

THE MUSSELS (*UNIONACEAE:BIVALVIA*) OF OKLAHOMA-PART 3: LAMPSILINI

Branley Allan Branson

Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475

Keys and distribution data for the genera and species of the tribe Lampsilini known from Oklahoma are presented. *Ptychobranchus occidentalis*, *Obliquaria reflexa*, *Cyrogenia aberti*, *Glebula rotundata*, *Ellipsaria lineolata*, *Carunculina glans*, *C. texasensis*, *C. parva*, *Ligumia nasuta*, *L. recta*, *Obovaria olivaria*, *O. jacksoniana*, *Plagiola triquetra*, *Truncilla truncata*, *T. macrodon*, *T. donaciformis*, *Leptodea amphichaena*, *L. leptodon*, *L. fragilis*, *L. laevisissima*, *Proptera alata*, *P. purpurata*, *Actinonaias ellipsiformis*, *A. ligamentina*, *Villosa iris*, *V. lienosa*, *Lampsilis rafinesqueana*, *L. ovata*, *L. teres*, *L. hydiana*, *L. powelli*, and *L. radiata* are discussed. Photographs of the species are included.

INTRODUCTION

The following discussion of the tribe Lampsilini, the largest complex of mussels in Oklahoma, concludes the work started in the first two parts (1, 2) of this series. As readers will discern, some genera of the Lampsilini are taxonomically difficult and there are sometimes differences of opinion among experts regarding the admission to species status of certain forms, such as *Carunculina texasensis*. Since several of these forms are well-marked and recognizable on morphological grounds, having been accorded species status in the past, I have included them as species until definitive proof to the contrary is forthcoming.

KEY TO GENERA AND SPECIES OF THE TRIBE LAMPSILINI

- 1a. Entire ventral portion of outer gill serves as a marsupium; valves thick, elongated; lateral teeth short, swollen posteriorly and pointed downward..... *Ptychobranchus occidentalis* Figure 1
- b. Only central or posterior part of outer gill serves as a marsupium; valves usually not so elongated; lateral teeth neither swollen posteriorly nor pointed downward 2
- 2a. Central part of outer gill serves as a marsupium 3
- b. Posterior part of outer gill serves as a marsupium 4
- 3a. Each valve bears a single, median row of enlarged, often flattened knobs *Obliquaria reflexa* Figure 2
- b. Value sculpturing and tuberculation various but never in the form of a single row of knobs
..... *Cyrogenia aberti* Figure 3
- 4a. Posterior halves of pseudocardinal teeth with a series of parallel, bladelike lamellae
..... *Glebula rotundata* Figure 4
- b. Pseudocardinal teeth often roughened but the posterior halves never with blade-like lamellae 5
- 5a. Valves compressed, very high with strongly arched anterior slope; posterior slope extremely short and acute; teeth very large and heavy..... *Ellipsaria lineolata* Figure 5
- b. Valves often high but not arched (if arched then valves are inflated rather than compressed); posterior slope not so acute (less than 90 with reference to disk) 6
- 6a. Adult valves 4 cm or less in total length; females with distinctive mantle swellings in front of branchial opening Genus *Carunculina* 7
- b. Adult valves usually longer than 4 cm in total length; no mantle swellings in front of female branchial opening 9
- 7a. Nacre usually purple *Carunculina glans* Figure 6
- b. Nacre white, purplish-white to salmon 8
- 8a. Posterior shell ridge well-developed; female shell, with an angular marsupial swelling posteriorly, truncated and greatly inflated in females *Carunculina texasensis* Figure 7
- b. Posterior ridge lacking or nearly so; female shell lacks marsupial swelling; shell of both sexes nearly evenly rounded behind; female shell not greatly inflated..... *Carunculina parva* Figure 8

- 9a. Height of shell into length goes 2.0 or more times 10
 b. Height of shell into length goes fewer than 2.0 times 12
- 10a. Inner edge of mantle with fingerlike papillae Genus *Ligumia* 11
 b. Inner edge of mantle with a ribbon-like flap *Lampsilis teres* Figure 9
- 11a. Adult shell usually less than 10 cm in total length and olive-green to olive-brown in color; posterior ridge distinct throughout length; posterior slope concave; a low wing produced at junction of posterior and dorsal margins *Ligumia nasuta* Figure 10
 b. Adult shell usually more than 10 cm in total length and olive-green to black in color, rarely brown; posterior ridge indistinct posteriorly; posterior slope not concave; no wing produced at junction of posterior and dorsal margins *Ligumia recta* Figure 11
- 12a. Valves nearly round (sometimes elliptical) or very high-oval; teeth very heavy and coarse
 Genus *Obovaria* 13
 b. Valves elongated, elliptical, triangular, or oval; teeth thin to heavy 14
- 13a. Beaks high and tilted anteriad; nacre white; shell ovate, almost as high as long *Obovaria olivaria* Figure 12
 b. Beaks lower, not tilted anteriad; nacre bluish-white; shell clearly longer than high
 *Obovaria jacksoniana* Figure 13
14. Adult shell less than 6.0 cm long and sexually dimorphic (because of an expansion over marsupial portion of gills); posterior slope very steep; periostracal rays chevron-shaped Plagiola (*Dysnomia*) *triquetra* Figure 14
 b. Adult shell usually longer than 6.0 cm; sexual dimorphism lacking or not marked; periostracal rays not chevron-shaped 15
- 15a. Posterior ridge strongly angular 16
 b. Posterior ridge rounded or absent 19
- 16a. Valves compressed with very shallow beak cavities 17
 b. Valves inflated with deep beak cavities *Lampsilis ovata* Figure 15
- 17a. Shell high and ovoid, nearly as high as wide; posterior ridge short and steep *Truncilla truncata* Figure 16
 b. Shell elongated and elliptical, longer than high; posterior ridge rounded 18
- 18a. Valves with narrow rays, never v-shaped; beak cavities shallow, nearly lacking
 *Truncilla macrodon* Figure 17
 b. Valves with broad rays, often v-shaped; beak cavities deeper, obvious *Truncilla donaciformis* Figure 18
- 19a. Pseudocardinal teeth poorly developed to nearly lacking Genus *Leptodea* .. 20
 b. Pseudocardinal teeth well developed 23
- 20a. Shell with a well-developed dorsal wing; height into length goes 1.5 or fewer times 22
 b. Shell lacking a dorsal wing or possessing only a very low one; height into length goes more than 1.5 times
 21
- 21a. Shell inflated, without a dorsal wing *Leptodea amphichaena* Figure 19
 b. Shell compressed, with a low dorsal wing *Leptodea leptodon* Figure 20
- 22a. Adult nacre white; periostracum yellow to grayish-brown; shell very fragile *Leptodea fragilis* Figure 21
 b. Adult nacre pink; periostracum greenish to yellowish-green *Leptodea laevissima* Figure 22
- 23a. Shell with a relatively high, well-developed dorsal wing *Proptera alata* Figure 23
 b. Shell lacking a dorsal wing 24
- 24a. Shell large (to nearly 12 cm) with purple nacre *Proptera purpurata* Figure 24
 b. Shell usually shorter than 12 cm and with white nacre (if nacre is purple then shell less than 6 cm in length)
 25
- 25a. Posterior inner edge of mantle lacks fingerlike papillae or flaps (may be undulating) Genus *Actinonaias* 26
 b. Posterior inner edge of mantle either papillate or with flaps 28
- 26a. Colored rays of shell faint or lacking entirely; shell only moderately heavy (see text)
 *Lampsilis rafinesqueana* Figure 25

- b. Colored rays of shell usually present and of equal intensity throughout length; shell heavy.....27
- 27a. Posterior half of shell not higher than part in front of beaks; periostracum dull.....
.....*Actinonaias ellipsiformis* Figure 26
- b. Posterior half of shell higher than part in front of beaks; periostracum more or less glossy
.....*Actinonaias ligamentina* Figure 27
- 28a. Posterior margin of mantle bears long, fingerlike papillae..... Genus *Villosa*.....29
- b. Posterior margin of mantle with a distinctive flap30
- 29a. Colored rays, broad and distinct and divided into sections, restricted to posterior two-thirds of shell;
greatest depth of shell goes 1.8-1.9 into greatest length.....*Villosa iris* Figure 28
- b. Colored rays, narrower and less distinct and not broken into sections, more or less uniformly distributed
over shell; greatest depth of shell goes about 1.6 into greatest length *Villosa lienosa* Figure 29
- 30a. Height of male shell goes 1.6 or more into length.....31
- b. Height of male shell goes less than 1.6 into length*Lampsilis ovata* Figure 15
- 31a. Posterior ridge high, ending in a salient point about midline of shell*Lampsilis teres* Figure 9
- b. Posterior ridge lower, usually ending lower than midline and not in a sharp point32
- 32a. Conspicuous colored rays, not fading ventrally, more or less uniformly distributed over shell
.....*Lampsilis hydiana* Figure 30
- b. Colored rays absent, limited to posterior slope, or become faded ventrally33
- 33a. Shell entirely lacking colored rays..... *Lampsilis powelli*... Figure 31
- b Shell usually with some degree of raying although faintly so*Lampsilis radiata* Figure 32

ANNOTATED LIST

Tribe Lampsilini

This tribe is represented in Oklahoma by possibly 15 genera (*Plagiola* has not been confirmed for the state), concentrated mostly in the eastern two-thirds of the state. Characteristically, the marsupia occupy restricted portions of the outer two demibranchs, where they are delineated by external grooves. Very often, there is a slight to marked sexual dimorphism of the shells in many of the species.

Genus *Ptychobranthus*

Only a single species of this principally Cumberlandian and Ohioan genus occurs in Oklahoma, most often reported as *P. fasciolare* Rafinesque in the past (3).

Ptychobranthus occidentalis (Conrad 1836) Figure 1

Oklahoma distribution: Red River and tributaries, including the Blue and Kiamichi, and the Verdigris, and Neosho and Chickaskia. rivers (4); Little, Mountain Fork and Blue rivers (5); Mountain Fork River (6); Blue, Kiamichi, Little and Glover rivers (3).

Ptychobranthus has a peculiarly pleated marsupial gill, a feature that is reflected in the nacre of female shells. The synonymy includes *Unio occidentalis* Conrad 1836, *Ptychobranthus clintonensis* Simpson 1900, and *P. phaseolus* Scammon 1906.

Genus *Obliquaria*

This monotypic genus ranges from the Great Lakes region through Oklahoma into Texas.

Obliquaria reflexa Rafinesque 1820 Figure 2

Oklahoma distribution: Blue, Muddy Boggy, Kiamichi, Little, Verdigris, Neosho, North Fork of the Canadian, and Poteau rivers, and large creeks of the Arkansas River drainage but not the Chickaskia River drainage (4); Neosho (7), Poteau (8), Lake Texoma (9), Big Caney River in Washington County, Salt Creek, Osage County (10); Washita, Blue, Kiamichi, Little and Glover rivers and Pennington Creek (5); Tenkiller Ferry Reservoir (Illinois River) (30).

One of the most easily recognized clams in North America—the large, widely spaced knobs are staggered one above the other when both valves are viewed from the end—this species is almost entirely restricted to large streams at lowland stations.

Genus *Cyprogenia*

Three species comprise this genus, *Cyprogenia irrorata* (Lea) and *C. stegaria* (Rafinesque) of the Ohio, Cumberland and Tennessee river systems (11), and *C. aberti* of Kansas, Missouri, Oklahoma and Arkansas (3,11,12).

Cyprogenia aberti (Conrad 1850) Figure 3

Oklahoma distribution: Verdigris River (3, 4).

The thick, compressed and externally mottled valves also bear wrinkles and small nodules on the upper portion of the disk. This is a species of large streams where it lives in rocks, gravel and mud. Synonyms include *Unio aberti* Conrad 1850, *U. lamarkianus* Lea 1852 and *U. popnoi* Call 1855.

Genus *Glebula*

This monotypic genus is easily recognized by means of shell characteristics: heavy, rotund valves, purplish to pink nacre, and the peculiar character of the pseudocardinal teeth alluded to in the key.

Glebula rotundata (Lamarck 1819) Figure 4

Oklahoma distribution: known only from Grand Lake near Fairland, Ottawa County (14).

Unio suborbiculata Lamarck 1819 is the only synonym (3).

Genus *Ellipsaria*

Another peculiar monotypic genus, this bivalve is easily diagnosed by way of the strongly arched, compressed valves, very large and heavy hinge teeth, and greenish, yellowish or brownish periostracum with dark chevrons (usually broken into series of blotches).

Ellipsaria lineolata (Rafinesque 1820) Figure 5

Oklahoma distribution: Kiamichi, Verdigris, Poteau and Neosho rivers (4); Poteau River (8).

In the author's opinion, this species should be considered as of Threatened or Endangered status by Oklahoma biologists. Synonyms are *Unio securis* Lea 1829 and *Plagiola securis* (Lea 1829) (3).

Genus *Carunculina*

Some writers (11) recognize but two species in this genus, submerging several nominate forms in the synonymy of *C. parva*. However, the three species discussed here seem to be distinct to this author and others (3, in part). Valentine and Stansbery (5) and White and White (9) use *Toxolasma* instead of *Carunculina*, a matter that needs to be addressed by the plenary powers of the International Commission. These are the smallest unionids in Oklahoma.

Carunculina glans (Lea 1831) Figure 6

Oklahoma distribution: unknown.

Valentine and Stansbery (5) suggested that this species might occur in Oklahoma because of the close proximity of its range in southern Arkansas and Missouri. It is known from the Spring and Elk rivers of Missouri as well (3). The synonymy includes *Toxolasma livida* Rafinesque 1831 and *T. glans* Lea 1831.

Carunculina texasensis (Lea 1859) Figure 7

Oklahoma distribution: reported only from Yashau Creek in McCurtain County (6).

Although Johnson (3) considered *C. texasensis* a synonym of *C. parva*, and Strecker (15) listed it as a subspecies of the latter, this is a well-marked and easily recognized species, one that is relatively common in northeastern Texas, adjacent Louisiana and extreme southeastern Oklahoma, particularly in sluggish, mud-bottomed streams and swampine habitats. The periostracum is usually dark green (sometimes black) and the nacre varies from yellowish or orangish to pale blue. The valves are usually considerably larger than those of *C. glans* or *C. parva*, often measuring in excess of 60 mm in total length, whereas in the other two species the length is usually less than 45 mm. The synonymy includes *Unio texasensis* Lea 1859, *U. bairdianus* Lea 1857, *U. beali* Lea 1862, and *U. haleianus* Lea 1842 (12, 15).

Carunculina parva (Barnes 1823) Figure 8

Oklahoma distribution: "Oklahoma City" (16), Bluff Creek, Grant County (17); Washita, Clear Boggy, Kiamichi and Blue rivers, Washita River and creek tributaries, Illinois, Poteau rivers, and Chickaskia River and creek tribu-

taries (4); Lake Texoma (9, 18); Gates Creek and Kiamichi, Little, Glover and Mountain Fork rivers (5); Poteau River (8); Kiamichi River, Lake Carl Blackwell (Payne County) and Waterfall Creek (McCurtain County) (6); Bird, Salt and Hominy creeks (Osage County) (10); and Ft. Gibson Reservoir (7).

This small, rather fragile unionid enjoys a widespread distribution in Oklahoma but it is easily overlooked during general collecting. The synonymy includes *Unio cromwelli* Lea 1865 and *Carunculina parva cahni* Baker 1927.

Genus *Ligumia*

If *Ligumia subrostrata* (Say 1831) is considered a synonym of *L. nasuta* (11), there are two species in the genus, both of which occur in Oklahoma.

Ligumia nasuta (Say 1817) Figure 10

Oklahoma distribution: Spring Creek, Grant County (17); Verdigris, Neosho, Illinois and Chickaskia rivers and creek tributaries (4); Blue, Kiamichi, Mountain Fork and Glover rivers (5); Mountain Fork, Kiamichi rivers (6); Caston Creek (8); Middle Caney River, Washington County, Bird, Salt and Hominy creeks, Osage and Tulsa counties (10).

This bivalve prefers mud habitats in the shallow water of ponds, creeks and rivers (5). The synonymy includes *Lampsilis subrostrata furva* Simpson 1914 (3).

Ligumia recta (Lamarck 1819) Figure 11

Oklahoma distribution: Verdigris, Neosho and Poteau rivers (4); Poteau River (8).

This very long and slender, black, large-river clam has never been reported from the Arkansas River proper, and it is rare to lacking in southern Oklahoma. Synonyms are *Lampsilis recta* Lamarck 1819, *Elliptio latissima* Rafinesque 1820, and *Unio sageri* Conrad 1831.

Genus *Obovaria*

There are five or six species in this genus (3, 11), mostly distributed east of the Mississippi River. Two of the species have been reported from Oklahoma.

Obovaria olivaria (Rafinesque 1820) Figure 12

Oklahoma distribution: unknown.

This species almost certainly occurs in northern and eastern Oklahoma, based upon its total range (3, 11, 12, 19). *Unio ellipsis* Lea 1828 is a synonym.

Obovaria jacksoniana (Frierson 1912) Figure 13

Oklahoma distribution: Kiamichi and Little rivers (4); Mountain Fork River (6). If Valentine's and Stansbery's (5) record for *Obovaria* is assumed to be *O. jacksoniana*, Glover River would be included.

This species is relatively common at certain localities in southeastern Oklahoma, but it is easily missed during general collecting unless the muddy bottoms are probed. Synonyms are *Obovaria castanea* (Lea 1831), *Unio castaneus* Lea 1831, *Unio castaneus* Rafinesque 1831.

Genus *Plagiola*

In recent years there has been a large amount of argumentation published on the proper generic designation for this complex of 17 (20) to 19 (11) species of handsome and Threatened mussels. I have elected to follow Johnson's (20) rationale in this matter.

Plagiola (Dysnomia, Epioblasma) triquetra (Rafinesque 1820) Figure 14

Oklahoma distribution: "Indian Territory" (12).

The above record is the only citation for the species in Oklahoma, hence is in need of verification. Modern distribution records, however, demonstrate the species occurrence in the Upper White River system of Missouri and the Missouri River drainage of Kansas (20). Most members of the genus possess marked sexual dimorphism.

Genus *Truncilla*

Three species are at present included in this genus (11); all have been reported from Oklahoma.

Truncilla truncata Rafinesque 1820 Figure 16

Oklahoma distribution: Blue, Lower Boggy, Clear Boggy, Kiamichi, Little, Verdigris, Neosho rivers and Poteau River and Salt Creek (4); Blue, Kiamichi and Glover rivers (5); Poteau River (8); Big Caney (and weathered shells on Middle Caney) River (10);

Neosho River (7); Blue and Illinois rivers (30).

The synonymy includes *Unio elegans* Lea 1831, *Plagiola elegans* (Lea 1831), and *Truncilla truncata lacustris* Baker 1928 (3).

Truncilla macrodon (Lea 1859) Figure 17

Oklahoma distribution: unknown.

This species is included here on the basis of Burch's (11) statement, i.e., "Texas and Oklahoma". However, all of Strecker's (15) localities lie well south of the Red River drainage.

Truncilla donaciformis (Lea 1828) Figure 18

Oklahoma distribution: Chickaskia River (17); Red, Washita, Blue, Muddy Boggy, Kiamichi and Little, Arkansas, Neosho, Verdigris, North Fork of Canadian, and Chickaskia rivers (4); Lake Texoma (9, 18, 21); Blue River, Lake Texoma, Pennington and Gates creeks (5); Mountain Fork River (6); Bird and Hominy creeks and Big Caney River (10); Neosho River (7); Blue River (30).

Often missed during general collecting, this pretty little bivalve is sometimes secured from raccoon middens.

Genus *Leptodea*

This genus includes four species, all of which have been reported from Oklahoma. Some authors (7, and others) place these species in the genus *Proptera* and Valentine and Stansbery (5) resurrected *Potamilis* to include these species and those in *Proptera* (see below). However, Johnson (3) has maintained usage of *Leptodea* and *Proptera*, admonishing any authors who would promulgate *Potamilis* to refer the case to the International Commission.

Leptodea amphichaena Frierson 1898 Figure 19

Oklahoma distribution: Mountain Fork River, McCurtain County (6).

Since this report was based upon a single specimen, the presence of this species in Oklahoma requires verification. It is not an uncommon species in Texas (22) but its range is mostly in the Eastern half of that state (15).

Leptodea leptodon (Rafinesque 1820) Figure 20

Oklahoma distribution: Kiamichi River (4); Kiamichi, Little and Mountain Fork rivers and Gates Creek (5).

This species is usually smaller than *L. fragilis*, for which it is apt to be mistaken, Oklahoma specimens seldom being larger than about 80 mm in length, whereas *L. fragilis* is usually 100 mm or longer. *Leptodea leptodon* is rare in the state and should be listed as of Special Concern. The synonymy includes *Lampsilis blatchleyi* Daniels 1902 and *Lampsilis leptodon* Rafinesque 1820 (3).

Leptodea laevisisima (Lea 1829) Figure 22

Oklahoma distribution: Red, Washita, Arkansas, Verdigris, North and Deep Forks of the Canadian, Chickaskia rivers and Cache (4); Lake Texoma (9, 18, 21); Neosho and Spring rivers (13); Grand Lake (6); Big Caney River and Bird and Middle Caney creeks, Washington County and Salt and Hominy creeks, Osage and Tulsa counties (10); and Neosho River (7).

Because of the axe-head shaped glochidia, *Leptodea laevisisima* should probably be assigned to the genus *Proptera* (5). The synonymy includes *Lampsilis laevisisima* (Lea 1829), *Proptera laevisisima* (Lea 1829), *Potamilus laevisisimus* (Lea 1829), *Potamilus ohiensis* (Rafinesque 1820), *Anodonta ohiensis* Rafinesque 1820, and *Lastena ohiensis* (Rafinesque 1820).

Leptodea fragilis (Rafinesque 1820) Figure 21

Oklahoma distribution: "Oklahoma City" (16); Shoofly Creek (Williston, Oklahoma) (17); Red, Washita, Blue, Clear and Lower Boggy, Kiamichi, Arkansas, Little, Verdigris, Neosho, Chickaskia and North Fork and Deep Fork of the Canadian rivers and Fourteenmile, Cache, Bird, Salt, Black Bear, Big Cabin, Gar, Shoofly and Pryor creeks (4); Lake Texoma (9, 18); Neosho and Spring rivers (13); Lake Texoma, Pennington and Gates creeks and Blue and Kiamichi rivers (5); Mountain Fork River (6); Big and Middle Caney rivers and Bird, Salt and Hominy creeks (Osage, Tulsa and Washington counties) (10); Neosho River (7); Blue River and Tenkiller Reservoir (30).

One of the most widely distributed unionids in Oklahoma, this species lives in ponds and lakes as well as in streams. The synonyms include *Unio gracilis* Barnes 1823 (11), *Lampsilis gracile* (Barnes 1823), *Lamp-*

silis simpsoni Ferris 1900, and *Leptodea lacustris* Baker 1922 (3).

Genus *Proptera*

Three (11) to six (5) species are assigned to this genus, and three of them have been reported from Oklahoma, one of them in error. Isely (4) reported *P. capax* (Green 1832) from the Kiamichi River, Branson (23) from the Verdigris River, and Shepard and Covich (7) from the Neosho River; the species has also been reported from the Arkansas River system in Kansas (24). All these records are probably based upon inflated females of *P. purpurata*. *Proptera capax* does not exhibit sexual dimorphism to any extent (3).

Proptera alata (Say 1817) Figure 23

Oklahoma distribution: Neosho River (5); Illinois and Neosho rivers (6); Illinois River and Grand Lake (30).

This is a species of the Ozarkian Crest eastward, hence is not common in Oklahoma. *Metaptera megaptera* Rafinesque 1820 is a synonym (3).

Proptera purpurata (Lamarck 1819) Figure 24

Oklahoma distribution: "Oklahoma City" (16); Chickaskia River (17); Washita, Blue, Lower and Clear Boggy, Kiamichi, Little, Poteau, Arkansas, Verdigris, Illinois and Chickashia rivers and Bird, Salt, Black Bear, Fourteenmile, Pryor, Cache, Caston, Bluff, and Big Cabin creeks (4); Blue, Little, Mountain Fork, Kiamichi, and Glover rivers and Gates Creek (5); Mountain Fork River (6); Big and Middle Caney rivers and Bird and Salt creeks (Osage County) (10); Neosho River (7); Blue River, Spavinaw and Medicine creeks and Ft. Gibson and Tenkiller Ferry reservoirs (30).

Potamilis purpurata (Lamarck 1819) and *Lampsilis purpurata* (Lamarck 1819) are synonyms.

Genus *Actinonaias*

Because of some parallel development, certain species of other genera may be diagnosed as *Actinonaias* based upon shell features alone. Thus, *Lampsilis rafinesqueana* (see below) usually keys to this genus unless attention is paid to the soft anatomy, particularly the mantle flaps. One species is known from Oklahoma and another is a possibility.

Actinonaias ellipsiformis (Conrad 1836) Figure 26

Oklahoma distribution: unknown.

This species has not been reported from Oklahoma. It is included here because of its occurrence in Arkansas (3).

Actinonaias ligamentina (Lamarck 1819) Figure 27

Oklahoma distribution: Kiamichi, Little, Neosho, Poteau rivers and Fourteenmile Creek (4); Kiamichi River and Glover River (5); Neosho and Mountain Fork rivers and Little River (6).

Unio carinatus Barnes 1823, *Actinonaias carinatus* (Barnes 1823) and *Lampsilis carinatus* (Barnes 1823) are synonyms.

Genus *Villosa*

This rather large and confusing genus, the distribution of which is principally east of the Mississippi River, is represented by two species in Oklahoma, both from the Red River drainage.

Villosa iris (Lea 1829) Figure 28

Oklahoma distribution: Little River system (5).

This small species (35-66 mm long but mostly under 50 mm) is light to dark yellow in color with greenish rays that are usually subdivided into series of blotches. It is locally abundant. Since these and other features are not entirely characteristic of the species, Valentine and Stansbery (5) tentatively diagnosed over 500 specimens as this species, indicating that the observed divergence, and those seen in the next species below, was perhaps the result of depauperacy at the extreme edge of the range. Synonyms include *Unio nebulosus* Conrad 1834, *U. ellipsiformis* Conrad 1836, *U. novieboraci* Lea 1838, and *Micromya iris* (Lea 1829).

Villosa lienosa (Conrad 1834) Figure 29

Oklahoma distribution: Blue, Kiamichi and Little rivers (5); Mountain Fork river (common) (6).

Contrasted with the last species, *V. lienosa* is light to dark brown (sometimes nearly black), often with only faint rays. In the Kiamichi, Little and Mountain Fork rivers the females have truncate shells, whereas they are rounded in the Blue River (5).

As in *V. iris*, these records are from the extreme limits of distribution, which may account for the apparent divergence in characteristics. However, both species ought to be more fully investigated to determine their overall status. Electrophoretic analysis of several enzyme systems would be of interest. *Micromya lienosa* (Conrad 1834) is a synonym.

Genus *Lampsilis*

For many years, *Lampsilis*, like *Unio*, was a catch-all genus. In fact, most of the unionids of North America at one time or another were included in *Lampsilis*. However, in the modern, more restricted sense, the genus includes only those species that possess the distinctive features of the mantle flaps, i.e., in which there is a submarginal flap that parallels the pallial line just anterior to the branchial opening on the mesial side of the mantle. Five species are definitely known from Oklahoma with a sixth being a possibility.

Lampsilis teres (Rafinesque 1820) Figure 9

Oklahoma distribution: "Oklahoma City" (16); Chickaskia River (17); Red, Washita, Blue, Lower and Clear Boggy, Kiamichi, Little, North and Deep Fork Canadian, Verdigris, Neosho, Poteau and Chickaskia rivers and Cache, Salt, Black Bear, Gar, Caston, Shoofly, Fourteenmile, Pryor and Big Cabin creeks (4); Blue, Kiamichi, Glover and Little rivers and Beaver (Jefferson County) and Gates and Pennington creeks (5); Machire Creek (Haskell County) (6); Poteau River and Fourche Maline Creek (8); Lake Texoma (9); Big and Middle Caney rivers and Bird, Salt and Hominy creeks, Osage and Tulsa counties (10); Blue River and Spavinaw Creek (30).

The *anodontoides* form of this species is usually pale yellow to brownish in color and usually lacks rays, whereas the *fallaciosa* form is slightly smaller with radiating green lines (5). The latter form is relatively rare in Oklahoma, more so than in Isley's day (4). Johnson (25) discussed in detail the availability of *L. teres* over *L. anodontoides* (Lea 1834) and *L. fallaciosa* (Smith 1899), both of which are synonyms.

Lampsilis ovata (Say 1817) Figure 15

Oklahoma distribution: Red, Washita, Blue, Clear Boggy, Kiamichi, Verdigris, Neosho, Illinois, Poteau rivers and Bird, Caston and Fourteenmile creeks (4); Neosho and Spring rivers and Flint Creek (13); Blue, Kiamichi, Little, Glover and Mountain Fork rivers (5); Mountain Fork River (6); Lake Texoma (9); Poteau River (8); Big Caney River (weathered fossils from Middle Caney, North Bird and Salt creeks) (10); Neosho River (7); Blue River, Spavinaw and Medicine creeks (30).

Lampsilis ventricosa (Barnes 1823) is considered as distinct from *L. ovata* by Havlik and Stansbery (26). Most workers, however, can find no valid reasons for keeping the two species separate. Thus, the synonym includes *Lampsilis cardium* Rafinesque 1820, *Unio ventricosus* Barnes 1823, *U. occidentalis* Lea 1829, *U. canadensis* Lea 1857, *Lampsilis ventricosa lurida* Simpson 1914, *L. v. perglobosa* Baker 1928 and *L. v. winnebagoensis* Baker 1928 (3). Johnson (27) and Valentine and Stansbery (5) discuss ecophenotypic variation in the species.

Lampsilis rafinesqueana (Frierson 1927) Figure 25

Oklahoma distribution: Big Caney River (10); Verdigris River and Illinois River (3); Illinois River at Moodys, Cherokee County (type locality) (28).

In the Ozarkian region, this species is easily confused with *Actinonais ligamentina*, although the latter species is more obviously rayed. The presence of mantle flaps is the key diagnostic feature between the two species. *Actinonais rafinesqueana* (Frierson 1927) is a synonym.

Lampsilis hydiana (Lea 1838) Figure 30

Oklahoma distribution: unknown.

The records for this species in Oklahoma are based upon the reports of Isley (4) and Branson (6), all of which were particularly well-marked specimens of *Lampsilis radiata* (see below). However, *L. hydiana* is a valid species (3) that occurs in the upper Arkansas, White and St. Francis rivers and in Louisiana and in East Texas.

Lampsilis powelli (Lea 1852) Figure 31

Oklahoma distribution: Neosho and Illinois rivers (3, 4).

This species is rare in Oklahoma and should be listed as of Special Concern pending population assessment. *Lampsilis powelli* is sometimes confused with *L. radiata siliquoidea* (see below), but that species usually bears rays on the valves.

Lampsilis radiata siliquoidea (Barnes 1823) Figure 32

Oklahoma distribution: Kiamichi, Blue, Clear Boggy and Little rivers and Bird, Fourteenmile, Pryor and Big Cabin creeks (4); Neosho and Spring rivers and Flint Creek (13); Haw Creek (LeFlore County) (29); Blue, Kiamichi, Mountain Fork and Glover rivers and Pennington and Gates creeks (5); Neosho, Mountain Fork and Blue rivers and Honey Creek (Murray County) (6); Poteau River (8); and Bird, Hominy and Salt creeks (10); Blue River and Spavinaw Creek (30).

This widespread, highly variable species in Oklahoma is most often straw-yellow to yellowish-brown with green rays (rarely lacking) that sometimes become brilliant (5). The synonymy includes *Unio luteola* Lamarck 1819, *Lampsilis luteolus* (Lamarck 1819), *Unio rosacea* DeKay 1843, *U. superiorensis* Marsh 1897, *Lampsilis siliquoidea pepinensis* Baker 1927 and *L. s. chadwicki* Baker 1928.

ACKNOWLEDGMENTS

For the loan of specimens otherwise unavailable, I thank Drs. David H. Stansbery (Ohio State University), Harold D. Murray (Trinity University), Joseph C. Britton (Texas Christian University), Dee S. Dundee (University of New Orleans), Paul W. Parmalee (University of Tennessee), John B. Burch (University of Michigan), and Guenter Schuster (Eastern Kentucky University). I greatly appreciate critical advice from Dr. Richard I. Johnson (Harvard University). A. E. ("Gus") Spreitzer (Ohio State University) provided me with some of the photographs.

REFERENCES

1. B. A. BRANSON, Proc. Okla. Acad. Sci. 62:38-45 (1982).
2. B. A. BRANSON, Proc. Okla. Acad. Sci. 63:49-59 (1983).
3. R. I. JOHNSON, Bull. Mus. Comp. Zool. 149:77-189 (1980).
4. F. B. ISLEY, Proc. Okla. Acad. Sci. 4:43-118 (1925).
5. B. D. VALENTINE and D. H. STANSBERY, Sterkiana :1-40 (1971).
6. B. A. BRANSON, Nautilus 87:8-10 (1973).
7. W. D. SHEPARD and A. P. COVICH, Southwest. Nat. 27:359-361 (1982).
8. D. S. WHITE, Proc. Okla. Acad. Sci. 57:103-105 (1977).
9. D. S. WHITE and S. J. WHITE, Southwest. Nat. 22:235-254 (1977).
10. A. L. METCALF, Trans. Kansas Acad. Sci. 83:1-19 (1980).
11. J. B. BURCH, *Freshwater Unionacean Clams (Mollusca:Pelecypoda) of North America*, Malacological Pub., Hamburg, Mich., 204 pp (1975).
12. C. T. SIMPSON, *A Descriptive Catalogue of the Naiads, or Pearly Freshwater Mussels*. Bryant Walker, Detroit, Mich., 1540 pp (1914).
13. B.A. BRANSON, Trans. Kansas Acad. Sci. 69:242-293 (1966).
14. B. A. BRANSON, Sterkiana 36:22 (1969).
15. J. K. STRECKER, Baylor Univ. Mus. Spec. Bull. 2:1-71 (1931).
16. J. H. FERRISS, Nautilus 20:116-117 (1906).
17. F. C. BAKER, Nautilus 23:91-94 (1909).
18. C. D. RIGGS and G. R. WEBB, Am. Midl. Nat. 56:197-203(1956).
19. R. F. CALL, Bull. Des Moines Acad. Sci. 1:5-57 (1885).
20. R. I. JOHNSON, Bull. Mus. Comp. Zool. 148:239-320 (1978).
21. J. E. SUBLETTE, Am. Midl. Nat. 57:371-402 (1957).
22. H. D. MURRAY and E. C. RAY, Sterkiana 30:25-42 (1968).
23. B. A. BRANSON, Trans. Kansas Acad. Sci. 66:501-512 (1963).
24. H. A. MURRAY and B. LEONARD, Univ. Kansas Mus. Nat. Hist. Misc. Pub. 28:1-184 (1962).
25. R. I. JOHNSON, Bull. Florida State Mus. 16:181-249 (1972).
26. M. E. HAVLIK and D. H. STANSBERY, Bull. Am. Malacol. Union 1977:9-12 (1978).
27. R. I. JOHNSON, Bull. Mus. Comp. Zool. 140:263-450 (1970).
28. L. S. FRIERSON, Nautilus 41:138-139 (1928).
29. B. A. BRANSON, Sterkiana 41:35-40 (1971).
30. E. N. NELSON, J. K. RICHARDSON and H. H. BAILEY, Proc. Okla. Acad. Sci. 55:159-162 (1975).

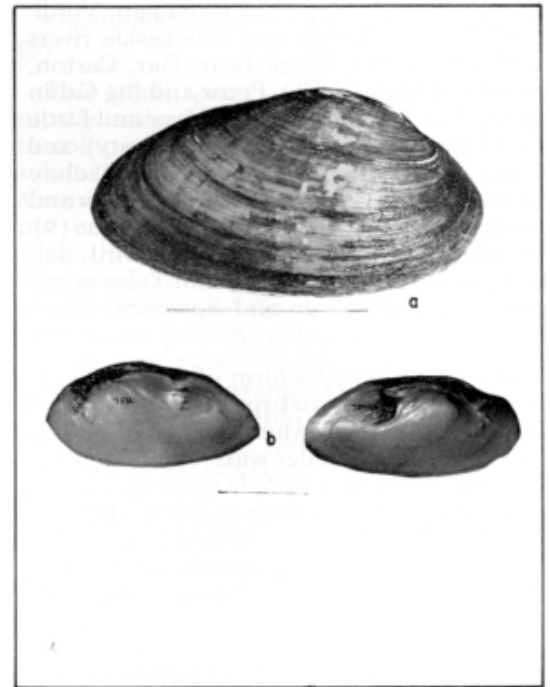


FIGURE 1. *Ptychobranthus occidentalis*. a=external view (scale=66 mm), b=internal view (scale=60 mm).

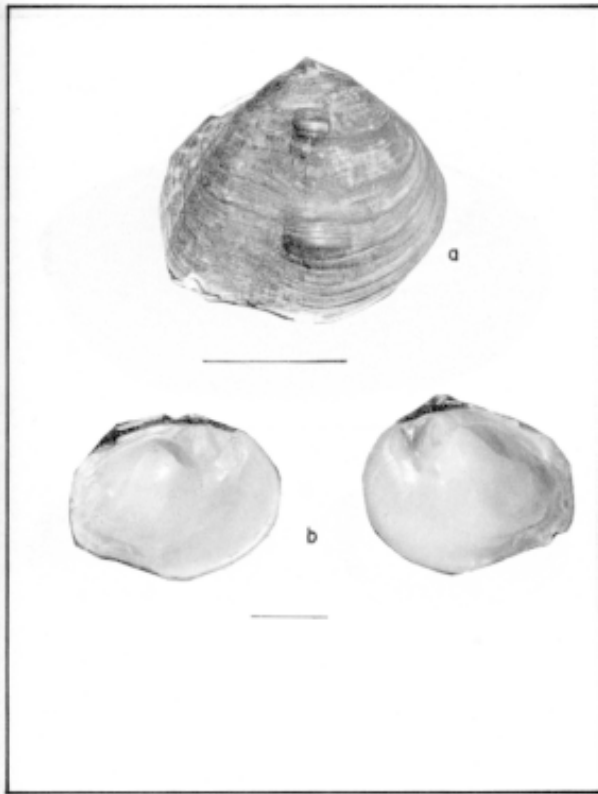


FIGURE 2. *Obliquaria reflexa*. a=external view (scale=23 mm), b=internal view (scale=21 mm).

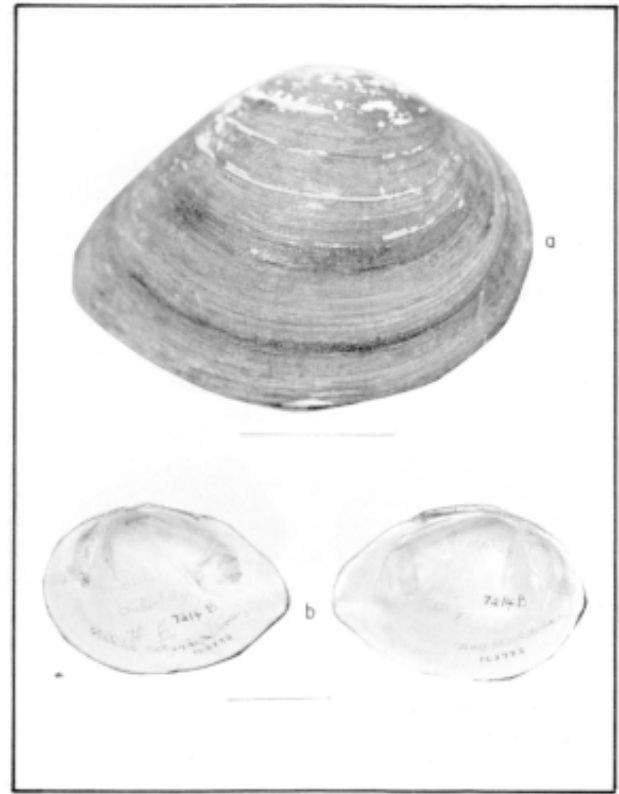


FIGURE 4. *Glebula rotundata*. a=external view (scale=28 mm), b=internal view (scale=33 mm).

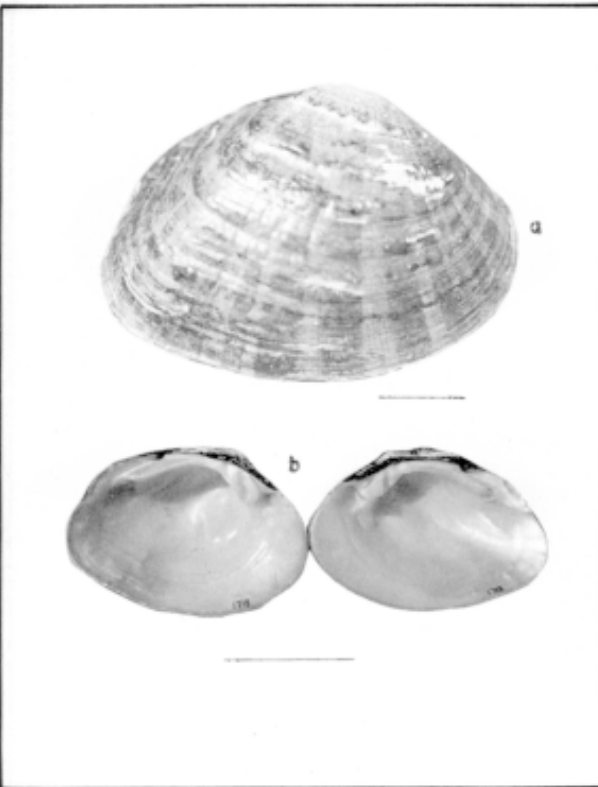


FIGURE 3. *Cyprogenia aberti*. a=external view (scale=17 mm), b=internal view (scale=43 mm).

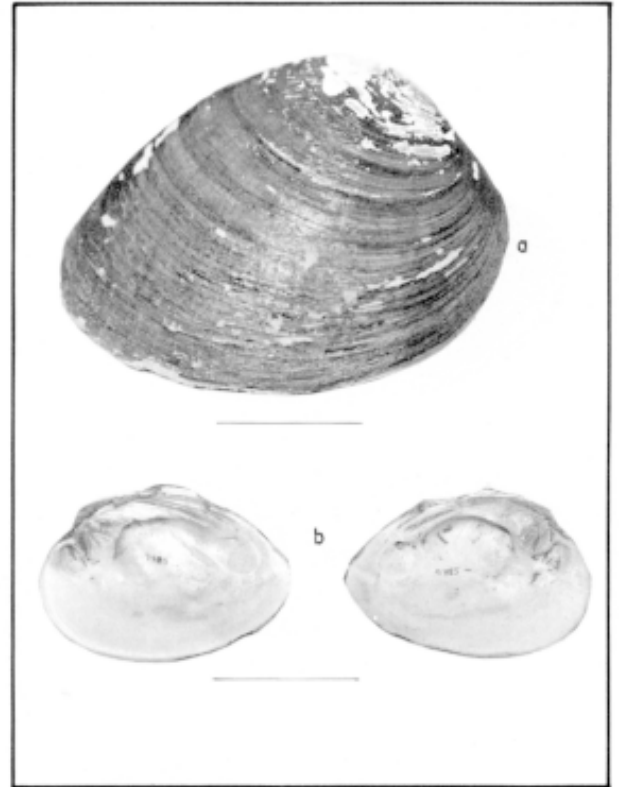


FIGURE 5. *Ellipsaria lineolata*. a=external view (scale=36 mm), b=internal view (scale=51.5 mm).



FIGURE 6. *Carunculina glans*. a=external view (scale=16 mm), b=internal view (scale=20 mm).

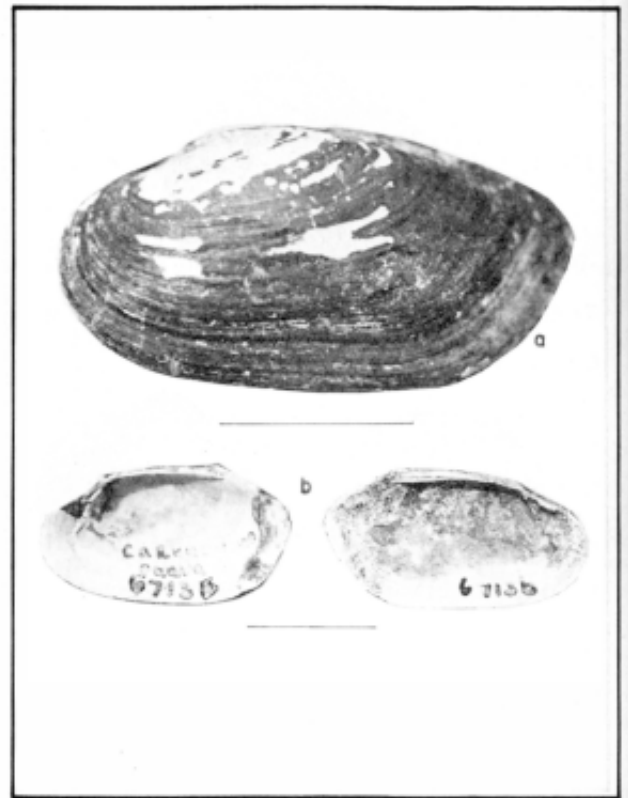


FIGURE 8. *Carunculina parva*. a=external view (scale=15 mm), b=internal view (scale=23 mm).

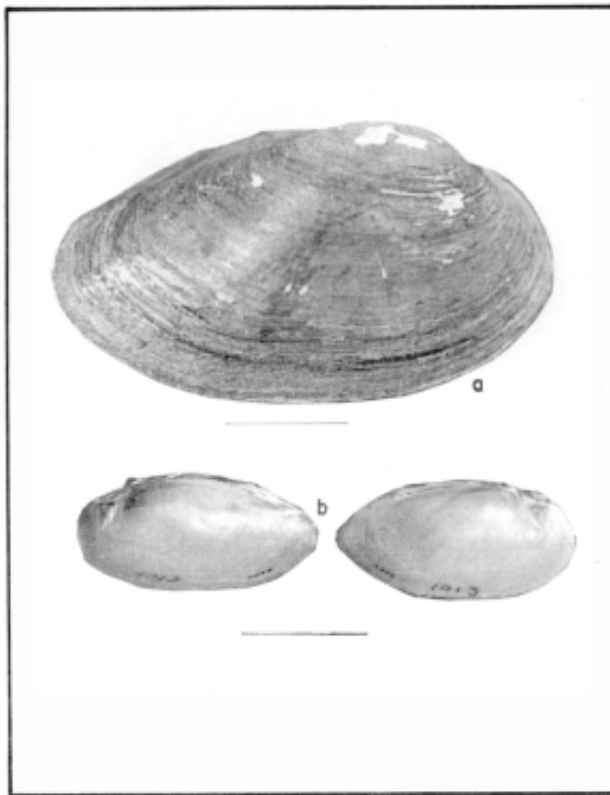


FIGURE 7. *Carunculina texasensis*. a=external view (scale=15 mm), b=internal view (scale=32 mm).

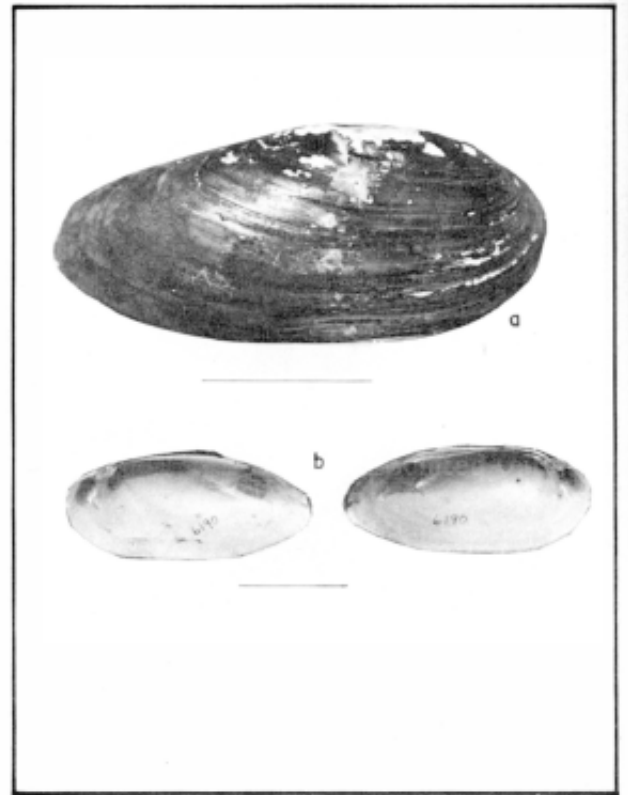


FIGURE 9. *Lampsilis teres*. a=external view (scale=30 mm), b=internal view (scale=52 mm).

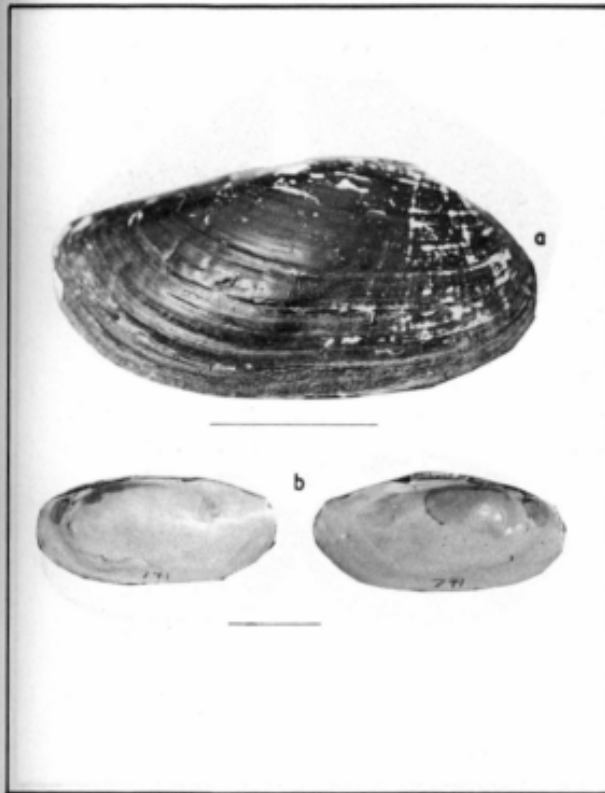
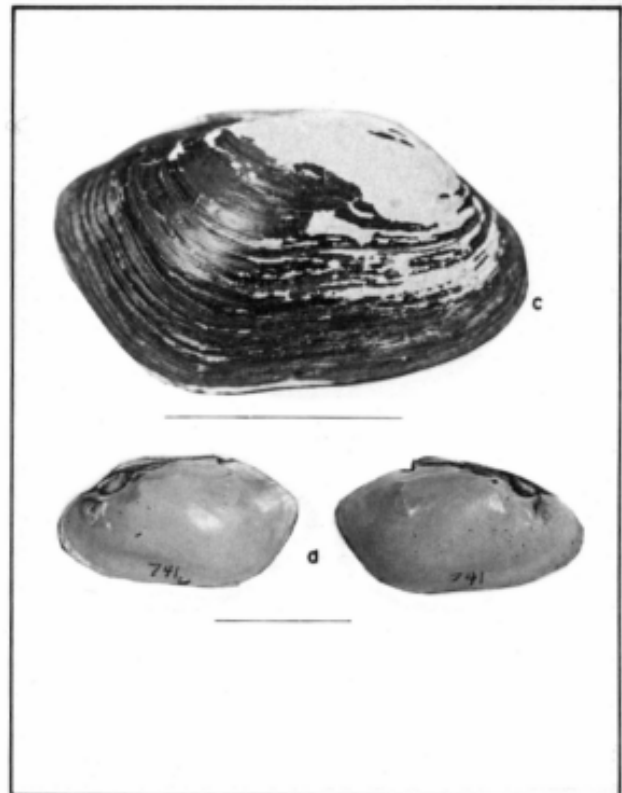


FIGURE 10. *Ligumia nasuta* (female). a=external view (scale=26 mm), b=internal view (scale=27 mm).



Male: c=external view (scale=33.5 mm), d=internal view (scale=38.5 mm).



FIGURE 11. *Ligumia recta*. a=external view (scale=45 mm), b=internal view (scale=44 mm).

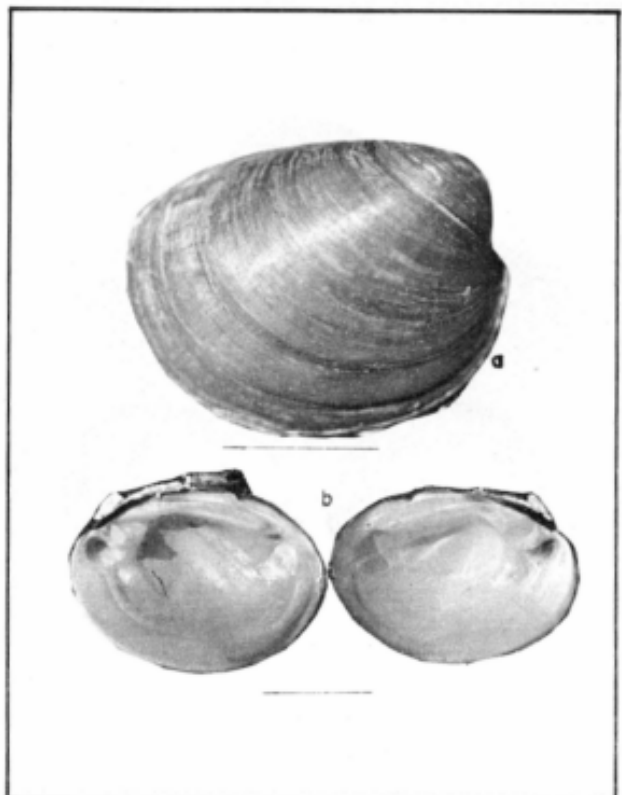


FIGURE 12. *Obovaria olivaria*. a=external view (scale=26 mm), b=internal view (scale=22 mm).

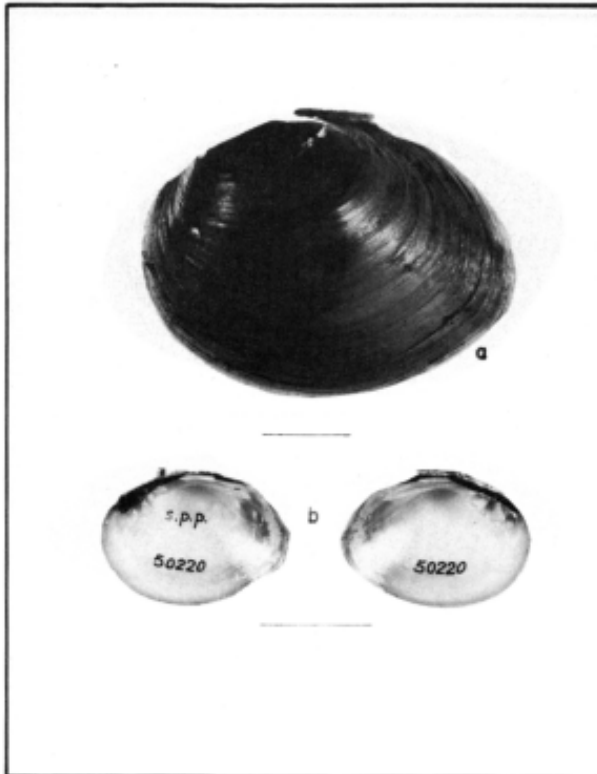


FIGURE 13. *Obovaria jacksoniana*. a=external view (scale=10 mm), b=internal view (scale=20 mm). Photograph by A. E. Spreitzer. Sipsey River at U.S. Route 82, 2.7 miles NE Elrod, Tuscaloosa Co., Alabama. Collector Leroy M. Koch; 10 October 1981. OSUM-50220.

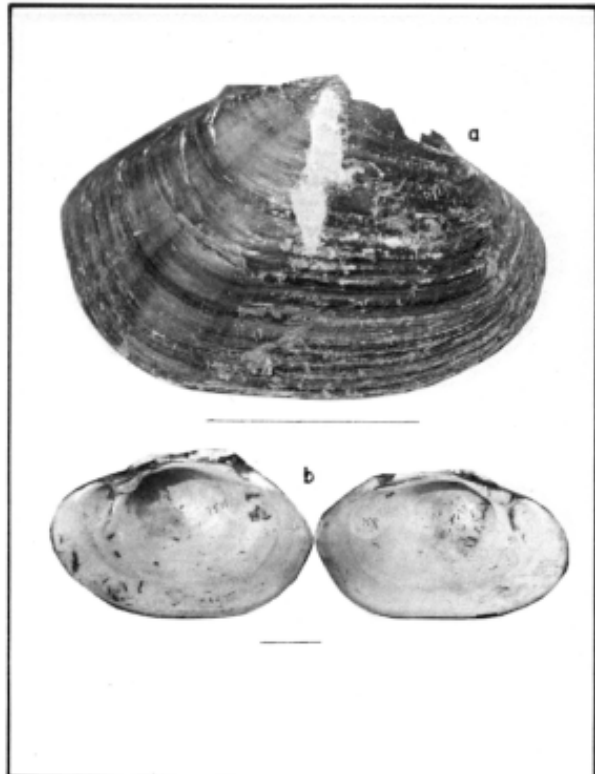


FIGURE 15. *Lampsilis ovata*. a=external view (scale=60 mm), b=internal view (scale=27 mm).

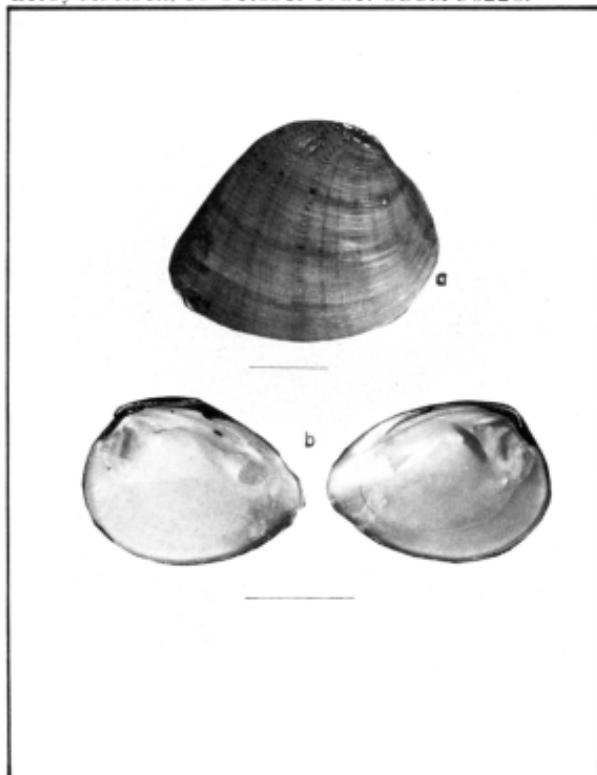


FIGURE 14. *Plagiola (Dysnomia) triquetra*. a=external view (scale=26 mm), b=internal view (scale=31 mm).

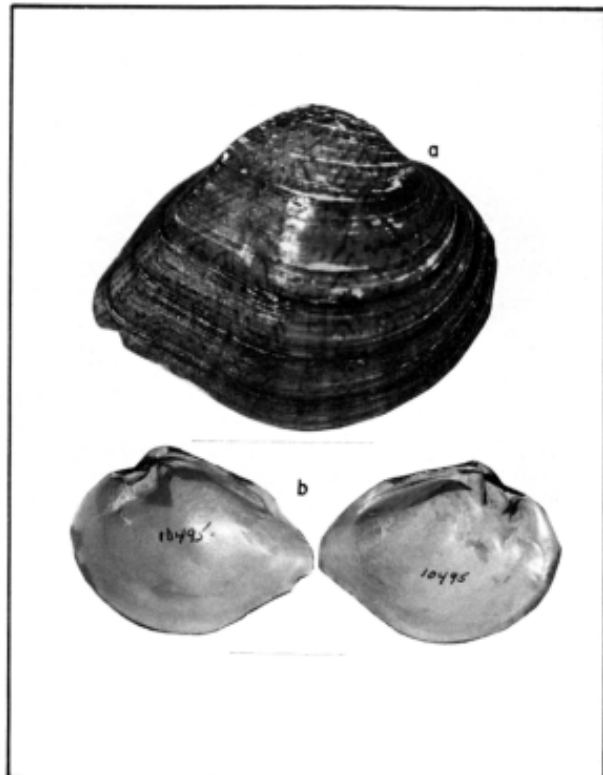


FIGURE 16. *Truncilla truncata*. a=external view (scale=28.5 mm), b=internal view (scale=30 mm).

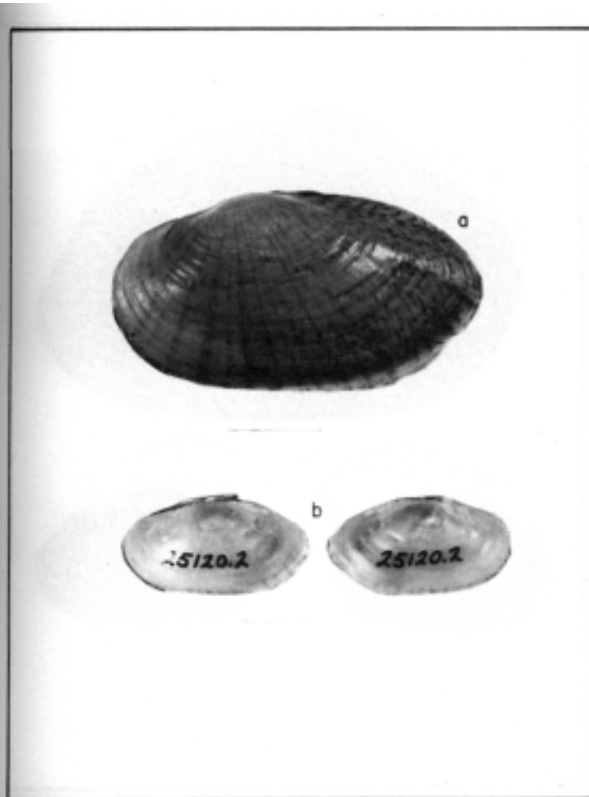


FIGURE 17. *Truncilla macrodon*. a=external view (scale=10 mm), b=internal view (scale=20 mm). Photograph by A. E. Spreitzer. Colorado River, 8 miles SE Smithville, Fayette Co., Texas. Collector Helmer Ode; 20-21 June 1970. OSUM 25120.2.



FIGURE 19. *Leptodea amphichaena*. a=external view (scale=30 mm), b=internal view (scale=30 mm). Photograph by A. E. Spreitzer. Sabine River, 10.5 miles W. Zwolie, Sabine Parish, Louisiana. Collector C. B. Stein, F. Procell and G. Procell; 28 July 1964. OSUM 20168.1.

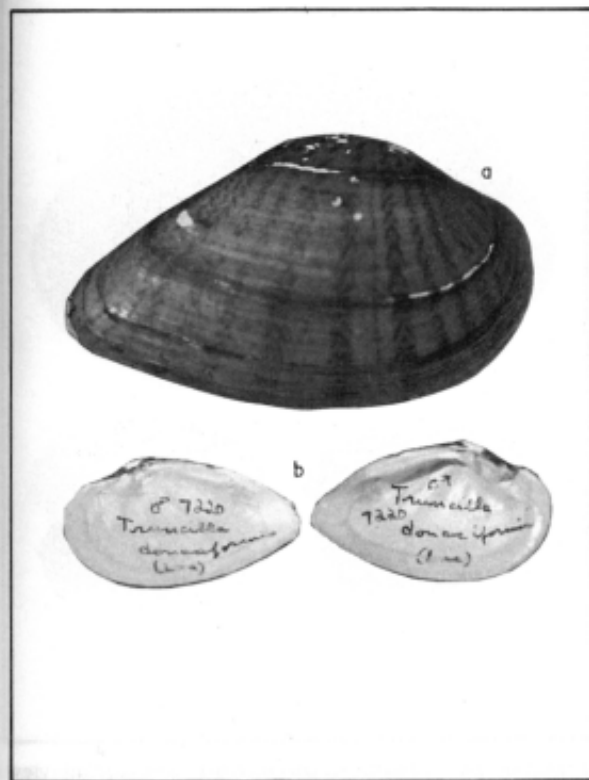


FIGURE 18. *Truncilla donaciformis*. a=external view (scale=15 mm), b=internal view (scale=18.5 mm).

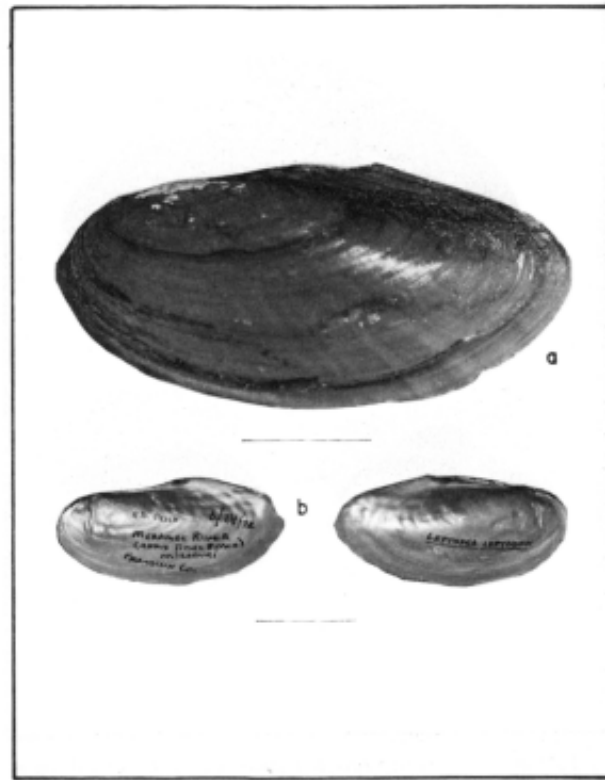


FIGURE 20. *Leptodea leptodon*. a=external view (scale=20 mm), b=internal view (scale=32.5 mm).

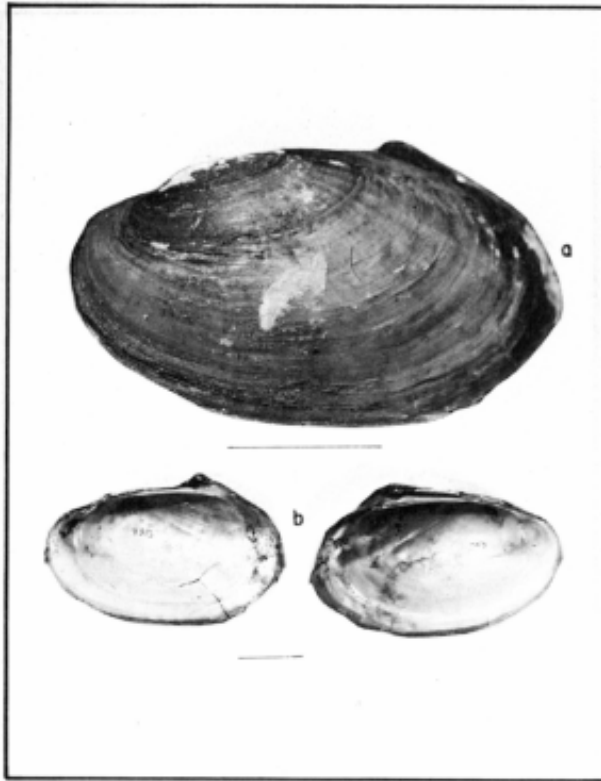


FIGURE 21. *Leptodea fragilis*. a=external view (scale=22 mm), b=internal view (scale=28.5 mm).

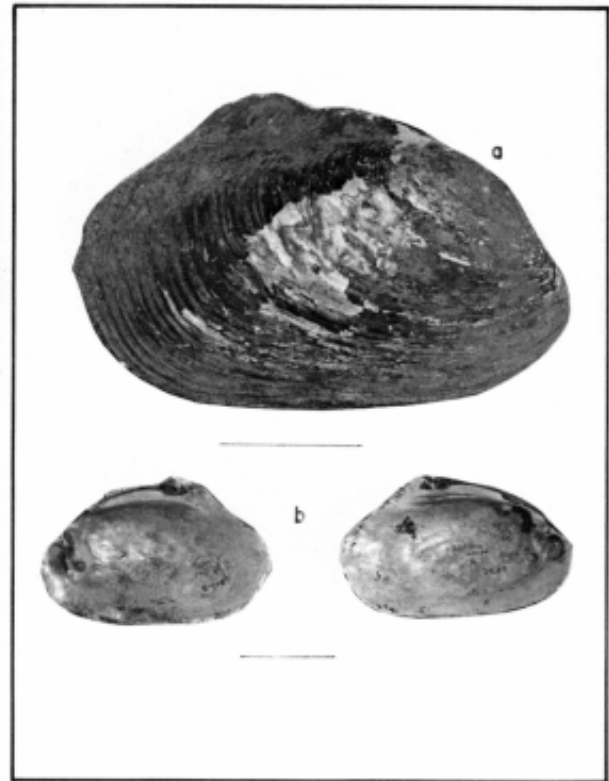


FIGURE 23. *Proptera alata*. a=external view (scale=62.5 mm), b=internal view (scale=20 mm).

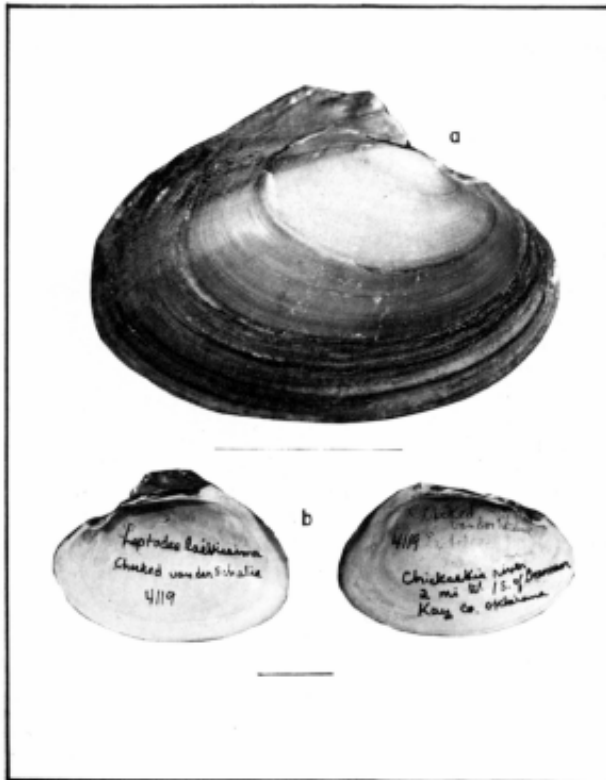


FIGURE 22. *Leptodea laevissima*. a=external view (scale=22 mm), b=internal view (scale=24 mm).

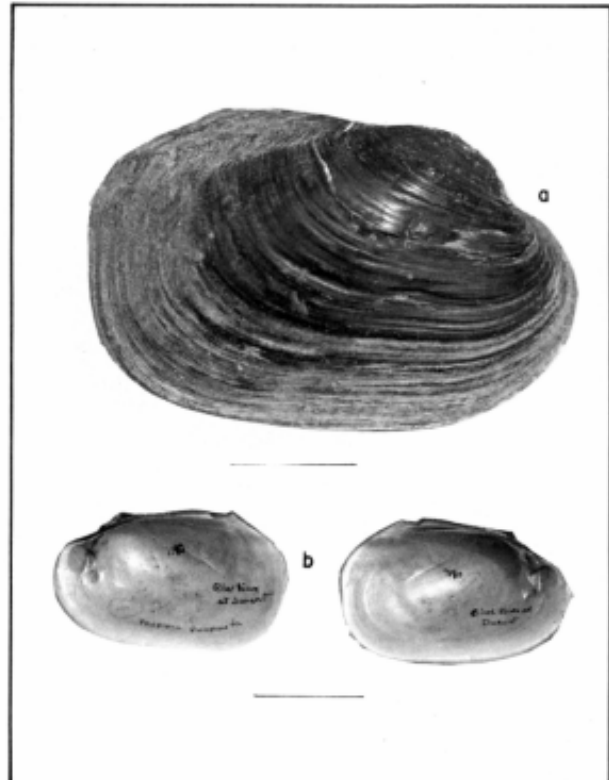


FIGURE 24. *Proptera purpurata*. a=external view (scale=23.5 mm), b=internal view (scale=41.5 mm).

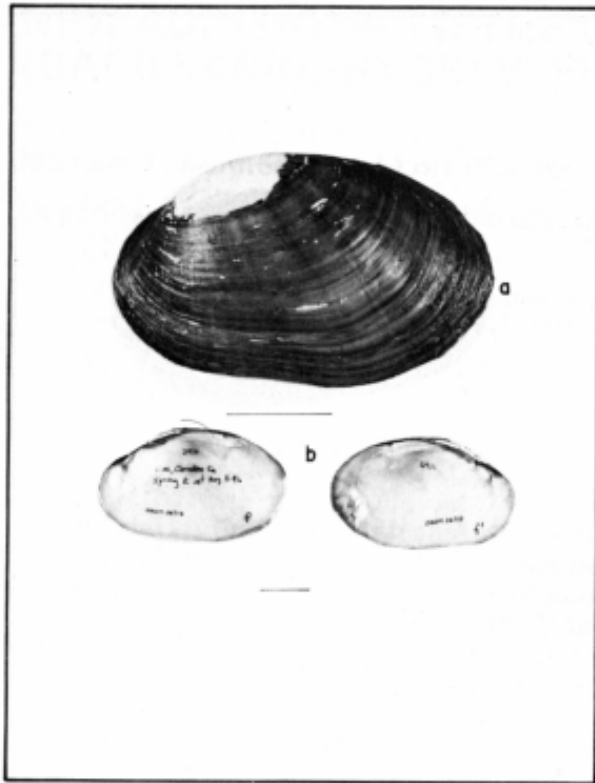


FIGURE 25. *Lampsilis rafinesqueana*. a=external view (scale=30 mm), b=internal view (scale=30 mm). Photograph by A. E. Spreitzer.

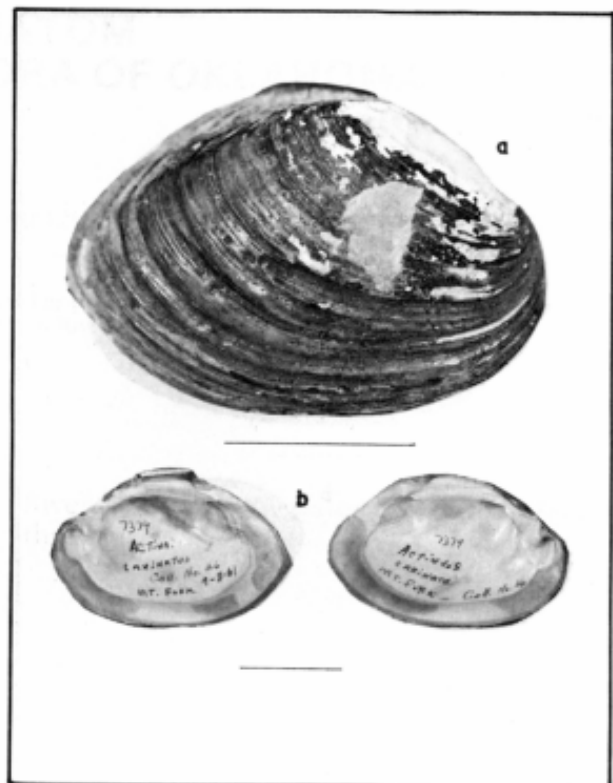


FIGURE 27. *Actinonaias ligamentina*. a=external view (scale=33 mm), b=internal view (scale=34.5 mm).

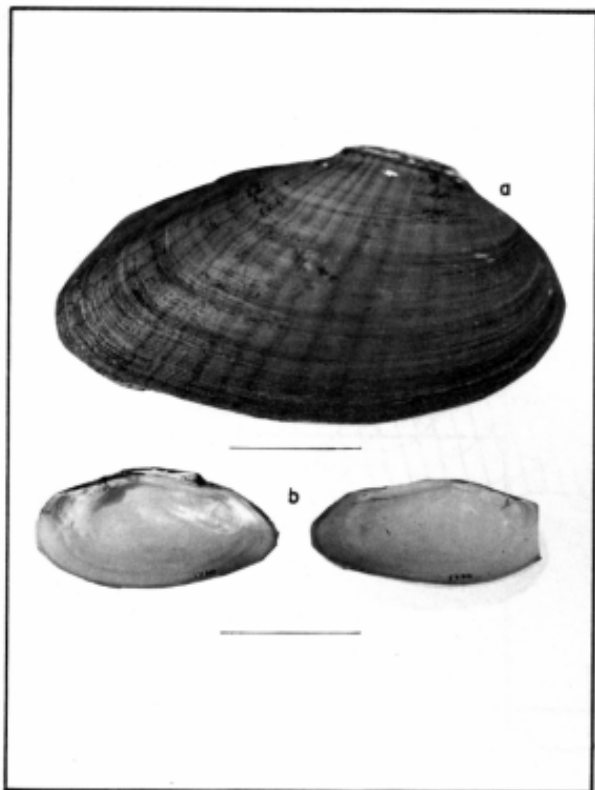


FIGURE 26. *Actinonaias ellipsiformis*. a=external view (scale=17.5 mm), b=internal view (scale=33 mm).

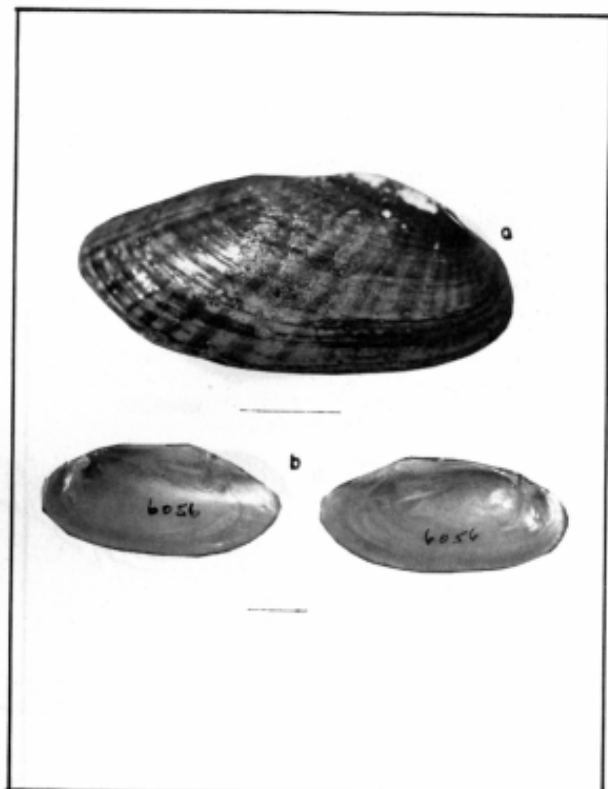


FIGURE 28. *Villosa iris*. a=external view (scale=12 mm), b=internal view (scale=12 mm).



FIGURE 29. *Villosa lienosa*. a=external view (scale=12.0 mm), b=internal view (scale=18 mm).

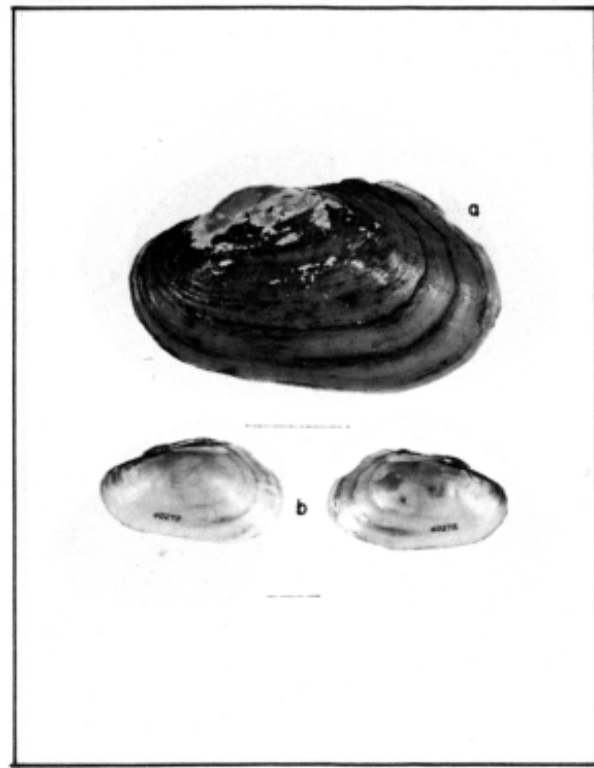


FIGURE 31. *Lampsilis powelli*. a=external view (scale=20 mm), b=internal view (scale=20 mm). Photograph by A. E. Spreitzer. South Fork of Saline River, 0.6 mile NE Nance, ASR 9, Saline Co., Arkansas. Collector H. W. Robinson; 17 April 1976. OSUM 40275.

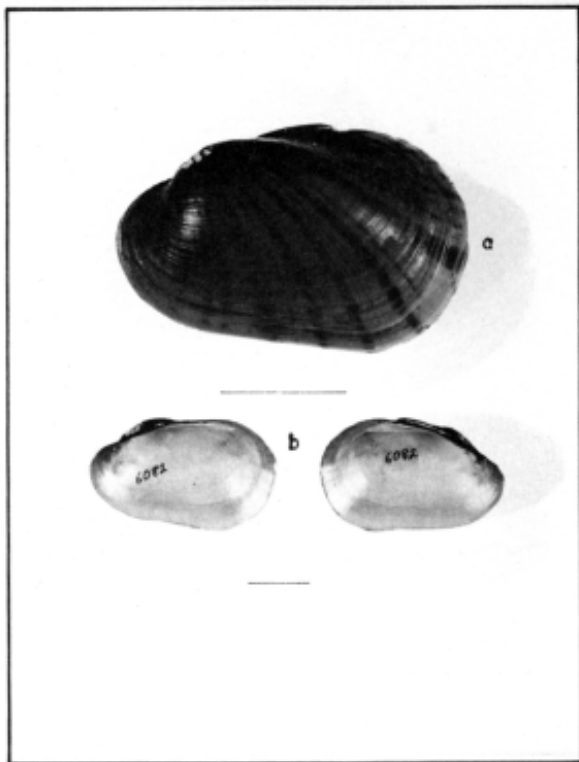


FIGURE 30. *Lampsilis hydiana*. a=external view (scale=20 mm), b=internal view (scale=20 mm). Photograph by A. E. Spreitzer. Bayou at junction of LSR 413 and 76, Baton Rouge, Louisiana. Collector F. Sogandares; 20 May 1962. OSUM 6082.

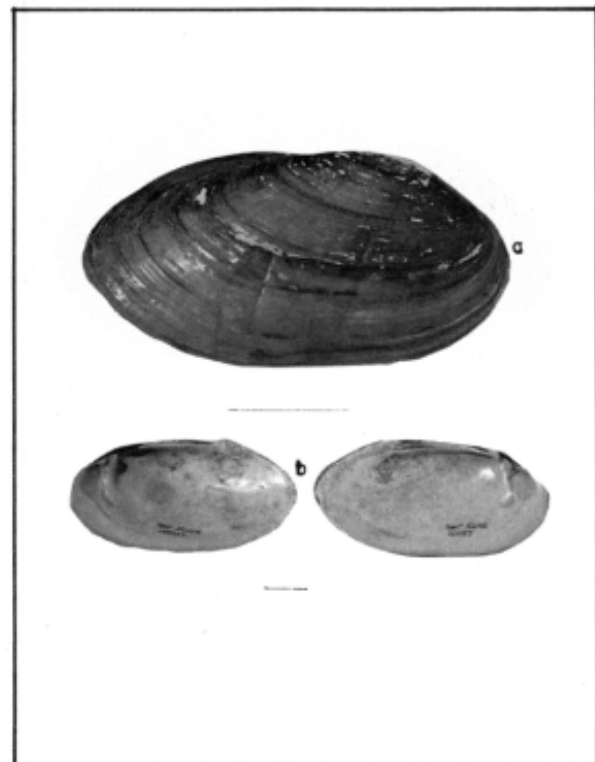


FIGURE 32. *Lampsilis radiata*. a=external view (scale=24 mm), b=internal view (scale=16 mm).