be no other record for the state, excepting the Fayetteville specimen.

*Accipiter velox velox* (Wilson). Sharp-shinned Hawk. Fairly common as a migrant, especially in the fall. Smith recorded one specimen here on July 24, 1913. My earliest fall record is October 28.

*Accipiter cooperi* (Bonaparte). Cooper's Hawk. A fairly common resident. The bird is a serious enemy to the chickens on the small mountain farms of the region. Its raids, together with those of the grey fox, often makes it almost impossible to raise poultry in certain localities. This species is especially common during the summer.

*Buteo borealis borealis* (Gmelin). Eastern Red-tailed Hawk. A very common resident. I have found this hawk quite common throughout the year. Smith (1915) reports it as occurring principally as a fall and winter visitor. Baerg (1931) lists it as a resident for the state, but considers that it nests in small numbers only. This is not now the case in the Winslow region where it is by far the most common of the hawks of all times of the year. Three specimens were shot in the act of killing grown hens. Although generally beneficial in this region, as elsewhere, it appears to be more of an enemy to

poultry here than commonly is the case. It is known as the "hen hawk" to most of the farmers and is hunted even more than *Accipiter cooperi*.

*Buteo lineatus lineatus* (Gmelin). Northern Red-shouldered Hawk. Smith (1915) reports this as the most abundant hawk within the area and a summer resident. I have never seen the bird near Winslow. If now present at all it is extremely rare. Apparently it has been replaced since the time of Smith's studies by *borealis*.

*Buteo platypterus platypterus* (Vieillot). Broad-winged Hawk. Reported by Smith (1915) as a transient and possible summer resident. Other than two immature females, shot July 23, 1927, I have found it as a fall migrant only. It is probable that these two July specimens were raised within the area as they were shot from a group of five, of which only one was an adult, and appeared to have not been out of the nest a great while. It is not especially rare in the fall, though not to be considered common.

*Buteo swainsoni* Bonaparte. Swainson's Hawk. Smith (1915) observed a single bird October 1, 1914. I have never seen the species.

*Aquila chrysaetos canadensis* (Linnaeus). Golden Eagle. The only authentic record for the region is that of a specimen collected by Smith (1915) October 18, 1913.

*Haliaeetus leucocephalus leucocephalus* (Linnaeus). Southern Bald Eagle. An accidental visitor. Smith (1915) reports the observation of single individuals on May 6 and September 29, 1914. I have reported elsewhere (Black 1929a) the only other positive record for the locality. It doubtless occurs rather frequently, because reports of its presence are heard on the average of two or three times a year.

*Circus hudsonius* (Linnaeus). Marsh Hawk. Not a rare migrant, but never really common. Apparently does not winter here. Most often seen in October and November. I have observed it as early as August 26 (1933) at Fayetteville, but have not found it in the Winslow region before the last part of September.

*Falco columbarius columbarius* Linnaeus. Eastern Pigeon Hawk. Very rare migrant. Smith (1915) gives one definite record for this species, on Sept. 22, 1913. I secured an immature female shot in the village of Winslow, Sept. 12, 1934. It is known only from these two specimens.

*Falco sparverius sparverius* Linnaeus. Eastern Sparrow Hawk. Rare. I have collected this species only twice, both times in November. Smith (1915) reported specimens in May and June of 1913, and January and August of 1914. It is probably a resident, but very rare as such.

*Colinus virginianus virginianus* (Linnaeus). Eastern Bob-white. Common resident. Not nearly as common, however, as the cover and food supply could support. The bird should occur in double its present numbers under ordinary conditions, but it is so heavily preyed upon by the bob cat and grey fox that it has lost ground instead of having gained within the last five years. The great horned owl is also a probable important factor in controlling the numbers of the bob-white.

*Meleagris gallopavo silvestris* Vieillot. Eastern Turkey. Smith (1915) listed one actual record; that of a flock of seven seen by a hunter near Clear Creek in Crawford County in early December, 1913. It is quite certain extinct within this section now and has been for at least ten years. The available cover offers an excellent opportunity for the stocking of areas near Winslow now planned, but the species will have very little chance to survive the predators now so common within the region.

*Porzana carolina* (Linnaeus). Sora. A rather rare migrant. One specimen, captured May 20, 1929 and banded with U. S. Biological Survey band No. 670771 and released. Skins in my collection from this locality were taken on the following dates: May 1, 1930; May 12, 1931; October 9, 1929. Two of the four birds were found dead on the highway, evidently killed by cars.

*Fulica americana americana* Gmelin. American Coot. Not especially rare as a migrant, but rather irregular in its appearance. There are records of April 13, 1930 and October 26 and 28, 1928. All were picked up far from water in exhausted conditions. They are occasionally reported from Clear Creek in both the fall and spring.

*Oxyechus vociferus vociferus* (Linnaeus). Killdeer. A common migrant in the vicinity of Nelson Pond. Elsewhere I have noted it only rarely. My earliest date for spring arrival is March 31, 1929.

*Actitis macularia* (Linnaeus). Spotted Sandpiper. A fairly common migrant and a rare summer resident. I have observed one family of young, just out of the nest, one mile north of Winslow, and another at Schaberg, five miles south of Winslow. A few other birds have been seen during the breeding season.

*Tringa solitaria solitaria* Wilson. Eastern Solitary Sandpiper. A rare migrant. The only specimen in my collection was taken at Nelson Pond May 18, 1929.

*Totanus flavipes* (Gmelin). Lesser Yellow-legs. Observed in small numbers almost every spring at Nelson Pond. One specimen was collected from a flock of four there April 28, 1929. Inasmuch as this appears to be the first published record for the bird from the western portion of the state, it might be well to add that one specimen was collected May 7 of the same year at Fort Smith, three others observed there the following day, and it was reported as common around Fort Smith during the spring migration. There is also one fall record from Nelson Pond, September 4.

*Pisobia melanotos* (Vieillot). Pectoral Sandpiper. Only one record, that of May 12, 1931 when five birds were seen and one collected at Nelson Pond. This record has been previously published (Black, 1931). It appears to be the only known record for the western part of the state.

*Steganopus tricolor* Vieillot. Wilson's Phalarope. One record only of four birds seen and one collected at Nelson Pond, April 28, 1929. The specimen collected was a female, mounted and in my collection. This appears to be the first published record for the state for the species. A single female was ob-

served at Fort Smith, May 7, 1929, in company with the yellow-legs mentioned above.

*Zenaidura macroura marginella* (Woodhouse). Western Mourning Dove. Although this bird is considered a winter resident within the northwest section of the state and I have observed it throughout most of that section during the winter months, it is apparently a summer resident only within the limits of the Winslow area. Smith reports it as arriving about April 1. (Smith, 1915). This is quite true of the elevations at which he did most of his work, but I have observed it as early as February 18 (1928) at 1700 feet. It commonly arrives around Winslow in March, usually the first week of that month. The bird becomes rare, even at 1500 feet, after the last of October. Both Albert Lano of Fayetteville and Smith have referred specimens from this section to the western sub-species, identifications which were substantiated by the Biological Survey. It is highly probable that both *marginella* and *carolinensis* occur within this vicinity during migration, but *marginella* seems to be the breeding form.

*Ectopistes migratorius* (Linnaeus). Passenger Pigeon. Once quite common throughout this section. No definite date as to the last record is to be obtained.

*Coccyzus americanus americanus* (Linnaeus). Yellow-billed Cuckoo. A very common summer resident, arriving as early as May 2, and remaining at least until October 12. In the fall of 1928 several nests of this bird were found very late in the season. Photographs were made of young in the nest of about five different nests on September 11, 12 and 16th, all of the young still being in quills.

*Coccyzus erythrophthalmus* (Wilson). Black-billed Cuckoo. Smith (1915) reported two specimens taken May 22, and one on September 17, of 1914. He considered it a migrant only. I have never made a positive record of the occurrence of the species during my study in the region. It is presumably a very rare and shy migrant.

*Otus asio asio* (Linnaeus). Southern Screech Owl. Fairly common resident. All specimens observed or collected, except three, have been of the red phase. Probably as common as *Strix varia varia*.

*Otus asio aikenii* (Brewster). Aiken's Screech Owl. Dr. Louis B. Bishop has referred two winter specimens from Winslow to this race, the birds being taken on January 15, 1929 and January 19, 1930. In view of the pronounced west-east migration which is known to have occurred within recent years this is not as remarkable as it might appear at first thought.

*Bubo virginianus virginianus* (Gmelin). Great Horned Owl. A common resident. Apparently able to maintain its status in the deeper ravines throughout the area, where it is quite common, in spite of almost continual trapping and hunting. It often raids chickens roosting in trees, and the habit of many of the farmers of this section to fail to provide proper housing for their poultry raises this species into the front rank as an enemy of poultry within the mountain portion of Arkansas.

*Strix varia varia* Barton. Northern Barred Owl. Fairly common resident. In sharp distinction to the changed distribution of the hawks in recent years and at the time of Smith's studies, the relative abundance of the owls seems to be about as he found it.

*Strix varia alleni* Ridgway. Florida Barred Owl. A single specimen, evidently a wanderer, of this race was taken here January 25, 1931. There is no other record for this section.

*Antrostomus carolinensis* (Gmelin). Chuck-will's-widow. A common summer resident. By far the most common of the family within this area, and is to be seen in almost any open patch of timber at nightfall throughout the summer. It is surprising that Smith did not record this species.

*Antrostomus vociferus vociferus* (Wilson). Whip-poor-will. Fairly common as a summer resident, and no doubt a breeding bird, though there are no nesting records.

*Chordeiles minor minor* (Forster). Eastern Nighthawk. A rather rare spring migrant but appears in great numbers in the fall. Frequently in the fall, and especially in late afternoon just after a rain, the birds appear in numbers of from 200 to 1000 over the larger valleys. Several specimens from such flocks have been collected, and in every instance their stomachs have been filled with winged ants of various species.

*Chordeiles minor chapmani* Coues. Florida Nighthawk. Specimens taken in this region in the fall and during the breeding season appear to vary from almost typical *chapmani* to stages intermediate between this race and *minor*. On the whole it appears best to refer all breeding specimens to the race *chapmani* because the tendency is greater toward that race than *minor*. It is probable that the breeding form for the entire state is *chapmani* or an intermediate phase.

*Chaetura pelagica* (Linnaeus). Chimney Swift. Common summer resident, arriving about April the 15th, and remaining until the first week in October.

*Archilochus colubris* (Linnaeus). Ruby-throated Hummingbird. A common summer resident. Always to be found in spring as soon as the blossoms of the Ohio buckeye (*Aesculus glabra*) are open. Apparently the bird feeds for the first two weeks of its stay almost exclusively on this plant.

*Megaceryle alcyon alcyon* (Linnaeus). Eastern Belted Kingfisher. Common summer resident. In spite of the fact that this bird is supposed to be resident throughout this area, I have never recorded it in the winter. In the summer it is to be found along all the reasonably large streams within the region.

*Colaptes auratus luteus* Bangs. Northern Flicker. A very common resident, especially common except during the more severe part of the winter when it tends to move down to lower elevations. Although now common, Smith (1915) did not find this species to be a summer resident.

*Ceophloeus pileatus pileatus* (Linnaeus). Southern Pileated Woodpecker. A fairly common resident. Prior to 1925 this bird was common, but begin-

ning then and continuing until 1930 the species became increasingly rare until it was virtually extinct by the latter date. Since 1930 it has again been on the increase, due no doubt to the decided increase in standing dead timber within the last four years, and is again reasonably common throughout the Winslow region. The bird is very shy, and is far more often heard rattling away at an old dead tree off across the valley than it is seen. For a bird of its size and prominence it is extremely difficult to collect.

*Centurus carolinus* (Linnaeus). Red-bellied Woodpecker. A very common resident. I found this woodpecker rare from 1920 until 1926 and not common until about 1928. Since then it has been about as common as the flicker, and may be recorded daily throughout the year.

*Melanerpes erythrocephalus* (Linnaeus). Red-headed Woodpecker. Fairly common as a summer resident. Another member of the family whose changing status is an unanswered puzzle. Smith (1915) found it a common migrant, but not a summer resident in 1913 and 1914. By 1920 it was nesting in scattered localities, but not commonly. After 1924 I did not see a summer bird until 1929, when a pair was found nesting near Winslow at an elevation of 1850 feet. In 1930 three nesting pairs were known, one on Signal Mountain. It was still increasing in 1931 and 1932 and considered fairly common since then. It appears to be equally distributed at all elevations within the area.

*Sphyrapicus varius varius* (Linnaeus). Yellow-bellied Sapsucker. Fairly common as a migrant and hardly to be considered rare as a winter resident. Smith (1915) reported that the immature birds outnumbered the adults about ten to one, a condition which appears to still prevail. Although my extreme dates are from October 28 to April 6, the bird commonly arrives about the middle of November and departs in the third week of March.

*Dryobates villosus villosus* (Linnaeus). Eastern Hairly Woodpecker. Rare resident. Smith (1915) reports this bird as "About as common as the downy, possibly more frequently seen during cold weather than at other times." This is exactly the condition that existed during the first five years of my study within the area. During the winter of 1925-26 the birds were noticeably less common than before, and from that time on entries of its occurrence are increasingly rare in my field notes. Only ten were observed and three collected during the entire summer of 1932. None were seen in either of the trips back into the region in 1933, and none during eight weeks there during the summer of 1934. It has become by far the rarest of the family represented within the area, although ten years ago it was one of the two most common. Specimens from this area are very close to *Dryobates v. auduboni* and certain individuals appear to be almost typical of that form, but taken as a whole, it seems best to refer all hairy woodpeckers from this region to *villosus*. It is possible that a very extensive series of breeding birds taken on both sides of the main divide would establish the northern limits of the northern race within the Winslow area. The material on hand indicates such a condition.

*Dryobates pubescens medianus* (Swainson). Northern Downy Woodpecker. The most common of its family and the only member that has main-

tained its present status unchanged throughout the course of my study. The same condition as to subspecies exists with this as with the preceding species, with many specimens nearly typical of *pubescens*.

*Tyrannus tyrannus* (Linnaeus). Eastern Kingbird. A very common migrant and fairly common summer resident, arriving as early as May 8 and departing on or before October 21. Considerably more common at the lower elevations and very rare as a summer resident above 2000 feet.

*Myiarchus crinitus boreus* Bangs. Northern Crested Flycatcher. Fairly common as a migrant, especially in spring, but extremely rare as a summer resident. I have found only three breeding pairs during all my field work. Smith (1915) reported three or four breeding pairs during his studies within the area.

*Sayornis phoebe* (Latham). Eastern Phoebe. A very common summer resident. I have found one pair working on a half completed nest as early as March 17, and Smith (1915) reports a fall record as late as Nov. 12.

*Empidonax flaviventris* (Baird and Baird). Yellow-bellied Flycatcher. Smith (1915) found this bird to be a regular migrant. I have only two sight records to add, that of a single bird on May 15, 1927 and of two birds on October 13, 1929.

*Empidonax virens* (Vieillot). Acadian Flycatcher. Smith (1915) says: "The common flycatcher during the period it was present, from April 28 to September 1." I have found it very common in the deeper ravines, absent elsewhere, and within the area as a whole outnumbered by the phoebe, wood pewee and the kingbird.

*Empidonax traillii brewsteri* Oberholser. Little Flycatcher. Smith (1915) reports two records. I have never observed it in Arkansas.

*Empidonax minimus* (Baird and Baird). Least Flycatcher. A rather rare but regular migrant. Smith (1915) found it to be a rather common migrant and gave dates of May 5-11 for the spring flight and September 8-16 for the fall migration.

*Myiochanes virens* (Linnaeus). Eastern Wood Pewee. A very common summer resident, arriving as early as April 28. It nests quite commonly along the wooded hillsides and is one of the most characteristic birds of the region.

*Nuttallornis mesoleucus* (Lichtenstein). Olive-sided Flycatcher. I have never recorded this species within the area under consideration. Smith (1915) reports it as uncommon but regular as a migrant, giving spring and fall dates for the 1914 migrations as May 16 and September 18.

*Otocoris alpestris praticola* Henshaw. Prairie Horned Lark. A fairly common resident, sometimes occurring in considerable numbers in the winter. First found nesting in 1928. I now consider the species rather common as a breeding bird. Inasmuch as it is more common at the elevations that Smith worked than elsewhere, and he did not find the bird, it is to be presumed that it did not occur there at that time.

*Iridoprocne bicolor* (Vieillot). Tree Swallow. This species was found by

Smith (1915) on October 2, 1913 and April 20, 1914. I have never seen it.

*Petrochelidon albifrons albifrons* (Rafinesque). Northern Cliff Swallow. Reported one time by Smith (1915) near the end of April 1913. Although I have never seen the bird within this area I have observed it during migration at both Fayetteville and Alma, so that it doubtless still occurs as a rare migrant.

*Progne subis subis* (Linnaeus). Purple Martin. A very common summer resident arriving March 13 and departing as late as September 28, though usually leaving much earlier.

*Cyanocitta cristata cristata* (Linnaeus). Northern Blue Jay. An extremely common resident. The seasonal difference noted by Smith (1915), with the bird less common from November to March, has not been evident in recent years.

*Corvus corax sinuatus* Wagler. American Raven. Although there are no specimens to substantiate a record, this species once occurred in the Winslow region in considerable numbers. "Raven Bluff," four miles southwest of Winslow, is supposed to have been so named because the region was frequented by these birds.

*Corvus brachyrhynchos brachyrhynchos* Brehm. Eastern Crow. Not especially common except in the early winter when it gathers into flocks of 20-50. Always to be found in small numbers, but never a serious pest.

*Penthestes carolinensis carolinensis* (Audubon). Carolina Chickadee. A very common resident, extremely common in winter.

*Baeolophus bicolor* (Linnaeus). Tufted Titmouse. A very common resident, and like the preceding, appears to be more common in winter and fall than during the breeding season.

*Sitta carolinensis carolinensis* Latham. White-breasted Nuthatch. Fairly common as a resident, more common in the fall and winter.

*Certhia familiaris americana* Bonaparte. Brown Creeper. A rare winter resident, always occurring in small numbers, but never common. Arrives as early as October 2, departing not later than April 7, usually before the end of March.

*Troglodytes aedon parkmani* Audubon. Western House Wren. In some years a very common spring migrant, and a rare summer resident. Smith (1915) recorded it as an uncommon fall migrant. It was exceedingly common in the spring of 1929, being present in numbers from April 20 to May 5. Formerly considered as not breeding there I found three nesting pairs in the summer of 1933, and was told that at least one pair had nested at the old site the previous year. The nests varied in elevation from the very top to the bottom of the range, so that their previous absence is difficult to understand.

*Nannus hiemalis hiemalis* (Vieillot). Eastern Winter Wren. A rare but regular winter resident. Always in brush piles or drift along the small streams.

*Thryomanes bewicki bewicki* (Audubon). Bewick's Wren. To be found as a summer resident in the higher portions of the region, but not observed regularly. I have photographed nests at Nelson Pond and Signal Mountain.

*Thyrothorus ludovicianus ludovicianus* (Latham). Carolina Wren. Very common resident. Known locally as the "House Wren," "Jenny Wren," and "Brown Wren," this bird is everywhere common the year round. It nests impartially under tree roots along the smaller mountain streams or around houses and barns. Three broods per summer are commonly reared, and always two. One pair (?) of these birds have been observed to use the same nesting site for seven consecutive summers for their first brood. Apparently during all this time a complete nest was never built, but the old one repaired as necessity demanded. Often the second brood is raised in the same nest as the first (Four times in seven years in the case of the above mentioned pair.).

*Mimus polyglottos polyglottos* (Linnaeus). Eastern Mockingbird. A very common summer resident at the lower elevations, rare but present throughout the higher elevations. A few remain throughout the winter in the warmer and more protected parts of the area. Occasionally an individual will frequent a fire table in the village all winter, even through severe weather.

*Dumetella carolinensis* (Linnaeus). Catbird. Perhaps the most common summer bird in the region. Much more common at the lower elevations, especially below 1800 feet. Quite as much at home in small openings along the wooded streams where the hawthorn and blackberry provide shelter, as in the farm yards and villages. Arriving as early as April 11, but usually around the 15th, the catbirds remain until the middle of October. In dry summers they retire to the larger streams about the middle of July, in company with other birds that ordinarily remains more evenly distributed, such as the cardinal and to a lesser degree the mockingbird.

*Toxostoma rufum* (Linnaeus). Brown Thrasher. Usually a very rare spring migrant. Common in 1929 from April 19 until May 5. The nearest nesting record to my knowledge is at West Fork, twelve miles north of Winslow.

*Turdus migratorius migratorius* Linnaeus. Eastern Robin. A summer resident of irregular status. Often absent or nearly so as a breeding bird, yet very common in other years. Usually represented by a few pairs of breeding birds, especially in the higher parts of the region. A winter visitor, but only rarely remaining throughout the year. Often, but not always, absent during the month of January. During the winter they often congregate in great roosts, flying out early in the morning considerable distances to feed on the berries of the common black gum (*Nyssa sylvatica*) and other berries available at that time. I have covered their winter habits in some detail in a previous paper (Black, 1932a). Friends reported that the early winter roost of 1932 was even larger than in previous years. There appeared to be no roost of any great size during the winter of 1933-34.

*Turdus migratorius achrusterus* (Batchelder). Southern Robin. Many of the birds of the winter roosts have been found to be typical of this race. This would apparently establish a northward migration in the fall and is a strong point favoring the argument that the movement of the species as a whole (*migratorius* and subspecies) outside of the breeding season is principally controlled by the abundance of desirable food.

*Hylocichla mustelina* (Gmelin). Wood Thrush. A very common summer resident throughout the region, especially so in the deep ravines, which they favor for nesting sites. It is not uncommon to see and hear as high as 100 singing males in a single afternoon around the first of May when the spring migration is at its height, their song completely dominating the forest for a few days each spring. They arrive as early as April 15, and depart about the middle of September, Smith (1915) reporting a date as late as September 21.

*Hylocichla guttata faxoni* Bangs and Penard. Eastern Hermit Thrush. A very rare winter resident. I have collected specimens in October, November and December, and observed it in January. It is confined to the darker, more secluded, ravines.

*Hylocichla guttata dwighti* Bishop. Dwight's Hermit Thrush. Dr. Louis B. Bishop, who has recently described this race (Bishop, 1933), informs me that he considers a specimen in his collection from Winslow, collected by myself, February 1, 1929, as almost typical of this race, the plumage being typical but the bill tending toward *guttata*. As Dr. Bishop says, this appears to be the eastern known limit of the winter range for the race.

*Hylocichla ustulata swainsoni* (Tschudi). Olive-backed Thrush. "An abundant spring and fairly common autumn transient." (Smith, 1915). Smith found it present from April 28 to May 25, and from September 7 to 18. I have only a single sight record, of four individuals, April 28, 1929, to add to this. Apparently a very irregular migrant.

*Hylocichla minima aliciae* (Baird). Grey-cheeked Thrush. I have recorded it only on one date, May 7, 1927. Smith (1915) reported it as a common spring migrant, not so abundant in fall.

*Sialia sialis sialis* (Linnaeus). Eastern Bluebird. A very common resident, sometimes disappearing for several weeks in winter, but often remaining through the most severe weather. May begin nesting as early as the second week in March.

*Poliophtila caerulea caerulea* (Linnaeus). Blue-gray Gnatcatcher. A very common summer resident arriving as early as April 7 and departing about the middle of September.

*Regulus satrapa satrapa* Lichtenstein. Eastern Golden-crowned Kinglet. Rather common migrant, but rare as a winter resident. Present here during the latter part of March and in November and December. One specimen was collected Feb. 3, 1929, during one of the most severe blizzards of the winter.

*Corthylio calendula calendula* (Linnaeus). Eastern Ruby-crowned Kinglet. Arrives in spring on March 31, or a few days later, present until May 5-8. Arrives in fall the last of September and remains for two months or longer, but not present during the severe part of the winter.

*Bombycilla garrula pallidiceps* Reichenow. Bohemian Waxwing. Reported as being present and carefully described by a friend on May 6, 1931. I observed and unquestionably identified a flock of ten of these six days later as

they fed on buds of the flowering dogwood. Previously reported (Black, 1932b) as the only record from this locality.

*Bombycilla cedrorum* Vieillot. Cedar Waxwing. An irregular visitant. Not known to breed here. Most common in May and October, and an irregular winter visitor, but not to be considered as a winter resident. My latest data in the spring is May 30.

*Lanius ludovicianus migrans* Palmer. Migrant Shrike. A rare transient, only occasionally noted in the spring, more often in October.

*Sturnus vulgaris vulgaris* Linnaeus. Starling. One record. A single bird was shot one mile north of Winslow by Sanford Nott and sent to me, November 15, 1932. The specimen is now No. 20336 in the University of Kansas collection. It was in company with a band of robins.

*Vireo griseus griseus* (Boddaert). White-eyed Vireo. A common summer resident, arriving as early as April 1, and remaining until the last part of September.

*Vireo belli belli* Audubon. Bell's Vireo. A summer resident, but rather rare locally. Recorded in the spring as early as April 8. It is generally confined to the small streams, and more common at the lower altitudes within the area.

*Vireo flavifrons* Vieillot. Yellow-throated Vireo. A fairly common summer resident, sometimes quite common in migration. Smith reported it as arriving as early as April 18 (my early date is April 28). It remains until the middle of September.

*Vireo solitarius solitarius* (Wilson). Blue-headed Vireo. A rather rare migrant. Smith (1915) reported its presence here as a fall migrant. I have previously reported it here in the spring (Black, 1925). In 1928 I found this species to be fairly common and observed it from May 1 to 8. In 1929 only two were recorded, both on April 21.

*Vireo olivaceus* Linnaeus. Red-eyed Vireo. Very common as a migrant and summer resident, arriving as early as April 7 and remaining until the last of September.

*Vireo philadelphicus* (Cassin). Philadelphia Vireo. The first, and to date only, published record of this bird's appearance within the state was of three individuals observed by Smith (1915) on April 30, 1914. I have observed the species a few times when identification was positive. My first record was April 24, 1927 when two were recorded, and another was studied at close range for a long period the following day. Single individuals were recorded in 1928 and 1929. I am inclined to believe that careful collecting would establish the species as an uncommon but regular spring migrant.

*Vireo gilvus gilvus* (Vieillot). Eastern Warbling Vireo. A fairly common summer resident and a very common spring migrant. Smith's (1915) dates of arrival and departure, April 27 and Sept. 9 correspond with mine, except for the year of 1928 when they arrived on April 1, and were repeatedly observed thereafter, becoming common by the 18th.

*Mniotilta varia* (Linnaeus). Black and White Warbler. A common summer resident. Present from the first of April until the middle of October. Throughout the summer the most common member of the family, sometimes being very common in the spring.

*Protonotaria citrea* (Boddeart). Prothonotary Warbler. A pair of these birds were observed one mile north of Winslow on May 27, 1929 by a party of three, including myself. I know it in the Winslow region only from this record.

*Helmitheros vermivorus* (Gmelin). Worm-eating Warbler. Smith (1915) reported three or four pairs nesting in a single ravine in 1914, arriving April 22, and departing Sept. 14. I have never observed the species.

*Vermivora chrysoptera* (Linnaeus). Golden-winged Warbler. "The first and only record from this region as well as for the state is of a single bird found in a grove, mostly consisting of witch-hazel, in a ravine bottom, May 16, 1914." (Smith, 1915) Apparently the state record still rests on this one observation.

*Vermivora pinus* (Linnaeus). Blue-winged Warbler. A fairly common spring migrant. Smith (1915) reported it as a breeding bird in small numbers. I have recorded it in the fall on September 18, and October 14. On the latter date in 1928 I observed 20 of these birds in a single maple tree in company with 25 *Vermivora r. ruficapilla*, 1 *Dendroica v. virens* and 17 *Corthylio c. calendula*. My earliest date for spring arrival is April 21.

*Vermivora bachmani* (Audubon). Bachman's Warbler. Smith (1915) collected one of these birds at an elevation of 2000 feet, May 5, 1914. It has not since been recorded in this region. The country here is decidedly unsuited for the species and the one collected was unquestionably a straggler.

*Vermivora peregrina* (Wilson). Tennessee Warbler. Fairly common in spring, arriving as early as April 8, usually about two weeks later. Not recorded in the fall.

*Vermivora ruficapilla ruficapilla* (Wilson). Nashville Warbler. A regular migrant, but both Smith (1915) and myself found it to be rather limited in numbers, only in the flight of Oct. 14, 1928, already mentioned, have I found more than an occasional individual. Smith's dates of "latter half of April," and "present in the month of September, after the 8th" are somewhat earlier than mine for both seasons.

*Compsothlypis americana pusilla* (Wilson). Northern Parula Warbler. A fairly common spring migrant and present as a summer resident, extreme dates being from April 6 to Sept. 24. Appears to prefer the sweet gum growth on the south side of the area, and rarely ever seen as a summer bird on the north side of the divide.

*Dendroica aestiva aestiva* (Gmelin). Eastern Yellow Warbler. Common summer resident, occurring in large numbers in the spring. Apparently does not arrive before May 10, and departs about the middle of September. It is surprising that this bird was not recorded by Smith (1915) as it now frequents the area with which he was most familiar.

*Dendroica magnolia* (Wilson). Magnolia Warbler. The only record for the species is of a single bird observed by Smith (1915) May 22, 1914. I have one or two sight records, none positive beyond question.

*Dendroica coronata* (Linnaeus). Myrtle Warbler. Fairly common as a migrant, and a rare winter visitor. Arrives in mid-October and seen thereafter rather irregularly until May 3. Not observed during the more severe parts of the winter.

*Dendroica virens virens* (Gmelin). Black-throated Green Warbler. An uncommon and irregular migrant. Present from April 7 to May 19 in the spring, totally absent some years. Smith (1915) reported it arriving as early as August 13 in the fall and "numerous for a month or more." My only record is of a single bird observed on Oct. 14, 1928.

*Dendroica cerulea* (Wilson). Cerulean Warbler. Fairly common as a summer resident within the southern part of the area where the large, dark ravines are to its liking. Smith (1915) with special opportunities to observe this species, found it fairly common as a spring migrant, arriving as early as April 16.

*Dendroica dominica albilora* Ridgway. Sycamore Warbler. Rare but present both as a summer resident and a migrant. Previously reported (Black, 1928) as a breeding bird on Clear Creek, where it is locally common. I have reported it in spring on April 6, and Smith (1915) reported several individuals on September 16, 1914.

*Dendroica pensylvanica* (Linnaeus). Chestnut-sided Warbler. Recorded only on May 6 and 8 of 1928 by myself, and on May 13 and 20 of 1914 by Smith (1915).

*Dendroica striata* (Forster). Blackpoll Warbler. An irregular spring migrant, common when occurring at all. In 1928 it was very common, and present from April 29 to May 25. I have recorded it as early as April 22.

*Dendroica pinus pinus* (Wilson). Northern Pine Warbler. Totally unknown prior to 1932, when Eugene Davis discovered breeding birds near Signal Mountain in a small clump of transplanted pines. Five or six specimens were taken during the summer and they seemed to remain in rather constant numbers throughout the season. All of the specimens collected were in the immature plumage. Possibly it is a regular resident in the pine grove mentioned. I have also taken the bird far from pine growth, 11 miles northeast of Winslow. Smith (1915) recorded several individuals in a migration wave on Sept. 29, 1914, his only Winslow record.

*Dendroica discolor discolor* (Vieillot). Northern Prairie Warbler. Smith (1915) reports the bird as "a common summer resident, departing very early." He gives dates of arrival and departure as April 28, and "July." Due perhaps to the difference in the area where we have worked, I have found it far from common.

*Sciurus aurocapillus* (Linnaeus). Oven Bird. One of the most common

of the warblers as a summer resident, and sometimes very numerous as a migrant. Arrives by April 7, and departs about September 15.

*Seiurus noveboracensis notabilis* Ridgway. Grinnell's Water Thrush. A rare migrant. I have recorded it only on April 19, 1925 and May 1, 1927. Smith (1915) had two records, Sept. 18 and 21, in 1914.

*Seiurus motacilla* (Vieillot). Louisiana Water Thrush. Common as a migrant and summer resident. Arrives April 6, and departs the last of August. Common along all the hill streams of any size.

*Oporornis formosus* (Wilson). Kentucky Warbler. A fairly common summer resident. Arrives by April 21 and remains until the middle of September. Frequents the cut-over hillsides, especially north slopes, where it is sometimes the predominating bird.

*Oporornis philadelphia* (Wilson). Mourning Warbler. A very rare spring migrant. I have only one record, of a badly injured bird which died soon after I acquired it on May 21, 1929. Smith (1915) considered it comparatively rare and present from "the end of April to May 21."

*Geothlypis trichas trichas* (Linnaeus). Maryland Yellow-throat. A fairly common summer resident. Prefers the lower elevations where it may be found from April 6 until the latter part of September.

*Icteria virens virens* (Linnaeus). Yellow-breasted Chat. A fairly common summer resident. Arrives about April 30 and remains until the end of August. Throughout the area, but more common below 1700 feet.

*Wilsonia citrina* (Boddaert). Hooded Warbler. Locally common as a summer resident along the dark hillsides of the southern portion of the region. Arrives April 18 and remains until the last of September.

*Wilsonia pusilla pusilla* (Wilson). Wilson Warbler. A rather uncommon migrant. I have recorded it from April 29 to May 10. Smith (1915) reported it from May 8 to 13, and again on Sept. 7.

*Wilsonia canadensis* (Linnaeus). Canadian Warbler. A rare migrant. Smith (1915) collected a single specimen, August 26, 1914. I have one sight record, well substantiated, on May 1, 1927.

*Setophaga ruticilla* (Linnaeus). American Redstart. Smith (1915) reported this bird as arriving by April 18 and remaining until September 21. I have had little opportunity to observe it except in mid-summer, but found it common in the larger ravines on the southern slope. I have never found it, even in migration, on the north side.

*Passer domesticus domesticus* (Linnaeus). English Sparrow. Extremely common in the village of Winslow and throughout the country, being abundant around every barn and dwelling. Often builds very bulky nests in trees, sometimes as many as 6 to 8 in a single tree. This overflowing population is in sharp contrast to the condition reported by Smith (1915) in 1914. His statement is quoted in full: "A small number were ever present in the town of Winslow, but the species was of irregular occurrence elsewhere. Roving individuals, sometimes alone, often in small flocks, could sometimes be seen

inspecting barns or outbuildings, even alighting and spending a few minutes in the yard, but eventually departing."

*Sturnella magna magna* (Linnaeus). Eastern Meadowlark. Perhaps the predominating race in the fall and winter, and rather common throughout November and December, rarer throughout the colder part of the winter. Both *magna* and *argutula* appear to avoid the higher portions of the region.

*Sturnella magna argutula* Bangs. Southern Meadowlark. The breeding form, rather common especially below 1700 feet. The resident form is very close to *magna*, radically different from specimens collected 50 miles south, but still to be considered closer to the southern than the northern form.

*Agelaius phoeniceus phoeniceus* (Linnaeus). Eastern Red-winged Blackbird. Fairly common as a migrant and a very rare summer resident. Smith reported a single individual from near the top of the range on Nov. 28, 1914. I have frequently observed it in flocks around Nelson Pond in the fall. Arrives in the spring as early as April 27, and present in small numbers on the extreme lower margin of the region through the summer, greatly augmented by migrants in October, and remaining until early December in small numbers, though mostly gone by the end of the first week in November.

*Icterus spurius* (Linnaeus). Orchard Oriole. A fairly common summer resident. Arrives by April 22, and eggs have been found in the nest on May 27. Remains in the vicinity, though difficult to find during the last month of its stay, until the last of August.

*Icterus galbula* (Linnaeus). Baltimore Oriole. An uncommon but regular migrant. Not known to nest within the limits of the Winslow region. Found in the spring from April 20 to May 1.

*Euphagus carolinus* (Müller). Rusty Blackbird. Migrant and winter visitant. Very irregular in its habits but it has been observed in the spring from April 9 to May 1, as well as occasionally in the winter. Frequently observed in November in flocks around Nelson Pond.

*Quiscalus quiscula aeneus* Ridgway. Bronzed Grackle. Fairly common migrant and early winter visitant. Recorded in reasonably large numbers in October and November when flocking and roosting with the robins. They always maintained separate flocks but came and went as the robins did and roosted in the same cover. Notes of November 8, 1928 tell of the grackles and robins engaging in battles, the grackles attempting to roost near the robins and the latter resenting their intrusion and driving them away by the effective use of sheer numbers (Bird for bird the grackles proved much the better fighters). The grackles persisted, however, and were often to be found at night roosting in the midst of the robins. The species is also often observed in the spring throughout March and April.

*Molothrus ater ater* (Boddaert). Eastern Cowbird. Common summer resident, accidental in winter. Arrives after March 22 and common soon thereafter. Smith (1915) did not find them breeding, but they are fairly common now below 1800 feet throughout the summer. Smith has recorded it "several days in November," and again on December 8.

*Piranga erythromelas* Vieillot. Scarlet Tanager. A common summer resident. Males arrive as early as April 12, the females about a week later. The very evident males seem to be everywhere for a day or so each spring during migration. Although mostly departing in mid-August a few may be found until the first of September.

*Piranga rubra rubra* (Linnaeus). Summer Tanager. Although not as common as the preceding, either as a migrant or a breeding bird it is fairly common. Arrives as early as April 15 and remains until October 3. Apparently does not travel in such a concentrated migration wave as the preceding species. This bird has been observed quite frequently in this region as a bee catcher, perching near a hive and picking off the bees on the wing much in the manner of the kingbird. Bee keepers have frequently reported the necessity of killing individual birds to protect their hives. I have never examined specimens thus killed to determine the percent of workers to drones taken.

*Richmondia cardinalis cardinalis* (Linnaeus). Eastern Cardinal. A very common resident, quite typical of the region and abundant throughout the year. Breeds with equal readiness in yards and along small streams and is always one of the most common frequenters of back-yard feed tables in the winter.

*Hedymeles ludovicianus* (Linnaeus). Rose-breasted Grosbeak. A fairly common spring migrant. Rare in fall. My earliest spring record is April 28. Smith (1915) found it on the 25th. Remains until the middle of May and may be found anywhere in heavy timber, especially along the streams. My only fall record, and apparently the only one for the state, is of a single male observed Oct. 14, 1928, in the very top of a large maple tree in the yard of our residence. This was the same tree in which the warbler wave already mentioned was noticed, and the grosbeak was in the tree for part of the same time the warblers were there.

*Guiraca caerulea caerulea* (Linnaeus). Eastern Blue Grosbeak. A very rare migrant. Smith (1915) did not record the bird and I have observed it only from May 13 to 23 in 1928. It appeared to be fairly common that one spring.

*Passerina cyanea* (Linnaeus). Indigo Bunting. A very common summer resident and migrant. Arriving any time between April 19 and May 1, and common thereafter until their departure in mid-September.

*Spiza americana* (Gmelin). Dickcissel. A rare but regular resident at the lower elevations within the area. Not known above 1650 feet at any season. Locally common about 5 miles north of Winslow along the White River bottom. I have no accurate migration dates for the species.

*Carpodacus purpureus purpureus* (Gmelin). Eastern Purple Finch. Fairly common as a winter visitant, arriving as early as Nov. 24 and remaining until April 20. A strange case of the nesting of this species here has been previously reported (Black, 1929b).

*Spinus pinus pinus* (Wilson). Northern Pine Siskin. Recorded by Smith (1915) on March 25 and 26, 1914.

*Spinus tristis tristis* (Linnaeus). Eastern Goldfinch. A common resident, abundant on occasions in the spring when it congregates in very large flocks.

*Pipilo erythrophthalmus erythrophthalmus* (Linnaeus). Red-eyed Towhee. A fairly common resident. Considerably more common during the breeding season than in winter.

*Passerculus sandwichensis savanna* (Wilson). Eastern Savannah Sparrow. A rare migrant. Smith (1915) reports it on only one occasion, April 6, 1914 when he observed several. I have only one record, that of eight individuals in the remarkable migration wave of Oct. 14, 1928.

*Ammodramus savannarum australis* (Maynard). Eastern Grasshopper Sparrow. A very rare migrant. Smith (1915) reports the taking of two individuals, one on March 23, 1914 (an aberrant specimen then reported as *A. bairdi*) and another on April 4, 1914. I have never seen the bird in Arkansas.

*Passerherbulus caudacutus* (Latham). Leconte's Sparrow. A very rare migrant, reported only by Smith (1915) on Nov. 29, 1913, May 11, 1913, and myself on March 16, 1930.

*Pooecetes gramineus gramineus* (Gmelin). Eastern Vesper Sparrow. A rather rare spring migrant. Smith (1915) reports it arriving March 25, in 1914 and remaining for about two weeks. I have found it only on one occasion when two birds spent from April 2 to 5 in our yard in 1927.

*Chondestes grammacus grammacus* (Say). Eastern Lark Sparrow. A common summer resident. Smith (1915) knew it only from one individual observed April 23, 1914. I have no dates of arrival for it always appears to be nesting when discovered, but it now is a very characteristic bird of the region, especially on the higher plateau region. Apparently another species that has invaded this region within recent years. I first became acquainted with the species in 1928 when two nests were found. It was slightly more common in 1929 and fairly common in 1930, since then to be found almost everywhere, though it prefers elevations above 2000 feet.

*Junco hyemalis hyemalis* (Linnaeus). Slate-colored Junco. Extremely common winter resident, arriving Oct. 11 or soon thereafter, and remaining until April 18.

*Junco oregonus shufeldti* Coale. Shufeldt's Junco. A specimen, now in the University of Kansas collection, collected here Jan. 22, 1930, has been identified by Dr. Alden H. Miller as of this form. Another identical specimen taken at the same time was accidentally destroyed. They were taken from a band of individuals at my home, and both were accidentally killed at my banding traps. They always maintained a separate flock from the other Juncos, and were easily differentiated from the other birds in the field. They remained about the place from January 15 until the 10th of February. This constitutes what appears to be the only record of the race from Arkansas.

*Spizella arborea arborea* (Wilson). Eastern Tree Sparrow. An irregular winter visitant. Smith (1915) recorded a small flock on February 16, 1914. I have one doubtful record from here in January of 1929, and Mr. James informs me that he saw the bird at his home, near Winslow, during the winter

of 1933-34. It should be found more commonly than has proven to be the case.

*Spizella passerina passerina* (Bechstein). Eastern Chipping Sparrow. A common summer resident, and present throughout the year except from mid-December to about the 17th of March, when it is not to be found. Ordinarily the species leaves the section about the last of October and returns on the 22nd of March.

*Spizella pusilla pusilla* (Wilson). Eastern Field Sparrow. A common summer resident, a small number remaining here throughout the winter. Perhaps a bit more common than the preceding.

*Zonotrichia querula* (Nuttall). Harris's Sparrow. Reported by Smith (1915) as an irregular transient. Found by him during the first week of May, 1913 and on Oct. 24 of that year. My only record is of an adult male captured at my home, Jan. 15, 1928 during one of the most severe winters this region has ever known.

*Zonotrichia leucophrys leucophrys* (Forster). White-crowned Sparrow. Smith (1915) found this species present in large flocks during the first half of May in 1913, but observed it only on May 6 the following year. I have recorded it only on May 15, 1927, as a single bird, and on Dec. 25, 1928, when two birds were seen.

*Zonotrichia albicollis* (Gmelin). White-throated Sparrow. A very common migrant, wintering in small numbers. Arriving as early as October 20, and remaining as late as May 8. Especially common through the last two weeks of March and the first two weeks of April. Also occurring in large numbers in November.

*Passerella iliaca iliaca* (Merrem). Eastern Fox Sparrow. Fairly common migrant and a rare winter resident. Present from October 15 until April 1. Considerably more common in fall than in winter and spring.

*Melospiza lincolni lincolni* (Audubon). Lincoln Sparrow. A rare migrant. I have recorded it on a few occasions from April 29 to May 13. Smith's only record is of an individual collected on September 30, 1914. (Smith, 1915).

*Melospiza georgiana* (Latham). Swamp Sparrow. Found to be a rare transient by Smith, who recorded it at intervals from April 6 to May 10. I have only a single record, on March 24, 1929.

*Melospiza melodia melodia* (Wilson). Eastern Song Sparrow. A fairly common winter resident. Smith (1915) recorded it as arriving October 23 and departing toward the end of April, which is correspondent with my dates for the mass movement. The species nest here rarely, however, though the breeding birds are probably of the race *beata*. It is to be regretted that breeding birds have never been collected as they will be needed to determine the presence of the breeding form.

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MUSEUM OF BIRDS AND MAMMALS,  
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# MAMMALS OF KANSAS

By J. D. BLACK, Museum of Birds and Mammals,  
University of Kansas, Lawrence

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## MAMMALS OF KANSAS

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Lawrence, Kan.

### INTRODUCTION

Probably no branch of biology carries more potential value in either economic importance or educational development than that of mammalogy. Few divisions of natural history have been so neglected as this study of our four-footed and furred friends. The neglect of this field by professional zoölogists is difficult to understand, but nevertheless the fact remains that even professional study of mammals has long been delayed and at the present is just beginning to attain a position in the scientific world comparable with that of ornithology (the study of birds).

It is a startling fact, but one often commented upon by zoölogists, that the group to which man himself must admit relationship has no true common name in the English language. We call the class Aves, birds; the class Reptilia, either reptiles, or lizards, snakes, turtles and saurians; the class Amphibia we know in popular terminology as amphibians or salamanders, toads and frogs. The class Mammalia, however, is most often erroneously called "animals" by the layman, a term which is all-inclusive and embraces all life, except plants. We are forced, therefore, to adopt and use the term "mammals," though to many readers it conveys a none-too-vivid picture.

In connection with this belated interest in mammals, satisfactory manuals for their identification have been slow in reaching the public. Even the professional mammalogist must oftentimes wade through masses of literature, frequently all too inadequate, and often difficult to secure, to identify material he has at hand. This is the apology for the present publication. It attempts to put into the hands of the average Kansas citizen, and those who live in the region adjoining Kansas in the neighboring states, a book that will enable him to identify with fair certainty the bat that flies through his open window, the mouse he finds in the field, or the ground squirrel he sees along the roadside.

The present work has many faults. It is impossible to write for the popular interest and yet preserve as strict a scientific accuracy as one would like. The problem of mammal distribution in Kansas

is as yet in a great measure unsolved; countless field trips must be made before this question of distribution can be discussed in an adequate manner. It is hoped that the present publication will stimulate an interest in this fascinating division of science that will add many facts to our store of knowledge.

#### COLOR

The matter of color has proved to be by far the most insoluble problem with which the author has had to deal in the present study. Mammal colors must be expressed in such terms as "vinaceous-buffy," "fulvous," or "cinnamon-rufous," and the like, to be of sufficient accuracy to have any value. These colors are so technical in their usage as generally to convey little or no meaning to the average reader. In spite of this no popular or semipopular work on mammals presenting these colors has ever reached the public. (A few are found in bird manuals, and Chapman's "Handbook of Birds of Eastern North America" is earnestly recommended as a possible source of information on this point.) Even in the field of professional zoölogy we must rely on a very scarce and out-of-print publication for the actual plates of the colors employed in descriptions.

In most cases the colors here given are based on those in Ridgway's "A Nomenclature of Colors for Naturalists," published in 1886; this edition was of hand-painted plates and is the only truly accurate color standard available to naturalists at this time. In many instances it has been found possible to simplify the color terminology without risking a misleading description; occasionally examination of Kansas material has caused me to disagree with written descriptions in some details, and in such cases an effort has been made to improve the description, again using the colors of Ridgway as a basis.

Such color terms as "white," "slaty" or "gray" are sufficiently self-explanatory. Often it is necessary to refer to the color pattern of a mammal as "tawny-orange," or "cinnamon-buff," or some similar combination. In such cases the suffixes "—ish" and "—y" indicate a tendency toward that color, so that "pinkish-buff" means a buff color tinged with pink, while "buffy-pink" would indicate that pink was the dominant color, and "pink-buff" would mean an intermediate color between the two combined elements.

It is apparent that handpainted plates giving exact shades of the technical colors used here are too expensive to be considered in a work of this kind. Lithographed plates are likewise very expensive,

and although useful in a general sense, are in final analysis inaccurate and unsatisfactory. The only alternative that appears at present possible in the matter of color has been adopted—the giving of additional characters in the descriptions, so that where doubt as to color occurs the identifications can usually be made by a careful consideration of the other characters listed. It is hoped that those who have occasion to use this book will soon be able to acquire a knowledge of the colors employed in mammalogy through the study of color terms applied to mammals with which they are already acquainted, and through descriptions of mammals new to them which may be identified by other characters.

LIFE ZONES

A better understanding of the reasons for the peculiar distributional patterns assumed by our mammals may be had through a consideration of the natural areas into which Kansas may be roughly divided. Certain species are found only in the extreme southeastern corner; others range over a wide central belt; still others are found in only some other corner of the state.

Smith (1934) found that the physiographic regions set up by Fenneman (1928) more nearly suited the distribution of Kansas amphibians than did the older and widely accepted life zones established by Merriam (1898). This also hold true for mammals. Of course, no set regions or zones as defined can be made to hold for every species; often a single form will be found to range over several of the zones or regions; others are very definitely limited to certain areas. The physiographic regions described for Kansas by

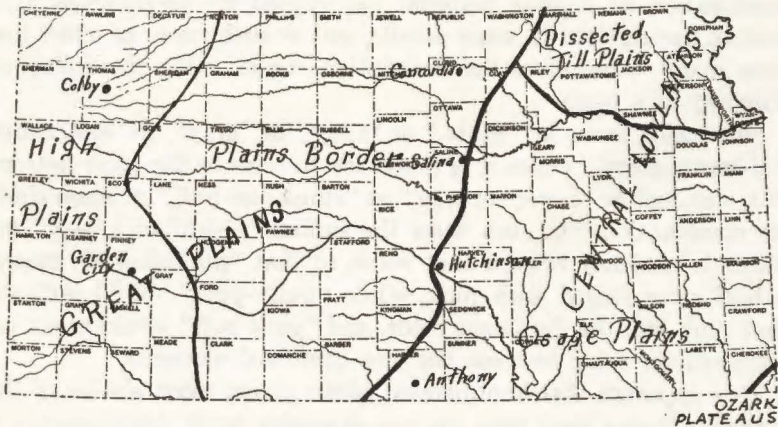


FIG. 17. Physiographic regions of Kansas (After Fenneman).

Fenneman are shown on the accompanying map (Fig. 17). All of the divisions recognized are well defined by the distribution of mammals.

The two divisions of the central lowland, namely, the Dissected Till Plains, or the northeastern part, and the Osage Plains, or southeastern Kansas, are well defined in the subspecific distribution of the cottontail rabbits, woodchucks, large short-tailed shrews and chipmunks, although the true division in mammalian distribution is about seventy-five miles south of the physiographic division in this instance.

The Ozark Plateau region has not been studied enough for us to know just how well it is defined in Kansas from the standpoint of mammalian distribution. It is easily the most clearly distinguished region in Kansas, however, from the standpoint of amphibian distribution, and with more work in this section on mammals no doubt will be found to be just as much so with reference to the distribution of this division of animal life.

The greatest barrier or break in the distribution of all forms of vertebrate life in Kansas is the Flint Hills. More mammals find their eastward or westward limits along this barrier than at all other similar divisions in the state. This corresponds with the division between the Great Plains and Central Lowlands provinces set up by Fenneman.

According to Fenneman's scheme the Great Plains Province is subdivided into the High Plains and the Plains Border. The division between these two regions is well marked in the subspecific distribution of the white-footed mice, grasshopper mice and pocket gophers, while it also marks the eastward limit of certain western forms.

In addition there seem to be three influences which are not easily mapped, due to our insufficient data. The first is the southwestern corner of the state, which is definitely Sonoran in its mammalian fauna. Another is the Barber-Comanche county region, which offers a remarkable puzzle of distributional confusion with such forms as the Mesquite Plains pocket gopher, the Mexican free-tailed bat, the little brown bat, and Oklahoma and New Mexico cottontails occurring together. This last-named section, however, seems properly classified with the Plains Border fauna, the difference being explained on the basis of temperature, as are the changes which produce the definite Sonoran fauna within the High Plains region in southwestern Kansas. The third local influence is that of the river

valleys in Montgomery, Labette, and Chautauqua counties, where purely southern lowland forms, such as the swamp rabbit, rice rat and Texas striped ground squirrel, are present. All of these local influences are minor in their scope, however, and have not been mapped as different subregions. Perhaps with additional study it will be necessary to mark off these three areas into minor subdivisions of their own.

#### CLASSIFICATION OF MAMMALS

To many people the use of Latin names by biologists for plants and animals with which they deal seems to be an effort of the scientists to "put on airs," and an attempt to assume a false attitude of learning; some think they are used in an effort to confuse other people. Such, however, could not be further from the truth. Scientific names are employed because they are easier to understand, mean more, and are international in usage. One has but to consider the oft-cited example of the name "gopher" to realize how utterly inadequate vernacular, or English, names really are. Thus, in different parts of our country, the name gopher applies to a salamander, a snake, a turtle, any of the pocket gophers (of which we have three genera, a large number of species, and innumerable subspecies), and various forms of ground squirrels. In the same way many local names may be applied to one animal, as is the case with the eastern flicker, which is known by over 300 vernacular names; but all referring to a single bird. The only possible way to avoid confusion is to have a standardized scientific name for each form, international in its usage, and based on an accepted standard system of nomenclature. Inasmuch as Latin was for years the accepted language of all science, it is only as a natural outgrowth of that influence that Latin chanced to be the language selected.

The system long in use is that established by the Swedish biologist, Linnaeus, in 1758. It is the binomial system of nomenclature, whereby every known species of plant or animal has two names, the first applying to the genus, or small, closely related group to which the plant or animal belongs, the second applying only to the particular species in question. Thus the name *Geomys* applies to all the eastern pocket gophers as the generic name for that group, while *breviceps* is a specific name and applies to a certain species. Often the representatives of a species are different in different sections of the country, usually as a result of geographic influence, and intergrade into one another, so that while certain individuals are easily recognized as different, other specimens from intermediate localities

will be found to be different from either of the typical forms, yet similar to both, being intermediate between the two, thus proving the close relationship between the two apparently different animals. In such the two forms are considered as subspecies of one another, and a third, or subspecific, name is applied so that the Louisiana pocket gopher, being the first of the species described, is called *Geomys breviceps breviceps*, and the Mesquite Plains pocket gopher, the race found in Kansas, is known as *Geomys breviceps llanensis*, both forms being merely geographic races of the same species. Some objections have been raised to this system of distinguishing a subspecies, but no better plan seems to have been devised.

Other than subspecific, specific and generic relations, larger groups of mammals are recognized by separate names, in order that we may more clearly define the systematic position of the forms which we encounter. Thus a number of genera, rather different in certain respects, yet showing certain fundamental relationships to one another, are united into a large group called a family, while families in turn are grouped into orders, orders into classes, classes into phyla, and the phyla finally into kingdoms. Hence, for example, the house mouse is a member of the animal kingdom, phylum Chordata, subphylum Vertebrata, class Mammalia, subclass Eutheria, order Rodentia, family Muridae, genus *Mus*, species *musculus*, and subspecies *musculus*. Sometimes a genus is divided into subgenera. In such cases the subgeneric name is given in parenthesis in this work. This subgeneric name, however, does not ordinarily appear in the name of a plant or animal.

It has also been found convenient, and frequently very important, to add after the scientific name of the species the name of the scientist who first described it. If the species is later changed into another genus, or the generic name under which the species was originally described is changed, the name of the author is then placed in parenthesis to indicate that the original description will be found bearing another generic name. This is frequently important in scientific research. Thus the full name of the house mouse is *Mus musculus musculus* Linnaeus. The Norway, or common, rat is known as *Rattus norvegicus* (Erxleben), the species having been originally described by Erxleben as *Mus norvegicus*.

#### MEASUREMENTS OF MAMMALS

In the following discussions all the measurements have been given in inches, although in the field of mammalogy they are usually taken in millimeters. For the purposes of this paper the original measure-

ments, or averages, have been changed from the more satisfactory millimeters into inches in order that the average reader may be able more readily to form a mental picture of the size of the particular species in question. This change has been made on the basis of one inch for every 25 millimeters; slightly inaccurate, but sufficiently close to make no difference in a study of this kind, especially when the wide individual variation of mammals is taken into consideration. The measurements here are those usually found in the species in question, but even where rather wide ranges of variation are given mammals will be found larger or smaller than those limits, because there are giants and dwarfs, just as there are wide color variations, in all species of mammals. These variations are exceptional and but rarely encountered, although it must be remembered that they do occur.

The total length of a mammal is taken with the specimen lying on its back and measured from the tip of the nose to the end of the tail vertebrae; that is, the hairs on the tail are *not* measured. The tail vertebrae measurement is taken with the tail at right angles to the body, the ruler placed firmly at the base of the tail and measured to the end of the tail vertebrae, along the dorsal surface of the tail. The hind foot is measured from the bend of the heel to the tip of the longest claw. Ear measurements are sometimes rather useful, and have been given in a few instances. This measurement is usually taken from the notch of the ear to the longest point. In bats two additional measurements are taken, the tragus (see fig. 2) and the forearm. The former is taken from the base of the tragus to its longest point; the latter is the overall measurement of the forearm, or second division of the forelimb. Other measurements such as thumb, tibia, and digits are sometimes useful to the scientific student, but are not given here because they would only serve to confuse most readers. In measuring the relation of ear to face on the bats care must be taken in laying the ear alongside the muzzle not to pull the base of the ear from its normal position, because very misleading conclusions will result from such an error.

#### DENTITION

At appropriate places, usually at the beginning of the discussion of each genus, a formula for the dentition of the particular group under consideration is given. The type of formula here given is that in most common use. The order in which the teeth are listed is: incisors, canines, premolars and molars; the number in the upper jaw preceding that of the lower jaw, and the entire formula (except

the total) being for one side of the head. Thus a formula such as  $1/1; 1/1; 2/3; 1/2-24$ , translated means that there are two upper incisors (one in each half jaw), two lower incisors, two upper and two lower canines, four upper and six lower premolars; two upper and four lower molars, making a total of 24 teeth.

In all our mammals the incisors, canines and cheek teeth are readily distinguished from one another, but the cheek teeth can usually be separated into molars and premolars only by knowing which of those teeth had predecessors in the milk set. If such a predecessor was present the tooth of the permanent set is considered a premolar; if it had no forerunner in the milk set it is a molar. The canine, or dog tooth, when present, is usually large, prolonged, and always with but one crown. These teeth in the human skull are frequently known as eye teeth if in the upper jaw, and stomach teeth if in the lower jaw, and in man are not well differentiated, except by their roots, from the adjoining ones. The teeth preceding the canines in the jaw are always incisors. Technically speaking, only those teeth which are borne on the premaxillary bones of the upper jaw, and those of the lower jaw opposing these, are incisors.

In the strictly scientific classification of mammals the teeth and skull are of great taxonomic value, while the number of teeth will often serve to aid even the amateur mammalogist in the identification of a specimen. The study of the mammal skull and tooth pattern have been considered as scientific problems, however, and in the present work external characteristics are utilized wherever possible, care having been taken to avoid references to the skull, which is not easily available except with museum specimens.

#### PREPARATION OF SPECIMENS

It is hoped that this work will stimulate at least a few readers to take up the study of mammalogy either as a profession or a serious hobby. Much is yet to be learned about our mammals and the field is an exceptionally interesting one. Biology teachers, scout leaders and many individuals will no doubt wish to learn how to prepare mammals for study. To offer that information is beyond the scope of this paper. Those interested are referred to the bibliography where they will find two or three excellent publications on that subject listed. Of these the most satisfactory is Bulletin 69 of the National Museum of Canada. This publication is now available only in the cloth-bound edition, and may be purchased from the Director of the Museum, at Ottawa. Its price is fifty cents. The methods discussed in this bulletin are essentially those in practice at the University of Kansas Museum of Birds and Mammals

(referred to as the K. U. museum in this work), except for the preparation of skeletons. The more modern method of skeleton preparation utilizing dermestid beetles for the cleaning process has supplanted the older method. Under the system now employed the carcass is never treated with any chemical.

#### ACKNOWLEDGMENTS

I am indebted to a number of friends and fellow workers without whose aid this paper could never have been completed. My interest in the field of mammalogy was first aroused by Mr. C. D. Bunker, assistant curator in charge of the Museum of Birds and Mammals, University of Kansas, who has aided all my studies in every possible way. Only by means of the records and specimens in his charge can any attempt be made to write intelligently on the mammals of Kansas. A year ago under the direction of Dr. E. H. Taylor, Professor of Zoölogy at the University of Kansas, an attempt was made to construct an artificial key to the mammals of the state. This key has been the foundation of the paper as here presented, although rewritten to phrase it in less technical language and make it more usable. All of the actual writing of this paper has been done under the direction of Dr. H. H. Lane, head of the Department of Zoölogy, University of Kansas, who has unsparingly given of his time in reading manuscript and who has offered many suggestions for its improvement.

C. W. Hibbard, author of the recently published "Revised Checklist of Kansas Mammals," (1933) has been very helpful in assisting me with my early studies, and the privilege of working with him from 1931 until 1934, while he was a student at the University of Kansas, has been of much value.

Drs. H. H. T. Jackson and A. H. Howell of the Bureau of Biological Survey, and Dr. Remington Kellogg of the United States National Museum, have rendered valuable services in supplying typical specimens for comparison or in making identifications of questionable material.

Outstanding among those who have made this work possible are my mother, Mrs. Etta Black, and my wife, Mrs. Ruby Black. They have patiently labored through many pages of copy, reading and correcting the countless errors that always appear in early drafts, giving many hours of their time in helping to improve this work. Errors will no doubt still be found in the finished paper; the blame is not theirs but rather that of the author. The former has been especially helpful in her critical study of the construction of the paper, while the latter has labored long and faithfully in preparing

the drawings used in the text and in typing all the final copies of the entire paper.

My fellow workers in the museum and in the university have been of help in many instances, as have numerous citizens of the state who have given information shedding light on the local habits of certain mammals, or who have donated specimens to the museum, the records from which valuable information has been secured. Every former worker in the museum and every citizen of Kansas who has supplied specimens or information to the museum has had a part in making this paper possible.

#### CONCLUSION

A few of the many inevitable criticisms of this work have been anticipated. Some will protest that the descriptions are too short to be accurate; others that they are too long to be readable or usable by the average citizen. My defense to both criticisms is that the descriptions were designed to help the layman to identify a mammal *found in Kansas*. No attempt has been made at a scientific comparison of Kansas forms with other similar species or subspecies occurring beyond the borders of our state. They have been made long enough to meet that need; I have not considered it wise to make them shorter. Others will find fault, and a few will complain bitterly, at my defense of certain supposedly "harmful" mammals. I have presented the facts as I see them. Still others will protest at the inclusion of scientific names in the discussions of relationships, habits and economic status. It has been more convenient to discuss the forms in this manner, because such a treatment has made possible both a more accurate and shorter work.

It is hoped that the people of Kansas will find this article a real help to them in their efforts to become better acquainted with the mammalian life that still teems about them. It is the wish of the author that the farmers and townspeople, the children and adults, into whose hands this work chances to come, will derive real pleasure and information from its pages. Above all it is his desire that it will awaken the uninformed and unsuspecting citizens of Kansas to their obligations as members of this and the next generation to protect our mammals in a sensible manner; to see that those on the verge of extinction in our state are saved from a doom that would add another blot on the splattered record of America's conquest of nature, and destroy a heritage we rightfully owe our children; that it will teach them to live in better harmony with even the most common of our wild animals and give them a better understanding of the four-footed citizens of Kansas.

## AN ARTIFICIAL KEY TO THE MAMMALS OF KANSAS

In using the keys which follow, the correct procedure is:

Refer to the first main head "A." If the characters thereunder are found to apply to the mammal in question then proceed to subhead "B"; if the characters of "A" do not apply refer to heading "AA" or "AAA." In the same way if "B" does not apply, after "A" or "AA" has been found satisfactory then refer to "BB," and so on until the specimen keys out. The correctness of the conclusion based on the key may be checked by referring to the detailed description of the animal in question. Persons unused to employing keys will at first find this method rather confusing, but a little practice should make the use of this key comparatively easy.

All the mammals are first keyed out, in the scheme adopted herewith, down to orders. After the proper order has been ascertained for the specimen in question the user is to refer to the detailed key for that order which follows. This in turn may key the animal down to the species or may refer the reader to another key for a special genus or family. This procedure, though appearing complicated at first, has proven to be the most practical.

No attempt has been made to key out the subspecies occurring within the state (except the rabbits), the key going as far as species only, and the subspecies being more or less discussed in the detailed consideration of each species.

External characteristics and the most evident features of the teeth have been utilized throughout whenever possible, recourse being taken to more technical terms and details only when no alternative was apparent. The reader is referred to the glossary of terms following this article for the explanation of terms employed.

## KEY 1. KEY TO LIVING ORDERS

- A. Teeth, 50, incisors 5/4, marsupium (pouch in which young are carried) present.  
The pouched mammals. ORDER MARSUPIALIA.  
The Virginia Opossum, *Didelphis virginiana virginiana* Kerr, is the only Kansas species.
- AA. Teeth, never over 44, usually much fewer; incisors never more than 4 above or three below in each half-jaw. No marsupium.
- B. Membranous (leathery) wings present...Bats. ORDER CHIROPTERA. (See key 3)
- BB. Forelimbs not specialized into leathery wings.
- C. Canines absent in both jaws, incisors highly specialized.
- D. Incisors 1/1; size very small to medium, if medium then the ears never long and prominent, and hind legs not specialized as jumping organs.  
The true rodents. ORDER RODENTIA. (See key 9)
- DD. Incisors 2/1, a small inner pair in the upper jaw being closely applied behind the larger front pair. Jumping animals of medium size with ears always large, long and narrow.  
Rabbits. ORDER LAGOMORPHA. (See key 8)
- CC. Canines present in at least the upper jaw, incisors not highly specialized.
- D. Very small to small. Fossorial or terrestrial. Lower canines absent. Fur velvety.....Moles and Shrews. ORDER INSECTIVORA. (See key 2)
- DD. Medium to large, canines large and present in both jaws. Incisors invariably 3/3. A pair of shearing (carnassial) teeth present. Mammals of brev.....True carnivores, including the raccoon, foxes, cats, weasels, etc.  
ORDER CARNIVORA. (See key 4)

## KEY 2. KEY TO THE ORDER INSECTIVORA. The Moles and Shrews

- A. Length, 6 inches or over, body robust. Front legs highly modified into strong, scooplike, digging hands...Moles. Family TALPIDAE. *Scalopus aquaticus* subspecies, 138
- AA. Length never more than 5 inches, body not nearly so robust. Front legs similar to hind legs, very weak and not developed as digging organs...Shrews. Family SORICIDAE, 140
- B. Larger, length, 3.5 to 5 inches; body about as thick as average man's first finger or thumb. Somewhat smaller in southeast corner of state than elsewhere.....Large short-tailed shrew. *Blarina brevicauda* subspecies, 142
- BB. Smaller, 3-3.3 inches long, size about that of average man's little finger or smaller.....Small short-tailed shrew. *Cryptotis parva*, 141

## KEY 3. KEY TO THE ORDER CHIROPTERA. The Bats

- A. Tail extending beyond interfemoral membrane for about half its total length. Fur velvety.....Free-tailed Bats. Family MOLOSSIDAE, 152
- One species occurs in Kansas: The Mexican Free-tailed Bat. *Tadarida mexicana*, 152
- AA. Tail all, or practically all, enclosed in interfemoral membrane. Fur not velvety, but more mouselike in character.....Family VESPERTILIONIDAE, 144
- B. Ears very long, more than .8 inch, being the most prominent feature of the animal.
- C. Very large, forearm 2.0-2.25 inches long, color, buffy-yellowish with fuscous markings, belly whitish. No lump on nose. Known at present only from Barber county.....Bunker's Bat. *Antrozous bunkerii*, 152
- CC. Not so large, forearm from 1.65 to 1.90 inches long, color pale rufous-brown above, whitish below. Prominent lump above nostrils. Known from Barber and Comanche counties.
- Pale Lump-nosed Bat. *Corynorhinus rafinesquii pallescens*, 151
- BB. Ear never as long as .8 inch, rarely over .6 inch, not especially modified.
- CC. Teeth, 38, small to medium sized; no special modifications of ear, tail or lips.....Genus *Myotis*, 145
- D. Size small; forearm less than 1.64 inches.
- E. Belly whitish, very pale yellowish-buff dorsally, face and ears dark brown, forming a very prominent facial mask. Forearm never more than 1.44 inches. Western Kansas.
- Say's Bat. *Myotis subulatus subulatus*, 147
- EE. Belly warm buff; plumbeous underfur on belly prominent, dorsal fur bright olive to almost black. Forearm usually around 1.55, rarely in adults as short as 1.44. No prominent facial mask.
- F. Ear when flattened against the head (base not pushed forward but in normal manner) reaching a little (.12 to .16 inch) beyond tip of nose. Fur not especially silky above, but shorter and wavy; color usually olive-brown, sometimes brownish-chestnut. Not yet reported from Kansas, but in all probability occurring rarely in northeastern and eastern parts of the state.
- Trouessart's Bat. *Myotis keenii septentrionalis*, 146
- FF. Ear, when applied to size of head, not reaching beyond tip of nose. Fur rather long and silky; size same as above, which it closely resembles, color as above. Eastern Kansas, reported also from Barber county.
- Little Brown Bat. *Myotis lucifugus lucifugus*,\* 145
- DD. Larger; forearm 1.72 to 1.88 inches. Pale whitish below, with hairs on flanks pure white to base, elsewhere plumbeous at base. Color pale olive-brown to dull rufescent brown. South-central Kansas.....Cave Bat. *Myotis velifer incautus*, 146

\* Although there are as yet no records to substantiate it, the Rocky Mountain race of this bat, *Myotis lucifugus carissima*, probably will be found in western Kansas, and will prove to intergrade with *Myotis l. lucifugus* throughout the central part of the state.

- CC. Teeth never more than 36, size variable, lips and ears sometimes slightly modified.
- D. Size very small, forearm less than 1.5 inches, teeth 36, yellowish-brown to reddish-brown above, belly a little paler. Skin around fingers and wing bones more noticeably rosy than in other Kansas species.....Georgian Bat. *Pipistrellus subflavus subflavus*, 148
- DD. Medium to large, forearm over 1.60 inches, color never yellowish.
- EE. Teeth, 32; forearm, 1.60 or over; ear low and rounded, color reddish more or less flecked with gray; upper side of inter-femoral membrane densely furred, like back.
- F. Reddish predominant over gray. Forearm 1.60 to 1.80 inches, common throughout eastern half of state.  
Common Red Bat. *Nycteris borealis borealis*, 150
- FF. Grayish predominant over red; forearm 1.85 to 2.12. State-wide, but rare...Hoary Bat. *Nycteris cinerea*, 151
- EE. Teeth, 36; size, medium; forearm, 1.60 to 1.80 inches; color, chocolate-brown, almost black; dorsal fur tipped with silver. Very rare in Kansas, but may be expected anywhere, ranging all over the United States.  
Silver-haired Bat. *Lasionycteris noctivagans*, 147
- EEE. Teeth, 32; forearm, 1.75 to 2.00 inches. Face and ears blackish, ears rather low, lips thicker and more fleshy than in other Kansas forms. Body rather robust. Color, bright chestnut to sepia, paler in western part of state. State-wide.  
Big Brown Bat. *Eptesicus fuscus*, 149

#### KEY 4. KEY TO THE ORDER CARNIVORA. The True Carnivores

- A. Five toes on each foot, claws nonretractile, plantigrade to nearly digitigrade (never truly digitigrade) lower molars, always 2.
- B. Molars 1/2, plantigrade to nearly digitigrade. Anal scent gland always well-developed, highly so in the skunks.  
Skunks, weasels, badgers, minks, otters, etc. Family MUSTELIDÆ. (See key 5)
- BB. Plantigrade, soles of feet naked. Tail relatively short, bushy, and ringed with alternate rings of black and brownish gray, molars 2/2. Family PROCYONIDÆ, 154  
Only one form in Kansas, a fairly common furbearer and state-wide.  
Missouri Valley Raccoon. *Procyon lotor hirtus*, 154
- AA. Digitigrade, toes never 5/5.
- B. Toes, 5 on front limb, 4 on hind. Claws sharp and retractile. Head roundish, muzzle short.....Cats. Family FELIDÆ. (See key 7)
- BB. Toes, 4 on front limbs, 5 on hind. Claws blunt and not retractile. Muzzle sharp and pointed.  
Dogs, wolves, coyotes and foxes. Family CANIDÆ (See key 6)

#### KEY 5. KEY TO THE FAMILY MUSTELIDÆ

- A. Form robust. Tail medium to long, bushy. Pelage long and loose; teeth, 34.
- B. Black and white in prominent markings. Anal scent glands highly developed. Tail long and bushy.
- C. Smaller, length, 17 to 22 inches; white arranged in four narrow, longitudinal stripes, usually more or less broken up into spots. More slender than the following. State-wide and usually common.  
Prairie Spotted Skunk. *Spilogale interrupta*, 159

NOTE.—Three other bats may be expected to occur in the state. The Twilight Bat, *Nycticeius humeralis* having been reported from Nebraska, Missouri, Arkansas and Oklahoma, and both the Indiana Bat, *Myotis sodalis*, and the Little Gray Bat, *Myotis grisescens*, being known from Arkansas and Missouri very close to southeastern Kansas.

- CC. Larger, body more robust. White arranged in a single median stripe from muzzle to shoulders, then dividing and continuing a varying distance as two dorsolateral stripes. Much individual variation in color pattern. State-wide in one of two subspecies  
Common Skunks. *Memphitis mesomelas* subspecies, 160
- BB. Grizzled gray with narrow median stripe of white from tip of muzzle to between shoulders or beyond. Front legs short and extremely stout, front claws large, tail short and bushy, head broad and flat.  
Badger. *Taxidea taxus* subspecies, 162
- AA. Form slender and lithe. Teeth, 34-36; pelage dense and short, tail never bushy.
  - B. Size large, length 40 to 45 inches, river dwelling, toes fully webbed, feet short and round, head flat and broad, tail long and muscular. Probably extinct in Kansas. Teeth, 36.....Interior Otter. *Lutra canadensis interior*, 158
  - BB. Length, 26 inches or less; tail small and rather weak. Weasel-like animals. Teeth, 34.
    - C. Larger, 20 to 26 inches long when adult.
      - D. Length, 24 to 26 inches, light brown, white spots on chin, throat and breast. Aquatic, toes webbed. Eastern Kansas. Rare.  
Mississippi Valley Mink. *Mustela vison letifera*, 157
      - DD. Length, 20 to 24 inches, upper parts pale buffy-yellow, lower parts even paler, hands, feet, mask and tip of tail black. Toes not webbed. Rare. Inhabits prairie dog towns in central and western parts of state.....Black-footed Ferret. *Mustela nigripes*, 157
    - CC. Smaller; length, 18 inches or less. Color variable, tail always tipped with black. Most slender of our carnivores.
      - D. Facial mask with a prominent white stripe between eyes and ears. Tail very long, usually about 8 inches. Extreme southwestern Kansas....New Mexico Bridled Weasel. *Mustela frenata neomexicana*, 156
      - DD. Tail always less than 7 inches. No white stripe across face.
        - E. Size large, tail from 5.5 to 6.7 inches, black tip on tail short, upper parts deep buffy-yellow to warm ochraceous, under parts strongly suffused with yellowish. Sometimes white in winter, with black tip on tail. Western, northern and north-central Kansas.  
The Long-tailed Weasel. *Mustela longicauda longicauda*, 155
      - EE. Smaller than preceding, tail about 5 inches long with longer black tip than above, belly bright yellow to whitish, upper parts bright Brussels brown to warm ochraceous. Eastern, southern and south-central Kansas.  
Missouri Weasel. *Mustela primulina*, 156

KEY 6. KEY TO THE FAMILY CANIDAE. Wolves, Foxes and Coyotes

- A. Less than 42 inches long. Muzzle pointed. True foxes.
  - B. Small; length, 26 inches. Tip of tail black, color of back buffy-yellow, intermixed with white and black-tipped hairs. Formerly over whole of Great Plains, now nearly extinct, if not wholly so, in Kansas.  
Kit Fox or Swift Fox. *Vulpes velox velox*, 165
  - BB. Larger; length, around 40 inches.
    - C. Upper parts yellowish-red, feet black, tail tipped with white. Eastern Kansas .....Eastern Red Fox. *Vulpes fulva*, 163
  - CC. Upper parts grizzled-grayish, reddish on sides, flanks and sides of head, tail with dorsal black stripe and prominently tipped with black. Eastern Kansas.....Bobcat. *Lynx rufus rufus*, 170



- AA. Over 42 inches long; skull much larger; muzzle not so pointed, sometimes broad; feet larger.
- B. Length, 42 to 48 inches. Tip of tail noticeably black.
- C. Brownish, mixed with black above. Tail with much black above. Once common in southern Kansas. Probably now extinct within the state.  
Oklahoma Wolf. *Canis frustrator*, 169
- CC. Upper side of tail like back. Under parts buffy to fulvous.
- D. Back of ear fulvous, black tipped hairs in collar. State-wide, but mostly through and east of the Flint Hills.  
Northern Coyote. *Canis latrans*, 167
- DD. Back of ears buffy, no black-tipped hairs in collar. Paler than preceding. West of the Flint Hills.  
Nebraska Coyote. *Canis nebrascensis nebrascensis*, 168
- BB. Over 48 inches long; muzzle blunt and broad; feet very large. Length usually from 54 to 56 inches. Adults normally grayish, sometimes bluish-black or rusty red. State-wide, now very rare or extinct. Timber Wolf. *Canis nubilus*, 169

#### KEY 7. KEY TO THE FAMILY FELIDAE. The Cats.

- A. Small; about 36 inches long; teeth, 28. Bobcats.
- B. Tail not black all around tip. Brownish in color and sharply spotted. Eastern Kansas.....Bobcats. *Lynx rufus rufus*, 170
- BB. Tail black all around at tip, and one fulvous and one blackish dorsal band on tail in front of black tip. Color in grays and buffs, rufescent in summer. South-central and western Kansas.....Bailey Bobcat. *Lynx rufus baileyi*, 170

#### KEY 8. KEY TO THE ORDER LAGOMORPHA. The Rabbits

- A. Large, robust rabbits; length, 23 to 25 inches; hind foot, 5 to 6 inches; ear, from notch, 3.6 inches or longer. Jack Rabbits.
- B. Larger; length, 24 to 25 inches, hind foot, 6 inches; ear shorter, 3.6 to 4.0 inches from notch. Tail white. Rare in northern Kansas.  
White-tailed Jack Rabbit. *Lepus townsendii campanius*, 208
- BB. Smaller; 23 to 24 inches; hind foot, 5 to 5.5 inches; ears longer, 4 to 4.4 from notch. Tail black. Common throughout state.  
Great Plains Jack Rabbit. *Lepus californicus melanotis*, 209
- AA. Smaller; length never over 22 inches, hind foot rarely much over 4 inches, usually slightly less, tail always white on underside. Cottontail Rabbits and Swamp Rabbits.
- B. Larger; length, 21 to 22 inches; upper parts grayish-brown, usually rather heavily intermixed with black, sometimes giving a spotted effect. Known at present only from extreme southeastern Kansas in swampy places along the larger streams.....Swamp Rabbit. *Sylvilagus aquaticus aquaticus*, 214
- BB. Smaller; rarely over 18 inches long. The True Cottontail Rabbits. (Keyed to subspecies, because of overlapping of specific characters and general difficulty in separating the different forms.)
- C. Mostly eastern Kansas in distribution, although occurring in extreme northwestern and south-central parts of state. Auditory bullae small and comparatively smooth; *S. floridanus* group.
- D. Northeastern Kansas. Grayish-brown above, heavily marked with black. Size, large; length, up to 19 inches, usually around 18 inches.....Mearn's Cottontail. *Sylvilagus floridanus mearnsi*, 210

NOTE.—The "panther," *Felis cougar*, and the Rocky Mountain Lion, *Felis oregonensis hippolestes*, which formerly occurred in eastern and western Kansas, respectively, are now considered extinct within the state. They are very large, eighty inches or more in length. They may be distinguished from one another by the black tip of the tail in the western form, whereas this part is brown in the "panther."

(The term "panther" was incorrectly applied by early settlers to the puma—*Felis cougar*. Personally, I would prefer to use "puma" instead of panther.)—Editor's Note.

- DD. Smaller; black not so prominent in coloration.  
 E. Prominently grayish, front and outside of forelegs light rufous. Extreme northwestern Kansas.  
 Nebraska Cottontail. *Sylvilagus floridanus similis*, 212  
 EE. Rusty reddish suffusion over back and sides. *Sides grayer than back*. Southern and south-central Kansas north to Greenwood county.  
 Oklahoma Cottontail. *Sylvilagus floridanus alacer*, 212  
 CC. Western and southern Kansas in distribution, east at least to Barber county. Auditory bullae relatively large and roughened; *S. auduboni* group.  
 D. Ears and feet extremely hairy, ear usually long (2.6 inches), but variable in Kansas. Pale cream-buff above, more uniform in color and larger than rabbits of the *floridanus* group whose ranges overlap *baileyi*. Range, roughly the western third of the state.  
 Wyoming Cottontail. *Sylvilagus auduboni baileyi*, 213  
 DD. Ears and feet not so hairy, ears much shorter. Smaller, reddish, much like Oklahoma Cottontail whose range overlaps it in south-central part of the state, *but sides reddish* like feet and legs. Extreme southern and south-central Kansas, probably not north beyond second tier of counties.  
 New Mexico Cottontail. *Sylvilagus auduboni neomexicanus*, 213

KEY 9. KEY TO THE ORDER RODENTIA. The Rodents

- A. Very large, nontypical rodents, length of adults over 20 inches, body very heavy, tail never long and bushy.  
 B. Tail flattened and scaled, extremely large, with brown, fine quality, dense fur. Aquatic and very rare, but known to occur along the Arkansas, Kansas and Republic rivers in scattered colonies.  
 Missouri River Beaver. *Castor canadensis missouriensis*, 185  
 BB. Tail not flattened nor scaled. Not aquatic.  
 C. Covered over most of body, especially tail and back, with long heavy quills, interspersed with long hairs. Extremely rare, known only from single specimens from Trego, Barber and Decatur counties within the last thirty years. Once common in northwestern Kansas.  
 The Nebraska Yellow-haired Porcupine. *Erethizon epixanthum bruneri*, 206  
 CC. Covered with coarse, dark hairs, tail short. Terrestrial and burrowing.  
 Kansas Woodchuck. *Marmota monax bunkeri*, 172  
 AA. Not as in A. Never over 21 inches long, and then with a very long, bushy tail. Extremely diverse, including gophers, rats, mice, squirrels and chipmunks.  
 B. External fur-lined cheek pockets. Tail long to short, never bushy.  
 C. Form very robust, fossorial, with strong, front claws, short legs and small eyes, tail short and sparsely haired. Color normally rufous to yellowish brown, rarely black or white.....Pocket Gophers, genus *Geomys*, 181  
 D. Larger; males 12 inches long, or nearly so (females in all Kansas forms average about 1 inch shorter than males), dark brown to chestnut, often spotted or marked with white, rarely wholly white, sometimes black. Hind feet normally dirty whitish. Eastern Kansas.....Shaw Pocket Gopher. *Geomys bursarius bursarius*, 181  
 DD. Smaller; males 11 inches long or less, and paler than the preceding.  
 E. Drab in winter, sometimes with a darker median stripe, yellowish in summer. Under parts buffy. Extreme western Kansas.....Yellow Pocket Gopher. *Geomys lutescens*, 182  
 EE. Upper parts light liver brown, middle of back dusky, under parts creamy to buffy white. South-central Kansas.  
 Mesquite Plains Pocket Gopher. *Geomys breviceps llanensis*, 182

- CC. Form slender, with relatively long tail, front legs normally developed or extremely weak, claws never pronounced.
- D. Tail very long, black above, white below, with prominent white brush at tip. Forelegs very weak, hind legs long, prominent white rump stripe across rufous back. Kansas west of the Flint Hills. Cheek teeth 4/4.  
Richardson Kangaroo Rat. *Dipodomys ordii richardsoni*, 184
- DD. Tail without brush, never prominent, color dull, no rump stripe. Cheek teeth 4/4. Pocket mice, genus *Perognathus*.
- E. Size large, 9 inches or longer in adults. Tail about as long as head and body, pelage harsh. Kansas west of the Flint Hills. Large Pocket Mouse. *Perognathus hispidus* subspecies, 183
- EE. Much smaller, never over 5.5 inches long.
- F. Length around 5 inches, pelage slightly harsh, upper parts light grayish-buff mixed with dusky, tail indistinctly bicolor. Common in western Kansas.  
Plains Pocket Mouse. *Perognathus flavescens flavescens*, 183
- FF. Smaller; about 4.5 inches long; pelage very soft. Upper parts pinkish-buff with light sprinkling of black, darkest in middorsal region, lateral line faint, tail almost concolor. Common in extreme western Kansas.  
Baird Pocket Mouse. *Perognathus flavus flavus*, 183
- BB. Cheek pockets, if present, internal and not fur-lined. Tail variable, often bushy, though usually not.
- C. Cheek teeth 4/3. Tail long, hind legs long, form typically mouse-like. Exceedingly rare, and reported only from eastern Kansas south to Elk county.....Prairie Jumping Mouse. *Zapus hudsonicus campestris*, 205
- DD. Cheek teeth 4/4 or 5/4. Tail hairy, usually more or less flattened and bushy. Squirrels, prairie dogs, ground squirrels, etc.  
Family SCIURIDAE. (See key 10)
- CC. Cheek teeth always 8/8 on each side.
- D. Crown pattern of cheek teeth tuberculate, tubercles arranged in three longitudinal rows. Tail scantily haired, and annulated. Imported rats and mice. Family MURIDAE.
- E. Large, length 15 or more inches in adult, tail 7-8 inches long. Color brownish to grayish, more or less mixed with blackish. State-wide....Common or Norway Rat. *Rattus norvegicus*, 205
- EE. Similar to the above in color, shape and habits, but much smaller, rarely over 6.5 inches long.  
House Mouse. *Mus musculus musculus*, 204
- DD. Crown pattern tuberculate or of annular figures: if tuberculate then tubercles arranged in two longitudinal rows.  
Native Rats and Mice. Family CRICETIDAE. (See key 11)
- KEY 10. KEY TO THE FAMILY SCIURIDAE. The Squirrels and Relatives
- A. Tail long and bushy. Length, 18 to 21 inches. Arboreal squirrels.
- B. Grayish to brownish above, under parts gray. A very small upper premolar before the four ordinary upper cheek teeth. State-wide wherever trees are found in reasonable numbers.  
Eastern Gray Squirrel. *Sciurus carolinensis carolinensis*, 179
- BB. Upper parts grizzled grayish, under parts rusty red, general cast of color a reddish-brown instead of grayish. No minute upper premolar preceding the four regular cheek teeth. Larger and heavier. Distribution as preceding, but preferring the heavier growth.  
Western Fox Squirrel. *Sciurus niger rufiventer*, 179

NOTE.—The Black Rat, *Rattus rattus rattus*, which preceded the Norway Rat to this country, once occurred in Kansas, but as elsewhere has been replaced by the Norway Rat. It is possibly still present in the state, though doubtful, in some isolated spots. It may be recognized by its black to slaty black color, smaller, or more slender-body, longer tail (usually around 9 inches) on which the annulations are also finer.

- AA. Tail flat and short. Total length never more than 17 inches.
  - B. Skin extended out between front and hind legs into a sailing membrane. Pelage very fine, soft and close, tail very flat, eyes extremely large. Arboreal, glissant, nocturnal. Timbered areas of eastern Kansas.
    - Small Eastern Flying Squirrel. *Glaucomys volans volans*, 180
  - BB. No sailing membrane, pelage coarse, not especially dense, terrestrial and burrowing, rarely, if ever, found in trees.
    - C. Tail extremely short, body large and robust, total length 14.5 to 16.5 inches, tail 3 to 4 inches. Color pinkish buffy above, slightly grizzled with black, terminal one third of tail black. Kansas west of the Flint Hills, irregular in distribution.
      - Black-tailed Prairie Dog. *Cynomys ludovicianus ludovicianus*, 177
    - CC. Body not so heavy, tail relatively longer. Ground squirrels and Chipmunks.
      - D. Rump with prominent rufous patch, five black stripes from rump to shoulders.....Chipmunks. *Tamias striatus* subspecies, 178
      - DD. No rump patch, more or less spotted, with or without stripes.
        - E. Striping absent, spotting often indistinct.
          - F. Large, length 14 inches. Mixed dusky, buffy and grayish white, giving general effect of grayish with dim buffy spots. Eastern one third of state, rare south of Anderson county.
            - Franklin's Spermophile. *Citellus franklini*, 176
          - FF. Smaller, general color sandy gray to vinaceous.
            - G. Conspicuously spotted, not so much so on rump as elsewhere. Brownish-vinaceous. Extreme southwestern Kansas.
              - Large Spotted Ground Squirrel. *Citellus epilosoma major*, 174
            - GG. More grayish-vinaceous instead of brownish. Spots nowhere conspicuous. Extreme northwestern Kansas.....Northern Spotted Ground Squirrel. *Citellus obsoletus*, 174
    - EE. Striped with 13 alternate black and buffy stripes, the dark stripes with central rows of whitish or buffy spots. State-wide.....The Thirteen-striped Ground Squirrel. *Citellus tridecemlineatus* subspecies, 175

KEY 11. KEY TO THE FAMILY CRICETIDAE. Native Rats and Mice

- A. Very large, body robust, tail laterally compressed. Pelage of long glossy overfur and short dense underfur, some shade of glossy brown, paler in western part of state, darkest in extreme southeastern corner. Aquatic.
  - Muskrat. *Ondatra zibethica* subspecies, 203
- AA. Tail very short, never over 1.8 inches long. Size small, body relatively short and thick, eyes very small. Pelage long and loose, feet not radically different in color from upper parts, never pure white.
  - B. Each upper incisor with faint longitudinal groove. General tone of upper parts from grayish to reddish brown. Limits of range unknown. Eastern Kansas, mostly in very damp bluegrass.
    - Goss Lemming Mouse. *Synaptomys cooperi gossi*, 200
  - BB. Upper incisors not grooved.
    - C. Pelage long, fine, close and glossy. Adults chestnut-colored. Wooded areas of eastern Kansas, usually in woodlands under decaying logs, more rarely in runs in bluegrass or sage grass.
      - Woodland Pine Mouse. *Pitymys nemoralis*, 202



- CC. Pelage short, fairly coarse, never glossy. True meadow mice, genus *Microtus*.
- D. Larger, length of adults 6.8-7.2 inches, tail 1.8 inches or slightly less. Color pale gray, slightly grizzled with fulvous and black, under parts creamy buff to whitish. Grassy regions of western Kansas.....Hayden Meadow Mouse. *Microtus haydenii*, 202
- DD. Smaller, length around 6 inches, tail 1 to 1.2 inches, back dark gray grizzled with fulvous and black, sometimes assuming a brownish cast, under parts pale cinnamon to fulvous. Common in Kansas east of the 98th meridian.  
Prairie Meadow Mouse. *Microtus ochrogaster*, 200
- AAA. Form typically mouse or ratlike, tail usually relatively long. Pelage variable, usually fine and close. Feet often, but not always, white.
- B. Larger, adults never under 9 inches long. Much larger if pelage is fine and close.
- C. Pelage rather long and coarse. Tail thinly haired and but faintly if at all bicolored. Length of adults 9 to 11 inches. Upper parts grayish brown.
- D. Feet whitish. Tail equal in length to head and body, not scaly. Not reported from Kansas except for one specimen collected by Goss at Neosho Falls, in 1866  
Texas Rice Rat. *Oryzomys palustris texensis*, 196
- DD. Feet grayish, tail slightly less than equal to head and body, tail scaly. Common in south-central Kansas, north at least to northern Greenwood county.  
Texas Cotton Rat. *Sigmodon hispidus texensis*,\* 197
- CC. Larger, adults 13 inches or more in length. Tail well haired, feet and under parts white.
- D. Color of adults in winter, ecru drab to pale gray. Total length usually slightly less than 14 inches. Known only from southern Kansas from Barber county west.  
Pale Wood Rats. *Neotoma micropus* subspecies, 198
- DD. Adults in winter some shade of buff, buffy gray, or vinaceous. Total length usually slightly more than 14 inches.  
Brown Wood Rats. *Neotoma floridana* subspecies, 198
- BB. Smaller; never 9 inches long; feet always white. Immature mice of this group usually a uniform dull bluish-gray above, and frequently very difficult to identify except by skulls.
- C. Upper incisors with median longitudinal grooves. Plantar tubercles 6.
- D. Bright, light ochraceous-buffy above, tail brown above, grayish white below, equal to or longer than head and body. Southeastern Kansas, north at least into Anderson county. Rare.  
Golden Harvest Mouse. *Reithrodontomys fulvescens aurantius*, 189
- DD. General color of upper parts duller, grayish to ochraceous, with much black intermixed in pelage. Tail never as long as head and body.
- E. Black spot on outer surface of ear. Slightly smaller than following, and tail averaging shorter. Fairly common throughout state except extreme northwestern and southeastern corners.....Little Gray Harvest Mouse.  
*Reithrodontomys albescens griseus*, 188
- EE. Ear drab, without black spot. Slightly larger and with longer tail than preceding. Fairly common over northern half of state.  
Dyche's Harvest Mouse. *Reithrodontomys megalotis dychei*, 189

\*If a similar animal is found in extreme southeastern Kansas, which is highly probable, and with brownish feet on the adult instead of grayish feet, it will be referable to *Sigmodon hispidus hispidus*, the Northern Cotton Rat.

- CC. Upper incisors without median groove. Plantar tubercles 4 or 6 (7 in one rare form).
- D. Plantar tubercles 4, tail relatively short, always tipped with white above, white below and brownish dorsally. Robust in build. Length, about 6 inches, tail about 1.75 inches.  
Grasshopper Mouse. *Onychomys leucogaster* subspecies, 187
- DD. Plantar tubercles 6 or 7, form not so robust, but more typically mouse-like, tail relatively long and always bicolor down to tip.
- E. Rudiment of 7th planter tubercule present. Upper parts bright tawny ochraceous (young similar to adult), under parts suffused with ochraceous. Nests in bushes and trees. Known at present only from the report of a single specimen, now lost, taken by Goss at Colony, Kan. Should occur rather commonly in wooded portions of southeastern Kansas.  
Southern Golden Mouse. *Peromyscus nuttalli aureolus*, 196
- EE. White below, rarely if ever nesting in trees, young always bluish-gray.
- F. Very large; adults over 8 inches long, tail very long, usually as long as head and body with prominent pencil on tip, ears very large, small pectoral spot of cinnamon. Found only in the cliffs and rocky ledges of extreme southeastern Kansas.  
Atwater Cliff Mouse. *Peromyscus boylii atwateri*, 195
- FF. Not a cliff dweller, ears not especially prominent; 7.5 inches long; no prominent pencil on tail.
- G. Larger, 6-7.5 inches long, tail faintly bicolor, skull 22-26 mm. long.  
Woodland Deer Mouse group.  
*Peromyscus leucopus* subspecies, 13
- GG. Smaller, length never over 6.5 inches, tail usually less than 2.4 inches and sharply bicolor, skull usually less than 22 mm. long.  
Prairie White-footed Mouse group.  
*Peromyscus maniculatus* subspecies, 192

## CLASS MAMMALIA

The highest division of the vertebrates. Characterized by the universal presence of hair (may be limited to embryonic stage in certain highly specialized whales); nursing of young from mammary glands; includes the largest of all vertebrates, and averaging larger than other groups; reduction of skull elements, and lower jaw consisting of dentary only, with a dentary-squamosal articulation; ear bones a chain of three or four separate elements; four optic lobes to brain; heart with a single left aortic arch; presence of a muscular diaphragm; red-blood corpuscles nonnucleate. These are the most important universal characters which distinguish the class. The living mammals are commonly divided into two main subclasses, of which the subclass Prototheria, as represented by existing species, is limited to one order, the Monotremata. This order is very primitive and reptilelike, its outstanding characteristic being the laying of eggs, and nursing of the young from a mammary pouch, tech-

nically distinguished from the marsupium of the order Marsupialia. The Monotremata are at present represented only by a few species of the family Echidnidae, or Australian Anteater group, and by the single living representative of the family Ornithorhynchidae, the Duckbill. They are limited to the Australian Region.

### SUBCLASS EUTHERIA

All nonegg-laying mammals are grouped together in the subclass Eutheria, though certain arguments have been advanced to separate the Marsupialia as a distinct subclass. A detailed discussion of the subclass characteristics, relationships of the Marsupials, placental mammals and the Monotremes is beyond the scope of this work. Interested readers are referred to the general works on mammals listed in the bibliography for this information.

### ORDER MARSUPIALIA

Mammals with a very short gestation period, the young being born in a larval condition and transferred to a mammary pouch or pocket in which they complete development. The young generally return to this pouch for protection long after they are sufficiently large to walk about. A very old order of mammals, now confined almost wholly to Australia, but represented by a few forms in the New World, of which but one family reaches North America, the Didelphidae, and of this family only one genus with three forms extends into the United States. One of these is found in Kansas.

### FAMILY DIDELPHIDAE

#### GENUS DIDELPHIS

*Dentition:* 5/4; 1/1; 3/3; 4/4—50.

Toes, 5 on each foot, tail long, scaly and prehensile. Small to medium in size.

#### VIRGINIA OPOSSUM

*Didelphis virginiana virginiana* Kerr.

*Characters.* In addition to those listed in the discussion of the family and order, the opossum may be characterized further as a medium-sized mammal; length, 30 to 36 inches; tail vertebrae, about 12 inches; hind foot, 3 inches. The general color effect is silvery gray to dusky gray above, due to the admixture of black and white hairs, the head and cheeks usually whitish. Ears rather large and broad, blackish with a yellowish spot on the upper edge. Frequently occurs in a black phase, and albino opossums are not especially rare.

*Range in Kansas.* Probably the whole state although yet reported only from Seward, Trego and Barber counties west of the Flint Hills. It is very common east of the Flint Hills, and especially so in the southeastern part of the state.

*Economic status and habits.* The opossum is well known to most residents of eastern Kansas, and is a very important fur-bearing animal over most of that portion of the state. In southern Kansas, as well as throughout most of the south, the animal is also a favorite item of food, and 'possum hunting with dog and lantern is an important sport.

The animal is well known in song and story for its habit of "sulling" or "playing 'possum" and for its predilection for persimmons, a fruit found over much of its native range. The opossum, although among the oldest of living mammals from the paleontological standpoint, is a very remarkable exception to the almost universal rule that marsupial mammals are vanishing from the earth due to their inability to compete with the higher placental forms. Instead of vanishing the opossum is increasing its range annually, a fact remarkable almost beyond parallel when it is remembered how extensively it is hunted for its flesh and fur.

Although the young of this animal may not be as well nourished during its period of development as those "higher" mammals with which it has to compete, the opossum has developed along three different lines which offsets, and, if we are to believe distributional data, more than offsets, the so-called advantages are: (1) Large litters of young. The young number from five to seventeen to the litter, with seven to ten the prevailing number. I have collected one adult carrying thirteen young whose combined weight probably equalled the parent. Such large numbers of young exceed by more than a 2 to 1 ratio the average number of young of mammals of a similar size in competition with the opossum.

(2) Omnivorous diet. The opossum will eat almost anything. This is a great advantage in the struggle for existence where available food always plays one of the most important rôles in limiting numbers. Grubs, insects, eggs, birds, lizards and any mammals it can catch, fruit, berries, carrion—all are gladly accepted by the opossum, so that the food problem is much less acute for the animal, as a species, than it is for competing forms with more specialized food habits.

(3) Resistance to accident. I have recently discussed this point elsewhere (Black, 1935). The skeletons of the opossum in the K. U. museum indicate an ability to survive injury that is greatly in excess of any other North American mammal. More than one third of the large series of skeletons of the opossum in that collection reveals broken bones that have healed and the animal recovered fully from this first accident, or series of accidents. Some of these injuries involve such vital parts as the skull, pelvic girdle, and vertebral column, while by far the larger number are of two or more ribs—frequently six or more. It is an almost inevitable law of nature that the sick and injured perish, and the number of such recoveries in other species native to this country will probably not average more than five percent, possibly much less. Certainly there is no known species where the degree of resistance to injury as exhibited in the skeleton even approaches that of the Virginia opossum.

These three factors, considered together, provide the answer, I think, to the puzzle of the increase of this "remnant" species. It appears quite possible that this old and lowly form may become the sole survivor of the larger North American mammals and be thus both the first to appear and the last to vanish in the parade of the present mammalian life on our continent.

ORDER INSECTIVORA. *The Insectivores*

Primitive mammals, small with simple primitive dentition, world-wide (Australia, of course, excepted) in distribution, almost wholly insectivorous in diet. There are several families distinguished by many different specializations, but only two families are represented in our fauna, the moles and shrews. All of our species have short, velvetlike fur, minute eyes and ears, and a long flexible snout. They are perhaps our most "high-strung" mammals, being very nervous, fierce fighters when aroused, and requiring prodigious amounts of food, the shrews being especially noted for their tremendous appetites and pugnacious natures.

FAMILY TALPIDAE. *The Moles*

This family is easily recognized by the great scoop-like forepaws which they use to dig their way through the earth in making their characteristic and well-known burrows. There are five genera in North America, but of these only one, representing in turn by a single species of three geographic races, is found in Kansas.

## GENUS SCALOPUS

*Dentition:* 3/2; 1/0; 3/3; 3/3—36.

## MISSOURI VALLEY MOLE

*Scalopus aquaticus machrinoides* Jackson

*Characters.* Large and robust. Clove-brown above in winter, light drab in summer. Color of this race, as with others, subject to much individual variation, and appearing quite different when viewed at different angles due to velvety nature of the fur. Total length of males, 7 inches; of females, 6.5 inches; tail vertebrae, .9-1.2 inches; hind foot, .75-.85 inch.

*Range in Kansas.* Roughly the eastern one third of the state, west to and including Cloud and Harvey counties. The range of the moles in Kansas has not been worked out sufficiently to make a definite limitation of the various forms possible. Intergradation with the southern form, *intermedius*, is apparent in specimens from Montgomery and Harvey counties. The type locality of *machrinoides* is Manhattan, Kansas.

## NORTHERN PLAINS MOLE

*Scalopus aquaticus caryi* Jackson

*Characters.* Similar to the preceding, but much paler, light drab to silvery, head paler than back. Length, about .5 inch shorter than preceding.

*Range in Kansas.* Known at present from Phillips, Smith and Trego counties in museum collections; but must occur at least north and west of those limits. In all probability extending south to Hamilton county and east at least to Rice county, as its range should be expected to meet *machrinoides* on the east and *intermedius* on the south.

## SOUTHERN PLAINS MOLE

*Scalopus aquaticus intermedius* (Elliot)

*Characters.* Similar in size to the preceding, which it most closely resembles. Color darker than *caryi* with a pinkish-ochraceous cast to the upper parts. The brownish-orange markings common to all the moles of this section seem

more common on this than on the other forms. These markings occur on the head, throat, forearms and less commonly on the breast, and maybe expected on any of the three races found in Kansas. The buffy to orange coloration seems typical on the wrists and nose of *intermedius*.

*Range in Kansas.* Southwestern and south-central Kansas, the limits being unknown. Specimens from Norton, Stafford, Pratt and Sumner counties have been referred to this race and are undoubtedly correct, but specimens from Montgomery and Crawford counties, which have been called *intermedius*, are beyond a doubt simply *machrinoides*, subject perhaps to the influence of the Arkansas mole, *pulcher*, and *intermedius*. The eastern limit of *intermedius* will probably be found to be in Cowley county, while Stafford county, no doubt, represents its extreme northern limit.



FIG. 18. The mole.

*Economic status and habits.* The mole, battled against and hated by the gardener for its so-called destructive ways, is not nearly so black a villain as it has been made out. The diet of this group is practically all earthworms and grubs. Their runs may be unsightly and they may have a damaging effect on vegetation through disturbing its root system, but they do not eat the roots of plants. As has been pointed out (Anthony, 1928) meadow mice sometimes appropriate the mole runs and eat the roots of plants, in which case the blame is laid to the mole. On the whole the mole may be considered as one of our most beneficial mammals, and should not be persecuted as is the custom.

Moles favor loose, easily worked soil where they can burrow near the surface and "hump" the dirt up as they go, but they will occasionally work in less favorable soil and at greater depths, in which case they may carry dirt up to the surface in short vertical tunnels and make dirt heaps at intervals along their runs quite like the Shaw pocket gopher. These deeper runs appear to be more common in the winter than in the summer in this region and are so nonmolelike that they are frequently not recognized as the work of this mam-

mal, leading to the belief that moles hibernate in the winter. I have observed that they are active practically the whole year at Lawrence, and probably will be found to utilize old, deep runs even in the coldest of weather. Their nervous high-strung temperament does not indicate a hibernating mammal and it is well known that their close relatives, the shrews, are active throughout the year.

The nest is usually placed near the base of a tree trunk, stump or rock and is situated at the end of a deep run. Here the three to six young (generally four) are born in April or May and remain until they are very similar to the adults before they leave the nest and are found in the runs. Nests are rarely found and most of the so-called "young moles" that come to attention are not moles but shrews. The mole, even in the hairless state, is much larger than an adult shrew and when it has attained sufficient size to be covered with its first short, stiff, silvery hairs is almost one half the size of the adult animal. Only one litter of young moles has ever come to my attention—a family of four, about three feet underground, excavated on the K. U. campus in May, 1934. They were well haired and about half grown, but almost perfectly helpless in their movements.

In times of unusual need the mole may be found above the ground, but it is only rarely that they ever leave their burrows. In the summer of 1934 during the extreme drought which was so prolonged and intense as to effect, severely, all wild life, I secured an adult mole, of the race *machrinoides*, in northwestern Arkansas, which was crossing a paved highway about one o'clock in the afternoon, while the thermometer stood at a temperature around 104 degrees in the shade. The mole when picked up fought fiercely and bit a number of holes in the mechanic's cap in which it was captured.

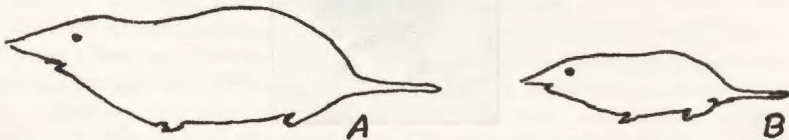


FIG. 19. Relative sizes of Kansas shrews. A, large, short-tailed shrew; B, little, short-tailed shrew. The Carolina short-tailed shrew is slightly smaller than the large short-tailed species. Sketches slightly less than one half natural size. (Copied from the "Mammals of Ontario" with permission of J. R. Dymond.)

#### FAMILY SORICIDAE. *Shrews*

Very small mammals with short, velvety fur, weak legs and feet, minute eyes, and small, sharp teeth of which the incisors are highly specialized and the canines greatly reduced above, absent below. The teeth in all North American species are tipped with red. Muzzle very sharp.

Two genera, each represented by a single species, one of these in turn by two subspecies, are found in Kansas. As with all the family, they are mostly insectivorous in diet, though their menu is often varied with meat and vegetable matter. They have been known to attack and kill field mice much larger than themselves, and to consume most of their kill in a very short time. It has been said that it is impossible for shrews to live without eating at least their own weight daily, and their normal requirements are from two to three times this amount. As this almost unbelievable food consumption indicates,

they are animals of rapid digestion and extremely nervous temperament. They search with diligence under decaying leaves, in brush piles, under logs and rocks, or in runways of mice for their food, which they locate by means of a highly developed sense of smell. The species occurring in Kansas frequent little runways of their own making, barely half an inch wide, although both species, *Blarina* in particular, make frequent use of mouse trails. Their nests are placed underground at the end of an almost vertical tunnel and usually under an old log, stump or rock.

They are vicious and morose of temperament, and Nelson (1918) in connection with the Common Shrew says that if two captive animals are placed in the same cage they will attack one another instantly, the fight continuing until one is killed, the victor then devouring its foe at a single meal.

Both our species are active day and night throughout the year.

#### GENUS CRYPTOTIS

*Dentition:* 3/2; 1/0; 2/1; 3/3—30.

#### LITTLE SHORT-TAILED SHREW

#### *Cryptotis parva* (Say)

*Characters.* A very small mammal with a short tail. Color varying from dark brown to a velvety bluish-black above, ashy gray below, darker in winter than in summer; tail bicolor, above like back, below like belly. Total length, 2.9 to 3.2 inches; tail vertebrae, .6 to .7 inch; hind foot, .40 to .45 inch.

*Range in Kansas.* Eastern Kansas, west at least to Riley and Harvey counties. Very common over much of this range. (See map 2.)

*Economic status and habits.* In addition to what has been said of shrews in general, it may be added that both this species, and the next, are very valuable mammals, and instead of being killed on sight as "baby moles," or "funny field mice," as is the common practice, they should be recognized as assets, and at least left unmolested. Their insect diet and their remarkable appetites make them very valuable mammals.

Few people ever see a shrew, and most of those who do fail to recognize it. Even in localities where they are very common the majority of people are totally unaware of their existence. They are so remarkably small and so unexpected that when they are encountered shrews are almost invariably mistaken as the young of some other mammal.

The only nest of this species of which I have direct knowledge was one containing eight young shrews, attended by the male, which was exposed when a large rock under which the nest was situated was turned over by a plow. The nest was composed of grass and leaves, and arranged in a compact ball. The usual number of young appears to be from four to six; they are born from April until late in the fall, and several litters may be produced each year.

Like other shrews this species possesses a very strong characteristic odor, rather suggestive of decaying garlic, and the idea advanced by Nelson (1918) that this scent makes them nauseous to other animals, and thus serves as a valuable protection, is undoubtedly correct.

## LARGE SHORT-TAILED SHREW

*Blarina brevicauda brevicauda* (Say)

*Characters.* In general similar to the preceding, but much larger, with longer pelage, and more robust. Color of upper parts glossy slate gray, darker in winter than summer; under parts ashy gray; tail bicolor, as with the preceding. Total length, 4.8 to 5.3 inches; tail vertebrae, .85 to 1.10 inches; hind foot, .6 to .7 inch.

*Range in Kansas.* This subspecies occurs in northeastern and east central Kansas, west at least to the Flint Hills and south into Anderson and Greenwood counties, intergrading there with the following subspecies.



FIG. 20. Distribution of shrews.

## CAROLINA SHORT-TAILED SHREW

*Blarina brevicauda carolinensis* (Bachman).

*Characters.* Similar to the preceding, with which it intergrades, but typically smaller, and with the upper parts tinged with brownish in the summer. Total length, 3.7 to 4.5 inches; tail vertebrae, .70 to .90 inch; hind foot, .5 to .6 inch.

*Range in Kansas.* Southeastern Kansas, north at least into Greenwood county, and west possibly to Harvey county, the single specimen available from Harvey county appearing to be closer to this than to the preceding subspecies, though plainly intermediate, as are those from Greenwood county. Specimens from Cherokee, Montgomery, Allen and Woodson counties are much nearer typical *carolinensis*.

*Economic status and habits.* The habit of the two subspecies of *Blarina brevicauda* found in Kansas are practically identical with those of *Cryptotis*. *Blarina* seems more addicted to damp places than the Little Short-tailed Shrew, which is not infrequently found in rather dry surroundings. The larger Short-tailed Shrews, probably on account of their size, appear to prey upon field mice rather frequently and easily vanquish even such large foes as the woodland pine mouse and the prairie meadow mouse.

This is the first time that the subspecies *carolinensis* has been reported from Kansas, and apparently marks a decided extension in its known range. Specimens of this shrew from southeastern Kansas have heretofore been referred to the sylvan shrew, *Blarina brevicauda hulophaga*. Doctor Jackson, of the Bureau of Biological Survey, the accepted authority on the order Insectivora in North America, has examined the Kansas specimens and has validated the present classification.

### ORDER CHIROPTERA. *Bats*

The outstanding character of this order which makes it readily recognized is the presence of membranous, or leathery, wings. The digits of the forelimb, corresponding to our fingers, with the exception of the thumb, are greatly elongated and joined by a highly innervated membrane which serves the bat as a very efficient wing. In other characters bats are rather primitive, more closely related to shrews than to any of our other mammals, and apparently are a very old group. Equipped with wings, they have been able to conquer all ordinary barriers which tend to restrict the distribution of land animals, and are more widely distributed than any other living mammalian group. There are many isolated oceanic islands on which bats are the only mammals represented. They are the only true placental mammals native to Australia.

No other single order offers so many fascinating, unsolved problems to the mammalogist as this one. No other order is as completely misunderstood by the layman. Scarcely a month passes but someone with whom I happen to talk expresses astonishment when told that bats are mammals and not birds. Very frequently I am asked: "Don't bats lay eggs?" Many are the doubters who think they are being teased when told that bats are true placental mammals, with fur and teeth like a shrew, and that they nurse their young, which are born alive, just as any ordinary mammal does.

This problem of mammals which fly is only a minor difficulty to the professional naturalist. Amazing as is this totally unique method of progression among mammals, it has its parallel in the famous extinct Pterodactyls, or flying reptiles, which once occurred over most of the world, and which attained their greatest development, according to present fossil records, in the region of the Cretaceous sea, in Kansas.

Other questions far more intriguing are: What is that unknown sense whereby bats fly so skillfully, catching minute insects from midair on the darkest night as they dart and swerve through the tree tops; and what is that homing instinct which brings them back each morning to their favorite cave or eave to sleep away the day no matter how far they wander? It has been rather definitely proved that although they are not blind, as sometimes stated, bats depend on their eyes very little. Their eyes, at least in our species, probably function for little more than light detection, and would be perfectly useless in enabling them to avoid obstacles at night as they do. Little by little we are acquiring information about the bats, their habits, physiology and anatomy, but the field is as yet barely scratched.

Bats are easily divided into two great subdivisions, the Old-World Fruit-eating Bats, or suborder Megachiroptera, and the so-called "insectivorous bats,"

or Microchiroptera. The former group is mostly Oriental in distribution, and none of its representatives is found in the New World. In this suborder are to be found all the large, heavy-bodied bats, some of which have a wing expanse of forty inches or more, although it also includes a number of small forms. In the suborder Microchiroptera, we find bats of varied diet, some frugivorous (fruit-eating), others sanguivorous (blood-sucking), with the great majority insectivorous. They are world-wide in their distribution, and very diverse in size, structure, and appearance. Two families are represented in Kansas.

The almost universal horror and dislike for bats is difficult to understand, unless it is because of their nocturnal habits and flitting, ghostlike flight. Their tendency to frequent dark, deserted "spooky" houses may also add to this feeling of revulsion toward bats, which in actuality are among our most interesting and useful mammals. The most serious charge that has ever been brought against any of the bats in our region is that they "carry bedbugs." This charge is made against only one species, the large brown bat, and is so poorly substantiated as to make it certain that this occurs but rarely. It is highly probable that parasites may occasionally be found on bats that may be mistaken for bedbugs, but inasmuch as practically all such parasites are limited to a single, or very closely related species, the probability against human parasites being found on bats is very great. On the other hand, our bats, without exception, are wholly insectivorous and do much good in consuming great quantities of insects, which are, for the most part, harmful. To quote a noted authority: "With such highly beneficial food habits the bats are probably almost as essential to successful agriculture as are the birds." (Bailey, 1931.) Bats are exceedingly numerous throughout the state, and in the cave region of Barber, Harper, and Comanche counties probably outnumber the total bird population, although not nearly so evident on account of their nocturnal habits. Our species, eleven in all, are in part migratory and in part permanent residents.

All are among the most heavily parasitized of mammals, certain species being extremely unfortunate in this respect.

Wherever they are found in large numbers, such as the Marehew Cave just across the Kansas-Oklahoma line in Woods county, Oklahoma, in the Havard cave in Barber county and other similar bat shelters, there are evidences of cruel and wanton destruction of the bats on one pretense or another. This needless and foolish killing of such harmless, interesting and valuable animals should be outlawed at once, and these bats protected as stringently as any game bird or mammal in the state.

#### FAMILY VESPERTILIONIDAE

This family includes all of our bats except the Mexican free-tailed, and its representatives may be recognized in our limits by the fact that all or practically all of the tail is enclosed in the interfemoral membrane (the membrane enclosing tail and joining hind legs). In scientific terminology they are characterized by the absence of leaf-like outgrowths on the nose; ears not joined at the base except in a few exotic genera; tragi (see fig. 21) prominent; only two bony digits in the third finger; and the absence of sucking disks on the sole of the foot and the thumb.

## GENUS MYOTIS

*Dentition:* 2/3; 1/1; 3/3; 3/3—38.

This genus is to be recognized by the large number of teeth, the largest of any of our North American genera, and by the rather unspecialized ears and facial region, with medium, rounded ears, and tragi about half as long as the ear, slender and straight or slightly curved. The Kansas species are all rather slight of build.

## LITTLE BROWN BAT

*Myotis lucifugus lucifugus* (LeConte)

*Characters.* Total length, 3.5 to 3.75 inches; tail vertebrae, 1.5 to 1.75 inches; forearm, about 1.5 inches. Rather light of build, ear and tragus narrow, the former reaching about to, or very slightly beyond, the nostril when laid forward. Fur everywhere slate colored at the base, golden brown to fuscous dorsally, slightly paler below. The fur is rather long and glossy on the back, giving the animal a silky appearance not so noticeable in our other species; wing and interfemoral membranes dark brown. Somewhat paler in western part of the state (western record at present is Barber county) where intergradation with the Rocky Mountain subspecies, *carissima*, is to be expected. Specimens, when collected, from west of the 99th meridian will probably be closer to *carissima* than *lucifugus*.



FIG. 21. Right ear of a bat, showing (T) tragus, and (A) antitragus. Greatly enlarged.

*Range in Kansas.* As indicated in description above. Probably state-wide in the subspecies *lucifugus* or *carissima*, but known only at present from eastern Kansas, and a single specimen from Barber county, collected by C. W. Hibbard September 23, 1933, from Havard cave in association with the Cave Bat. The latter is the only record at present outside of Douglas county. At Lawrence it is rare, but of regular occurrence, and has been found present in small numbers every summer. Winter specimens are as yet unknown from the state. The range of this bat almost certainly extends over the entire state to meet *carissima* either in western Kansas or eastern Colorado, probably in Kansas as indicated by the Barber county specimen, practically indistinguishable from specimens taken at Estes Park, Colorado.

*Economic status and habits.* This bat is the most common species over most of the eastern United States, and in one subspecies or another ranges from coast to coast, north into Canada and Alaska and south to southern Mexico. It frequents both dark buildings and caves, and winters in caves within its breeding range. It is rather social in its habits, although so far Kansas specimens have been reported singly. In Arkansas and Missouri this species has been found in summer in small colonies under railroad bridges and it is probable that it has similar habits in eastern Kansas.

As with all our other Kansas species this bat is highly beneficial in its food habits, consuming large quantities of night-flying insects, its value being limited only by its relative scarcity. The great energy expended by bats in flight combined with their very nervous disposition demands that they consume a large amount of food, especially since the waste material in insects bulks very large, so that the nutritive value per ounce of food is relatively low.

Trouessart's Bat, *Myotis keenii septentrionalis*, which should be found in northeastern Kansas, is almost identical in appearance and habits with the little brown bat, though much rarer throughout its range. It is to be recognized by the fact that the ears when appressed to the side of the face extend somewhat (.12 to .16 inch) beyond the tip of the nose. This species has not yet been reported from the state.

#### CAVE BAT

#### *Myotis velifer incautus* (J. A. Allen)

*Characters.* Pale olive brown to dull rufescent brown above; pale whitish below; base of hairs everywhere plumbeous except on the flanks, where the hairs are white to the base. Ear medium in size, when laid forward reaching to or slightly beyond the nostril; tragus slender and nearly straight, half as long as ear. Largest of the genus in Kansas, total length, 3.65 to 3.90 inches; tail vertebrae, 1.40 to 1.65 inches; forearm, 1.72 to 1.88 inches.

*Range in Kansas.* So far known only from Barber, Pratt and Comanche counties, but may be expected in the adjacent counties as all the cave-dwelling bats are known to have a rather extensive feeding range. It is found in great numbers in numerous caves in the counties mentioned above.

*Economic status and habits.* This species is probably one of the most important insect controls operating in south-central Kansas, being found in the various caves in that region in vast numbers, and therefore necessarily consuming great hordes of insects. They are highly gregarious in habit, being found in caves in flocks of from thirty or forty to several thousand. They have been reported from houses and outbuildings, and may be found to frequent such places in Kansas, in which case they will probably occur in small flocks or singly. They are a desert species, occurring over most of New Mexico and Western Texas, their known eastern limit being from the reported localities in Kansas. The accepted common name in most literature is the house bat, in contrast to the name cave bat generally applied to the more western subspecies, *M. v. velifer*, but in this region the big brown bat is so commonly known as the house bat that the latter name has been reserved for the big brown bat, *Eptesicus fuscus fuscus*. On the whole, too, the name house bat seems a sad misnomer for *incautus*, because it is one of our most distinctive cave bats.

This species is sometimes heavily parasitized by a small mite, and has also been found to be host to a species of tick, a fly, and a flea, this remarkable assemblage even being found on the same individual, although the flies are rather rare, and lice not common. Bats, strangely enough, appear rather helpless to defend themselves against these parasites which congregate on some specimens about the root of the tail on the upper side in such great numbers as completely to conceal the skin.

## SAY'S BAT

*Myotis subulatus subulatus* (Say)

*Characters.* A very small bat, pale buffy-yellow in color, and with a prominent facial mask of dark brown involving the ears, lips and general facial region, standing out in sharp contrast with the extremely pale fur of the back; under parts very pale, creamy buff, nearly white; membranes brownish. Total length, 3.4 to 3.7 inches; tail vertebrae, 1.4 inches; forearm, 1.44 inches. Very similar in proportions and structure to the little brown bat, but much smaller, paler, and easily distinguished by the facial mask. In color and size resembles the Georgian bat, *Pipistrellus subflavus subflavus*, but nearly always paler than the latter, which *never* has a facial mask. These two species may be found together in parts of Kansas, though their range has not as yet been reported as overlapping.

*Range in Kansas.* Little is known of the distribution of this bat in Kansas. Specimens are available from Trego and Logan counties; probably common in western Kansas as it has been found rather commonly in Colorado.

*Economic status and habits.* So little is known about this bat in Kansas that practically nothing can be said about its economic status except in generalities, its importance again depending solely upon its actual distribution and numbers. The specimens from Trego county were collected around the rocky cliffs where they were flying in large numbers at dusk, flitting in and out of the shadow of the rocks so that the shooting of the specimens was difficult. Their flight is reported as very erratic and rapid, and in this respect would agree very closely with the Georgian bat, one of the most erratic of all our bats in flight.

## GENUS LASIONYCTERIS

*Dentition:* 2/3; 1/1; 2/3; 3/3—36.

Represented by a single species which ranges over most of North America, its distribution being highly irregular, and apparently extremely rare in Kansas.

## SILVER-HAIRED BAT

*Lasionycteris noctivagans* (LeConte)

*Characters.* A medium-sized bat, of very distinctive characters; color above dark chocolate-brown, almost black, the hairs tipped with silvery white, the light-tipping being much less developed on the under parts, which otherwise are like the back. The membranes are dark brown, the ears broad, low and round, with a broad, straight tragus. Total length, 3.8 to 4.3 inches; tail vertebrae, 1.45 to 1.60 inches; forearm, 1.60 to 1.80 inches.

*Range in Kansas.* Known from single records from Douglas and Trego counties, as reported by Hibbard (1933). Ranging as it does from coast to coast this bat is certain to occur rarely over the entire state, at least in migration, and may be expected anywhere.

*Economic status and habits.* This bat is a migrant, breeding in the northern parts of its range, and migrating southward in the fall. There are specimens in the K. U. museum collected in the mountains of Georgia in January, which were killed, while flying, in the daytime. It is known to be more diurnal than our other bats, though its principal activity is confined to the night. This species may be found sleeping in bunches of leaves, in hollow trees, crevices in rocks or caves. The young, as with the genus *Myotis*, are one or two, born in the spring. According to Anthony (1928) "It seems to prefer the banks of forested streams or mountain meadows where it appears when twilight has set in."

#### GENUS PIPISTRELLUS

*Dentition:* 2/3; 1/1; 2/2; 3/3—34.

This genus, represented in the United States by two species with two geographic races each, is very similar to *Myotis* in structure, differing chiefly in the loss of one premolar from each jaw, thus reducing the number of teeth from 38 to 34. Both our species are quite small and closely related. It would not be surprising to find *Pipistrellus hesperus* occurring in the southwest corner of Kansas, though the species is as yet unknown from our state.

#### GEORGIAN BAT

*Pipistrellus subflavus subflavus* (F. Cuvier)

*Characters.* Very small, color above varying from yellowish-brown, frequently with a rufous cast, to pale buffy-yellow, often intermixed with brownish hairs; under parts much paler, buffy-cream; ears much as in *Myotis*, but slightly broader, and with the tip of the tragus bluntly rounded; pelage throughout slaty at base; membranes blackish, with the membrane around the bones prominently rosy in life. Length, 3.25 to 3.50 inches; tail vertebrae, 1.3 to 1.6 inches; forearm, 1.3 to 1.45 inches.

*Range in Kansas.* Reported from Barber, Butler and Woodson counties, the last, a specimen in the Goss collection, now lost. Very common throughout the Ozarks and north, at least, to Columbia, Missouri. This species probably occurs commonly throughout southeastern Kansas. Little information is as yet available on its Kansas distribution.

*Economic status and habits.* Throughout the south and east this bat is very common, and in many regions is the most common species. It appears at dusk and may frequently be seen flitting about with very erratic flight in groups of from two or three to a dozen or more. I have seen them swoop back and forth through a flock of dancing midges in a forest road, twisting and turning with unbelievable skill and flying with great rapidity. They seem to prefer flying close to such shelters and are often seen skirting the tree line at the edge of a meadow or field, frequently sweeping out over a small stream to drink on the wing as do other bats.

They hibernate in caves of both limestone and sandstone formations, and always occur singly or in groups of two. They dwell in the moist parts of these caves and are not infrequently seen hanging covered with a film of moisture that makes them appear snow white in some lights. Reports of "white bats," when traced down, are nearly always water-covered *Pipistrellus*. Except for a few individuals they desert the caves early in summer and spend the warmer season in the open, sleeping in crevices in rocks. Totally dormant

specimens hanging apparently lifeless in caves otherwise deserted are not infrequent. After being warmed up a bit these bats become active and appear quite normal. I have never found any satisfactory explanation for this behavior, which, although apparently very general among cave-dwelling bats, appears to be most frequent, so far as my experience goes at least, among the members of this species.

GENUS *EPTESICUS*

*Dentition:* 2/3; 1/1; 1/2; 3/3—32.

BIG BROWN BAT

*Eptesicus fuscus fuscus* (Beauvois)

*Characters.* A very large, heavy-bodied bat, with long, glossy brown pelage, black ears and membranes, and a characteristic, skunk-like odor. Length, 4.25 to 4.80 inches; tail vertebrae, 1.5 to 1.75 inches; forearm, 1.6 to 2.0 inches. Body very heavy. Color of upper parts varying from glossy rich chestnut

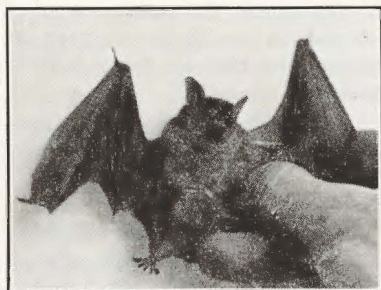


FIG. 22. Brown bat (*Eptesicus fuscus*)

brown to sepia; under parts slightly paler, tinged with buffy; membranes, ears, nostrils and lips black; ears medium and rather broad and rounded, with a medium-length tragus, rounded at the tip.

*Range in Kansas.* Common east of the 99th meridian, especially about houses. A rare cave dweller.

*Economic status and habits.* Being large and of common occurrence throughout the state this species must be considered as one of the principal insect controls we have. Although solitary in their roosting habits, and but rarely found in large numbers in any certain roosting place, they seem to come from somewhere like magic with the approach of darkness and mingle with the smaller species over the parks and meadows. They may be identified by their size and their more steady flight, being so large as to be readily distinguished from all but the hoary bat, which is even larger, but unlike the big brown bat, very erratic in flight. The hoary bat, too, is whitish below, a field mark which often aids in its identification. The big brown bat has been found to hibernate in the storm, or flood sewers underneath Lawrence, coming into these drains sometimes in November and remaining until early spring. They almost invariably hang singly, but will bunch in groups of two or three in a crevice, and we have found as many as six hanging together where a

brick had fallen out. In caves I have never found more than a single specimen at a place. When disturbed, or especially when seized, they give off a violent, characteristic odor strongly suggestive of the spotted skunk, *Spilogale*. The source of this scent is a pair of large glands just above the nostrils, present in varying degrees of development on all our bats, but none other has as strong an odor as this species.

## PALE BROWN BAT

*Eptesicus fuscus pallidus* (Young)

*Characters.* Exactly as with the preceding, but upper parts brownish-ashy and under parts silvery to buffy, making a much paler form than the eastern race.

*Range in Kansas.* Probably all of Kansas west of the 99th meridian. Specimens from Logan county are typical of this pale race.

*Economic status and habits.* In habits this race seems to be like the preceding. There has been much controversy regarding the subspecific distinctness of this and other races of *Eptesicus fuscus*, but I can see no reason for not recognizing the form. Certainly the specimens of *Eptesicus* from New Mexico and Western Kansas in the K. U. collection are more distinct when compared with the eastern form than are many fully accepted subspecies of other mammals and birds.

## GENUS NYCTERIS

*Dentition:* 1/3; 1/1; 2/2; 3/3—32.

## NORTHERN RED BAT

*Nycteris borealis borealis* (Müller)

*Characters.* Upper parts rufous red, lightly frosted all over with white, the pelage black at the base; under parts paler than back; upper surface of the interfemoral membrane densely furred, concolor with the back; prominent shoulder patch of creamy white, and another similar patch at the bend of the wing. Medium in size, length, 4 to 4.5 inches; tail vertebrae, 1.75 to 2.20 inches; forearm, 1.60 to 1.80 inches.

*Range in Kansas.* Common east of and through the Flint Hills, and known from Stafford county west of the Flint Hills. Probably west throughout the state.

*Economic status and habits.* This bat is found rather commonly throughout eastern Kansas, probably being the most common species in the north-eastern section, and it has been found to be by far the most common bat in Greenwood county. Its feeding habits are quite similar to *Pipistrellus* with which it is frequently found feeding in regions where the two species occur together. Its flight is swift and erratic; the wings are long and pointed. The species is solitary, usually hanging singly, rarely in twos, and spending the day in trees. One of these bats hanging from a twig closely resembles a dead curled leaf. They are highly migratory. Anthony (1928) states that it is not infrequently seen in the daytime; I have never seen it abroad earlier than *Myotis* or *Pipistrellus*. This species, as well as the following, which is closely related to it, has from one to four young at a time and carries its young with it. Nursing females of both species with three young are received every spring, and judging from the records at the Kansas University Museum, three seems to be the most common number of young.

## HOARY BAT

*Nycteris cinerea* (Beauvois)

*Characters.* Very similar to the preceding to which it is closely related, but much grayer and larger. Color of upper parts predominately gray, although the pattern is rufous, tipped with grayish-white, as with the preceding. Like the red bat, the interfemoral membrane of this species is densely haired. A narrow yellowish-brown stripe along the brown membrane of the forearm, extending down onto the fingers, further distinguishes this species. Length, 5.35 to 6.0 inches; tail vertebrae, 2.0 to 2.5 inches; forearm, 1.85 to 2.12 inches.

*Range in Kansas.* This bat, which ranges from coast to coast, has been reported only from Riley, Douglas, Anderson and Woodson counties, but it should be found throughout the state. It has been considered quite rare in years past, but through the summers of 1933 and 1934 was found to be rather common around Lawrence.

*Economic status and habits.* Little can be added concerning the habits of this species that has not already been given under the heading of the red bat, which it closely resembles. This species was thought for years not to breed this far south, but it has been definitely proven in recent years to be common at Lawrence through the breeding season, and is probably so throughout at least the eastern part of the state. No August records are at hand from Kansas, although data from the east indicates that the southward migration does not occur until the first fall frost.

## GENUS CORYNORHINUS

*Dentition:* 2/3; 1/1; 2/3; 3/3—36.

## PALLID LUMP-NOSED BAT

*Corynorhinus rafinesquii pallescens* (Miller)

*Characters.* Medium large, with long, prominent ears and a prominent lump over the nostrils. Pale rufous-brown above; buffy to whitish below; hairs grayish basally everywhere except for a throat patch of whitish-buff hairs; ears long and curled, joined at the base across the top of the head, marked with cross striations, and by far the most prominent feature of the animal; a rather large glandular lump above the nostrils. Membranes brownish. Length, 3.75 to 4.20 inches; tail vertebrae, 1.80 to 2.20 inches; forearm, 1.65 to 1.90 inches.

*Range in Kansas.* Known in Kansas only from Comanche and Barber counties, occurring in the gypsum caves in that region.

*Economic status and habits.* This bat is almost strictly a cave dweller though it is found in mine shafts and rarely in old, deserted buildings. It is among our shyest and rarest bats, and has been found very difficult to collect during the active season; it flies off quickly when spotted with a light or disturbed in any manner. It has not been taken in Kansas during the winter, though it probably hibernates in these caves. The flocks which were found by the 1933 and 1934 parties into the region varied from five or six to about thirty, though they sometimes occur in much larger numbers. Their food habits are similar to the other members of the family.

## GENUS ANTROZOUS

*Dentition:* 1/2; 1/1; 1/2; 3/3—28.

## BUNKER'S BAT

*Antrozous bunkerii* Hibbard

*Characters.* A rather large, heavy-bodied bat with long, striated ears. Light yellowish-drab above; whitish below; with the pelage everywhere light at the base; dorsal region marked with a "V" of dusky hairs and a few dusky hairs elsewhere; membranes brownish; ears paler. Ear, 1.2 inches long, with a narrowly rounded tip and a slender, tapering tragus. Length, 4.2 to 4.5 inches; tail vertebrae, 1.75 inches; forearm, 2.0 to 2.25 inches.

*Range in Kansas.* These bats were discovered by C. W. Hibbard, September 2, 1933, in the irrigation tunnel at Natural Dam, Barber county, and twenty-five specimens were collected at that time. They have never been seen since, the only other record being that of a dried carcass found in the tunnel by a field party from K. U. in the fall of 1934. The latter party had returned to the region with the express purpose of securing additional specimens of this newly discovered species. Hibbard has since (1936-'37) collected additional specimens near the type locality.

*Economic status and habits.* As has been indicated, practically nothing is known of this bat. Hibbard discovered the one flock in the tunnel on the date given and reported (Hibbard, 1934) that they had apparently occupied this shelter for only two nights, roosting at a different place each night. Various field parties have returned to the region and watched for the bat in both Kansas and Oklahoma, but so far it is known only from the original series.

## FAMILY MOLOSSIDAE

This family is characterized in part by the following: Tail projecting well beyond the limits of the short interfemoral membrane; tragus small and rounded, antitragus well-developed; muzzle blunt and obliquely truncate and bearing highly specialized hairs with spoon-shaped tips. They are skillful fliers, strictly insectivorous in diet, and of wide distribution in the tropical regions of the western hemisphere. Only a few forms reach the United States, and but one is found in Kansas.

## GENUS TADARIDA

*Dentition:* 1/2 or 1/3; 1/1; 2/2; 3/3—30 or 32.

## MEXICAN FREE-TAILED BAT

*Tadarida mexicana* (Saussure)

*Characters.* A rather small, delicately built bat, easily recognized because of its short, velvety fur and its free tail. Color varying from velvety grayish-black to hair-brown; slightly paler below than above; membranes blackish. Length, 3.75 to 4.10 inches; tail vertebrae, 1.2 to 4.1 inches; forearm, 1.6 to 1.75 inches. Lips rather thickened and glandular, and face thinly covered with short, bristle-like hairs. Ears rather coarsely striated with cross-bands. Ears meet on the head where they arise, but are not actually joined.

*Range in Kansas.* Known so far only from Barber and Gove counties, but probably occurs over much of south-central Kansas. The probabilities of the range in the Gove-Trego county region cannot be inferred at this time,

as this record is based on a single specimen from the Castle Rock region, collected by Peter Meier, in 1934. (Black, 1935.)

Since this work was prepared a note has appeared which definitely establishes the Mexican free-tailed bat as a breeding mammal in Kansas. Hibbard (Journal of Mammalogy, vol. 17, pp. 167-168, May, 1936) reporting the discovery of several colonies at Medicine Lodge by a University of Kansas museum party on August 31, 1935.

*Economic status and habits.* This is the species about which so much has been written with regard to the control of mosquitoes, and for which the bat houses, seen in the southwest, are erected. There seems to be no satisfactory proof that these bats act as effective mosquito controls, but nevertheless they are certain to be a tremendous check on the general insect life in any region



FIG. 23. Mexican free-tailed bat  
(*Tadarida mexicana*)

where they occur, because when present at all they generally are in such tremendous numbers as to force them to range widely in order to secure food.

No roosting cave of this species has yet been found in Kansas, but several caves occupied by the Mexican free-tailed bat are known not far across the state line in Oklahoma. Of these Marehew Cave, one half mile across the state line in Woods county, is the most famous. Although residents of the region insist that at present the bats are greatly decreased in number due to a guano fire which burned in the cave for several months before burning itself out and driving all the bats away, they are now present there in untold thousands. The entrance of this cave is wide and high, yet A. B. Leonard, of the Department of Zoölogy, University of Kansas, who has collected bats throughout this region at different times, tells me that when he timed the exodus from Marehew Cave one evening in September, 1934, it required two hours and forty minutes for the bats to get out of the cave. All the while, he says, they were flying out and away very rapidly and in an almost steady stream. This is the same species as that occurring in such tremendous numbers in the famous Bat Room of Carlsbad Cavern.

ORDER CARNIVORA. *Carnivorous Mammals*

Mammals of diverse size, with claws, and with highly specialized teeth modified for a flesh diet with the development of a pair of carnassial (shearing) teeth on each side, the incisors more or less reduced, and the canines strongly developed in both jaws. Clavicle reduced or absent; mostly terrestrial, but some aquatic or semiaquatic; brain rather highly developed. World-wide in distribution, excepting some oceanic islands and Australia.

## FAMILY PROCYONIDAE. RACCOONS

Hind feet plantigrade, like bears; toes 5-5; tail long, bushy and ringed; medium sized; tuberculate molars; muzzle elongated; front toes spreading. Only one species, of several geographic races, occurs in the eastern United States.

## GENUS PROCYON

*Dentition:* 3/3; 1/1; 4/4; 2/2—40.

## MISSOURI VALLEY RACCOON

*Procyon lotor hirtus* Nelson and Goldman

*Characters.* Size medium; total length, 28 to 33 inches; tail vertebrae, 9 to 11 inches; hind foot, 3.75 to 4.50 inches. Tail clublike, ringed with alternate rings of grayish and blackish; upper parts grizzled gray, brown and black, giving a grayish-brown color effect; prominent black mask across forehead and eyes; under parts dull brownish intermixed with yellowish-gray.

*Range in Kansas.* State-wide wherever timber and water are found; hence more common in eastern portion than elsewhere.

*Economic status and habits.* This animal is so well known to most people that a discussion of many of its habits appears unnecessary. It is most famous for its adept, almost monkeylike use of the forefeet; its childlike curiosity; and its remarkable habit of washing all food. In fact the specific name of this species, "*lotor*," is derived from the Latin word meaning "a washer." The inquisitive nature of the raccoon is put to practical use by trappers the country over by setting traps under water "baited" with only a bright piece of a tin can on the pedal of the trap—a lure which raccoons cannot resist.

No other mammal has figured so largely in accounts of the early settlement of our country as the raccoon, which furnished the famous "coon-skin cap" of the early hunter-trapper. From the very beginning of the fur trade in North America this mammal has been one of the most profitable and popular of the furbearers; in spite of this the raccoon has held its own remarkably well.

They usually den in hollow trees, although on occasion bluffs and rocky ledges are utilized. They prefer rather open woodland, and always frequent the borders of a small or medium sized stream, where they secure much of their food. They are rather omnivorous in diet, their food ranging from green corn and nuts to snakes, lizards, birds, small mammals, and eggs, while crayfish and frogs are favorite items.

Raccoons are strictly nocturnal, rarely being found abroad in daylight, and always hunt along streams. They are active most of the year, but hole up in the very coldest weather. The young, three to six in number, are generally born in April, and remain with their parents at least until fall.

This animal is one of our most valuable commercial mammals. Raccoon farming, pursued all over the country, has proven to be rather profitable, and the animals are reasonably easy to care for in captivity. In the wild state they are extensively hunted for their fur and for their flesh alike, their skins commanding a good price on the market, while young raccoon, properly prepared, is one of the best, if not the very best, flavored of all wild meats.

FAMILY MUSTELIDAE. *Minks, Weasels, Skunks, Otters, and Badgers*

Typically long and slender (badger and skunk more robust), short-legged carnivores with an anal scent gland more or less developed; teeth 34 to 38 of the typical flesh-eating type; upper molars always 1-1; toes 5-5; digitigrade to subplantigrade. Aquatic, semiaquatic and terrestrial, some forms not found in Kansas are semiarboreal. Six very distinct subfamilies are found in North America, four of these being known from Kansas.

Subfamily MUSTELINAE. *Weasels and Minks*

The typically long, slender mustelids. Digitigrade; tail slender or bushy (slender in Kansas forms); anal scent glands fairly developed; terrestrial or semiaquatic. The genus *Martes* is semiarboreal and occurs throughout the forested and mountainous parts of North America, but has long been extinct in Kansas.

GENUS MUSTELA

*Dentition:* 3/3; 1/1; 2/2; 1/2—34.

Both the terrestrial weasels and the semiaquatic minks are included in this large genus. With but few exceptions they are valued as fur-bearing mammals. All are famous as cruel and wanton killers.

LONG-TAILED WEASEL

*Mustela longicauda longicauda* Bonaparte

*Characters.* A rather large, long-tailed weasel. Color of upper parts pale yellowish-brown, darker on the head, upper lip and chin white; under parts paler, varying from almost whitish to sulphur yellow or buffy yellow; black tip of tail relatively short. Often pure white in winter except for the tip of the tail which remains black. Total length, of males, 17 to 18.5 inches; tail vertebrae, 6 to 7 inches; hind foot, 1.9 to 2.2 inches. Measurements of females somewhat less, total length averaging about 2.5 inches shorter than males.

*Range in Kansas.* This form of the weasel occurs in northern Kansas west of the Flint Hills. Specimens from as far south as Pratt county and east to Riley county have been referred to this race. The genus is now being monographed by Dr. E. R. Hall of the University of California. Until his work is completed the exact subspecific relationship and distribution of this and the following two forms in Kansas will be open to question. The tentative arrangement supplied Hibbard in 1933 by Doctor Hall is followed here.

*Economic status and habits.* All weasels are killers of the highest rank, and are greatly feared by animals many times their size. As Nelson (1918) so aptly says "Weasels are wonderfully endowed for their predatory work and are undoubtedly the most perfectly organized machines for killing that have been developed among mammals." Their slender, snakelike build makes it possible for them to track out their prey in places inaccessible to other mam-

mals, while their keen eyes, sensitive ears and well-developed sense of smell makes them especially well adapted for the detection of prey. These faculties, combined with a lust to kill that has no equal in all the animal kingdom, have justly earned for them the rank of "killers unexcelled."

Wherever weasels are found their habits are much alike. Rats—fierce fighters themselves—rabbits many times larger than weasels, and poultry are easy victims of this bloodthirsty pirate. All the smaller mammals live in constant dread of the weasel, which acts as a very decided check upon the increase of rodent life.

Their habit of killing much more than they can hope to use for food is well known in relation to chickens, and many a farmer has ruefully surveyed a henhouse strewn with the bodies of dead chickens as the result of a night raid by a weasel. I have known a single animal to kill twenty-six grown chickens in one night, while Nelson (1918) says they often kill thirty or forty.

Weasels, strangely enough, are not common in this region, and, indeed, are not anywhere as common as one might expect. They seem to be victims of larger predators than themselves, and apparently pay a heavy toll to the other Carnivora. Otherwise their numbers would increase quite rapidly, as the matter of securing food does not appear to be a restricting factor with them. From four to twelve, usually five or six, young are born each year, in one litter, and the time of birth is given as anywhere from April to June, probably the last of April in this section. They frequent rock fences, ledges and outbuildings. Weasels are often found in the burrows of other animals, which they have probably taken by force.

#### MISSOURI WEASEL

##### *Mustela longicauda primulina* Jackson

*Characters.* Differing from the preceding in being smaller, with a shorter tail, darker upper parts and a yellow belly; black tip on tail also relatively longer. Upper parts a rich glossy brown ("Brussels brown"), the belly varying with individuals from a rather canary yellow to pale sulphur yellow; chin white; tail rather broadly tipped with black. Not known to turn white in winter. Total length of males, 12 to 14 inches; tail vertebrae, 5 to 6 inches; hind foot, 1.8 to 2.2 inches. Females averaging slightly smaller.

*Range in Kansas.* This is the form of weasel found throughout eastern Kansas. Locality records are rather unsatisfactory and its definite limits are not known; it may be expected to range west at least to the Flint Hills, and should be found to intergrade in central Kansas with typical *longicauda*.

*Economic status and habits.* Practically the same, so far as known, as the preceding.

#### NEW MEXICO BRIDLED WEASEL

##### *Mustela frenata neomexicana* (Barber and Cockerell)

*Characters.* A very large, long-tailed weasel with a conspicuous white "bridle" across the head. Upper parts pale buffy-brownish, tail like back, with terminal one inch black; belly pale buffy-yellow; face and top of head blackish-brown with a rather broad white stripe across the head between the eyes. Total length, 18.5 to 21 inches; tail vertebrae, 7.5 to 8.5 inches; hind

foot, about 2 inches. These measurements as usual, apply to the males, the females in the entire genus being somewhat smaller.

*Range in Kansas.* Known at present only from a few records from Stevens and Seward counties. Limits in Kansas unknown; possibly entire southwestern corner.

*Economic status and habits.* Like the two forms above. A rather powerful animal, and Nelson (1918) has recorded a battle between one of these weasels (the Mexican form) and a very large pocket gopher which he ended by collecting the gopher, but it was quite evident that the weasel was the master of the situation.

#### BLACK-FOOTED FERRET

##### *Mustela (Putoris) nigripes* (Audubon and Bachman)

*Characters.* A weasel-like animal, somewhat larger than any of our weasels, and with a distinctive color pattern. Upper parts pale buffy yellow, whitish on the face. All of under parts, including the throat and lower surface of the tail, whitish. Slightly darker brownish on top of head and along middle of back, and with a prominent black mask across the eyes; feet and terminal one third of tail black. Average measurements of males as given by Anthony (1928) are: total length, 23 inches; tail vertebrae, 5.3 inches; hind foot, 2.4 inches; females slightly smaller.

*Range in Kansas.* Throughout western and central Kansas wherever prairie-dog towns are still found; very rare, but the isolated records are well scattered. The eastern known limits are Lincoln and Kingman counties.

*Economic status and habits.* Seton (1929) sums up much of the scant knowledge about this carnivore in the following sentence: "We know that it lives as a parasite in the dog towns, lives like a mouse in a cheese, for the hapless prairie dogs are its favorite food, and its den is one originally made by the prairie dog for himself."

It is most certainly a competent slayer of prairie dogs, and there are many accounts of dog towns which were supposed to have been exterminated due to the activities of a family of ferrets. No doubt it kills and eats other small animals that it chances to find, as do all the weasels, but its known range is identical with that of the prairie dog, and it lives only in their burrows, therefore one is quite safe in presuming that the ferret is absolutely dependent on the prairie dog.

#### MISSISSIPPI VALLEY MINK

##### *Mustela (Lutreola) vison letifera* Hollister

*Characters.* A rather large, short-tailed, weasel-like mustelid, aquatic in habits. Color everywhere light brown, except spotted on the throat, breast, and chin with white. Pelage rather glossy, due to the long, glossy "guard" hairs overlaying the shorter underfur. Total length, of males about 26 inches; tail vertebrae, 7.5 inches; hind foot, 2.9 inches; females somewhat smaller.

*Range in Kansas.* State-wide wherever permanent water is found in any quantity; the only museum record of which I have knowledge west of the Flint Hills is from Logan county, but it is known to have occurred throughout the state. There are numerous records from eastern Kansas. Once common, but now rapidly becoming extinct.

*Economic status and habits.* Wily and cautious though the mink is, the relentless trapping of this mammal for its valuable pelt has so greatly reduced its numbers that it can no longer be considered of any economic importance in our state. It was once common along all the streams in eastern Kansas, but now the catching of a mink is something of an event. Trappers so pride themselves on their ability to catch this animal that no mink has a chance once its presence in a locality is discovered—no thought seems to be given to the fact that such ruthless slaughter can lead to but one result—absolute extinction of a valuable fur bearer.

Concerning the disposition of the mink, Anthony (1928) says: "A trapped mink is the triple-distilled essence of fury and red-eyed rage." They are well known for their ferociousness and their lust to kill, though they are not as given to wanton slaughter as are weasels. They are limited neither to the land nor water for their food, but secure their prey either from the streams themselves or along their banks, their food thus ranging from frogs and fish to rabbits, mice, birds, and eggs.

The single litter of young, three to ten in number, usually five or six, is born in April or May. The den is always situated near water.

#### Subfamily LUTRINAE. *Otters.*

Long, slender mustelids, with webbed toes, flattened heads, short legs, and a long, muscular tail. Semiaquatic in habit.

#### GENUS LUTRA

*Dentition:* 3/3; 1/1; 4/3; 1/2—36.

#### INTERIOR OTTER

#### *Lutra canadensis interior* Swenk

*Characters.* This mammal, if ever seen again in Kansas, may be easily distinguished by its dark-brown color, long muscular tail, lithe body, and webbed feet. Total length, 50 to 55 inches; tail vertebrae, 16.5 to 20 inches; hind foot, 4.5 to 5.2 inches.

*Range in Kansas.* Formerly ranged over the entire state, or presumably so. There are museum records from Trego, Wabaunsee, Douglas, Miami and Greenwood counties. Now wholly extinct within the state. There is but scant possibility that it will ever be found in Kansas again.

*Economic status and habits.* Because of the great improbability that this animal will ever be found in Kansas but little needs be said on this point. The extremely valuable fur of the otter has been the cause of its extinction. The fate of the otter should make us consider carefully our treatment of the other fur bearers. The mink, at least, is doomed soon to join the otter on the list of those mammals which "once lived in Kansas."

Perhaps the most characteristic feature about the home life of the otter is its habit of making slides on which it plays much of the time, such slides being made either in the snow, if it be winter, or in clay during summer.

The one to three young that are born in the single annual litter arrive in April or May. Their den is near a stream, and usually with an under-water entrance.

Although various forms of aquatic life are utilized, such as frogs, crayfish, and mollusks, fish comprise the principal part of their diet.

## Subfamily MEPHITINAE. Skunks

Rather robust in form, tail long and bushy, color pattern conspicuously black and white; anal scent glands well-developed; terrestrial in habit.

## GENUS SPILOGALE

*Dentition:* 3/3; 1/1; 3/3; 1/2—34.

## PRAIRIE SPOTTED SKUNK

*Spilogale interrupta* (Rafinesque)

*Characters.* The only representative of the genus found in Kansas, and always easily recognized by its black-and-white color pattern, medium build and bushy tail. Much smaller and not so robust as the following. Color everywhere black except for irregular spots or stripes of white on the head and back, four narrow, irregular longitudinal white stripes generally in the shoulder region, these frequently broken up into spots. Tail black, sometimes with a few terminal hairs of white. Total length, 17 to 22 inches; tail vertebrae, 7 to 9 inches; hind foot, 1.75 to 2.25 inches.

*Range in Kansas.* Common throughout the state.

*Economic status and habits.* Very important as a fur bearer. The low price of its fur is offset by its common occurrence over much of the state.

There is hardly a locality in Kansas where these carnivores are not found. Plains and woodland alike seem to be accepted by them, and it has been frequently noted that this species is decidedly on the increase; the range of the genus is steadily spreading.

Their method of protecting themselves with a secretion from a pair of anal scent glands, exactly as the larger skunks do, is well known. People agree that the musk of this genus is more powerful and more disagreeable in every respect than the similar protection of the common skunk. This rather unique protection employed by the skunk tribe has earned for them the respect of all land dwellers and they are remarkably free from molestation by other animals. The great horned owl seems to be the one enemy that disregards this protection; at any rate the majority of these birds are well "perfumed" when taken and remains of *Spilogale* or *Mephitis* in great horned owl stomachs are rather common. The bobcat is also known to prey upon the skunks.

As with most of the other carnivores native to Kansas this species is rather diversified in its food habits and is not at all limited to a meat diet. Although mice form a large share of their menu, stomach analyses seem to indicate that their predominant food is insects. Fruit, nuts and other vegetable matter are frequently taken. Gray squirrel remains have been found in their dens, and they are often caught in pocket gopher runs, indicating that this injurious rodent is a frequent victim of the spotted skunk.

They produce but a single litter a year, two to six in number, nearly always four or five. The den is usually a natural cavity in the rocks, or a burrow deserted by, or captured from, some other animal, although they have been known to dig burrows for themselves. Not infrequently they inhabit deserted houses and outbuildings, and I have recently been informed of an instance where these animals took possession of the second story of an occupied dwelling. The latter instance took place in a well-to-do section of a fairly large southern city. My latest information was to the effect that the "civet

cats" (their common name over most of the south) were still very much in command of the situation.

Its food habits make this self-confident little carnivore a valuable asset, even more valuable alive than as a part of a fur coat. Most of the charges brought against it are untrue, or unfairly emphasized. Thus, it is beamed as a killer of chickens, but such cases are rare. The most serious crime charged against the spotted skunk is that it carries rabies, and this mammal is frequently known as the "Hydrophobia Skunk." As Anthony (1928) points out, the spotted skunk may indeed carry rabies, and in fact deaths have been recorded from their bite, but it is no more likely to carry rabies than any other animal, and is certainly not nearly so dangerous on this score as either the domestic dog or cat. Nelson (1928) relates a few instances of bites received by ranchmen in the southwest, inflicted while the men were sleeping in the open, and by a spotted skunk which unquestionably had rabies. Needless to say, however, the odds are very great against it, and one runs more risk of infection every day from some stricken dog or cat.

#### GENUS MEPHITIS

*Dentition:* 3/3; 1/1; 3/3; 1/2—34.

#### ILLINOIS SKUNK

*Mephitis mesomelas avia* (Bangs)

*Characters.* Easily distinguished from all other mammals in its range by the robust build, long bushy tail, bright black pelage and the characteristic white striping. Similar to the following, with which it intergrades. Color everywhere a glossy black except for a white stripe arising on the face, spreading out and dividing into two dorsolateral stripes at the shoulders. This stripe is quite variable in both width and length, frequently extending into the tail on the Kansas specimens. All or most of the hairs on tail are black to the base. Total length, 23 to 25.5 inches; tail vertebrae, 8 to 10 inches; hind foot, 2.25 to 2.80 inches.

*Range in Kansas.* Quite common east of the Flint Hills. Specimens from Greenwood county have been referred to this race.

#### LONG-TAILED TEXAS SKUNK

*Mephitis mesomelas varians* (Gray)

*Characters.* Very similar to the preceding, but differing in having a much longer tail in which most or all of the hairs are white at the base, and usually with the dorsolateral white stripes much wider. It may be rather easily distinguished in typical specimens by the very long tail. Over much of central Kansas, however, intergradation with the preceding form is to be expected, so that the majority of specimens from this region are probably not very much like either form. Specimens from western Kansas are almost typical of *varians*. Total length of males, 28.5 to 31 inches; tail vertebrae, 15 to 16 inches; hind foot, 2.3 to 3.0 inches. Females about 3 inches shorter.

*Range in Kansas.* As indicated above; that is all of Kansas west of the Flint Hills, but being intermediate over much of the central portion with *avia*. Museum material from all the central Kansas area of this, as with most other forms, is not available, so no definite statement can be made regarding

what form occurs in this section. Specimens from Harvey county have been referred to *varians*.

*Economic status and habits.* No bully ever swaggered through the streets of a country village with more self-confidence and arrogance than the skunk swaggers its way through life, boldly certain that no other furred animal will cross its trail. Now and then the country bully comes to sudden and unexpected grief, and in the same way the confidence of the skunk is poorly founded if a hungry bobcat or great horned owl meets with it, but otherwise its life is an unmolested one—the other wild animals respect and fear its liquid-gas protective apparatus and give this mammal a wide berth wherever it chooses to wander. So certain has the skunk become of the all-powerful effect of its scent that fear, and even shrewdness, have been lost. This carnivore is not the lithe, agile creature that its cousin the weasel is; nor is it a shy, cautious animal as are most of the other wild creatures. Instead the skunk blunders and struts through life, and if one may judge from the numbers which are to be found in most localities it is correct in assuming this attitude, for the animal is certainly a successful one. Against man the scent gland protection is rather ineffectual—it will not spring traps, nor ward off shot, but it certainly is a potent protective device against most of the wild animals that otherwise would make short work of the skunk.

The color pattern of the skunk has been variously interpreted. Some believe that it is a warning coloration—a flag worn on the back to advertise to the world that this four-footed being is equipped with an ample and extremely disagreeable method of defense. Others believe that it is a color pattern that in the night light—when the skunks do most of their hunting—serves to conceal them from their intended prey; a type of color pattern we call “offensively protective.” The first idea appears to be the most reasonable, especially when we take into account that the skunk secures most of its food by rooting and digging, and that a large percent of its diet is made up of insects. There seems no doubt but this warning coloration saves many a skirmish with an unsuspecting enemy, and thus serves as a direct protection as well as to enable it to conserve its supply of liquid gas.

Other than insects, the diet of the skunk, as with many of our other carnivores, is quite varied, and may include almost any sort of animal life and small fruits. Mice, lizards, birds and bird eggs, ground squirrels, frogs and salamanders are eagerly sought for. Grasshoppers are a favorite food. They frequently raid chicken houses and may destroy large numbers of poultry, but such cases involve only a single individual and with the killing of the particular skunk the matter should be considered a closed chapter. It is not only needless but foolish to make the depredations of a single animal the excuse for war against all its kind. The skunk is a valuable fur bearer and for this reason alone should be protected and trapped only enough to make certain that the drain is not more than the population can stand. In food habits all of our Mustelidae are highly beneficial, and the skunks especially so.

Skunks den up during the very coldest weather in the north and probably do so for short periods during extreme weather in this latitude. The young, two to sixteen in number, usually four, five, or six, are born in April or May. They remain in the same den with their mother until the following spring, the

male usually living alone except for a period of about two months in early spring, being driven off by the female before the young are born. Their den may be in a cliff, a rock pile, a cave, or any other sort of natural shelter. Old badger burrows are frequently utilized on the prairie, while they may on occasion dig their own den.

#### Subfamily TAXIDIINAE. *American Badgers*

Robust, short-legged carnivores, with remarkably strong forelimbs armed with long, strong digging claws; tail rather short; body flattened.

#### GENUS TAXIDEA

*Dentition:* 3/3; 1/1; 3/3; 1/2—34.

#### COMMON BADGER

*Taxidea taxus taxus* (Schreber).

*Characters.* The following, in addition to those listed under the discussion of the subfamily: Large and heavy-bodied; general color of upper parts grizzled gray with a prominent narrow stripe of white arising on the forehead and continuing to or a little beyond the shoulders; a whitish patch on each side of the face before the eye and ear; rest of face prominently marked with dull black; the feet black; tail yellowish brown; under parts buffy-whitish. Total length, 26 to 29.5 inches; tail vertebrae, 5 to 6 inches; hind foot, 3.7 to 4.4 inches. Average weight about fourteen pounds, frequently much larger, H. H. T. Jackson has reported an adult male from Wisconsin which weighed twenty-three pounds, six ounces, apparently the largest specimen on record.

*Range in Kansas.* All of Kansas west of the Flint Hills. Specimens have been taken east as far as Riley and Greenwood counties. The single record from Greenwood county approaches the Texas badger, *berlandieri* in color, but it seems best to refer this specimen to the present race in the light of our knowledge of the distribution of the badger.

*Economic status and habits.* This powerful, low-built carnivore, which has been described as "A small bear which has been flattened somehow . . .," is one of the most characteristic of the plains mammals. It is slow of movement and truculent of disposition, and such a capable fighter that it quite easily overpowers any other mammal of its own size which it chances to encounter. Some years ago an incident occurred in the K. U. Museum which well illustrates the remarkable strength of this animal. A large captive badger had become entangled with a bit of burlap, which had been hung in the cage for its amusement, in such a manner that its mouth was bound shut. As soon as its plight was discovered, probably after three or four days, Mr. C. D. Bunker, assistant curator in charge of the museum, set about to remove the cord from the badger's mouth. Before the mammal was finally released six grown men were helping with the work, five holding it in various places while Mr. Bunker removed the cord, and after that struggle the badger remained morose and sullen, soon dying, probably as the result of some internal injury.

The strength of the badger's forelegs is almost unbelievable. Observers watching this animal on the prairie have frequently reported its ability to dig in hard prairie soil so rapidly as to send a spray of dirt four or five feet into the air.

They secure their food by just such digging as this, ground squirrels and prairie dogs being their favorite victims, although all rodents are readily captured; the eggs and young of ground-nesting birds are also eaten when opportunity affords. Insects form a minor part of their diet. Wherever badgers occur their diggings comprise somewhat of a menace to livestock.

The two to five young are born in late May or early June, in a burrow which seems to be somewhat of an elaboration of any one of the countless holes these animals are always digging.

The badger is another of the many mammals which seem doomed to extinction, although one of great value to man. Whether it be for its pelt, or because of the holes its digs, or simply for the sake of killing something, man tends to kill as many badgers as possible wherever his habitation and that of the badger coincides. The work of this animal in controlling injurious rodents should earn it full protection from the farmer, whom it befriends, instead of such relentless persecution.

#### FAMILY CANIDAE. *Wolves, Coyotes and Foxes*

The members of this family are instantly recognized because of their dog-like appearance, the dog in fact being its best-known representative. These animals form a compact, well-differentiated group, all very much alike in general appearance and habits. They are carnivores and prey upon various other animals according to their size, ability and surroundings. Their teeth are typically carnivorous with strongly developed canines (the tooth named from this family, hence the "dog tooth"), reduced incisors, and well-developed shearing teeth.

Technically they are further distinguished by their long muzzles, long, slender legs, nonretractile claws, digits four on front foot, five on hind foot, tail in our forms usually bushy, and progression digitigrade. Three of the four North American genera are represented in Kansas.

#### GENUS VULPES

*Dentition:* 3/3; 1/1; 4/4; 2/3—42.

To this genus belongs two Kansas species, the red fox and the swift or kit fox. The generic characters are practically those in common to the two species.

#### EASTERN RED FOX

#### *Vulpes fulva* (Demarest)

*Characters.* A medium-sized animal normally with bright golden to reddish upper parts; bushy tail mixed yellowish and black, *prominently tipped with white*. Head paler, rump lightly grizzled, and under parts white. Forefeet black to the elbow and the hind feet black. As Seton (1929) says: ". . . marvelous color beauties of its exquisitely blended tawny pinks, russets and yellow browns, set off by the old gold, dull silver, and shining ebony of its extremities." It may be instantly distinguished from the gray fox by the white-tipped tail and black forelegs.

Total length, about 40 inches; tail vertebrae, 12 to 13 inches; hind foot, 7 inches.

*Range in Kansas.* Eastern Kansas, east of the Flint Hills in the wooded portions of the state; locally common.

*Economic status and habits.* Few of our smaller mammals are as well known as the red fox, famous both in this country and England as an animal of the chase.

There is a prevailing opinion that our species is not native to this country, but imported from England, while others believe it to be a mongrel species representing our northwestern red fox on one side, and the English red fox on the other. Seton (1929), who has given considerable time to the study of the fox, is of the latter opinion. At any rate the eastern red fox, rare in the eastern part of the country in the early colonial days, has increased ever since the advent of the white man and is still increasing its range so that practically the whole of North America is now represented by some race. There have been a number of subspecies described, but the ranges of most of them are so imperfectly known as to make it impossible at the present to say which subspecies occurs in Kansas. The usual method is adopted herewith and the species called merely by the full specific name.

Wherever common the red fox is quite a predator of poultry and cases are frequent of this species making off with entire flocks of chickens by a series of raids. In most of Kansas, however, it does not occur in sufficient numbers to be of any great importance other than as a fur bearer. Red fox skins have always commanded relatively high prices among the fur mammals, and the animal is much sought after by hunters and trappers wherever it occurs. The cross fox and the black or silver fox of the North are unusual color phases of the red fox. The justly famous silver fox is an extremely melanistic phase of the animal and is the second most valuable of all North American furs, only the extremely rare sea otter pelt commanding a higher figure. Canadian silver fox furs have frequently sold for more than \$1,000. Kansas red fox skins range in market value from as low as \$4 to \$20 or \$25 in seasons of high prices.

The value of the red fox to a given area is a much disputed question. In some sections it is rigidly protected and "preserved for the chase" as in Arkansas where the species, along with the gray fox, is awarded full protection the year-round. In others it is considered an undesirable predator, and extensive fox hunts are organized for its extermination, and, in Pennsylvania at least, it has been considered so great a menace to other wild life that bounties have been paid for red-fox scalps. As is usually the case where such extreme divergence of opinion is encountered, a middle course seems most advisable. It is reasonably certain that a normal open season on this species would serve to keep it sufficiently in check to prevent any serious inroad on other wild life without recourse to bounties. On the other hand the full protection of such a hardy and wily animal in a favored habitat cannot fail to result in overpopulation, with great damage both to domestic poultry and wild life. In northwestern Arkansas at present the two species of fox occurring there have so wholly overrun the section that countless farmers have abandoned all efforts to raise poultry, while the quail population (whether from this cause or others I will not attempt to say) is diminishing to a dangerously low level. Such protection is wholly unwarranted, as is proven by the fact that in the neighboring regions of Oklahoma, where the same sort of habitat prevails, the foxes are very plentiful and provide ample numbers for the chase as well as being a profitable source of revenue to fur hunters and trappers.

Much has been written, but apparently little known, concerning the food

habits of the red fox. Seton (1929), whose excellent study of the same animals embraces a large percent of all our present knowledge of our fur-bearing mammals, reports cases of mouse hunting that have been observed, and suggests that although game birds, poultry and rabbits may form a goodly share of the red fox diet, mice are the important staple food item. In the south-central United States, at least, this must certainly be true for the simple reason that there would not be sufficient food to support the known population in certain regions if they did not resort to smaller game than poultry and rabbits, and that throughout the region where foxes become exceedingly common the mice soon become rather scarce. Ecological data from Oklahoma, Arkansas, Missouri and southeastern Kansas on this question would be of considerable interest if they could be gathered.

A recent paper (Hamilton, 1935) dealing with the food of the red fox in New York and New England contains some very interesting information on the food of this species. Stomach analyses of 206 fall and winter red foxes are given. Of these specimens 29.3 percent of the food, by bulk, was found to be mice, 22.1 percent rabbits, 13.9 percent grasses, 8.0 percent carrion, with shrews, birds, worms, grains, nuts, insects, fruits and trash in small quantities. Poultry was found in 11 stomachs and bulked 3.1 percent of the total food, while game birds were found in only 5 stomachs to make up but 1.4 percent of the total. In the same report some consideration is given to summer food, of which but little is as yet known. Remains found by, or reported to Hamilton, however, indicate a strong tendency for such items as turtle eggs, woodchucks, fruits and berries.

In view of the great spread of this species over most of the country, its apparent absence, or at least extreme rarity, in western and central Kansas is of considerable interest. Data have been advanced which show that the fox is but a poor competitor against the coyote, and it is probable that the abundance of the latter animal over the true prairie region of Kansas is the factor which limits the westward distribution of the red fox.

Both this and the gray fox den under rocks, in bluffs and in deserted (or captured?) dens of other mammals and hollow logs and stumps. The three to nine young are born early in the spring, usually in March in this section.

#### KIT FOX

#### *Vulpes velox velox* (Say)

*Characters.* A very small, lightly built fox, much paler than the preceding, buffy yellow, frosted with white and intermixed with black above; under parts white; tail buffy gray above, *tipped with black*. Size small, "not larger than a house cat," total length, about 26 inches; tail vertebrae, 9 inches; hind foot, 4 inches.

*Range in Kansas.* So far as museum records indicate this fox is known from specimens from Douglas, Logan and Cheyenne counties. It is most certainly extinct in the eastern part of the state now, and nearly so if not entirely extinct in all Kansas. It possibly still occurs in a few localities.

*Economic status and habits.* In Kansas this typically prairie mammal is, if present at all, now so rare as to make it of no importance from an economic standpoint. The species is now rare in most localities where it persists, and but little is known concerning its habits. It is extremely shy and secretive, very

fleet of foot, hence the often applied name "swift" and the scientific name "*velox*" meaning the same thing. They den in burrows dug on the prairie and the common number of young appears to be five.

There seems to be little doubt that this fox is doomed for extinction. Reports and scientific papers from throughout its known range clearly indicate that, quite unlike its larger relative, it cannot stand the competition of man. It was probably the least harmful and most beneficial of all species of Canidae occurring in this section.

GENUS UROCYON. *Gray Foxes*

*Dentition:* 3/3; 1/1; 4/4; 2/3—42.

WISCONSIN GRAY FOX

*Urocyon cinereoargenteus ocythous* Bangs

*Characters.* Size, about the same as the red fox, hind foot somewhat smaller, total length, 40 to 41 inches; tail vertebrae, 12 to 15 inches; hind foot, 5.0 to 5.5



FIG. 24. Gray fox

inches. Color of upper parts, including top of tail, grizzled gray and black; sides, sides of neck, most of legs, under side of tail and chest band rufescent or tawny-yellowish, varying in intensity; under parts white, with a black spot on the chin; tip of tail *black*, and a black stripe above on terminal two thirds of tail.

*Range in Kansas.* Eastern Kansas, east of the Flint Hills, specimens being available in the K. U. museum from Douglas, Greenwood, Elk and Wilson counties. Probably much more common in southeastern Kansas than the red fox, as in the adjoining states, where this species outnumbers the red fox by at least five to one.

*Economic status and habits.* Most of that which has been said concerning the red fox applies to this species. It is more southern in distribution and increases in proportion to the red species in the southern part of the state, but there is every indication that the red fox is increasing more rapidly than the native gray, and in a few years may outnumber the latter.

Although not as "sporty" a fox as the red, this, like its more famous relative,

is hunted for the chase, the idea being not to kill the fox, but to enjoy the "music" of the barking dogs. It holes more readily than the red fox, however, and consequently does not provide as much entertainment. From the standpoint of commercial value the skin is worth considerably less than that of the red fox, but this is offset by the fact it is usually more easily caught in traps.

The exact classification of these foxes is in as much of a muddle as that of the red foxes, and the entire group is badly in need of a careful revision. The precedent of Hibbard (1933) in referring the Kansas specimens to the subspecies *ocythous* is here followed, and that is the name under which Kansas specimens are catalogued at the K. U. museum. It is highly probable that the specimens from southeastern Kansas, at least, should be referred to *cineroargenteus*, or to a subspecies as yet undescribed.

In breeding habits and selection of a den this species is very similar to the red fox. The number of young appears to be less, the accepted number being from three to five. They apparently prefer rougher, more densely wooded cover than the red fox and are found in greatest numbers in the region of forests and bluffs away from cultivation, though they are not uncommon through the farming region, and capture chickens from the barnlot quite as readily as the red species.

In food habits the gray fox is not as strictly carnivorous as most of the Canidae, but is rather omnivorous and is said to accept almost any available sort of food, from small birds and mammals to berries, nuts, and even mushrooms. In view of this it would appear that this species should easily hold its own against the more wily and daring red fox in spite of the latter's larger families and more resourceful ways. The balance seems to favor the red fox, however, no doubt due to its greater ability to cope with man and man's various devices of destruction.

#### GENUS CANIS

##### *Wolves and Coyotes*

*Dentition:* 3/3; 1/1; 4/4; 2/3; 42.

In this genus are to be found two groups, poorly defined from one another, the subgenus *Thos* including the coyotes, and the subgenus *Canis* the true wolves. They are much like the foxes in general characters, but somewhat larger and heavier of build. There are four species known from Kansas.

#### NORTHERN COYOTE

##### *Canis latrans* Say

*Characters.* Grizzled buffy, grayish and black above, under parts whitish with some black hairs in throat forming a collar, *back of ears fulvous*; upper side of tail like back, tipped with black, below whitish at base succeeded by buffy-yellow. Length, from 34 to 49 inches. Males averaging somewhat larger than females. Seton (1929) suggests that this species may usually be distinguished from the gray wolf by the fact that the underfur of the wolf is usually gray-brown, and that of the coyote is usually sienna-brown. Mr. C. D. Bunker, who has had much experience with the two species in the field, tells me that one of the most reliable distinguishing characters is the size of the foot, or rather that part of the foot which strikes the ground, more properly the digits, which is much larger in the wolf than the coyote. Seton (1929)

gives a wolf track illustration of a front foot which measured four and three fourths inches both directions while that of the coyote is much shorter and scarcely half as wide. In color the two species are almost identical.

*Range in Kansas.* Eastern Kansas, mainly from the Flint Hills east, but also known from Clark, Comanche and Cheyenne counties, thus occurring throughout the state, with the probable exception of the extreme southeastern corner, from which it has not been reported. It is known from Greenwood county, where it is rather common.

*Economic status and habits.* The coyote is extensively hunted as a killer. It is condemned alike by ranchers and all others because it "kills sheep" or "kills game." It is readily admitted that coyotes do kill some sheep, and that on occasion they may even kill calves, but in view of the limited sheep raising now being attempted in Kansas they can do but scant damage to livestock in this state. On the other hand, they prey constantly and with remarkable success on rodents and consume vast quantities of jack and cottontail rabbits. It is almost certain that if hunting of coyotes was not carried to such an extreme the people of western Kansas would not be plagued with rabbits as they are at present. In killing off the coyotes they have removed one of the most perfect of the many controls of nature and have brought upon themselves the necessity of killing the rabbits as well. The unrelenting attitude of "kill, kill, kill" has become so uppermost in the minds of most people that they fail to see the good in any animal which does not profit them in dollars and cents in the most direct manner.

The coyote may be a rascal and a pest; it may even be as bad as it is painted to be in certain limited sections, but the coyote isn't bad enough to merit the relentless war of extermination that is being waged against it. An experiment of protecting the coyote in two or three western counties for five or six years and at the same time carefully checking the amount of damage done by coyotes, as well as noting the decrease in rodents and rabbits, and the lessened damage credited to them, in contrast to the conditions in similar counties under the present system, might be rather educational. As a final plea of justice for the coyote I would suggest that its enemies carefully consider how much of the damage charged to it is really the work of the coyote and how much should be placed against the account of dogs.

They do not run in packs as the wolves do, but prefer to hunt singly or in pairs. Occasionally, however, they do gather in packs to hunt larger game, such as deer. Many interesting stories, too lengthy to be recorded here, are told concerning their shrewdness and teamwork in securing prey.

The young, three to ten in number, usually five, six or seven, are born in April and remain in the den until August. The dens are usually dug in the prairie by the coyotes, although their use of badger holes has been recorded.

#### NEBRASKA COYOTE

#### *Canis nebracensis nebracensis* Merriam

*Characters.* Very similar to the preceding and of virtually the same size, but much paler in coloration. Its chief distinguishing characteristics are the absence of a black collar and the buffy instead of fulvous color of the backs of the ears. It also averages slightly smaller than *latrans*, but the difference is not appreciable on individual specimens.

*Range in Kansas.* Entire state west of the Flint Hills. This is the common wolf of western Kansas. It has been recorded as far east as Ottawa and Riley counties.

*Economic status and habits.* What has been said of the preceding species also applies to this animal.

## OKLAHOMA WOLF

*Canis frustrator* Woodhouse

*Characters.* Small for a wolf and considered a coyote by some writers. Reddish yellow to brown above, the tail prominently tipped with black and with much black on the upper surface. Size about the same as the two preceding.

*Range in Kansas.* Now probably extinct in Kansas. The last-known record is that of a specimen shot in Cherokee county in 1909. It once was common in southern Kansas, and is still to be found in small numbers in parts of Oklahoma. "Yellow wolves" from northwestern Arkansas, rarely reported, are possibly of this species; otherwise it appears to be quite extinct.

*Economic status and habits.* Probably the same in general as the rest of the genus. Definite information concerning this species is not available.

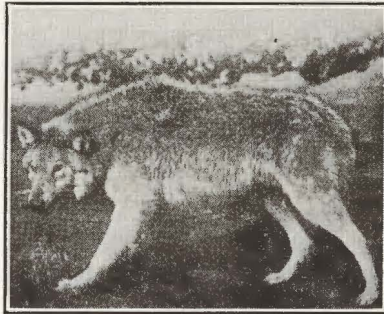


FIG. 25. Timber wolf.

## TIMBER WOLF

*Canis nubilus* Say

*Characters.* Coloration practically identical with the northern coyote, as above, and to be distinguished by its much larger track and larger size; there are also cranial and dental differences which serve to distinguish it. Total length, 52 to 63 inches; tail vertebrae, 12 to 16 inches; hind foot, 9 to 10 inches. Females, as with the coyotes, considerably smaller than the males. Black wolves are rather common, while some are yellowish, and might easily be confused with the preceding species.

*Range in Kansas.* Extinct in the state so far as known. It is quite probable, however, that occasional specimens may wander into the southeastern corner of the state, as it is known to be locally common in parts of the Ozarks, and is at least holding its own if not actually gaining in numbers.

*Economic status and habits.* This powerful and famous killer, if it is ever again found in Kansas, is never likely to regain numbers sufficiently to be of

any economic importance. It is well known that they kill both cattle and sheep in large numbers, frequently killing far more than they need for food; in short, little can be said in their defense, although it is regrettable that such a colorful and powerful animal is so certainly doomed to extinction because his habits make him an enemy of man.

#### FAMILY FELIDAE. *The Cats*

Medium to large carnivorous animals, with large strong canines, shearing cheek teeth, retractile claws. Toes, five in front, four behind. Practically world-wide, and of several genera, but represented in Kansas by only a single genus.

#### GENUS LYNX. *Bobcats*

*Dentition:* 3/3; 1/1; 2/2; 1/1—28.

#### BOBCAT

#### *Lynx rufus rufus* (Schreber)

*Characters.* A medium-sized, short-tailed cat, total length, 27 to 33 inches; tail vertebrae, about 7 inches; hind foot, 7 inches. Color, buffy-brownish, spotted with blackish, the darker coloration occurring in the middorsal region; top of head streaked with black, small black tuft on ear, which is black posteriorly with a gray spot; tail concolor with back above tipped with black, concolor with belly below, no black on tip on underside of tail. Whitish on under parts, neck washed with buffy and breast spotted with black.

*Range in Kansas.* Formerly all over eastern Kansas, now limited to the more heavily wooded portions in the southeast corner of the state.

#### BAILEY BOBCAT

#### *Lynx rufus baileyi* Merriam

*Characters.* Averaging smaller than preceding, tail usually about six inches long. The weight of this form, according to Bailey (1931), is twenty pounds for a young adult female. Much like preceding, but color in summer pale yellowish, and yellowish-gray in winter. "Tail has, invariably, a white tip with black subterminal bar above and traces of several narrower bars back of this." Under parts generally rather spotted with black.

*Range in Kansas.* Specimens from the cave region of Barber and Harper counties as well as those from Decatur, Logan and Scott counties, have been referred to this form. Probably now limited to the south-central region of the state, although this is the form to be expected anywhere west of the Flint Hills. If this is a true subspecies of *rufus*, as here considered, intergradation should be expected to occur over much of central Kansas. Specimens are not available to settle this point.

*Economic status and habits.* Little is known of the exact present status of the bobcat in Kansas, but on the whole it seems to be so rare except in restricted localities as to make it of no economic importance. In southeastern Kansas it is possible that it makes its presence felt to a marked degree among game animals, and it is possible that the western form does some damage to domestic animals, as it is a known killer of both young calves and sheep, Bailey (1931) stating that in New Mexico in the damage it does to sheep herds the bobcat is second only to the coyote. So little has been reported as

to its status in Kansas that apparently it does very little damage in this state. Its possibilities are unlimited, however, and it has been found to be a powerful menace to all wild life wherever it exists in large numbers.

There is a case on record (Bailey, 1905, p. 169) where the ranchmen in a certain region of Texas protected the bobcat, fearing that their places would be overrun with rats, mice, and rabbits if the cats were killed out. It is very true that they are one of the most effective checks known upon rodents and rabbits, and that on the whole in most regions they offset the damage they do through their control of these animals. As is usually the case, the damage apparently done by the bobcat is more in the way we wish to look at the subject than in any actual great monetary loss suffered. Apparently the bobcat may be locally harmful or helpful, depending upon the type of country occupied.

In certain portions of the Arkansas Ozarks I have had occasion to observe the bobcat and its habits (Black, 1932). It is certain that this animal is very destructive to small wild life, notably robins in this instance. In both Arkansas and Oklahoma, where conditions are quite similar to those of extreme south-eastern Kansas, the animal is considered a serious enemy of the quail, which seems highly probable. Seton (1929), however, quotes statistics which would tend to disprove this.

Bobcats mate in January or February in this latitude and produce from 2 to 4 young, usually 3, which are born sometime in March or April. Dens are, according to Seton (1929), in various localities such as under an old log, in a thicket of vines, or in a hollow log, "but their favorite place is a standing hollow tree." Our form, at least, dens in caves and under large rocks in bluffs. They appear to be limited almost wholly to rather rough, inaccessible places throughout their range.

#### ORDER RODENTIA. *True Rodents*

This order is easily distinguished from all other mammals by reduction of the incisors to 1/1 (a total of four), which are highly developed as gnawing tools or chisels; total loss of the canines; development of a relatively long diastema between the incisors and the premolars; reduction of the cheek teeth to not more than five, usually three or four, in each half jaw. Other features of the order are: clavicle always present, frequently reduced; form very diverse; size varying from very small to medium; molar crowns always more or less flat; incisors growing from a persistent pulp; mostly terrestrial, but very many fossorial, aquatic, arboreal, and even glissant.

The order Rodentia includes a very large percent of the Kansas mammals, and is by far the most important single order of mammals in North America. The rodents greatly outnumber the total of all the other mammals occurring in Kansas.

#### FAMILY SCIURIDAE. *Squirrels*

As recognized by Miller (1923) this family includes a very diverse assemblage and is at best but a loosely associated collection of several rather distinct natural mammalian groups. The family characters given here seem better suited to distinguish a suborder. For the sake of consistency the plan followed by Miller, and generally in use, is adhered to in the present work.

The commonly accepted subfamilies, however, seem to be so poorly arranged under the present system that they are omitted in the following discussion. The classification of the German scientist, Weber (1928), is much to be preferred to the system used in America at this time.

As now recognized in this country, the family Sciuridae is characterized by small to medium size; cheek teeth four or five in upper jaw, always four in lower; molars tuberculate and rooted; clavicles well-developed; ribs 12-13 pairs; tail usually well haired and flattened; head rounded (muzzle never sharply pointed).

GENUS MARMOTA

Dentition: 1/1; 0/0

KANSAS WOODCHUCK

*Marmota monax bunkerii* Black.

*Characters.* The woodchuck (also known as ground hog in some sections) is so well known wherever it is found as to require little description. It is in-



FIG. 26. Woodchuck.

stantly recognized by its silver-grizzled gray to blackish-grizzled color, its large size, and short, bushy tail. The Kansas subspecies, but recently described (Black, 1935), is one of the most readily distinguished of the many geographic races of this species. The outstanding characteristics distinguishing this subspecies from the typical form include: large size, especially very large hind foot; very large skull; females as large as males. Coloration also appears to average somewhat darker; the rufous-cinnamon or hazel axillary patches, groin patches, and side stripe are more pronounced than in the typical subspecies.

The average measurements for all known adult specimens are: total length, 25 inches; tail vertebrae, 6 inches; hind foot, 3.8 inches.

*Range in Kansas.* So far as known, only from Franklin, Douglas, Leavenworth, Atchison, Doniphan and Riley counties, thus limiting our knowledge of this animal's distribution to a very narrow belt. Probably intergrades in

southern Kansas with *Marmota monax monax*, distinguished by its smaller size, with the females much smaller than the males, the usually paler coloration and the reduction of the brown areas. Specimens from southeastern and central Kansas are badly needed to complete our knowledge of the distribution of the woodchuck in this state.

*Economic status and habits.* This form of the woodchuck seems almost entirely limited to the banks of streams, and the large entrance holes to its burrows are very common in the vicinity of Lawrence. These holes are ordinarily well concealed by weeds and underbrush in the summer, when the animals are active, and its burrows usually have two or more openings.

Woodchucks are considered as harmful rodents because of their destruction of farm crops, and in most regions because of the damage they do in making their burrows. So far as observed, however, the Kansas woodchuck rarely ever digs burrows in useable land, but its food habits are nearly as destructive as the other subspecies. They prefer a burrow close to a cultivated field and in spite of almost constant trapping, poisoning, and shooting, seem able to hold their own against man in most sections.

Their food is composed of various kinds of vegetation, including grasses and native plants of a great variety of species. Cultivated crops such as corn, clover and alfalfa are great favorites, while in certain sparsely populated and mountainous sections of the south it is exceedingly difficult to raise any sort of garden because of the depredations of these large and rather sly rodents. There is some evidence that the woodchuck may on occasion feed on insects.

They usually live alone in their dens, except, of course, the mother with her young.

The young, two to eight in number, usually four or five, are born in the latter part of April, and remain in the den for about six or seven weeks. The woodchucks are well known as winter sleepers, or hibernators. They retire in September or October, being at the time of their disappearance very fat, and remain in their winter dens until early March when they emerge, apparently with total disregard to the advancement of the season and prevailing weather. The superstition that they always come out on the second of February (the 14th in some localities) and return for six more weeks of sleep if they see their shadow—remaining out if they do not see their shadow and spring therefore beginning early—is, of course, quite untrue. The superstition of "Groundhog Day" is one of the most firmly established ideas of its kind in existence, though apparently having a rather recent origin among the Negroes of the eastern states.

Woodchucks, as rodents, should be heavily preyed upon, for it is the Rodentia which provide the bulk of the food for all predators, but such is not the case. Only a few of the larger carnivores apparently care to tackle the woodchuck, a rather capable and valiant fighter, and of these larger species that are able to conquer the marmot only a very few individuals remain. Perhaps it is this reduction of natural enemies as much as the availability of more and better food that has made the woodchuck such a successful mammal in association with man, and it has thus, strangely enough, profited by the presence of its most bitter enemy. The red and gray foxes, and where their ranges meet perhaps the coyote, are the worst natural enemies of the woodchuck.

Seton (1929) has presented rather conclusive evidence, gathered from numerous sources, to the effect that woodchucks do climb trees on occasion, and may readily swim—two much-disputed questions.

Another interesting fact concerning this rather unusual mammal is the frequent development of abnormal teeth. The powerful incisors grow rather rapidly and normally are subject to a great deal of wear owing to the coarse diet of the animal. If some accident occurs to the woodchuck so that its incisors do not meet naturally one or all of them may greatly elongate, and become rather remarkably distorted. Skulls are not infrequently found where such an abnormal incisor has pierced the brain and killed the animal, while it is evident that many others have died of starvation from a similar cause. Although this is true of all rodents it appears to be especially common in this genus.

GENUS CITELLUS. *Ground Squirrels*

*Dentition:* 1/1; 0/0; 2/1; 3/3—22.

LARGE SPOTTED GROUND SQUIRREL

*Citellus pilosoma major* (Merriam)

*Characters.* Upper parts light brown, indistinctly spotted over back and rump with roundish white spots, more numerous on the rump than elsewhere; "tail pale reddish brown on proximal half above, buffy brown on terminal half, with a submarginal black band, bordered with pale buffy, below buffy" (Anthony, 1928); under parts white. Early spring pelage more grayish. Total length, 9.0 to 9.7 inches; tail vertebrae, 2.9 to 3.3 inches; hind foot, 1.1 to 1.35 inches.

*Range in Kansas.* Known only from two specimens, one collected in Morton county, the other in Seward county. Probably of rare occurrence throughout extreme southwestern Kansas.

*Economic status and habits.* This ground squirrel is a desert form which barely invades the corner of the state, and therefore is of practically no economic importance within Kansas. It is active in the morning and late evening, remaining in its burrow through the heat of the day—a habit quite common with the squirrels. Exact dates of its retirement into hibernation and its spring emergence are not known, but according to Bailey (1931), "it is more probable that these squirrels disappear late in October and reappear early in March." (New Mexico.)

So far as known their food habits are beneficial, consisting mainly of desert plants, grasshoppers and beetles. This species probably produces two litters of young each season, varying in number from five to ten.

NORTHERN SPOTTED GROUND SQUIRREL

*Citellus obsoletus* (Kennicott)

*Characters.* Quite similar to the preceding, but more grayish; less distinctly spotted, spots not so clear white; tail above concolor with back, banded subterminally with black, and pale ochraceous below; feet whitish; under parts whitish. Total length, 8 to 9 inches; tail vertebrae, 2.3 to 2.6 inches; hind foot, 1.3 inches.

*Range in Kansas.* Known in Kansas only from a single specimen in the K. U. museum, collected July 10, 1922, in Cheyenne county, by E. R. Hall.

*Economic status and habits.* Essentially the same as the preceding.

## THIRTEEN-STRIPED GROUND SQUIRREL

*Citellus tridecemlineatus tridecemlineatus* (Mitchill)

*Characters.* Conspicuously striped and spotted; tail short; build slender; ear, as with other members of the genus, very small. Upper parts striped with narrow alternate stripes of dark and buffy whitish, the dark stripes with central rows of whitish spots except on the neck and shoulders; tail mixed, black and buffy above, rufous-chestnut with much less black below; under parts, lower sides of body, fore legs and sides of neck yellowish. Specimens from eastern Kansas frequently are rather strongly washed with reddish brown. They were considered characteristic of the subspecies *baduus*, a race no longer recognized. Total length, 10.6 to 11.3 inches; tail vertebrae, 3.6 to 4.2 inches; hind foot, 1.35 to 1.60 inches.

*Range in Kansas.* All of eastern Kansas, west probably through the Flint Hills, where it intergrades with *arenicola*; replaced in south-central Kansas by *texensis*.

## PALE STRIPED GROUND SQUIRREL

*Citellus tridecemlineatus pallidus* (Allen)

*Characters.* Paler than the preceding and slightly smaller; light markings creamy white instead of buffy, the dark stripes much paler, with less black; under parts everywhere yellowish white. Total length, about 9 inches; tail vertebrae, 3 inches; hind foot, 1.3 inches.

*Range in Kansas.* Extreme northwestern corner of the state.

## PALE GROUND SQUIRREL

*Citellus tridecemlineatus arenicola* A. H. Howell

*Characters.* Smaller and paler than *tridecemlineatus*; paler than *pallidus*. Dark stripes of upper parts light brown; light stripes and dots cream-colored to light buff, under parts white or whitish. Average measurements of topotypes: total length: 9.5 inches; tail vertebrae, 3 inches; hind foot, 1.2 inches.

*Range in Kansas.* Described from Pendennis, Kan., in 1931 by A. H. Howell. Type locality probably represents about the northeastern limit of this race in its typical form, ranging from there south and west throughout the state; specimens through central Kansas are probably nearer this than to the other races of the species.

## TEXAS STRIPED GROUND SQUIRREL

*Citellus tridecemlineatus texensis* (Merriam)

*Characters.* Size practically identical with *pallidus*, but more nearly like *tridecemlineatus* in color, being richly overlaid on the sides and back with reddish, the dark stripes dark chestnut brown, the light markings buffy, intermixed with chestnut; tail strongly marked with rusty red below and on basal half above; under parts buffy.

*Range in Kansas.* South-central Kansas, south of the Arkansas river and east of the 99th meridian. The subspecific ranges of the various forms of the thirteen-striped ground squirrel in Kansas cannot be limited very definitely at this time, due to the lack of material from the areas of intergradation in central Kansas. A very careful study, with large series of skins from many localities, will be necessary before the subspecific limits of these ground squirrels can be determined with any degree of accuracy. A revision of the genus

*Citellus* is now in the process of preparation by Dr. A. H. Howell. It will fill a long-felt need in helping to determine more accurately the distribution of the various races of this and other species.

*Economic status and habits.* There is probably not a resident of Kansas who is not familiar with the thirteen-striped ground squirrel. It is everywhere abundant except in the southeastern corner of the state, and is known to occur there. Meadows or pastures are the favorite habitats of this squirrel, and sloping hillsides seem to be preferred when they are available. Due to its long period of hibernation probably but one litter of young is raised each summer.

The call note of this group, according to Anthony (1928), is a long trilling whistle. I have heard them give a soft, high-pitched chatter, almost a whistle, when driven into their burrows.

Their coloration renders them rather inconspicuous, and their habit of "freezing" in an upright position at the slightest hint of danger is apparently a very useful one, because they are extremely difficult to see in their native surroundings when thus poised.

Their food consists mainly of various wild grasses and weeds which they can secure close to their burrows, although they are rather omnivorous and may eat small mammals, or insects. They store seed and grain in their burrows, but eat the more perishable food without making any attempt to store it.

#### FRANKLIN GROUND SQUIRREL

#### *Citellus franklini* (Sabine)

*Characters.* A large, robust, gray ground squirrel, with a very short, narrow tail. Upper parts mixed buffy, grayish white and dusky, rather uniformly but indistinctly spotted; sometimes rather brownish in general effect; tail mixed black and gray; under parts a grayish to buffy. Total length, 14 inches; tail vertebrae, 5 inches; hind foot, 2 inches.

*Range in Kansas.* Eastern and north-central parts of the state. A line drawn from Phillips county, southeast through Greenwood and Cherokee counties would mark off, as accurately as is possible on the basis of present knowledge, the limits of this species. Extremely rare along periphery of the range; not common anywhere in Kansas.

*Economic status and habits.* Similar to the thirteen-striped species, with which it is closely related. They are more or less social and their burrows are usually found in small groups. These ground squirrels prefer denser cover than the other Kansas species, and are usually found in bushy or grassy border lands. They are extremely shy and secretive. Like the other species in this latitude they have a long hibernation period and raise but one litter of young each summer.

The ground squirrels are among our most beautiful and interesting mammals and it is very fortunate that their food habits, at least in Kansas, do not meet with man's disapproval. On the whole these mammals are more beneficial than harmful, although their food habits are probably of but little economic significance.

GENUS CYNOMYS. *Prairie Dogs*

*Dentition:* 1/1; 0/0; 2/1; 3/3—22.

## BLACK-TAILED PRAIRIE DOG

*Cynomys ludovicianus ludovicianus* (Ord)

*Characters.* A medium-sized, robust, short-legged and short-tailed rodent with a short, weak, black-tipped tail. Above pinkish buffy, slightly grizzled with black; below buffy white to whitish; tail like back, except terminal one third black. Males slightly larger than females. Total length, of males, 14.5 to 16.5 inches; tail vertebrae, 3 to 4 inches; hind foot, 2.5 to 3.3 inches.

*Range in Kansas.* All of Kansas west of the Flint Hills, eastern records being from Lincoln, Riley and Lyon counties. Although formerly much more common than at present the prairie dog still persists in a few scattered localities.

*Economic status and habits.* This plump, woodchuck-like, prairie dweller has been bitterly warred against because of the grazing land laid waste by its towns. Now, however, the towns are relatively scarce in Kansas, and those that are still found are very small in comparison with the extensive colonies of the past.

The prairie dog is strictly a dweller of the open country, and always social to a high degree. They are perhaps the most sociable of rodents, being very friendly in their relationships with one another, and depend largely upon social organization for their preservation. Their selection of open, grassy places for their towns is also very useful as a protection against many enemies, whose approach is thus very readily detected. Their enemies are legion, however, and the question again must be asked if this social habit, which unquestionably originated as a protective one, is not detrimental to the animal. Such congregation together makes their capture as prey relatively easy for the proper predator, and works very favorably for such hunters as the badger and black-footed ferret. As most any Kansan knows, the oft-repeated story of the happy community life led by burrowing owls, prairie rattlers and prairie dogs is purely a myth. All that is needed to make the story perfect as an example of impossible nature yarns is to add the black-footed ferret to this "happy family group." We do not know a great deal about what goes on in the burrows, but it is certain that the rattler is one of the most bitter enemies of the prairie dog, and many reliable observers have reported instances of these fat little rodents rallying together with a chorus of excited barks to bury a snake. That the three species are always found in close proximity is surely true, but the arrangement is not made with the consent of the prairie dog.

The food of these rodents consists almost wholly of grass, so that Bailey (1931) has said "they might almost be called grazing animals."

Their young, three to eight in number, usually four, five, or six, are born early in May and grow very rapidly.

Prairie dogs hibernate during the coldest part of the winter; in the warmer parts of the country they do not go into hibernation, but they have at least a short hibernation period throughout Kansas.

GENUS TAMIAS. *Chipmunks*

*Denition:* 1/1; 0/0; 1/1;3/3—20.

## GRAY EASTERN CHIPMUNK

*Tamias striatus griseus* Mearns

*Characters.* A brightly colored rodent, similar to the ground squirrel in general build. Upper parts grizzled grayish rusty, brightest on rump, and marked with five longitudinal stripes of black from the rump to the shoulders, the pair of latero-dorsal black stripes separated by a stripe of whitish; upper surface of the tail similar to the back, rufous below; under parts buffy to whitish; hands, feet, flanks, and sides ochraceous to tawny. Total length, 10 to 11.3 inches; tail vertebrae, 3.75 to 4.2 inches; hind foot, 1.35 to 1.5 inches.

*Range in Kansas.* Known only by a very few scattered records from Douglas, Riley, Leavenworth and Wyandotte counties. No doubt occurs rarely throughout northeastern Kansas, south to intergrade with the following subspecies in the central-eastern part of the state.

## BANGS CHIPMUNK

*Tamias striatus venustus* Bangs

*Characters.* Similar in size and general color pattern to the preceding, but much brighter in color, and with the dorsal stripes shorter. Rump patch a glossy rich chestnut, with the upper parts everywhere free of the grayish tinge of *griseus*.

*Range in Kansas.* Known only from a very few specimens from Cherokee and Montgomery counties, and considered very rare except in Cherokee county; must extend northward to intergrade with *griseus*, but specimens have not been reported from other localities.

*Economic status and habits.* I have lived most of my life in a region where the Bangs chipmunk is very common and I have never heard a complaint against this exceedingly beautiful mammal. This is a recommendation that can hardly be matched in the order Rodentia. Very many of the rodents are useful, many are beautiful and all are interesting, but to the popular mind there is probably no single mammal which makes the universal appeal that the chipmunk does. They are industrious, and truly squirrel-like in their habits, while their shy, half-confiding dispositions and saucy mannerisms have won them a place in the affections of every lover of wild life.

Chipmunks frequent rock fences, open woodlands, highway embankments, and almost any other sort of region where they can find suitable shelter. I have often found them in dark, damp woods where a few rocks or a fallen tree provided a home shelter, although they are much more common around rock walls, near human habitation.

Their food consists of nuts, especially acorns, berries, and various wild seeds, as well as occasional bits of animal life such as insects, frogs and lizards.

Exceedingly quiet and shy during the breeding season, they assume a new attitude toward the world as soon as the young are large enough to shift for themselves and begin their work of storing food for the winter. They are more or less active throughout the winter, although often denning up during bad weather, just as the arboreal squirrels do. Although it is generally believed that the chipmunks hibernate, as they do in the north, it is highly improbable that the Kansas specimens ever enter into a true hibernation.

They produce but a single litter each year, four to five in number.

GENUS SCIURUS. *Arboreal Squirrels*

## Subgenus SCIURUS

*Dentition:* 1/1; 0/0; 2/1; 3/3—22.

*Sciurus carolinensis carolinensis* Gmelin

*Characters.* Upper parts grayish to brownish, depending upon the percentage of each of these colors present; head and middorsal region more brownish than sides; under parts grayish white; tail long and bushy with hairs yellowish gray at base, banded with black and tipped with white or rusty. This species occurs rather frequently in a melanistic, or black phase, and although rather rare in the white phase, albino squirrels in this region usually prove to be this species rather than the fox squirrel. Total length, 16.5 to 19 inches; tail vertebrae, 7.75 to 9 inches; hind foot, 2.2 to 2.7 inches.

*Range in Kansas.* Very common over most of the eastern part of the state. There is also a single record from Osborne county, which indicates that it occurs up the rivers in Kansas for a considerable distance, no doubt ranging that far west along all the principal rivers in the state.

*Economic status and habits.* Both this and the fox squirrel are well known, because of their interesting characteristics, and their value as game animals.

The gray squirrel is found almost anywhere throughout eastern Kansas where there is sufficient timber to provide the necessary shelter and food, and has been able to maintain its numbers with rather unusual success against its natural enemies and man. Although this is the common park-dwelling species, throughout the east it is seldom found in towns in Kansas, being replaced by the larger, more aggressive fox squirrel. Their favorite habitat is wooded slopes near small streams where acorns, nuts and berries may be found in abundance.

They are strictly diurnal in habit and, except for brief periods during extremely cold or stormy weather, are active the year round. Their nest may be either a bulky loose structure of leaves or a cavity in a tree trunk. One or two litters, of from four to six each, are born every summer, the first litter usually arriving in March.

Subgenus GUERLINGUETUS. *Fox Squirrel*

*Dentition:* 1/1; 0/0; 1/1; 3/3—20.

## WESTERN FOX SQUIRREL

*Sciurus (Guerlinguetus) niger rufiventer* (Geoffroy).

*Characters.* A larger, robust arboreal squirrel with distinctive rusty, fox-like coloration. Upper parts tawny to rufous, heavily grizzled with black and gray; under parts pale rufous to rich hazel; tail mixed black and tawny rufous, even larger and fuller than that of the gray squirrel. Color pattern extremely variable; sometimes occurs in a completely melanistic black phase, while partially melanistic squirrels are not especially rare. Total length, 18 to 20.5 inches; tail vertebrae, 8 to 9.25 inches; hind foot, 2.1 to 2.6 inches.

*Range in Kansas.* East of an imaginary line joining Phillips, Harvey, Elk and Montgomery counties, according to museum records. Very common throughout eastern Kansas, the records from Harvey and Phillips counties being rather isolated from other records. Probably occurs west to, or beyond, the 99th meridian throughout the state wherever sufficient timber is available.

*Economic status and habits.* The two tree squirrels occurring in Kansas are very similar in their habits, although the fox squirrel is more common throughout the state than the gray species, and is extremely common in most of the larger towns throughout eastern Kansas, abounding in the parks and shade trees. In such places it becomes exceedingly tame, and is one of the most interesting and valuable assets a city can have. When hunted in the wild state, however, it becomes shy and wild, possibly even more so than the gray squirrel. The extensive and sporadic mass migrations so frequently noted in connection with the gray species have not been found to be a trait of the fox squirrel, although both species make rather extensive migrations every fall in search of food.

There appears to be but one litter of young each season, of from two to four, born usually in late March or April. Their nest and food habits are practically identical with that of the gray squirrel.

GENUS GLAUCOMYS. *Flying Squirrels*

*Dentition:* 1/1; 0/0; 2/1; 3/3—22.

SMALL EASTERN FLYING SQUIRREL

*Glaucomys volans volans* (Linnaeus)

*Characters.* Readily recognized in Kansas, being the only flying squirrel occurring in our fauna. Gliding membranes covered with furlike upper and under parts, connecting the fore and hind legs, extending down on the limbs to the wrist and ankle joints; tail closely haired and very flat; eyes very large; pelage soft and silky. Upper parts varying from pinkish drab to cinnamon, everywhere slate-colored at the base; under parts white; tail above like back, below light pinkish cinnamon. Total length, 8.75 to 9.5 inches; tail vertebrae, 3.4 to 4.5 inches; hind foot, 1 to 1.4 inches.

*Range in Kansas.* Of rare occurrence throughout the eastern one fourth of the state, the known western limits being Elk and Shawnee counties. Probably occurs more commonly in the extreme southeastern corner.

*Economic status and habits.* The flying squirrel is so rare in most of Kansas that but few people are familiar with it. In many places in the south and east it is extremely common, often becoming somewhat of a nuisance through its habit of taking up living quarters in the attics of houses. In Kansas it is known only along the streams where there is sufficient standing dead timber to provide ample shelter for this strange animal.

The flying squirrel is strictly nocturnal in habits, and it is a sight long remembered when one chances to find a family of these animals playing in the forest on a moonlight night. They travel by an alternate series of jumps, or "flights," landing with uncanny skill at the base of a tree, climbing to the desired elevation and then hurling themselves out into space, gliding a remarkable distance before finally coming near the ground, where they alight on a tree trunk, and climb up again for another jump. They remind one very much of ghosts as they sail on silent wings through the shadow-streaked forest and are certainly much more like phantoms of the spirit world than like live, flesh and blood squirrels.

It is because of its nocturnal habits that the flying squirrel is so rarely seen

in Kansas. Almost the only way one ever chances to find the animal is to cut down a tree in which it is nesting, or to pound on a likely looking dead tree. If a dead tree is inhabited they will soon run out their hole, if the trunk is rapped, and jump immediately, this being their best defensive action. Boys throughout the Ozarks frequently amuse themselves by hunting for flying squirrels in this manner. Often they are able to catch young specimens alive, which they cherish as pets. These rodents are rather shy and morose of temperament in captivity, however, and are not as satisfactory for pets as are the other squirrels.

They are rather omnivorous in diet, although their main food is nuts. They nest in dead trees in either a natural cavity or a deserted woodpecker hole, and not infrequently they cut through the wall of a house and appropriate the attic or take up living quarters between the walls. Once securely settled in a house they are rather troublesome because of the noise they make at night, and are rather difficult to dislodge. They are such interesting little mammals, however, that frequently they are accepted by the residents of the house as worthwhile guests.

#### FAMILY GEOMYIDAE. *Pocket Gophers*

Medium-sized fossorial rodents, with short legs; strong digging forelimbs, armed with large claws; eyes small; external ears reduced to a mere ring; cheek pouches present, external, fur-lined and very large; tail rather short, blunt and scantily haired.

#### GENUS GEOMYS. *Eastern Pocket Gophers*

*Dentition:* 1/1; 0/0; 1/1; 3/3—20.



FIG. 27. Pocket gopher.

#### SHAW POCKET GOPHER

#### *Geomys bursarius bursarius* (Shaw)

*Characters.* Dark brown above; pale brown below; forefeet white; hind feet whitish; tail brown like back basally, terminal two thirds white, and in life tipped with pink. Extremely variable in color, sometimes being rather pale chestnut, often spotted or blotched about the head, shoulders, throat and breast with white; frequently black or partly black, and rarely pure white. Total length, of males, 11 to 13 inches; tail vertebrae, 3.2 to 3.9 inches; hind foot, 1.35 to 1.60 inches. Females averaging about 1 to 1.5 inches shorter than males.

*Range in Kansas.* Most of eastern Kansas, west to Riley and Harvey counties. Not reported from southeastern part of the state.

## YELLOW POCKET GOPHER

*Geomys lutescens* (Merriam)

*Characters.* Similar to the preceding, but averaging about one inch shorter, with slightly smaller hind feet and much paler coloration. Upper parts pale, dull yellowish to buffy ochraceous; under parts buffy. Darker in winter, upper parts a drab with a more or less defined middorsal stripe of blackish.

*Range in Kansas.* There are records of this gopher from Logan, Trego and Morton counties. Probably occurs over most of the western one third of the state.

## MESQUITE PLAINS POCKET GOPHER

*Geomys breviceps llanensis* Bailey

*Characters.* Slightly smaller than *lutescens*, from which it may readily be distinguished by color alone; similar in color to *bursarius*, but much smaller. Under parts pale cinnamon to whitish, never brown as in *bursarius*. Upper parts light cinnamon to dark russet, usually chestnut brown.

*Range in Kansas.* South central part of state from Sumner county west to Seward county and north at least to Stafford county. There is no group of mammals more in need of a careful distributional study than the pocket gophers. The ranges as known in Kansas are very unsatisfactory and no doubt fail to represent the true condition.

*Economic status and habits.* Wherever they are found pocket gophers are usually common. In many localities two or three species may occur together, but so far overlapping of ranges has not been demonstrated in the Kansas forms. The habits of the different species are quite similar and differ mainly in the changes made necessary by the different habitat in which they are found.

Pocket gophers are very highly specialized as fossorial animals, second only to the moles in their high degree of development for a subterranean life. This mode of living accounts for their enlarged front feet, large claws, very small eyes and greatly reduced external ears. They remain underground practically all the time, our species only rarely appearing above the surface. They are active throughout the year, constantly digging their way into new territory in search of roots and tubers on which they feed. When they find more food than needed for immediate consumption they store the surplus in little side pockets dug out of the walls of their tunnels for this purpose. A good idea of their activity may be gained from part of an account by Bailey (1931). He says: "In a ten-acre alfalfa field there were approximately eight pocket gophers to the acre with an average of fifty mounds to a gopher. On one sandy place the writer counted forty mounds in a row, pushed up by one big pocket gopher after the last rain, probably within two weeks."

The mounds referred to are piles of surplus dirt which the gopher carries to the surface and throws up in such a manner that the opening is nearly always plugged. The digging is accomplished by the use of the forefeet and the dirt is thrown back under the belly of the animal, which then turns and pushes the loose soil ahead of it out one of the vertical openings whenever it had dug out enough to make a load.

Pocket gophers are very destructive to many cultivated crops, doing considerable damage to potatoes, fruit trees, and alfalfa. They are, however, not difficult to control, being very easily trapped or poisoned.

Little appears to be known of their life history. Apparently but one litter a year is born in this region, usually in April, of from four to six young.

FAMILY HETEROMYIDAE. *Pocket Mice and Kangaroo Rats*

Very small to small rodents with hind legs more or less elongated; external cheek pockets well developed and fur-lined; tail usually as long as head and body, sometimes much longer, and frequently with a banner; forefeet usually rather weak and claws not well developed. Two genera are represented in Kansas.

GENUS PEROGNATHUS. *Pocket Mice*

*Dentition:* 1/1; 0/0; 1/1; 3/3—20.

PLAINS POCKET MOUSE

*Perognathus flavescens flavescens* (Merriam)

*Characters.* Upper parts buffy gray, heavily washed with black; under parts white; feet and legs white; a bright buffy line along side from nose to end of the tail; tail faintly bicolor; pelage rather harsh. Total length, 4.8 to 5.5 inches; tail vertebrae, 2.2 to 2.7 inches; hind foot 0.6 to 0.7 inch.

*Range in Kansas.* Probably all of the western part of the state. Eastern records are from Pratt and Reno counties; it has also been taken in Morton, Logan, Trego and Rush counties, and has been found common in most localities where it is known.

BAIRD POCKET MOUSE

*Perognathus flavus flavus* Baird

*Characters.* A very small, short-tailed, bright-colored mouse, with soft pelage. Upper parts buffy, tinged with pinkish and intermixed lightly with black, darker along the middorsal region; under parts white; lateral line faint; tail faintly bicolored; spot back of ear buffy, like lateral line. Total length, 4.5 inches; tail vertebrae, 2 inches; hind foot 0.6 inch.

*Range in Kansas.* Reported only from Morton and Seward counties. Appears to be common in the former, and may be expected over much of extreme western Kansas.

KANSAS POCKET MOUSE

*Perognathus hispidus paradoxus* (Merriam)

*Characters.* A very large pocket mouse with a long tail, and distinctive pattern. Upper parts yellowish-brown, intermixed with black; sides ochraceous; under parts white; tail sharply bicolor, blackish above, ochraceous on sides and below; pelage glossy, but rather coarse. Total length, 8.9 inches; tail vertebrae, 4.3 inches; hind foot, 1 inch.

*Range in Kansas.* Fairly common throughout the state west of the 98th meridian. Replaced on the eastern side by *spilotus*, with which it intergrades.

TEXAS POCKET MOUSE

*Perognathus hispidus spilotus* Merriam

*Characters.* Very similar to the preceding, but larger, and brighter in color. Upper parts buffy gray, heavily intermixed with black; lateral line bright ochraceous; tail sharply bicolor; under parts white. Total length, 9.6 inches; tail vertebrae, 4.4 inches; hind foot 1.1 inches.

*Range in Kansas.* From the 98th meridian east into the Flint Hills, being reported from Cowley, Greenwood, Riley and Woodson counties.

*Economic status and habits.* The three species of pocket mice occurring in Kansas may be readily distinguished from one another on the basis of size alone, while their color pattern is also distinctive. *Spilotus* is best distinguished from *paradoxus* by its bright color, although the average size is somewhat greater; geographical distribution will serve to aid in distinguishing between these two subspecies.

The subspecific name *spilotus* applies to the same animal that has heretofore been known as *maximus*, the latter subspecies, described by Elliott in 1903, having been found to be synonymous with *P. h. spilotus* described from Gainesville, Texas, by Merriam, in 1889. I am indebted to Drs. Remington Kellogg and A. H. Howell for the information concerning the proper name of this subspecies.

The pocket mice in general are all very much alike in habits. They prefer desert or plains for their dwelling places and in but few instances are they ever found in a forested region. They are burrowing in habit, nesting underground, but are not in any sense fossorial, merely utilizing these underground burrows for nesting and daytime shelters, coming above the ground to feed with the approach of night.

They are active food gatherers, and in their burrows store food which they carry in large cheek pockets. Their food consists of whatever sorts of seeds and grain they can find. One of the remarkable things about the pocket mice and kangaroo rats is their ability to subsist on such extremely dry food and at the same time go without water for indefinite periods. This power of producing the necessary water for their life processes by some physiological means is the principal reason for their remarkable success as desert and arid plain dwellers.

The young, from four to seven in each litter, are born in the underground nests, several litters a year being born in this region.

#### GENUS DIPODOMYS. *Kangaroo Rats*

*Dentition:* 1/1; 0/0; 1/1; 3/3—20.

#### RICHARDSON KANGAROO RAT

*Dipodomys ordii richardsoni* (Allen)\*

*Characters.* A medium-sized rodent, with an extremely long tail, long hind legs, weak front legs, and saltatorial progression. Upper parts buffy ochraceous, sometimes with a decided rufous tinge, and lightly intermixed with black; a prominent rump stripe of white across the thighs; under parts white; tail black above, white on the sides, blackish below for the basal half, then whitish, and with a prominent banner on the tip. Total length, 103 inches; tail vertebrae, 5.8 inches; hind foot, 1.6 inches.

*Range in Kansas.* All of western Kansas, east to Riley county. Not known in southern Kansas east of Barber county.

\*The plan of Miller's Check List (1928) is followed here in considering Richardson's Kangaroo Rat as a subspecies of *ordii*, and of the genus *Dipodomys*. Bailey (1931) in a recent work has revived the genus *Perodipus* for the five-toed kangaroo rats, and placed the subspecies *richardsoni* in the *montanus* group, thus making the name accepted by Bailey for this rat *Perodipus montanus richardsoni* Allen.

*Economic status and habits.* The kangaroo rat is a dweller of the loose sand, and is never found away from this habitat. It throws up sizeable nesting mounds and its presence is readily detected by these dirt heaps. Their burrows radiate out in every direction from one of these common central heaps and one such pile may mark the abode of several rats.

They have been called the most handsome of all the North American rodents, but they must share this distinction with the chipmunks, although it is admitted that the richly colored back, the white rump stripe and the long bannered tail combine to make a strikingly beautiful animal.

Like the pocket mice, they gather seeds and grain of whatever sorts are available and pack them in their cheek pockets, then carry them into their burrows where they are eaten. They also eat leaves and stems of various plants to a limited degree.

Their breeding habits do not differ greatly from those of the pocket mice. The young are born almost throughout the entire year, from three to five at a litter being the ordinary number.

In food habits they do not seem to conflict in any way with the interests of man, except in very unusual instances, and, due to their control of weeds, through the destruction of seeds, they must be considered as beneficial mammals. Over most of its range the subspecies occurring in Kansas occupies territory not much used, and the rats, therefore, are of no great economic importance.

#### FAMILY CASTORIDAE. *Beavers*

This family has but one genus, *Castor*, represented in North America by three species and a number of geographic races. The genus was formerly circumpolar and its known range covers a wide area in Europe and Asia, but it has long been extinct over much of this territory in the Old World. The beaver is easily recognized by its large, flat, scaly tail, robust build, and aquatic habitat. It is, in general, rather squirrel-like, but aside from the differences already listed is further distinguished by the possession of rootless molars and premolars, the crown pattern of which is annular instead of tuberculate; toes 5-5; ears short, skull massive.

#### GENUS CASTOR

*Dentition:* 1/1; 0/0; 1/1; 3/3—20.

#### MISSOURI RIVER BEAVER

#### *Castor canadensis missouriensis* Bailey

*Characters.* In addition to those given above, the Missouri river beaver is further characterized by its size and color. Upper parts bright hazel brown; under parts smoke gray. The pelage, as with all beavers, is made up of a soft underfur and a long, harsh, glossy overfur. Total length, about 41 inches; tail vertebrae, 15 inches; hind foot, 6.5 to 7.0 inches; width of tail 4.2 to 5.0 inches.

*Range in Kansas.* This subspecies appears to have invaded Kansas in comparatively recent years from the northwest, and is now rather widespread throughout the state, although still of very local occurrence. Colonies have been reported along the Kansas and Republican rivers quite recently, and it has also been reported from the Blue, Smoky Hill, Solomon, Mulberry and

Arkansas rivers, as late as 1924 (Seton, 1929). There is some possibility that the southern records refer to the subspecies *carolinensis* which formerly ranged over all of Kansas, but which was early exterminated and then replaced, at least in the northern part of the state, by *missouriensis*. The beaver appears to be reestablishing itself very rapidly, and it is to be hoped that the trappers will give the animal a reasonable chance to succeed.

*Economic status and habits.* Articles by the dozen, and even books have been written about the beaver and its ways. Only a few of the outstanding features of this very interesting animal's life can be given here.

According to Bailey (1926), who has made a rather careful study of this subspecies in North Dakota, the winter food of this beaver is mostly willow, cottonwood, and chokecherry bushes—plants of but little commercial value in most of its range. Many reports have been investigated by members of the United States Biological Survey concerning damages done by these rodents, but in almost every case the damage was more imaginary than real, and was far outweighed by the value of the beavers. Actual damage, however, does rarely occur. The same trees and bushes are generally utilized for the building of their dams, but other trees may also be used for this purpose.

In the autumn these bushes and trees are cut and stored under water for winter food, where they are kept fresh by the cold water and ice. In the summer season their food consists practically altogether of grasses and sedges growing along river banks.

The houses are of two types, bank houses, which are rather small, and the large deep water house, often six or eight feet in diameter, which has an under-water entrance leading off into the nest from the deep water of the pond. The nest chamber in one of these big houses is barely above the water level. The bank houses, similar in structure, are usually built on low banks; if on high banks they have an under-water entrance.

There is but a single litter each year, of from four to six young. Beavers grow rather slowly and do not reach full size for several years.

#### FAMILY CRICETIDAE. *Native Rats and Mice*

Form, very diverse, from typically rat and mouselike to short and heavy; dentition always 1/1; 0/0; 0/0; 3/3—16; molar crowns either annular or tuberculate, but if the latter then with two longitudinal rows of tubercles.

#### Subfamily CRICETINAE

This group of rodents is distinguished by the molars which are rooted, and crown pattern of which is tuberculate. In this subfamily, as recognized in America at present, we find the typical cricetine mice such as *Peromyscus*, *Onychomys* and *Reithrodontomys*. The wood rats of the genus *Neotoma* and the cotton rats of the genus *Sigmodon*, with their relatives, have been considered as distinct subfamilies by some authorities, but are lumped in the subfamily Cricetinae under the system now in vogue in this country.

GENUS *ONYCHOMYS*. *Grasshopper Mice*

## GREAT PLAINS GRASSHOPPER MOUSE

*Onychomys leucogaster arcticeps* (Rhoads)

*Character.* Rather robust of build, with a short, stout tail; pelage very soft and silky; four tubercles on hind foot. Upper parts buffy brown, lightly washed with pinkish; under parts and feet white; tail white except for a narrow strip of brownish on the basal two thirds of the upper surface; tufts at base of ears white. Immature specimens are grayish to blackish brown above, without the ear tufts, but may be distinguished by their tail and general build. Total length, 5.5 to 6.4 inches; tail vertebrae, 1.35 to 1.60 inches; hind foot, .75 to .87 inch.

*Range in Kansas.* Well distributed over the western one third of the state, intergrading with the following subspecies in Meade and Ellis counties. Specimens from these localities, however, have been referred to the subspecies *arcticeps*.



FIG. 28. Grey grasshopper mouse.

## SHORT-EARED GRASSHOPPER MOUSE

*Onychomys leucogaster breviauritus* Hollister

*Characters.* Similar to the preceding, but with a number of color differences in typical pelage. Upper parts rich brown; sides paler than back; rump pinkish cinnamon; under parts as in *arcticeps*; ear tufts not white, but *cinnamon buff*; upper surface of tail grayish brown almost to tip, white elsewhere. Specimens average a trifle larger than *arcticeps*.

*Range in Kansas.* This mouse is rather common in parts of Nebraska and Oklahoma and no doubt occurs in reasonable numbers in central Kansas, but so far is known from only three widely scattered localities, namely: Edwards, Woodson and Geary counties. There are no specimens from Kansas in the K. U. museum, and additional information concerning the distribution of this mouse is badly needed.

*Economic status and habits.* The grasshopper mice are among our most useful small mammals, their diet consisting almost wholly of insects, particularly grasshoppers, although they eat some seed, and occasionally other mice (a habit which I believe is rather universal among small mammals, and certainly is among mice).

These mice, like the representatives of the family Heteromyidae, are residents of the open country and are to be expected only in unforested regions.

Their days are spent in underground burrows and their nights in hunting for food, just as with *Perognathus*.

Probably two or three litters are born each year in Kansas, the number of young commonly being four in each litter.

#### GENUS REITHRODONTOMYS. *Harvest Mice*

The mice of this genus are all slender and delicate of build, with rather small eyes. They are easily distinguished by the presence of a longitudinal groove on the anterior face of each upper incisor, a character which occurs only in this genus and *Synaptomys* within the family Cricetidae. The latter is a microtine rodent, very robust, and cannot be confused with the harvest mice, which are more nearly like *Peromyscus* than any of the other genera occurring in Kansas.

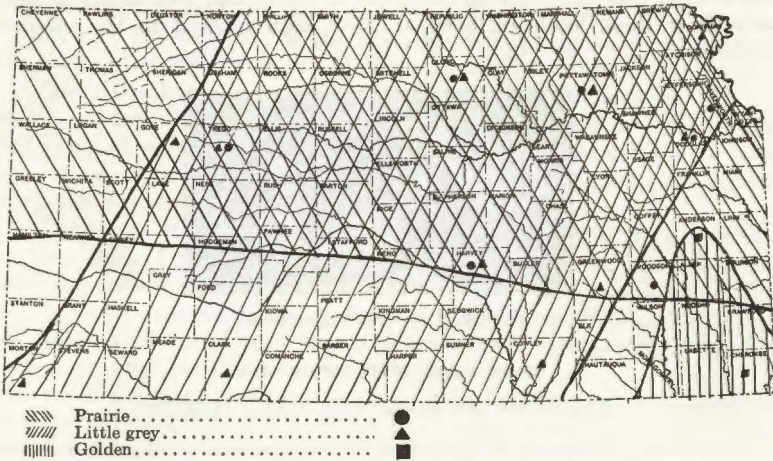


FIG. 29. Map showing distribution of Harvest mice.

Although ranging throughout the state in some species, the genus *Reithrodontomys* is nowhere common, and is but rarely seen even by the professional mammalogist. Our species seem rather difficult to trap and the few specimens secured at K. U. during the past four years have all been caught alive at night when staff members were hunting for amphibians or reptiles.

Our knowledge of the distribution of the Kansas forms, as well as their life history and habits, is very inadequate.

#### LITTLE GRAY HARVEST MOUSE

##### *Reithrodontomys albescens griseus* (Bailey)

**Characters.** A very small mouse with a short, sharply bicolored tail. Upper parts light ochraceous buff, sprinkled with black, the black thicker along the middorsal region to form a well defined stripe; sides lighter; under parts white; usually with a distinct black patch on the outer surface of the ear. Total length, 4.7 to 5.8 inches; tail vertebrae, 2.0 to 2.5 inches; hind foot, .55 to .68 inch.

*Range in Kansas.* This mouse occupies a diagonal strip through Kansas, ranging from the state line on the west, east to eastern Cowley county on the southern border, and from the middle of Norton county east to central Leavenworth county on the northern side of the state. Everywhere rare within these limits.

## PRAIRIE HARVEST MOUSE

*Reithrodontomys megalotis dychei* (Allen)

*Characters.* This mouse may be distinguished from the preceding by several characters in typical pelage, although both forms are exceedingly variable. Typically *dychei* is brown instead of gray above; the dorsal stripe is very faintly defined, the outside of the ear is drab without a black spot; the tail is much longer and more faintly bicolor, being broadly striped with brown above, shading into grayish white below. There are a few minor cranial differences, also, but Kansas material is extremely difficult to distinguish in some instances, on the basis either of skull or pelage. In a very careful study of all the Kansas specimens of these two forms recently I can find but one consistent difference; that is in the development of a small but definite accessory cusp on the outer edge of the first lower molar, interposed between the first and second larger cusps, a character which is universally present on all the specimens of *dychei* examined with unworn teeth, and which is not even indicated on any of the specimens of *griseus*.

*Range in Kansas.* Northern part of state, south into Hamilton and Harvey counties. (See Fig. 29.)

*Economic status and habits.* The two species of harvest mice listed above (*dychei* and *griseus*) are very much alike in their habits. Both frequent border grassy places, and are most often found on the edges of cultivated fields. Their nest is a grass ball with an opening in the side, which is generally suspended a few inches from the ground in tall grass; sometimes these nests are placed on the ground. Harvest mice are active day and night, throughout the year.

Their food consists almost entirely of grass and weed seeds, and although beneficial they do not occur anywhere in Kansas in sufficient numbers to be of much economic importance.

Like so many of the rodents, they produce several litters of young a year, with two to five in each litter. It is only the terrific toll which the rats and mice pay to their natural enemies that serves to keep them in check. On the other hand these mammals have been able to continue existence only through this natural compensation of large and frequent litters of young—a universal characteristic of the hunted.

## GOLDEN HARVEST MOUSE

*Reithrodontomys fulvescens aurantius* (Allen)

*Characters.* Upper parts rich ochraceous tawny, heavily intermixed with blackish brown to produce a general color effect of golden brown; sides clearer than back; under parts grayish white, frequently tinged with buffy; feet white; tail long and sharply bicolor, brown above, whitish below. Total length, 6.2 to 7.2 inches; tail vertebrae, 3.3 to 4.2 inches; hind foot, 0.7 to 0.8 inch.

*Range in Kansas.* Known only from Cherokee and Anderson counties; apparently very rare in Kansas.

*Economic status and habits.* Although in general similar to the last two species the golden harvest mouse appears to prefer a mixed brush and grass habitat rather than the grass shelter common with the other forms. The few specimens of *aurantius* which I have taken were in old fields or meadows where tall grass and underbrush were mixed, and with considerable adjoining areas where short grass prevailed. All the nests of this form on which I have data, have been in, or under, logs.

This harvest mouse is very brightly colored and quite similar to the southern golden mouse, a *Peromyscus*, which occupies much of the same range, and which is often found in close association with the golden harvest mouse. The grooved incisors of the harvest mouse, however, will readily distinguish it.

#### GENUS PEROMYSCUS. *White-footed Mice*

This genus comprises the most important group of small mammals found in Kansas. Its representatives outnumber all other mammals in Kansas as to the number of individuals. Two species are to be found throughout the state, each being represented by three geographic races while the remaining two species are very limited in their Kansas distribution.

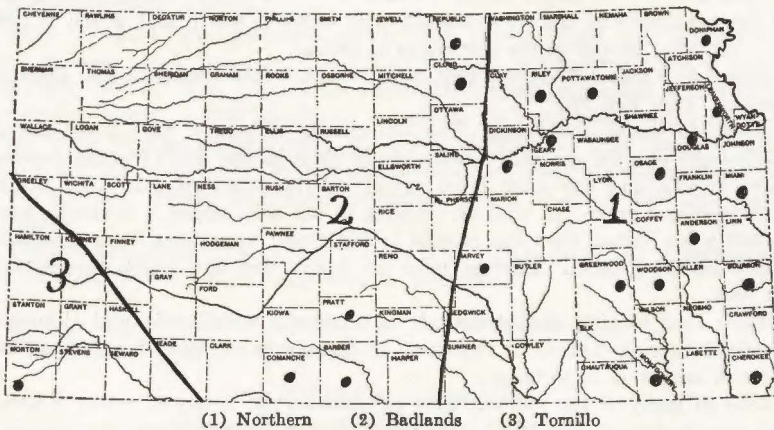


FIG. 30. Map showing distribution of white-footed mice.

Common names applied to members of this genus include the white-footed mouse and deer mouse. They are easily distinguished from other small mammals by their rather long, more or less hairy and bicolored tail, their rather large ears projecting above the fur in typical mouse fashion, and their white feet. They are of varying shades of brown or grayish brown in color, the extreme being found in the *maniculatus* group where adults vary from a very bright tawny-orange to dull vinaceous gray. Except for the southern golden mouse all the races are white beneath.

Only three other genera of mice occur in Kansas which are sufficiently similar to *Peromyscus* to be confusing. Of these the pocket mouse, genus *Perognathus*, may be distinguished by its external cheek pouches, and the presence of four instead of three cheek teeth in each jaw. The harvest mouse,

genus *Reithrodontomys*, is strikingly similar to the *Peromyscus* group in external appearance, but may be easily distinguished by a faint and invariable longitudinal groove down the face of each upper incisor. It is also smaller and lighter of build than the white-footed mouse. The grasshopper mouse, genus *Onychomys*, is very robust, tends to be more grayish in color in the adult than *Peromyscus* and is easily distinguished by its stout, short tail, sparsely haired and always broadly tipped with white in the Kansas specimens. All four genera occur together west of and through the Flint Hills, but in the eastern part of the state the grasshopper mouse and pocket mouse are unknown.

The molars are tuberculate in pattern, similar to those of the house mouse, but as mentioned previously, the tubercles are in two instead of three longitudinal rows. The customary six plantar tubercles, or foot pads, are found on the hind feet of the members of this genus except the rather aberrant southern golden mouse which has seven plantar tubercles.

They rank among the most important mammals from the economic standpoint. The representatives of the *maniculatus* group all prefer the open country and are found in great numbers around cultivated fields where, in a grain producing state such as ours, they destroy large quantities of grain. They are well known to every farmer as the field mouse found most commonly under the shocks of corn or wheat. Because of their immense numbers they may consume and waste large quantities of wheat, oats and corn. On the other hand, they destroy great quantities of weed seed and perhaps a large number of insects as well. By virtue of their habitat the other species are not of direct economic importance. These mice form the principal item of diet for most hawks and owls and are extensively preyed upon by almost every carnivorous animal. In order to maintain themselves in such numbers against this host of enemies it is evident that they must be very prolific and such is indeed the case. From three to six or rarely seven, generally four, young are born in a litter, with four or more litters per year. They are active the year round and likewise appear to breed throughout the year in our latitude.

The white-footed mouse is a delicate, graceful little mammal, very cleanly in its habits. Of all animals of my acquaintance none makes as delightful a pet as one of these mice. They will eat almost anything in captivity, and are easily tamed. I kept a southern golden mouse for seven months at one time, raising it from a very small hairless infant, feeding it first on diluted milk with a medicine dropper and shifting it then to rolled oats and finally feeding it altogether on bird seed. Its adaptability to captivity has made it a favorite laboratory animal, much more pleasant to work with than the white or albino house mouse.

It is known to enter houses and is quite as bad in such cases as the imported house mouse, but it will not be found in houses infested by the house mouse, the latter, though smaller, being able to drive the white-footed mouse out. I have noticed, however, that in cultivated fields where the house mouse sometimes becomes quite common, the white-footed mouse (here almost always of the *maniculatus* group) appears able to hold its own with its more domesticated competitor.

The immature mice of the genus, again the southern golden mouse excepted, are bluish-gray above and may be identified only by their size, tail, habitat or parents.

These mice are nocturnal, and may abound in numbers unnoticed unless attention is called to their presence through their depredations or accidental discovery.

## OSGOOD WHITE-FOOTED MOUSE

*Peromyscus maniculatus osgoodi* (Mearns)

*Characters.* Like all of the *maniculatus* group native to Kansas this is a small mouse. The total length is from 5.8 to 6.7 inches; tail vertebrae, 1.8 to 2.8 inches; and the hind foot, .8 to .84 inch. In color it is the duller of the group, adults varying from cream buff to pale ochraceous buff, more or less intermixed with dusky, producing a dusky grayish effect, the middorsal region the darker, the buffy being most pronounced on the sides. The sides have

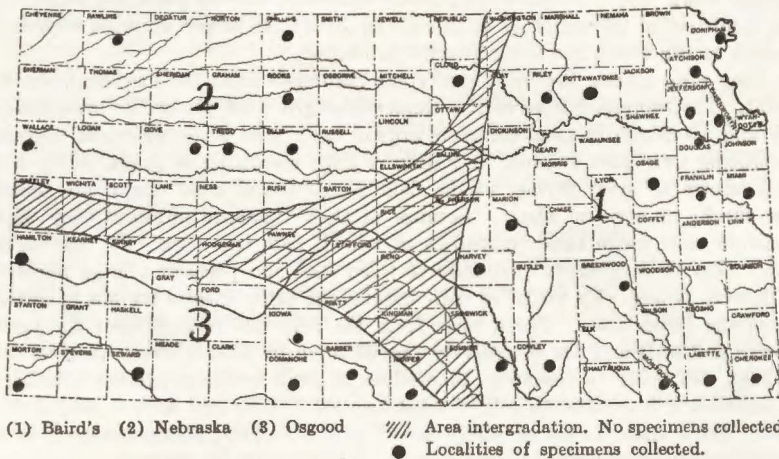


FIG. 31. Map showing distribution of white-footed mice.

a pinkish or vinaceous cast on many specimens. The tail is well haired and sharply bicolored, dark brownish-black above and white below. "Ankles" buffy or dusky; ears blackish, thinly haired, edged with white and with a small tuft of whitish hairs at the anterior base of the ear.

*Range in Kansas.* At least from Hamilton county south, and east as far as Harper and Pratt counties. Specimens from Coolidge very closely approach *nebrascensis*, while those from Harper and Sumner counties are intermediate between *osgoodi* and *bairdii*. (See map 4.)

## NEBRASKA WHITE-FOOTED MOUSE

*Peromyscus maniculatus nebrascensis* (Coues)

*Characters.* Similar in size and general characters, tail, feet, ears, etc., to the preceding, but with slightly smaller ears (typically much smaller, but there is little difference in most Kansas specimens) and brighter upper parts. This is the most brilliantly colored representative of the *maniculatus* group, varying from a dull grayish-buff rather well mixed with dusky, to a bright orange-tawny, with little or no intermixture of dusky hairs. In the latter pelage a bright ochraceous lateral line is often present, while in almost all cases the middorsal stripe is little, if at all, distinct from the remainder of the upper

parts. In Kansas this form attains its highest coloration in the extreme north central part of the state, the specimens from Cloud county being the most brilliant in the K. U. collection. South and west it gradually intergrades into *osgoodi*.

*Range in Kansas.* From eastern Cloud county (probably east into Clay county), west and south to Greeley county. Little is known of its range south in the central part of the state. See Fig. 31 for the probable range and known records.

#### BAIRD'S WHITE-FOOTED MOUSE

##### *Peromyscus maniculatus bairdii* (Hoy and Kennicott)

*Characters.* Very similar to the two preceding, but with certain differences in color. Upper parts rich russet or warm brown, rarely tinged with rufescent; dorsal stripe dusky or blackish, usually very prominent, sometimes obscured in old pelage (generally May to July); anterior ear tufts dusky brown; upper side of tail black; under parts as with *osgoodi*. This form is so much darker than the other two subspecies in Kansas as to make it readily distinguishable, the brown ear tufts, prominent dark middorsal stripe and black upper surface of the tail being very distinctive. It is more likely to be confused with *Peromyscus leucopus noveboracensis* than with any other representative of the *maniculatus* group. The differences between *bairdii* and *noveboracensis* are discussed under the head of the latter form.

*Range in Kansas.* Eastern Kansas, west at least to Harvey and Riley counties. Specimens from Sumner county have been referred to this form, though very close to *osgoodi*. For ranges of all the subspecies of this group see Fig. 31. The hatched area is probably all an area of intergradation, but material is lacking from this part of Kansas, making it impossible even to infer what forms occur in this zone.

*Economic status and habits.* Of the *maniculatus* group the Baird's white-footed mouse is the only form which I have personally collected. It is the most common mammal in eastern Kansas and occurs along the edges of every field and meadow, usually in large numbers. Like others of its kind, it appropriates old burrows and runways of other mice, and apparently sometimes makes short burrows of its own for nesting cavities when necessity arises. Old logs, boards, posts and even farm implements are quickly utilized as shelter for their nests, which are made up of grasses and vegetable fibers. In the Flint Hills, and elsewhere in Kansas where rocks are plentiful, they are frequently found under flat rocks by museum parties when hunting for reptiles under such shelters.

#### NORTHERN WHITE-FOOTED MOUSE

##### *Peromyscus leucopus noveboracensis* (Fischer)

*Characters.* Coloration similar to that of *bairdii*, but the dorsal stripe not so pronounced on most specimens, and the general color much more reddish or rufescent than on *bairdii*. Much larger than the mice of the *maniculatus* group, with a sparsely-haired, rather dully colored and not so sharply bicolored tail in the typical pelage. The general color of the upper parts varies from fawn to tawny cinnamon-rufous, with the dusky dorsal stripe usually prominent, but sometimes obscured; ear blackish. Total length, 6.0 to 7.5 inches; tail vertebrae, 2.5 to 3.3 inches; hind foot, .8 to .9 inch. The larger size and longer

tail, together with the more sparsely haired condition and fainter bicoloration of the tail, should easily distinguish this form from *bairdii*, the only other white-footed mouse found over most of its range.

*Range in Kansas.* About the same as that of *bairdii*, that is, eastern Kansas west to Harvey and Riley counties, intergrading, along a line, mostly uncertain, with *aridulus*. See Fig. 30 for the specific ranges of all the *leucopus* group.

These mice are more given to frequenting woodlands than the *maniculatus* group, and perhaps for this reason are so poorly known in Kansas west of the Flint Hills, though the species is statewide in one of three races. They are more frequently called deer mice than are the other members of the genus, and are also sometimes known as cave mice. The subspecies *aridulus* is known to inhabit caves through Barber and Comanche counties, and *noveboracensis* is a common cave dweller throughout its range where caves occur. I have taken the species in old runs of the woodland pine mouse (*Pitymys*), under decaying logs, and in woodlands on slopes at the openings of burrows evidently made by pine mice.

They subsist for the most part on various weed seeds and nuts, acorns being a favorite food of the subspecies *noveboracensis*.

Although the general consensus of opinion among mammalogists seem to be that under normal conditions the subspecies of *leucopus* will not hybridize with those of *maniculatus*, with which it occurs, specimens from eastern Kansas are so patently hybrids between *noveboracensis* and *bairdii* as to admit of no other interpretation of their status. In the spring of 1933 I collected a series of mice of this kind from an islet between two small streams near Lawrence, and other members of the museum staff have secured additional specimens from the same locality since that time. These mice were taken in runways, apparently of their own making, under brush piles and fallen timber. They possess the sharply bicolored and well-haired tails of *bairdii*, but are reddish or tawny like *noveboracensis*, and their tails are usually nearer the length of that found on typical *noveboracensis*, although this character is quite variable. In size these specimens vary from that typical of one species to the other, all degrees of variation being found. The skulls, which ordinarily separate the two species instantly on size alone, are strictly between the two, with some at either end of the series which appear to be clearly *bairdii* in the case of the smaller, and *noveboracensis* in the case of the larger specimens. There appears to be no character which will separate such specimens either into one species or the other, the only conclusion possible, therefore, being that they are true hybrids.

The northern white-footed mouse nests in the ground in burrows either of its own making or appropriated from some other species, in hollow stumps, logs, trees, or under rocks, rarely nesting in bushes. I have very frequently found them in close association with *bairdii* on the one hand and with the woodland pine mouse on the other.

#### BADLANDS WHITE-FOOTED MOUSE

#### *Peromyscus leucopus aridulus* Osgood

*Characters.* Similar to *noveboracensis* but larger and paler. The dorsal stripe is but poorly marked off from the remainder of the upper parts, which are ochraceous-buff, often tending to pale brown in Kansas specimens, the

ears of this subspecies are pale brownish instead of blackish. This form averages about .5 inch longer than the preceding, and is to be recognized chiefly by its pale upper parts and brownish ears.

*Range in Kansas.* Little is known of the distribution of this mouse in Kansas. It has been recorded from Barber and Comanche counties on the south-east, Cloud county on the north, and Clark county on the southwest. Its probable range is shown in Fig. 30.

#### TORNILLO MOUSE

##### *Peromyscus leucopus tornillo* (Mearns)

*Characters.* Very close to *aridulus*, with which it must intergrade in southwestern Kansas, but paler and fawn-colored instead of ochraceous. The upper part of the tail is brownish instead of black, making the bicoloration even fainter than the others of this group. It averages slightly larger than *aridulus*, but Kansas specimens will probably be indistinguishable on this point.

*Range in Kansas.* This form is known at present only from extreme southwest Kansas, from Morton county. It is probable that it will be found in the two or three adjacent counties.

*Economic status and habits.* As far as I know the habits of these last two subspecies are not especially different from those of *noveboracensis*. The economic status of the forms is that common to the genus.

#### ATTWATER CLIFF MOUSE, OR ATTWATER BRUSH MOUSE

##### *Peromyscus boylii attwateri* (Allen)

*Characters.* This unusual white-footed mouse may be instantly recognized by its very large ears and long, well-haired tail, quite unlike any other Kansas form. In color it is paler than any other southeastern Kansas species, being a pale cinnamon above, finely intermixed with dusky, the head marked with gray; adolescent specimens are predominantly gray. The lower sides of the face, usually a narrow lateral line, and a pectoral spot of ochraceous-buff further serve readily to distinguish this mouse. Total length, 7.5 to 9.0 inches; tail vertebrae, 3.7 to 4.5 inches; hind foot, .90 to 1.0 inch.

*Range in Kansas.* So far this species has been reported only from Cherokee county, but may be expected to occur anywhere in the southeastern part of the state where suitable habitat occurs.

*Economic status and habits.* This mouse appears to be confined wholly to rocky ledges and cliffs, and is able to maintain itself in very barren and unpromising places. It is often found in association with the Attwater pack rat, and seems well able to hold its own, judging from the numbers that occur wherever it is found.

I have had considerable experience with this mouse in the Arkansas Ozarks and have found it very local in its distribution there, being abundant along certain cliffs and totally absent from others which appear to be quite as suitable. It is easily trapped wherever it is found and is one of the most beautiful of all our midwestern mammals. The tail is tipped with a prominent brush or "pencil" of hairs giving it a very striking and characteristic appearance. It nests in cracks between and under rocks, and piles up brush and sticks on a small scale similar to the habit of the pack rat. Like their larger neighbors, acorns appear to be one of their favorite foods.

## SOUTHERN GOLDEN MOUSE

*Peromyscus nuttallii aureolus* (Audubon and Bachman).

*Characters.* Young similar to parents throughout life, becoming brownish-gray in the preadolescent stage, but never bluish-gray, as with all other members of this genus. A rudimentary seventh plantar tubercle on the hind foot. Color, rich tawny ochraceous above; buffy-ochraceous below; upper parts little if any intermixed with dusky; *head and ears like rest of upper parts*; tail brownish above, creamy white below, rather faintly bicolored, that is to say, the transition between the upper and lower surfaces is rather gradual. Total length, 6.5 to 7.6 inches; tail vertebrae, 3.0 to 3.6 inches; hind foot, .7 to .8 inch.

*Range in Kansas.* Known so far only from a single specimen collected at Colony, Kan., March 7, 1873, at one time in the Colonel Goss collection at Neosho Falls. This specimen appears to be lost. For this reason Hibbard (1933) removed the species from the state list and placed it in the hypothetical list, but it seems so well characterized as to be unmistakable. Recent sight records from Colony could hardly refer to any other mouse, and it is therefore thought best to return this species to full rank.

The southern golden mouse is very local in its distribution, being totally absent over wide expanses of country where it is found. Frequent reports from Colony of the occurrence of a "red mouse" or a "golden mouse" from that region which lives in trees clearly indicates its presence there. They are rather social in their habits where found. I have seen perhaps thirty old nests in grape vines within a strip 100 yards long and 20 yards wide. They invariably nest in trees or bushes, at heights from 18 inches to 25 feet. Their favorite habitat seems to be wild grape vines on dark, heavily-wooded hill-sides, where they suspend their nests in the twigs like bird nests which they are said sometimes to utilize for foundations. These nests are made up of shredded plant fibers, the inner loose bark of the grapevine being especially favored for this, and are in the form of a rather loose ball about five or six inches in diameter. There is no evident and fixed opening to these nests, they being opened at random when the mouse enters or leaves, and at all other times are apparently closed, either through the nature of their construction or by a voluntary act on the part of the mouse. I have examined a number of the nests and have yet to find a definite entrance to a single one. This species is rather common in the Arkansas Ozarks, around Winslow, and has been taken at Red Oak, Okla., and St. Louis, Mo. It may be expected to occur in favorable localities anywhere in southeastern Kansas.

GENUS ORYZOMYS. *Rice Rats*

## TEXAS RICE RAT

*Oryzomys palustris texensis* Allen

*Characters.* Upper parts grayish-brown, pelage coarse and long; under parts white; feet whitish; tail whitish below, brown above, long and thinly haired. Much like a young Norway rat, but may be distinguished by the bicolored tail, which is more hairy, and by the difference in molar crown pattern, a family characteristic. From the closely related *Sigmodon* this rat may be distinguished by the slighter build, white feet, unscaled and shorter tail of the

rice rat. Total length, 9 to 11 inches; tail vertebrae, 4.3 to 5.3 inches; hind foot, 1. to 1.5 inches.

*Range in Kansas.* Known in this state only from one specimen, now in the museum of Comparative Zoölogy, Harvard University, Cambridge, Mass., collected in 1866 at Neosho Falls, Woodson county, by Col. B. F. Goss. It possibly will be found to be of rare occurrence along the rivers in southern Kansas, although it is more likely that this specimen represents a straggler from farther south. The latter alternative is the more probable because the rat has never been reported from the intervening territory in Oklahoma nor from western Arkansas.

*Economic status and habits.* Although these animals are prolific breeders and often become rather important economic pests in certain sections of the south, it is obvious from the preceding paragraph that such is not the case in Kansas. They usually inhabit wet, marshy places, where they feed on various grasses, sedges and other semiaquatic plants, although they are sometimes found in open meadows. In certain sections of the south they do considerable damage to rice fields, and may in some instances, damage meadows to some extent.

One or two litters, of from four to seven young each, are born annually, either in an underground nest if on the drier upland, or in a grass nest located in the marginal tall grass, if in a marshy place.

#### GENUS SIGMODON. *Cotton Rats*

##### TEXAS COTTON RAT

#### *Sigmodon hispidus texianus.* (Audubon and Bachman)

*Characters.* A rather robust, small rat with a medium-long, scaly tail, and long, coarse pelage. Upper parts grayish-brown to buffy gray, intermixed with black (the underfur showing through); under parts grayish-white; feet gray; tail faintly bicolored, dusky above, pale below. Total length, 9.2 to 11.4 inches; tail vertebrae, 3.7 to 4.4 inches; hind foot, 1.0 to 1.35 inches. Characters by which this rat may be distinguished from the rice rat are discussed under the heading of the preceding species.

*Range in Kansas.* Southeastern and south central Kansas north and west at least to Harvey, Greenwood and Allen counties. Probably intergrades with *hispidus* in extreme southeastern Kansas. When sufficient specimens are available it is possible that the cotton rat present in the extreme southeastern part of the state will be found to bear a greater resemblance to *hispidus* than to *texianus*.

*Economic status and habits.* Considerable damage is done by the cotton rat wherever it is common—and that is usually wherever it occurs—through its destructive work in meadows and orchards. It is somewhat of a nuisance in meadows, too, due to the mounds it throws up about its nesting burrows which catch and clog up the sickle bar of a mowing machine when an attempt is made to cut over meadows infested with these rodents. I have known of a number of cases of farm implement breakage due to these mounds. In orchards they gnaw the young trees and are often the source of bark damage to young fruit trees, which is laid to the account of the cottontail rabbit.

They make wide, extensive runs through the meadow grass and are exceedingly active, especially in the early morning and late evening. They

apparently are not active at night. Where they prove troublesome they may easily be reduced to small numbers, either by placing rat traps baited with oatmeal across their runs, or by the use of poisoned grain.

The nest is almost always in an underground burrow, where several litters of from three to six young each are born every year. That the ratio of young to adults is extremely large is easily proven by trapping. Over several seasons I have secured perhaps an average of twelve immature or adolescent cotton rats to every adult specimen taken. This is rather remarkable, especially when their rapid rate of development is taken into consideration.

GENUS NEOTOMA. *Wood Rats*

BAILEY WOOD RAT

*Neotoma floridana baileyi* Merriam

*Characters.* A large, typically ratlike mammal, with a relatively short, bi-colored tail. Color—Fresh winter pelage: "Upper parts creamy buff, varying to buffy gray, clearest along sides, thinly overlaid dorsally with dusky hairs; feet and underparts white, the fur basally plumbeous along sides of belly; tail sharply bicolor, brownish gray above, white below. Worn pelage (spring, summer and fall): above, varying shades of dark rusty brown." (Goldman, 1910). Average measurements about: total length, 15 inches; tail vertebrae, 6.4 inches; hind foot, 1.6 inches.

*Range in Kansas.* As limited here this subspecies is found only in the eastern part of the state, intergrading with *campestris* on the west, probably just west of the Flint Hills, and with *attwateri* in the extreme southeastern corner of Kansas. The latter subspecies has not yet been reported from the state, but no doubt is the form present in the extreme southeast, where the Ozark influence is so strong.

KANSAS WOOD RAT

*Neotoma floridana campestris* Allen

*Characters.* This subspecies, in its typical pelage, differs from the preceding by being much paler. Pelage difference as summed up by Kellogg (1914) include: Upper parts buffy ochraceous, or light yellowish-gray; the broad stripe extending from posterior base of ear to sides of neck and throat white instead of ochraceous buff; absence of ochraceous spot on sides of throat in front of forelegs; tail not so sharply bicolor, pelage "long, soft and cottony" in *campestris*, rather bristly in *baileyi*; measurements are practically identical for both races.

*Range in Kansas.* From the Flint Hills west, but apparently absent from the southwest corner, being known as far south as northern Hamilton county on the western boundary, and west into Comanche county on the southern boundary. Overlaps in certain parts of western Kansas with *Neotoma micropus micropus*, a very similar species.

BAIRD WOOD RAT

*Neotoma micropus micropus* Baird

*Characters.* Similar to *Neotoma f. campestris*, but may be distinguished from that form by the rather sharply bicolored tail, which is blackish above and gray below. Color of upper parts also slightly different, being ecru drab

in *micropus*. Pelage short and rather harsh. Total length, 14 inches; tail vertebrae, 6.5 inches; hind foot, 1.6 inches.

*Range in Kansas.* South central Kansas, from Sumner county or Cowley county, west into Stevens or possibly Morton county, north into Pratt and Logan counties. Specimens from most of Stevens, Stanton and Grant counties are intermediate with the following subspecies.

HOARY WOOD RAT

*Neotoma micropus canescens* Allen

*Characters.* Very similar to *micropus*, but paler, smaller, and with longer, softer pelage. Upper parts ashy gray; tail grayish-brown to blackish above. Not known to overlap in distribution with any other wood rat in Kansas. Total length, 13.2 inches; tail vertebrae, 5.5 inches; hind foot, 1.4 inches.

*Range in Kansas.* Known in Kansas only from a series of specimens in the K. U. museum, collected from extreme southwestern Morton county.

*Economic status and habits.* The pack rat, wood rat, or trade rat, as it is variously known, is famous for its trading instincts. This strange habit of carrying off any and everything loose and small enough for the rat to move—but almost always bringing something to replace it—is best known, and perhaps most pronounced, in the species inhabiting the Rocky Mountain region, but it is well marked in all the species. Nelson (1918) says: "In the wood rat country where small articles are missed from camp it is always worth the trouble to investigate the nearest rats' nest."

They live, in our section, almost entirely in caves, bluffs and along rocky ledges where they pile great heaps of sticks, leaves and rubbish in which they make their nests. I have seen rubbish heaps in caves, but I have also found one extremely compact nest on a ledge in a cave, completely exposed and very birdlike, which was occupied by an adult female, nursing young. That the nest was not just a recently built, emergency shelter was proven by the fact that only a little improvement in the way of a roof had been added to the nest in the year that followed, when it was found to still be occupied. They are mainly nocturnal and play along their home cliff throughout the night.

Several litters may be raised each year, the young varying from three to six in each litter. As with most of the other rodents it is only the constant toll demanded by hawks, owls and carnivorous mammals that keeps these animals in check. The bot fly, a serious natural enemy of all rodents, is also considered a very important controlling agent of the wood rat.

The habitat generally occupied by the pack rat is such that it does not come in conflict with the interests of man except under rather unusual conditions, and is, as yet, of but very little economic importance in Kansas. It is a very interesting and beautiful mammal, being totally unlike the repulsive and rightfully disliked Norway rat.

Subfamily MICROTINAE. *Voies, Lemmings and Water Rats*

Distinguished by the possession of flat-crowned molars with annular crown pattern. The members of this subfamily are usually more robust than those of the subfamily Cricetinae.

GENUS SYNAPTOMYS. *Lemming Mice*

## GOSS LEMMING MOUSE

*Synaptomys cooperi gossi* (Coues)

*Characters.* A robust, small rodent, with rather long, loose and coarse pelage. small eyes, small ears, and a short tail. Upper incisors with a longitudinal groove on the anterior face of each tooth. Upper parts varying from a mixed grayish brown to grizzled brownish rufous; under parts slaty; tail bicolor, brownish above, white below. Total length, 5 to 6 inches; tail vertebrae, 0.7 to 0.85 inch; hind foot, 0.75 to 0.85 inch.

*Range in Kansas.* Periodically common in eastern Kansas, and has also been reported from Stafford county. This rodent is very dependant on wet meadows, and has been greatly reduced in recent years on account of the prevailing dry conditions. It disappears quickly sometimes when very common, and may just as suddenly appear in a region where it has not been known before.

*Economic status and habits.* The sporadic and irregular occurrence of this mammal makes it one of considerable interest to the student of animal distribution. It has been found to occur around Lawrence in great numbers, only to be extremely rare or even totally absent the next year. Apparently they make wholesale and extended migrations when conditions do not suit them, although, so far as I know, such migrations have not actually been observed.

The Goss lemming mouse is never found except in very wet localities, where grass, usually bluegrass, grows in abundance. Here it makes little runways, very similar to those of its relative, the meadow mouse. It feeds almost exclusively on young shoots of bluegrass, which may frequently be found in small bundles in their runways where they have not yet carried them into their burrows.

The runways of *Pitymys*, *Microtus* and *Synaptomys* are so similar that their owners cannot be identified except by specimens of the mouse itself, or the color of the droppings found in occupied runways, which are always light green if from *Synaptomys*, and dark brown or blackish from the other two genera.

Several litters may be born throughout the warmer part of the year, varying from three to six young at a time.

GENUS MICROTUS. *Meadow Mice*

## PRAIRIE MEADOW MOUSE

*Microtus ochrogaster ochrogaster* (Wagner)

*Characters.* Similar in general to the preceding, but larger and without the grooved incisors; upper parts often indistinguishable from *Synaptomys c. gossi*, though usually much grayer and more grizzled; under parts cinnamon to fulvous; tail dusky above, buffy below. Total length, 5.5 to 6.7 inches; tail vertebrae, 1.0 to 1.5 inches; hind foot, 0.7 to 0.85 inch.

*Range in Kansas.* Known to range west into Republic, Cloud and Pratt counties; common in eastern Kansas in normal seasons.

*Economic status and habits.* This form of *Microtus* prefers damp situations and may be found to occupy the same runways with *Synaptomys*, although generally preferring runs that are not quite so wet as those frequented by the latter. Their habits are very similar to those of the lemming mouse, the

principal differences being in their preference for a drier habitat, their more omnivorous diet, and wider, more stable distribution. They are active throughout the year.

The ability of the meadow mouse to live in drier localities makes it somewhat of an agricultural pest, and it is often the source of damage to cultivated crops. These mice spend much of their time underground and very often take over deserted mole runs, feeding on the roots of plants exposed by the mole

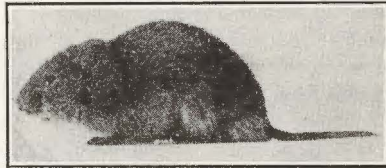


FIG. 32. Meadow mouse.

in its hunt for grubs and worms. In the east, at least, meadow mice damage young fruit trees by gnawing the barks and roots. Throughout the country they are perhaps the most damaging of the native rodents and exact a great toll from the agricultural wealth. Alfalfa, grain of all kinds, bulbs, roots, in fact almost all sorts of plants are utilized for food, and while the amount consumed by a single individual is very small they exist in such great numbers as to waste a tremendous quantity of food and forage.

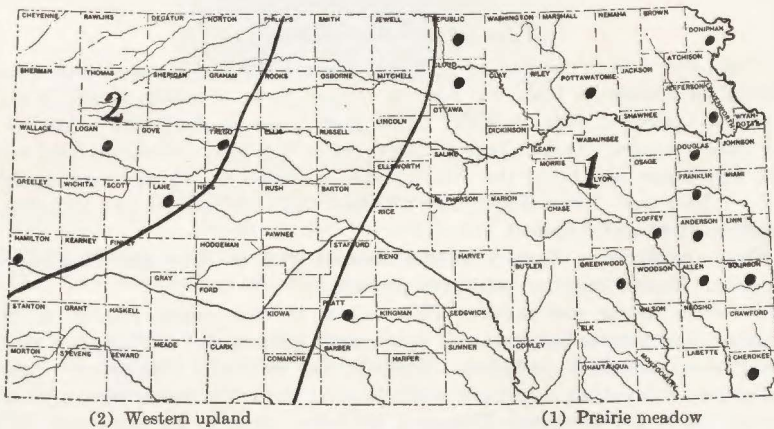


FIG. 33. Map showing distribution of meadow mice.

Meadow mice are extremely shy, although active in the day, and never venture far from their sheltered runs, instead extending these covered trails to the feeding grounds.

These rodents are the most heavily preyed upon of all mammals, and are, therefore, of necessity, very prolific. Several litters, of from four to eight young, are born annually.

## WESTERN UPLAND MOUSE

*Microtus ochrogaster haydenii* (Baird)

*Characters.* Very similar to the preceding, with which it intergrades, but paler and larger. Upper parts light gray, grizzled with whitish and blackish in summer; in winter more brownish; under parts slightly paler. Averages about one half inch shorter than *ochrogaster*.

*Range in Kansas.* This form is now considered as a subspecies of *ochrogaster* (Bailey, 1926), and while the range of the two Kansas forms has not been found to meet within the state this is probably due to the very incomplete knowledge we have of the mammals from central Kansas. As now known *haydenii* is found in western Kansas north and west of a semicircle running from Phillips county southwest through Ness and Hamilton counties. (See Fig. 33 for the known records.) The ranges of these two subspecies should be expected to meet in central Kansas with a broad belt of intergradation throughout most of the region left blank on the map.

*Economic status and habits.* Although now (1935) on the verge of extinction in western Kansas, due to the prolonged drought, this mouse is normally very common in the northwestern part of the state. It is adapted to a dry, uplands habitat, however, and does not require the moist conditions necessary for the eastern form. It is frequently found in rather exposed places in short grass, although it occupies longer cover wherever it is available. Its general food and breeding habits are quite similar to the preceding subspecies.

## GENUS PITYMYS. Pine Mice

## WOODLAND PINE MOUSE

*Pitymys nemoralis* (Bailey)

*Characters.* Very similar to *Microtus ochrogaster ochrogaster*, and often difficult to distinguish from that species. Upper parts, of adults, usually a rich chestnut, sprinkled with blackish; under parts paler, washed with cinnamon; tail faintly bicolor, blackish brown above, below like belly. Pelage is long, soft and very dense, this being the most reliable character by which to distinguish it from *Microtus*. Total length, 5 to 6 inches; tail vertebrae, 0.8 to 1.15 inches; hind foot, 0.65 to 0.8 inch.

*Range in Kansas.* Eastern Kansas, west at least to Riley and Greenwood counties. Rather common wherever present.

*Economic status and habits.* This animal is very closely related to the meadow mice (formerly considered in the same genus), and is in general much like these mammals in its habits. Typically the woodland pine mouse prefers the cover of moist woods where it makes runs under the fallen trees and decaying leaves, but in eastern Kansas it has been found in the same runs with both *Microtus* and *Synaptomys*; in fact in 1934 we trapped a patch of bluegrass near Lawrence for *Synaptomys* and caught *Pitymys* in the lower, damper bluegrass, getting our few specimens of *Synaptomys* in the higher, drier sage on the edge of the woodland, a complete reversal of normal conditions.

Their food and breeding habits are quite similar to the other species of this general group. Until recently this mouse has been considered rather rare throughout eastern Kansas, but has been found to be common in both Greenwood and Douglas counties within the past three years.

GENUS ONDATRA. *Muskrats*

## COMMON MUSKRAT

*Ondatra zibethica zibethica* (Linnaeus)

*Characters.* A rather robust, ratlike rodent with a scaly, laterally compressed tail. Hind feet webbed, legs rather short, and feet broad. Pelage as with the beaver, that is, short, dense underfur, overlaid with glossy guard hairs. Upper parts rich, glossy, dark brown, chestnut on the sides; under parts similar to sides but lighter, almost whitish on throat and belly; a black spot on chin; feet dark brown, blackish about the wrists and heels; underfur basally slaty gray. Total length, 21 to 24 inches; tail vertebrae, 9.5 to 10.7 inches; hind foot, 3 to 3.5 inches.

*Range in Kansas.* This subspecies is limited to the extreme southeastern corner of the state, but intergrades over a wide zone with the subspecies *cinnamomina*, this intergradation occurring over most of eastern Kansas. Specimens from Cherokee and Bourbon counties in the K. U. collection seem closer to *zibethica* than to *cinnamomina*.

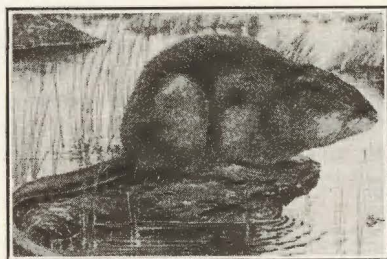


FIG. 34. The muskrat.

## GREAT PLAINS MUSKRAT

*Ondatra zibethica cinnamomina* Hollister

*Characters.* Very similar to the preceding, but typically much paler and somewhat smaller. Upper parts cinnamon-brown; under parts paler. Total length, 19 to 21.5 inches; tail vertebrae, 9 to 10 inches; hind foot, 2.6 to 3.1 inches.

*Range in Kansas.* State-wide except for the southeastern corner. Specimens from Douglas, Woodson and Franklin counties, although closely approximating *zibethica*, have been referred to the paler western race, while specimens from west of the Flint Hills are quite easily distinguished from the darker eastern race. The type locality of *cinnamomina* is Wakeeney, Trego county, Kansas.

*Economic status and habits.* The muskrat is by far the most important fur-bearing mammal in North America. Probably ten million muskrats are killed every year either for their fur or flesh, in spite of which they appear to be holding their own over most of their range and actually are gaining new territory in some instances.

In this country the habits of the muskrat do not appear to interfere to any great degree with man, and the only really serious threats against the future

security of this mammal from man are overtrapping and destruction of breeding grounds. Game laws are likely to protect it from the first, while the muskrat is so widespread that there is little danger of its extinction on this account, at least for many years to come. The continual draining of swamps and marshes, however, is certainly reducing the muskrat population in many sections. In Europe, where it has been imported and allowed to escape, it is quite a different story. Probably no other single animal has caused the loss and destruction in central Europe that has been charged against the muskrat within the past few years. A recent paper (Mohr, 1933) is very informative on this point. The case of the muskrat in Europe is an excellent illustration of the folly of importing birds and mammals into a region where their natural controls are not present, and shows, quite beyond argument, the importance of natural enemies in the control of any species.

For food the muskrat utilizes almost any sort of vegetable matter, and at times takes clams, crayfish and frogs, although bulbs, roots and leaves of aquatic plants are its staple items of diet.

There are annually three to six litters, each of three to thirteen, usually from five to seven young. They remain in the nest about three or four weeks, and are notoriously tame and unsuspecting while young.

The muskrat house is built of mud and trash, rising some two to four feet above water level and with an under-water entrance. In instances where marshes and swamplike places are not available, however, the home of the muskrat is a burrow in the bank of the stream or lake which the animal frequents. Such a den usually has an under-water entrance, although there may be other entrances into the house.

#### FAMILY MURIDAE. *Old World Rats and Mice*

Typically mouselike or ratlike; molars three in each half-jaw; distinguished from similar Cricetidae by the fact that the tubercles on the molars are arranged in *three* longitudinal series in all the forms found in this country. Dentition for both introduced genera is: 1/1; 0/0; 0/0; 3/3—16.

#### GENUS MUS

#### HOUSE MOUSE

#### *Mus musculus musculus* Linnaeus

*Characters.* A typically mouselike rodent, with dull yellowish-brown to gray pelage, under parts similar to upper parts but paler; small eyes; tail long, annulated, and sparsely haired; tail dusky above and but little paler below. Total length 5.8 to 6.6 inches; tail vertebrae 2.85 to 3.5 inches; hind foot, .65 to .75 inch.

*Range in Kansas.* Throughout the state.

*Economic status and habits.* Nothing of good can be said about this rodent; nothing bad needs be said—its reputation is too well known to every citizen to necessitate comment. Like the English sparrow, it has not been content to dwell in the city, but has pushed its range into the remotest sections of the country, overrun houses and outbuildings, and has in some places driven the normally exceedingly prosperous white-footed mice from the fields. It is this obnoxious species, with its disagreeable odor, that has so turned the mind of the

ordinary person against anything that bears the name "mouse," although our native species are beautiful, cleanly, and extremely interesting mammals.

Only one native group, the harvest mice, are likely to be confused with the house mouse. These may be distinguished by the more thickly haired and more sharply bicolored tail, and the grooved incisors of the harvest mice. The eyes of the native group are also a little larger than those of the house mouse, while pelage differences are usually distinct enough to separate the species.

#### GENUS RATTUS

##### *Rattus norvegicus* (Erxleben)

*Characters.* Quite similar to the preceding, but much larger, brown to grayish above, ashy below; tail but faintly bicolor. Total length, 15 to 16 inches; tail vertebrae, 7 to 8.5 inches; hind foot, 1.5 to 1.75 inches.

*Range in Kansas.* State-wide.

*Economic status and habits.* Essentially the same as the house mouse. Much has been written concerning the tremendous financial loss suffered in this country and elsewhere by the depredations of the Norway rat. It is more confined to human habitation than the house mouse, and does not seem inclined to establish itself in the fields—a limitation for which we should be very thankful.

#### FAMILY ZAPIDAE. *Jumping Mice*

Typically mouselike mammals, with remarkably long tails and hind legs; internal cheek pockets; upper incisors grooved; molar surfaces complex. Represented in North America by two genera, and in Kansas by a single subspecies.

#### GENUS ZAPUS

*Dentition:* 1/1; 0/0; 1/0; 3/3—18.

#### PRAIRIE JUMPING MOUSE

##### *Zapus hudsonicus campestris* Preble

*Characters.* "A medium-sized mouse with very long, slender hind legs and feet and small front feet; tail, very slender and longer than head and body; ears, small. Upper parts, bright buffy yellow along sides, darker along the back; under parts, pure white. Average measurements: Total length, 8.9 inches; tail 5.4 inches; hind foot 1.22 inches." (Bailey, 1926).

*Range in Kansas.* Apparently very rare in Kansas. Known only from Douglas, Brown, Trego, Anderson and Elk counties, by one specimen from each county except Douglas, from which there are four specimens in the K. U. museum. May be expected to occur anywhere over northern and northeastern Kansas.

*Economic status and habits.* W. J. Hamilton, Jr., of Cornell University, has just published an excellent paper on the "Habits of Jumping Mice," (1935) from which the following brief bits are summarized:

These mice appear to prefer rather densely covered territory, especially woodland margins thinly grown up in grass and weeds. The jumping mouse when frightened has been found capable of making a leap of ten feet, although shorter jumps of about four or five feet are the normal method of progression.

They are capable of climbing and swimming and apparently are rather adept at both.

They hibernate throughout the winter, rolled up tightly in a characteristic ball, becoming very fat before entering hibernation, apparently entering this state in late October or early November under normal conditions, and awakening in late April or early May. Representatives of the genus *Zapus* hibernate from a few inches to several feet below the surface, digging in themselves, and constructing a snug nest of leaves or grass in which to pass the winter sleep.

Their food is composed largely of grass seeds, although berries, nuts, various fruits, roots and insects are also eaten.

But one litter of young, from two to seven in number, is raised in New York, but it is probable that two or three litters are raised annually in Kansas.

#### FAMILY ERETHIZONTIDAE. *American Porcupines*

Readily recognized as the only quilled mammal in North America. Large and robust in build; molar crown pattern annular and complex; toes, four on front feet, five on hind feet, all bearing strong, sharp, curved claws; tail (in our forms) broad and bushy, densely covered with quills; very long hairs partially covering the quills on the back. All of the North American species are arboreal. One genus occurs in North America, represented in Kansas by a single sub-species, which is very rare.

#### GENUS ERETHIZON

*Dentition:* 1/1; 0/0; 1/1; 3/3—20.

#### NEBRASKA YELLOW-HAIRED PORCUPINE

#### *Erethizon epixanthum bruneri* Swenk

*Characters.* Upper parts brownish to blackish, strongly overlaid with pale yellow; the quills generally brownish, tipped with yellowish white, and the long hairs black basally, very broadly tipped with pale yellow. Under parts spineless, somewhat paler than upper parts; underside of tail brownish. Total length, averaging about 34 inches; tail vertebrae, 8 inches; hind foot, 4 inches.

*Range in Kansas.* In recent years known only by single specimens from Decatur, Trego and Barber counties. Another specimen, unpreserved, was known to have been killed in Barber county in 1931. Formerly common throughout the western part of the state. This scattered distribution indicates that the species occurs very rarely throughout the western portion of Kansas, although records are so inadequate that no presumption can be made regarding its exact status. The one Barber county specimen in the K. U. collection is rather small and decidedly different in coloration from typical *bruneri*; additional material may prove the presence of an undescribed race of porcupine in that region.

*Economic status and habits.* Few of the legion of superstitions about animals are so widespread as the belief that porcupines "shoot" their quills when molested. The belief is due to the lightning-quick swipe of the tail that is made so rapidly as to be almost invisible. Then, too, loose quills may occasionally be thrown out in the direction of an enemy by this violent motion. Those who have watched captive porcupines are well aware of their defense position—facing away from the enemy with quills erect and tail ready to deal its much feared blow.

So efficient is the defensive armament of the porcupine that the animal is practically unmolested. This protection, like the skunk and its musk, has resulted in the degeneration of all the other defensive powers of the mammal, so that it is exceedingly slow, clumsy and dumb almost beyond belief. Among all the predators in this country only the fisher appears to be willing to tackle the porcupine. Seton (1929) cites instances of the fisher feeding on this rodent, and has given evidence which shows that the fisher preys with remarkable success upon the porcupine, and that where the former is common the latter is usually rare, while the extermination of the fisher in a locality will almost invariably result in a decided increase in the porcupine population. Other than this fearless carnivore the worst enemies of the porcupine are tapeworms and forest fires. Surber (1932) says that the porcupine is common in northern Wisconsin "though forest fires have beyond question destroyed thousands of them."

Probably, however, the one great factor which has reduced the numbers of these interesting mammals over much of their range is neither tapeworms, fishers or forest fires, but man—the relentless and selfish. The porcupine destroys timber, sometimes in rather large quantities, through girdling the trees; it does considerable damage to camps; and it frequently kills hunting dogs which are foolish enough to attack it. For these reasons—and the inborn lust to kill—man has warred against the porcupine until it is now quite extinct in many sections. In the extreme north, however, the reduction of the number of fishers and stringent laws which forbid the killing of porcupines except for emergency food has again restored their numbers in that region.

The two or three young, well covered with spines, are born in a den situated in a hollow tree, under a fallen log, or in a natural opening in a rocky place. Concerning the young, Merriam (1886) says: "They are born about the first of May and are monstrous for the size of the species. They are actually larger, and relatively more than thirty times larger, than the young of the black bear at birth . . ." If ever found breeding in Kansas the young will probably be born in April.

#### ORDER LAGOMORPHA. *Rabbits, Hares and Pikas*

Easily recognized in Kansas because the only family in our fauna belonging to this order is the Leporidae, or rabbits. Also contains the family Ochotonidae, or pikas of the west. The order has characters similar to those of the Rodentia, but is readily distinguished by the presence of a rudimentary pair of upper incisors directly behind, and applied to the larger first pair. The tail is short or very short; habits strictly terrestrial. Other distinguishing characteristics are: the extension of the enamel on the incisors upon the posterior surface of the tooth (the Rodentia incisor has enamel only on the anterior face); narrow bony palate; and lateral motion of mastication, due to the fact that only side of the upper and lower jaws oppose one another at a time.

#### FAMILY LEPORIDAE. *Rabbits*

This family is characterized by: soft, long pelage; very long ears; soles of feet hairy; saltatorial progression with resultant greatly elongated hind legs. (There is a very aberrant, microtine-like form in Mexico). Three genera and

several species are known from North America. Two genera, with a total of five species, occur in Kansas. One of these species is represented by three geographic races, another by two races.

GENUS LEPUS. *Hares and Jack Rabbits*

*Dentition:* 2/1; 0/0; 3/2; 3/3—28.

WHITE-TAILED JACK RABBIT

*Lepus townsendii campanius* Hollister

*Characters.* A very large rabbit, with large ears and a tail which is wholly white. Color of upper parts uniform buffy gray, with the nape buffy to grayish; under parts white except for gray throat, washed with buffy; legs like back; ears brownish, whitish basally and tipped with black. Occurs in a white winter phase in the northern part of its range, but not known in this pelage from Kansas. Total length, 23 to 25 inches; tail vertebrae, 3.2 to 4 inches; hind foot, 5.7 to 6.2 inches; ear from notch, 3.5 to 4.2 inches.

*Range in Kansas.* Theoretically the northern half of Kansas, over most of which it was once common. It is now very rare, and no doubt extinct in many localities. The known limits of its range in Kansas are Finney county on the south and Riley county on the east.

*Economic status and habits.* Very similar in most respects to the black-tailed jack rabbit. The white-tailed species has apparently developed the habit of "freezing," or remaining motionless in order to escape detection, to a very high degree, although this defensive trick is frequently used by all the rabbits.

The first litter of young, three to six in number, is usually born in the latter part of May. There may be two or three broods each summer.

The white-tailed jack rabbit is much more speedy than the black-tailed species, and takes longer leaps. Seton (1929) concludes that this animal is "faster than the dog, fox or coyote, and that it can maintain an average speed of thirty miles an hour for a distance of more than a mile." It has been found to jump from 18 to 21 feet at a leap, while the average jump is around 12 feet. In comparing the jumps of the two species Seton says: "The Whitetail runs like a deer, with high, long bounds; the Blacktail, lower, with shorter, quicker bounds, and much more regularly punctuated with spy-hops."

Their feeding habits are similar to those of rabbits in general—any green vegetable matter or grain available.

This mammal is easily able to outdistance all terrestrial enemies, but is quite at the mercy of the hawks and owls, both of which prey quite heavily upon all the rabbits. Foxes and coyotes formerly destroyed a large percent of the young.

Although this work deals strictly with mammals I cannot resist the impulse at this point to enter a strong plea for a fairer treatment of the hawks and owls. They are killed at every opportunity by a great majority of the population—either on the pretense that they kill game, catch chickens, or simply because someone wants to kill a large and showy bird. Nothing could be more foolhardy. In bygone years our prairies teemed with hawks every fall, and many remained the year around, while owls were once very common throughout the state. Rabbits, though common, were not nearly so numerous then as now. We have exterminated the kit fox, we would poison and shoot

coyotes into oblivion, and we try our best to kill all the hawks and owls—and then complain to our federal and state government that “something must be done about the rabbits—they are destroying everything we raise.” The government may send men out by the dozen to kill rabbits; they may spend thousands upon thousands of dollars that we as taxpayers will eventually have to repay—but they can never control our rodent and rabbit pests as well as nature would have done if we *wise* Americans had only been foreseeing enough and sensible enough not to tamper too much with the natural controls. Why people cannot be made to understand that hawks, owls, coyotes, foxes, and all the other predatory animals were placed here for a purpose, and are useful, in the main, is quite beyond my comprehension. *No living animal in North America, be it mammal, bird, reptile, or amphibian, is a sufficient enemy to the public welfare to justify its extinction.* In a few instances, and these mainly where we have created an unreasonable lack of balance as we have with our rabbits, some measure of *control* may be necessary. *Such control, however, must be applied with extreme caution.*

GREAT PLAINS JACK RABBIT

*Lepus (Macrotolagus) californicus melanotis* (Mearns)

*Characters.* A large rabbit, slightly smaller than the preceding, and easily distinguished by the prominent black band extending from the rump onto the tail. A conspicuous white rump patch is another excellent field mark. Upper parts bright ochraceous buff, somewhat intermixed with black, sides grayish; under parts white, except for a prominent throat patch of rich ochraceous buff. Total length, 21.5 to 24 inches; tail vertebrae, 2.9 to 3.5 inches; hind foot, 4.8 to 5.5 inches; ear from notch, 4 to 4.5 inches.

*Range in Kansas.* Common throughout the state, especially so west of and through the Flint Hills.

*Economic status and habits.* This well-known mammal, more often called the black-tailed jack rabbit or simply jack rabbit, is one of the mammals on the farmer's black list which rightfully belongs there. That the jack rabbit is such a pest is not wholly the rabbit's fault, but nevertheless the blame is placed at its door. That centuries of evolution have developed a mammal with sufficient reproductive powers, speed and food habits to make it a successful plains dweller is not the fault of the jack rabbit. Neither is the animal to be blamed when man, through short-sighted greed, removes the natural controls which have developed parallel with the rabbit as a part of the scheme of life on the plains, and as a result allowed the latent possibilities of increase in the rabbit to run rampant. Man, however, does not accept the blame for his mistakes. The rabbit is warred against tooth and nail, and so it must be—we seem to prefer the expense and burden of running nature to suit ourselves. Perhaps a time will come when America will awaken to the wisdom of nature's way and make an attempt to restore the balance, although such awakening will probably come only after the predators have all been wiped out.

One or two litters of young are born each year, each litter containing two to four individuals.

Their style of running and their food habits are sufficiently discussed under the heading of the preceding species, and are for that matter so well known to Kansans as to make further discussion here unnecessary.

## GENUS SYLVILAGUS. Cottontail and Swamp Rabbits

*Dentition:* Same as for *Lepus*. Smaller and shorter-legged than the preceding genus. Underside of tail always white in Kansas forms. Species and subspecies very difficult to separate on the basis of external characters.

## MEARN'S COTTONTAIL

*Sylvilagus floridanus mearnsi* (Allen)

*Characters.* Largest of the true cottontails occurring in Kansas, but much smaller than the jack rabbit. "Top of head and back pale pinkish buffy, sometimes with a slight ochraceous tinge, and always darkened by the overlying and usually strong wash of black; sides of head and body grayer than back and usually much paler, though with a thin wash of black on tips of

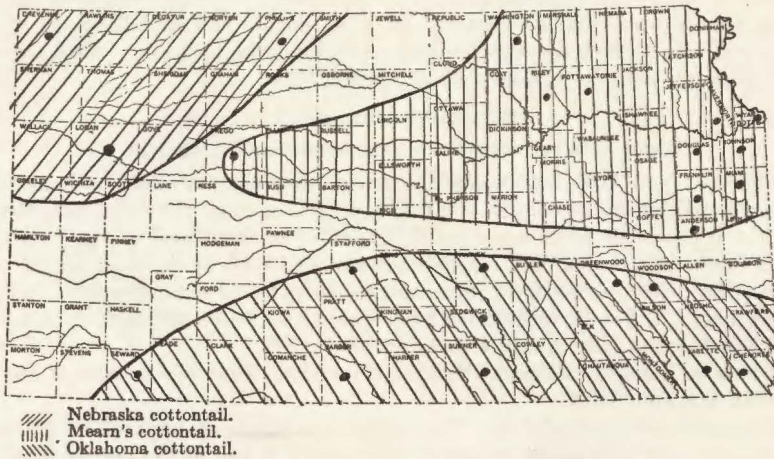


FIG. 35. Map showing distribution of cottontail rabbits.

hairs; rump dull iron gray forming a distinct though not strongly contrasted rump patch . . . washed and darkened with black; upper side of tail dull brownish, more or less strongly grizzled with buffy or buffy gray; nape rather dark rusty rufous; front and sides of forelegs rusty rufous . . . Shading into pale ochraceous buffy on top of forefeet; back and outside of lower hind legs overlaid with rusty chestnut and washed with pale buffy cinnamon; tops of hind feet white, sometimes pale buffy whitish; under side of neck varying from dull pinkish buff to dull ochraceous or to pale creamy buff becoming dull yellowish gray on pale individuals; under side of body white, this pale area more restricted than usual; outside of ears buffy grayish, distinctly grayer than top of head and strongly bordered with black along anterior margin and about tip; inside of ear dull gray, sometimes becoming more or less buffy along posterior border." Thus does Nelson (1909) describe the fresh pelage of this rabbit in his excellent monograph of the family. The rabbits of the *floridanus* group are best distinguished from those of the *auduboni* group by the difference in the auditory bullae, which are small, compact, and smooth in the *floridanus* group, but rather inflated and with roughened surfaces in the

*auduboni* group. So far as known no other cottontail overlaps the range of this form in Kansas, hence it is rather easily distinguished in this state on the basis of distribution alone. Total length, 17.8 inches; tail vertebrae, 2.4 inches; hind foot, 4.16 inches\*

All the descriptions here are of animals in fresh fall pelage, which is brighter and darker than at any other time of the year, the other extreme being naturally reached in the early summer just before the moult begins. There is considerable individual variation as well as this seasonal change.

*Range in Kansas.* Northeastern and north-central Kansas, southwest to near the center of the state. Extremely common over most of the known range, and will no doubt be found to intergrade with the other subspecies of *floridanus* over much of the area from which we at present have but very few or no specimens. The distribution of the cottontails is best understood through a careful study of the accompanying maps, based on those of Nelson (1909), the actual known records being indicated.

*Economic status and habits.* This discussion is intended to apply to all the cottontails occurring in Kansas, except the swamp rabbit, which will be considered separately, the remaining forms being very closely related and very similar in their general habits.

The cottontails are very well known and there is hardly a school child outside the larger cities who is not familiar with whichever form of the genus occurs in his or her home region.

The young cottontail differs rather decidedly from the young jack rabbit in the degree of development at birth, the jack rabbit being born with eyes open, well covered with hair, and ready to run, while the cottontail is born naked and with eyes closed, perfectly helpless. They remain in the nest for two weeks or longer; the nest itself is made of grass and leaves, warmly lined with hair from the mother's body, and covered over with a bit of nest material to protect the young during the day—the mother visiting her family only at night. From three to eight young are born in each litter, usually four to six.

The widespread abundance of the cottontail is no doubt due in large measure to its willingness to utilize almost any sort of vegetable matter for food. There are few plants which the cottontail will not eat, although, like other animals, it has its favorites, of which alfalfa is perhaps the most outstanding. Seton (1929) in fact, suggests a "compromise" with rabbits where they prove troublesome, either to garden crops or through gnawing the bark of fruit trees, by providing food for them, and he says "Cottontails are so fond of alfalfa and soybeans, that a crop of one of these is a guarantee of immunity to nearly everything else that grows in the garden." Orchardmen have long fed the rabbits during the winter in many localities as a measure of economy, while others leave the winter prunings on the ground in order to prevent rabbits from attacking the trees. In most orchard sections, however, cylinders of wire are placed around the bases of the trees to prevent any possibility of injury by the rabbits. Others wrap the lower part of the tree trunks with burlap, which is an effective protection against the cottontail, but one that provides a very fine shelter for many insect pests and is not as economical as it appears to be.

\* Throughout the discussion of the genus *Sylvilagus* presented here the measurements are the averages given by Nelson (1909) merely translated from millimeters into inches. The color descriptions, as well, are either taken from this excellent source or based on those given there.

No other animal pays as high a toll to the Great American highway as does the cottontail. Every night throughout the land hundreds of cottontails are killed by automobiles; if you wish really to appreciate the appalling number of rabbits that are killed in this manner every year just make a "dead rabbit" census for yourself the next time you drive 100 miles or more—then estimate the daily, monthly or annual casualty rate for any region you have in mind. I have seen more than fifty rabbits, all killed within the night, on a seventy-five-mile drive. Although this number is rather high, the average is surprisingly great, and becomes especially so when we make comparisons with the number of birds or mammals of other species killed in this manner.

The automobile, however, is just a minor hazard in the life of the cottontail. Practically every eater of flesh of any size places cottontail meat at the head of its list—weasels, skunks, foxes, hawks, owls—and all the rest, yet in spite of these enemies, not to mention man and diseases without number, the cottontail persists as a common mammal throughout practically all of the United States.

The cottontail is especially subject to diseases, and it is well known that whenever the animal occurs in a given locality in large numbers an epidemic is sure to break out which will practically exterminate the species in that region. The great wave of Tularemia, or rabbit fever, which swept over the country a few years ago was just one of many different sorts of epidemics which serve to keep the cottontail in check. A consistent enemy is the bot fly which undoubtedly kills many thousands of cottontails every year, or so weakens them that they fall easier victims to some carnivorous animal.

#### NEBRASKA COTTONTAIL

##### *Sylvilagus floridanus similis* Nelson

*Characters.* Somewhat smaller than *mearnsi* and much grayer in color, being pale pinkish buffy above, washed with gray, and the black not nearly so evident as with the preceding. The front and outside of the forelegs are light rufous. The general gray coloration and smaller size should be sufficient to distinguish this rabbit from *S. auduboni baileyi* whose range overlaps that of *similis*. Total length, 16.3 inches; tail vertebrae, 2 inches; hind foot, 4 inches.

*Range in Kansas.* Properly the extreme northwestern corner of the state, although ranging south and east to intergrade with both *mearnsi* and *alacer*.

#### OKLAHOMA COTTONTAIL

##### *Sylvilagus floridanus alacer* (Bangs)

*Characters.* Even smaller than *similis* and with a characteristic rusty red suffusion over the back. It may be distinguished from *S. auduboni neomexicanus* by the fact that the *sides are grayer than the back*. General color of upper parts deep ochraceous buff, more or less washed with black; top of tail reddish brown; front and sides of forelegs deep, rich ferruginous, a little paler on the tops of the forefeet; the hind legs dull cinnamon to rusty rufous, shading into pale rufous or rusty buff on the tops of the hind feet. Total length, 16.7 inches; tail vertebrae, 2.2 inches; hind foot, 3.7 inches.

*Range in Kansas.* Southern and south-central Kansas, from the eastern boundary west at least to Seward county and north through Stafford and Greenwood counties.

## WYOMING COTTONTAIL

*Sylvilagus auduboni baileyi* (Merriam)

**Characters.** A large cottontail with very hairy ears and hind feet, and distinguished by uniform creamy buff coloration of the upper parts, only lightly washed with black; throat dark buff to creamy buff; front and outside of forelegs creamy buff to dark buffy, shading into darker buff on top of the forefeet; backs and sides of lower hind legs similar, but darker, sometimes shaded with brownish. Worn pelage, as with the whole group, considerably paler and grayer. Total length, 16.5 inches; tail vertebrae, 2.3 inches; hind foot, 3.9 inches.

**Range in Kansas.** The western one third of the state, intergrading through Morton, Haskell and Ford counties with *neomexicanus*.

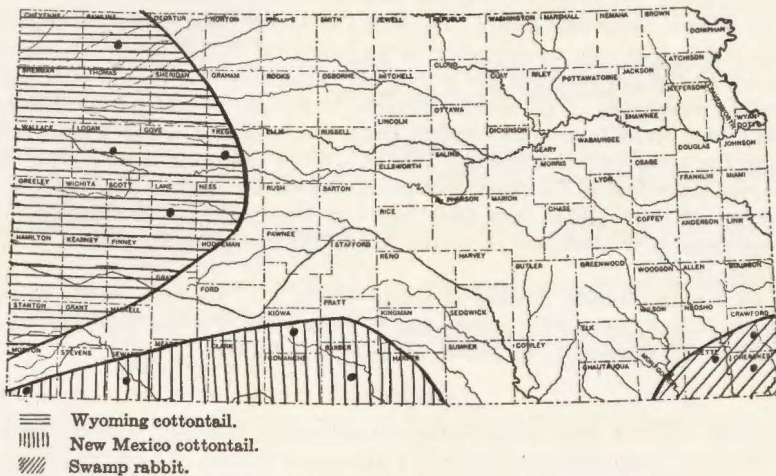


FIG. 36. Map showing distribution of cottontail and swamp rabbits.

## NEW MEXICO COTTONTAIL

*Sylvilagus auduboni neomexicanus* Nelson

**Characters.** A very small, intensely colored cottontail, more like *alacer* in external appearance, but distinguished from it by the fact that its *sides are reddish, and brighter than the back*. From typical *baileyi* it is extremely different, but the two races intergrade over a wide belt, and none of the Kansas specimens may be considered typical of *neomexicanus*, although they must be referred to this race in many instances. Typical specimens are dark buffy gray above, with a bright rufous nape and dark buffy ochraceous throat; forelegs rusty rufous, shading to rusty buff on top of forefeet; sides of shoulders rather intense rusty buff, shading into a paler rusty cinnamon on the lower hind legs, thus making a continuous lateral line of the rusty coloration; ear smaller than in *baileyi*. Total length, 15 inches; tail vertebrae, 2 inches; hind foot, 3.5 inches.

**Range in Kansas.** This form is found in extreme southern Kansas west of Sumner county, north into Pratt county, and thence angling off into southern Morton county.

## SWAMP RABBIT

*Sylvilagus (Tapeti) aquaticus aquaticus* (Bachman)

*Characters.* Much larger than our representatives of the subgenus *Sylvilagus*, and with shorter legs, smaller ears, and more robust build. A swamp dwelling and semiaquatic species. Upper parts grayish-brown, usually rather heavily intermixed with black, sometimes giving a spotted effect; rump reddish-brown; sides grayer than back; legs and feet cinnamon rufous; tail white below, concolor with rump above; under parts white, except for the underside of neck which is a dull buffy grayish, similar to the lower border of the flanks. Total length, 21.5 inches; tail vertebrae, 2.6 inches; hind foot, 4.2 inches.

*Range in Kansas.* Known at present only by a few specimens from Crawford, Labette and Cherokee counties. Said to be locally common in certain regions along the streams in Labette and Montgomery counties.

*Economic status and habits.* Its swamp or marsh habitat at once excludes this rabbit from any consideration as an animal of economic importance except from the standpoint of the hunter. It swims very readily, and often does solely for pleasure. This species, however, is frequently found some distance away from rivers in wooded districts, but it has been reported in Kansas only from the more typical marshlike habitat. When disturbed it makes for the nearest water just as the plains cottontail runs for the shelter of a cactus or a burrow. Nelson (1918) says their tracks in the mud may be distinguished from those of the ordinary cottontail due to the spreading toe pattern of the swamp rabbit.

Its breeding habits, number of young, litters, etc., are very similar to the true cottontail, although it is supposed to make more of a nest than our other rabbits. Little seems to be known of its feeding habits.

## GLOSSARY

*Annular.* Ringed, used in describing certain mammalian teeth with flat crown surfaces, where the enamel forms a distinctive pattern of loops and angles.

Also of tails of certain rodents, where tails are noticeably ringed with scales.

*Antitragus.* An expanded portion of the lower part of the external ear on bats; see fig. 21.

*Aquatic.* Living in the water, most or all of the time.

*Arboreal.* Dwelling in trees.

*Auditory bulla.* The enlarged bony part of the external meatus of the ear.

*Axilla.* The armpit.

*Axillary region.* The region of, and immediately adjacent to, the armpit; often used in describing the color of hair on a mammal on that part of the body.

*Bicolor.* With two colors.

*Bulla*, pl. *bullae*. Same as the auditory bulla; frequently an important aid in the classification of mammals, as with the rabbits.

*Burrowing.* An animal is so described that nests in underground burrows, or dens; it may carry on most of its life activities above ground; see *fossorial*.

*Canine.* The usually large, single-coned tooth between the premolars and incisors; sometimes missing.

*Carnassial.* The shearing teeth of carnivores, large and with special shearing crown patterns.

*Carnivorous.* Meat-eating.

- Colonial.* Living in colonies, as do the prairie dogs.
- Clavicle.* The collar bone.
- Concolor.* Of the same color; a color continuous with that of a mentioned adjoining region.
- Diastema.* The space between the incisors and cheek teeth in rodents and rabbits; sometimes a diastema occurs between the canines and premolars, in forms which have retained the canines.
- Digit.* Any toe or finger.
- Digitigrade.* Walking on the toes.
- Diurnal.* Active during the day.
- Dorsal.* Pertaining to the back; *mid-dorsal stripe*, a more or less differentiated stripe running down the middle of the back.
- Fauna.* The animal life of a given area.
- Fossorial.* Living underground all, or most, of the time, as moles and gophers.
- Frugivorous.* Fruit eating.
- Glissant.* Gliding; the so-called "flying" progression of flying-squirrels.
- Gregarious.* Feeding or living together, as certain cave bats.
- Herbivorous.* Plant-eating.
- Hibernation.* Sleeping during all, or part, of the winter.
- Incisor.* Any of the first teeth before the canine, or before the first cheek tooth if the canine is lost.
- Interfemoral membrane.* The membrane on bats joining the hind legs and enclosing all, or part, of the tail.
- Membranes.* Thin, leathery skin; here restricted to apply to the wing and interfemoral membranes of bats.
- Molars.* The permanent jaw teeth, not having forerunners in the milk set; always farthest back in the jaw.
- Nocturnal.* Active at night.
- Omnivorous.* Eating diverse kinds of food, literally "all" *ominis*, Latin, all, every.
- Orbit.* The eye socket.
- Pelage.* The hair or fur of a mammal.
- Pencil.* The tuft of hairs on the tips of tails of some mammals.
- Plantar.* Pertaining to the sole of the foot.
- Plantigrade.* Walking on the soles of the feet.
- Premolars.* The cheek teeth first in the series, and which have been preceded by teeth in the milk set.
- Retractile.* Capable of being withdrawn, as the claws of cats.
- Saltatorial.* Jumping progression, as rabbits.
- Social.* Living in groups or colonies; same as colonial.
- Tragus.* The more or less elongated, erect process within the external ear of bats; see fig. 21.
- Tubercle.* A raised surface; used here with reference both to foot pads, and crown patterns of molar teeth.
- Ventral.* The under surface of the body.

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## A WINTER ROBIN ROOST IN ARKANSAS

BY J. D. BLACK

During the three recent winters (1926-27, 1927-28, and 1928-29) there have been roosts of varying size including the common and southern varieties of the Robin (*Turdus migratorius migratorius* and *T. m. achrusterus*) situated in and around Winslow, and during the past winter the writer had the opportunity to study their habits closely, the 1928 roost being only about a mile north of his home and containing at one time over 250,000 individuals.

Winslow, known throughout the south as "The Top of the Ozarks", has an elevation of 1734 feet at a central point in the village, and the surrounding territory, or rather most of it, is considerably higher, some places being as high as 2500 feet above sea level. The immediate vicinity of Winslow is covered with deciduous growth, the various oaks, hickories, maples, etc., being the most common trees. It has been, and still is, a considerable lumber center, with great numbers of trees being cut, leaving a heavy growth of underbrush over a large proportion of the land. The 1928 roost, being occupied from October 22 to December 16, 1928, was situated on a hill, or hills, at the head of a small ravine, facing east, although some of the birds roosted in the ravine itself, at an elevation of about 1800 feet.

The roost, when at its height, covered about a mile square, the birds never concentrating as they did in 1926, although being sufficiently thick to give the impression of immense numbers—concerning which we will deal later. The tract of land occupied has been closely cut over, leaving only occasional trees standing among the dense undergrowth, but the slopes of the ravine are well covered with small trees—nearly all second growth timber.

The first Robins arrived on October 22, and these were augmented by a few others before the first check as to the number present was made on the evening of the 24th, when an estimated number of 4,000 went into the roost. By the 28th there were at least 25,000 birds present, for six observers, covering less than half the territory surrounding the roost, reported 16,948 birds flying into the roosting grounds on that date.

The last actual check of the birds flying into the roost was made on November 7, when six observers, all well trained, covering only the south, southeast, east, and southwest, with the west half of the south section, the west, northwest, north, and northeast not being watched, listed over 74,000 birds going in. The estimates were carefully computed and the lowest figure adopted in all cases. The writer was in

the roost at the time of the flight and knows that more birds arrived from the north, northeast, and northwest, than from other directions, and believes that an estimate of 150,000 birds at that date is extremely low. The figure probably would have exceeded 200,000. Many more birds arrived after November 7 and at the time of their departure, on December 16, there were at least 250,000 birds roosting on this tract.

Due credit should be given here for the assistance of Robert Adkins, Paul Vandiver, Allen Land, and my brother, Olan H. Black, for their valuable assistance in helping check the flight of the birds, and to Paul Vandiver, Omer A. Winn, and Leonard Wallace (the last named accidentally shot and killed himself November 18, while hunting bobcats within the boundaries of the roost) for their generous assistance in the banding work carried on at night.

A study of the time of arrival of the birds at the roost, in relation to the direction from which they came, together with their speed of flight, and the time required for all the birds to pass over, leads to several interesting conjectures as to the distance covered in their search for food.

The check of October 28, being the most detailed from this standpoint, and covering the widest range of observation points, will be used to bring out these facts, the larger flights on later dates differing only in the number of individuals involved.

On this date my brother and Paul Vandiver worked together on the southeast, Robert Adkins handled the southwest, and I the east, while others were posted along the west, but it is regrettable that these observers (on the west) left their posts too soon for their work to be of any value on this point, and their reports have been eliminated.

From the southeast the first bird arrived at 4:25, and the flight proper commenced at 4:32, continuing almost steadily until 5:22, with the majority of the birds passing between 4:46 and 5:10. Seven thousand, eight hundred and ninety-two birds were listed from that direction, 3,000 from 4:56 to 5:00 P. M.

From the east I recorded the first bird at 3:45, five stragglers going in at that time, and five more at 3:49, while the flight proper commenced at 4:31, with a flock of 100, and continued until 5:10. The main body passed from 4:40 until 5:05, with 2,400 going over during the five-minute period from 4:45 to 4:50. The observations of Robert Adkins on the southwest coincided closely with those of myself, and were, on the average, ten minutes earlier throughout than the southeast reports.

The birds flew at an average speed of twenty-five miles per hour, being timed in various manners, on several different dates, the early arrivals sometimes flying as slowly as twenty miles per hour, and the late ones as fast as thirty.<sup>1</sup> On cloudy, dark days the birds would fly somewhat faster than on clear days, and would come in about fifteen minutes earlier. On clear days they usually made considerable commotion flying over, while on cloudy days they scarcely made a sound, flying as though the most important object in their lives was to get into the roost and comfortably settled before darkness overtook them.

The birds that came in from the southeast, and which arrived on the average ten minutes later than the others, all passed directly over Winslow and a strip of land from two to three miles wide that was barren, or nearly so, of the food they demanded. This distance possibly explains the difference in the time of arrival, but does not exactly coincide with the ten minute variation in the time. It is evident that they ranged slightly farther than the others.

Assuming that the Robins all left their feeding grounds at the same time, and traveled at the speed of fifteen miles per hour, occasional stops included, (flight speed of 25 miles per hour, allowance thus being made for rests, whether they were taken or not cannot be determined definitely, but it is supposed they did), and assuming that the first arrivals fed nearby, the conclusion would be reached that at least part of the birds fed at a distance of twelve and a half miles from the roost—the speed of flight being fifteen miles per hour and the period of flight covering fifty minutes over the southeastern sector. These are, of course only approximate figures, but have been pretty well substantiated by reports from points ten to fifteen miles away of flocks of Robins flying toward Winslow in the evening and appearing again from that direction in the morning. Some of the birds that appeared from the east during the first fifteen minutes of the actual flights often were seen coming from the trees of the first mountain east of the point of observation, while the late arrivals always were flying high and straight, as though from a great distance.

The birds lived, for the most part, on the berries of the Black Gum (*Myassa sylvatica*) during their stay here, although they con-

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<sup>1</sup>Two methods of calculating the speed of flight were used. The first method required two observers, with synchronized watches, located at different points. A given bird was timed by each observer as it passed his station, and the records were later compared. The second method was operated by a single observer who timed a flying bird as it passed two points a known distance apart. The first method was discarded as unsatisfactory, and figures derived by the second method are used in this paper.

sumed vast quantities of the small Fox Grape, as well as various other berries that were available at that time of the year.

The Black Gum produced enormous quantities of berries last season and thus furnished food for these birds for a considerable period of time, the only logical explanation for their long stay here, and the reason for their leaving as well; for after the 18th of December hardly a berry was left on any of the gum trees I saw, and the same condition was reported by others for several miles around Winslow. The birds were observed to go into the roost in the same vast numbers on the evening of December 16, but not so much as a single bird was again seen until February 18, when they re-appeared in small numbers for the breeding season.

Most interesting to me of all was the behavior of the birds in the roost in the evening as they came in, and I spent several evenings in this study, making photographs of the birds while in the roost. Two typical days were the 30th of October and November 7.

To quote from my notes of October 30: "Robins were everywhere, and thousands more coming in all the time. Robins flying from the north, east, south, and west in continual streams, there being Robins coming to rest in trees nearby, others flying over hunting for suitable resting places, and still more Robins coming into sight on the horizon."

"They were in a singing mood and sometimes as many as five or six hundred would be singing at the same time! There was also a continual chattering and chirping as the birds settled down, this being underway when I arrived and still going on when I left."

Again on November 7, when there were many more birds present: "While the boys were checking the flight this evening, I was again on the hill where the Robins were settling and it was marvelous to watch, with many, many birds coming in. I arrived on the hill about 4:30 and left an hour later, and aside from the continual chirping and chattering the birds made another sound—like that of rain falling on dried leaves—caused by the birds' wings brushing the leaves as they went in and out of the bushes. This sound was continuous and very noticeable. They were singing very little this evening and never did I notice more than ten or twelve birds singing at the same time."

On an occasion or two I firmly believe that I heard as many as a thousand of these birds singing at the same time, the song accompanied by the rushing sound of wings; and the din of their incessant chattering as they settled down was a sound that made a deep and lasting impression on my mind—one that I will be able to recall vividly many

years from now. The birds that were singing would invariably seek the upper limbs of the large leafless trees, and sometimes I have seen forty or fifty birds singing in a single tree. You who have thrilled at the song of a single Robin in the springtime, can, possibly, imagine the effect of a thousand of these gifted vocalists in full song during the bleak days of early winter.

There was almost every conceivable plumage and type of Robin in the roost. Many semi-melanistic birds were there, very dark specimens, one being observed that possessed glossy black under tail coverts, while the others (of the dark type bird) usually had a blackish effect on the back and the rufous of the breast was considerably darker than the typical variety which breeds here. There was a third type—besides the common and the dark plumaged birds—which I have never been able to convince myself was referable to either *migratorius* or *achrusterus*, and certainly not the western variety (*propinquus*). They were considerably larger than the ordinary Robin and very pale, the feathers being distinctly edged with whitish, the rufous of the breast in some cases being exceptionally faint, and the white spots on the tail very large. All three types of birds roosted separately and were decidedly different in their behavior when captured. We knew the birds as Types One, Two, and Three, in the order described, (Type One, the blackish birds; Type Two, the typical *migratorius* and *achrusterus*; and Type Three, the large, pale birds), and found this a convenient way of referring to them.

With the assistance of the helpers previously mentioned I caught and banded an even hundred birds, all of which were reported as *migratorius*, because of the fact that there were so many hybrids and phases of plumage present that it was impossible to classify the birds properly, particularly at night, as to the subspecies. Type One never made a sound when captured and these birds were the delight of the entire banding crew. They seemed to roost in more open localities than either of the other two types, while the large whitish birds, the Type Three, were exceedingly difficult to capture, being very wary, always the first to take wing, always screaming loudly when netted, and roosting in the most inaccessible portions of the cover.

The birds banded were captured, in most instances, with a large, specially constructed net, much on the order of a butterfly net, only many times stronger, and somewhat larger. Some birds were caught by hand, and a few in a very small net, which was particularly useful in the very dense underbrush, where it was impossible to take the larger net, much less attempt to use it.

Dry, moonlight nights were excellent times to observe the restless traits of these birds, but it was impossible to even approach them on such occasions, they taking alarm a full hundred yards ahead, and flying off into the night in flock after flock; they made a roaring noise like thunder as thousands of birds took wing. They would occasionally fly a considerable distance but usually stopped, even on bright nights, after a flight of one or two hundred yards, and on dark nights they would go only a short distance.

The best time for banding work was on a very dark night, just after a rain, when the leaves underfoot were damp, allowing one to walk without making a crackling sound. Our best work was done in about three hours on such a night, when we banded thirty-nine birds. We would leave a burning lantern in the old timber road—this was necessary to keep from becoming lost—and would work on either side of the road with flashlights, spotting the bird and netting him, in this manner sometimes catching two at a time. Only one injury, a broken leg, resulted during the entire period, and this was caused by inexperience on the part of the captor, who became very adept after this accident. The bird injured was a large pale bird, belonging to Type Three, but the specimen was not preserved. The disturbance caused by a capture was great, but the birds were very capable of flight in the night, and soon were again at rest.

Both Barred and Great-horned Owls preyed continually upon the Robins, as did the bobcats, and house cats that had become feral. Red-tailed Hawks were usually to be seen sailing over as the birds came in late in the evening, but I never noticed any disturbance caused by the hawks, nor did they seem interested in the many Robins flying about.

The deep, guttural "meow's" of the bobcats as they stalked their prey nearby and that almost terrifying snarl as they made the kill furnished a regular thrill that served to make the night work interesting. Assured by old hunters that they were perfectly harmless, I was confident that they would not attack; yet being continually followed by from one to four of these animals as they softly padded along uttering a regular purring "meow" always made me uneasy.

The most blood curdling sound of the woods was made, however, not by the cats, but by the Barred Owl, when after killing a bird he would let forth a medley of unearthly hoots, squawks, and screams that sounded as if the demons of Pandemonium were paying a personal visit to the roosting grounds.

On several occasions both species of owls as well as the cats would make kills so near that the dying sounds made by the Robins could be heard distinctly, the cats being particularly unmindful of our presence in this respect, one cat killing three birds within twenty-five feet of a party of four one night within a very few minutes. The toll these raptures and cats collected from the flock was enormous.

A résumé of the study produces these evident facts:

First, that the birds of the entire country—as shown by plumage variation—flock and feed together during the winter season, but segregate into small bunches, probably family groups and units of such, of their own race, at night.

Second, that in feeding they cover a radius of at least twelve miles. Thus the birds of a single roost range and feed over a territory of somewhat more than 452 square miles, at the least estimate.

Third, that their migration during the winter is decidedly irregular and determined solely, or nearly so, by the presence of desirable food.

And Fourth, that in banding together to protect themselves from their enemies they defeat their own purpose, as do most other birds with this habit, and, instead, open themselves to the united attack of every possible enemy for miles around.

WINSLOW, ARKANSAS.

## MAMMALS OF NORTHWESTERN ARKANSAS

BY J. D. BLACK

The five counties included in this report, together with Carroll County, which differs slightly in having a mixed evergreen stand over most of its area, comprise the northwest corner of the state of Arkansas, and include elevations of from 400 feet at Ozark to 2250 feet or more near Winslow. From this divide near Winslow the Ozarks fall away rather rapidly into the Arkansas River Valley on the south, and more slowly into the valleys of the White and Illinois rivers on the north. An arm of prairie or semi-prairie country reaches into the region up the Illinois Valley around Prairie Grove and Lincoln, and another near Maysville and Gravette. The caves in the Boston Mountain region proper are in sandstone; those of Madison and Benton counties are in limestone. The trees of the region are, for the most part, deciduous species which in certain limited areas are mixed with red cedar and pine.

Unless otherwise stated the mammals listed in this report are in the Museum of Birds and Mammals, University of Kansas, Lawrence, Kansas. The map of the region presented with this paper is based on the life-zone map by A. H. Howell, used as a frontispiece for his study of *The Birds of Arkansas* (1911).

### LIST OF SPECIES

*Didelphis virginiana virginiana* Kerr. Virginia opossum. This is the commonest fur-bearer and is to be found everywhere throughout the region, appearing to be able to maintain its numbers fairly well in spite of extensive hunting. Next to the cottontail rabbit this species ranks first among the mammals of the section in the matter of highway mortality. Melanistic specimens are rather rare, although not as unusual as albinistic individuals. One adult female found in the summer of 1932 carried 13 young, with bodies about 5 inches long. Six of these were black and the remaining 7 normal. Winslow, 3; Mountainburg, 1.

*Scalopus aquaticus machrinoides* Jackson. Missouri Valley mole. Specimens from both Winslow and Fayetteville have been referred to this subspecies by Jackson, although they vary toward *pulcher*. Specimens from Ozark no doubt will be found referable to the latter race. Winslow, 10 (1, U. S. N. M.); Fayetteville, 7 (4, Univ. Ark.).

*Cryptotis parva* (Say). Little short-tailed shrew. Although taken only in and around Winslow, this shrew appears to be fairly common throughout the region. The farmers often refer to this and the next species as baby moles. Winslow and vicinity, 11.

*Blarina brevicauda carolinensis* (Bachman). Carolina short-tailed shrew. An individual was found by Ruby Black, August 28, 1934, dried and crushed on one of the streets of Winslow. Inquiry revealed that it had been caught in a mouse trap at a nearby house some days before and discarded as a "mouse." The subspecific identification therefore is problematical. Other specimens of *Blarina* from around Winslow have been reported to me and accurately described, but I have never been able to secure one. Winslow, 1, badly damaged.

*Myotis grisescens* A. H. Howell. Gray bat. This bat is very abundant in certain limestone caves throughout the northern part of the region. As many as 3000 have been observed in the breeding colony in Denney Cave, and probably as many or more are to be found in Cave Springs Cave and Crystal Cave. They have not been taken in mid-

winter at either of these three spots, but I did find them in small numbers at Bat Cave on July 6 and December 21, 1934. The specimens from Crystal Cave were taken by R. D. Harding, April 13, 1933, while they were still in hibernation. This locality has not been visited in summer, nor the Cave Springs Cave in winter. Crystal Cave, 168; Cave Springs Cave, 52; Bat Cave, northwest of War Eagle, 15; Denney Cave, 45.

*Myotis sodalis* Miller and Allen. Indiana bat. This bat is much less numerous than the preceding. The 3 specimens from Denney Cave were collected singly on June 11, 1933, March 30, 1934 and July 17, 1934. One specimen was taken in Bat Cave, July 6, 1934; the remaining 50 on December 21, 1934, when perhaps 500 were found hibernating in a single large dry room, hanging in scattered clumps of from 2 or 3 to 70. Denney Cave, 3; Bat Cave northwest of War Eagle, 51.

*Pipistrellus subflavus subflavus* (F. Cuvier). Georgian bat. This is by far the commonest bat throughout the Ozarks, and is to be seen almost anywhere on summer evenings. It winters in rather large numbers in Devil's Den, 10 miles west of Winslow, as well as in Bat Cave, northwest of War Eagle, and in Denney Cave. One or two may usually be found dormant in almost any moist cave visited in the summer, although the bulk of the individuals apparently desert the caves very early in summer. I have never found more than two individuals of this species hanging together, and this but rarely; they almost always hang singly and rather far apart. Many reports have come to me of "white" bats in the Arkansas caves, reports at first difficult to understand, but on December 21, 1934, we found a number of *Pipistrellus* in Bat Cave, northwest of War Eagle, that appeared to be pure white. When examined, however, they proved to be perfectly normal specimens covered with droplets of water, which in artificial light appeared snow white, or yellowish-white. During our visit at Ozark in July, 1934, we saw 4 individuals of this species, 2 each on successive nights, flying along the Arkansas River. More than 300 specimens were collected from the following localities: Bat Cave, east of Springdale; Bat Cave, northwest of War Eagle; Gregory Cave; Treasure Cave; Basset Cave; Denney Cave; Ferris Cave; various caves near Prairie Grove, and Winslow.

*Eptesicus fuscus fuscus* (Beauvois). Big brown bat. Single specimens have been taken from each of the 3 caves listed. The remaining 3 individuals were taken in buildings in Winslow. All were secured in summer except the individual from Bat Cave, northwest of War Eagle, taken December 21, 1934. I understand that Bat Cave north of Ozark formerly was densely populated with this species in the winter, and that they still winter there in reasonably large numbers. On the whole the species seems to be rather rare throughout the section. Bat Cave northwest of War Eagle, 1; Bat Cave north of Ozark, 1; Denney Cave, 1; Winslow, 3; Fort Smith, 3 (U. S. N. M.) and "mouth of Poteau River, Arkansas," 1 (U. S. N. M.).

*Nycteris borealis borealis* (Müller). Northern red bat. In addition to the specimens collected I have observed this bat at Mountainburg and Fayetteville. Here it is rather common and no doubt it occurs in reasonable numbers in summer throughout the region. Winslow, 18; Fort Smith, 2 (U. S. N. M., according to Harrison Allen, 1893).

*Nycticeius humeralis* (Rafinesque). Rafinesque bat. No doubt this species occurs in limited numbers throughout the Arkansas River Valley, and thus within the limits of this study in Franklin and Crawford counties. Fort Smith, 5 (U. S. N. M., according to Miller, 1897.)

*Corynorhinus rafinesquii rafinesquii* (Lesson). Rafinesque lump-nosed bat. There is known but a single specimen from the state; a skeleton, no. 5645 Univ. Kansas collection, taken at Mulberry, Crawford County, Arkansas, October 1, 1926, by R. E. McEntyre.

*Corynorhinus macrotis* (LeConte). LeConte lump-nosed bat. G. M. Allen (1916) listed a single specimen from Osage River (Carroll Co.?) Arkansas, Mus. Comp. Zool. collection. This appears to be the only actual record for the state.

*Euarctos americanus americanus* (Pallas). American black bear. Wayne Henbest, of Fayetteville and Winslow, tells me that he has collected and placed in the Zoology Department of the University of Arkansas, Fayetteville, tracks of this animal fixed in clay. He secured these at Bear Den Cave, 6 miles east of Lowell. The cave is reported to be filled with wallows and tracks of bears but no one seems to know how recent has been their occurrence. Stories of the killing of black bears as late as 50 years ago circulate throughout the Ozarks, but there are available no definite data as to time of the actual extinction of the animal in the region.

*Procyon lotor hirtus* Nelson and Goldman. Missouri Valley raccoon. No specimens of this fairly common fur-bearer were collected.

*Mustela primulina* Jackson. Missouri weasel. The species is present but apparently it is rather rare. Fur dealers at Winslow secure one or two skins each year, while a few more are bought at Ozark and Huntsville. Winslow, 2; Crawford Co., 10 miles south of Winslow, 1; Fayetteville, 1 (Univ. Ark. coll.).

*Mustela vison* mink (Peale and Beauvois). Mink. The only available museum specimen is that of a mounted individual from Alix, Arkansas (near Ozark), in the University of Arkansas collection, taken January 7, 1931 by a Mr. Melton. Although this area is in the zone of intergradation between *mink* and *letifera* (Hollister, 1913), it seems better to refer the specimen examined to the former race. The species occurs rarely throughout the entire section. I have examined skins in the hands of fur dealers from south of Winslow, in Crawford County, and from near West Fork. Dealers also report occasional purchases of skins from around Huntsville.

*Spilogale interrupta* (Rafinesque). Prairie spotted skunk. No museum specimens are available. Claude Prater, fur dealer at Brentwood, north of Winslow, who purchases furs from a wide territory in Washington and Madison counties, had about 20 skins in his storeroom at the end of December, 1934. These I examined carefully and there is no doubt that the spotted skunks of this region should be referred to the above species.

*Mephitis mesomelas mesomelas* Lichtenstein. Louisiana skunk. No museum specimens are at hand, but the species is very common throughout the region. Although evidently belonging to this race (specimens from Marble Cave, Stone County, Missouri, just across the state line were thus considered by Howell, 1901) the local specimens are extremely variable, with a very high percentage showing white in the tail, and white often predominating over the black.

*Vulpes fulva* (Desmarest). Eastern red fox. A very old male was killed by dogs near Winslow, July 4, 1934. The skeleton of this fox is the only specimen available, although both this species and *Urocyon* have become very common since the year-round closed season in Arkansas went into effect.

*Urocyon cinereoargenteus cinereoargenteus* (Schreber). Eastern gray fox. The gray fox is extremely common throughout this area, especially in southern Washington County and east through Madison and northern Franklin counties. It is protected like the red fox, which it outnumbered about 5 to one. Museum specimens are limited to one adult female skeleton from near Winslow, and 2 immature individuals from the same locality, in captivity at Lawrence and alive at this writing.

*Canis nubilus* (Say). Timber wolf. The proper name for the local wolf is somewhat in doubt. It is highly probable, however, that the species is *nubilus*. Although rare, this animal still ranges through southern Washington and Madison counties, the northern parts of Franklin and Crawford counties, and through the more inaccessible portions of the Ozarks. For the past 6 years from 1 to 8 pelts have been purchased each season by fur buyers in the Winslow region. Probably one-fourth of the skins have been in the black phase. There are no museum specimens.

*Lynx rufus rufus* (Schreber). Bobcat. A tanned skin in my private collection, from

Crawford County, south of Winslow, is the only specimen of which I have knowledge. The species is rather common, however, although difficult to secure. The Arkansas Game and Fish Commission formerly paid a bounty of \$2.50 per scalp for these animals, at which time numbers were taken, but trappers now cannot be induced to secure specimens for a reasonable sum. The range of the bobcat includes all of the Ozarks, although apparently the animal is more common in the rougher, wilder portions of the hills and rarer in the valleys. The bobcat is very common at times and is known to gather in numbers along with hawks and owls in and around the large robin roosts which are of almost yearly occurrence near Winslow. I have seen bobcats in these roosts at night and have repeatedly heard them make their kills (Black, 1928).

**Marmota monax monax** (Linnaeus). Southern woodchuck. Marmots are extremely common throughout the region except in the Arkansas River Valley, where they are known, but are considered rather rare. Winslow, 4; West Fork, 2; Fayetteville, 3 (Field Mus.).

**Tamias striatus venustus** Bangs. Southwestern chipmunk. Chipmunks are very common throughout the Ozarks. The only specimen observed at Ozark was in the bluff along the Arkansas River, but it is reported as normally common there. Sight records include Huntsville, Ozark, Mountainburg, and Gravette, in addition to museum specimens as follows: Winslow, 12; Fayetteville, 4.

**Sciurus carolinensis carolinensis** Gmelin. Southern gray squirrel. The species is fairly common, and sometimes abundant, throughout the region. One specimen, otherwise normal, is remarkable in having a bright rufous tail. Several other individuals of this type were reported as being killed in 1932 out of two small hollows west of Winslow, where the specimen that I secured was taken. The black phase of this species is practically unknown from this region. The few albino squirrels that I have seen from the Ozarks have all proven to be of this species. Winslow (Crawford and Washington counties), 10.

**Sciurus niger rufiventer** (Geoffroy). Western fox squirrel. Fox squirrels are common throughout the area, preferring the denser growths of timber. The black phase, or intermediate pelages, is not infrequent. Winslow and vicinity, 8.

**Glaucomys volans volans** (Linnaeus). Small eastern flying squirrel. Of the 15 specimens of flying squirrels collected, probably 8 should be referred to this race, all from the Winslow region.

**Glaucomys volans saturatus** Howell. Southeastern flying squirrel. In his revision of the group, Howell (1918) wrote: "In the Boston Mountains (in this instance around Stilwell, Oklahoma) intergradation (between *volans* and *saturatus*) occurs." This is quite true of the Boston Mountains of Arkansas as well. Specimens from the Winslow region, although all purely intermediate, clearly show that those to the south of the transverse chain of hills, below 1500 feet, are closer to *saturatus* than to *volans*, while specimens from above 2000 feet, and north of the divide at all elevations, seem more closely related to the race *volans*. If any clear geographical line of demarcation is to be erected for differentiating the ranges of the two races it might be placed at 1600 feet and below on the southern boundaries of Washington and Madison counties. Unfortunately, specimens from Ozark and Gravette are not available. The species is considered rare along the Arkansas River Valley, but common elsewhere in the region. Of the specimens collected, 7, all from the Winslow region, seem best referred to this race.

**Geomys breviceps breviceps** Baird. Louisiana pocket gopher. This species is known to occur on both sides of the Arkansas River, and it has been reported to me from Ozark, Mulberry and Van Buren. It does not seem to be as common as is generally the case with animals of this group, and I have not secured examples. Known specimens are limited to 7 from Fort Smith (U. S. N. M.) listed by Merriam (1895).

*Reithrodontomys fulvescens aurantius* (Allen). Golden harvest mouse. Only 5 specimens of this mouse were collected, 2 from the same trap on successive nights. Winslow, 4; Huntsville, 1.

*Peromyscus maniculatus ozarkiarum* Black. Ozark white-footed mouse. This is by far the most common mouse and perhaps the most common of all the mammals in the region. A specimen secured by Henry Mills, of Winslow, 7 miles west of Stilwell, Oklahoma, December 26, 1934, seems clearly to belong to this race, and thus its known range is extended definitely west into Oklahoma. Winslow and vicinity, 49; Gravette, 2; Huntsville, 2.

*Peromyscus leucopus leucopus* (Rafinesque). Southern white-footed mouse. Huntsville, 2; northeast of Mountainburg, 1.

*Peromyscus leucopus noveboracensis* (Fischer). Northern white-footed mouse. The subspecific separation of these two forms, like the case of the flying squirrels, has offered a problem of much interest in connection with the study of the mammals of the northwest Arkansas region. After all the specimens were carefully compared with typical material supplied by the United States National Museum I have concluded that the specimens from Huntsville, although intermediate, should be considered as belonging to the southern race. The specimen from Mountainburg is almost typical of *leucopus*. Those from Fayetteville clearly belong to the subspecies *noveboracensis*, as do most of those from Winslow; but the latter in certain instances show considerable similarity to the southern form. Winslow and vicinity, 26; Fayetteville, 3.

*Peromyscus boylii attwateri* (Allen). Attwater white-footed mouse. This interesting form appears to be quite common in favorable localities throughout the region. At Ozark, for instance, during an exceptionally unfavorable season, we secured 5 from a line of 35 traps in as many nights. Signs of their presence were abundant all along the cliff bordering the Arkansas River at Ozark, and the animals have recently been found to be just as abundant near Winslow, where I secured 3 in one night. It is common at Stilwell, Oklahoma, and has been taken at Batesville, Arkansas (Osgood, 1909), so that it must range all across the region in question. Winslow, 7; Ozark, 5.

*Peromyscus nuttalli aureolus* (Audubon and Bachman). Southern golden mouse. Previous knowledge of the distribution of this mouse indicated that it was to be found in Arkansas only in the lower elevations (Osgood, 1909), but I have found it at elevations from 1850 to at least 2100 feet, and probably at 2200 feet near Winslow. In the fall of 1932, 7 miles northeast of Winslow, Henry Mills secured 10 of these mice in 16 trap nights. They were all taken from a single slope where they were nesting in tangled wild grape vines from 8 to 15 feet high. At that time nests were to be found at very short intervals along this dark, densely wooded slope, but a year later this colony was completely deserted. The other specimens were secured in an old pasture overgrown with blackberry and wild grape vines, and some small trees, and just beyond the limits of the village of Winslow. Winslow, 19.

*Sigmodon hispidus hispidus* Say and Ord. Northern cotton rat. Although intermediate between this race and *texianus*, all the specimens taken seem referable to the typical form. A. H. Howell has so considered one specimen in my private collection from Winslow. This species is very common at Winslow and Gravette, and is reported as normally common at both Ozark and Huntsville. Winslow, 32; Ozark, 1; Gravette, 2.

*Neotoma floridana attwateri* (Mearns). Attwater pack rat. This animal is very common throughout the Ozarks. I have encountered indications of its presence in a large majority of the caves visited, and found abundant signs, although always old, along the cliffs at Ozark. I frightened a large female, nursing 4 young, from her nest on a rock ledge far back in Delap Cave, near Prairie Grove, June 12, 1933. She escaped, carrying the young clinging to her sides, but she did not appear to be alarmed especially by our presence. Her nest was on a narrow ledge, about 4 feet from the floor of

the cave, probably 200 yards from the entrance. It was not the usual rubbish heap of these animals, but a neat, bird-like nest-cup made of grasses, with an inside diameter of about 5 and an outside diameter of not more than 8 inches. On revisiting the nest a year later I found that the tenant was away but the nest had been freshly relined and a sort of roof of grass had been built over it, after the fashion of the ovenbird or Carolina wren.

*Pitymys nemoralis* (Bailey). Woodland pine mouse. Although specimens are available only from Winslow, this species should be found to occur throughout the region. I have found old runs, apparently belonging to this species, around Huntsville and Ozark. Near Winslow specimens have been secured by trapping in burrows under decaying logs, in runs in tall blue grass, and in burrows through decaying hay, the latter situation proving by far the most fruitful. One specimen was taken by Hugh Phillips as it crossed the barn lot at his home near Winslow at mid-day, July 9, 1934, during the extreme period of heat and drought prevailing at that time. This activity away from cover and under conditions of such extreme heat (temperatures were daily over 100 degrees) evidently indicates an emergency migration, at least for this individual. Winslow and vicinity, 17.

*Ondatra zibethica zibethica* (Linnaeus). Common muskrat. No museum specimens of muskrat are available, but the animals are taken every season along the White River from Fayetteville north, at Huntsville and at Ozark. One or two specimens have been taken at Winslow, although the water there is inadequate to support the species under normal conditions. I have recently examined a pelt taken at Brentwood. This animal is said to be extending its range each year into the smaller streams and is now fairly well established at West Fork, where it was unknown a few years ago.

*Rattus norvegicus* (Erxleben). Norway rat. No specimens have been preserved, but as elsewhere this species is a serious pest around barns, feed stores and granaries.

*Mus musculus musculus* (Linnaeus). House mouse. This species has been taken (although not preserved) at Ozark, Huntsville and Fayetteville, far from houses, and seems to thrive in open fields in competition with *Peromyscus*. Winslow, 24.

*Lepus californicus melanotis* (Mearns). Great plains jack rabbit. Although as yet no specimens have been secured to substantiate this record, I am including this form because of the abundance of evidence indicating its presence in the region. It is known to be locally common around Prairie Grove and Lincoln, Washington County, and around Maysville, Benton County. It also has been reported from Springdale, Evansville, Summers, Winslow, and Mountainburg. It seems to have increased somewhat within the last 3 years in the semi-prairie portion of the region and now appears to be well established in that section.

*Sylvilagus floridanus alacer* (Bangs). Oklahoma cottontail. Cottontails are extremely common throughout the region and subject to a very high mortality on the highways, which take a far greater toll than do hunters. Winslow, 2; Mountainburg, 1.

*Sylvilagus aquaticus aquaticus* (Bachman). Swamp rabbit. Hunters inform me that this species is locally common along the White River near Springdale and Elkins, and near Prairie Grove on the Illinois River. These points vary from 900 to 1300 feet in elevation, and are all within the Upper Austral Zone. Fayetteville, 2 (coll. Univ. Ark.).

*Odocoileus virginianus virginianus* (Boddaert). Virginia deer. It seems reasonably certain that the native deer were exterminated in the region under consideration long ago. The last record from Washington County, of which I have knowledge, was that of an individual killed north of West Fork during the winter of 1890-91. In recent years deer have been introduced once more and a herd of considerable size now ranges in the Ozark National Forest in Washington, Crawford, Madison and Franklin counties.

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## A NEW RACE OF PEROMYSCUS MANICULATUS FROM ARKANSAS

BY J. D. BLACK

In the course of studying a collection of mammals secured in northwest Arkansas at various times during the last three years it has been evident from the first that the representative of *Peromyscus maniculatus* in that region was distinctly different from either the typical specimens of *bairdii*, its nearest known relative, or the aberrant form of *bairdii* found in southeastern Kansas. Further study and comparison of the Arkansas series with typical material of *bairdii* and *pallescens* furnished for that purpose by the United States National Museum and the Field Museum of Natural History, as well as with various other races represented in the University of Kansas collection, has established beyond doubt the presence of a distinct race of *maniculatus*, which although so far as known, limited in range, seems so sharply defined from *bairdii* as to necessitate its separation.

Appreciation should be expressed to C. D. Bunker, assistant curator in charge of the Museum of Birds and Mammals, University of Kansas, for his assistance in many ways, notably his efforts making possible the collection and study of the material in question and the permission to publish the results, and to Hugh Phillips, Eugene Davis, and John Davis, all of Winslow, Arkansas, who have helped secure the type series of the proposed new form.

### *Peromyscus maniculatus ozarkiarum*, new subspecies

*Type*.—Male adult, skin and skull; no. 10104, Museum of Birds and Mammals, University of Kansas; 3 miles south of Winslow, Washington Co., Arkansas; August 30, 1934; collected by Ruby Black; original number 853.

*Measurements*.—Type: Total length, 148 mm; tail vertebrae, 61; hind foot, 20; ear, 14. Skull: greatest length, 24.6; basilar length of Hensel, 19.1; zygomatic width, 12.5;

interorbital constriction, 4.1; interparietal length and width, 8.8 x 2.3; nasals, 9.5; shelf of bony palate, 4.4; palatine slits, 4.6; diastema, 6.3; postpalatal length, 9.2; maxillary tooth row, 3.5. Average measurements of 11 adults: total length, 141.4 (134–154); tail vertebrae, 53 (41–61); hind foot, 18.5 (17–20); ear, 14.7 (13.5–16). Skull (10 adults): greatest length, 23.9 (22.6–24.8); basilar length of Hensel, 18.3 (17.4–19.1); zygomatic width, 12.4 (11.6–13.1); interorbital constriction, 3.9 (3.6–4.1); interparietal length and width, 8.3 x 2.3 (8.0–9.1 x 1.9–2.5); nasals, 9 (8.4–9.5); shelf of bony palate, 4.1 (3.6–4.4); palatine slits, 4.7 (4.5–5.1) diastema, 6.3 (5.7–6.8); postpalatal length, 8.7 (8.1–9.2); maxillary tooth row, 3.3 (2.8–3.5).

*Distribution.*—Known from Winslow, south to the Crawford-Washington County line, from Huntsville in Madison County, and from Gravette, in Benton County. Found only in open fields, but impartially at all elevations from 900 to 2200 feet. Probably ranges throughout most or all of the Arkansas and southern Missouri Ozarks, and westward into northeastern Oklahoma.

*Characters.*—A small form, similar in size to *bairdii* but with a slightly larger and different skull, and marked coloration distinctions. Feet, tail, and underparts as in *bairdii*, but dorsal area fawn instead of russet or Mars brown, and with only a faintly defined dorsal stripe. The sides and back rather duller and more grayish in fresh than in worn pelage, with the dorsal stripe better defined. Top of the head grayer than the remainder of the dorsal region and with the area before and between the eyes brighter fawn. Adult pelage with a bright cinnamon-fawn patch below each eye. In worn pelage the color is almost pure bright fawn above, only sparsely and finely intermixed with dusky along the sides, and with the dusky arranged in a very faint dorsal stripe slightly darker than the adjoining regions, being never very distinct, sometimes practically absent, and never blackish and sharply defined as in *bairdii*. Shoulder patch and hip patch often tending to become bright cinnamon-fawn. The total color effect of the form is much more like that of *rufinus* of New Mexico than of *bairdii*, but is fawn where *rufinus* is cinnamon-tawny, and in comparable pelage has even a less sharply defined dorsal stripe than *rufinus*.

The skull is slightly larger than that of *bairdii* and less arching, the parietals and interparietals being more angular and flatter than in most specimens of *bairdii*.

*Remarks.*—The specimens from Huntsville and Gravette, though from much lower elevations than those from the Winslow area, are quite as distinct as the latter, the only justification for the preference of Winslow as the type locality being the more abundant material from that region. A very old individual from Gravette, otherwise perfectly normal, has an apparently abnormal tooth row of 2.8 mm, the three molars all being present, but each greatly reduced in size. The next shortest tooth row in the series is 3.1.

*Specimens examined.*—Twenty-seven, as follows: Arkansas: Gravette, 2; Huntsville, 2; Winslow, 23.

*Museum of Birds and Mammals, University of Kansas, Lawrence, Kansas.*

## A NEW WOODCHUCK FROM KANSAS

BY J. D. BLACK

In 1914, when A. H. Howell was engaged in his study of the American marmots, only nine specimens were available from Kansas, all from the vicinity of Lawrence, and all supplied by the Museum of Birds and Mammals, University of Kansas. After he had examined this small series, consisting of six males and three females, one of the latter a subadult, Mr. Howell wrote C. D. Bunker, Assistant Curator of the Kansas Museum, that on the basis of the meagre material it was inadvisable to describe a new subspecies from eastern Kansas, but the specimens examined indicated that there might be a new race there, and suggested that additional material be secured. These same conclusions were published a year later in Mr. Howell's "Revision of the American Marmots," (North American Fauna, no. 37, 1915, pp. 24-25), at which time he pointed out the larger size of the hind foot and skull in females of *Marmota monax* from Kansas.

In the twenty years that have elapsed since the appearance of Howell's revision, a very satisfactory series of Kansas specimens has been accumulated in the museum at Lawrence. They have been collected, for the most part, by Fred Hastie, 7 miles southwest of Lawrence. This series proves conclusively that the preliminary suppositions based on the first nine specimens were correct. In addition to the characters mentioned there are several slight external and cranial differences which, taken as a whole, serve to distinguish the Kansas form readily from typical *Marmota monax monax*.

Appreciation should be expressed here to the Bureau of Biological Survey

for providing typical specimens of *Marmota monax monax* for comparison, as well as to Dr. H. H. Lane, Head of the Department of Zoology of the University of Kansas, under whose supervision this study has been carried on, for his counsel and for examination of the manuscript; and especially to C. D. Bunker, Assistant Curator in Charge, Museum of Birds and Mammals, University of Kansas, who has placed that institution's entire series of *Marmota* at my disposal, who suggested over a year ago the study resulting in the present paper, and who has been instrumental in securing a very fine series of Kansas specimens. It is a privilege, therefore, to designate this typically Kansas mammal as:

***Marmota monax bunkeri*, new subspecies**

*Type*.—From 7 miles southwest of Lawrence, Douglas County, Kansas; adult female, skin and skull, no. 3089, Univ. of Kansas Museum of Birds and Mammals, Lawrence, Kansas; collected by Fred Hastie, March 8, 1920.

*Distribution*.—At least northeastern Kansas from Franklin County north to Doniphan County; limits of range unknown, but probably extending north into Nebraska and west in Kansas up the rivers for a considerable distance.

*General characters*.—Female as large as the male, with a very large hind foot and large skull; males slightly larger than in typical *Marmota monax monax*, thus making it the largest subspecies of the group. Coloration variable, similar to that of *monax* but averaging darker; legs and lateral stripe (almost always present) cinnamon-rufous or bright hazel. A typical gray phase and a black phase occur together. Feet always black and tail much less intermixed with grizzled buffy-white than is usually the case in *monax*. Braincase broader and flatter than in *monax*.

*Color*.—Underfur of upperparts varying from pallid neutral gray to rather bright ochraceous-buff terminally, and varying basally from dull blackish-brown to pure black. Long hairs of upperparts varying from clove brown to pure black, in either case broadly banded near the tip with white and then tipped by a narrow band of the dark color. Long hairs around the front legs nearly pure cinnamon-rufous or bright hazel, varying in intensity and saturation. These hairs are always lighter toward the tips and are black basally, the ratio of black to rufous also varying somewhat. Long hairs around hind legs sometimes almost like those around front legs, sometimes concolor with the back, usually intermediate between the two. On the majority of adult specimens there is a faint ventro-lateral stripe of cinnamon rufous intermixed with grizzled gray from the axilla to the groin. This cinnamon-rufous also invades the neck region ventrally to form a more or less distinct band of cinnamon-rufous or hazel across the lower throat. About two-thirds of the specimens examined have the long hairs of the back clove brown basally and about one-third are in the melanistic phase with these hairs black, in the latter case with the basal portion of the underfur also black so that the black is definitely dominant over the gray and white in the general color. On all the specimens examined the feet are black, the brown sometimes occurring in *monax* not being found. The tail varies from pure black to a very dark brown, sparsely if at all mixed with buffy or whitish hairs. The top of the head varies from seal brown to clove brown.

*Skull*.—Similar to that of *monax*, but those of females much larger than of females of typical *monax*, and as large as those of males from Kansas. Braincase more massive, broader and lower than in *monax*. The sagittal crest is well developed in only about one-half of the adult females examined and seems never to attain the high development

typical of the males. The maxillary tooth row averages considerably longer than in *monax*, and the teeth, though highly variable, are wider and heavier than those of *monax*.

*Measurements.*—(Type): Total length, 620 mm.; tail vertebrae, 145; hind foot, 95. Seven female topotypes: Total length, 624 (605–650); tail vertebrae, 149 (122–160); hind foot, 95 (90–108). Eleven male topotypes: Total length, 630 (602–653); tail vertebrae, 150 (120–189); hind foot, 94.4 (90–98).

Skull (*type*): condylobasal length, 101.3; palatal length, 60.5; postpalatal length, 36.2; length of nasals, 43.4; zygomatic breadth, 68; breadth across mastoids, 47; least interorbital breadth, 27.9; breadth of rostrum, 21; maxillary tooth row, 23. Seven adult female topotypes: Condylobasal length, 98.5 (95–100.5); palatal length, 57.9 (56–59.5); postpalatal length, 36.1 (35.5–37.2); length of nasals, 42.5 (41.6–42.7); zygomatic breadth, 66.1 (64.5–66.8); greatest mastoid breadth, 47 (45.5–49); least interorbital breadth, 27.7 (27–30); breadth of rostrum, 22.3 (20.6–23.7); maxillary tooth row, 22.2 (21–23). Eleven adult male topotypes: Condylobasal length, 98.2 (94–101); palatal length, 57.1 (55.5–59.3); postpalatal length, 36.7 (34–39); length of nasals, 42.1 (40–44); zygomatic breadth, 66.5 (65–69.2); greatest mastoid breadth, 48.2 (46.8–50.5); least interorbital breadth, 27.9 (26.2–29.5); breadth of rostrum, 22.3 (20.5–23.5); maxillary tooth row, 22 (20–23).

*Specimens examined.*—Sixty-one, from the following localities in Kansas: Douglas County, 36 skins and skulls, 20 skeletons or skulls only; Leavenworth County, 2 skins and skulls; Doniphan County, 5 skins and skulls; Franklin County, 1 skin and skull; Atchison County, 1 skull only.

*Remarks.*—The specimens from Franklin and Doniphan counties, as well as those from Leavenworth and Atchison counties, seem to be quite typical of this race, the maximum skull length so far found (102 mm.) being that of a male from Doniphan County. Two females from that county, both subadult, measure 97.2 and 98.5 in condylobasal length, with the other measurements in proportion. A specimen from McDonald County, Missouri, as well as those from Stone County, Missouri, appear to be typical of *monax*, lacking the large size and dark coloration of the Kansas form, so that intergradation may be expected to occur between the two forms somewhere in southern Kansas. One very interesting abnormality was found in the topotype series, an adult female (K.U., no. 3911) with an extra premolar in each of the four jaws, apparently the retention of a milk tooth, squeezed slightly median of the tooth row, second in the series in each jaw, and intermediate in size between the teeth before and behind it. The maxillary tooth row of this specimen was 25.5 mm. Another abnormality in tooth structure was that of an adult male topotype (K.U., no. 3920), where the maxillary tooth row measured 24.6, because of the unusually large size of the anterior premolar.

*Summary.*—In considering this form in contrast to *monax* it might be convenient to compare certain features of the two animals. The condylobasal length of the skulls of *monax*, according to Howell, averages 97.8 mm. in males and 91.2 in females. This is in contrast to averages of 98.2 for males and 98.5 for females of the Kansas form. The hind foot measurements for males of typical *monax* are given by the same authority as 82 and 88 (only two measurements are given), while that of females for the typical form averages 83. The hind foot of males of the Kansas form averages 94.4, and of females 95. The average total length of females of *monax* is given by Howell as 557, while the average of seven females from Kansas is 624. The maximum length of nasal bones of *monax* is given as 40.6, the average 38.7, in contrast to an average of 42.5, a minimum of 41.6, and a maximum of 43.4 in the Kansas females.

*Museum of Birds and Mammals, University of Kansas, Lawrence, Kansas.*

NOTES ON ARKANSAS MAMMALS

BY S. C. DELLINGER AND J. D. BLACK

At the time of the preparation of a paper "Mammals of Northwestern Arkansas" by one of the present authors (Black, Jour. Mamm., vol. 17, pp. 29-35) a considerable share of the data from the University of Arkansas collection was not available. We now present these data together with additional records that have been accumulated since 1935. Unless otherwise indicated, the specimens listed here are preserved as skins in the University of Arkansas Museum.

*Didelphis virginiana virginiana* Kerr. Virginia opossum.—Several additional instances of unusual pelage have been recorded, including one cinnamon-colored animal from three miles south of Elkins, Washington Co., and one pure albino from near Mountain Home, Baxter Co. They were two of a lot of odd-colored specimens that were kept alive at the university for genetical experiments. Later, both were lost. We have data on several white opossums with black-tipped ears and toes, including two skins as follows: Three miles N. of Springdale, Washington Co., 1; near Eden's Bluff, Benton Co., 1. We also have a mounted cinnamon-colored specimen from Sulphur City, Washington Co., 1939.

*Cryptotis parva* (Say). Little short-tailed shrew.—Two of these were taken from a storm cellar (one preserved) one mile west of Fayetteville, Haskell Heights, Washington Co. Approximately twenty adults and young were taken by Eugene Cypert from post

holes at the Migratory Waterfowl Refuge at St. Charles, Arkansas Co., March 21, 1938. Three of these are preserved in the University of Arkansas Museum, as well as one from Big Island Chute, Arkansas Co., April 12, 1938.

*Blarina brevicauda carolinensis* (Bachman). Carolina short-tailed shrew.—Formerly known in northwestern Arkansas only from the crushed skeleton reported in 1935. Additional data now show that the species is not rare. Three specimens (all adults) were secured near Winslow, Washington Co., during the winter of 1937-38, two at the University Farm in 1927, and one near the University campus in 1934. Six were found (not preserved) in window wells at the United States Veterans Facility, Fayetteville, Washington Co., October, 1938. One was reported by Harold Wales as coming from Mammoth Springs, Fulton Co., 1939.

*Myotis grisescens* A. H. Howell. Gray bat.—Bella Vista Cave, Benton Co., 2; Crystal Cave, five miles N. of Bentonville, Benton Co., 12.

The breeding colony in Denney Cave, reported in 1935, is much smaller than in former years, a condition that holds true for all the bats in this section. This diminution in numbers is probably due to the severe drought in the summer of 1935.

*Myotis keenii septentrionalis* (Trouessart). Eastern long-eared bat.—Three of these bats were collected April 25, 1938, at Crystal Cave, five miles N. of Bentonville, Benton Co., by Eugene Crawley. Apparently this is the third record from Arkansas and the second record with definite locality. Miller and Allen (Bull. U. S. Nat. Mus. no. 144, p. 106, 1928) mentioned one from Delight, and two from "Arkansas".

*Eptesicus fuscus fuscus* (Beauvois). Big brown bat.—Big brown bats were found in large numbers at Devil's Den, 9 miles west of Winslow, Washington Co., in October, 1935.

*Lasurus cinereus* (Beauvois). Hoary bat.—Trut Holder, University of Arkansas taxidermist, collected three of these at Little Rock, Pulaski Co., in June, 1932. These specimens went by exchange to a Mr. Bartineck of Chicago. Before 1928 the species was fairly common during the summer at Winslow but has not been known there since. Apparently the Little Rock specimens form the only definite record from Arkansas.

*Euarctos americanus americanus* (Pallas). American black bear.—A black bear was killed near Holly Grove, Phillips Co., during the 1927 flood, which drove it out of the cane brakes. One skull and part of a skeleton of a black bear was taken from the White River bluffs on the John Berry Graham farm, 8 miles east of Springdale, Washington Co., during archaeological explorations in 1929. Trut Holder reports one sight record at the Scrub Grass Bayou, Migratory Waterfowl Refuge, Arkansas Co., October, 1938.

*Procyon lotor hirtus* (Nelson and Goldman). Missouri Valley Raccoon.—We have secured specimens as follows: West Fork of White River, 5 miles southeast of Fayetteville, Washington Co., 1; six miles west of Goshen, Washington Co., 2; West Fork, Washington Co., 1; near War Eagle, Benton Co., 1; Clark Co., 2.

*Mustela vison mink* (Peale and Beauvois). Mink.—To the few definite records of this species in Arkansas should be added a large male now mounted in the University of Arkansas Museum; collected near Augusta, Woodruff Co., December, 1935, by Roy Wood, Museum taxidermist, and three taken near Cave Springs, Benton Co., 1938.

*Lutra canadensis interior* (Swenk). Interior otter.—One tanned skin, without skull, of an otter trapped near Helena, Phillips Co., in December, 1929, is now in the Museum. One was examined in the hands of a trapper on Big Piney Creek, Pope Co., in 1926. We have authentic sight records from near Monticello, Drew Co., in October, 1935, and from Spavinaw Creek, near Gravette, Benton Co., in May, 1937. These animals are fairly common on Spavinaw Creek since Arkansas has closed the season on them. Several complaints have been made that the otters are ruining fishing in this stream. Eugene Cypert, Biologist, White River Migratory Waterfowl Refuge, reports them as increasing in Desha and Arkansas counties.

*Spilogale interrupta* (Rafinesque). Prairie spotted skunk.—All the specimens and

skins we have examined seem fairly typical of this form. The species apparently reaches its eastern limit, in this state, at Hot Springs where it is reported common; however, we do not have specimens from that locality. Museum specimens include: Fayetteville, Washington Co., 1 mounted and 1 tanned skin; 2 miles west of Sulphur City, Washington Co., 1 mounted; Marble Falls, Boone Co., 1 skin.

*Mephitis mephitis mesomelas* (Lichtenstein). Louisiana skunk.—In December, 1936, Dellinger examined three pure albino skunks in the possession of Doctor Henry Kirby of Harrison, Boone Co. A nest with four young was found on Clear Creek, five miles north of Fayetteville, Washington Co., in May, 1935. These together with adults from that locality are mounted in the museum or preserved as skins. There is also a skin from four miles southwest of Fayetteville, Washington Co.

*Mustela primulina* Jackson. Missouri weasel.—The museum has one skin from near Fayetteville. Gene Rush, of the museum staff, examined a white skin in the hands of a trapper at Marble Falls, Boone Co., in January, 1938.

*Vulpes fulva* (Desmarest). Eastern red fox.—A good series of red foxes is now in the museum, taken during the winter of 1937-38 in predatory control work in the State Game Refuge near West Fork, Washington Co. Also one skin from south of Durham, Washington Co., one from near Winslow, Washington Co., and one from nine miles south of Prairie Grove, Washington Co.

*Urocyon cinereoargenteus cinereoargenteus* (Schreber). Eastern gray fox.—Specimens as follows: near Berryville, Carroll Co., 2 (mounted); near Newport, Jackson Co., 2; three miles north of Gravette, Benton Co., 1; near Fayetteville, Washington Co., 1; and State Game Refuge, near West Fork, Washington Co., 10.

*Canis latrans* subsp. Coyote.—The museum has one coyote skin (without skull) from Cincinnati, Washington Co., taken in January, 1924. Puppies from a den on Kessler Mountain, west of Fayetteville, Washington, Co., were offered for sale in the streets of Fayetteville in June, 1922.

*Canis rufus gregoryi* (Goldman). Mississippi Valley wolf.—Wolves are becoming rather common in the Ozarks. Many skins pass through the hands of fur traders each winter. According to game wardens they are found in the game refuges throughout the state. One from Kessler Mountain, near Fayetteville, Washington Co., was examined in the possession of a dealer in January, 1936, as well as several from near Schaberg, Crawford Co., and from the Devil's Den region, west of Winslow, Washington Co. We have a skin of one large male caught by a government trapper in 1936 near St. Joe, Searcy Co., and another from near Summer, Washington Co., also taken by a government trapper. Two black wolves, a male (length 58½ inches) and a female (length 42½ inches) were taken by game warden Bland in the Big Woods Game Refuge, Howard Co., in September, 1939.

*Lynx rufus rufus* (Schreber). Bobcat.—Two were taken near Alabam, Madison Co., in October, 1922, and sent to Ward's Natural Science Establishment, Rochester, New York. The museum has the following specimens: Near Alabam, Madison Co., 1; two miles north of Cass, Franklin Co., 1 (mounted); near Marble Falls, Boone Co., 2; State Game Refuge near Graysonia, Clark Co., 2; State Game Refuge, near Umpire, Howard Co., 1.

*Marmota monax monax* (Linnaeus). Southern woodchuck.—Five miles east of Cass, Franklin Co., 1; Marble Falls, Boone Co., 1; six miles north of Elkins, Washington Co., 1. Dellinger saw one albino in captivity at Yellville, Marion Co., 1938.

*Tamias striatus venustus* (Bangs). Southwestern chipmunk.—Clear Creek, five miles north of Fayetteville, Washington Co., 1; Beaver Dam, Crawford Co., 1; Cass, Franklin Co., 1.

*Geomys breviceps breviceps* (Baird). Louisiana pocket gopher.—Magnolia, Columbia Co., 3 skins, 18 alcoholic; near Mansfield, Sebastian Co., 1 alcoholic.

*Reithrodontomys fulvescens aurantius* (Allen). Golden harvest mouse.—Barling, Sebastian Co., 2; near Cass, Franklin Co., 1.

*Peromyscus leucopus noveboracensis* (Fischer). Northern white-footed mouse.—Fayetteville, Washington Co., 2; five miles southeast of Fayetteville, 2; near Cass, Franklin Co., 1.

*Peromyscus gossypinus megacephalus* (Rhoads). Rhoads cotton mouse.—Barling, Sebastian Co., 6; Fourche Bayou, near Little Rock, Pulaski Co., 12; Russellville, Polk Co., 5.

*Peromyscus boylii attwateri* (Allen). Attwater's white-footed mouse.—Natural Dam, Crawford Co., 2.

*Peromyscus nuttalli aureolus* (Audubon and Bachman). Southern golden mouse.—One skin and skull, adult male, collected by Trut Holder, March 14, 1939, Island No. 80, Chicot Co.; one from one-half mile west of Fayetteville, Washington Co.

*Oryzomys palustris texensis* (Allen). Texas rice rat.—Fourche Bayou, near Little Rock, Pulaski Co., 3; Stuttgart, Arkansas Co., 1.

*Sigmodon hispidus hispidus* (Say and Ord). Eastern cotton rat.—Fourche River Bottom, near Little Rock, Pulaski Co., 10.

*Neotoma floridana attwateri* (Mearns). Attwater wood rat.—Near War Eagle, Benton Co., 1.

*Pitymys nemoralis* (Bailey). Woodland pine mouse.—Barling, Sebastian Co., 1; Beaver Dam, Crawford Co., 1; Cass, Franklin Co., 1; Fourche Bayou, near Little Rock, Pulaski Co., 1.

*Ondatra zibethica zibethica* (Linnaeus). Common muskrat.—Mammoth Springs, Fulton Co., 2; near Elm Springs, Benton Co., 2. We have in addition numerous sight records from around Fayetteville, Washington Co., including Fayetteville Junction, Roacher's Pond and Clear Creek; also a nest seen at Roacher's Pond during 1922, 1923, and 1924. Muskrats seem to be increasing in numbers in the Ozarks.

*Lepus californicus melanotis* (Mearns). Great plains jack rabbit.—Four young jack rabbits were taken from a clump of blue stem grass late in April, 1937, one-half mile west of Tontitown, Washington Co. Two of these were raised to adulthood in captivity and were observed several times by Dellinger. In addition we have several authentic sight records for this animal in northwestern Arkansas, including one killed on highway 45, eight miles east of Fayetteville, Washington Co.; several one mile south of Farmington, Washington Co.; repeatedly on Dellinger farm on Clear Creek, five miles north of Fayetteville, Washington Co.; very common south of Gravette, Benton Co.; and observed just recently about two miles south of Evansville, Crawford Co. We have lately secured one from five miles northwest of Prairie Grove, Washington Co., on Muddy Fork of the Illinois River, and one from near Gravette, Benton Co.

*Sylvilagus aquaticus aquaticus* (Bachman). Swamp rabbit.—White River, near Augusta, Woodruff Co., 2; Stuttgart, Arkansas Co., 1.

*Odocoileus virginianus* subsp. Virginia deer.—Five Lakes Hunting Club, Crittenden Co., 3 (mounted); Fourche Mountains, Yell Co., 2 (skins and skulls). In addition one was killed seven miles north of Fayetteville, Washington Co., on the Springdale Golf Course in 1937, but was not preserved.

*Dasypus novemcinctus texanus* (Bailey). Texas nine-banded armadillo.—A live armadillo was taken from a brush pile near Cane Hill, Washington Co., by a farmer in the fall of 1921. We were unable to purchase this specimen from the owner. There are additional reports of this animal from Barling, Sebastian Co., and Paris, Logan Co., as well as numerous reports of its occurrence in Miller and Little River counties in the vicinity of Texarkana. Apparently the species is well established in extreme southwestern Arkansas. One caught near Altus, Franklin Co., was examined August 20, 1938, but was too badly decayed to preserve. Doctor Pink Carrigan of Hope reports that armadillos have been breeding in Hempstead Co., for the past two or three years. We

have a mounted specimen, trapped by Carl Lewis at the entrance of its burrow, two miles east of Durham, Washington Co. This specimen was apparently overcome by cold during the night.

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*University of Arkansas Museum, Fayetteville, Arkansas.*

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*Notropis perpallidus*, a New Minnow from Arkansas

By CARL L. HUBBS and JOHN D. BLACK

DURING the course of an ichthyological survey of Arkansas the junior author has collected two specimens which obviously represent a very distinct, hitherto unknown species referable to the large genus *Notropis*. In its extreme pallor (suggesting the scientific name *perpallidus* and the vernacular, colorless shiner), and in the large size of the few remaining melanophores, it is matched only by a technically very distinct form, *Notropis volucellus buchani* Meek. That shiner has only 8 anal rays and 4—4 teeth.

The systematic relationships of *Notropis perpallidus* are hardly discernible in the maze of species now included in the genus. In the general form, in the shape of the mouth, and in some other respects it rather closely resembles another southern Ozarkian species of similarly uncertain affinities, namely *Notropis ortenburgeri* Hubbs (*in* Ortenburger and Hubbs, 1927: 127; Hubbs and Ortenburger, 1929: 72-73). It differs from *ortenburgeri* in its pallid appearance, the presence of teeth in the outer row, the less elevated dorsal fin, and probably in the higher average number of anal rays (10 or 11 instead of 8 to 10).

When compared with other species of the same region, it perhaps most closely resembles *N. boops*. The depigmentation, higher number of anal rays (8 in *boops*), more flap-like mandible, and numerous other differences show that this similarity is superficial.

Compared with other species having as many as 10 or 11 anal rays and as many as 2 teeth in the outer row, *N. perpallidus* differs in its weaker pigmentation, its somewhat clavate mandible, and in various other details. The little-decurved lateral line and the regular squamation, with rather large scales before the dorsal, set it off from all members of the *Lythrurus* group (including *N. fumeus* and *N. notemigonoides*); otherwise it is rather like *N. u. umbratilis*. The dorsal fin is less posterior than in the species of the *atherinoides-rubellus* complex, other than the terete *N. photogenis*. Numerous features separate *N. perpallidus* from all species of the southeastern lowlands, including *N. hypselopterus* (*N. metallicus*) and its allies. The general frailness, more compressed body, and numerous other features render unnecessary any detailed comparison with *N. ariommus* and its subspecies (*ariommus*, *telescopus*, and *arcansanus*). Compared with *N. amabilis* of Texas and Mexico (*N. socius*, *N. megalops*, and *N. swaini* are synonyms), our new form differs in the more oblique mouth with blackened lips, in the much frailer texture, and in numerous other characters.

*Notropis perpallidus*, new species

The two known specimens of *Notropis perpallidus* were seined by John D. and Ruby Y. Black on June 20, 1939, in a very silty, weedless backwater of the Saline River (a Red River tributary), 5 miles north of Warren, Bradley County, Arkansas; in rolling country between the Coastal Plain and the hills. The water temperature at 2 P.M. was 86° F. The holotype, 30 mm. in standard length, is deposited in the University of Michigan Museum of Zoology, as Cat. No. 125991. The paratype, U.M.M.Z. 125992, is 29 mm. long. In the following description the determinations for the paratype, when different from those of the holotype, are entered in parentheses.

The body of this very frail shiner is rather strongly compressed: the depth of the body is 1.7 times the greatest width, and measures 5.2 (5.6) times in the length to caudal base; the head is slightly less than half as wide as long; when "stepped" downward from the highest point of the back, the greatest width extends just to the lateral line. The body is distinctly deeper near the middle of the trunk than at the origin of the dorsal fin, as the predorsal contour is rather strongly arched. The origin of the dorsal is a

little elevated. Posteriorly the dorsal and ventral contours gently converge in the long, slender urosome. The length of the caudal peduncle enters the head 1.2 times, and contains the least depth 2.0 (2.4) times.

The margins of the body merge evenly into the symmetrical and rather strongly arched dorsal and ventral contours of the head. The tip of the muzzle lies on a horizontal passing scarcely below the center of the pupil. The symmetrical appearance of the head is enhanced by the vertically submedian position of the eye: in lateral view the interorbital rises above the eye a distance at least half the depth of the head below the eye. The greatest depth of the head slightly exceeds the combined length of snout and eye, and is two-thirds the length of the head, which enters the standard length 4.1 times.

The mouth rises at an angle of about  $40^\circ$ . Toward the symphysis the mandible is somewhat hooked upward and backward, and its front edge is broadly U-shaped when viewed from below. The lower jaw consequently has a rather flap-like appearance as the mouth is opened and closed. The upper jaw is bent toward a horizontal position near the anterior end. Because of the direction of the two jaws anteriorly, the upturned end of the mandible is definitely included within the broadly rounded tip of the premaxillary. The jaws show a reduced obliquity at the posterior as well as the anterior end, so that in side view the mouth is distinctly sigmoid. As seen from below, the sides of the gape are somewhat curved outward posteriorly. The upper lip is coterminous with the snout. The lips are thin. Upper jaw 3.4 (3.6); length of broadly rounded snout 3.8 (4.0); eye just equal to least bony interorbital width, 3.2 (3.1); least suborbital width one-third eye. The pharyngeal teeth number 2, 4-4, 2 (1, 4-4, 1), and bear rather broad and deep grinding surfaces beneath the hooks.

Dorsal rays 8 (7); anal rays 11 (10); principal caudal rays 19; pectoral rays 14-14 (13-13); pelvics 9-9, including a rudimentary outer ray. The dorsal is inserted over the middle (or end) of the pelvic base, equidistant between base of caudal and a point one pupil's length behind (or one pupil's length before) the tip of snout. The dorsal fin is moderately rounded; its depressed length is contained 1.7 (1.6) times in the distance forward to the occiput. The length of the short pectoral fin enters either the interspace between pectoral and pelvic insertions or the head 1.5 (1.4) times. The pelvic fin barely covers the anus; its length is contained 1.7 times in the head.

The scales are obviously very thin and deciduous. They are difficult to count, but by enumerating the scale pockets it is possible to arrive at a reasonably close approximation of the number: 7-34-4 (6-36-4),  $2\frac{1}{2}$  between lateral line and pelvic insertion, 18 (15) before the dorsal. The trunk scales seem to be somewhat elevated, but those of the lateral line are not much higher than the others. The lateral line is only moderately decurved, though rising rather abruptly toward the head: the distance between the pelvic insertion and the lateral line is contained 1.3 (1.5) times in the distance from the origin of the dorsal fin to the lateral line. Dermal structures indicate that the lateral line is probably complete.

The fish is very pale and frail. The flesh is distinctly translucent: the

myocommata show clearly by reflected light, the muzzle has a watery appearance, and the gills and the brain are visible through the bones of the head. The body as a whole is devoid of pigment. The lateral band is represented on the trunk by one very irregular, scattering row of large, stellate melanophores (almost lacking in the paratype), and on the tail region by about two very irregular rows of such specks. There is no definite caudal spot, but the basal part of the branched caudal rays, except for the median rays of the upper lobe, are separated by blackish streaks; the rudimentary caudal rays are clear of pigment. The axial septum is marked behind the middle of the trunk by a very fine, dashed line. The back before the dorsal fin bears about three very irregular rows of large, stellate, widely spaced melanophores. Such spots are clustered into a short stripe on either side of the median line immediately in advance of the dorsal fin. Along the middle of the base of the dorsal there is a conspicuous dark stripe composed of two series of black specks. On the back behind the dorsal there are two rows of well-scattered specks, showing a tendency to cluster just before the caudal fin. The holotype (but not the paratype) shows several giant melanophores on the mid-line of the belly. There is a cluster of such pigment spots just behind the anus, and there is a black speck near the base of each anal ray, with streaks extending a short distance upward and forward between the myomeres. A few linear melanophores form two irregular series behind the anal fin. Otherwise the body is virtually unpigmented. The dorsal, anal, and paired fins are entirely colorless. The top of the head is marked by large melanophores, each with a light ring between the broad dark center and blackish marginal fimbriae. These specks are thickly concentrated in a shield-shaped parietal blotch. The frontal region is devoid of pigment except for a band on either side composed of 3 to 5 especially enlarged melanophores. A few specks on the opercle faintly represent a continuation of the lateral band. The anterior, median arch of the snout is darkened by scattered melanophores, and there is a group of giant color cells on the anterior part of the preorbital region. The lips are blackened and there are a few minute black specks between the rami of the mandibles anteriorly. Otherwise the head is almost completely clear of pigment spots.

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PERCID FISHES RELATED TO *POECILICHTHYS*  
*VARIATUS*, WITH DESCRIPTIONS OF  
THREE NEW FORMS

BY CARL L. HUBBS AND JOHN D. BLACK

IN 1931 J. Clark Salyer, II, secured for the University of Michigan Museum of Zoology two immature darters from the Big Niangua River, near Buffalo, Missouri. These were tentatively referred to *Poecilichthys variatus* by Hubbs and Trautman (1932: 33), but now, after having been carefully compared with more abundant material, seem to represent a distinct and hitherto unnamed form, herein called *P. tetrazonus*. Later, 1 young and 1 adult of the same species, from the Gasconade River system in Missouri, were found in the United States National Museum.

During the summer of 1938, in the course of field work leading to a general survey of Arkansas fishes, the junior author and Mrs. Black obtained in the White River system several specimens of another new darter closely related to *Poecilichthys variatus*. It differs from that species in several respects, and on available evidence appears to be specifically distinct. It is herein named *Poecilichthys euzonus euzonus*.

At the same time A. Hugh Denney, while collecting fishes in connection with a fish-management project of the United States Forest Service in southeastern Missouri, in another section of the White River system, seined several specimens of a very

similar darter, which we regard as subspecifically distinct from the Arkansas form. It is designated *Poecilichthys euzonus erizonus*.

Specimens which may be regarded as *Poecilichthys euzonus euzonus*, approaching *P. euzonus erizonus*, were located in the National Museum. They came from Black and Spring rivers at Black Rock and from the White River at Batesville, Arkansas. These darters, as well as 2 examples of *P. tetrazonus* mentioned above, were incorrectly referred by Meek to *Etheostoma uranidea* Jordan and Gilbert (in Gilbert, 1887: 48-49). The true *Imostoma uranidea* (Jordan and Gilbert), although often showing a color pattern much like that of *Poecilichthys variatus*, is a very different species. After comparing the types and other material, we regard *Etheostoma (Hadrop-terus) ouachitae* Jordan and Gilbert (in Gilbert, 1887: 49-50) as a synonym of *Imostoma uranidea*.

We are much indebted to Alexander Wetmore and Leonard P. Schultz for the privilege of examining and reporting on specimens in the United States National Museum.

The material of these 3 new forms, together with additional specimens of 3 related species already named, enables us to present this review of the *Poecilichthys variatus* group, in which we include:

1. *Poecilichthys osburni* Hubbs and Trautman, 1932
2. *Poecilichthys tetrazonus*, new species
3. *Poecilichthys variatus* (Kirtland, 1838)
4. *Poecilichthys euzonus*, new species
  - 4a. *Poecilichthys euzonus erizonus*, new subspecies
  - 4b. *Poecilichthys euzonus euzonus*, new subspecies
5. *Poecilichthys blennioides* (Gilbert and Swain, 1887)

The 5 species of the *Poecilichthys variatus* group, as here defined, may be recognized by the 4 conspicuous dark crossbars (5 in *P. osburni*), laid down over a pale and more or less uniform ground color above the lateral line. Other common characters—each shared, however, with some other species of the genus—are given as item 1a in the key.

It has just been discovered that 1 other species of *Poecilichthys* bears the 4 or 5 conspicuous oblique saddles characteristic of the *P. variatus* group. As Reeve M. Bailey has pointed out to us, the species described by Radcliffe and Welch (1913: 31-32, Pl. 18) as *Hadropterus sellaris* is not referable to *Hadropterus*, for it lacks all traces of the enlarged, spiny scales along the mid-ventral line, even between the pelvic fins where a very spiny plate is always evident in *Hadropterus* and other genera defined on this squamational character. *Poecilichthys sellaris*, known only from the two types collected in Swan Creek near Havre de Grace, Maryland, close to the head of Chesapeake Bay, may well bear no immediate relationship with the species of the Mississippi Valley having similar coloration. That the agreement in color pattern may have resulted from parallel evolution seems more plausible when we recall that very similar markings are developed in certain totally unrelated fishes of the riffles, for example in species of *Hypentelium* and *Cottus*. *P. sellaris* differs trenchantly from the species of the *P. variatus* group, including *P. blennius*, in the V-shaped border of the gill-membranes and in the scaleless belly. The distinctive genital papilla of the adult male of *P. sellaris* is a subspherical process, preceded and partly covered by a complex flap consisting of a subtriangular shelf, on either side of which there is a large flat lobe turned under and back at the outer side to produce a small, thickened flap which is nearly hidden in ventral aspect. Other characters suggest relationship with *P. variatus*: (1) the saddles rival those of *P. blennius* in boldness and are similarly set off by light borders; (2) the anal fin is almost as expansive as the second dorsal; (3) the pelvics are separated by an interspace about two-thirds as wide as the base of either fin.

Some doubt is involved in the reference of *Poecilichthys blennius* to the *P. variatus* group. As indicated in the key, it is sharply set off from the 4 other species, which seem to constitute a well-circumscribed *Formenkreis*. No other characters than those of coloration seem to align *P. blennius* definitively with this group.

Generic or subgeneric classification among the darters is extraordinarily difficult. The only respect in which this group of species provides an exception to the statement arises from the circumstance that *variatus* is the genotype of *Poecilichthys* Agassiz (1854: 304–6).<sup>1</sup> Consequently, *variatus* and its immediate relatives will remain in *Poecilichthys*, whether or not that genus is disrupted. We see no valid occasion for either the subgeneric or generic separation of any of the 4 other species here treated. Jordan and Evermann (1896: 1067) referred *Etheostoma variatum* to the subgenus *Poecilichthys* and *E. blennioides* to *Nanostoma*, but the criteria used by these authors to distinguish the 2 subgenera (“anal fin nearly as large as soft dorsal,” instead of much smaller; “spinous dorsal with about 13 spines,” rather than 9 to 12) fail completely, in the light of the data presented in this paper. Nor is there anything distinctive in the supplementary characters assigned to *Poecilichthys* (“head almost naked; fins very large; colors brilliant”). We therefore interpret *Nanostoma* as subgenerically synonymous with *Poecilichthys*. There is certainly no trace of justification for the generic separation of *Nanostoma* from *Poecilichthys*, as advised by Jordan (1916: 26) and as recently practiced by Jordan (1929: 163), and by Jordan, Evermann, and Clark (1930: 289).

The same authors—Jordan (1929: 157), Jordan, Evermann, and Clark (1930: 287)—and some others following their lead, have referred *Poecilichthys blennioides* to the genus *Ulocentra*. It is possible that this reference has a natural basis, since *blennioides* does strongly resemble the species of *Ulocentra*. It has, however, a definite though narrow frenum, and is therefore retained by us in *Poecilichthys*.

Since all 5 species under discussion seem referable to *Poecilichthys* in subgeneric as well as generic sense, there is no present reason for considering here whether *Poecilichthys* should be divided into subgenera or into genera. The consid-

<sup>1</sup> On the use of this name for all or part of the group called *Etheostoma* by Jordan and Evermann (1896: 1066–99), see Jordan (1916: 25) and Hubbs (1926: 63).

erable diversity in the species here treated, in the degree of union of the gill-membranes, lessens the taxonomic significance of this rather intangible character, which, with the equally tenuous character of the completeness of the lateral line, has been used in the primary division of the whole group.

In the species group as here established, the lateral-line system of the head (Hubbs and Cannon, 1935: 10-11, Pl. 2) is remarkably uniform. The lateral canal of the head gives off 5 pores, each of which, except the hindmost, opens at the end of a narrow tube directed, and commonly curved, downward and slightly backward. The supratemporal commissure is complete, with the median pore at the end of a short, backward-extending canal. The lateral pore on either side lies directly on the canal. In some individuals a small sense organ, superficially resembling a pore, is developed on either side of the supratemporal canal, between the lateral pore and the median line. The interorbital pores are present, as is the coronal, which terminates a backward-extending tube. The two nasals are widely separated, for the anterior one lies slightly in advance of the anterior nostril, whereas the posterior one is near the posterior nostril. The infraorbital canal is complete with 8 pores, but presents a peculiarity: although each of the 4 posterior pores lies at the end of a downward-projecting tube, the posteriormost or fourth of the anterior set is frequently, in some forms almost invariably, at the end of a short tube which extends upward to near the eye. In *P. blennius* and *P. tetrazonus*, however, this pore typically opens out directly on the canal, or even at the end of ventral tubes (see descriptions of these species). There is some variation in this character, even on the two sides of an individual. The operculomandibular series comprises 10 pores, of which those on the opercle open at the end of short, downward-projecting tubes.

Due to the previous association of *P. blennius* with the subgenus or genus *Nanostoma*, a check was made on the pores of the head in the various species referred to that group. *P. swannanoa* alone showed the upward-projecting fourth pore, and only as a variation from the more usual condition, in

which the pore lies below or on the canal. In *P. zonalis zonalis*, *P. zonalis arcansanus*, *P. lynceus* (= *P. elegans*), and *P. rupestris*, this pore opens on the lower side of the canal, as in most other darters, with a complete canal, which we have examined.

ANALYSIS OF THE SPECIES AND SUBSPECIES OF THE  
*POECILICHTHYS VARIATUS* GROUP

1a (common characters).—Lateral line complete (occasionally with 1 or 2 pores missing). Gill-membranes more or less broadly connected. Form robust. Dorsal rays XI to XIV (X to XII in *P. tetrazonus*)—11 to 16; anal with 2 stiff spines and 8 to 11, commonly 9 or 10, soft rays. *Body above lateral line crossed by 4 conspicuous dark bars (5 in P. osburni), on a pale and more or less uniform ground color.*

2a.—Snout more or less produced (angle of muzzle 44° to 70°). Gill-membranes moderately to rather broadly connected, forming an angle of 50° to 90°. Scales 6 to 9—50 to 73—7 to 11 (5 or 6—47 to 54—7 or 8 in *P. tetrazonus*). Soft rays 12 to 15 in dorsal fin, 9 to 11 in anal, and 14 to 16 in pectoral. Least bony interorbital width 2.2 to 3.8 in eye. Least suborbital width 5.8 to 12.0 in head. Upper jaw 3.3 to 3.7 in head (3.5 to 4.0 in *P. euzonus erizonus*). Highest dorsal spine 2.2 to 2.8 in head; longest pectoral ray 0.8 to 1.2; length of pelvic fin 1.0 to 1.5. Dorsal saddles not set off by a light posterior border. Lateral blotches not fused into a zigzag line.

3a.—Five blackish saddles. Head 3.6 to 4.0. Eye 1.3 to 2.0 in snout, 4.4 to 5.6 in head. Snout 2.8 to 3.4. Least suborbital width 5.8 to 7.3.

4a.—Scales 7 to 9—59 to 69 (53 to 57 in a variant form)—8 to 11. Dorsal spines 11 to 14. Saddles and lateral markings fairly well developed in young, becoming obsolescent in adult females but intensified in breeding males; lateral blotches in adults forming 9 to 11 rather regular bars, almost encircling body posteriorly; 11 or 12 orange bars in breeding males. Body moderately compressed (width 1.5 in projection of depth). Least bony interorbital width 2.3 to 2.5 in eye. Vertical soft fins high (highest dorsal ray 1.4 to 1.7, and highest anal ray 1.7 to 1.8 in head). Interspace between pelvic fin and union of gill-membranes 1.2 to 1.4 in distance thence to tip of mandible. Breast scaleless (rarely with a few scales near pelvic fins); angle between supra-temporal and lateral head canals and the opercle and cheeks

scaless. *Upper Kanawha River system, Virginia and West Virginia:*

1. *P. osburni*

3b.—Four blackish saddles. Head 3.3 to 3.7. Eye 0.8 to 1.5 in snout, 3.7 to 4.7 in head. Snout 3.0 to 4.3. Least suborbital width 6.5 to 12.0 (usually more than 7.2).

4b.—Scales 5 or 6—47 to 51—7 or 8 (4 specimens known). Dorsal spines 10 to 12. Saddles and lateral markings moderately prominent; lateral blotches in adults forming about 10 rather regular bars on lower part of body, with weak extensions dorsally. Body moderately compressed (greatest width 1.4 to 1.7 in projection of depth). Least bony interorbital width 2.2 to 3.0 in eye. Vertical soft fins little elevated (highest dorsal ray 1.8 to 2.1, and highest anal ray 2.0 to 2.3, in head). Interspace between pelvic fin and union of gill-membranes 1.5 to 1.6 in distance thence to tip of mandible. Breast more or less scaled; angle between supratemporal and lateral head canals scaled or scaless; opercle with 1 to 6 scales; cheeks with none. *Big Niangua and Gasconade River systems (Missouri River drainage basin), Missouri:*

2. *P. tetrazonus*

4c.—Scales 6 or 7—50 to 58—7 to 9. Dorsal spines 11 to 13, most frequently 13. Saddles and lateral bars very distinct in young, but becoming obscure in adults, particularly in breeding males; lateral blotches 9 to 11, not forming regular bars, those in the breeding males indistinct and not forming orange bars; the orange bars therefore few (5 or 6). Body more compressed (width 1.5 to 1.7 in projection of depth). Least interorbital width 2.5 to 2.7 in eye. Vertical soft fins high (highest dorsal ray 1.4 to 1.9, and highest anal ray 1.6 to 2.0, in head). Interspace between pelvic fin and union of gill-membranes 1.5 to 1.7 in distance thence to tip of mandible. Breast almost always scaless, except near pelvic fins; angle between supratemporal and lateral head canals scaless, or with 1 to 3 embedded scales; opercle ordinarily without scales, rarely with a few; cheeks always naked. *Ohio River drainage basin in New York, Pennsylvania, West Virginia, Ohio, Indiana, and Kentucky, exclusive of the Upper Kanawha, Wabash, Kentucky, and Tennessee River systems:*<sup>2</sup>

3. *P. variatus*

<sup>2</sup> A single record for the Cumberland River system, in Tennessee, has been doubted (Hubbs and Trautman, 1932: 33).

4d.—Scales 7 to 9—57 to 73—8 to 11 (6—54—9 in 1 specimen from Spring River with unusually large anterior scales). Dorsal spines 12 to 14, most frequently 13. Saddles and lateral markings very prominent in both sexes, at all ages and seasons. Body more terete (greatest width 1.2 to 1.5 in projection of depth). Least bony interorbital width 3.0 to 3.8 in eye (2.6 to 3.3 in young and half-grown specimens from Black Rock and Batesville, Arkansas). Vertical soft fins little elevated (highest dorsal ray 1.8 to 2.5, and highest anal ray 1.8 to 2.4, in head). Interspace between pelvic fin and union of gill-membranes 1.2 to 1.6 in distance thence to tip of mandible. Breast more or less completely scaled (with rare exceptions); angle between supratemporal and lateral head canals with a patch of ctenoid scales; cheeks with or without scales. *White River system in Missouri and Arkansas:*

4. *P. euzonus*

5a.—Cheeks with several ctenoid scales (wholly lacking in 1 of 18 specimens, and limited to 1 or 2 on each cheek in another); breast always well scaled, and the posterior scales usually somewhat ctenoid; opercle covered with ctenoid scales. Scales above lateral line 7, rarely 8. Lateral blotches 8 to 10, usually 8 or 9, less definitely connected with the saddles, more triangular, and becoming more disrupted with age; saddles in adult also less regular and straight-edged; light areas considerably tessellated with dark in adult; stippling of anterior lower surfaces restricted to the cheeks (usually leaving below the eye a clear patch transversed by a faint subocular bar) and to mottlings on the chin. Gill-membranes usually more broadly connected, forming an angle of 52° to 81° (typically 65° to 75° in adults). Snout more constricted and produced (angle of muzzle 40° to 50°), 3.0 to 3.5 in head. Eye smaller, 1.3 to 1.5 in snout, and 3.7 to 4.7, usually 4.0 to 4.5, in head. Highest dorsal ray 1.8 to 2.1 in head. Head 3.4 to 3.7, usually 3.5 to 3.6. *Current River (White River system), southeastern Missouri:*

4a. *P. euzonus erizonus*

5b.—Cheeks scaleless; breast scaleless anteriorly, with embedded scales posteriorly (wholly scaleless in 1 of 9 specimens); opercle not quite fully scaled. Scales above lateral line 8, rarely 9. Lateral blotches 5 to 8, usually 7 or 8, more definitely connected with the saddles, mostly squarish (somewhat triangular in young), and little disrupted with

age; saddles in adult also more regular and straight-edged; light areas scarcely tessellated with dark in adult; stippling of anterior lower surfaces densely extended over cheeks, throat, branchiostegal membranes, and fore part of breast (less developed in young, but always better developed at comparable sizes). Gill-membranes usually less broadly connected, forming an angle of  $50^{\circ}$  to  $62^{\circ}$ . Snout heavier and more declivous (angle of muzzle  $44^{\circ}$  to  $57^{\circ}$ ), 3.3 to 4.0 in head. Eye larger, 0.9 to 1.2, usually 1.1 to 1.2, in snout, and 3.7 to 3.9 in head. Highest dorsal ray 2.0 to 2.3 in head. Head 3.0 to 3.4. *White River system, in typical form above Batesville, Arkansas:*

4b. *P. euzonus euzonus*

2b.—Snout more declivous (angle of muzzle  $69^{\circ}$  to  $75^{\circ}$ ). Gill-membranes very broadly connected, forming an angle of  $89^{\circ}$  to  $110^{\circ}$ . Scales 4 or 5—42 to 45—6 or 7. Soft rays 11 to 13 in dorsal fin, 8 or 9 in anal, and 16 or 17 in pectoral. Least bony interorbital width 1.8 to 2.0 in eye. Least suborbital width 4.8 to 6.8 in head. Upper jaw 3.7 to 4.2 in head. Highest dorsal spine 1.9 to 2.0 in head; longest pectoral ray 0.7 to 0.8; length of pelvic fin 0.9 to 1.0. Dorsal saddles set off by a creamy white posterior border. Lateral blotches fused into a zigzag line.

3c.—Four green-black saddles. Head 3.6 to 4.0. Eye 1.2 to 1.8 in snout, 4.0 to 4.9 in head. Snout 2.7 to 3.4. *Tennessee River system, in Alabama and Tennessee:*

5. *P. blennioides*

EXPLANATION OF MEASUREMENTS AND COUNTS.—The measurements of the head include the opercular membrane. The eye (rather than the orbit) is measured between the margins of the cornea on the longest dimension. Scales above the lateral line are counted from the origin of the dorsal fin downward and backward to the lateral line, beginning with the one beside the first dorsal spine and ending with the scale row above the lateral line. Scales below the lateral line are enumerated diagonally upward and forward from beside the first anal spine to the lateral line, again excluding the lateral-line scale row, but including the very small row of scales often present next to the anal fin. The lateral-line count begins with the last scale which is in contact with the shoulder girdle and ends at the structural base of the caudal fin. The last ray of the

dorsal and anal fins is always counted as a divided ray—a criterion at times requiring careful examination.

1. *Poecilichthys osburni* Hubbs and Trautman

*Poecilichthys osburni*.—Hubbs and Trautman, 1932: 31–38, Figs. 1–2 (original description; records). Morgan, 1937: 150 (no air bladder).

This well-marked, isolated species shows direct relationship only with *P. variatus*. Its distinguishing characters are indicated in the original account, and as items 1a, 2a, 3a, and 4a of our key. The material in the University of Michigan Museum of Zoology has been examined. Some collections have been received since the type description was published. All are from the Kanawha (New) River system above Kanawha Falls. Series from the Kanawha system below these falls prove referable to *P. variatus*. Since certain errors in the original description have been discovered, we give here the counts and measurements of the holotype, and, in parentheses, of 6 adult paratypes.

Scales 8–64–9 (7 to 9–59 to 66–9 or 10). Dorsal rays XIII–13 (XII to XIII–13 to 15); anal rays, II, 9 (II, 9 or 10, usually 10); pectoral rays 15–15 (14 to 15, generally 15). Lateral markings 11 (9 to 11), not counting the blotch at the caudal base nor the continuation of the nuchal saddle. These markings form more definite bars than do those in other species. The posterior bars in the adult male almost encircle the body.

Depth 5.0 (4.8 to 5.4). Greatest width 1.5 (1.5) in projection of greatest depth. Head length 3.9 (3.6 to 3.9). Least suborbital width 6.5 (5.8 to 7.3) in head. Least interorbital width 2.3 (2.3 to 2.5) in eye. Eye 5.5 (4.8 to 5.6) in head; 1.8 (1.5 to 2.0) in snout. Snout 3.2 (2.8 to 3.4) in head. Upper jaw 3.6 (3.3 to 3.6). Angle of muzzle  $55^{\circ}$  ( $49^{\circ}$  to  $58^{\circ}$ ); of gill-membranes  $61^{\circ}$  ( $61^{\circ}$  to  $78^{\circ}$ ). Eye 2.7 (2.4 to 2.8) in distance from tip of mandible to union of gill-membranes; latter distance 1.8 (1.7 to 2.0) in head, and 1.2 (1.1 to 1.4) times interspace between union of membranes and insertion of pelvic fin. Highest dorsal spine 2.2 (2.2 to 2.5) in head,

2.5 (2.2 to 2.9) in first dorsal base, and 1.4 (1.4 to 1.5) in the highest dorsal soft ray, which enters the head 1.4 (1.4 to 1.7) times and the second dorsal base 1.1 (1.1 to 1.2) times. Length of caudal fin 1.5 (1.4 to 1.5) in head. Highest anal ray 1.7 (1.7 to 1.8) in head, and 1.2 (0.8 to 1.2) in the anal base, which enters the head 1.7 (1.5 to 2.3) times and the second dorsal base 1.3 (1.3 to 1.4) times. Longest pectoral ray 0.9 (0.8 to 1.0) in head; length of pelvic fin 1.2 (1.2 to 1.3). Interspace between pelvic fins 1.6 (1.4 to 1.7) in pelvic base.

In the original description a large-scaled variant of this form was mentioned. Three similar specimens, in the National Museum, were collected by Leonard P. Schultz and Earl D. Reid in Crooked Creek, 4 miles east of Galax, Virginia, July 13, 1938. They show the following characters: Scales 7—53—9 (1) or 10 (2); dorsal, XI (1) or XIII (2), 12 (1) or 13 (2); depth 5.1 to 5.6; eye 1.3 in snout, 4.4 to 5.2 in head; head 3.8 to 4.0; dorsal saddles 5; male with numerous light bars.

## 2. *Poeciliichthys tetrazonus*, new species

(Pl. I, Fig. 1)

*Etheostoma uranidea* (misidentification).—Meek, 1891: 123 (Gasconade River at Arlington, and Little Piney River at Newburg, Missouri).  
*Poeciliichthys variatus* (misidentification).—Hubbs and Trautman, 1932: 33 (Missouri record only).

The holotype, University of Michigan Museum of Zoology No. 111330, is a half-grown specimen 33 mm. in standard length. It was seined in Big Niangua River, at mouth of Greasy Creek, 6 miles southeast of Buffalo, Dallas County, Missouri, by J. Clark Salyer, II, on August 28, 1931. One paratype, a young fish 22 mm. long, was taken with the holotype.

The two type specimens of this species were recorded by Hubbs and Trautman as *Poeciliichthys variatus*, but on more detailed study appear to represent a distinct species. The two darters from the Gasconade River system of Missouri, referred by Meek to *Etheostoma uranidea*, seem to represent the same form. The contrasting characters of *P. variatus* and *P. tetra-*

*zonus* are given as items 4*b* and 4*c* in our key. When compared with the two subspecies of *P. euzonus*, *P. tetrazonus* is seen to differ sharply in the size of the scales and in numerous other characters, as stated in items 4*b* and 4*d* of the key. The available evidence indicates the full specific separation of *tetrazonus* from *variatus* and *euzonus*, but the relationships between these forms seem rather close. Further material may indicate subspecific intergradation.

In the following description the counts and measurements are given first for the holotype, followed, in parentheses, by determinations for (1) the paratype; (2) the young specimen, 28 mm. long, from Gasconade River; and (3) the adult, 57 mm. long, from Little Piney River.

Scales 5—51—7 (5—47—7; 6—52—8; 6—54—8). Breast with several ctenoid scales (with several cycloid scales in paratype; posterior half of breast well covered with ctenoid scales and anterior half with some embedded scales, in the 2 other specimens). Angle between supratemporal and lateral head canals with 1 large, ctenoid scale on one side but none on the other side (with none on either side in paratype; with several large ctenoid scales in the other specimens). Opercle of each side with 1 large ctenoid scale in the holotype (with a few ctenoid scales in the 3 others). Cheeks scaleless (in all specimens).

Dorsal rays XII-14 (X-14; XII-13; XII-13); anal rays II, 9 (II, 10; II, 9; II, 10); pectoral rays 15-15 (14-15; 14-?; 15-16). The dorsal fins are well separated.

The canals and pores of the head correspond with the description given on p. 5. The posteriormost of the anterior group of 4 infraorbital pores opens directly from the canal at its upper edge on one side and at its lower edge on the other side (at mid-line of canal on both sides; on lower edge of canal; at ends of short, downward-projecting tubes).

The body is shaped about as in specimens of like size of *P. variatus*; depth 5.3 (5.1; 4.6; 4.8). The body is moderately compressed; width 1.6 (1.4; 1.7; 1.7) in projection of depth.

The head is rather large, 3.3 (3.3; 3.7; 3.7) in standard length. Least suborbital width 9.6 (9.0; 10.0; 8.0) in head. Least interorbital width 3.0 (3.0; 2.5; 2.2) in eye. The eye is rather large: 4.2 (4.2; 4.5; 4.7) in head, 1.3 (1.0; 1.1; 1.5) in snout. The snout is rather short, 3.8 (4.2; 4.3; 3.6) in head, but rather pointed: angle of muzzle  $55^\circ$  ( $52^\circ$ ;  $51^\circ$ ;  $57^\circ$ ). Upper jaw 3.6 (3.5; 3.7; 3.6) in head. Angle of gill-membranes  $66^\circ$  ( $55^\circ$ ;  $74^\circ$ ;  $77^\circ$ ). Eye 2.4 (2.7; 2.5; 2.7) in distance from tip of mandible to union of gill-membranes; latter distance 1.6 (1.6; 1.6; 1.7) in head, and 1.6 (1.5; 1.4; 1.3) times interspace between union of gill-membranes and insertion of pelvic fin. Highest dorsal spine 2.7 (2.4; 2.3; 2.4) in head, 2.4 (2.0; 2.4; 2.8) in first dorsal base, and 1.3 (1.3; 1.3; 1.4) in the highest dorsal soft ray, which enters the head 2.1 (2.0; 1.8; 1.9) times and the second dorsal base 1.4 (1.4; 1.3; 1.4) times. Length of caudal fin 1.3 ( — ; 1.5; 1.4) in head. Highest anal ray 2.3 (2.0; 2.0; 2.0) in head, and 1.0 (1.0; 1.0; 0.9) in the anal base, which enters the head 2.3 (2.0; 2.0; 1.8) times and the second dorsal base 1.4 (1.4; 1.3; 1.3) times. Longest pectoral ray 1.0 (0.9; 1.0; 1.0) in head; length of pelvic fin 1.4 (1.5; 1.2; 1.3). Interspace between pelvic fins 2.0 (1.5; 1.6; 1.5) in pelvic base.

The coloration of the holotype is as follows: The back is crossed by 4 regular dark saddles, about as in the related species. These crossbars are less blackened than in *P. euzonus*. As in *P. euzonus erizonus*, the anteriormost saddle is expanded backward to include the extreme front of the dorsal fin. This band splits at the pectoral insertion to form 2 narrow lines, 1 on either side of the fin (the anterior fork is under the gill-cover). The second and third saddles, descending from the rear of the spinous and soft dorsal fins, respectively, fail by 1 scale row to reach the lateral line. The fourth saddle, on the caudal peduncle, is continued to near the mid-ventral line. In addition there is a faint spot at the base of the caudal fin. There are about 9 lateral blotches (10 in the paratype). Of these the first 2 are rectangular, the others more or less triangular. The general ground color of the upper surfaces in alco-

hol' is olivaceous tan, lighter than in *P. euzonus* because the melanophores on the scales are less dense. The bars radiating from the eye (1 downward and forward, 1 downward, and 1 backward) are short. The opercle and the angle of the preopercle are stippled, and there are melanophores near the radiating bars and at the tip of the chin. Otherwise, the lower sides of the head are nearly clear of pigment.

The young paratype, perhaps largely on account of its size, is unusually pale, resembling *Boleosoma*.

The Gasconade River specimen is colored much like the holotype, though the second and third bars show a tendency, with bilateral variation, to connect with lateral bars. The basal caudal spot is conspicuous. There are 10 lateral blotches, mostly squarish. The scale centers tend to be lighter, the crosshatching more conspicuous. A dusky blotch on the upper anterior sides represents a trace of the second saddle of *Poecilichthys osburni*.

The single adult specimen (from Little Piney River) approaches *P. osburni* in that the lateral blotches, 9 on one side and 10 on the other, form rather definite bars on the lower sides, with weak extensions above the lateral line. There is no definite trace of the second saddle of *P. osburni*. The first saddle is truncated at the base of the first dorsal spine. There are faint connections between the second and third dark saddles and the lateral blotches below them. The basal caudal spot is inconspicuous. The cheeks and the lower side of the head are evenly and densely stippled.

The name *tetrazonus*, derived from *τετράς*, four, and *ζώνη*, zone, refers to the 4 prominent dark saddles characteristic of this and related species.

### 3. *Poecilichthys variatus* (Kirtland)

(Pl. II, Fig. 1)

*Etheostoma variata*.—Kirtland, 1838: 168 and 192 (virtual *nomen nudum*; Mahoning River, Ohio; Cuyahoga River record probably based on *P. caeruleus*); 1841: 274-76, Pl. 2, Fig. 2 (original description; Mahoning River).

*Etheostomata variatum*.—Agassiz, 1850: 299 (type of genus *Poecilo-*

*soma*); 1854: 306 (type of *Poecilichthys*). Jordan and Eigenmann, 1885: 71 (skeleton). Woolman, 1892: 280, 286 (Kentucky records; characters). Boulenger, 1895: 81 (synonymy; description; Big Creek, Hyden, Kentucky). Jordan and Evermann, 1896: 1069-70 (description; range; synonymy).

*Hadropterus variatus*.—Putnam, 1863: 4 (synonymy). Jordan, 1885: 163-65 (rediscovery; synonymy; description).

*Poecilichthys variatus*.—Fowler, 1919: 70 (Pennsylvania records). Fowler and Carlson, 1927: 72 (color; Pennsylvania records). Jordan, 1929: 163 (description; range, Arkansas excepted). Jordan, Evermann, and Clark, 1930: 289 (range; synonymy). Hubbs and Trautman, 1932: 31-38, Fig. 1 (records and comparisons; Arkansas and Missouri records excepted). Morgan, 1937: 150 (no air bladder). Greeley, 1938: 72 (New York records). Fowler, 1938: 106 (Pennsylvania records).

*Etheostoma notatum*.—Agassiz, 1850: 299 (*nomen nudum*). Putnam, 1863: 4 (in synonymy of *H. variatus*).

?*Hadropterus tessellatus*.—Jordan, 1877: 7 (original description; synonymy excepted; Foxburg, Pennsylvania).

As Jordan (1885: 163) noted, the name *variatum* was transferred by himself and others for a time to *Poecilichthys caeruleus*. Vaillant (1873: 84-87) used the name *Boleosoma variatum*, and Jordan and Gilbert (1883: 503) that of *Alvordius variatus*, in describing species of *Hadropterus*.

This species, as here delimited, has been characterized by the authors cited in the synonymy. In our analysis of the species, it is compared in detail with the other forms of the group now recognized. Items 1*a*, 2*a*, 3*b*, and 4*c* of the key constitute a description. Additional characters are given below. The determinations were mostly made on 7 Ohio specimens 31 to 73 mm. in standard length.

Dorsal rays XI to XIII-12 to 16; anal rays II, 9 or 10, usually 9; pectoral rays 14 to 16, usually 15. Lateral markings 9 to 11.

Depth 4.6 to 5.4. Head length 3.5 to 3.7. Least suborbital width 8.0 to 9.5 in head. Eye 3.8 to 4.0 in head, 0.8 to 1.0 in snout. Snout 3.3 to 4.0 in head. Upper jaw 3.4 to 3.7. Angle of muzzle 55° to 70°; of gill-membranes 61° to 90°, increasing with age. Eye 2.2 to 2.5 in distance from tip of mandible to union of gill-membranes; latter distance 1.5 to 1.7 in head.

Highest dorsal spine 2.4 to 2.6 in head, 2.2 to 2.5 in first dorsal base, and 1.3 to 1.7 in highest dorsal soft ray, which enters the second dorsal base 1.0 to 1.4 times. Length of caudal fin 1.4 to 1.5. Highest anal ray 0.9 to 1.0, usually 1.0, in the anal base, which enters the head 1.6 to 2.0 times and the second dorsal base 1.3 to 1.4 times. Longest pectoral ray 0.8 to 0.9 in head; length of pelvic fin 1.1 to 1.3. Interspace between pelvic fins 1.5 to 2.0, usually 1.5, in pelvic base.

#### 4. *Poecilichthys euzonus*, new species

This species is characterized by the very decided contrast between the dorsal saddles and the ground color; the smaller fins, as compared with those of *P. variatus* and *P. osburni*; and the more cylindrical body (the body form, especially in *P. euzonus erizonus*, approaches that of *Hadropterus*). The scales, about as in typical *P. osburni*, are somewhat smaller than in *variatus*. From *osburni*, the new species differs in the size of the fins, the general body shape, the number of bands, other features of coloration, and in various other characters. The squamation of the head and breast, too, separates this species distinctly from others of the group, though there is considerable difference in this respect between the 2 subspecies of *P. euzonus*. The details of the specific description are presented in the accounts of the 2 subspecies. Common specific characters are stated as items 1a, 2a, 3b, and 4d.

*Poecilichthys euzonus*, as here constituted, is a complex of 2 rather distinct subspecies, which are contrasted in items 5a and 5b of the key (p. 8). *P. e. euzonus* occurs in the White River system of Arkansas, above Batesville, and *P. e. erizonus* in the Current River of Missouri, which is also in the White River system.

Specimens from Spring River and Black River, at Black Rock, and from White River at Batesville, Arkansas, misidentified as *Etheostoma uranidea* by Meek (1894a: 268; and 1894b: 80), appear more like typical *P. euzonus*, but approach *erizonus* in distribution and in some characters. The Spring River specimens have been referred to *Poecilichthys variatus* by

Hubbs and Ortenburger (1929: 48) and by Hubbs and Trautman (1932: 33). It is possible that these fish should be interpreted as intergrades, but their small size and long preservation preclude a precise subspecific determination. In the Spring and White River series the breast is rather more scaled than in typical *euzonus*, but less so than in *erizonus*, and the cheeks bear no scales except for a few in 1 specimen from Spring River. The individual from Black River has the breast densely scaled and the cheeks about as well scaled as in *erizonus*. In general physiognomy all 3 lots are more like *euzonus* than *erizonus*. The saddles are more like those of *euzonus*; the lateral blotches, rather intermediate. In counts and measurements (Table I) the resemblances are diverse. As would be expected, the specimens from White River at Batesville seem somewhat closer to *euzonus* than do those from Black Rock.

4a. *Poecilichthys euzonus erizonus*, new subspecies

(Pl. I, Fig. 2)

The holotype, University of Michigan Museum of Zoology No. 124597, is an adult male 66 mm. in standard length. It was collected by A. Hugh Denney on August 10, 1938, in Current River, at "The Nook," T. 23 N., R. 2 E., Sec. 9, Ripley County, Missouri. The paratypes were all collected by Denney in Current River in Missouri: 5 with the holotype; 8 from near the Carter County Hunting and Fishing Club, T. 26 N., R. 1 E., Sec. 11 and 12, Carter County, July 25, 1938; 2 from the Doniphan Boat Landing, T. 23 N., R. 2 E., Sec. 27, Ripley County, July 26, 1938; 2 from the river just above the mouth of Pike Creek, T. 27 N., R. 1 W., Sec. 23, Carter County, August 18, 1938. The 18 available specimens of this form range in size from 34 to 70 mm.; 15 are 58 to 70 mm. long.

The diagnostic characters are given as items 1a, 2a, 3b, 4d, and 5a in the key. Probably the most obvious difference between this subspecies and typical *euzonus* is the more extensive squamation of the breast and the scaled cheeks. The blotches on the side and the scale rows above the lateral line each aver-

TABLE I

COUNTS AND MEASUREMENTS OF *POECILICHTHYS EUZONUS*

Extreme counts and measurements, representing only 1 or 2 specimens, are indicated in parentheses for some of the items.

	<i>P. e. erizonus</i>		<i>P. e. euzonus</i> approaching <i>erizonus</i>			<i>P. e. euzonus</i>	
	Holotype	Paratypes	Black River	Spring River	White River	Paratypes	Holotype
Number of specimens .....	1	17	1	12	8	8	1
Standard length (in mm.)	66	34-70	30.5	28.5-38.5	36-45	28-49	60.5
Scales above lateral line...	7	7-8	7	(6)7-8	8-9	8(9)	8
Scales in lateral line .....	67	62-68(73)	62	(54)60-66	57-65	63-67	65
Scales below lateral line...	9	9-11	9	(8)9-10	10-11	9-10	9
Dorsal spines .....	13	(12)13(14)	13	(12)13	12-13	13(14)	13
Dorsal soft rays .....	14	14-15	14	14(15)	13-14	(13)14	14
Anal rays .....	10	(9)10-11	10	10(11)	9-11	(9)10	10
Pectoral rays .....	16-16	(14)15-16	15-15	15-16	15-16	15-16	15-16
Lateral blotches below lateral line .....	8	8-10	8	7-10	7-8(9)	5-8	6
Depth in length .....	5.1	4.9-5.5(5.8)	4.7	(4.7)4.8- 5.0	(5.0)5.1- 5.3(5.6)	5.5-5.6(5.8)	5.2
Greatest width in projec- tion of depth .....	1.4	1.3-1.4(1.5)	1.5	1.5	(1.4)1.5	(1.2)1.3-1.4	1.3
Head in length .....	3.6	3.4-3.7	3.5	3.2-3.4	3.3-3.6	(3.0, 3.1) 3.2-3.4	3.4
Least suborbital width in head .....	7.2	(6.5)7.2- 8.0(8.5)	9.3	(8.7)9.0- 9.5(10.0)	10.0-12.0	(9.1)9.3- 9.5(10.0)	8.8
Least interorbital width in eye .....	3.0	3.0-3.5	3.2	(2.6)3.0- 3.2(3.3)	2.6-2.7(2.8)	3.5-3.6(3.8)	3.5

TABLE I—(Continued)

	<i>P. e. erizonus</i>		<i>P. e. euzonus</i> approaching <i>erizonus</i>			<i>P. e. euzonus</i>	
	Holotype	Paratypes	Black River	Spring River	White River	Paratypes	Holotype
Eye in head .....	4.5	(3.7)3.9- 4.5(4.7)	3.8	3.9-4.6(5.0)	4.3-4.6	3.7-3.9	3.9
Eye in snout .....	1.5	1.3-1.5	1.1	(1.0)1.2- 1.5(1.6)	1.1-1.3	(0.9)1.1-1.2	1.2
Snout in head .....	3.3	3.0-3.5	3.6	(3.1)3.3- 3.7(3.9)	(3.6)3.9-4.1	3.3-3.6(4.0)	3.6
Upper jaw in head .....	3.6	3.5-3.7(4.0)	3.5	3.5-3.6(3.7)	(3.5)3.6-3.7	3.4-3.6	3.5
Angle of muzzle .....	45°	40-50°	41°	(39)44-48 (55)°	(48)50-55°	44-57°	53°
Angle of gill-membranes	68°	(52)62-78 (81)°	52°	55-68°	62-67°	(50)53-62°	62°
Eye into distance from tip of mandible to union of gill-membranes .....	2.5	(2.1)2.3-2.5	2.3	(2.3)2.5- 2.7(2.8)	2.5-2.6	2.0-2.3(2.4)	2.1
Latter distance into head	1.7	(1.6)1.7-1.9	2.0	1.7-1.9	1.7-1.8	(1.7)1.8-2.0	2.0
Interspace between inser- tion of pelvic fin and union of gill-membranes in distance thence to tip of mandible .....	1.3	1.2-1.5	1.3	1.4-1.6	(1.2)1.3-1.5	1.3-1.4	1.3
Highest dorsal spine in head .....	2.6	2.4-2.6(2.8)	2.7	2.5-2.7(2.8)	2.4-2.7	2.3-2.6	2.7
Highest dorsal spine in first dorsal base .....	2.5	2.4-2.8	2.5	2.4-2.6(2.7)	2.2-2.5	(2.1)2.2-2.3	2.5

TABLE I—(Continued)

	<i>P. e. erizonus</i>		<i>P. e. euzonus</i> approaching <i>erizonus</i>			<i>P. e. euzonus</i>	
	Holotype	Paratypes	Black River	Spring River	White River	Paratypes	Holotype
Highest dorsal spine in highest dorsal ray .....	1.3	1.3-1.5	1.3	1.2-1.3	1.0-1.1	(1.1)1.3-1.4	1.4
Highest dorsal soft ray in head .....	2.0	1.8-2.1	2.2	2.1-2.2 (2.5)	2.3-2.4	2.0-2.3	2.1
Highest dorsal soft ray in second dorsal base.....	1.5	1.4-1.6	1.5	(1.2)1.3- 1.4(1.5)	1.6	1.3-1.5	1.4
Length of caudal fin in head .....	1.4	1.4-1.6	1.5	1.4-1.5	(1.4)1.5	1.5-1.7 (1.8)	1.5
Highest anal ray in head	2.0	1.8-2.3	2.4	(2.1)2.2- 2.3(2.4)	1.9-2.3	(2.0)2.1-2.3	2.1
Highest anal ray in anal base .....	1.0	1.0-1.1(1.2)	1.0	(0.9)1.0	0.9-1.0	(0.9)1.0-1.1	1.1
Anal base in head .....	2.0	(1.5, 1.7) 1.8-2.1	2.4	(2.1)2.2- 2.4(2.6)	2.0-2.3	(1.9)2.1- 2.3(2.4)	2.0
Anal base in soft dorsal base .....	1.5	1.3-1.6	1.2	1.2-1.3(1.6)	1.4-1.5	1.2-1.4	1.3
Longest pectoral ray in head .....	0.85	0.9-1.0(1.2)	1.1	(1.0)1.1 (1.2)	1.1-1.2	1.1-1.2	1.1
Length of pelvic fin in head .....	1.0	1.1-1.2(1.4)	1.3	1.3-1.4	(1.3)1.4	1.2-1.4	1.2
Interspace between pelvic fins in pelvic base .....	1.5	1.4-1.6(1.9)	1.3	1.5-1.7 (1.8)	1.3-1.6	(1.4)1.5	1.5

age about 1 fewer than in *euzonus*. In *erizonus* the eye averages smaller and the snout longer, so that the eye-snout ratio is quite distinct (1.3 to 1.5 in *erizonus*, 0.9 to 1.2 in *euzonus*). The fins, notably the pectoral, tend to be somewhat larger in *erizonus* than *euzonus*, though smaller than in *osburni* and *variatus*. Distinctions in coloration are evident, and there are several other minor differences. The 2 subspecies are compared as items 5a and 5b of the key, and in Table I.

The dorsal fins are separated in all the types.

In preserved specimens the ground color between the saddles of the back is olivaceous tan. Each scale of these regions is finely and closely speckled with black, except at the center, which is clear. Some scales, in irregular patches in the light areas, are much more densely speckled than others and produce a slightly tessellated effect. The back is crossed by the 4 strong fuscous bands characteristic of the *P. variatus* group. The margins of these dorsal saddles are not as sharply defined as in *P. e. euzonus*. The first saddle, extending over the posterior part of the nape, has its posterior margin somewhat extended backward along the sides of the first 1 or 2 spines of the dorsal fin. This mark extends solidly down to the insertion of the pectorals, where it divides, sending one line down behind the fin and another in front of the fin under the gill-cover. The second dorsal saddle begins at the back of the spinous dorsal and slopes more sharply forward than the first saddle. It widens at the lateral line and forks to form, below the lateral line, 2 less blackened lateral blotches, which are more distinctly separated from the dorsal saddles than in *euzonus*. The third saddle, located at the back of the soft dorsal, is quite similar, likewise giving off blotches below the lateral line. The fourth saddle, well back on the caudal peduncle, is not forked, but becomes markedly widened below the lateral line. There is a poorly defined dark spot on the peduncle near the base of the caudal fin.

The blotches below the lateral line, usually numbering 8, occasionally 9, in 1 fish 10, are all decidedly more triangular than in specimens of *euzonus* of similar size, never forming

squarish blocks or bars. With age this triangular pattern breaks down to produce a more irregular pattern, vaguely suggesting right triangles joined by their apices. The lateral markings are definitely more separated from the dorsal saddles than in *euzonus*, usually showing at most a slight connection.

The cheeks are lightly speckled with melanophores. The suborbital region ordinarily remains clear, except for a narrow rim below the eye and a narrow blackish bar extending downward from the middle of the eye. Otherwise the under side of the head and breast is usually immaculate at all ages, except for several black specks on the chin. Some adults show a tendency toward speckling on the under side of the head, but the degree of pigmentation characteristic of adult *euzonus* is never approached.

After 3 months in formalin the holotype and other breeding males retained some of the nuptial colors. A longitudinal band of yellow-orange extends along the lower side of the trunk, above and to slightly behind the depressed pelvic fin. Irregular red dots on the sides tend to be more or less centered, one on each pale area below the lateral line. Above the lateral line red dots begin behind the second blackish saddle, are arranged in groups of 3 or 4 before the third saddle, and become larger and more numerous toward the caudal fin. The light interspaces between the dark lateral blotches are tinted with lemon-orange. The spinous dorsal shows a basal stripe containing blocks of brown, then a clear streak followed by a band of black; then an orange-red submarginal stripe within the clear border. The basal half of the soft dorsal is colored like the caudal; the distal half is clear or nearly so. The caudal fin is marked by wavy vertical lines, alternately dusky and red; the red is intensified toward the base of the fin. The anal and pelvic fins are whitish. The pectoral, reddish orange on the base, is elsewhere marked by alternating blocks of red and dusky. The life colors correspond rather closely with those described for *P. variatus* and *P. osburni*, but the breeding males apparently do not become so intensely pigmented as in *variatus*, since a very strong contrast between the saddles and the ground color is retained.

The name *erizonus* is taken from the Greek:  $\epsilon\rho\iota$ , intensive prefix, and  $\zeta\acute{\omega}\nu\eta$ , zone.

4b. *Poecilichthys euzonus euzonus*, new subspecies

(Pl. I, Fig. 3)

*Etheostoma uranidea* (presumed identification).—Meek, 1894a: 268 (record for White River at Oxford Bend, which is 9 miles northeast of Fayetteville, Washington County, Arkansas).

The holotype, University of Michigan Museum of Zoology No. 123548, is an adult male, 60.5 mm. in standard length. It was collected July 8, 1938, in Buffalo River, 4 miles southeast of St. Joe, Searcy County, Arkansas, by John D. and Ruby Y. Black. The 8 paratypes, all taken by the same collectors in the White River system of Arkansas, comprise 5 specimens collected with the holotype; 2 from King's River, 3 miles east of Alabam, at Denney Cave, Madison County, June 30, 1938; 1 from White River near Busch, Carroll County, July 8, 1938. The 9 types range in standard length from 28 to 60.5 mm.

The distinctive features of this form are mostly given in the key and in Table I.

The dorsal fins are separated in 7 specimens, united in 2.

The ground color of preserved specimens is a clear tan, apparently lacking the olivaceous tinge of *erizonus*. The side and back are finely and evenly speckled with fine black dots, except at the clear center of each scale. Since very few, usually none, of the scales on the back between the saddles are conspicuously darkened, the tessellated effect of *erizonus* is lacking. The saddles are all fuscous, possibly a little more brownish than in the other members of the group. The first saddle, crossing the nape just before the dorsal fin, is usually sharp-edged behind, extending just to the first dorsal spine, but in some specimens is extended backward as in *erizonus*, so that the saddle surrounds the first 2 spines. This saddle shows considerable variation, but its margins are sharper and straighter than in *erizonus*. The first saddle is continued down to the insertion of the pectoral fin where it divides into 2 rather narrow lines, one running down the side behind the

pectoral, the other extending along the fin base just under the edge of the gill-cover. The second dorsal saddle, extending downward and somewhat forward from the posterior part of the first dorsal base, splits at the lateral line to form an inverted Y. The resulting blotches on the sides below the lateral line are definitely block-shaped in the holotype and other adults, and are connected by at least a corner with a dorsal saddle. The similar third saddle, located at the back of the soft dorsal, shows no offset in the front margin, as the anterior of the 2 associated lateral blotches is continuous with the front half of this saddle. The fourth saddle, well back on the caudal peduncle, is undivided but expanded below the lateral line. There is also a poorly defined caudal spot. As in *erizonus*, the black speckling fades out rapidly below the lateral line. The sides below the blackish blotches are virtually immaculate.

The blotches along the sides are fewer than in any other species of the group, numbering 5 to 8, usually 7 or 8. In the adults they are clean-cut blocks, losing the more triangular shape which seems characteristic of the younger fish.

The sides and lower surfaces of the head, as well as the anterior half of the breast, are closely and finely speckled with black, particularly in the adults. In this respect the adults of *erizonus* and *euzonus* are surprisingly unlike, though immature individuals are not so distinct. The young of *euzonus* lack most of the speckling, but at comparable sizes are more pigmented than those of *erizonus*.

Almost nothing is known of the breeding colors of the male. However, the checkered pattern on the pectorals, caudal, and soft dorsal, and some color remaining on the spinous dorsal, indicate that the colors of the fins as a whole are similar to those of *erizonus*. As in that form, the pelvics and anal are apparently devoid of color.

The name *euzonus* is from εὖ, well or beautifully, and ζώνη, zone.

5. *Poecilichthys blennius* (Gilbert and Swain)

(Pl. II, Fig. 2)

*Etheostoma* (*Rhothoeca*) *blennius*.—Gilbert and Swain, in: Gilbert, 1887: 55-56 (original description; near Florence, Alabama).

*Etheostoma blennioides*.—Jordan and Evermann, 1896: 1073 (description).

*Ulocentra blennioides*.—Jordan, 1929: 157 (description). Jordan, Evermann, and Clark, 1930: 287.

*Poeciliichthys blennioides*.—Kuhne, 1939: 92.

*Etheostoma thalassinum* (misidentification).—Boulenger, 1895: 83 (in part).

This very distinct species was well described by Gilbert and Swain. It is contrasted in our key with the other and more typical species referred to the *Poeciliichthys variatus* group. Its pertinence to the genus *Poeciliichthys* is discussed on p. 3.

Apparently the types are the only previously recorded specimens. Additional material has lately been collected by L. F. Miller, working under A. R. Cahn of the Tennessee Valley Authority: 1 adult 47 mm. long from Greene River, Duck River system, Wayne County, Tennessee, May 16, 1937; 1 small adult, 43.5 mm. long, from Brush Creek, Duck River system, Perry County, Tennessee, May 17, 1937; 1 adult male, 49 mm. long, from Bumpass Creek, Tennessee River system, Lauderdale County, Alabama, February 16, 1938; 13 half-grown, 25 to 27 mm. long, from Second Creek, Tennessee River system, Lauderdale County, Alabama, November 4, 1937.

The scales are relatively large. In the 3 adults and 6 young specimens the counts are: 4 or 5, usually 5—42 to 45—6 or 7. The head and breast are completely naked.

Dorsal rays XI to XIII—11 to 13. Anal rays II, 8 or 9. Pectoral rays 16 or 17, usually 16. The dorsals are well separated in all the specimens.

The lateral-line canals and pores of the head agree with the description for the group (p. 5), except that there is considerable variation in the posteriormost of the anterior set of 4 pores of the infraorbital series. In the Greene River specimen, the pore of one side opens by a short upward-projecting tube; on the other side, by a short downward tube. In all other examples examined, this pore opens into the canal, or just below it.

This is one of the most heavily set of all the darters. It is almost cylindrical, though relatively deep through the shoulders. The contours taper rapidly behind the spinous dorsal.

The abruptly declivous snout accentuates the appearance of robustness.

Considerable differences in proportionate measurements appear when the 2 adult specimens from the Duck River system are compared with the half-grown fish from nearer the type locality, in Alabama. Since the differences may reflect some local variation, as well as age changes, the measurements of the 2 lots are presented separately: those for the Duck River specimens first; those for the Alabama material in parentheses, and separately for the 1 adult and for 6 half-grown. Depth 4.4 to 4.7 (5.0; 4.7 to 5.0). Greatest width 1.3 (1.3; 1.4 to 1.5) in projection of greatest depth. Head length 3.9 to 4.0 (4.1; 3.6 to 3.8). Least suborbital width 5.3 to 5.5 (4.8; 6.0 to 6.7) in head. Least interorbital width 1.9 to 2.0 (1.9; 1.7 to 2.0) in eye. Eye 4.9 (4.6; 4.0 to 4.3) in head; 1.8 (1.6; 1.2 to 1.5) in snout. Snout 2.7 to 2.8 (2.9; 3.1 to 3.6) in head. Upper jaw 4.0 to 4.2 (3.7; 3.8 to 4.1). Angle of muzzle  $72^\circ$  to  $73^\circ$  ( $70^\circ$ ;  $68^\circ$  to  $75^\circ$ ); of gill-membranes  $97^\circ$  to  $98^\circ$  ( $110^\circ$ ;  $89^\circ$  to  $95^\circ$ ). Eye 2.7 (2.4; 2.3 to 2.6) in distance from tip of mandible to union of gill-membranes; latter distance 1.6 to 1.7 (1.9; 1.6 to 1.9) in head; and 1.3 to 1.4 (1.2; 1.4 to 1.6) times interspace between union of membranes and insertion of pelvic fin. Highest dorsal spine 1.9 to 2.0 (1.95; 2.0 to 2.2) in head, 2.2 to 2.3 (2.6; 2.0 to 2.1) in first dorsal base, and 1.2 to 1.3 (1.2; 1.2 to 1.3) in highest dorsal soft ray, which enters the head 1.6 to 1.8 (1.6; 1.7 to 1.8) times, and the second dorsal base 1.2 to 1.4 (1.3; 1.1 to 1.2) times. Length of caudal fin 1.3 (1.2; 1.3 to 1.4) in head. Highest anal ray 1.6 to 1.7 (1.7; 1.7 to 1.8) in head, and 0.8 (1.0; 0.7 to 0.8) in the anal base, which enters the head 1.8 to 2.2 (1.7; 2.1 to 2.4) times, and the second dorsal base 1.4 to 1.6 (1.3; 1.3 to 1.4) times. Longest pectoral ray 0.7 (0.8; 0.7) and length of pelvic fin 0.9 (1.0; 0.9) in head. Interspace between pelvic fins 1.1 to 1.2 (1.3; 1.4 to 1.5) in pelvic base.

The following color notes were made after the specimens had been in formalin about two weeks. In the adult from Greene River, the whole color tone was pinkish, owing to the light

brownish red spot on the center of each scale from the dorsal fins to the side of the belly. These spots became weak and tan colored on the lower sides of the caudal peduncle, but deeper and brighter under the pectorals. The lower sides, especially between and near the lateral blotches, were bright golden. The belly was white. The breast was bright silvery with strong mottlings of ivory before and behind the pectoral fins. The dark bars of the body were blackish green. The head was mottled with light and dark olive. The margin of the first dorsal fin was narrow and blood-red forward, still narrower and yellower posteriorly, but broad and red-brown near the end of the fin. There was a dusky reddish brown stripe on each interspinal membrane from the base well toward the tip, and a somewhat similar, but less reddish mark on each membrane of the second dorsal. The greenish caudal rays were very indefinitely banded with dusky. The anal and pelvic rays were mostly yellow, becoming a little orange forward and outward. The pectoral fin was mostly yellowish on the rays, but the median part of the fin was banded with pink and green.

The specimen from Brush Creek was brighter, although the red spots on the scales were fainter (hardly evident on the white underparts). The blackish green oblique saddles were abruptly set off on the posterior edge by bright cream, as in the other specimen, and there was a tannish semicircle on the nape in front of the first saddle. The red border on the spinous dorsal was developed only anteriorly. The dorsal spines and soft rays were individually barred with deep green and amber, and the membranes were only slightly blotched. The greenish caudal was barred with darker and lighter. The pectoral showed 2 pink crescents near the base, and bars of yellowish and greenish outward. The pelvic fin was definitely dappled with pink.

The adult male from Bumpass Creek was described as richly though not brilliantly colored. The light areas covering most of the sides and back were enriched by a strong rosy wash, mostly concentrated toward the centers of the scales. The dorsal spines were set off in translucent streaks, between which

the membranes were deep red-brown. The first dorsal became pinkish brown just within a fine, pale edge. The second dorsal was mostly red-brown on the membranes, becoming sooty outward and pale brown along the rays. The caudal and pectoral fins were dusky green and yellowish; the pelvic, dusky with a cream edge; the anal, pale.

In the small specimens from Alabama the light areas were a rich tan. The base of the pectoral was marked with a conspicuous watery orange crescent.

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PLATE I

FIG. 1. Holotype of *Poeciliichthys tetrazonus*, a half-grown specimen 33 mm. in standard length, from Big Niangua River, Missouri.

FIG. 2. Holotype of *Poeciliichthys euzonus erizonus*, an adult male 66 mm. in standard length, from Current River, Missouri.

FIG. 3. Holotype of *Poeciliichthys euzonus euzonus*, an adult male 60.5 mm. in standard length, from Buffalo River, Arkansas.

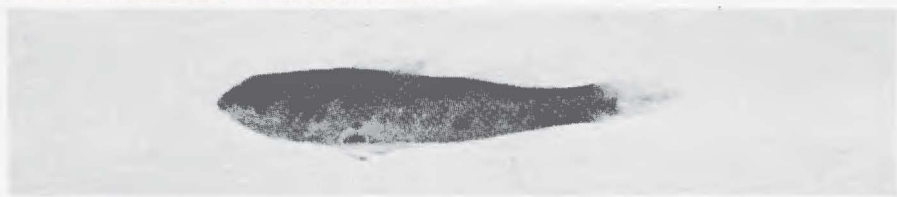


FIG. 1

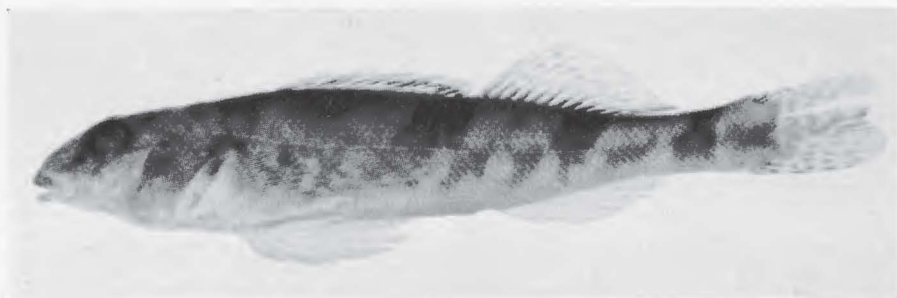


FIG. 2



FIG. 3

Photographs by F. W. Ouradnik.

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PLATE II

FIG. 1. Breeding male of *Poeciliichthys variatus*, 73 mm. in standard length, from Columbiana County, Ohio.

FIG. 2. Adult of *Poeciliichthys blennius*, 43.5 mm. in standard length, from Brush Creek, Duck River system, Tennessee.

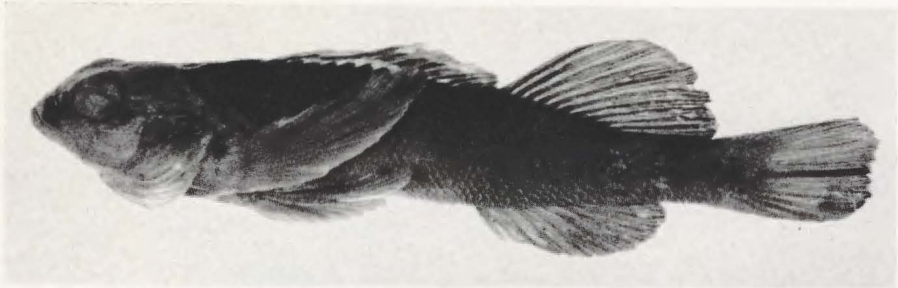


FIG. 1

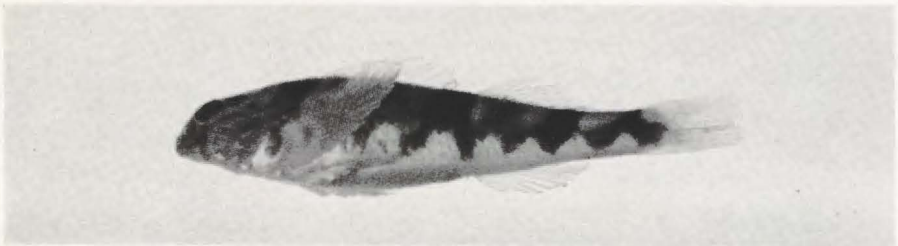


FIG. 2

Photographs by F. W. Ouradnik.