GUIDE TO THE IDENTIFICATION AND DISTRIBUTION OF FRESHWATER MUSSELS (BIVALVIA: UNIONIDAE) IN MISSISSIPPI

ROBERT L. JONES, MATTHEW D. WAGNER, WILLIAM T. SLACK, SCOTT PEYTON, AND PAUL HARTFIELD

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CHECKLIST OF FRESHWATER UNIONID MUSSELS OF MISSISSIPPI

1. *Actinonaias ligamentina* – Mucket 75
2. *Amblema plicata* – Threeridge 78
3. *Arcidens confragosus* – Rock-Pocketbook 81
4. *Cyclonaias asperata* – Alabama Orb 84
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21. *Hamiota perovalis* – Orangenacre Mucket 137
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23. *Lampsilis fasciola* – Wavyrayed Lampmussel 143
24. *Lampsilis hydiana* – Louisiana Fatmucket 146
25. *Lampsilis ornata* – Southern Pocketbook 149
26. *Lampsilis ovata* – Pocketbook 152
27. *Lampsilis siliquoidea* – Fatmucket 155
28. *Lampsilis straminea* 159
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    form *claibornensis* – Southern Fatmucket
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43. *Plethobasus cyphyus* – Sheepnose 204
44. *Pleurobema beadleianum* – Mississippi Pigtoe 207

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45. *Pleurobema curtum* – Black Clubshell 210
46. *Pleurobema decisum* – Southern Clubshell 213
47. *Pleurobema marshalli* – Flat Pigtoe 216
48. *Pleurobema perovatum* – Ovate Clubshell 219
49. *Pleurobema rubrum* – Pyramid Pigtoe 222
50. *Pleurobema taitianum* – Heavy Pigtoe 226
51. *Pleuronaia barnesiana* – Tennessee Pigtoe 229
52. *Pleuronaia dolabelloides* – Slabside Pearlymussel 232
53. *Potamilus alatus* – Pink Heelsplitter 235
54. *Potamilus capax* – Fat Pocketbook 238
55. *Potamilus inflatus* – Inflated Heelsplitter 241
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71. *Theliderma stapes* – Stirrupshell 290
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73. *Toxolasma texasiense* – Texas Lilliput 296
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75. *Truncilla donaciformis* – Fawnsfoot 302
76. *Truncilla truncata* – Deertoe 305
77. *Uniomerus declivis* – TaperedPondhorn 308
78. *Uniomerus tetralasmus* – Pondhorn 311
79. *Utterbackia imbecillis* – Paper Pondshell 314
80. *Utterbackiana hartfieldorum* – Cypress Floater 317
81. *Utterbackiana suborbiculata* – Flat Floater 320
82. *Villosa lienosa* – Little Spectaclecase 323
83. *Villosa vibex* – Southern Rainbow 326

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INTRODUCTION

Mississippi has 83 described species of freshwater mussels (family Unionidae) which are found throughout the state (Fig. 1), and perhaps one or more undescribed species as well. Jones et al. (2005) presented information on the status and distribution of freshwater mussels (sometimes called unionids or naiads) in Mississippi, but the taxonomy of this group has undergone substantial changes since then, including the resurrection of older generic names, the description of new taxa, and a re-evaluation of the status and distributions of several species. This document is both an update and an expansion of the information about freshwater mussels contained in that earlier publication. It consists of general information on the biology of freshwater mussels followed by individual accounts for each species found in the state with details on identification, life history, and distribution in Mississippi. Much of the information on freshwater mussel biology, morphology, and the economic and ecological value of unionids in this document is from a poster on freshwater mussels issued by the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) in 2010. The sections on river drainages and the conservation status of mussels in Mississippi are in part from the 2005 publication. Much of the information in the species accounts is based on data from specimens in the MDWFP collection housed in the Museum of Natural Science (MMNS) in Jackson, Mississippi. Additional data is based on records compiled by the United States Army Engineer Research and Development Center Environmental Laboratory EEA (USACE) in Vicksburg and from other sources as indicated.

There are a variety of publications dealing with the mussel faunas of various states, including Mississippi's bordering states of Louisiana (Vidrine, 1993), Tennessee (Parmalee and Bogan, 1998), and Alabama (Williams et al., 2008). Several of these publications deal with subjects that we do not cover here, including descriptions of the internal anatomy of various species, descriptions of larval mussels, and partial to relatively complete synonymies. We would direct those interested in these topics to the publications listed above, particularly to Williams et al. (2008), which includes many of the freshwater mussels that occur in Mississippi.

DRAINAGE BASINS AND RIVERS OF MISSISSIPPI - Mississippi has 82 counties (Fig. 2) and a number of relatively large rivers within its borders (Fig. 3). There are two major drainage basins in Mississippi, the Mississippi River Basin and the Gulf of Mexico Basin. These basins can be further subdivided into drainages (Fig. 4), each with its own mussel fauna (Appendix 1). Mississippi's freshwater mussels are found throughout the state, occurring primarily in rivers and streams, although a few species can inhabit lakes or ponds.

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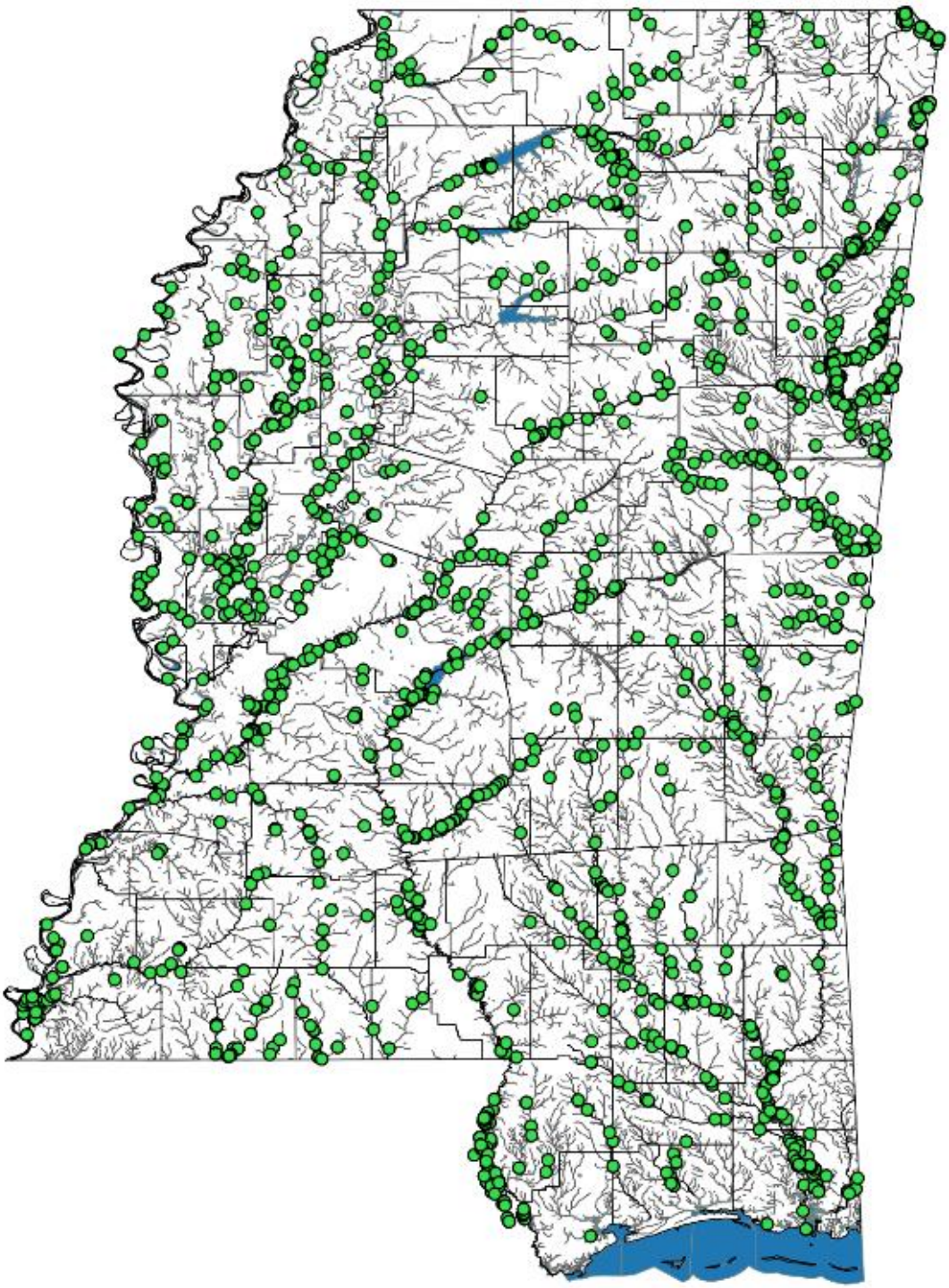

Figure 1. Locations in Mississippi where freshwater mussels have been found and from which specimens have been collected and deposited in the MDWFP collection.

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The Mississippi River Basin includes five drainages:

Mississippi River North (Fig. 5) - This drainage, approximately 4895 km^2 in area, includes the Mississippi River north of the mouth of the Yazoo River, the Wolf River, the Hatchie River, and the Tuscumbia River, among others, in north central Mississippi. It has 30 species of freshwater mussels. All of the larger streams in this drainage system except the Wolf River have been severely altered by channelization, which makes streams unsuitable for most mussel species.

Mississippi River South (Fig. 6) - This drainage, approximately 9573 km^2 in area, includes the Mississippi River south of the mouth of the Yazoo River, Bayou Pierre, the Homochitto River, and the Buffalo River in southwestern Mississippi. There are 38 species of freshwater mussels known from this drainage system.

Big Black River (Fig. 9) - The Big Black River drainage, which is approximately 8692 km^2 in area, has 38 species of freshwater mussels. This river has small populations of the state-listed *Pleurobema rubrum* and the federally listed *Theliderma cylindrica*, but both appear to be declining. It also has archaeological remains of *Plethobasus cyphyus* and *Cyprogenia aberti*, although none are known to occur there now.

Yazoo River (Fig.11) - The Yazoo River drainage (36,641 km^2) includes the Sunflower River, Tallahatchie River, Yocona River, Coldwater River, and Yalobusha River, and drains much of the Delta Region and the adjacent hills. This drainage has the second largest number of mussel species (44) in the state. Most of the major rivers in this drainage have been altered by channelization and construction of headwater dams. The most diverse remaining fauna is in the Sunflower River, which has the only known extant population in Mississippi and the southern-most population known nationally of the federally and state listed *Plethobasus cyphyus*. It also has the only known population of *Actinonaias ligamentina* in the state. Other species of significance in the Sunflower River include the federally and state listed *Theliderma cylindrica* and large numbers of *Pleurobema rubrum*. The Sunflower River once supported populations of *Cyprogenia aberti* as indicated by the presence of its shells in archaeological middens and weathered dead shells in a few mussel beds, but no existing populations of the Western Fanshell are known from this drainage.

Tennessee River (Fig. 12) - The major streams within the Tennessee River drainage (1077 km^2) in Mississippi are Bear and Cedar creeks. The northern border of Mississippi is bounded by Pickwick Lake, which was once the main channel of the Tennessee River and which now has a variety of lake-adapted species. Headwater dams in Alabama have altered both Bear Creek and Cedar Creek, and Bear Creek has been partly channelized in Mississippi. Thirty-four species are known from the Tennessee drainage in Mississippi, including the federally listed *Epioblasma brevidens, E. triquetra, Pleuronaia dolabelloides,* and *Theliderma cylindrica*.

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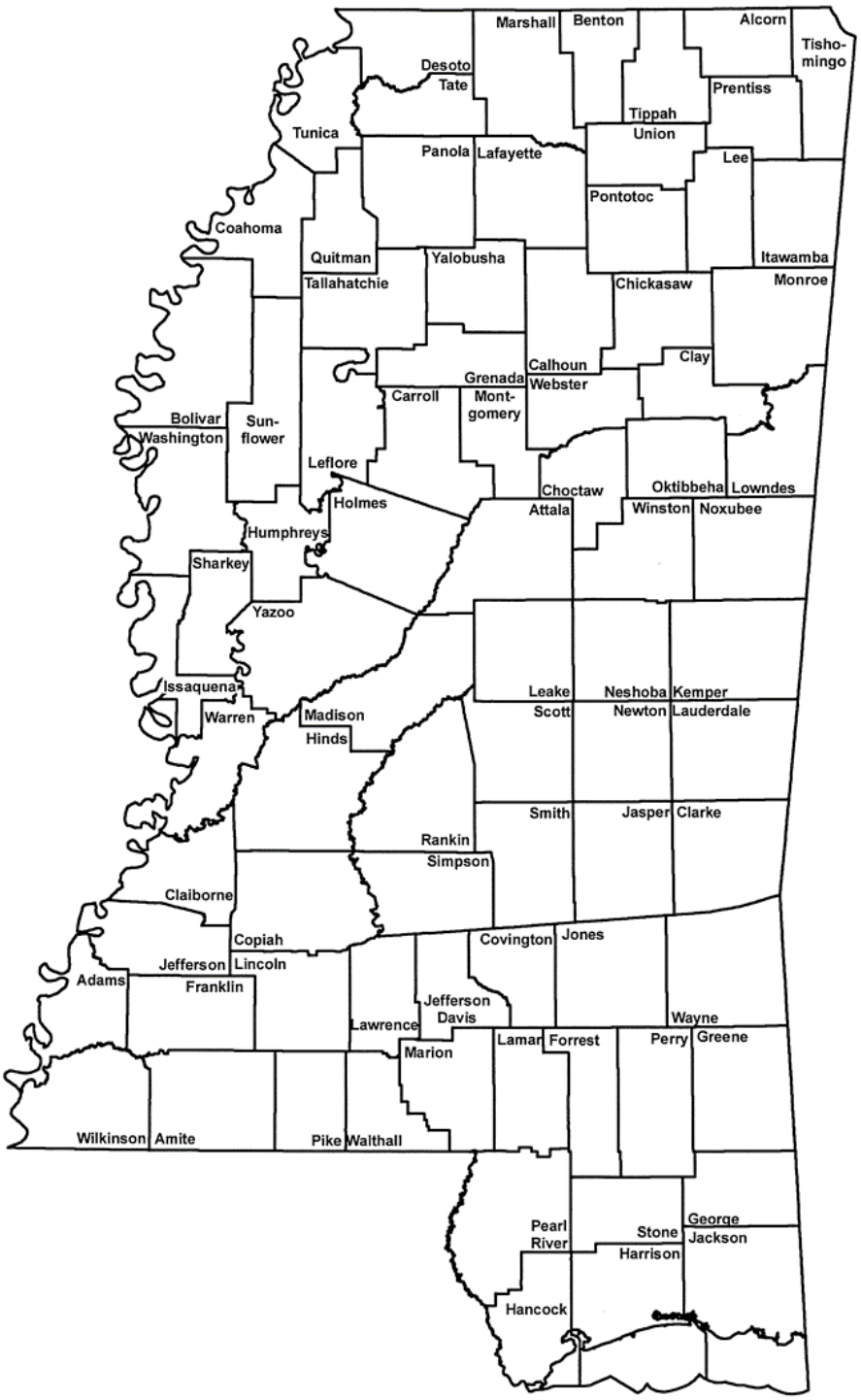

Figure 2. Counties of Mississippi (Mississippi Automated Resource Information System: https://www.maris.state.ms.us/misc_maps/state_bw.pdf)

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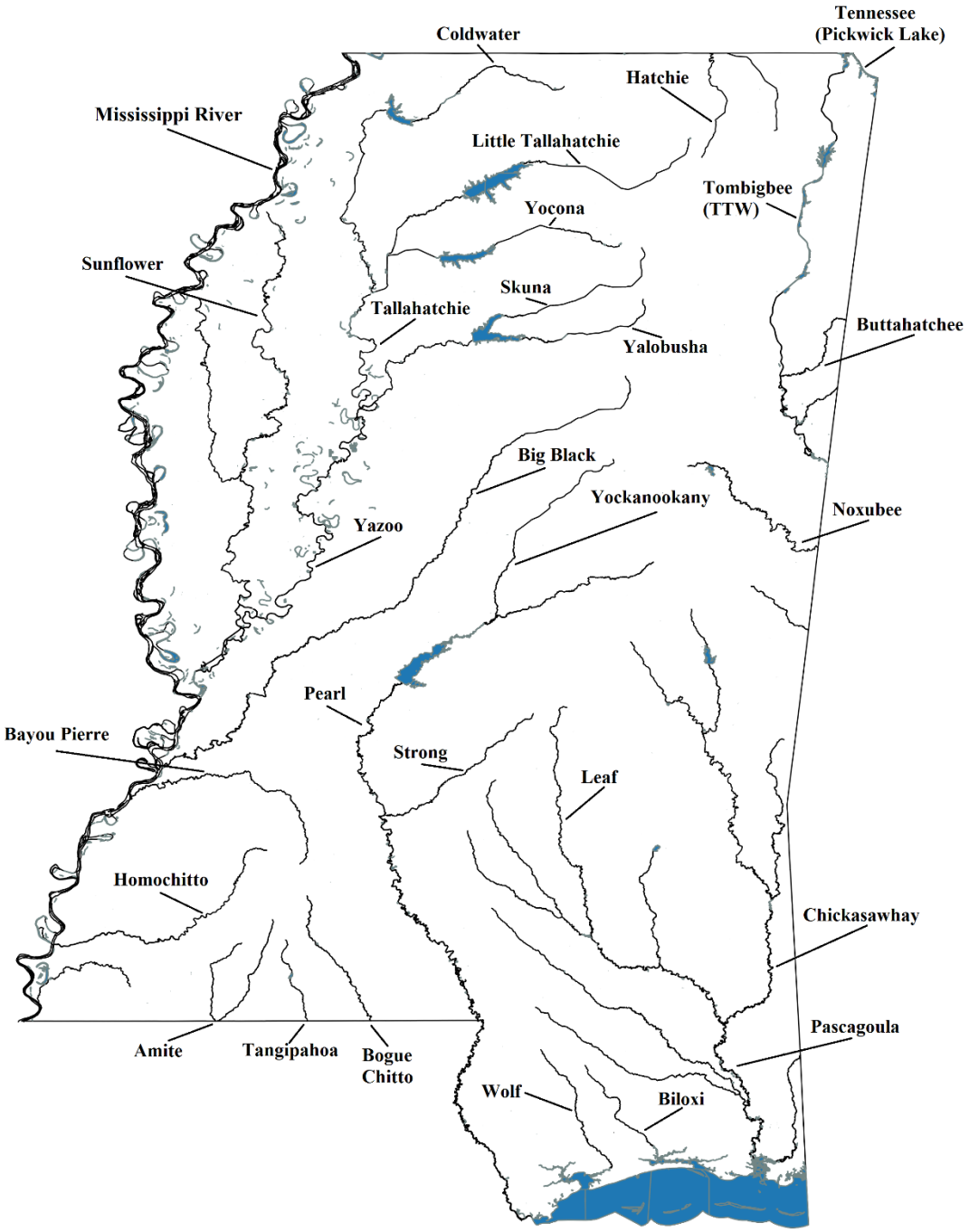

Figure 3. Larger rivers of Mississippi. Major reservoirs are Arkabutla on the Coldwater River, Sardis on the Little Tallahatchie River, Enid on the Yocona River, Grenada on the Yalobusha and Skuna rivers, and Ross Barnett on the Pearl River. TTW is the Tennessee-Tombigbee Waterway.

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The Gulf of Mexico Basin contains the following drainages:

Coastal Rivers (Fig. 13) - The coastal rivers drainage includes the Wolf River, Tchoutacabouffa River, Biloxi River, and Jourdan River. These rivers drain about 4206 km^2 in south Mississippi between the Pearl River to the west and Pascagoula River to the east. All are relatively small rivers that travel only a short distance from their headwaters to the Gulf of Mexico. Mississippi's Coastal Rivers drainage appears to support very few mussels, as only eight species are known from this drainage and none are restricted to it. This may be due in part to habitat, composed mostly of shifting sand, which is usually not suitable for mussels, but may also result from the fact that these streams are probably one of the least sampled regions in the state

Pearl River (Fig. 14) - The Pearl River drainage includes the Pearl River, Bogue Chitto River, Strong River, Fair River, and Yockanookany River. The Pearl River drainage covers approximately 20,036 km^2 in the central and south central part of state. There are 39 species of freshwater mussels known from the Pearl River drainage. As with some of our other drainages, there are no unique mussel species found only in the Pearl River drainage. Channelization has destroyed mussel habitat in part of the Pearl, and much of the riverine habitat in the vicinity of Jackson has been converted to lake conditions by Ross Barnett Reservoir. *Potamilus inflatus*, which is a federally listed species, occurs in the lower part of the Pearl River in Louisiana, and was known historically from near Jackson.

Pascagoula River (Fig. 15) - The Pascagoula River drainage includes the Pascagoula River and its major tributaries the Chickasawhay River, Leaf River, and Escatawpa River. This drainage includes about 22,471 km^2 in the southeastern part of the state. The Pascagoula drainage has 33 species of freshwater mussels. One of the more interesting aspects of the mussel fauna of the Pascagoula drainage is the absence of *Obliquaria reflexa*, which is a relatively common species found in both the Tombigbee drainage to the east and the Pearl to the west.

Tombigbee River (Fig. 16) - The Tombigbee River drainage encompasses about 15,600 km^2 in northeast and eastern Mississippi. Major rivers of this system are the Buttahatchee River, Noxubee River, Sucarnoochee River, Town Creek (West Fork Tombigbee River), Bull Mountain Creek, Tibbee Creek, and Luxapallila Creek. The Tombigbee River drainage has the largest number of mussel species (51) in Mississippi. Mussels found (or formerly found) in the Tombigbee River watershed in Mississippi include the federally listed *Theliderma stapes*, *Epioblasma penita*, *Hamiota perovalis*, *Medionidus acutissimus*, *Pleurobema curtum*, *P. decisum*, *P. marshalli*, *P. perovatum*, and *P. taitianum*. Of these, *Theliderma stapes*, *Pleurobema curtum*, *P. marshalli* and *P. taitianum* are no longer found within the state.

Lake Pontchartrain (Fig. 17) - This drainage covers a small section (2334 km^2) of the southwestern portion of state and includes the Amite River, Tickfaw River, and Tangipahoa River. There are 18 species of freshwater naiads known from the Mississippi portions of these streams. There are no unique species in the Lake Pontchartrain drainage, as all of the mussels found there are also present in other drainages within the state. The lower Amite River in Louisiana has a population of the federally listed *Potamilus inflatus*, but that species has not yet been found in the Mississippi portion of the Amite River.

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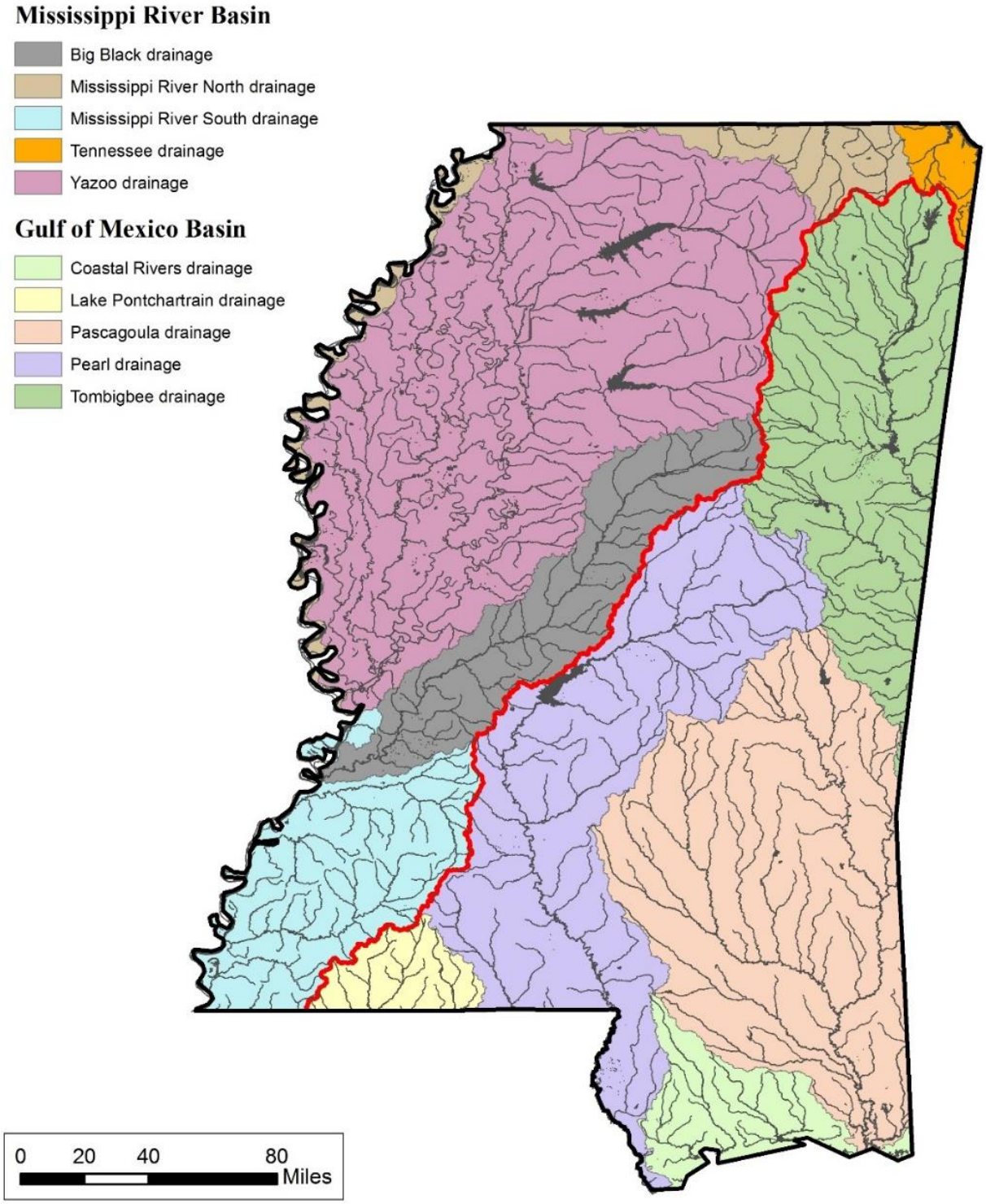

Figure 4. Drainages of Mississippi. The Gulf of Mexico Basin and the Mississippi River Basin and their respective drainages are separated by the red line

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Figure 5. Mississippi River at Catfish Point, Bolivar County, Mississippi River North drainage.

MUSSEL MORPHOLOGY - The shell of a freshwater mussel has right and left sides (valves) which are held together by a ligament. Each valve is made up of at least three distinct layers: the outer epidermis or periostracum, the smooth inner mother-of-pearl layer or the nacre, and a thin layer of calcite between the two. The fleshy part of a freshwater mussel contains all of the organs of digestion, respiration, circulation, excretion, and reproduction, along with the muscles and the nervous system (Fig. 7). The mantle is a thin layer of tissue just inside the shell which contains the sensory organs, aids in respiration, feeding, and reproduction, and is responsible for secreting the shell (Fig. 8). The foot is a muscular organ that the mussel uses in movement. The foot is extruded from between the two valves and extended into the substrate, which helps the mussel either anchor itself to the bottom or to move from one place to another. The gills lie just inside the mantle on both sides of the foot and function in both respiration and reproduction. There are also two important structures on the posterior end of the mussel, the incurrent and excurrent siphons. These structures bring water into and out of the mantle cavity within the shell.

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Figure 6. Old channel of the Homochitto River below Lake Mary, Wilkinson County, Mississippi River South drainage.

FEEDING - Unionids are filter-feeders, bringing water with food particles into their mantle cavities through their incurrent siphons. The food particles are separated from the water within the gills and transported to the mouth and digestive system. Food consists primarily of algae, protozoans, diatoms, plant and animal debris, mold spores, and other particulate organic matter. After both food particles and oxygen are extracted within the gills, the water is passed out of the mantle cavity via the excurrent siphon.
REPRODUCTION - The sexes are usually separate in freshwater mussels, although there is evidence that at least a few species or a few individuals within a species may be hermaphroditic. Male mussels release sperm into the water from their excurrent siphons. Female mussels pick up the sperm by way of their incurrent siphons. Female mussels produce eggs in their ovaries, and these eggs are released into the mantle cavity, eventually winding up in specialized areas on the gills called brood sacs or marsupia (Fig. 8). Females of several species of mussels have a swollen posterior of the shell, which accommodate the marsupia and are referred to as marsupial swellings. Fertilization apparently takes place within the marsupia.

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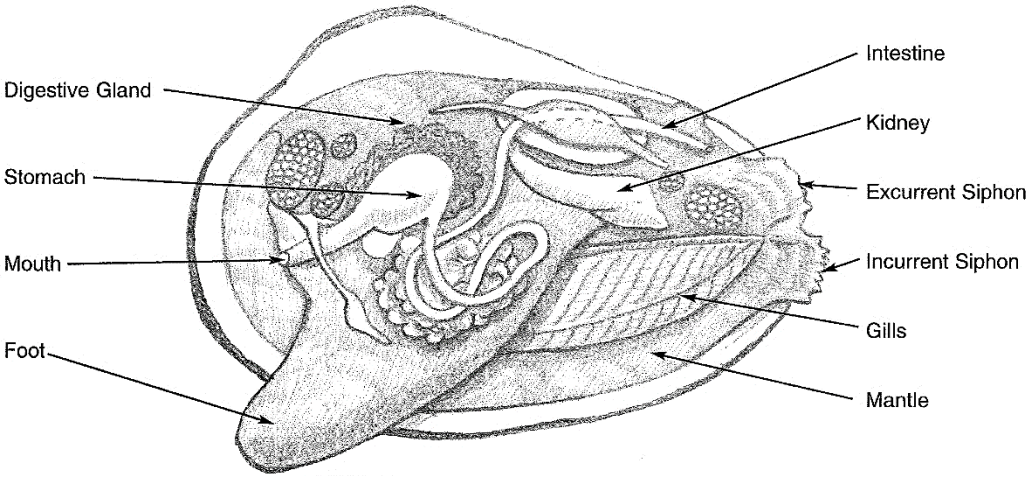

Figure 7. Internal anatomy of a freshwater mussel.

The fertilized eggs develop into small larvae called glochidia, which are in a relatively early stage of embryonic development. Glochidia come in a variety of shapes but are usually round, oval, or triangular. Some glochidia have hooks but others do not. The glochidia are released from the marsupia and discharged through the excurrent siphon of the female mussel. The glochidia must attach themselves to a fish (although some mussel species use amphibians as hosts) and become parasitic in order to complete their development. If they do not attach to a host, the glochidia die. Attachment to a fish is usually to either the gills or fins. The glochidia may stay attached to the host from one to six weeks. Although the glochidia are parasites, they almost never harm their hosts. The glochidia complete their development, undergo metamorphosis, and become tiny versions of adult mussels. They then drop off the host to the substrate to start their lives as freshwater mussels (Fig. 10).

There are several difficulties in having a reproductive cycle like that of a freshwater mussel. First, for most mussels, not just any species of fish is suitable as a host for glochidia. Specific species of mussels require specific species of fish for hosts, and if these fish are not present in the immediate area, the glochidia have no place to attach and complete their development. Secondly, even if the proper fish hosts are present, if they have been previously parasitized those fish may develop a resistance to the glochidia. Glochidia attempting to attach to the resistant fish do not survive. Finally, glochidia are not able to swim but can only drift with the currents.

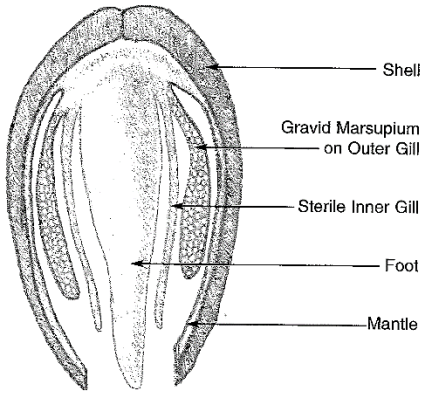

Figure 8. Cross section of a freshwater mussel.

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Figure 9. Big Black River near Hwy 16, Madison County, Big Black River drainage.

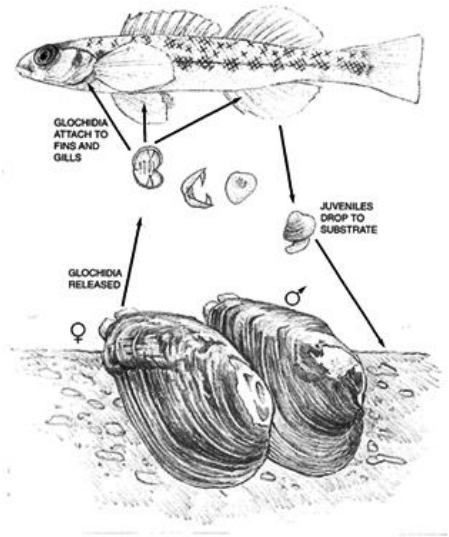

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Figure 10. Reproductive cycle of a freshwater mussel.

If fish hosts are absent or not close enough to the female mussels for glochidia release and attachment, successful reproduction may be difficult. Some mussels therefore employ a variety of strategies to increase the chances that their glochidia will have an appropriate host. Some have modified mantle tissue that resembles fish or aquatic insects. The mussel moves this modified mantle tissue in the water to attract fish which are lured in by the prospect of obtaining a meal. However, as the fish bites at the modified mantle tissue, the female mussel ejects a concentrated mass of glochidia into the fish's mouth, which then attach themselves to the fish. Other species of mussels produce conglutinates, which

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Figure 11. Tallahatchie River near Money, Leflore County, Yazoo River drainage.

are packets of glochidia massed together to resemble fish or aquatic insects. These conglutinates are expelled from the female mussel through the excurrent siphon. They usually trail a sticky thread that becomes attached to rocks or debris. The conglutinates are then moved by water currents and resemble live fish or insects. Fish observe the conglutinates and, believing that they are prey, attempt to eat them. When the conglutinates are bitten, they rupture, leaving the fish with a mouth and gills full of glochidia. A few species of mussels carry this behavior to an extreme, producing what is known as a super conglutinate. This is a structure made up of a long clear gelatinous tube with all of the mussel's glochidia packed in the end into a structure that resembles a fish. The entire complex is extruded from the female mussel and trails downstream of her excurrent siphon. The super conglutinate is buffeted by currents, and its movements resemble those of a small fish swimming in the stream. Larger fish see this super conglutinate and attack it, thinking that they have located easy prey. Instead, they become a host for larval mussels. These are just a few of the ways that female mussels get their glochidia attached to the proper hosts. Although we know some aspects of reproduction and the fish hosts for some mussel species, much remains to be learned about reproduction in freshwater unionids.

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Figure 12. Bear Creek, Tishomingo County, Tennessee River drainage.

ECONOMIC AND ECOLOGICAL USES OF FRESHWATER MUSSELS - Freshwater unionids are preyed upon by a variety of species. Muskrats often eat large quantities of small species and small individuals of larger species. These mammals have a habit of going to the same location, usually at the mouth of their bank den, to consume any mussels they have found. The mussel shells are discarded after the muskrat has eaten the soft parts, resulting in a pile of mussel shells, often referred to as a muskrat midden. These shell piles can number several hundred individuals. Raccoons and otters, among other mammals, also eat freshwater mussels. Females of some species of turtles, such as the Alabama, Pearl, and Pascagoula map turtles, have specialized head and jaw structures, which enable them to crush mussel shells. Some fish, such as the freshwater drum and shellcracker, also consume mollusks, including small species of freshwater mussels.

Man has also used freshwater mussels extensively throughout history. Native Americans ate freshwater mussels, although there is some debate about whether they were preferred food items or eaten only by necessity. Native Americans harvested mussels at particular sites along rivers and streams over many generations, discarding the shells at the harvest site. These discarded shell piles, which are also referred to as shell middens, often became very large over time. Native American shell middens are widespread across Mississippi and eastern North America, and provide a glimpse of what local mussel faunas were like thousands of years ago.

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Figure 13. Tchoutacabouffa River near White Plains, Jackson County, Coastal Rivers drainage.

Native Americans also used the shells of freshwater mussels as ornaments or as utensils. Larger shells were made into tools, such as hoe blades and hide scrapers. Native Americans, although making only limited use of freshwater mussel shell, appeared to highly value freshwater pearls as decorative items. Europeans, after settling eastern North America, used and continue to use freshwater mussels for a variety of purposes. Taking mussels for freshwater pearls was probably one of the first uses of unionids by Europeans.

The first major industry using freshwater mussel shell was the button industry, which began in the late 1800's and continued through the early 1960's. This industry turned freshwater mussel shells into "pearl buttons" which were used on a wide variety of clothing throughout the early part of the 20th Century. Based on information in a report by F.A. Cooke, first director of the Mississippi Game and Fish Museum, at least 19 people were collecting mussel shell for the pearl button industry from four locations in the Pearl River, Pearl River County, in 1937. At least one of these locations was said to produce one ton of shell every four days, but the site was workable only three months each year. The pearl button industry began to decline upon the introduction of plastic buttons after World War II, and the last pearl button factory closed in the 1960's.

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Figure 14. Pearl River near Columbia, Marion County, Pearl River drainage.

More recently, freshwater unionid shells have been used extensively in the cultured pearl industry. A natural pearl results when an object, which might be either a small piece of tissue or a foreign object, becomes embedded in the mantle tissue of a bivalve. This object stimulates the bivalve to produce a layer of nacre around it, thus forming a natural pearl. A cultured pearl results when an object is intentionally implanted into the mantle of a bivalve, stimulating the production of a pearl. The pearl has thus been artificially produced rather than produced naturally, and is referred to as a cultured pearl. The foreign object used as the starting point for a cultured pearl is referred to as the nucleus. The center of the cultured pearl industry is in Southeast Asia, where the Japanese first developed the art of producing cultured pearls. The best material to use as a nucleus, however, is a bead formed from the shell of a North American unionid. These shells are harvested from North American rivers and shipped to the Asian cultured pearl industry. Beads are cut from these mussel shells, implanted into pearl oysters, and after a few months, cultured pearls are harvested from the oysters. Cultured pearls are therefore primarily North American freshwater mussel shell surrounded by a thin layer of nacre produced by the pearl oyster. The cultured pearl industry uses thousands of tons of freshwater mussel shells annually.

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Figure 15. Chickasawhay River near Waynesboro, Wayne County, Pascagoula River drainage.

CONSERVATION STATUS OF FRESHWATER MUSSELS IN MISSISSIPPI - Approximately 26% of Mississippi's mussel species are listed as threatened or endangered by either the U.S. Fish and Wildlife Service (USFWS) or the MDWFP (Appendix 1). The Tombigbee River drainage has the highest percentage of listed species (22% of its fauna), followed closely by the Tennessee River drainage (18%) and the Yazoo River drainage (11%). The major factor responsible for the imperilment of freshwater unionids today is the destruction and alteration of mussel habitats. Alteration of rivers and streams through dam construction and channelization changes stable riverine conditions to lake or unstable drainage ditch conditions. Some species of mussels can adapt to lakes, but many cannot, and are lost from the fauna. Almost no species of mussel can adapt to the constantly shifting substrates of a channelized streambed. Improper forestry, agricultural, or road construction practices can result in erosion, which clogs rivers and streams with thick layers of silt. Silt can kill small mussels and prevent feeding in larger individuals, and may prevent detection of mussel "lures" by fish hosts. The latter may result in decreased production of juvenile mussels and a decline in the population over time.

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Figure 16. East Fork Tombigbee River, Itawamba County, Tombigbee River drainage.

Another factor detrimental to mussels in Mississippi is a type of streambed erosion called headcutting (Hartfield, 1993). This occurs when some alteration, such as channel modifications, in-stream gravel mining, or some other activity that drastically alters the stream bottom, occurs at a downstream location in a creek or river. This destabilization sets off waves of erosion, which move in an upstream direction as the stream attempts to regain bed stability. These waves of erosion, called headcuts, result in collapsing stream banks and loose, shifting, and unstable streambeds, which are highly detrimental to mussel populations. Thus, even though a particular section of a river or stream may not have been directly altered, downstream events that result in headcutting may destroy that section's mussel fauna. Another factor that may result in the decline of certain species of mussels is the loss of its fish hosts. If a particular species of mussel depends exclusively on one or two species of fish as hosts for its glochidia, and if that fish is lost due to, for example, water pollution, then the mussel will not be able to complete its life cycle and will die out.

Mississippi has several statutes and regulations that are concerned with freshwater mussels. Sections 49-9-1 through 49-9-17, Mississippi Code of 1972, specifically deals with all species of freshwater mussels in the state. Section 49-9-3 states that all freshwater mussels are the property of the State of Mississippi. Section 49-9-5 says in part that "It is unlawful for any person to take, catch or kill mussels by means of any kind

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Figure 17. Tangipahoa River near Osyka, Pike County, Lake Pontchartrain drainage.

of apparatus or in any manner whatsoever in any of the fresh waters of this state without first having secured a license or permit issued in accordance with this chapter." There are also several regulations issued by MDWFP that deal with mussels. One of these lists all mussels in Mississippi that are classified as endangered by the state, and further states that "It shall be unlawful for any person to take, possess, transport, export, process, sell or offer for sale or shipment, and for any common or contract carrier to knowingly transport or receive for shipment any species" on the Mississippi Endangered Species list. Another MDWFP regulation states "Be it ordered that all waters in the State of Mississippi are closed to commercial harvest of mussels." These statutes and regulations prohibit the take or killing of any freshwater mussel in the State of Mississippi.

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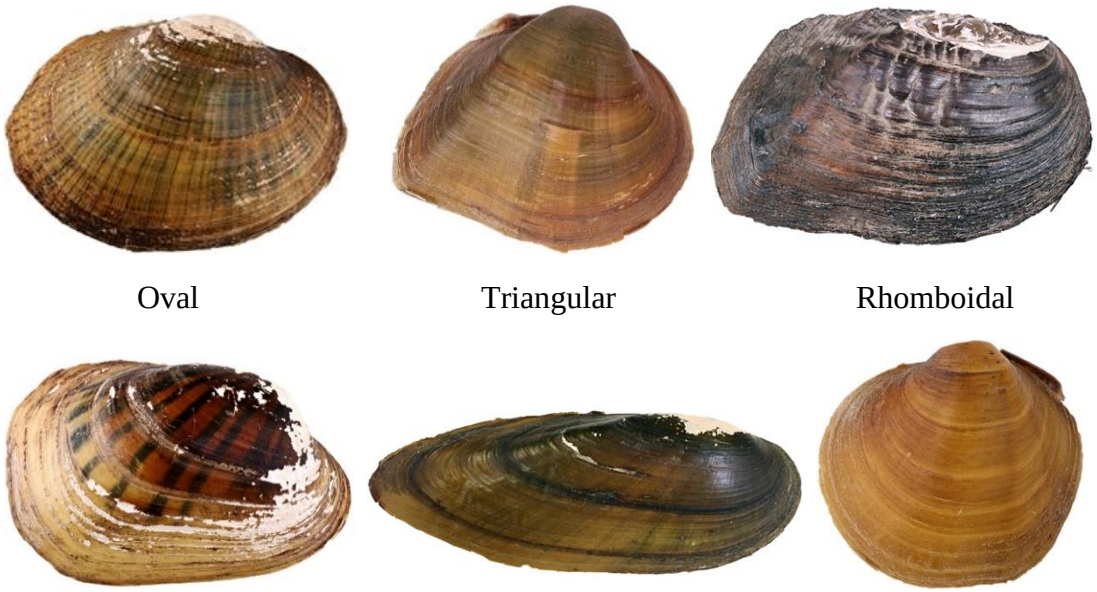
MUSSEL IDENTIFICATION

Mussel shells come in a variety of shapes. The shape of a shell is related in part to the location of its umbo, a raised area along the dorsal edge. Shell shapes have been described using many different terms, but here we are using only six (Fig. 18).



Oval Triangular Rhomboidal

Quadrate Elliptical Round

Figure 18. Shell shapes of freshwater mussels. Definitions are: *Oval*: Length noticeably greater than height, ratio of length to height approximately 1.3 -1.6. Slope from the umbo to the anterior and posterior ends of the shell usually smooth and gradual. *Triangular*: Length and height of the shell nearly equal, umbo usually located at the mid-point of the dorsal surface of the shell, slope from the umbo to the anterior and posterior end of the shell relatively steep, outline of shell roughly triangular. *Rhomboidal*: More or less rectangular with opposite sides roughly equal. *Quadrate*: Shell round to oval but posterior end truncate and enlarged relative to the anterior end. *Elliptical*: Length approximately twice or more the height of the shell. *Round:* Length and height nearly equal, umbo located at approximately the mid-point of the dorsal surface of the shell.

Identification of a mussel requires the ability to differentiate the anterior end of the shell from the posterior end. In general, the anterior of the shell is the end which is closest to the umbo, and the posterior is the end farthest from the umbo. Mussels in a natural position have been described as "standing on their heads" as they normally have the anterior end embedded in the substrate and the posterior end at the surface.

The exterior of the valves may be perfectly smooth or have a variety of surface structures, and may be marked or unmarked (Fig. 19). The color and markings of the periostracum and the structural ornamentation on the valves are significant diagnostic

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characters useful in species identifications. The exterior of the shell also has other structures that can be important in identification. Some shells have expanded edges dorsally, referred to as “wings”, which can be anterior or posterior to the umbo (Fig. 20).

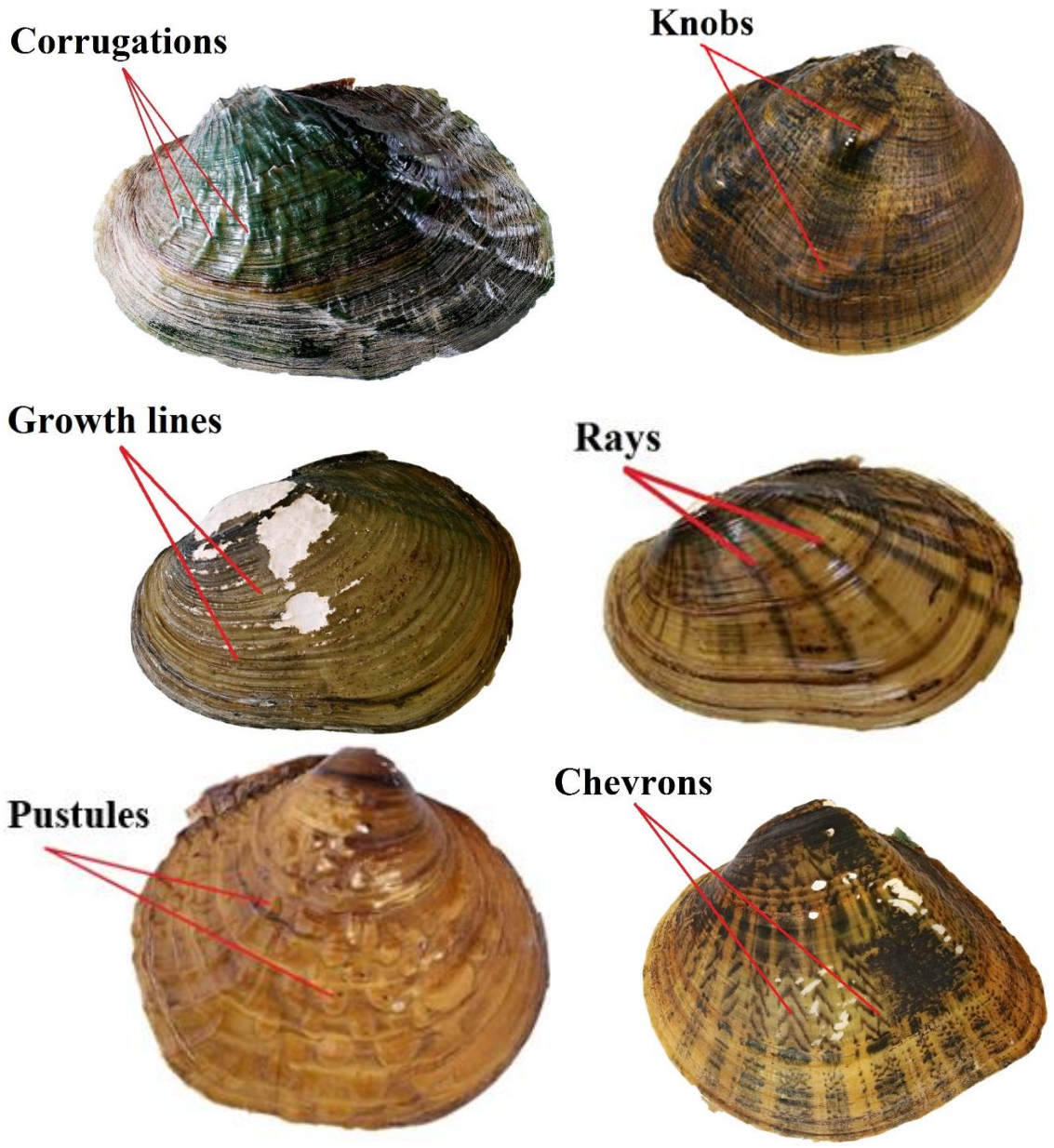

Figure 19. Structural ornamentation (corrugations, knobs, pustules, tubercles, growth lines) and markings (rays, chevrons) on the exterior of a freshwater mussel shell.

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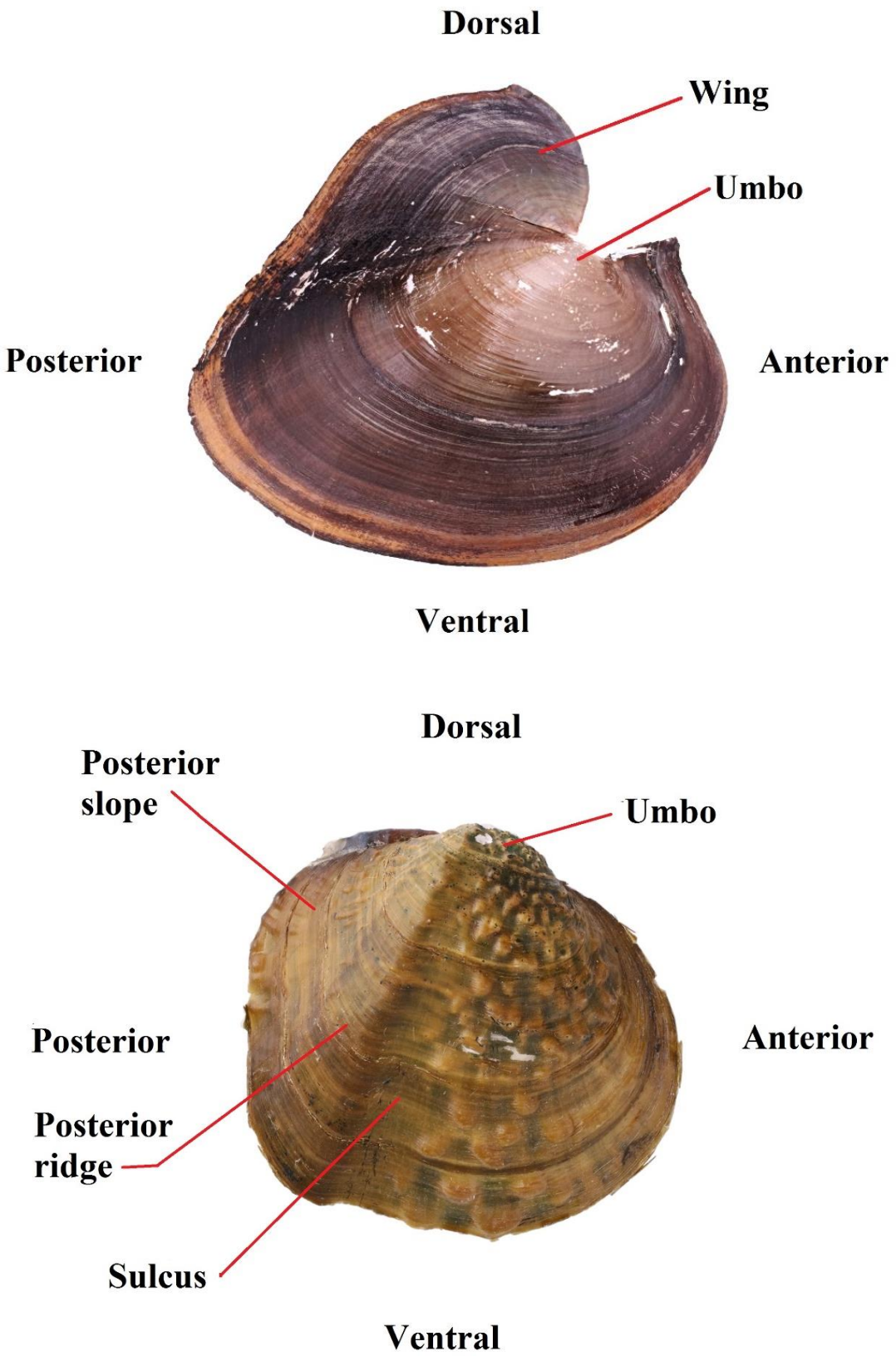

Figure 20. External features of a mussel shell.

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Other features that may be of significance include the shape and size of the posterior slope, the presence or absence and prominence of the posterior ridge, and whether or not a narrow depression (referred to as a sulcus) is present. The inner part of the shell also has a variety of diagnostic features. Most species of mussels have two kinds of "teeth", pseudocardinal teeth and lateral teeth (Fig. 21), which are raised structures in each valve that fit together with corresponding structures on the other valve. The teeth prevent the two valves from sliding past one another and being torn apart by shear forces produced by water currents. Shell size is a character that is often useful in the identification of freshwater mussels (Fig. 22). Shell width is often directly measured, but is sometimes evaluated descriptively. If the shell has a relatively large width, it is referred to as being obese or inflated, and if it has a relatively small width, it is described as being compressed (Fig. 22).

Several descriptions of mussel shell morphology reference whorls on the umbo as taxonomic characters. We did not use whorls here because, although they may be useful characters elsewhere, they are generally not useful in Mississippi. Our rivers and streams have an abundance of sand and small particulate matter, which often results in excessive erosion of the umbos of resident mussels. This results in an absence or distortion of whorls on the vast majority of our mussel specimens, thus making that character essentially worthless as a taxonomic character in this state.

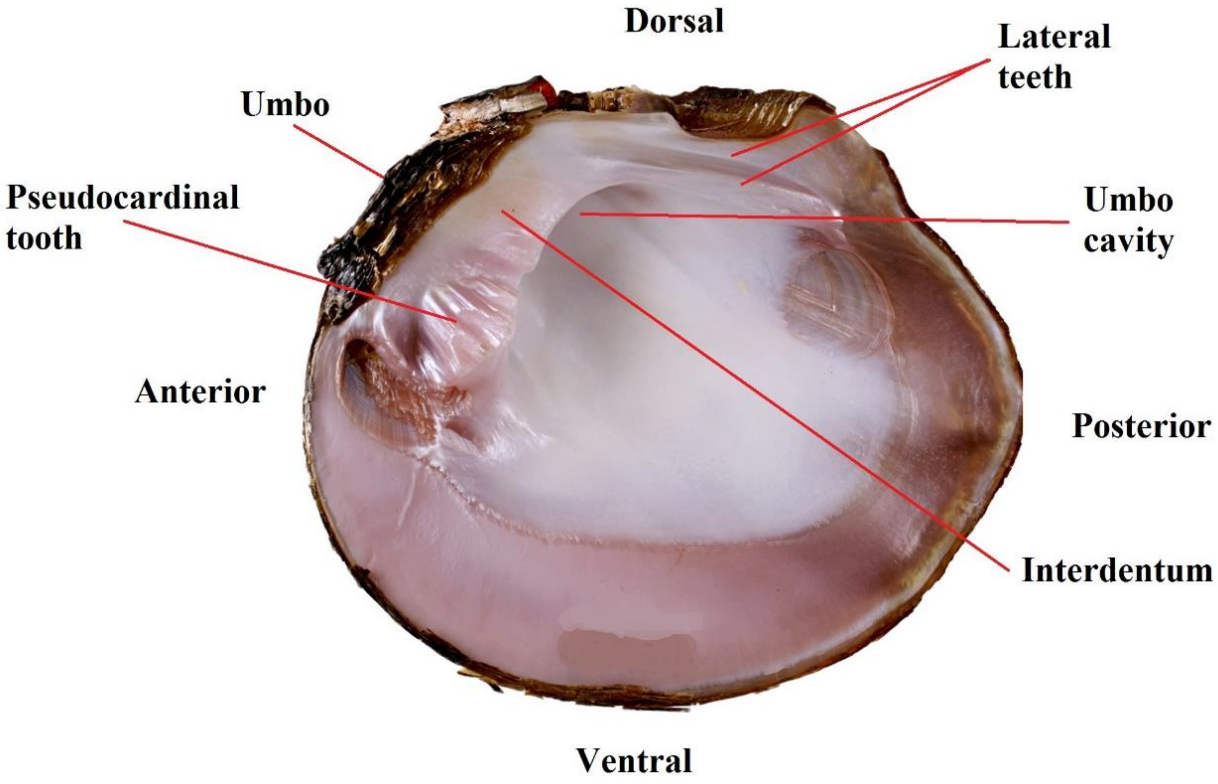

Figure 21. Internal features of a mussel shell. Pseudocardinal and lateral teeth are collectively called hinge teeth and the interior surface of the shell is referred to as the nacre.

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Figure 22. Measurements of a mussel shell. Shell length - Distance from anterior to posterior end of the shell. Shell width - Cross sectional distance from edge of one valve to the edge of the other valve measured through the center of the shell. Shell height - Distance from ventral to dorsal edge of the shell. Shells with a large shell width relative to shell height are referred to as inflated while those with a small shell width relative to shell height are characterized as compressed.

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UNIOID MUSSELS THAT MAY POTENTIALLY OCCUR IN MISSISSIPPI AND NON-UNIONID MUSSELS FOUND IN FRESHWATER HABITATS THAT ARE MIS-IDENTIFIED AS UNIONID MUSSELS

SPECIES OF POTENTIAL OCCURRENCE IN MISSISSIPPI - There are a number of freshwater mussel species that, although we lack records of their historical presence in Mississippi, either likely occurred here within the last 100 years or will likely be found in the state at some time in the foreseeable future. In the latter category is *Obovaria oliveria* (Hickorynut), a species of the Mississippi River Basin known from the Tennessee River in Alabama (Williams et al., 2008) and Tennessee (Parmalee and Bogan, 1998) and the Mississippi River or its tributaries in Arkansas, Missouri (McMurray et al., 2012), and Louisiana (Vidrine, 1993). Two records, one from the Mississippi River in Lee County, Arkansas, opposite Tunica County, Mississippi, and the other from the Mississippi River in Desha County, Arkansas, opposite Bolivar County, Mississippi, indicate that this species will eventually be found within the borders of Mississippi. Archaeological specimens of the Hickorynut associated with the Big Black River have been found in Hinds County (Peacock et al., 2011).

Hickorynut
Obovaria olivaria - 61 mm (2.4 in.)

Another group of species that occur in the Tennessee River drainage may appear in Bear or Cedar creeks in Tishomingo County in the future. *Villosa vanuxemensis* (Mountain Creekshell) and *Lampsilis abrupta* (Pink Mucket) have been found in Bear Creek in Colbert County, Alabama (McGregor and Garner, 2004), just downstream from the Mississippi state line and may already occur or could soon be found in Tishomingo County. *Lampsilis virescens* (Alabama Lampmussel), a federally listed species that once occurred in Bear Creek in Alabama, has been propagated in captivity by the Alabama Department of Conservation and Natural Resources at its Alabama Aquatic Biodiversity Center (AABC) and released in Bear Creek, Colbert County, Alabama. Other species that are being propagated and released by the Alabama Aquatic Biodiversity Center in Bear Creek include *Medionidus conradicus* (Cumberland Moccasinshell) and *Toxolasma cylindrellus* (Pale Lilliput). Releases of another propagated species, *Epioblasma ahlstedti*, (Duck River Dartersnapper; the species pictured below, *E. capsaeformis*, is virtually identical morphologically) are planned for the near future (Paul Johnson, AABC, in litt.). If these re-introductions are successful, these species could eventually be found in the Mississippi portion of Bear Creek.

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Mountain Creekshell
Villosa vanuxemensis – 50 mm (2.0 in.)

Pink Mucket
Lampsilis abrupta – 110 mm (4.3 in.)

Alabama Lampmussel
Lampsilis virescens – 55 mm (2.2 in.)

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Cumberland Moccasinshell
Medionidus conradicus – 40 mm (1.6 in.)

Pale Lilliput
Toxolasma cylindrellus - 34 mm (1.3 in.)

Oystermussel
Epioblasma capsaeformis – 46 mm (1.8 in.)

Ortmann (1925) reported on mussels collected in Bear Creek at Burleson, Alabama, a site approximately 8.5 miles upstream of the Mississippi state line. Most of these mussels were collected at least 100 years ago or longer, including *Actinonaias pectorosa* (Pheasantshell), *Alasmidonta marginata* (Elktoe), *Epioblasma turgidula* (Turgid Blossom), *Fusconaia cuneolus* (Finerayed Pigtoe), *Pleurobema oviforme* (Tennessee Clubshell), *Toxolasma lividum* (Purple Lilliput), and *Villosa iris* (Rainbow). Although there are no records of these species from Mississippi and several are now extinct, it is likely that many once occurred in the Mississippi section of Bear Creek (McGregor and Garner, 2004).

There may be one or two species of *Toxolasma* in Mississippi that are not included in the accounts section of this report. Williams et al. (2008) indicated three records of *Toxolasma corvunculus* (Southern Purple Lilliput) in Mississippi, all in the

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Tombigbee drainage. This species is apparently rare in Alabama and one of the least understood species in that state (Williams et al., 2008). It is said to resemble *Toxolasma parvum* but differs in that it has a thicker shell, less compressed pseudocardinal teeth, has a yellowish periostracum, is slightly larger, has a purple rather than a white nacre, and is more strongly sexually dimorphic (Williams et al., 2008). If it occurs in Mississippi, it should be present in creeks in the Tombigbee drainage.

There is an undescribed *Toxolasma* in Alabama (Williams et al., 2008) and Florida (Williams et al., 2014), referred to as the Gulf Lilliput, which is apparently closely related to *Toxolasma corvunculus* (Williams et al., 2014). We have found a *Toxolasma* in Mississippi which differs from the two known species in that genus in the state (*T. parvum, T. texasiense*) and most closely resembles the Gulf Lilliput. This species has been found in a few creeks in the Big Black drainage and it or a similar form at least once in the Wolf River of the Mississippi River North drainage. It attains a shell length of at least 40 mm, has a yellowish to greenish periostracum, and appears to be sexually dimorphic, with females having an expanded ventral region relative to males. It is generally larger than *T. parvum* but smaller than *T. texasiense*, has a differently colored periostracum than those two species, and is more sexually dimorphic than *T. parvum* but less so than *T. texasiense*. Its exact status awaits further study.

Undescribed species, Big Black River
Toxolasma sp. – 39 mm (1.5 in.)

NON-UNIONID BIVALVE MUSSELS IN MISSISSIPPI - There are five species of non-unionid bivalve mussels that might be encountered in Mississippi freshwater habitats and which could be mistaken for unionids. Three of these are found in coastal areas, generally in transitional habitats where brackish water and freshwater come into contact, and two in freshwater areas usually not near the brackish-freshwater interface along the coast. The latter two species are not native to Mississippi but have been introduced to the state and have become established here.

Native brackish water mussels - There are three species in this group, *Rangia cuneata* (Atlantic Rangia), *Polymesoda caroliniana* (Carolina Marsh Clam), and *Mytilopsis leucophaeata* (Dark False Mussel). The MDWFP collection has records of *R. cuneata* (Family Mactridae) from freshwater to slightly brackish water areas in Hancock and Jackson counties (Fig. 23), but it likely has a much wider distribution along the coast than our records indicate. Our largest specimen has a shell length of 46 mm (1.8 in.) although this species can attain a shell length of up to approximately 85 mm (3.3 in.; Williams et al., 2008). The Atlantic Rangia can be distinguished from unionid mussels as it has both

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Atlantic Rangia
Rangia cuneata – 44 mm (1.7 in.)

Carolina Marsh Clam
Polymesoda caroliniana – 43 mm (1.7 in.)

Dark False Mussel
Mytilopsis leucophaeata – 13 mm (0.5 in.)

anterior and posterior lateral teeth while unionids have only posterior lateral teeth. *Rangia cuneata* has been observed 10 miles above the mouth of the Pascagoula River in Parish Lake, Jackson County, in association with the unionids *Glebula rotundata, Pyganodon grandis, Plectomerus dombeyanus, Villosa lienosa,* and *Toxolasma*

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texasiense. The habitat at this site was a mud bottom in relatively shallow water with no current.

Polymesoda caroliniana (Family Corbiculidae) is similar in general appearance to *R. cuneata*. We have two records of this species from fresh/brackish water areas in Jackson County (Fig. 23). It can also be distinguished from unionids by the presence of both anterior and posterior lateral teeth, and can be separated from *R. cuneata* as the latter has a deep pit (chondrophore) anterior to the posterior lateral tooth. Our largest specimen has a shell length of 44 mm (1.7 in.) but it can attain a size of up to 90 mm (3.5 in.; Williams et al., 2008). It is one of the most characteristic species of tidal marshes in the southeastern U.S. (Heard, 1982).

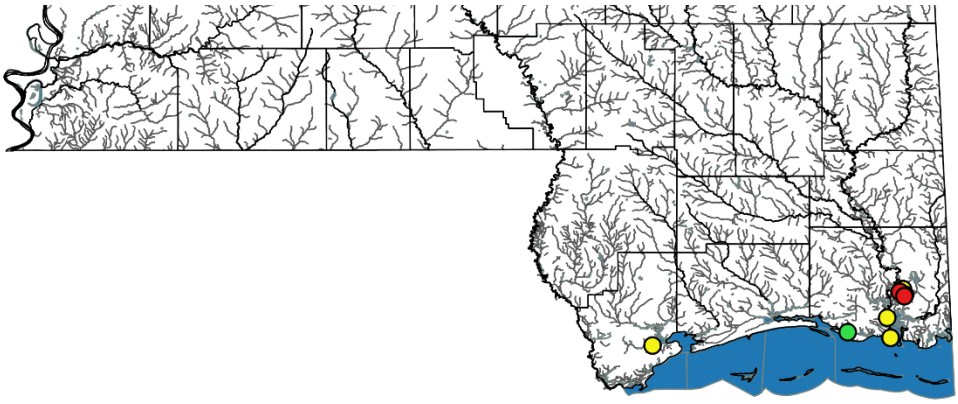

Figure 23. Records of non-unionid brackish water mussels from MDWFP collection in coastal Mississippi counties. Red dots are *Mytilopsis leucophaeata*, green dots are *Polymesoda caroliniana*, and yellow dots are *Rangia cuneata*.

Mytilopsis leucophaeata (Family Dreissenidae) is a very small mussel, usually no larger than 25 mm (1.1 in.) shell length (Williams et al., 2008). We have two records of this species from the Pascagoula drainage in Jackson County (Fig. 23), and the largest specimen in these collections has a shell length of 15 mm (0.6 in.). The Dark False Mussel is usually found attached to hard surfaces like sunken logs, rip-rap, or similar objects. It can be distinguished from unionids by its small size, roughly elliptical shape with a very pointed and usually downward curving anterior end, and absence of teeth on the interior of the shell. It does, however, have a small tooth-like structure referred to as an apophysis on the anterior inner end of the shell. It can be separated from *Dreissena polymorpha*, the Zebra Mussel, which it strongly resembles, by the presence of the apophysis (a small tooth-like structure), which Zebra Mussels lack.

Introduced freshwater bivalves – The two species in this group are *Corbicula fluminea* **(**Asian Clam) and *Dreissena polymorpha* (Zebra Mussel). *Corbicula fluminea* (Family Corbiculidae) is distributed over most of the state (Fig. 24), with MMNS records from 74 counties and all drainages except the Coastal Rivers. The largest Mississippi specimen we have is 49 mm (1.9 in.) shell length, but there is a 60 mm (2.4 in.) specimen in the collection from Jackson County, Florida. There is some question about the precise taxonomic status of this species, as it has been suggested that *C. fluminea* in this country might be composed of as many as four different species (Tiemann et al., 2017; Foster et al., 2019). This species occurs in a variety of habitats from gravel-bottomed streams with

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current to backwaters with mud bottoms. It can be very abundant in some localities. *Corbicula fluminea* can be distinguished from unionids by the presence of both anterior and posterior lateral teeth. Unionids, if they have lateral teeth, have only posterior laterals.

Asian Clam
Corbicula fluminea – 36 mm (1.4 in.)

Zebra Mussel
Dreissena polymorpha – 14 mm (0.6 in.)

Dreissena polymorpha (Family Dreissenidae) is a small mussel up to 40 mm (1.6 in.) shell length (Williams, et al., 2008); usually with a striped shell, which has been found most frequently in the Mississippi River within the state (Fig. 24). We have records from five counties in Mississippi, from either the Mississippi River North or the Mississippi River South drainages, but it has also been reported from the Tennessee drainage in Tishomingo County. Our largest specimen is 25 mm (1.0 in.) shell length and was found in Gilliam Chute in Jefferson County. This species, like *Mytilopsis leucophaeata*, is usually found attached to rocks, logs, or any other hard surfaces, even the shells of unionid mussels. It can be distinguished from the Dark False Mussel by the absence of the apophysis, a small tooth-like structure, in the anterior end of the shell. Like the Dark False Mussel, it can be distinguished from unionids by its small size, roughly elliptical shape with a very pointed and usually downward curving anterior end, and absence of teeth on the interior of the shell.

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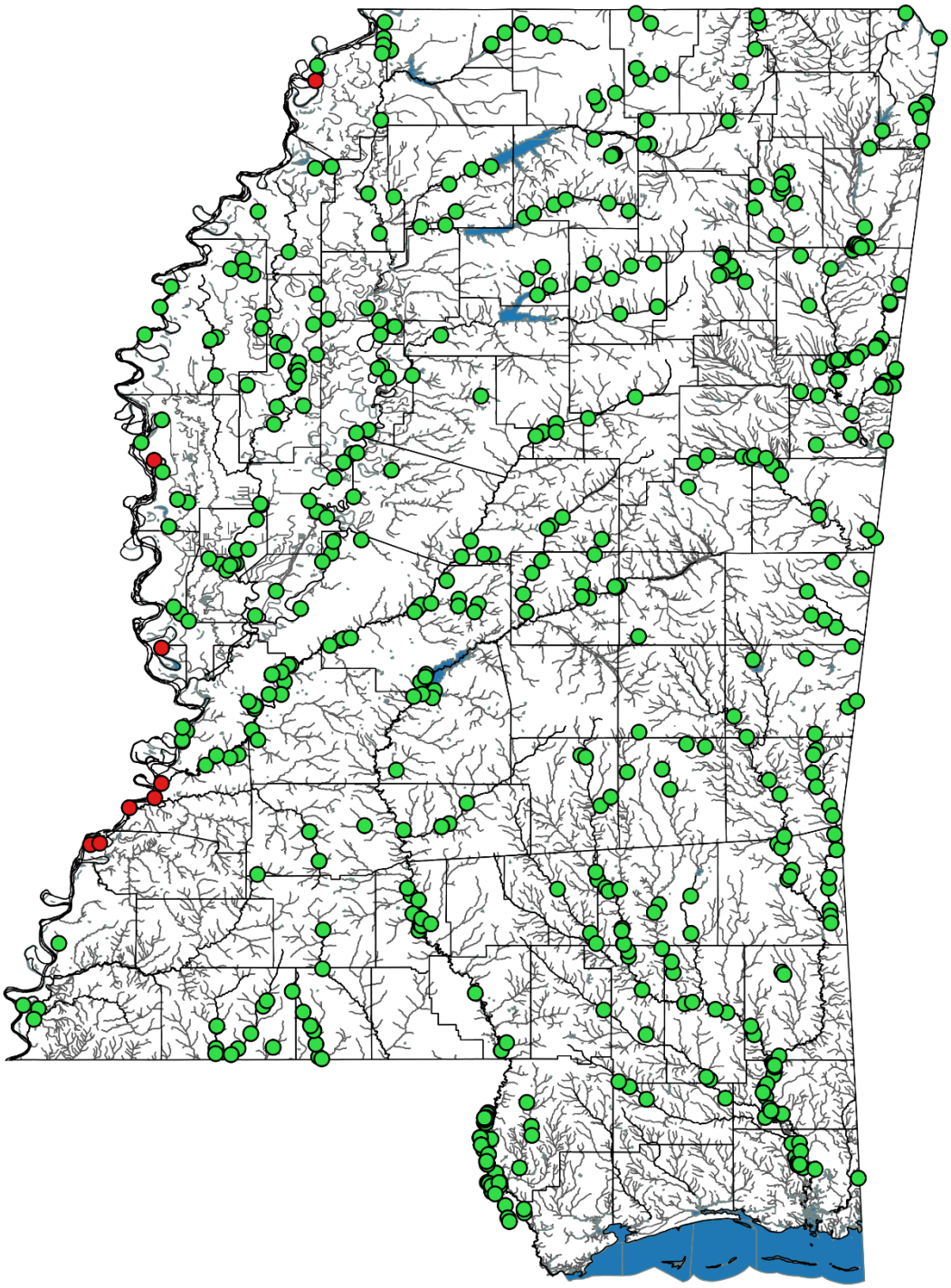

Figure 24. Distribution of *Corbicula fluminea* (green dots) and *Dreissena polymorpha* (red dots) in Mississippi. The latter apparently also occurs in the Tennessee drainage, but at present we have no specimen records from that drainage.

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KEY TO THE FRESHWATER MUSSELS OF MISSISSIPPI

An old adage in biology states that "Keys are made by those who don't need them for those who can't use them." This is another way of saying that when using this or any other key, not all specimens will be accurately identified because a key cannot account for all variation within a species. It is assumed that most individuals reading this are familiar with keys. Much of this key is dichotomous, where the description of a character state leads to a choice between two mutually exclusive groups. In some cases, however, this key has trichotomous or even tetrachotomous sections, which leads to a choice among, respectively, three and four groups. The probability of correctly identifying a mussel will increase through time as the ability to recognize shell characters typical for a particular genus or species increases. Even with experience, however, there will be some specimens that are not easily identified.

If a specimen that has been keyed to a particular species does not fit the description in the species account or does not occur within the range of the species in Mississippi, check other members of the same genus to see if the keyed specimen might be closely related. Also, check to see if the specimen might be one of the non-unionid species found in freshwater habitats in Mississippi (page 33) or one of the unionid species that may eventually come to be found in Mississippi (page 30). There is also pronounced sexual dimorphism in some Mississippi mussels, which involves a marsupial swelling of the posterior end of the shell in females. This could result in confusion about the identity of some mussels. If a specimen exhibits most of the characters of a particular species except for the conformation of the posterior end of the shell, check the last part of this key (page 70), which illustrates several females that exhibit dimorphism. If the specimen still cannot be identified, narrow the potential choices to those species that occur in the same drainage (Appendix 1), then key out the specimen again and use the information in the accounts until arriving at an identification based on morphology, distribution, and variation within the species that appears logical. If the mussel appears to be of a particular species, but that species does not occur in the drainage where it was collected, it is possible that the specimen represents a new drainage record.

Group A: Shell with structural ornamentation (p. 41)
- **Section 1: Linear ornamentation on shell (p. 42)**
- **Section 2: Round ornamentation on shell (p. 44)**

Group B: No structural ornamentation (p. 52)
- **Section 1: No hinge teeth or with only pseudocardinal teeth (p. 52)**
- **Section 2: Hinge teeth present (p. 54)**
  - **Part 1: Shell thin and fragile, usually compressed, no posterior ridge (p. 54)**
  - **Part 2: Shell not thin and fragile, prominent posterior ridge (p. 55)**
  - **Part 3: Shell not thin and fragile, posterior ridge absent or broadly rounded (p. 58)**
    - **Division 1: Shell shape round (p. 58)**
    - **Division 2: Shell shape elliptical (p. 60)**
    - **Division 3: Shell shape oval (p. 62)**
    - **Division 4: Shell shape quadrate (p. 72)**

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External surface of shell with structural ornamentation (tubercles, pustules, knobs, or corrugations); may be limited to the wing or otherwise occupy only a small area of the shell surface .....**Group A** (p. 41)
External surface of shell smooth, no structural ornamentation, although elevated growth lines and rays or other markings may be present.....**Group B** (p. 52)

Group A Shell with structural ornamentation

Group B Shell without structural ornamentation

Group A: Shell with structural ornamentation

Structural ornamentation on shell surface primarily linear (corrugations or ridges) usually without circular or oval elements (tubercles, knobs, pustules); if present, tubercles, knobs, or pustules are infrequent; corrugations or ridges may be small to large .. **Section 1** (p. 42)

Shell surface with primarily tubercles, knobs, pustules, or other round or oval ornamentation; shell may have a few ridges or folds, but linear elements occur at much lower frequency than round or oval elements..... **Section 2** (p. 44)

Section 1 Linear ornamentation

Section 2 Round and oval ornamentation

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Group A: Shell with structural ornamentation
Section 1: Linear ornamentation on shell

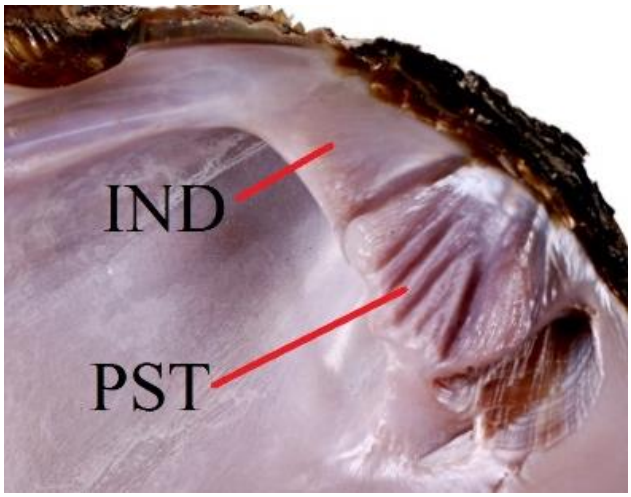
1 Nacre bronzy purple or purple, or a mixture of salmon and bluish white 3
2 Nacre white or white with slight bluish tint.....5

3(1) Shell thin, tiny, usually less than 25.4 mm (1 in.) in length, elliptical, nacre bluish white posteriorly, salmon in umbo cavity.....
.....*Medionidus acutissimus* **Alabama Moccasinshell** (p. 183)
4(1) Shell much larger, thicker, rhomboidal, nacre purple or bronzy purple .....
.....*Plectomerus dombeyanus* **Bankclimber** (p. 201)

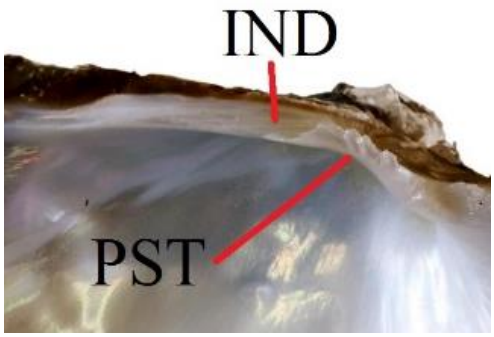
3 Elliptical shell with bluish white nacre posteriorly

4 Rhomboidal shell with purple nacre

5(2) Pseudocardinal teeth thick, large; lateral teeth well developed, moderate to wide interdentum present.....7
6(2) Pseudocardinal teeth thin, blade-like; lateral teeth poorly developed; interdentum very narrow to absent.....*Arcidens confragosus* **Rock Pocketbook** (p. 81)



5 Pseudocardinals (PST) thick, interdentum (IND) wide



6 Pseudocardinals (PST) thin, interdentum (IND) narrow

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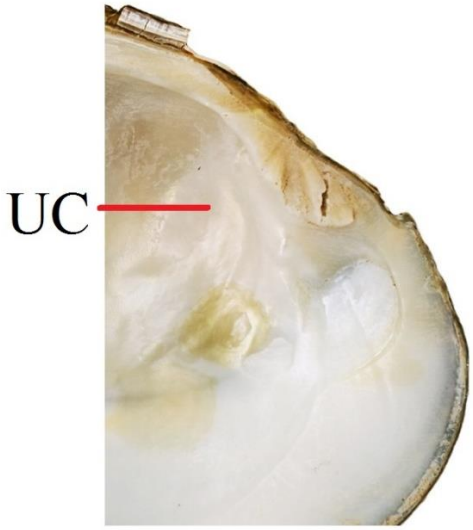
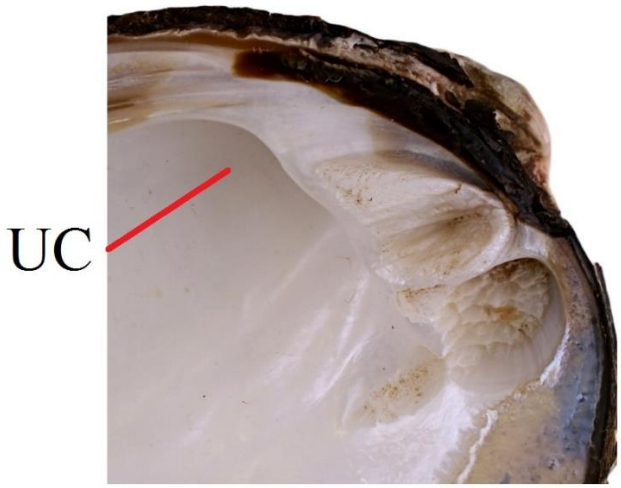
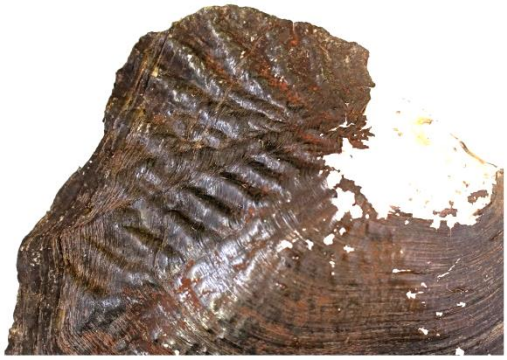
7(5) Umbo cavity shallow; shell relatively thin.....9
8(5) Umbo cavity moderately deep to very deep; shell thick 13





7 Shallow umbo cavity (UC) **8 Deep umbo cavity (UC)**

9(7) Shell anterior to the posterior ridge and the posterior slope usually smooth, with little or no ornamentation; not in Tombigbee River drainage ....*Lasmigona complanata* **White Heelsplitter** (p. 168)
10(7) Shell anterior to posterior ridge and posterior slope usually with numerous elongated pustules or corrugations.....11



9 Smooth posterior slope **10 Posterior slope with numerous corrugations**

11(10) Shell oval, height almost equal to length, with a prominent posterior wing, Tombigbee River drainage.....*Lasmigona alabamensis* **Alabama Heelsplitter** (p. 165)
12(10) Shell elliptical, shell length much greater than height, Tennessee River drainage.... .....*Lasmigona costata* **Flutedshell** (p. 171)

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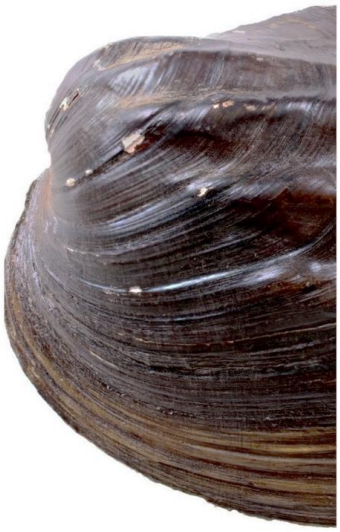
11 Shell oval, height almost equal to length

12 Shell elliptical, length greater than height

13(8) Corrugations and other ornamentation extend anterior to umbo..... ..... *Megalonaias nervosa* **Washboard** (p. 186)
14(8) Corrugations and other ornamentation do not extend anterior of umbo ....*Amblema plicata* **Threeridge** (p. 78)

11 Ornamentation anterior to umbo



12 No ornamentation anterior to umbo

Group A: Shell with structural ornamentation
Section 2: Round ornamentation on shell

1 Shell elliptical; length equal to or greater than 1.4 times its height.....3
2 Shell oval, round, or triangular; length less than 1.4 times its height.....7

3(1) Posterior ridge with knobs, tubercles, or pustules; posterior slope strongly ornamented with ridges and folds.....5
4(1) Posterior ridge and posterior slope with no ornamentation, usually a few pustules scattered along mid-lateral part of the shell anterior to posterior ridge..... .....*Plethobasus cyphyus* **Sheepnose** (p. 204)

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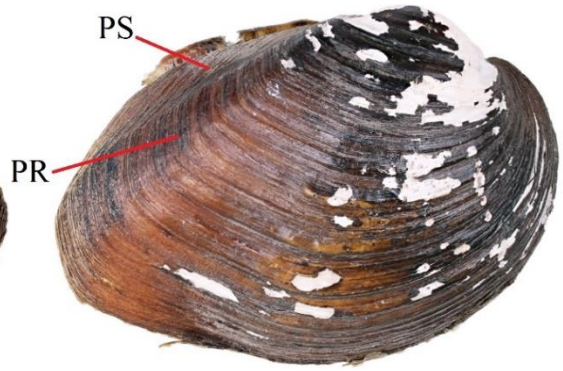
3 Posterior ridge (PR) and posterior slope (PS) with ornamentation



4 No ornamentation on posterior ridge (PR) and posterior slope (PS)

5(3) Numerous small pustules on side of shell anterior to posterior ridge; posterior ridge with small and indistinct knobs and ridges; posterior slope narrow at umbo but widening toward posterior edge of shell, usually with prominent corrugations near dorsal edge; dorsal margin of shell posterior to umbo slopes downward toward posterior end of shell ... . *Tritogonia verrucosa* **Pistolgrip** (p. 299)

6(3) Shell with large, distinct knobs on posterior ridge; few or no pustules on side of shell; posterior slope well developed; dorsal margin of shell posterior to umbo nearly level with umbo for its entire length ..... *Theliderma cylindrica* **Rabbitsfoot** (p. 283)

5 Pustules on side of shell, widening posterior ridge, sloping posterior dorsal margin

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6 Few pustules on side of shell, dorsal margin relatively straight throughout its length

7(2) Posterior ridge absent, or if present, low and broadly rounded.....9
8(2) Posterior ridge prominent, conspicuous, sometimes much higher than surrounding periostracum, or if posterior ridge only moderately conspicuous, then bordered by a relatively deep sulcus just anterior to it 21

7 Posterior ridge broadly rounded

8 Posterior ridge prominent

9(7) Nacre purple, color may be intense or faint, entire surface of nacre may be purple or only parts may be purple, especially if the shell has faded from long exposure to sunlight 11
10(7) Nacre white 13

11(9) Interdentum wide, length of lateral tooth less than 1.5 times width of interdentum; usually with pustules and tubercles; Tennessee River drainage .....*Cyclonaias tuberculata* **Purple Wartyback** (p. 97)
12(9) Interdentum narrower, length of lateral tooth more than twice width of interdentum; pustules usually small, round, not in Tennessee River drainage .....*Cyclonaias refulgens* **Purple Pimpleback** (individuals with purple nacres will key out here, p. 94)

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11 Wide interdentum, relatively short lateral teeth

12 Narrower interdentum, longer lateral teeth

13(10) Umbo cavity deep.....15
14(10) Umbo cavity very shallow; a few large, flattened pustules along posterior ridge ....*Pleurobema marshalli* **Flat Pigtoe** (in part, p. 216)

15(13) Few to many small pustules scattered over lateral part of shell from umbo to near ventral margin of shell, but not in two rows bordering each side of a sulcus.....17
16(13) Pustules few, scattered on sides of shell; usually some tubercles present; usually two rows of pustules and/or tubercles, a row bordering each side of a shallow sulcus; found in Mississippi River Basin..... *Cyclonaias nodulata* **Wartyback** (p. 87)

15 Pustules not in two rows flanking a sulcus

16 Row of pustules on each side of sulcus

17(15) Periostracum usually medium brown to yellow; nacre white; not from Pearl, Pascagoula, or Lake Pontchartrain drainages 19
18(15) Periostracum usually very dark brown; nacre light purple, sometimes faded to mostly white; from Pearl, Pascagoula, or Lake Pontchartrain drainages ....*Cyclonaias refulgens* **Purple Pimpleback** (shells with whitish nacres will key out here, p. 94)

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17 Periostracum medium brown to yellow

18 Periostracum very dark brown

19(17) Occasionally with a wide, greenish ray from umbo toward posterior ventral margin; from Mississippi River Basin drainages.....*Cyclonaias pustulosa* **Pimpleback** (in part; individuals with pustules will key out here, p. 90)
20(17) Never with a green ray; from the Tombigbee drainage ....*Cyclonaias asperata* **Alabama Orb** (in part; individuals with pustules will key out here, p. 84)

19 Shell with wide green ray

20 Shell without a green ray

21(8) Each valve with usually three large knobs on mid-lateral surface; knobs asymmetrical between valves; one knob near umbo, one near ventral margin, one midway between umbo and ventral margin..... *Obliquaria reflexa* **Threehorn Wartyback** (p. 189)
22(8) Various ornamentation but not with three asymmetrical knobs on each valve.....23

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21 Valve with three asymmetrical knobs

23(22) Shell with elevated ridges along growth lines; ridges composed of variously shaped small pustules; umbo cavity shallow; periostracum with broad rays of varying intensity anteriorly; rest of periostracum and area between rays with small specks of dark pigment on a lighter ground color, giving the periostracum a stippled appearance ....*Cyprogenia aberti* **Western Fanshell** (p. 100)
24(22) Shell with various ornamentation and markings, but not as above; umbo cavity relatively deep.....25

23 Shell with elevated ridges along growth lines, stippled periostracum

24 Shell without elevated ridges on growth lines

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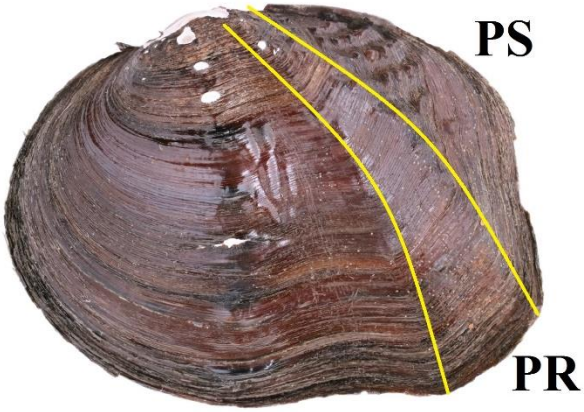
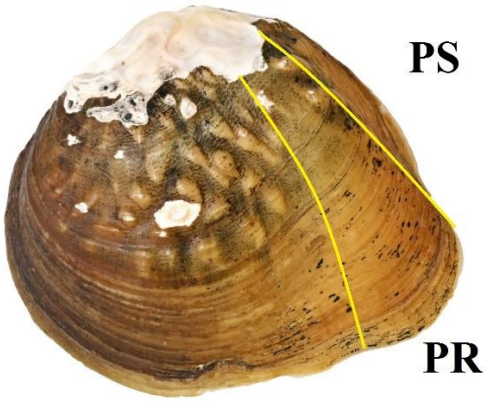
25(24) Posterior slope relatively wide, usually wider than width of posterior ridge at its midpoint 27
26(24) Posterior slope truncated, narrower than width of posterior ridge at its midpoint..... ..... *Theliderma stapes* **Stirrupshell** (p. 290)



25 Posterior slope (PS) wider than posterior ridge (PR)



26 Posterior slope (PS) narrower than posterior ridge (PR)

27(25) Sulcus anterior to posterior ridge bordered by two rows of pustules, one row on each side, at least on umbo, but usually for the entire length of the sulcus 29
28(25) Sulcus may be bordered by randomly arranged pustules or have a row of pustules along one side, but never with a row of pustules on each side 31

27 Sulcus bordered by two rows of pustules

28 Sulcus not bordered by two rows of pustules

29(27) Periostracum usually very dark brown to almost black; usually numerous pustules on posterior slope; found in Gulf of Mexico basin ....*Quadrula nobilis* **Gulf Mapleleaf** (p. 262)
30(27) Periostracum usually a lighter shade of brown; pustules on posterior slope but usually not in great numbers; found in Mississippi River Basin ....*Quadrula quadrula* **Mapleleaf** (p. 265)

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29 Very dark periostracum, numerous pustules on posterior slope

30 Lighter brown periostracum, few pustules on posterior slope

31(28) Posterior ridge with a few scattered pustules, with no pustules, or with large knobs 33
32(28) Posterior ridge and sulcus usually with numerous pustules..... ..... *Quadrula apiculata* **Southern Mapleleaf** (p. 259)

31 Posterior ridge and sulcus with no pustules

32 Posterior ridge and sulcus with pustules

33(31) Posterior ridge with large, somewhat flattened knobs at growth rings, particularly well-developed near umbo.....*Theliderma metanevra* **Monkeyface** (p. 287)
34(31) Posterior ridge may have a few pustules, but does not have large, flattened knobs .. .. *Quadrula rumphiana* **Ridged Mapleleaf** (p. 268)

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33 Posterior ridge with knobs **34 Posterior ridge lacking knobs**

Group B: No structural ornamentation

No hinge teeth or with only pseudocardinal teeth ..... **Section 1** (p. 52)
Hinge teeth present ..... **Section 2** (p. 54)

Group B: No structural ornamentation
Section 1: No hinge teeth or with only pseudocardinal teeth

1 Pseudocardinal teeth present, lateral teeth absent.....3
2 Both lateral and pseudocardinal teeth absent.....9

3(1) Shell nearly quadrate, posterior margin broadly rounded to almost square, posterior slope usually steep ..... *Pseudodontoides subvexus* **Southern Creekmussel** (p. 250)
4(1) Shell elliptical to oval, posterior margin usually pointed, posterior slope usually descends more gradually to the posterior dorsal margin 5

3 Shell nearly quadrate, steep posterior slope **4 Shell elliptical to oval, gradual posterior slope**

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5(4) Shell relatively thin, usually with prominent rays; umbo cavity wide and very shallow; posterior slope low, flat; dorsal margin relatively straight.....7
6(4) Shell thin to moderately thick, usually without rays or with faint rays; umbo cavity moderately deep; posterior slope moderately steep; dorsal margin sinuous..... .....*Strophitus undulatus* **Creeper** (p. 280)

7(5) Found in Pascagoula River, Pearl River, and Lake Pontchartrain drainages..... ..... S*trophitus pascagoulaensis* **Pascagoula Creekshell** (p. 274)
8(5) Found in drainages other than those listed above ....*Strophitus radiatus* **Rayed Creekshell** (p. 277)

9(2) Shell round to triangular, ventral margin very broadly rounded.....11
10(2) Shell elliptical, ventral margin straight or only slightly rounded.....13

11(9) Shell compressed, almost flat, umbo below hinge line .... *Utterbackiana suborbiculata* **Flat Floater** (p. 320)
12(9) Shell swollen, umbo appears more rounded than flat, umbo above hinge line..... ..... *Utterbackiana hartfieldorum* **Cypress Floater** (p. 317)

11 Shell compressed, umbo below hinge line

12 Shell swollen, umbo at or above hinge line

13(10) Top of umbo usually extends above hinge line..... .....*Pyganodon grandis* **Giant Floater** (p. 256)
14(10) Top of umbo even with or below hinge line .... *Utterbackia imbecillis* **Paper Pondshell** (p. 314)

13 Top of umbo extends above hinge line

14 Top of umbo even with or below hinge line

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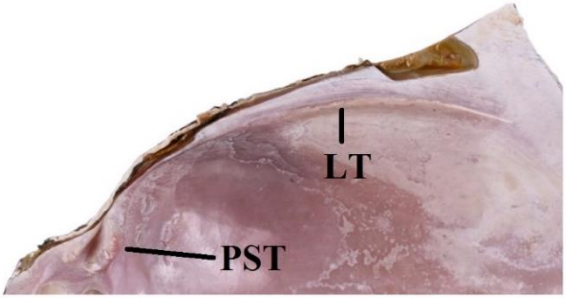
Group B: No structural ornamentation
Section 2: Hinge teeth present

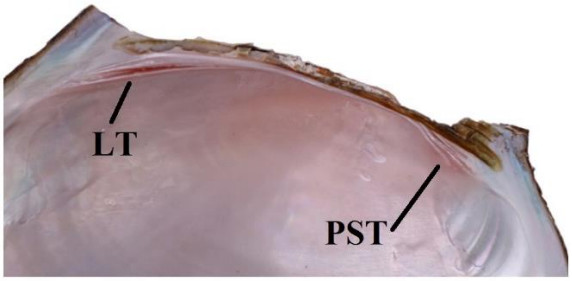
Shell thin to very thin, usually fragile, usually compressed; shell with both anterior and posterior wings variously developed, although these may be broken off; posterior wing may be relatively small to very large ..... **Part 1** (p. 54)
Shell thicker, may or may not be compressed; with prominent posterior ridge ..... **Part 2** (p. 55)
Shell thicker, may or may not be compressed; either lacking a posterior ridge or with a broadly rounded posterior ridge ..... **Part 3** (p. 58)

Group B: No structural ornamentation
Section 2: Hinge teeth present
Part 1: Shell relatively thin and fragile, usually compressed, no posterior ridge

1 Shell thin but not particularly fragile; pseudocardinal and lateral teeth well developed, the former thicker than lateral teeth; periostracum green to greenish brown to brown, with or without rays; nacre usually pinkish purple; Tennessee River drainage..... *Potamilus alatus* **Pink Heelsplitter** (p. 235)
2 Shell thin, fragile; pseudocardinal teeth very thin, bladelike, usually no thicker than lateral teeth.....3



1 Pseudocardinal teeth (PST) well developed, thicker than lateral teeth (LT)



2 Pseudocardinal teeth (PST) thin, blade-like, almost same width as lateral teeth (LT)

3(2) Periostracum yellow to brownish yellow, often with wide, faint rays posteriorly; nacre bluish-white in young individuals, white with a pinkish wash in and around the umbo cavity in adults ..... *Leptodea fragilis* **Fragile Papershell** (p. 174)
4(2) Periostracum medium to dark brown, may be greenish yellow in juveniles; usually without rays, but if present, then rays are faint and very thin; nacre bluish white in juveniles and purple to white in adults 5

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3 Periostracum yellow to brownish yellow

4 Periostracum medium to dark brown

5(4) Shell with very high posterior wing, shell height almost equal to shell length; shell very thin, fragile..... *Potamilus inflatus* **Inflated Heelsplitter** (p. 241)
6(4) Shell with posterior wing, but wing not as high, shell height usually less than shell length; shell thicker, usually not extremely fragile; nacre pink to light purple .... *Potamilus ohiensis* **Pink Papershell** (p. 244)

5 Very high posterior wing

6 Wing not as high

Group B: No structural ornamentation
Section 2: Hinge teeth present
Part 2: Shell not thin and fragile, prominent posterior ridge

1 Posterior ridge very pronounced for most of its length; posterior slope bends away from posterior ridge at almost a 90 degree angle toward middle of shell, giving the posterior surface of the shell a squared off appearance 3
2 Posterior ridge prominent to relatively prominent throughout most of its length but posterior slope not so steeply angled from posterior ridge, posterior of shell does not appear squared off.....7

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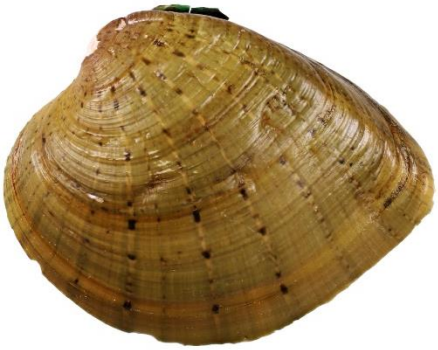

1 Posterior slope steeply angled away from posterior ridge **2 Posterior slope not steeply angled**

3(1) Shallow sulcus anterior to posterior ridge; periostracum usually marked with numerous rays, which may or may not be composed of small chevrons..... ..... *Truncilla truncata* **Deertoe** (p. 305)

4(1) Sulcus lacking; periostracum may be marked with few to many rays, but usually rays not composed of chevrons 5

5(4) Pseudocardinal teeth large, heavy; interdentum wide; shell sometimes moderately inflated but usually moderately to greatly compressed .... *Ellipsaria lineolata* **Butterfly** (p. 103)

6(4) Pseudocardinal teeth smaller, almost blade-like; interdentum narrow; shell, particularly posterior end, moderately to greatly inflated..... ..... *Epioblasma triquetra* **Snuffbox** (p. 121)

5 Pseudocardinals large, interdentum wide **6 Pseudocardinals small, interdentum narrow**

7(2) Shallow to moderately deep sulcus anterior to posterior ridge; umbo cavity shallow to deep.....9

8(2) No sulcus anterior to posterior ridge; umbo cavity moderately shallow to deep.....16

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7 Sulcus anterior to posterior ridge

8 No sulcus anterior to posterior ridge

9 (7) Umbo cavity very shallow, from Tombigbee drainage only.....11
10(7) Umbo cavity shallow to deep, from various drainages 13

11(9) Shell moderately thick; umbo not prominent, only slightly above hinge line, located near the midpoint of the dorsal edge of the shell; interdentum narrow to moderately wide ..... *Epioblasma penita* **Southern Combshell** (males with a moderate posterior ridge will key out here, p. 118)
12(9) Shell thicker; umbo prominent, well above the hinge line, located closer to anterior of the dorsal edge of the shell than to the midpoint; interdentum wide..... ..... *Pleurobema taitianum* **Heavy Pigtoe** (p. 226)

13(10) Umbo cavity shallow; no sulcus anterior to posterior ridge; umbo not prominent, slightly above the hinge line ..... *Pleurobema beadleianum* **Mississippi Pigtoe** (p. 207)
14(10) Umbo cavity moderately deep to deep; umbo prominent, well above hinge line.15

15(14) Interdentum wide; shell usually lacks rays; teeth usually large, prominent.....17
16(14) Interdentum narrow; shell almost always with rays, which are often composed of stacked chevrons; teeth relatively thin, not prominent .... *Truncilla donaciformis* **Fawnsfoot** (p. 302)

11 Posterior ridge prominent, rays faint

12 Posterior ridge moderately rounded, rays prominent

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17(15) Found in Mississippi River Basin drainages ..... *Fusconaia flava* **Wabash Pigtoe** (p. 131)
18(15) Found in Gulf of Mexico drainages .... *Fusconaia cerina* **Southern Pigtoe** (p. 127)

19(8) Shell relatively thin but not fragile; umbo swollen, very prominent; periostracum yellowish to brownish-yellow; Tennessee River drainage ..... *Lampsilis ovata* **Pocketbook** (p. 152)
20(8) Shell moderately to very thick; umbo not prominent; periostracum dark brown to black.....*Elliptio crassidens* **Elephant Ear** (p. 112)

19 Shell thin, prominent umbo, periostracum yellow to brownish-yellow

20 Shell thick, umbo not prominent, periostracum dark brown to black

Group B: No structural ornamentation
Section 2: Hinge teeth present
Part 3: Shell not thin and fragile, posterior ridge absent or broadly rounded

Shell shape round, length less than 1.4 times shell height.....**Division 1** (p. 58)
Shell shape elliptical, length equal to or greater than 1.4 times shell height.....**Division 2** (p. 60)
Shell shape oval, length noticeably longer than height, ratio of length to height approximately 1.3 – 1.6 .....**Division 3** (p. 62)
Shell shape quadrate, shell round or oval but posterior end truncate and enlarged relative to the anterior end .....**Division 4** (p. 72)

Group B: No structural ornamentation
Section 2: Hinge teeth present
Part 3: Shell thicker, posterior ridge absent or broadly rounded
Division 1: Shell shape round

1 Periostracum texture, rough, cloth-like; nacre with a smooth, shiny, satiny appearance... .....*Glebula rotundata* **Round Pearlshell** (p. 134)
2 Periostracum texture smooth, somewhat shiny, not dull and cloth-like; nacre may be smooth and shiny but not satiny.....3

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1 Periostracum texture cloth-like

2 Periostracum texture smooth

3(2) Shell moderately swollen to swollen, growth rings slightly raised, periostracum usually not shiny 5
4(2) Shell more compressed, periostracum moderately smooth and shiny, growth rings not raised.....7

5(3) Shell usually round, sometimes round to oval; pseudocardinal tooth in right valve usually directed more toward the ventral edge of the shell than toward the anterior; angle between pseudocardinal and lateral teeth rounded; found in Gulf of Mexico Basin..... .....*Obovaria unicolor* **Alabama Hickorynut** (p. 198)
6(3) Shell usually more oval than round; pseudocardinal tooth in right valve usually directed more toward the anterior end of the shell than the ventral edge; angle between pseudocardinal teeth and lateral teeth not rounded; found in the Mississippi River Basin ... .*Obovaria subrotunda* **Round Hickorynut** (p. 195)

5 Right valve with pseudocardinals (red line) directed more toward ventral edge of shell; shell more round than oval

6 Right valve with pseudocardinals (red line) directed toward anterior; shell more oval than round

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7(4) Periostracum usually very dark brown; from Pearl, Pascagoula, or Lake Pontchartrain .... drainages.....*Cyclonaias refulgens* **Purple Pimpleback** (in part; individuals lacking pustules will key out here, p. 93)
8(4) Periostracum usually medium brown to yellow; not from Pearl, Pascagoula, or Lake Pontchartrain drainages.....9

7 Periostracum very dark brown

8 Periostracum medium brown to yellowish

9(8) Occasionally with a wide, greenish ray from umbo to posterior ventral margin; from Mississippi River Basin drainages.....*Cyclonaias pustulosa* **Pimpleback** (in part; shells lacking pustules will key out here, p. 90)
10(8) Never with a green ray; from the Tombigbee drainage ....*Cyclonaias asperata* **Alabama Orb** (in part; shells lacking pustules will key out here, p. 84)

Group B: No structural ornamentation
Section 2: Hinge teeth present
Part 3: Shell thicker, posterior ridge absent or broadly rounded
Division 2: Shell shape elliptical

1 Most prominent color of periostracum is yellow, which may range from light to dark yellow, but predominant color and most of the shell is yellow 3
2 Most prominent color of periostracum is brown, which may range from light brown to almost black, but predominant color and most of the shell is brown 5

3(1) Shell compressed; teeth moderately well developed; interdentum wide; found only in Tennessee drainage.....*Ptychobranchus fasciolaris* **Kidneyshell** (p. 253)
4(1) Shell not compressed, usually slightly inflated; teeth thin, rather small; interdentum thin to absent; common throughout the state. ... *Lampsilis teres* **Yellow Sandshell** (p. 162)

5(2) Shell length usually 2.25 times or more greater than shell height 7
6(2) Shell length usually less than 2.25 times shell height.....9

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7(5) Shell usually thin, delicate, and small, shell length usually less than 70 mm (2.8 in.); pseudocardinal teeth peg-like, small, and poorly developed pseudocardinal teeth ....*Elliptio arctata* **Delicate Spike** (p. 109)
8(5) Shell thick, heavy, and large, shell length up to at least 178 mm (7.0 in.); pseudocardinal teeth moderate in size and well developed ....*Ligumia recta* **Black Sandshell** (p. 177)

7 Poorly developed pseudocardinal teeth (PST)

8 Well developed pseudocardinal teeth (PST)

9(6) Shell slightly to moderately compressed, width to length ratio usually less than 0.32 11
10(6) Shell slightly to moderately inflated, width to length ratio usually 0.33 or larger...13

11(9) From Mississippi River Basin drainages; sometimes with a shallow sulcus and a slightly concave ventral margin .....*Eurynia dilatata* **Spike** (p. 124)
12(9) From Gulf of Mexico Basin drainages; no sulcus present and ventral margin usually straight to slightly rounded..... *Elliptio arca* **Alabama Spike** (p. 106)

11 Shallow sulcus, ventral margin slightly concave

12 No sulcus, ventral margin slightly rounded

13(10) Interdentum absent; posterior end of shell a blunted point located either at mid-point of posterior end or closer to dorsal margin of shell; modest posterior wing usually present; frequently with rays which may be prominent or obscure ....*Ligumia subrostrata* **Pondmussel** (p. 180)
14(10) Interdentum present, but may be very narrow; posterior end of shell usually closer to ventral margin of shell than dorsal margin; rays absent 15

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13 Posterior tip closer to dorsal margin of shell **14 Posterior tip closer to ventral margin of shell**

15(14) Posterior ridge tapers rapidly from umbo to posterior end of the shell, terminating in a rather narrow point..... *Uniomerus declivis* **Tapered Pondhorn** (p. 308)
16(14) Posterior ridge tapers gradually from umbo to posterior end of the shell, terminating in a broadly rounded point..... *Uniomerus tetralasmus* **Pondhorn** (p. 311)

15 Posterior ridge tapers rapidly from umbo **16 Posterior ridge tapers gradually from umbo**

Group B: No structural ornamentation
Section 2: Hinge teeth present
Part 3: Shell thicker, posterior ridge absent or broadly rounded
Division 3: Shell shape oval

1 Shell with umbo located at or close to the anterior end of the shell, 10 -15% of the length of the dorsal edge of the shell is anterior to the umbo.....3
2 Shell with umbo located closer to mid-point of the dorsal edge of the shell than to the anterior end, more than 15% of the length of the dorsal edge of the shell is anterior to the umbo 19

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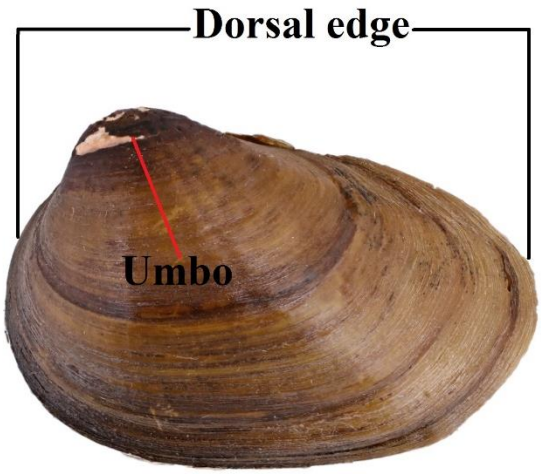
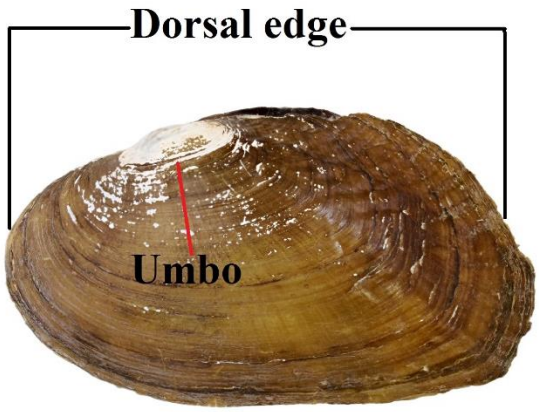


1 Umbo located very close to the anterior end of the shell



2 Umbo located closer to middle of the dorsal edge than to the anterior end of the shell

3(1) Umbo cavity deep to very deep.....5
4(1) Umbo cavity shallow to moderately shallow 7

5(3) Anterior adductor muscle scar with ragged, roughened surface, round to oval in shape; umbo cavity very deep; shell thick, heavy; periostracum with a coarse texture, particularly in larger individuals..... *Reginaia ebenus* **Ebonyshell** (p. 271)
6(3) Anterior adductor muscle scar with smoother surface, wedge shaped; umbo cavity deep; shell not exceptionally thick; periostracum usually smooth ....*Pleurobema rubrum* **Pyramid Pigtoe** (p. 222)

5 Anterior adductor muscle scar (AAMS) round with jagged, roughened surface. PST is the pseudocardinal tooth

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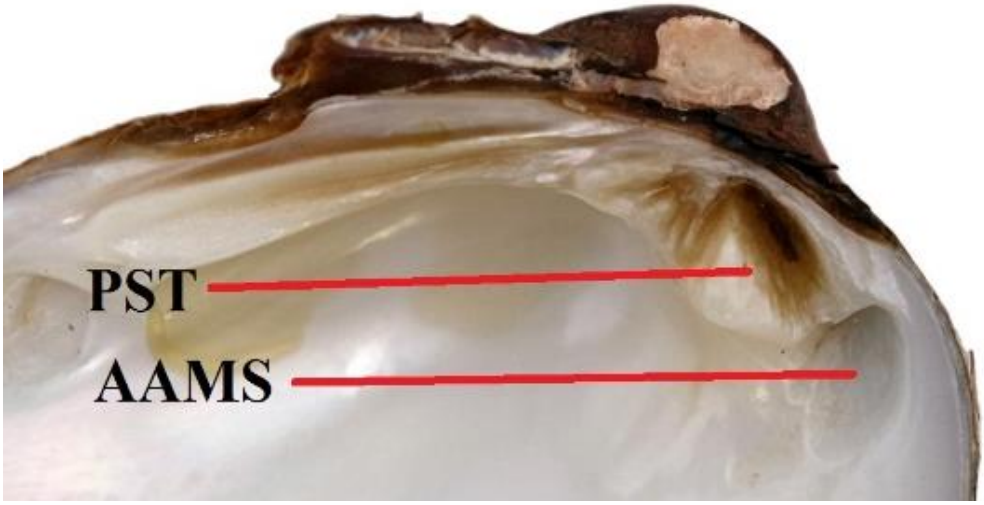

6 Anterior adductor muscle scar (AAMS) wedge-shaped with relatively smooth surface. PST is the pseudocardinal tooth

7(4) Umbo terminal, located at the extreme anterior end of the shell; shell shape resembles a club, with prominent, enlarged anterior end tapering to a smaller posterior end.....9
8(46) Umbo not terminal, located nearer to middle of dorsal edge of shell 11

9 Shell club shaped, umbo terminal

10 Umbo not terminal

9(7) Periostracum dark, almost black; ventral edge of shell strongly rounded ....*Pleurobema curtum* **Black Clubshell** (p. 210)
10(7) Periostracum lighter in color, dark brown to yellow; ventral edge of shell less rounded, relatively straight ..... *Pleurobema decisum* **Southern Clubshell** (p. 213)

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11 Periostracum dark, ventral edge rounded

12 Periostracum lighter, ventral edge less rounded

11(8) Shell more broadly elliptical than oval, moderately inflated; anterior lobe of left pseudocardinal tooth bladelike .....*Pleurobema perovatum* **Ovate Clubshell** (p. 219)
12(8) Shell more oval to nearly round than elliptical, moderately compressed; somewhat flattened laterally; pseudocardinal tooth in left valve robust, not bladelike 13

13(12) Umbo prominent, swollen, extends above the hinge line .... *Pleurobema marshalli* **Flat Pigtoe** (in part; specimens without pustules will key out here, p. 216)
14(12) Umbo not prominent, even with or slightly above the hinge line 15

11 Shell broadly elliptical

12 Shell oval to round, laterally flattened

15(14) Shell moderately or greatly inflated, relatively thick; periostracum slightly roughened, texture somewhat cloth-like ....*Obovaria arkansasensis* **Southern Hickorynut** (p. 192)
16(14) Shell slightly inflated to compressed; periostracum smooth to slightly coarse but not cloth-like; restricted to the Tennessee River drainage.....17

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17(15) Interdentum relatively wide and long; posterior ridge angular, curved ventrally; posterior slope relatively steep; umbo moderately shallow; periostracum color usually yellow to tawny brown..... *Pleuronaia dolabelloides* **Slabside Pearlymussel** (p. 232)
18(15) Interdentum shorter; posterior ridge less angular, not curved ventrally; posterior slope less steep; color usually brownish yellow to dark brown..... .....*Pleuronaia barnesiana* **Tennessee Pigtoe** (p. 229)

17 Posterior ridge curved ventrally, posterior slope steep

18 Posterior ridge not curved ventrally, posterior slope less steep

19(2) Shell usually with rays, relatively prominent, which may be either sparse or numerous.....21
20(2) Shell usually without rays; if rays are present, they are few in number and are either faded very narrow, or extend only slightly down from the umbo, and are neither obvious nor prominent.....47

21(19) Umbo prominent, swollen, extends well above the hinge line; umbo cavity deep 23
22(19) Umbo not prominent, even with or slightly above hinge line, umbo cavity shallow to moderately deep.....25

21 Umbo swollen, prominent

22 Umbo not swollen nor prominent

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23(21) From the Gulf of Mexico Basin drainages ....*Lampsilis ornata* **Southern Pocketbook** (in part, specimens with rays will key out here, p. 149)
24(21) From the Mississippi River Basin drainages ....*Lampsilis cardium* **Plain Pocketbook** (in part, specimens with rays will key out here, p. 140)

25(22) Nacre usually purple, orange, or peach 27
26(22) Nacre white 29

27(25) Nacre pale to deep purple 29
28(25) Nacre pale to bright orange, salmon, or peach, at least in the umbo cavity 31

29(27) Shell thick, heavy; umbo cavity relatively deep, nacre usually dark purple but may be a lighter shade of purple in some specimens; shell relatively large, length usually greater than 75 mm (3.0 in.); umbo extends beyond hinge line; small posterior wing present .... *Potamilus purpuratus* **Bleufer** (in part, specimens with rays will key out here, p. 247)
30(27) Shell thin, umbo cavity shallow, nacre purple to purplish yellow; shell relatively small, length usually less than 75 mm (3.0 in.); umbo barely extends beyond hinge line; small posterior wing absent ....*Villosa lienosa* **Spectaclecase** (in part; specimens with rays will key out here, p. 323)

31(28) Interdentum thin to absent .....*Villosa lienosa* **Spectaclecase** (in part; specimens with rays will key out here, p. 323)
32(28) Interdentum narrow to moderate width.*Hamiota perovalis* **Orangenacre Mucket** (in part; specimens with rays will key out here, p. 137)

33(26) Shell usually very thin, fragile; umbo cavity shallow; nacre white to bluish white; pseudocardinal teeth small, bladelike, not prominent; rays usually well developed ....*Villosa vibex* **Southern Rainbow** (p. 326)
34(26) Shell thicker, more robust, not fragile; umbo cavity shallow to deep, pseudocardinal teeth relatively small but well developed, not bladelike.....35

35(34) Rays usually prominent 37
36(34) Rays faint, not prominent; shell relatively small, length usually less than 75 mm (3.0 in.), nacre usually light purplish white and restricted to the umbo ..... *Villosa lienosa* **Spectaclecase** (in part; specimens with faint rays and whitish rather than purple nacre will key out here, p. 323)

37(35) Shell small, length usually less than 38 mm (1.5 in.); rays narrow, often broken; posterior slope very narrow, dorsal edge of shell posterior to the umbo slopes steeply toward the posterior end of the shell 39
38(35) Shell larger; rays usually wider, prominent; posterior slope wider, dorsal edge of the shell posterior to the umbo gradually slopes toward the posterior end of the shell 41

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39(37) Shell more rounded, shell length to height ratio approximately 1.3, Tombigbee drainage..... *Epioblasma penita* **Southern Combshell** (in part, males will key out here, p. 118)
40(37) Shell more elliptical, length to height ratio approximately 1.6, Tennessee drainage .....*Epioblasma brevidens* **Cumberlandian Combshell** (in part, males will key out here, p. 115)

39 Shell more rounded

40 Shell more elliptical

41(38) Shell not swollen, shell height usually greater than shell width 43
42(38) Shell swollen, nearly as wide as high; rays relatively wide and numerous, covering most of the shell and extending up onto the umbo ....*Lampsilis hydiana* **Louisiana Fatmucket** (in part, specimens with rays will key out here, p. 146)

43(41) Rays very narrow, but numerous, usually covering almost the entire shell; found in the Tennessee River drainage .....*Lampsilis fasciola* **Wavyrayed Lampmussel** (p. 143)
44(41) Rays wide to relatively wide 45

43 Rays narrow, but numerous

44 Rays relatively wide

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45(44) Rays most evident on posterior end of shell, do not extend up onto the umbo; found in Mississippi River Basin drainages exclusive of Tennessee River..... . *Lampsilis siliquoidea* **Fatmucket** (in part, specimens with rays will key out here, p. 155)
46(44) Rays numerous, usually covering almost the entire shell; found in the Tombigbee drainage..... *Hamiota perovalis* **Orangenacre Mucket** (in part, shells with white nacre will key out here, p. 137)

47(20) Umbo prominent, swollen, extends well above the hinge line; umbo cavity deep 49
48(20) Umbo not prominent, even with or slightly above hinge line, umbo cavity shallow to moderately deep 53

49(47) From the Gulf of Mexico Basin drainages ....*Lampsilis ornata* **Southern Pocketbook** (in part, specimens without rays will key out here, p. 149)
50(47) From the Mississippi River Basin drainages.....51

51(50) Distal surface of pseudocardinal tooth in left valve relatively even across the length of the tooth; the more dorsal pseudocardinal tooth in the right valve equal to or greater in height than the more ventral tooth; hinge line shaped like an elongated "S"..... ..... *Potamilus capax* **Fat Pocketbook** (p. 238)
52(50) One end of the distal surface of left valve pseudocardinal tooth usually higher than the other end, usually a distinct gap between the two ends of the tooth; ventral pseudocardinal tooth in the right valve distinctly greater in height than more dorsal tooth; hinge line straighter, not shaped like an elongate "S" ....*Lampsilis cardium* **Plain Pocketbook** (in part, specimens without rays will key out here, p. 140)

51 Pseudocardinal tooth in left valve relatively even across the length of the tooth

52 Pseudocardinal tooth in left valve with a distinct gap between the two ends of the tooth

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51 Hinge line shaped like an elongated "S"

52 Hinge line straighter

53(48) Nacre purple 55
54(48) Nacre may be white, salmon, or orange, but not purple.....57

55(53) Shell thick, heavy; umbo cavity relatively deep, nacre usually dark purple but may be a lighter shade of purple in some specimens; shell relatively large, length usually greater than 75 mm (3.0 in.); umbo extends beyond hinge line .... *Potamilus purpuratus* **Bleufer** (p. 247)
56(53) Shell thin, umbo cavity shallow, nacre purple to purplish yellow; shell relatively small, length usually less than 75 mm (3.0 in.); umbo barely extends beyond hinge line .... .. *Villosa lienosa* **Spectaclecase** (in part; specimens without rays will key out here, p. 323)

57(54) Shell moderately thick to thin; hinge teeth well developed, but not prominent; interdentum narrow or absent 59
58(54) Shell thick, heavy; hinge teeth large and very prominent; interdentum wide..... .....*Actinonaias ligamentina* **Mucket** (p. 75)

59(57) Periostracum with a cloth-like texture, usually not shiny, ranges in color from green to greenish brown to dark brown to almost black; shell usually small, length usually less than 50 mm (2.0 in.) 61
60(57) Periostracum texture smooth, not cloth-like, often rather shiny but may have elevated growth lines, color light reddish brown, yellowish brown, or orange; shell larger, length usually greater than 75 mm (3.0 in.) 63

61(59) Shell very small, length in adults seldom larger than 25 mm (1 in.); posterior ridge usually absent; shape more oval than elliptical; anterior and posterior ends of the shell are relatively similar in size ..... *Toxolasma parvum* **Lilliput** (p. 293)
62(59) Shell larger, shell length in adults usually 65 – 75 mm (2.6 – 3.0 in.); posterior ridge usually present but broadly rounded; shape more elliptical than oval; anterior and posterior ends of the shell are much different is size, particularly in females..... .....*Toxolasma texasiense* **Texas Lilliput** (p. 296)

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61 Shape more oval than elliptical

62 Shape more elliptical than oval

63(60) Shell swollen, nearly as wide as high; found primarily in the Mississippi River alluvial plain (Mississippi Delta Region) .....*Lampsilis hydiana* **Louisiana Fatmucket** (in part, specimens without rays will key out here, p. 146)
64(60) Shell not swollen, shell height usually greater than shell width 65

65(64) Interdentum narrow to moderate width; lateral teeth thick; restricted to the Tombigbee drainage.....*Hamiota perovalis* Orangenacre Mucket (in part, specimens without rays will key out here, p. 137)
66(64) Interdentum thin to absent; lateral teeth thin.....67

67(66) Nacre orange or peach, rarely white; periostracum usually very dark brown or black.....*Villosa lienosa* **Spectaclecase** (in part; specimens without rays will key out here, p. 323)
68(66) Nacre white; periostracum usually yellow, orange, or light brown 69

69(68) Nacre white, found in headwater streams of the Yazoo drainage, the Big Black drainage, and the Mississippi River South drainage.....*Lampsilis siliquoidea* **Fatmucket** (in part, specimens without rays will key out here, p. 155)
70(68) Not from the Yazoo, Big Black, or Mississippi River South drainages.....71

71(70) Shell with elevated growth lines, giving the surface of the periostracum a rough, almost corrugated appearance.....*Lampsilis straminea* form *straminea* **Rough Fatmucket** (p. 159)
72(70) Shell smooth, growth lines evident but not elevated above the rest of the periostracum.....*Lampsilis straminea* form *claibornensis* **Southern Fatmucket** (p. 159)

69 Elevated growth lines

70 Growth lines not elevated

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Group B: No structural ornamentation
Section 2: Hinge teeth present
Part 3: Shell thick, posterior ridge absent or broadly rounded
Division 4: Shell shape quadrate

Females of many species of oval mussels have enlarged marsupial regions on the posterior of the shell. The characters used to differentiate these females from one another are essentially the same as used earlier in the key except that instead of shell shapes being oval, they are quadrate. Some species have obvious marsupial regions, others do not. Some of the more obvious examples are shown below:

Epioblasma brevidens

Epioblasma penita

Epioblasma triquetra

Lampsilis cardium

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Lampsilis hydiana

Lampsilis ornata

Lampsilis siliquoidea

Lampsilis straminea

Toxolasma texasiense

Villosa lienosa

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SPECIES ACCOUNTS

These accounts include almost all of the freshwater mussels known or thought to occur in Mississippi. Each account begins with the scientific and common names of the species. Both follow the taxonomy and nomenclature of Williams et al. (2017). Next are photographs of the species showing both the external and internal features of the shells along with information on the size of the specimens in the photographs and where they were collected. After the photographs are the following sections:

Shell characteristics - a description of shell characters that are believed to be most useful in identification of the species.

Distribution - information on the distribution of the species nationally;

Mississippi distribution - data on the distribution of the species by drainage within Mississippi.

Similar species - information about how the species can be differentiated from other species with which it could be and often is confused.

Natural history - a short summary of the natural history of the species including information on habitat, reproduction, and fish hosts. Much of the information on reproduction and body sizes of gravid females came from mussels in the MDWFP collection. Gravid females in the collection were identified by the presence of glochida in their gills. Data on fish hosts came from the Freshwater Mussel Host Database maintained cooperatively by Ohio State University and the Illinois Natural History Survey (**Freshwater Mussel Host Database. 2017. The freshwater mussel host database, Illinois Natural History Survey & Ohio State University Museum of Biological Diversity, 2017)** **http://wwx.inhs.illinois.edu/collections/mollusk/data/freshwater-mussel-host-database)** accessed in November, 2018.

Status - information on the conservation status of the species in Mississippi. This is indicated by its rank as determined by the Mississippi Natural Heritage Program (MNHP) of the MDWFP. The rank is composed to two parts, the national rank, designated by a G, and the rank in Mississippi, designated by an S. Accompanying each is a numeric score from 1 to 5, where rarity is inverse to the numerical score. For example, a rank of G5S2 indicates that the species is secure nationally (G5), but rare in Mississippi (S2). Whether the species is listed as threatened or endangered by either the USFWS or MDWFP follows the MNHP rank, and includes any other information that we have on the conservation status of the species in the state.

Taxonomic notes - this section, if present, indicates recent changes in the scientific name of the species and any questions concerning its taxonomic standing.

Following the sections listed above is a map showing the distribution of the species in Mississippi. The map is based primarily on locality data from specimens in the MDWFP mussel collection with additional data from the USACE in Vicksburg.

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ACTINONAIAS LIGAMENTINA (LAMARCK, 1819)
MUCKET

***Actinonaias ligamentina* – Top: MMNS 5510, Sunflower River, Sunflower County, 93 mm (3.7 in.); Bottom: MMNS 4779, Sunflower River, Sharkey County, 93 mm (3.7 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval to sub-triangular, smaller specimens laterally compressed, some larger specimens moderately inflated; shell relatively heavy.
Posterior ridge: Very broadly rounded, more prominent in smaller individuals; posterior slope relatively narrow.
Umbo: Slightly above hinge line, anterior to midpoint of dorsal margin.
Color and pattern: Chestnut brown to dark brown to light yellowish brown. Rays sometimes present in smaller specimens, obscure to absent in larger animals, extending from umbo to ventral margin; may be narrow to moderately narrow, broken or entire.
Surface: Smooth, no ornamentation.
Nacre: Milky white, slightly iridescent around margins.
Umbo cavity: Shallow to moderately shallow.
Teeth: Two pseudocardinal teeth in each valve, one prominent lateral tooth and sometimes a narrower ledge ventrally in the right valve, two lateral teeth in left.
Interdentum: Relatively wide.

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Size: Maximum shell length of specimens from Mississippi is 100 mm (3.9 in.).

DISTRIBUTION: Southern Canada east to New York, west to Kansas, south to Louisiana and Mississippi.

MISSISSIPPI DISTRIBUTION: Yazoo drainage in western Mississippi. May occur in the Tennessee drainage, as it formerly occurred in that system in Alabama (Williams et al., 2008).

SIMILAR SPECIES: May be confused with *Ellipsaria lineolata* or *Plethobasus cyphyus*, but the former has a prominent posterior ridge, and the latter usually has at least a few distinct pustules on the sides of the shell.

NATURAL HISTORY:

Habitat: Known only from two specimens taken from the Big Sunflower River in Sharkey and Sunflower counties. The latter was taken in moderately fast current over a substrate of clay and gravel.

Reproduction: Nothing is known of the life history of this species in Mississippi. In other parts of its range, it is apparently gravid for an extended period of time.

Fish hosts: There are 24 species of fish in nine families that have been identified as hosts for this mussel, 17 of which occur in Mississippi. These include the White Bass (*Morone chrysops*), Walleye (*Sander vitreus*), Sauger (*S. canadense*), Yellow Perch (*Perca flavescens*), American Eel (*Anguilla rostrata*), Tadpole Madtom (*Noturus gyrinus*), Creek Chub (*Semotilus atromaculatus*), Common Carp (*Cyprinus carpio*), Central Stoneroller (*Campostoma anomalum*), and eight species of sunfishes (Centrarchidae).

STATUS: MNHP: G5S1; MDWFP: Endangered.

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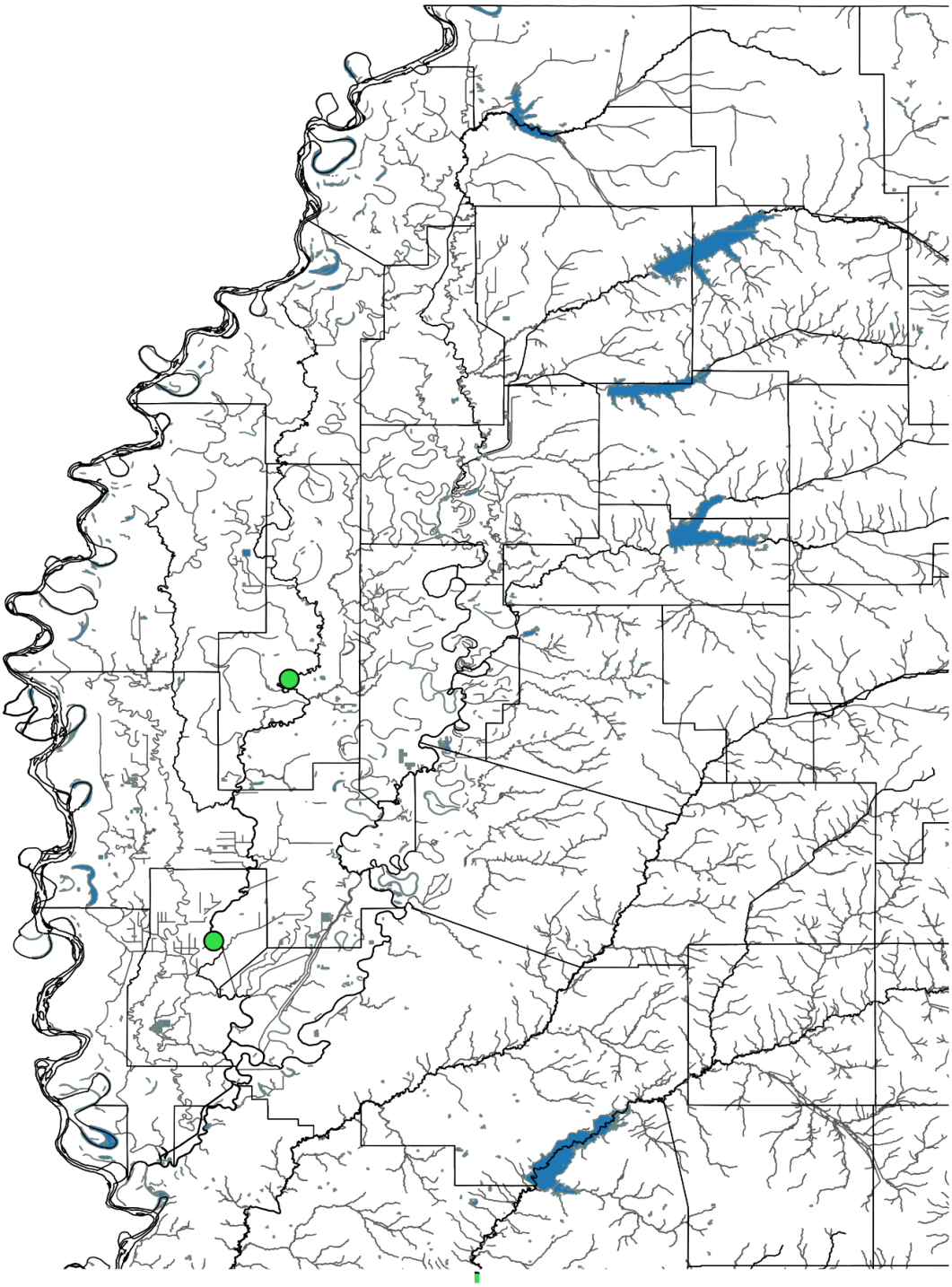

Distribution of *Actinonaias ligamentina* in Mississippi.

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AMBLEMA PLICATA (SAY, 1817)
THREERIDGE

***Amblema plicata* – Top: MMNS 4071, Little Tallahatchie River, Panola County, 115 mm (4.5 in.). Bottom: MMNS 331, Pearl River, Rankin County, 115 mm (4.5 in.).**

SHELL CHARACTERISTICS:

Shape and structure: Quadrate to almost oval, slightly to moderately inflated, shell thick. Dorsal margin with a slight wing posteriorly, usually more pronounced in juveniles.

Posterior ridge: Broadly rounded; posterior slope moderately wide along mid-dorsum.

Umbo: Above hinge line and near anterior of shell.

Color and pattern: Light to dark brown, often with lighter shading on ventral part of anterior end of shell; no rays.

Surface: Three to five prominent ridges extending laterally from posterior of umbo to near posterior end of shell, often curving dorsally onto wing if one is present.

Nacre: Creamy white, often with violet shading toward posterior.

Umbo cavity: Deep.

Teeth: Two pseudocardinals in each valve. One lateral tooth in right valve, two in the left valve.

Interdentum: Wide.

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Size: Largest Mississippi specimen in MDWFP collection is 140 mm (5.5 in.) shell length.

DISTRIBUTION: East-central Canada south to Texas and east to the southern Appalachians.

MISSISSIPPI DISTRIBUTION: Known from all drainages in Mississippi except Lake Pontchartrain and Coastal Rivers. There are specimens in the MDWFP collection from Tangipahoa and Amite rivers in Louisiana, both in the Lake Pontchartrain drainage, and the species likely occurs in those rivers in Mississippi as well.

SIMILAR SPECIES: Most closely resembles *Megalonaias nervosa*, which has small corrugations anterior to the umbo that the Threeridge lacks.

NATURAL HISTORY:

Habitat: Found in a variety of aquatic habitats, including rivers, creeks, oxbows, and reservoirs, in areas with good current as well as those with virtually no current. Substrates vary from sand or gravel mixtures to clay and silt.

Reproduction: Gravid females have been found in June, July, and August in Mississippi. There are two June records of gravid females from the Pascagoula River in Jackson County, one from the Sunflower River in Sunflower County, and another from the Tallahatchie River in Leflore County. An additional gravid female was found in the Sunflower River, Sunflower County in July, and another in Steele Bayou, Sharkey County, in August. These females ranged in size from 60 - 108 mm (2.4 – 4.3 in.) and averaged 82 mm (3.2 in.) shell length.

Fish hosts: Fish hosts identified for the Threeridge include 27 species in 10 families, 24 of which occur in Mississippi. These include the Yellow Perch (*Perca flavescens*), Sauger (*Sander canadense*), Logperch (*Percina caprodes*), White Bass (*Morone chrysops*), Mooneye (*Hiodon tergisus*), Blacktail Shiner (*Cyprinella vensuta*), Red Shiner (*C. lutrensis*), Steelcolor Shiner (*C. whipplei*), Spotfin Shiner (*C. spiloptera*), Emerald Shiner *(Notropis atherinoides*), Shortnose Gar (*Lepisosteus platostomus*), Flathead Catfish (*Pylodictis olivaris*) Channel Catfish (*Ictalurus punctatus*), Freshwater Drum (*Aplodinotus grunniens*), Black Redhorse (*Moxostoma duquesnei*), Golden Redhorse (*M. erythrurum*), Northern Hog Sucker (*Hypentelium nigricans*), and seven species of sunfishes (Centrarchidae).

STATUS: MNHP: G5S5.

This species is widely distributed in the state and can be relatively abundant even in what appears to be marginal habitat. We have collections from 42 Mississippi counties, but most are from larger rivers including the Big Black, Pearl, East Fork Tombigbee, and Sunflower, although we have a large number of specimens from Gilliam Chute in Jefferson County.

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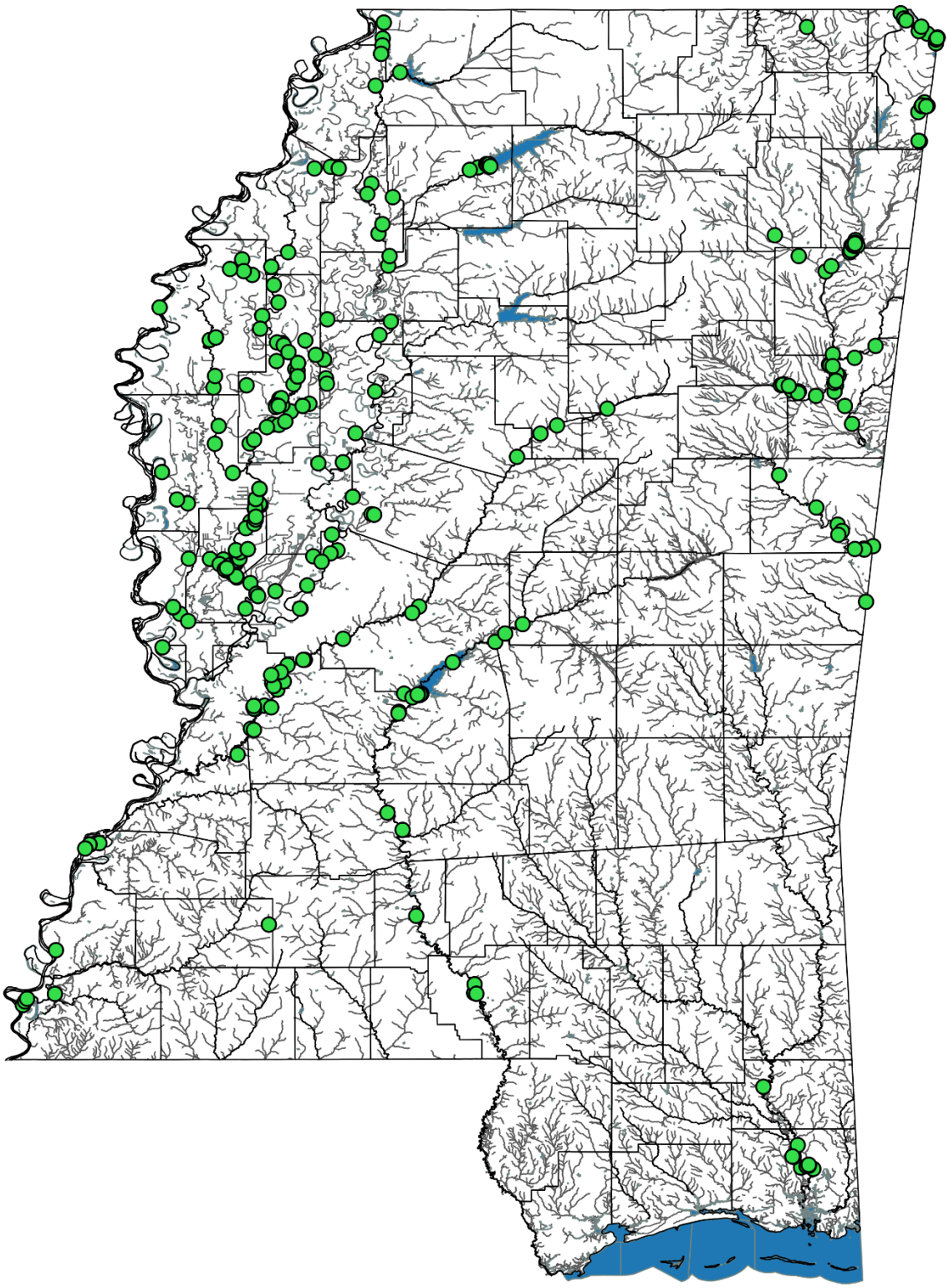

Distribution of *Amblema plicata* in Mississippi.

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ARCIDENS CONFRAGOSUS (SAY, 1829)
ROCK-POCKETBOOK

***Arcidens confragosus* – Top: MMNS 2563, Steele Bayou, Washington County, 147 mm (5.8 in.). Bottom: MMNS 8689, Sunflower River, Sharkey County, 77 mm (3.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to broadly elliptical, inflated, moderately thick in larger individuals, relatively thinner in smaller specimens, posterior margin tapering to a truncated point, dorsal margin broadly rounded with low wing posterior to umbo.
Posterior ridge: Broadly rounded in juveniles, absent in larger specimens.
Umbo: Prominent, above hinge and folded inward.

Color and pattern: Very dark brown, some smaller specimens have a greenish or yellowish wash; no rays.
Surface: Anterior surface smooth in larger specimens, posterior surface with broad ridges and corrugations, more prominent in smaller shells. In the latter there may be two parallel rows of pustule-like prominences from the umbo extending about half way to the ventral margin.
Nacre: Creamy white.
Umbo cavity: Moderately deep to shallow in larger specimens.

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Teeth: Pseudocardinal tooth in right valve prominent, thick, bladelike, directed upward toward umbo cavity; lateral teeth in right valve short, almost straight; two elongated, thickened, pseudocardinals in left valve; lateral tooth smaller, not as prominent as those in right valve.
Interdentum: Absent.
Size: Maximum shell length of largest Mississippi specimen in MDWFP collection is 160 mm (6.3 in.).
DISTRIBUTION: Occurs from Wisconsin and Michigan south to Texas and Alabama.
MISSISSIPPI DISTRIBUTION: Known from all drainages except the Mississippi River North, Lake Pontchartrain, Pascagoula, and the Coastal Rivers.
SIMILAR SPECIES: The Rock-Pocketbook is most likely to be confused with *Amblema plicata* or *Megalonaias nervosa*. Those two species both have heavier, thicker shells, more prominent pseudocardinal and lateral teeth, and both have an interdentum, which is absent in *A. confragosus.*
NATURAL HISTORY:
Habitat: This species is found in large creeks and rivers where it can be found in a variety of substrates including sand, gravel, mud, clay, or silty clay, in areas with little or no current to moderate current.
Reproduction: Two gravid females in the MDWFP collection were both found in October, one in the Tombigbee River in Alabama and the other in the Sunflower River in Sunflower County. The shell length of one of these females was 78 mm (3.1 in.), the other was 80 mm (3.1 in.).
Fish hosts: Fish hosts identified for *A. confragosus* include 25 species in 11 families, 17 of which occur in Mississippi. These include the Channel Catfish (*Ictalurus punctatus*), Shorthead Redhorse (*Moxostoma macrolepidotum*), Quillback (*Carpiodes cyprinus*), Smallmouth Buffalo (*Ictiobus bubalus*), Creek Chub (*Semotilus atromaculatus*), Common Carp (*Cyprinus carpio*), Golden Shiner (*Notemigonus chrysoleucas*), Rock Bass (*Ambloplites rupestris*), White Crappie (*Pomoxis annularis*), Green Sunfish (*Lepomis cyanellus*), Orangespotted Sunfish (*L. humilis*), Gizzard Shad (*Dorosoma cepedianum*), American Eel (*Anguilla rostrata*), Blackspotted Topminnow (*Fundulus olivaceus*), Yellow Perch *(Perca flavescens*), Walleye (*Sander vitreus*), and Freshwater Drum (*Aplodinotus grunniens*).
STATUS: MNHP: G4S2S3.
This species is somewhat uncommon within Mississippi, although we have specimens from 25 counties in the state. The majority of our collection records are from the Sunflower River although a large number of specimens were found in Lake Cormorant Bayou in Tunica County.

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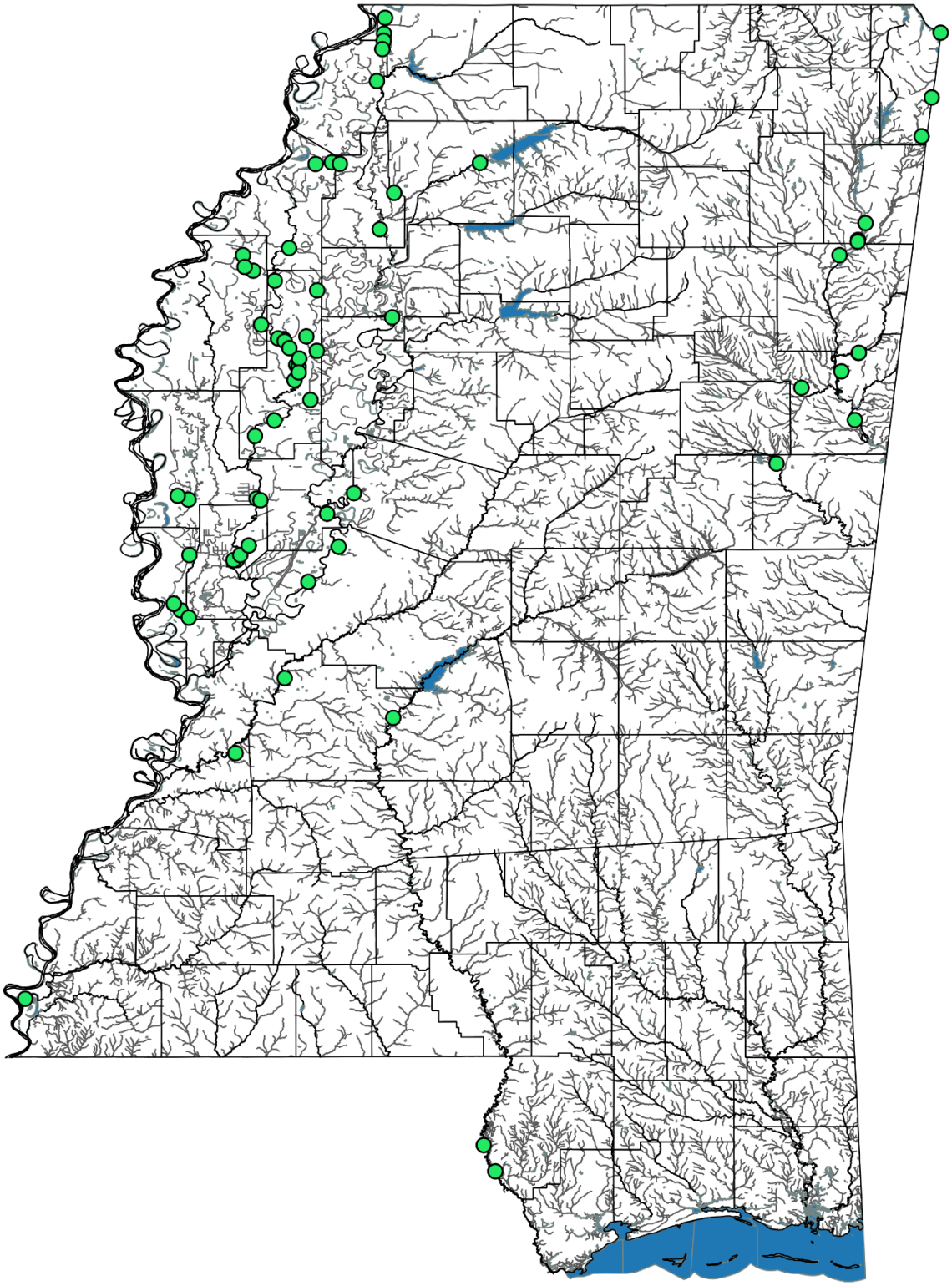

Distribution of *Arcidens confragosus* in Mississippi.

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CYCLONAIAS ASPERATA (LEA, 1861)
ALABAMA ORB

***Cyclonaias asperata* – Top: MMNS 619, East Fork Tombigbee River, Itawamba County, 65 mm (2.6 in.). Bottom: MMNS 613, Buttahatchee River, Monroe County, 43 mm (1.7 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Round to oval, moderately inflated, shell thick, posterior slope relatively narrow. .
Posterior ridge: Absent.
Umbo: Above hinge line, relatively pronounced, curved inward toward midline, located at about the midpoint of the dorsal edge of the shell.
Color and pattern: Light to dark brown, sometimes a lighter brownish yellow; no rays.
Surface: Ranges from completely or almost completely covered with pustules to pustules clustered in different parts of

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the shell to almost completely lacking pustules. Narrow corrugations or rows of slightly elongated pustules sometimes found on the posterior slope or on the anterior part of the shell.
Nacre: Generally pearly white.
Umbo cavity: Relatively deep.
Teeth: Two pseudocardinals and two laterals in the left valve, one pseudocardinal and one lateral in the right valve. Teeth generally large and well developed.
Interdentum: Present and relatively wide.
Size: Largest specimen from Mississippi in MDWFP collection is 81 mm (3.2 in.) shell length.
DISTRIBUTION: Mobile Basin in Mississippi, Alabama, Georgia, and Tennessee.
MISSISSIPPI DISTRIBUTION: Tombigbee drainage, including the Buttahatchie, East Fork Tombigbee, and Noxubee rivers and Luxapallila and Tibbee creeks.
SIMILAR SPECIES: Most similar to *Cyclonaias pustulosa*, which does not presently occur in the Tombigbee drainage, but could eventually move into the drainage via the Tenn-Tom Waterway. Specimens with only a few pustules, which are relatively more common in Yellow Creek, a tributary of Luxapallila Creek, than elsewhere in the distribution, might be mistaken for either *Obovaria unicolor* or *Fusconaia cerina*, but the presence of even a few pustules will separate *C. asperata* from the former and the absence of a posterior ridge will separate it from the latter.
NATURAL HISTORY:
Habitat: Most commonly found in gravel, sand, and mud or a mixture in slow to fast current in large creeks and in rivers.
Reproduction: A gravid female 64 mm (2.5 in.) shell length was found in July in the Noxubee River in Noxubee County. Females apparently mature at from three to nine years of age (Haag and Staton, 2003).
Fish hosts: Two fish hosts have been identified for the Alabama Orb, the Channel Catfish (*Ictalurus punctatus*) and the Speckled Madtom (*Noturus leptacanthus*).
STATUS: MNHP: G4S4.
We have records of this species from six Mississippi counties, and it can be very abundant in some Tombigbee watershed streams. Most of our collection records and specimens are from the larger rivers in the state including the Buttahatchee and East Fork Tombigbee rivers.
TAXONOMIC NOTES: This species was formerly included in the genus *Quadrula* but was moved to the *Cyclonaias* by Williams et al. (2017). Lopes-Lima et al. (2019) have suggested, based on genetic data that this species is conspecific with *Cyclonaias kieneriana* (Coosa Orb) and should be referred to by that name.

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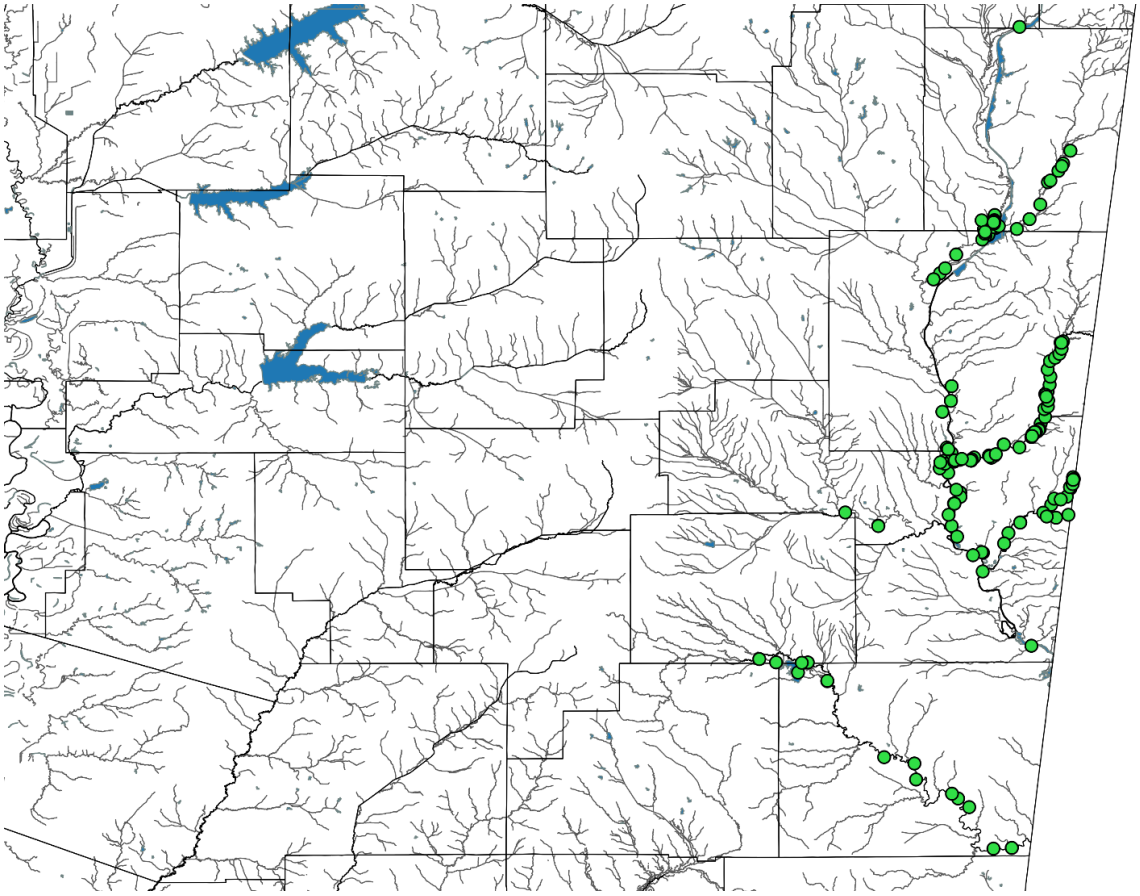

Distribution of *Cyclonaias asperata* in Mississippi**.**

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CYCLONAIAS NODULATA (LEA, 1868)
WARTYBACK

***Cyclonaias nodulata* – Top: MMNS 5157, Hushpuckena River, Bolivar County, 48 mm (1.9 in.). Bottom: MMNS 5349, Big Black River, Warren County, 49 mm (1.9 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Round to slightly oval, moderately inflated, shell relatively thick.
Posterior ridge: Absent in smaller specimens, very broadly rounded in larger ones.
Umbo: Above hinge line, relatively prominent, directed toward the midline.
Color and pattern: Dark brown to light yellowish brown.
Surface: Most commonly two rows of sparse pustules, usually horizontally elongated, on either side of a shallow sulcus just anterior to the posterior ridge. Occasionally areas of small corrugations on posterior slope, which also has a few clusters of small pustules. Some

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individuals may have only one row or only a partial row of pustules next to the sulcus.
Nacre: Creamy white.
Umbo cavity: Deep.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth relatively large. Usually the anterior most pseudocardinal in the left valve is the largest of the two.
Interdentum: Present, relatively narrow to relatively wide.
Size: Largest Mississippi specimen in MDWFP collection is 70 mm (2.8 in.) shell length.
DISTRIBUTION: Mississippi River Basin from Minnesota south to Louisiana.
MISSISSIPPI DISTRIBUTION: Found in the Big Black, Homochitto, Sunflower, Tallahatchie and Yazoo river drainages, including Fourteen Mile Creek, Gilliam Chute, Yazoo Pass, Steele Bayou, and Bogue Phalia.
SIMILAR SPECIES: This species most closely resembles *C. pustulosa*, which does not have two rows of pustules flanking a sulcus. The Wartyback also tends to have many fewer pustules than most *C. pustulosa*.
NATURAL HISTORY:
Habitat: The Wartyback occurs in mud or mixtures of sand, gravel, and mud in creeks to rivers, usually in areas with at least some current.
Reproduction: Seven gravid females, which averaged 57 mm (2.2 in.) shell length and ranged from 43 to 63 mm (1.7 – 2.5 in.), are in the MDWFP collection. Three of these, from the Sunflower River system in Sunflower County, were found in July and four, found in the Sunflower River in Humphreys County, the Big Black River in Warren County, and Steele Bayou in Sharkey County, were found in August.
Fish hosts: Ten fish hosts in two families have been identified, all of which occur in Mississippi: Channel Catfish (*Ictalurus punctatus*), Blue Catfish (*I. furcatus*) Flathead Catfish (*Pylodictis olivaris*), Black Bullhead (*Ameiurus melas*), Brown Bullhead (*A. nebulosus*) Slender Madtom (*Noturus exilis*), Black Crappie (*Pomoxis nigromaculatus*), White Crappie (*Pomoxis annularis*), Bluegill (*Lepomis macrochirus*), and Largemouth Bass (*Micropterus salmoides*).
STATUS: MMNH: G4S3.
This species is rather uncommon in Mississippi even though we have specimens from 17 counties. The majority of our collection records are from the Sunflower and Big Black rivers, although we have a large number of specimens from Gilliam Chute in Jefferson County.
TAXONOMIC NOTES: This species was formerly included in the genus *Quadrula* but was recently moved to the genus *Cyclonaias* (Williams et al. 2017).

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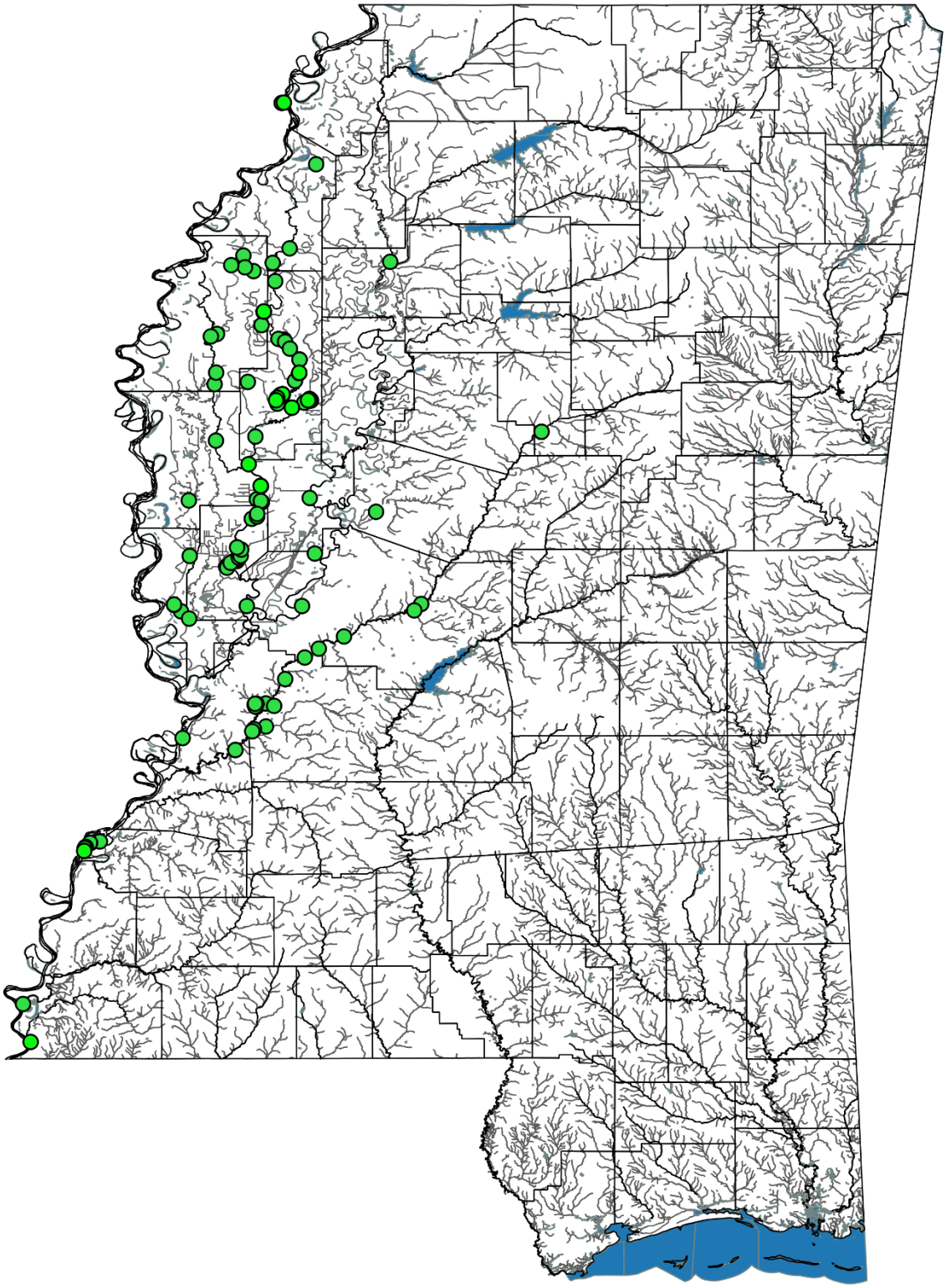

Distribution of *Cyclonaias nodulata* in Mississippi.

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CYCLONAIAS PUSTULOSA (LEA, 1831)
PIMPLEBACK

***Cyclonaias pustulosa* – Top: MMNS 4232, Little Tallahatchie River, Panola County, 52 mm (2.0 in.). Middle: MMNS 5234, Sunflower River, Sunflower County, 63 mm (2.5 in.). Bottom: MMNS 1551, Bear Creek, Tishomingo County, 36 mm (1.4 in.).**

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SHELL CHARACTERISTICS:
Shape and structure: Round to oval, moderately inflated, shell relatively thick.
Posterior ridge: Completely absent in smaller specimens, may be very broadly rounded in larger specimens.
Umbo: Above hinge line, somewhat prominent, usually tips pointed slightly inward toward the midline of the shell.
Color and pattern: Dark brown to light yellowish brown, occasionally with a broad greenish-black ray beginning on the umbo and extending partially or entirely to the ventral edge of the shell. A few specimens may have the ray broken into segments, and a few have a second rather broad ray on the posterior slope. Rays appear to occur more frequently in juveniles than adults.
Surface: Ranges from entirely covered with small pustules to only a few pustules to no pustules. Pustules can be widely scattered or clustered in specific areas. Occasionally small corrugations occur on the posterior ridge.
Nacre: Creamy white.
Umbo cavity: Deep.
Teeth: Two lateral and two pseudocardinal teeth, the more anterior pseudocardinal larger, in the left valve and one lateral and one pseudocardinal tooth in the right valve. Teeth relatively large.
Interdentum: Present, relatively wide.
Size: Largest Mississippi specimen in MDWFP collection is 79 mm (3.1 in.) long.
DISTRIBUTION: Widespread in the Great Lakes and Mississippi River basins.
MISSISSIPPI DISTRIBUTION: Widespread including the Big Black, Mississippi River North, Mississippi River South, Tennessee, and Yazoo drainages, among others.
SIMILAR SPECIES: The Pimpleback resembles *Cyclonaias nodulata*, with which it sometimes co-occurs, but can be distinguished from it because the latter usually has a row of pustules on each side of a shallow sulcus near the posterior ridge.
NATURAL HISTORY:
Habitat: Found in large creeks and rivers with current, usually in sand, mud, gravel, or a mixture of the three. Also occurs in larger lakes or reservoirs.
Reproduction: Fourteen gravid females, four from the Tallahatchie River in Leflore County, one from Tchula Lake in Holmes County, one from the Hushpuckena River in Bolivar County, and four from Steele Bayou in Sharkey County, have been collected in Mississippi from June through August. These 14 females averaged 59.7 mm (2.4 in.) shell length and ranged from 30 – 74 mm (1.2 – 2.9 in.). Haag and Staton (2003) reported that female *Q. pustulosa* mature at ages of from 3-7 years.
Fish hosts: Six species of fish in three families have been identified as hosts of *C. pustulosa*. These include the Black Bullhead (*Ameiurus melas*), Brown Bullhead (*A. nebulosus*), Channel Catfish (*Ictalurus punctatus*), Flathead Catfish (*Pylodictis olivaris*), White Crappie (*Pomoxis annularis*), and Shovelnose Sturgeon (*Scaphirhynchus platorynchus*).
STATUS: MNHP: G5S5. This species can be one of the more common mussels found in some streams within its Mississippi range. We have specimens from 31 counties in the state, but the majority of our collection records are from the Big Black and Sunflower rivers.

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TAXONOMIC NOTES: This species was formerly included in the genus *Quadrula*, but was recently moved to the genus *Cyclonaias* (Williams et al. 2017).

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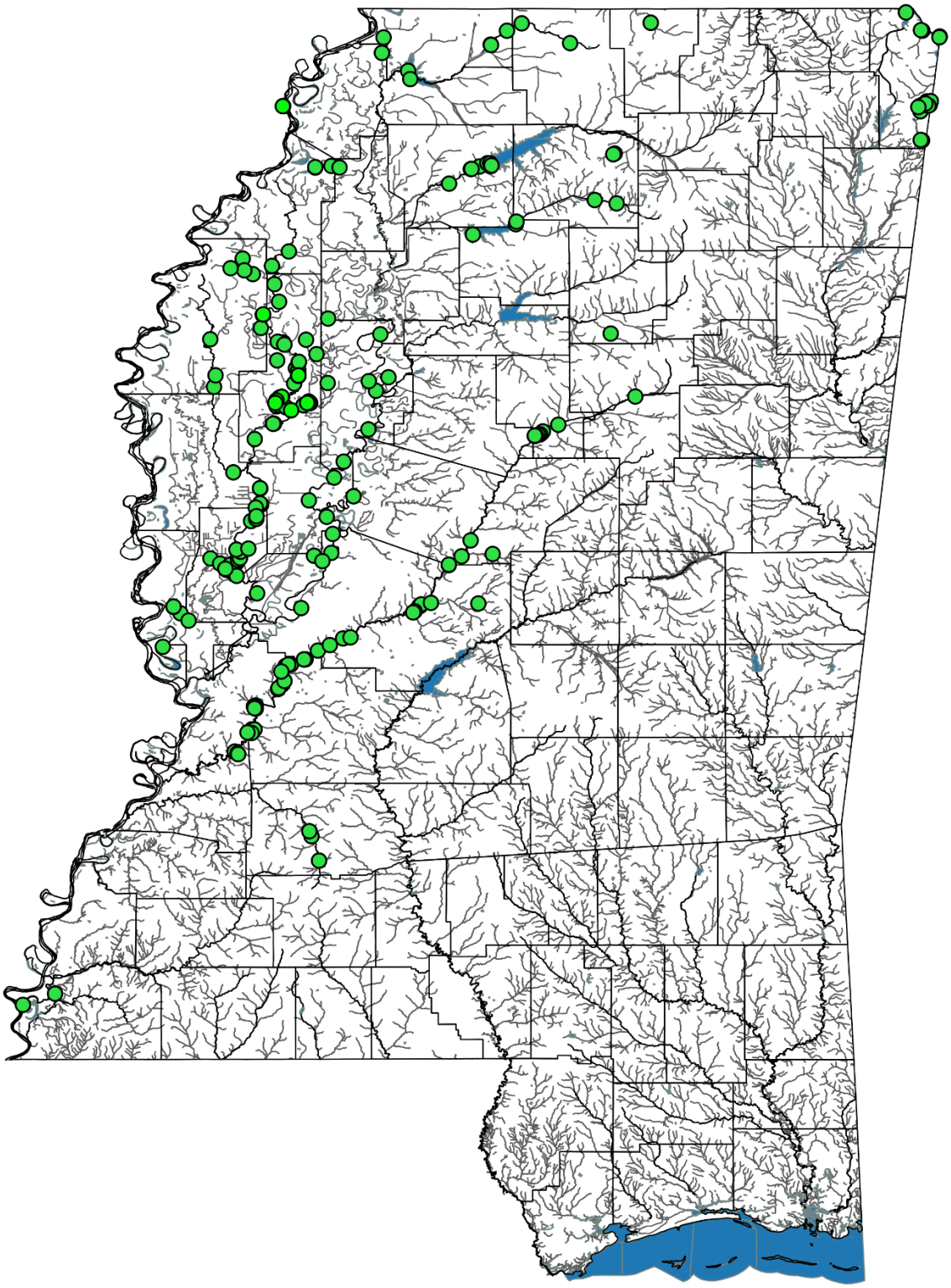

Distribution of *Cyclonaias pustulosa* in Mississippi.

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CYCLONAIAS REFULGENS (LEA, 1868)
PURPLE PIMPLEBACK

***Cyclonaias refulgens* – Top: MMNS 9952, Yockanookany River, Leake County, 41 mm (1.6 in.). Middle: MMNS 10383, Pearl River, Hancock County, 39 mm (1.5 in.). Bottom: MMNS 1577, Chickasawhay River, George County, 48 mm (1.9 in.).**

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SHELL CHARACTERISTICS:
Shape and structure: Usually round, but can be oval to almost quadrate; moderately inflated, shell relatively thick.
Posterior ridge: Absent in smaller specimens, very broadly rounded in larger ones.
Umbo: Above hinge line, not prominent.
Color and pattern: Dark reddish brown.
Surface: The surface can vary from completely covered with small, roundish pustules to almost completely without pustules to pustules concentrated on certain parts of the shell but not others. Sometimes small corrugations are found on the posterior slope.
Nacre: Purplish in fresh specimens, particularly around outer edge of shell; Nacre may fade to white over time in freshly dead or relict shells.
Umbo cavity: Relatively deep.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth relatively large.
Interdentum: Present, relatively wide.
Size: Largest Mississippi specimen in MDWFP collection has a shell length of 64 mm (2.5 in.).
DISTRIBUTION: Gulf Coast drainages east of the Mississippi River in Mississippi and Louisiana.
MISSISSIPPI DISTRIBUTION: Lake Pontchartrain, Pearl, and Pascagoula drainages, including the Amite, Tangipahoa, Chickasawhay, Escatawpa, Pearl, Strong, Bogue Chitto, Yockanookany, and Pascagoula rivers and Red, Black, and Okatoma creeks.
SIMILAR SPECIES: The Purple Pimpleback looks somewhat like both *C. asperata* and *C. pustulosa* but does not occur within the same drainages as those two species. It might be confused with either *Quadrula apiculata* or *Q. nobilis*, with which it co-occurs, but both of those have a much more prominent posterior ridge and a different shell outline than most *Q. refulgens*.
NATURAL HISTORY:
Habitat: This species occurs in larger creeks and smaller rivers within its range, where it can be found in sand, gravel, and mud or a mixture of the three substrates.
Reproduction: Gravid females (n = 22) from Mississippi ranged from 37 to 61 mm (1.5 – 2.4 in.) shell length and averaged 47.3 mm (1.9 in.) in size. Two of these females were collected in April (Pearl River, Hinds County; Tangipahoa River, Pike County), nine were collected in May (Pearl River, Pearl River County), five were found in June (1-Pearl River, Rankin County; 1-Pascagoula River, Jackson County; 3-Leaf River; Perry County), five were found in July (1-Pearl River, Rankin County; 3-Pearl River, Pearl River County; 1- Yockanookany River, Leake County), and one was found in September (Leaf River, George County).
Fish hosts: Unknown.
STATUS: MNHP: G3G4S3S4.
We have collection records of this species from 26 Mississippi counties, and it can be abundant in rivers in the southern part of the state. Most of our collection records and specimens are from the Leaf, Pascagoula, Pearl, and Strong rivers.
TAXONOMIC NOTES: This species was formerly included in the genus *Quadrula* but was recently moved to the genus *Cyclonaias* (Williams et al., 2017). Johnson et al. (2018) hypothesized, based primarily on genetic data, that this species was more properly considered a synonym of *C. pustulosa* and was not a distinct species.

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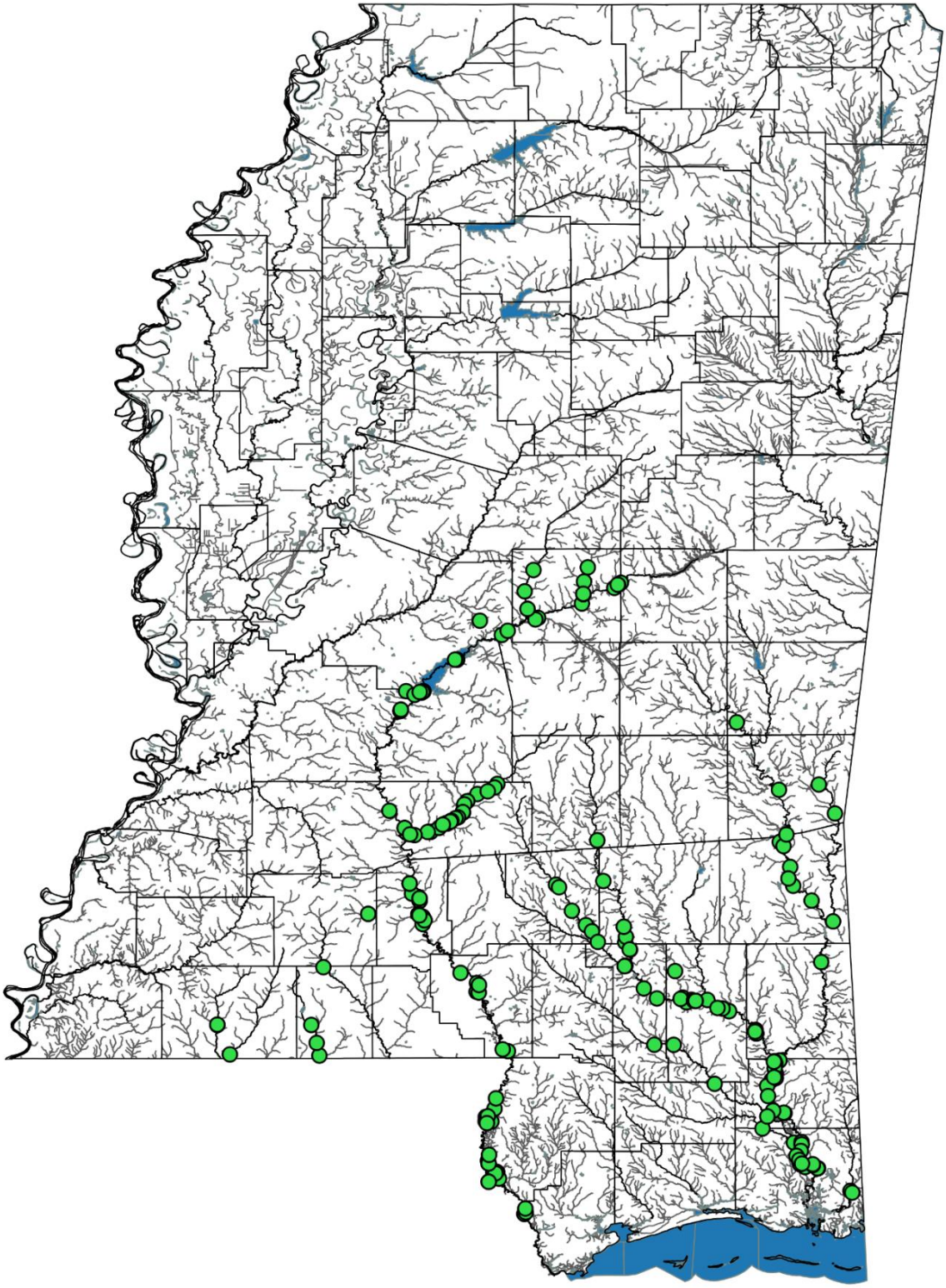

Distribution of *Cyclonaias refulgens* in Mississippi.

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CYCLONAIAS TUBERCULATA (RAFINESQUE, 1820)
PURPLE WARTYBACK

***Cyclonaias tuberculata* – Top: MMNS 5592, Bear Creek, Tishomingo County, 99 mm. (3.9 in.). Bottom: MMNS 5569, Bear Creek, Tishomingo County, 95 mm (3.7 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Broadly oval to round, shell heavy, thick, somewhat compressed; dorsal margin broadly rounded with prominent, truncated wing posterior to umbo, best developed in smaller specimens.
Posterior ridge: Broadly rounded.
Umbo: Slightly above hinge line and directed inward.
Color and pattern: Dark to light reddish brown, no rays.
Surface: Posterior with numerous pustules, variable in size, some elongated.
Nacre: Purple with bronzy wash posteriorly near edge of shell in some specimens.
Umbo cavity: Very deep.
Teeth: Pseudocardinal in right valve large, prominent; two lateral teeth in

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right valve, both short and curved. Two pseudocardinals in left valve; one short and curved lateral tooth in left valve.
Interdentum: Present, prominent, very broad.
Size: Largest specimen from Mississippi in MDWFP collection has a shell length of 98 mm (3.9 in.).
DISTRIBUTION: Occurs from Wisconsin and Michigan east to Pennsylvania, south to Alabama and Mississippi, and west to Arkansas.
MISSISSIPPI DISTRIBUTION: Known only from the Tennessee drainage in Tishomingo County.
SIMILAR SPECIES: All other round or oval mussels in the Tennessee drainage in Mississippi have white nacres rather than a purple nacre as in this species.
NATURAL HISTORY:
Habitat: The Purple Wartyback has been found in both Bear and Cedar creeks in Tishomingo County where it occurs in gravel substrates with current.
Reproduction: No gravid females have been found in Mississippi, but two in the MDWFP collection from Arkansas collected in July were 57 mm (2.2 in.) and 75 mm (3.0 in.) shell length. This species is gravid from April through August (Williams et al., 2008).
Fish hosts: All known fish hosts are catfishes and include the Channel Catfish (*Ictalurus punctatus*) and Flathead Catfish (*Pylodictis olivaris*) Yellow Bullhead (*Ameiurus nebulosus*) and Black Bullhead (*A. melas*).
STATUS: MNHP: G5S1; MDWFP: Endangered.
This species is uncommon in the Bear Creek watershed in Tishomingo County.

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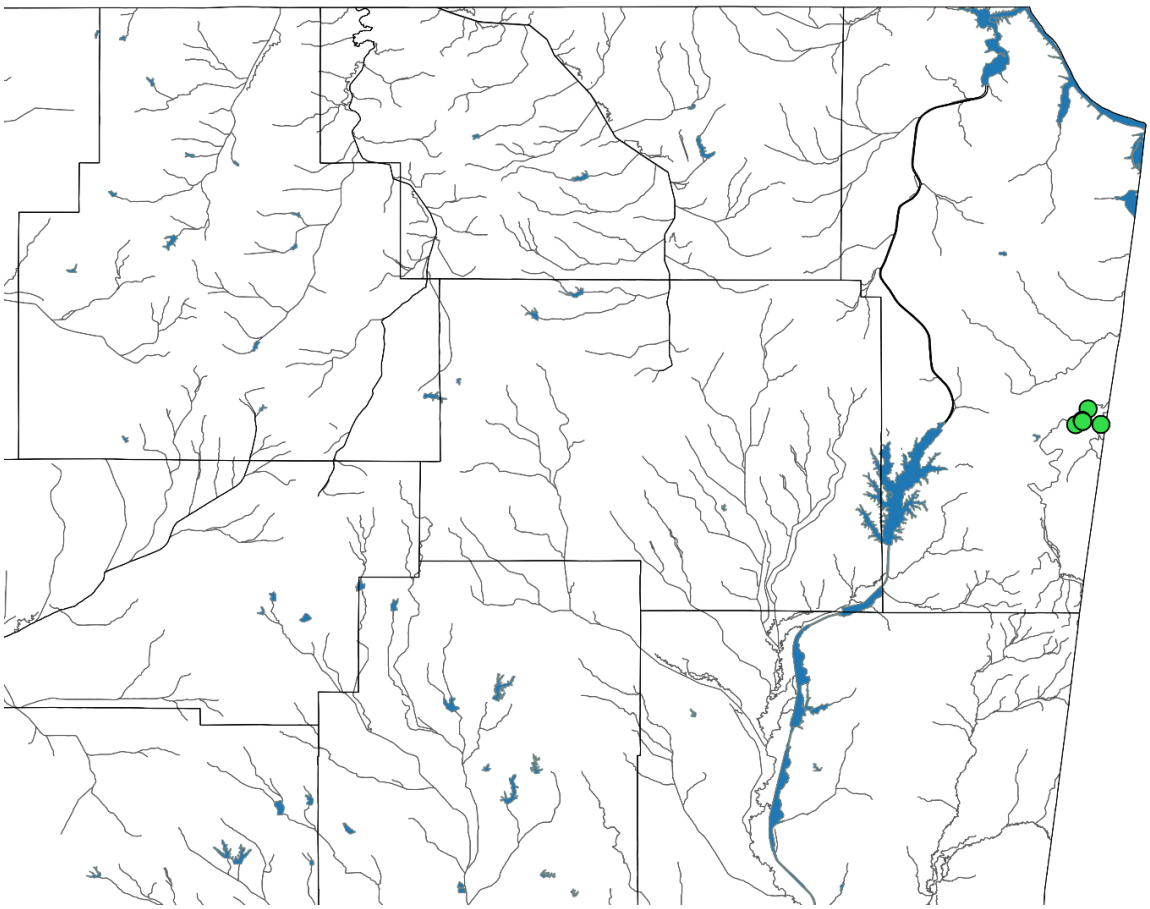

Distribution of *Cyclonaias tuberculata* in Mississippi.

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CYPROGENIA ABERTI (CONRAD, 1850)
WESTERN FANSHELL

***Cyprogenia aberti* – Top: MMNS 2051, Black River, Randolf County, Arkansas, 57 mm (2.2 in.). Bottom: MMNS 9000, Spring River, Lawrence County, Arkansas, 37 mm (1.5 in.).**

SHELL CHARACTERISTICS:

Shape and structure: Round to oval, shell moderately thick and moderately inflated.

Posterior ridge: Well defined posterior ridge extending from umbo to posterior margin, flanked on anterior side by a relatively broad and well defined sulcus.

Umbo: Prominent, above hinge line, directed inward.

Color and pattern: Dark greenish brown to yellowish brown. Rays present

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and prominent, relatively wide, more prominent from anterior end of the shell to the posterior ridge, dark to light brown.
Surface: Prominent ridges along growth lines extending from anterior to posterior margins; corrugations transversing posterior ridge on some specimens; rows of small pustules posterior to posterior ridge along growth lines.
Nacre: White.
Umbo cavity: Moderately deep.
Teeth: Left valve; two prominent pseudocardinals, well separated, two relatively short but prominent and straight laterals. Right valve; one large, prominent pseudocardinal and one short almost straight lateral tooth.
Interdentum: Present and broad.
Size: Largest shell length of specimens from Mississippi in MDWFP collection is 54 mm (2.1 in.).
DISTRIBUTION: Occurs in Kansas, Missouri, Oklahoma, and Arkansas.
MISSISSIPPI DISTRIBUTION: This species has only been found in Mississippi in archaeological middens or as very old relict shells in the Sunflower River in Sunflower County. There are also specimens from archaeological sites along the Sunflower River in Coahoma and Sunflower counties, the Yazoo River in Yazoo County, and near the Big Black River in Hinds County drainage (Peacock et al., 2011), the Yazoo River in Humphreys County (Peacock et al., 2017), and the Tallahatchie River in Leflore County (Peacock et al., 2016).
SIMILAR SPECIES: *Cyclonaias pustulosa* and *Obliquaria reflexa* both superficially resemble this species, but neither has multiple rays nor elevated growth lines.

NATURAL HISTORY:
Habitat: This species inhabits upland creeks with gravel in Missouri (McMurray et al., 2012).
Reproduction: The Western Fanshell is gravid from fall to the following spring (Eckert, 2003).
Fish hosts: Four species of fish, all of which occur in Mississippi, have been identified as hosts for this mussel, including the Goldfish (*Carassius auratus*), Fantail Darter (*Etheostoma flabellare*), Logperch (*Percina caprodes*), and Banded Sculpin (*Cottus carolinae*).
STATUS: MNHP: G2SH.
Cyprogenia aberti has not been found live in Mississippi. Relict shells of this species from the Little Sunflower River were not in association with any known archaeological sites and may represent a population that was extant as recently as 30 - 50 years ago. The sheepnose (*Plethobasus cyphyus*) was also thought to occur in Mississippi only as archaeological or relict shells until live specimens were found by MDWFP biologists in 2000, so perhaps *Cyprogenia* also persists somewhere in the Sunflower River.

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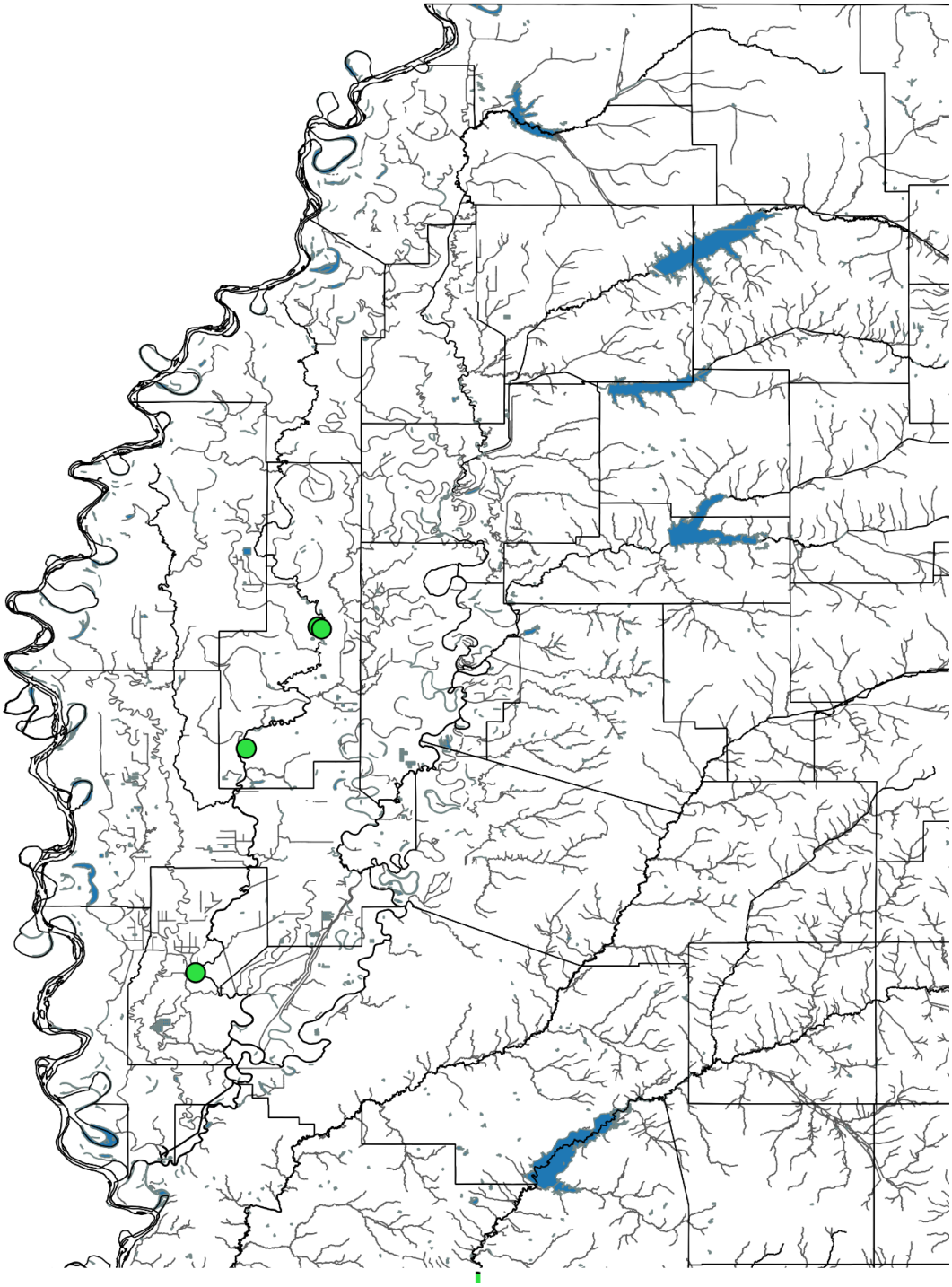

Distribution of *Cyprogenia aberti* in Mississippi.

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ELLIPSARIA LINEOLATA (RAFINESQUE, 1820)
BUTTERFLY

***Ellipsaria lineolata* – Top: MMNS 6532, Sunflower River, Sunflower County, 112 mm (4.4 in.). Bottom: MMNS 1161, Tombigbee River, Monroe County, 60 mm (2.4 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Triangular to broadly oval, moderately to highly compressed, some big river specimens moderately inflated with thick shells.
Posterior ridge: Prominent but short.
Umbo: Slightly above hinge line.
Color and pattern: Yellow in young specimens, yellowish or reddish brown in older specimens. Greenish wash sometimes present, particularly in specimens from the Yazoo drainage. Rays usually narrow, entire or broken, sometimes resembling a dashed line with alternating light and dark pigment, occasionally appear to be composed of chevrons, which are more frequent and prominent in Yazoo drainage specimens.
Surface: Smooth, no ornamentation.
Nacre: White, tinged with blue posteriorly, slightly iridescent.
Umbo cavity: Shallow to moderately deep.
Teeth: Pseudocardinal teeth prominent, one in right valve, two in left. Lateral teeth present, one in right valve, two in

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left, all relatively short and straight to slightly curved.
Interdentum: Wide.
Size: Largest specimen from Mississippi in MDWFP collection is 124 mm (4.9 in.) shell length.
DISTRIBUTION: Alabama to Georgia north to Pennsylvania, west to Minnesota and Iowa, south to Texas and Louisiana.
MISSISSIPPI DISTRIBUTION: Big Black, Mississippi River North, and Yazoo drainages in western Mississippi, Tennessee and Tombigbee drainages in eastern Mississippi. Populations still occur in the East Fork Tombigbee, Big Sunflower, and Big Black rivers, Bear Creek and Pickwick Lake in the Tennessee drainage, and the main channel of the Mississippi River in Issaquena County. A freshly dead specimen was found in the Noxubee River in 1994, but the status of the species in that river is uncertain.
SIMILAR SPECIES: *Pleuronaia dolabelloides* (Tennessee drainage) and *Truncilla truncata* (western Mississippi drainages) could both be mistaken for *Ellipsaria lineolata*. *Ellipsaria* can be distinguished from *Pleuronaia* by the shape of the posterior ridge (pronounced in the former, broadly rounded in the latter), and from *Truncilla* by the absence of a shallow sulcus anterior to the posterior ridge which is present in *Truncilla.*
NATURAL HISTORY:
Habitat: Occurs in rivers and large creeks, usually found in mixtures of sand and gravel in substantial current. It occurs in mixed clay and gravel substrates in moderate currents in the Sunflower River.
Reproduction: Two gravid females have been found in Mississippi, both in September. One 76 mm (3.0 in.) specimen was found in the East Fork Tombigbee River in Itawamba County, and a 72 mm (2.8 in.) specimen was found in the Sunflower River in Sunflower County.
Fish hosts: Known fish hosts are Freshwater Drum (*Aplodinotus grunniens*), Green Sunfish (*Lepomis cyanellus*), and Sauger (*Sander canadense*).
STATUS: MNHP: G4S2S3. - Although relatively widespread in Mississippi, this species is not common within the state. We have specimen records from 10 counties, but most of specimens are from the East Fork Tombigbee River, Bear Creek (Tishomingo County), and the Sunflower River.

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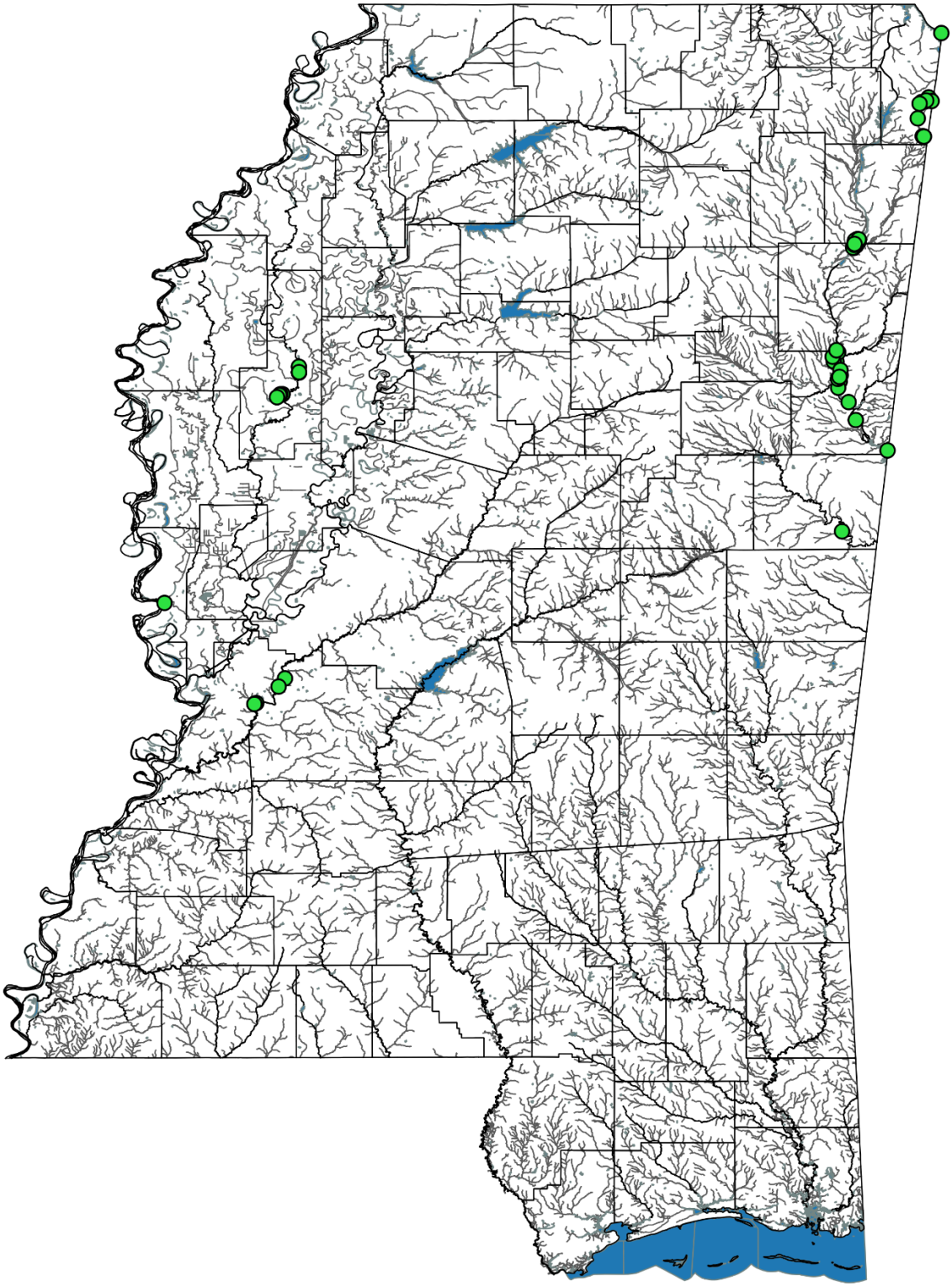

Distribution of *Ellipsaria lineolata* in Mississippi.

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ELLIPTIO ARCA (CONRAD, 1834)
ALABAMA SPIKE

***Elliptio arca* – Top: MMNS 10826, Buttahatchie River, Monroe County, 78 mm (3.1 in.). Middle: MMNS 5715, Yellow Creek, Lowndes County, 75 mm (3.0 in.). Bottom: MMNS 5768, Yellow Creek, Lowndes County, 59 mm (2.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, moderately thick to relatively thin in smaller specimens, moderately compressed.
Posterior ridge: Broadly rounded, may be obscure in larger specimens.
Umbo: Low, slightly above hinge line.
Color and pattern: Greenish to greenish brown to dark brown. Rays absent in many specimens, faint in others, prominent in yet others. Rays dark brown to greenish, broader near dorsal margin, curving downward and toward posterior. Some rays are very

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wide near the dorsal margin, but most are very thin.
Surface: Smooth.
Nacre: May be purple, white, or orange. In a sample of 578 specimens from the Tombigbee drainage in the MDWFP collection, 81% of the shells had purple nacre, 10% had white nacre, and 9% had orange nacre.
Umbo cavity: Shallow.
Teeth: Left valve; two widely spaced pseudocardinals, not prominent, and short, straight to slightly curve laterals, the ventral longer than the dorsal. Right valve; one peg-like pseudocardinal and one short to slightly curved lateral.
Interdentum: Present, narrow, but fairly long.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 131 mm (5.2 in.).
DISTRIBUTION: Mississippi, Alabama, and Louisiana.
MISSISSIPPI DISTRIBUTION: Formerly relatively abundant in the Tombigbee drainage, less so in the Pascagoula drainage, and one record from the lower Pearl River drainage. A record from the Amite River in Louisiana may indicate that it also occurs in that drainage in Mississippi.
SIMILAR SPECIES: This species could be confused with juvenile *Elliptio crassidens*, which are slightly less elongate, have heavier shells, and are relatively wider than *E. arca*, and with *E. arctata*, which has a thinner, more delicate shell and usually a slight indentation in the ventral margin with *E. arca* lacks. *Eurynia dilatata* also occurs in Mississippi, but it is more elongate that *E. arca* and has not been found in sympatry with that species.

NATURAL HISTORY:
Habitat: Generally found in gravel and sand substrates with moderate to fast currents.
Reproduction: A single gravid female *E. arca* in the MDWFP collection was 70 mm (2.8 in.) shell length and was collected in June in the Buttahatchee River of Lowndes County.
Fish hosts: Identified fish hosts are the Redspot Darter (*Etheostoma artesiae*), Blackbanded Darter (*Percina nigrofasciata*), and Southern Sand Darter *(Ammocrypta meridiana*).
STATUS: MNHP: G2G3S3.
This species, which was formerly abundant in the Buttahatchie River, has declined precipitously in recent years and is now uncommon in that stream. We have specimens from 11 Mississippi counties, but most of our specimens are from the Buttahatchee River and Yellow Creek, a tributary of Luxapallila Creek, which is an east bank tributary of the Tenn-Tom Waterway. A drought in 2000 which impacted Yellow Creek resulted in the death of many specimens of *E. arca*, and it is unknown if it has recovered in that stream since that time.

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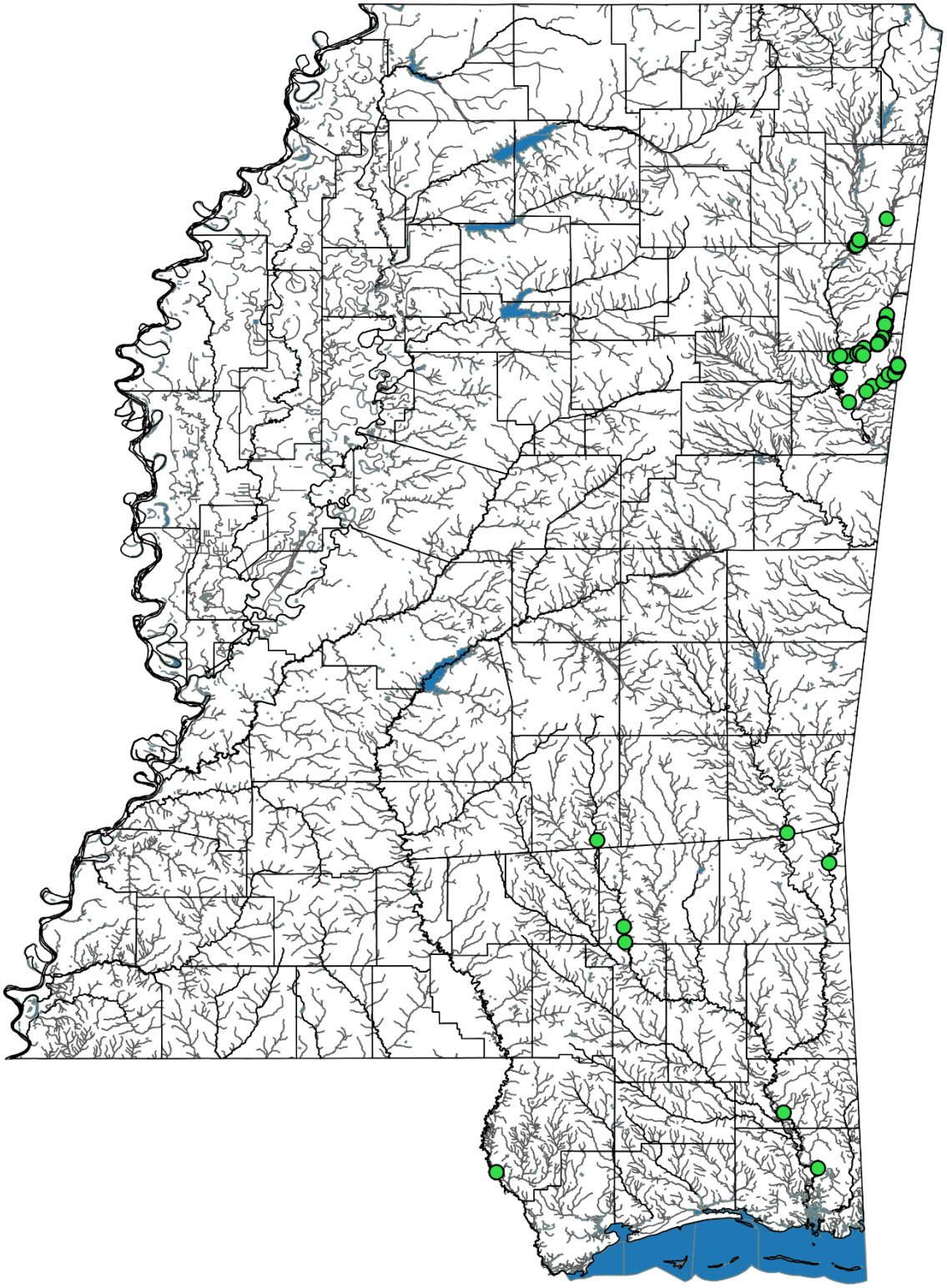

Distribution of *Elliptio arca* in Mississippi.

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ELLIPTIO ARCTATA (CONRAD, 1834)
DELICATE SPIKE

***Elliptio arctata* – Top: MMNS 5644, Buttahatchee River, Monroe County, 61 mm (2.4 in.). Middle: MMNS 3757, Pascagoula River, George County, 33 mm (1.3 in.). Bottom: MMNS 2992, Buttahatchee River, Lowndes County, 38 mm (1.5 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Elliptical, shell thin, compressed, ventral margin almost straight, usually with a slight indentation at its midpoint, dorsal margin broadly rounded, highest part posterior to umbo forms a modest wing.
Posterior ridge: Broadly rounded.
Umbo: Low, slightly above hinge line.
Color and pattern: Yellowish brown to dark brown. Rays present in some specimens but absent or obscure in others. Some specimens have broad, diffuse, greenish rays posteriorly, other specimens have narrow rays extending from the umbo the posterior margin at the middle of the shell.
Surface: Smooth, no ornamentation.
Nacre: Mostly white, but some with a purplish wash.
Umbo cavity: Very shallow.
Teeth: Left valve; two peg-like, widely separated pseudocardinals, and two straight laterals, the ventral longer than the dorsal. Right valve; one peg-like pseudocardinal and one short straight to slightly curved lateral.
Interdentum: Present, narrow.

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Size: Shell length of largest Mississippi specimen in MDWFP collection is 73 mm (2.9 in.)

DISTRIBUTION: Mississippi east to Florida and Georgia.

MISSISSIPPI DISTRIBUTION: Known from the Tombigbee, Pascagoula, and Pearl drainages.

SIMILAR SPECIES: Most similar to *E. arca*, from which it differs by its smaller size, thinner shell, and slight indentation in the ventral margin. Much smaller and more elongate than *E. crassidens*. Similar in some respects to smaller *Eurynia dilatata* from the Wolf River in northern Mississippi, but the two species are not known to occur together.

NATURAL HISTORY:

Habitat: Usually found in sand and gravel substrates in areas with moderate currents.

Reproduction: Presumed to be gravid in spring and summer (Williams et al., 2008) but aspects of its reproductive biology are unknown.

Fish hosts: Unknown.

STATUS: MNHP: G2G3S1; MDWFP: Endangered**.**

We have specimens from only eight counties in Mississippi. The most recent records are from the Pearl drainage in 1980, the Tombigbee drainage in 1990, and the Pascagoula drainage in 2004.

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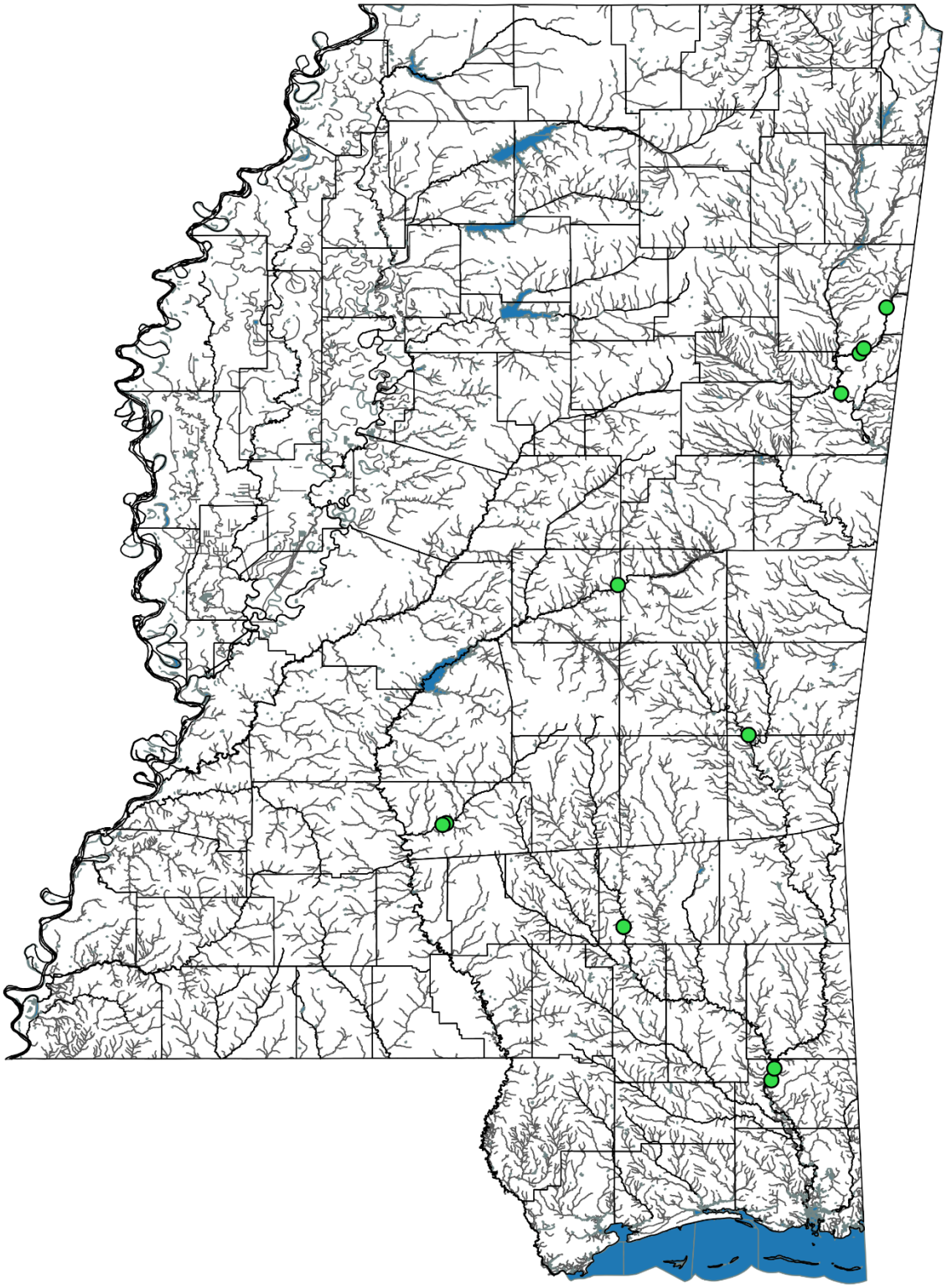

Distribution of *Elliptio arctata* in Mississippi.

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ELLIPTIO CRASSIDENS (LAMARK, 1819)
ELEPHANT EAR

***Elliptio crassidens* – Top: MMNS 5986, Pascagoula River, George County, 104 mm (4.1 in.). Middle: MMNS 1732, Amite River, Amite County, 96 mm (3.8 in.). Bottom: MMNS 3122, East Fork Tombigbee River, Monroe County, 136 mm (5.4 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Quadrate to elliptical, some specimens almost oval. Shells range from heavy and thick to relatively thin. Shells from the East Fork Tombigbee River are thicker than those from other areas, and those from the Amite River are thinner and more elliptical than elsewhere in the state.
Posterior ridge: Broadly rounded to prominent, usually less prominent in larger individuals.
Umbo: Low, slightly above hinge line.
Color and pattern: Dark brown to black, light reddish or yellowish brown in some populations. Rays absent in

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most specimens but sometimes found along middle of shell from the umbo to the ventral margin. Rays may be thick to thin and are dark.
Surface: Usually smooth but occasionally a few short corrugations along the sides.
Nacre: Mostly white, but may have a purplish wash.
Umbo cavity: Shallow.
Teeth: Left valve; two large, ragged pseudocardinals, and two prominent, curved laterals. Right valve; one large triangular pseudocardinal and one curved lateral.
Interdentum: Present, moderately wide.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 146 mm (5.8 in.).
DISTRIBUTION: Minnesota east to Pennsylvania and south to Louisiana and Georgia.
MISSISSIPPI DISTRIBUTION: Occurs in all drainages except the Yazoo and Coastal Rivers drainages.
SIMILAR SPECIES: Young *E. crassidens* can be mistaken for *E. arca*, but the former is usually less elongate, has a thicker shell, and is wider laterally than *E. arca*.

NATURAL HISTORY:
Habitat: Occurs in large creeks and rivers where it is found in sand, gravel, clay, or mud substrates.
Reproduction: Mean shell length of six gravid females, three from the East Fork Tombigbee River in Itawamba County and three from the Amite River in Amite County was 112 mm (4.4 in.) and ranged from 101 - 124 mm (4.0 – 4.9 in.). The Amite County specimens were collected in March and the Itawamba County specimens were collected in May.
Fish hosts: The Skipjack Herring (*Alosa chrysochloris*) and the Alabama Shad (*A. alabamae*) are the only known fish hosts for this species.
STATUS: MNHP G5S4.
We have specimens from 29 Mississippi counties. Most of these are from the Pascagoula drainage, including the Chickasawhay, Leaf, and Pascagoula rivers, and the Tombigbee drainage, particularly the East Fork Tombigbee and Buttahatchee rivers. We also have a substantial number of specimens from the Amite River and its tributaries in Amite County.

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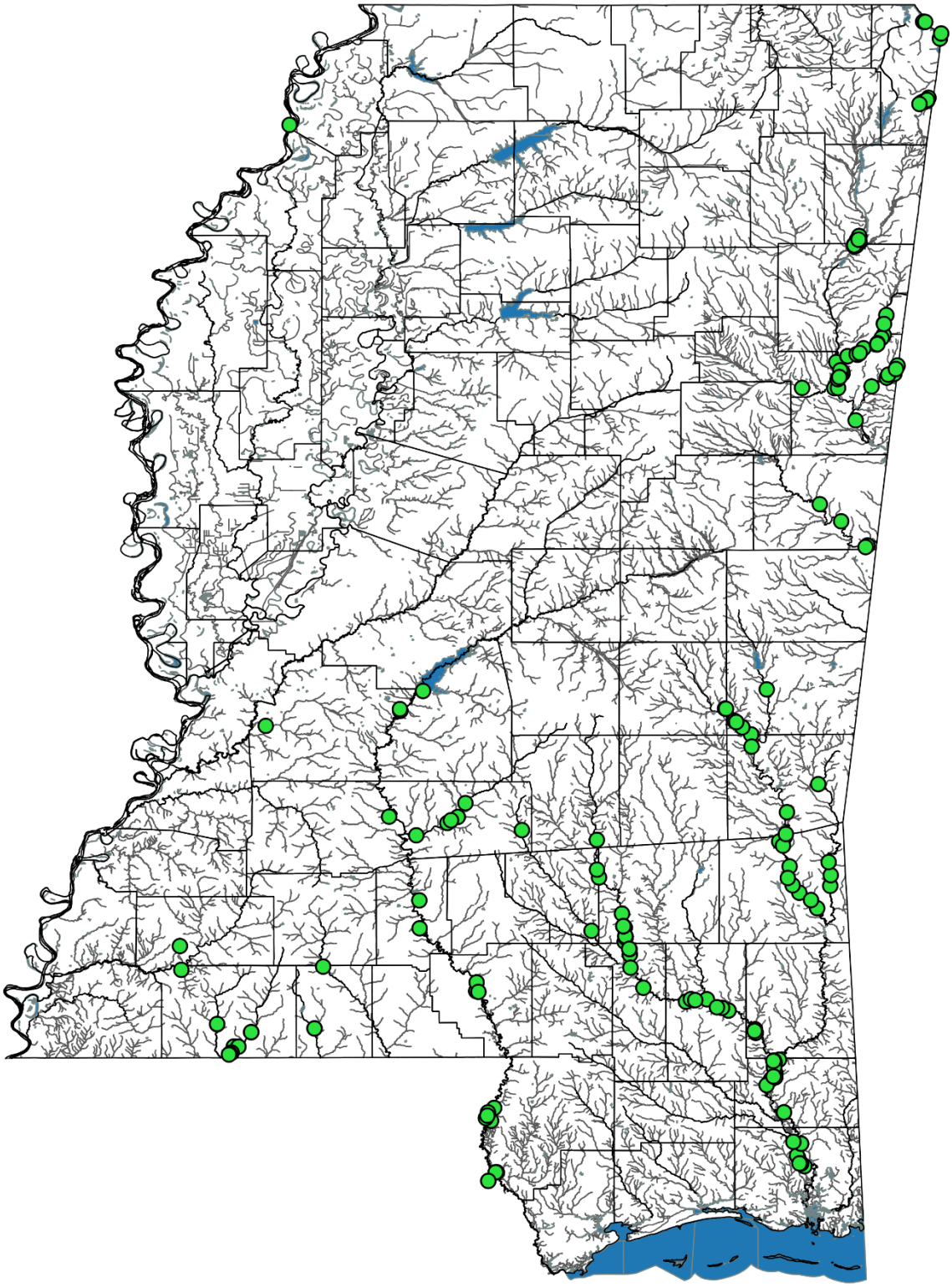

Distribution of *Elliptio crassidens* in Mississippi.

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EPIOBLASMA BREVIDENS (LEA, 1831)
CUMBERLANDIAN COMBSHELL

***Epioblasma brevidens* – Top: MMNS 9681, male, Clinch River, Hancock County, Tennessee, 39 mm (1.5 in.). Bottom: MMNS 5591, female, Bear Creek, Tishomingo County, 50 mm (2.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval, shell moderately thick, pronounced posterior swelling on females that makes the shell appear somewhat quadrate.
Posterior ridge: Present but rounded in males, greatly exaggerated in females because of the posterior swelling, directed strongly toward the ventral margin.
Umbo: Low, slightly above hinge line.
Color and pattern: Light yellowish brown.
Rays present and either narrow or broken into small segments, curving from umbo downward toward but not extending to the ventral margin.
Surface: Smooth in males, corrugations on swollen posterior ridge in females, tooth-like structures on the posterior edges of the marsupial swelling in females.
Nacre: White.
Umbo cavity: Shallow to moderately shallow.
Teeth: Left valve with two blade-like pseudocardinals subequal in size, and two short, curved laterals. Right valve with two pseudocardinals, anterior tooth

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small and peg-like, posterior much larger, and one short, curved lateral.
Interdentum: Present, narrow.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 50 mm (2.0 in.).
DISTRIBUTION: Tennessee, Alabama, and Mississippi.
MISSISSIPPI DISTRIBUTION: Known from Bear Creek in Tishomingo County.
SIMILAR SPECIES: The only other *Epioblasma* present in the Bear Creek watershed in Tishomingo County is *E. triquetra*. The latter has a very sharp posterior ridge which *E. brevidens* lacks, is more obese, has smaller teeth, and a wider interdentum.
NATURAL HISTORY:
Habitat: This species appears to prefer gravel riffles with substantial current in Bear Creek. It may also inhabit cobble and sand substrates (Williams et al., 2008).
Reproduction: A displaying gravid female was observed in Bear Creek in September, 2018, by MDWFP biologists. This species is usually gravid from late summer or fall until the following summer (Williams et al., 2008).
Fish hosts: Identified hosts are seven species in two families, five of which occur in Mississippi, including the Banded Sculpin (*Cottus carolinae*), Greenside Darter (*Etheostoma blennioides*), Redline Darter (*Etheostoma rufilineatum*), Snubnose Darter (*Etheostoma simoterum*), and Logperch (*Percina caprodes*).
STATUS: MNHP: G1S1; USFWS: Endangered; MDWFP: Endangered. This species was reported from both Bear and Cedar creeks in Tishomingo County in 1965 (Isom and Yokley, 1968) but was not encountered again until 2000, when MDWFP biologists found a recently dead specimen in Bear Creek. The population of *E. brevidens* in Bear Creek in Mississippi and Alabama is the only known population of this species in the lower Tennessee River watershed (McGregor and Garner, 2004).

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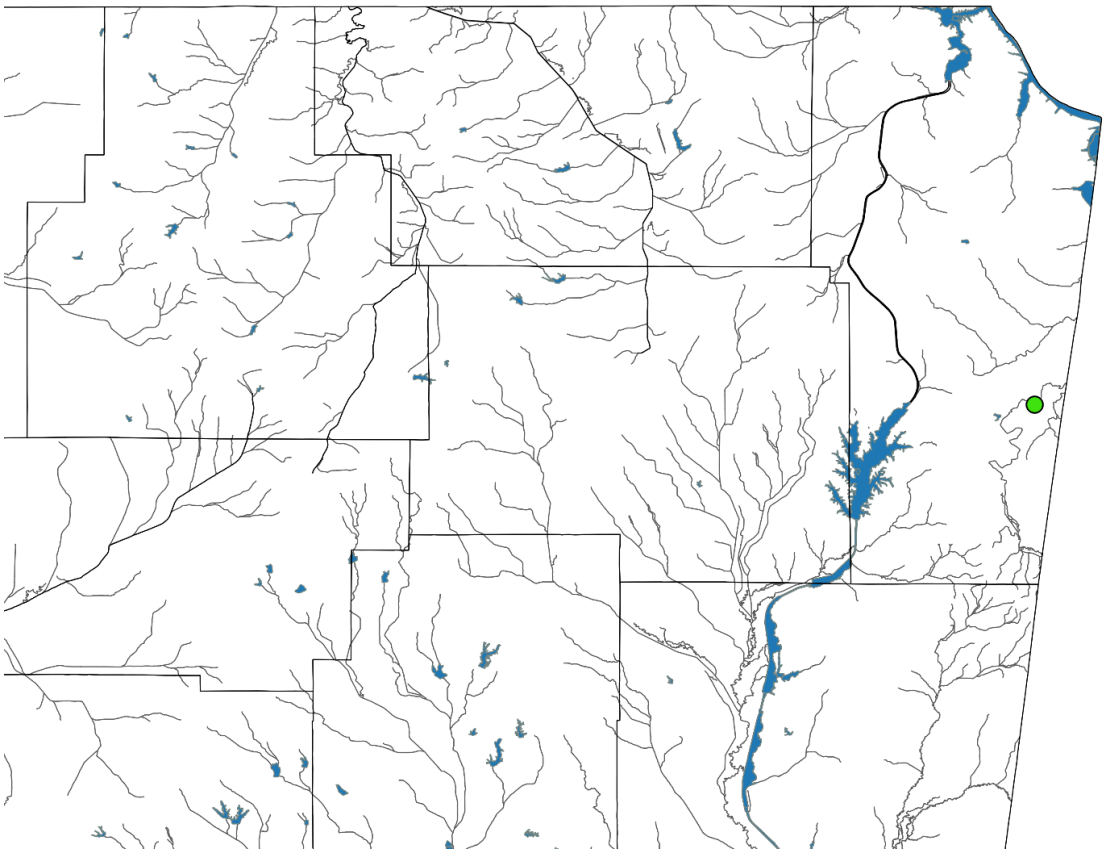

Distribution of *Epioblasma brevidens* in Mississippi.

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EPIOBLASMA PENITA (CONRAD, 1834)
SOUTHERN COMBSHELL

***Epioblasma penita* – Top: MMNS 3633, male, Buttahatchee River, Monroe County, 39 mm (1.5 in.). Bottom: MMNS 8077, female, Buttahatchee River, Monroe County, 39 mm (1.5 in.).**

SHELL CHARACTERISTICS:

Shape and structure: Triangular to oval to quadrate. Shell inflated, more so in females than in males; shell moderately thick. Females have a marsupial swelling at the posterior end of the shell. A shallow sulcus is anterior to the posterior ridge, very pronounced in females but not as obvious in males.

Posterior ridge: Prominent in some specimens but broadly rounded in others.

Umbo: Slightly raised above the hinge line, directed slightly toward the anterior of the shell.

Color and pattern: Yellowish brown to almost yellow. Rays extend from the umbo to the ventral margin, are usually thin and broken, are more obvious in smaller specimens, and are usually more prominent on the posterior ridge and posterior slope.

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Surface: Usually no ornamentation on males, but some corrugations on the marsupial swelling of females, which may also have raised ridges along the growth lines. Small tooth-like projections along the posterior edge of the marsupial swelling in some females.
Nacre: White or grayish white.
Umbo cavity: Shallow.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth are relatively prominent.
Interdentum: Present, narrow to moderately wide.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 67 mm (2.6 in.) long, but most specimens are around 50 mm shell length (2 in.) or smaller.
DISTRIBUTION: Mobile Bay basin in Georgia, Alabama, and Mississippi.
MISSISSIPPI DISTRIBUTION: Formerly in the Tombigbee, Buttahatchee, and Noxubee rivers of the Tombigbee River drainage, but currently found only in the Buttahatchee River of Monroe and Lowndes counties.
SIMILAR SPECIES: Male Southern Combshells may resemble *Fusconaia cerina*, but the latter has a much deeper umbo cavity, is more elongated and less triangular in shape, and has a sharper, more prominent, posterior ridge than *E. penita*. Females, with their marsupial swelling, may resemble *Epioblasma brevidens* females, but the latter is known only from the Tennessee River drainage, is more elongated and less triangular in shape, and has a more rounded marsupial swelling than the Southern Combshell. Both sexes of *E. penita* might also be confused with *Epioblasma triquetra*, but the latter occurs only in the Tennessee drainage in Mississippi and has a much more pronounced posterior ridge and a wider posterior slope than in the Southern Combshell.
NATURAL HISTORY:
Habitat: This species usually occurs in moderate to fast currents in gravel and sand substrates in the Buttahatchee River.
Reproduction: One gravid female, 27 mm shell length, was observed in the Buttahatchee River in Monroe County in September. The species is usually gravid from late summer to the following summer or fall (Williams et al., 2008).
Fish hosts: Know fish hosts are two darters, the Mobile Logperch (*Percina kathae*) and the Blackbanded Darter (*Percina nigrofasciata*).
STATUS: MNHP: G1S1; USFWS: Endangered; MDWFP: Endangered**.**
A reintroduction program using offspring of broodstock from the Buttahatchee is currently underway in Bull Mountain Creek between the East Fork Tombigbee River and the Tenn-Tom Waterway. This program is a cooperative project between the Mississippi Department of Wildlife, Fisheries, and Parks, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, and the Alabama Department of Conservation and Natural Resources and its Alabama Aquatic Biodiversity Center, which is producing the mussels that are being reintroduced. As of 2018, the reintroduction of this species appears to be successful.

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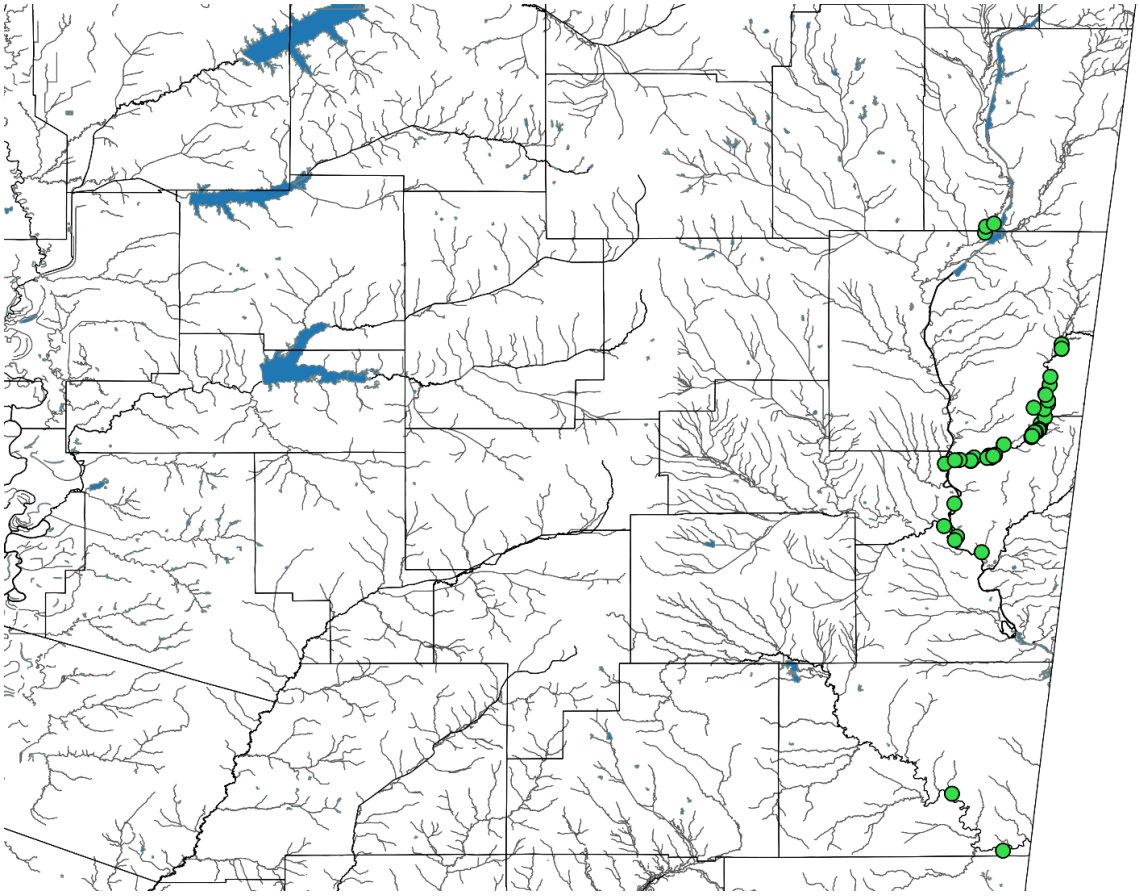

Distribution of *Epioblasma penita* in Mississippi.

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EPIOBLASMA TRIQUETRA (RAFINESQUE, 1820)
SNUFFBOX

***Epioblasma triquetra* – Top: MMNS 1549, male, Bear Creek, Tishomingo County, 34 mm (1.3 in.). Bottom: MMNS 9679, female, Clinch River, Hancock County, Tennessee, 32 mm (1.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Triangular to almost quadrate. Usually very inflated, shell thin to moderately thick.
Posterior ridge: Prominent, posterior slope at nearly 90 degree angle to posterior ridge in some specimens, shallow sulcus anterior to the posterior ridge in females, not present in males.
Umbo: Slightly above hinge line, not prominent.
Color and pattern: Yellowish brown. Rays present, relatively thick to very thin, dark greenish black, from anterior end to mid-shell, but fade out on the posterior slope. Rays form almost solid dark blotch just anterior to the posterior ridge in some specimens.
Surface: Usually smooth, sometimes very small corrugations on the posterior slope.
Nacre: White.
Umbo cavity: Shallow to moderately deep in larger specimens.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Pseudocardinals relatively thin, narrow; laterals rather short and thin.
Interdentum: Present to absent, if present, very narrow.

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Size: Shell length of largest Mississippi specimen in MDWFP collection is 35 mm (1.4 in.).

DISTRIBUTION: New York west to Minnesota and Kansas, south to Missouri, Alabama, and Mississippi, east to Virginia and West Virginia.

MISSISSIPPI DISTRIBUTION: Known only from Bear Creek in the Tennessee River drainage, Tishomingo County.

SIMILAR SPECIES: The Snuffbox may be confused with *Epioblasma brevidens*, a species also present in Bear Creek, but differs in that the latter is more compressed, has a rounded posterior ridge, larger teeth, and a narrow interdentum.

NATURAL HISTORY:

Habitat: This species occurs in gravel and mixed sand and gravel substrates in current in both large creeks and small rivers.

Reproduction: Nothing is known about its reproduction in Mississippi. It is usually gravid from September until the following May (Williams et al., 2008).

Fish hosts: Identified hosts include eight species in three families, but only three of these, the Blackside Darter (*Percina maculata*), Logperch (*Percina caprodes*), and Banded Sculpin (*Cottus carolinae*), occur in Mississippi.

STATUS: MNHP: G3S1; USFWS: Endangered; MDWFP: Endangered. There are three records of this species from Mississippi, one from Bear Creek in Tishomingo State Park collected in 1967, and one each from Bear and Cedar creeks in 1965 (Isom and Yokley, 1968). There have been no records of the species in Mississippi since that time.

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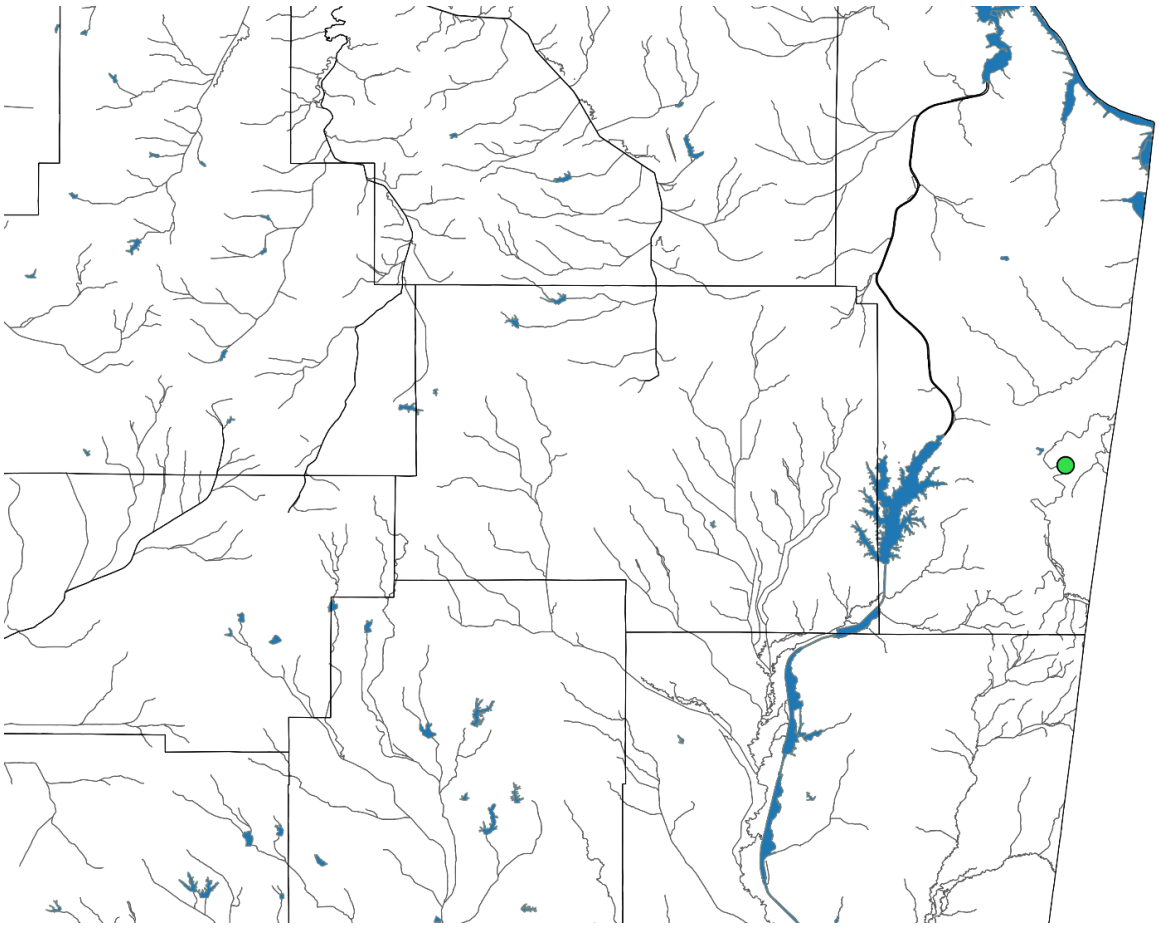

Distribution of *Epioblasma triquetra* in Mississippi.

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EURYNIA DILATATA (RAFINESQUE, 1820)
SPIKE

***Eurynia dilatata* – Top: MMNS 4926, Wolf River, Benton County, 88 mm (3.5 in.). Bottom: MMNS 6518, Sunflower River, Sunflower County, 90 mm (3.5 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Elliptical, compressed, relatively thin in the Wolf River population in northern Mississippi, thicker and more robust in the Sunflower River population.
Posterior ridge: Broadly rounded, curved toward ventral margin posterior to the umbo in some specimens from the Wolf River.
Umbo: Low, slightly above hinge line, curved inward.
Color and pattern: Dark brown to black to lighter brown with dark yellowish wash. Rays may be present or absent. Specimens from the Wolf River in Benton County are relatively strongly rayed. Rays are dark brown, more prominent on the anterior surface, less prominent and blend into one another on the posterior surface.
Surface: Smooth, no ornamentation.
Nacre: Purple.
Umbo cavity: Very shallow.
Teeth: Left valve; two small peg-like pseudocardinals, posterior larger than anterior; two curved laterals, dorsal tooth longer than ventral. Right valve; one peg-like pseudocardinal and one curved lateral.
Interdentum: Present, narrow.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 104 mm (4.1 in.).
DISTRIBUTION: Northern New England west to Minnesota, south to Louisiana and Georgia.
MISSISSIPPI DISTRIBUTION: Found only in the Wolf River in Benton County and in the Sunflower River in Sunflower, Washington, and Sharkey counties. Archaeological records are from near the

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Coldwater River in Quitman County, the Yazoo River in Holmes and Yazoo counties, the Sunflower River in Sunflower, Sharkey, and Coahoma counties, the Big Black River in Hinds County (Peacock et al., 2011), and the Tallahatchie River in Leflore County (Peacock et al., 2016).

SIMILAR SPECIES: This species is not likely to be confused with any other species in the Sunflower River or the Wolf River in Mississippi. Although it might be mistaken for an *Elliptio*, there are no species of that genus known from either the Wolf or Sunflower rivers.

NATURAL HISTORY:

Habitat: The specimens from the Sunflower River were found in a mixture of clay, gravel, and sand in moderate current. Those from the Wolf River in Benton County occurred in a swampy area with numerous flowing channels with gravel and sand substrates.

Reproduction: There are no reproductive data for this species in Mississippi, but apparently gravid females can be found from May to August in other areas (Williams et al., 2008).

Fish hosts: There are 34 species of fish in 12 families that have been identified as hosts for the Spike, 24 of which occur in Mississippi. This includes seven species of sunfishes (Centrarchidae), 10 perches and darters (Percidae), the Banded Sculpin (*Cottus carolinae*), Flathead Catfish (*Pylodictis olivaris*), Golden Shiner (*Notemigonus crysoleucas*), Blackspotted Topminnow (*Fundulus olivaceus*), Longnose Gar (*Lepisosteus osseus*), Gizzard Shad *(Dorosoma cepedianum*), and American Eel (*Anguilla rostrata*).

STATUS: MNHP: G5S1; MDWFP: Endangered.

This species can still be found in the Wolf River, but only a few live specimens have been seen in the Sunflower River, where it appears to be close to extirpation.

TAXONOMIC NOTES: This species was previously in the genus *Elliptio* but was recently placed in the genus *Eurynia* by Williams et al. (2017).

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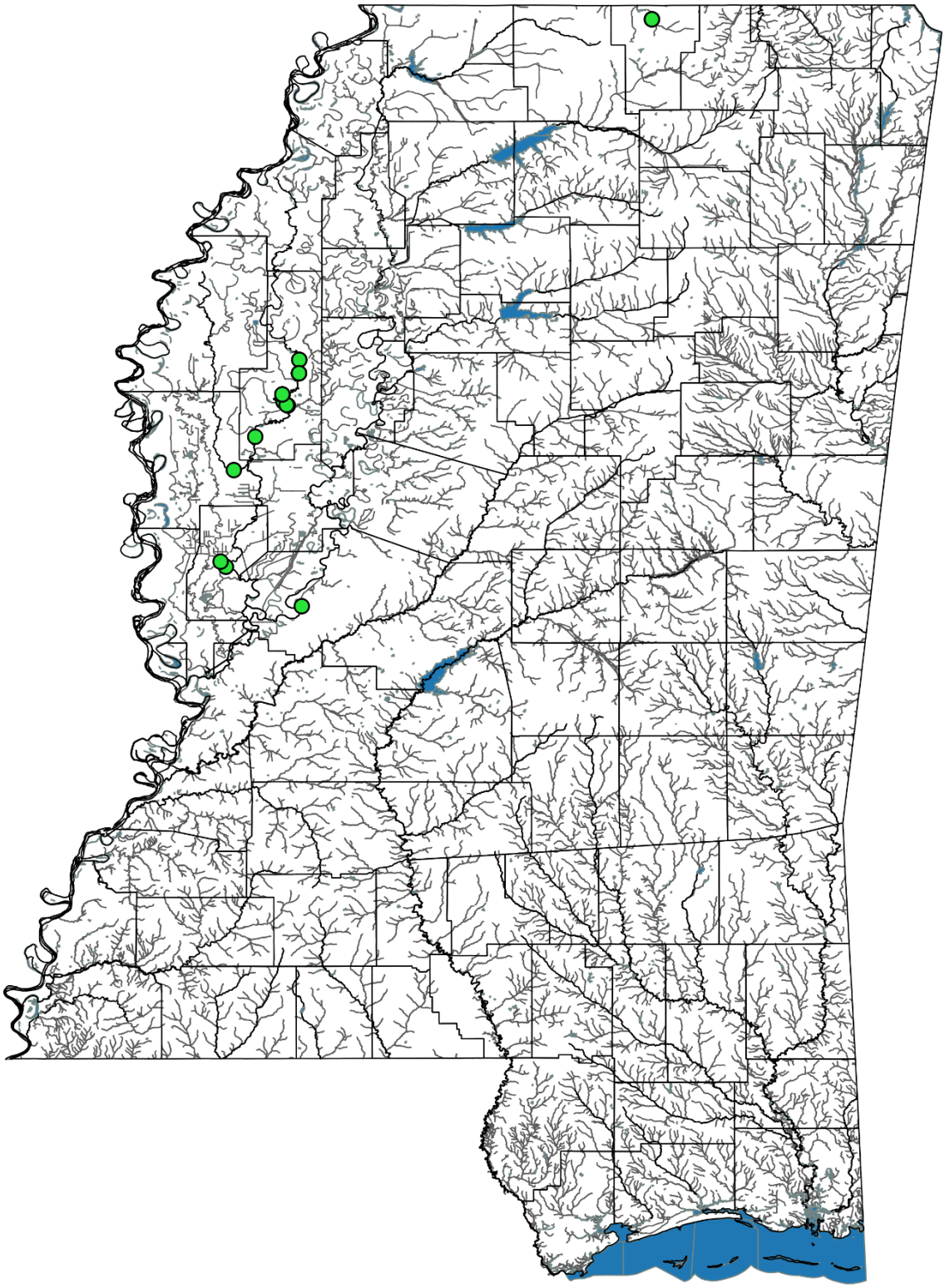

Distribution of *Eurynia dilatata* in Mississippi.

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FUSCONAIA CERINA (CONRAD, 1838)
SOUTHERN PIGTOE

***Fusconaia cerina* – Top: MMNS 3106, East Fork Tombigbee River, Itawamba County, 76 mm, (3.0 in.). Bottom: MMNS 11296, Caswell Lake, oxbow of Pascagoula River, Jackson County, 54 mm (2.1 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval, triangular, or quadrate. Moderately inflated to moderately compressed. Shell thick to relatively thin. Shallow sulcus anterior to posterior ridge. Specimens from the Pearl and Tombigbee drainages are more inflated compared to the more compressed individuals from the Pascagoula and Lake Pontchartrain drainages. The most inflated *F. cerina* with the thickest and largest shells occur in the Tombigbee drainage, and although those from the Pearl River are smaller, they are similar in conformation. Small river forms tend to be more compressed, more elongated, and have thinner shells.
Posterior ridge: Prominent.
Umbo: Above hinge line, prominent even in compressed forms.
Color and pattern: Chestnut brown to almost black in larger specimens, rays

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present in a few specimens, usually thin to relatively thick, but generally faded, appearing washed out and normally found on the side of the shell anterior to the posterior ridge.

Surface: Smooth, no ornamentation, shiny in smaller specimens, rough and cloth-like in large specimens, particularly from the Tombigbee drainage.

Nacre: Usually white, but with a hint of pink or orange on occasion, particularly in specimens from Yellow Creek in Lowndes County (Tombigbee drainage).

Umbo cavity: Relatively deep.

Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth thick, relatively massive in large shells, but prominent in all shells including smaller individuals.

Interdentum: Present, usually wide in inflated forms, narrower in compressed shells.

Size: Shell length of largest Mississippi specimen in MDWFP collection is 96 mm (3.8 in.).

DISTRIBUTION: From Mobile Bay drainages in Alabama west to Lake Pontchartrain drainages in Mississippi and Louisiana.

MISSISSIPPI DISTRIBUTION: Tombigbee, Pascagoula, Coastal Rivers, Pearl, and Lake Pontchartrain drainages.

SIMILAR SPECIES: Most similar to *Fusconaia flava*, but the two species are not found in the same drainages. Could be mistaken for *Reginaia ebenus*, but the latter has a very broadly rounded to absent posterior ridge while the Southern Pigtoe has a sharp posterior ridge. Small specimens of this species could also be confused with *Pleurobema beadleianum*, which also has a posterior ridge, but the latter has much smaller and more delicate teeth and a shallower umbo cavity than does *F. cerina*.

NATURAL HISTORY:

Habitat: *Fusconaia cerina* is often found in sand and gravel mixtures in moderate to strong currents in larger rivers like the Pearl, Tombigbee, or Pascagoula, but also occurs in slower currents with sand or clay substrates in smaller rivers such as the Tickfaw, Amite, and Tangipahoa.

Reproduction: Twenty gravid female Southern Pigtoes from Mississippi in the MDWFP collections averaged 53.6 mm (2.1 in.) and ranged from 37 - 92 mm (1.5 – 3.6 in.) in shell length. Two were collected in April (Bowie River, Covington County; Pearl River, Hinds County), 14 collected in June (two from Big Black Creek, Jackson County; two from the Buttahatchie River, Lowndes County; six from the Pascagoula River, Jackson County; two from West Hobolochitto Creek, Pearl River County; and one each from the Pearl River in Rankin County and the Tangipahoa River in Pike County, two collected in July (Pearl River, Hinds and Rankin counties), one in August (Pascagoula River, Jackson County), and one in September (East Fork Tombigbee River, Itawamba County).

Fish hosts: Twelve species of minnows (Cyprinidae), all of which occur in Mississippi, have been identified as fish hosts for this species. These include the Alabama Shiner (*Cyprinella callistia*), Blacktail Shiner (*C. venusta*), Pretty Shiner (*Lythrurus bellus*), Orangefin Shiner (*Notropis ammophilus*), Emerald Shiner (*N. atherinoides*), Silverstripe Shiner (*N. stilbius*), Golden Shiner (*Notemigonus crysoleucas*), Striped Shiner (*Luxilus chrysocephalus*), Clear Chub (*Hybopsis winchelli*), Bluehead Chub (*Nocomis leptocephalus*),

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Bluntnose Minnow (*Pimephales notatus*), and Largescale Stoneroller (*Campostoma oligolepis*).

STATUS: MNHP: G5S5.

We have specimens from 34 Mississippi counties, but most of our collection records are from the Pearl, East Fork Tombigbee, and Buttahatchee rivers. We also have a substantial number of specimens from both the Tangipahoa and Pascagoula rivers.

TAXONOMIC NOTES: A recent study (Inoue et al., 2018) has suggested, based on genetic data, that *F. cerina* and *F. flava* are the same species.

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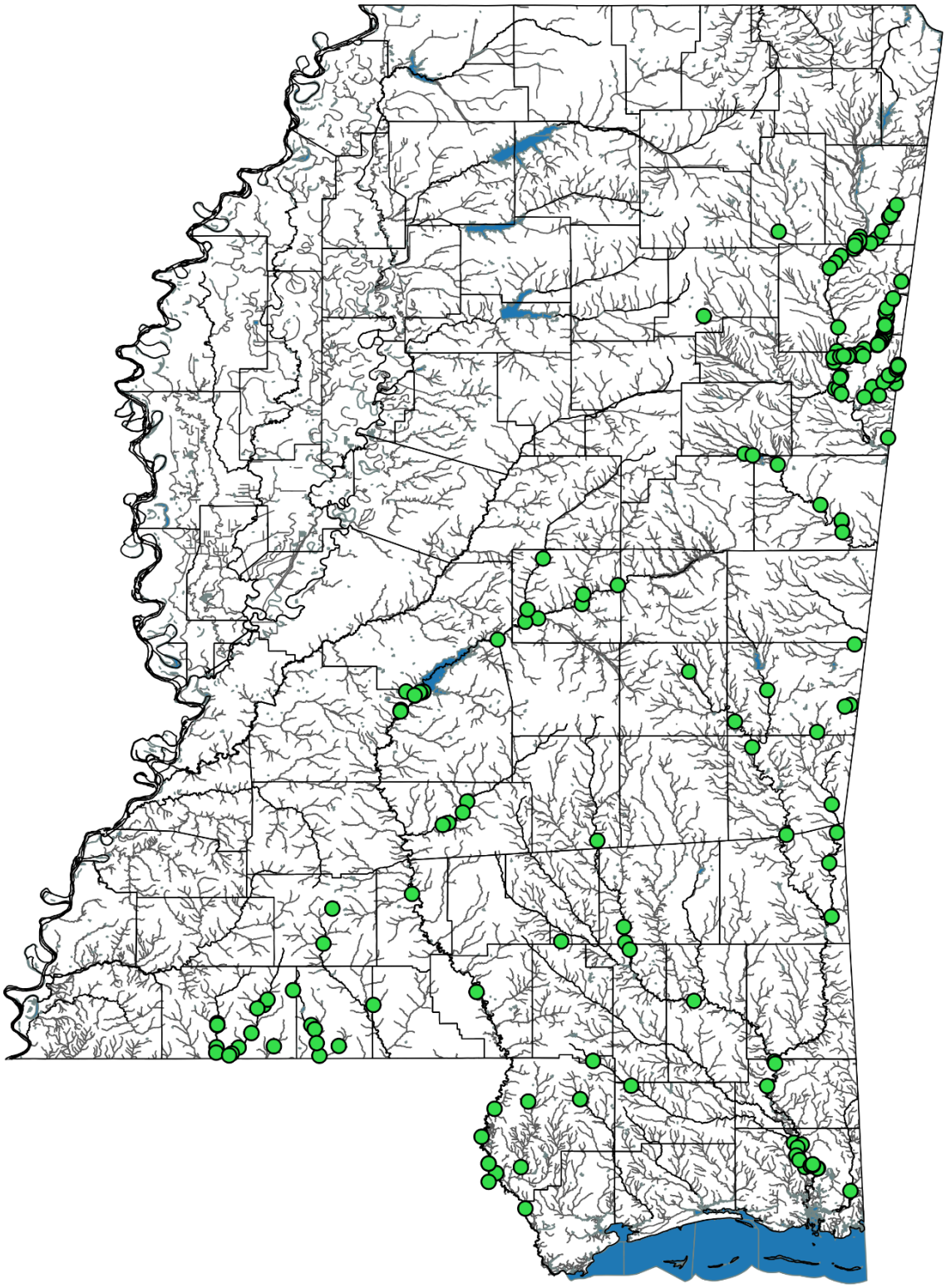

Distribution of *Fusconaia cerina* in Mississippi.

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FUSCONAIA FLAVA (RAFINESQUE, 1820)
WABASH PIGTOE

***Fusconaia flava* – Top: MMNS 8625, Sunflower River, Sunflower County, 70 mm (2.8 in.). Bottom: MMNS 1315, Big Black River, Warren County, 76 mm (3.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Triangular, oval, to almost elliptical. Shell usually relatively thick, but some shells relatively thin. Inflated to moderately compressed. Sulcus anterior to posterior ridge very shallow to moderately deep. The most compressed specimens are from Homochitto River tributaries in Franklin County.

Posterior ridge: Prominent in most specimens but less so in compressed shells.
Umbo: Above hinge line and usually prominent.
Color and pattern: Light brown, dark brown, or chestnut. Rays present in some specimens, almost always faint, thin to relatively thick, extending from

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umbo to ventral margin, including on posterior slope.
Surface: No ornamentation, usually smooth, but coarse, slightly rough surface in larger specimens.
Nacre: White, sometime faint yellowish tint in umbo cavity.
Umbo cavity: Deep to moderately deep.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth relatively large and thick in larger specimens.
Interdentum: Present, usually wide.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 88 mm (3.5 in.).
DISTRIBUTION: New York and Pennsylvania west to South Dakota and Minnesota, south to Texas and Louisiana, east to Mississippi and Tennessee, and north to West Virginia.
MISSISSIPPI DISTRIBUTION: Big Black, Lower Mississippi River North, Lower Mississippi River South, and Yazoo drainages, including Bayou Pierre, the Big Black, Wolf, Homochitto, Coldwater, Hushpuckena, Sunflower, Yocona, Quiver, Bogue Phalia, and Yazoo rivers, in smaller creeks in those drainages, and in Clear Springs Lake (Homochitto River system) and Wolf Lake (Yazoo River system).
SIMILAR SPECIES: *Fusconaia flava* most closely resembles *F. cerina* but the two species do not co-occur. It may also resemble some *Reginaia ebenus*, but has a prominent posterior ridge that the latter lacks.
NATURAL HISTORY:
Habitat: The Wabash Pigtoe occurs in creeks, rivers, and reservoirs in a variety of substrates, including gravel, sand, clay, and mixtures of all three.
Reproduction: Gravid females (N = 16) have been found in Mississippi from May into August, including nine from creeks in Madison County, one from a creek in Webster County, four from the Sunflower River in Sunflower County, and two from the Coldwater River in Desoto County. These females averaged 57 mm (2.2 in.) and ranged from 38 – 87 mm (1.5 – 3.4 in.) in shell length.
Fish hosts: Identified fish hosts include 15 species in four families. Thirteen of these species occur in Mississippi, including five sunfishes (Centrarchidae), four darters (Percidae), the Spotfin Shiner (*Cyprinella spiloptera*), Creek Chub (*Semotilus atromaculatus*), Goldfish (*Carassius auratus*), and Silver Redhorse (*Moxostoma anisurum*).
STATUS: MNHP: G5S5.
We have specimens from 25 Mississippi counties, but most are from the Big Black and Sunflower rivers and from Bayou Pierre in Copiah and Claiborne counties.
TAXONOMIC NOTES: A recent study (Inoue et al., 2018) has suggested, based on genetic data, that *F. flava* and *F. cerina* are the same species.

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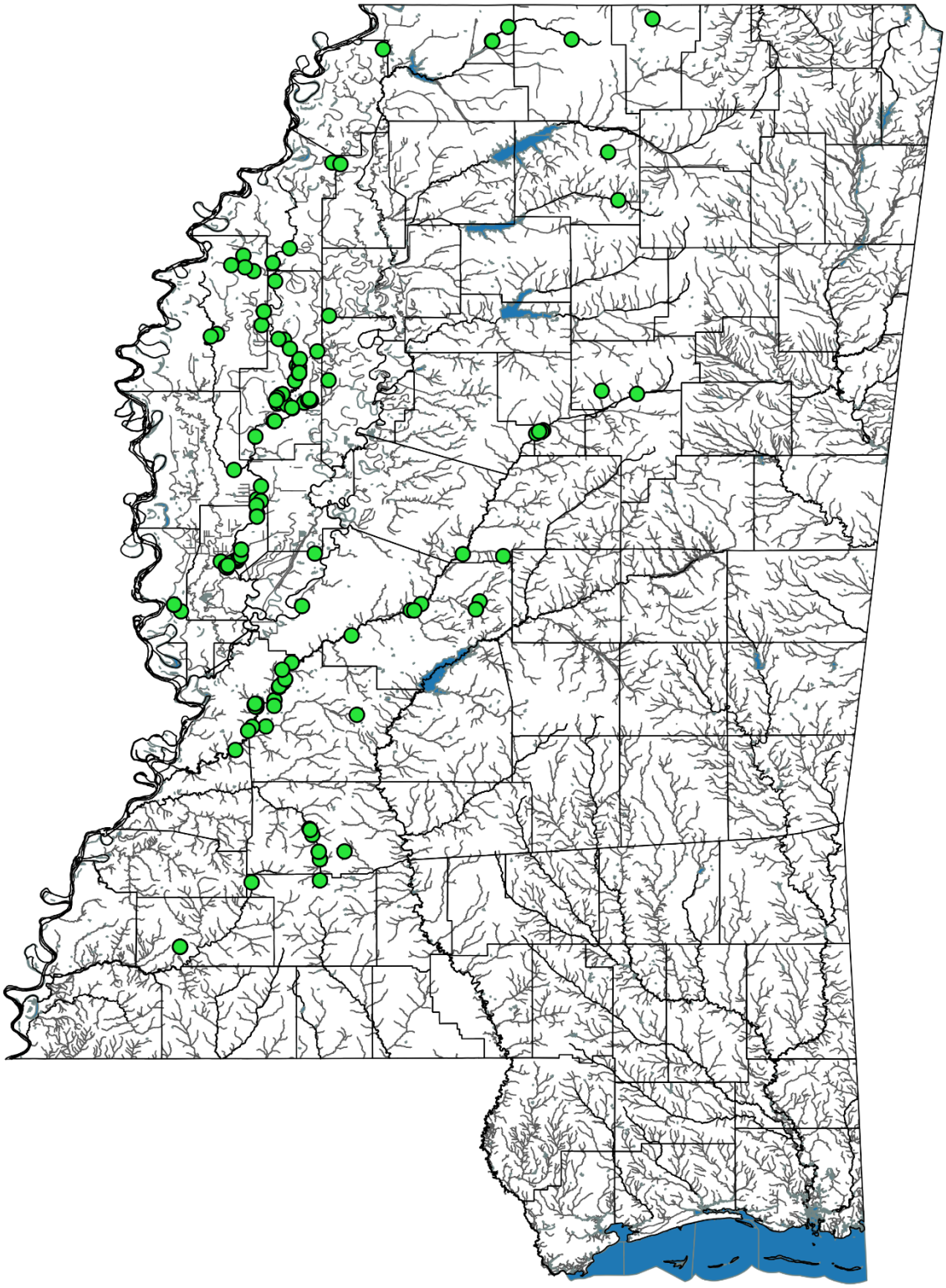

Distribution of *Fusconaia flava* in Mississippi.

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GLEBULA ROTUNDATA (LAMARK, 1819)
ROUND PEARLSHELL

***Glebula rotundata* – Top: MMNS 8441, Sunflower River, Sharkey County, 87 mm (3.4 in.). Bottom: MMNS 11263, Pascagoula River, George County, 65 mm (2.6 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Round to oval. Shell inflated, relatively thick. Sulcus usually absent; a few specimens may have a very shallow sulcus on the ventral edge of the shell at the terminus of a broadly rounded posterior ridge.
Posterior ridge: Absent in round specimens, broadly rounded in a few of the more elongated oval specimens.
Umbo: Even with the hinge line or just slightly above it.
Color and pattern: Greenish brown to dark brown to almost black.
Surface: No ornamentation but periostracum with a coarse, cloth-like texture, particularly in larger individuals.
Nacre: Pearly white ground color but with a yellowish-green wash in specimens from the Pascagoula River

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and a pinkish-purple wash in those from the Mississippi River basin.
Umbo cavity: Relatively shallow.
Teeth: Left and right valves with two pseudocardinals and usually 2 laterals in the left valve and 1-2 in the right valve. Teeth in the right valve tend to be smaller than the corresponding teeth in the left valve. Teeth usually relatively thin.
Interdentum: None to very narrow.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 108 mm (4.3 in.).
DISTRIBUTION: Florida west to Texas and north to Arkansas and Oklahoma.
MISSISSIPPI DISTRIBUTION: Found in the Big Black, Pascagoula, Pearl, and Yazoo drainages, in the Pascagoula, Escatawpa, Leaf, Pearl, Quiver, and Sunflower rivers as well as in smaller creeks and numerous oxbow lakes.
SIMILAR SPECIES: This species might be mistaken for an *Obovaria*, but has much smaller teeth than any of the species in that genus, plus the interior of the shell has a very pearly, glossy sheen that makes the interior appear unusually large given the size of the specimen.

NATURAL HISTORY:
Habitat: This species is usually found in areas with clay, mud, or silty substrates and occasionally in areas with primarily sandy bottoms.
Reproduction: Eight gravid females found in Mississippi averaged 58.1 mm (2.3 in.) and ranged from 40 - 91 mm (1.6 – 3.6 in.) in shell length. These females were found in June (2 - Pascagoula River in Jackson County), July (4 - Pearl River in Pearl River County), and August (1 - Pascagoula River in Jackson County, 1 - Sunflower River in Humphreys County).
Fish hosts: Known hosts include the Hogchoker (*Trinectes maculatus*), Spotted Gar (*Lepisosteus oculatus*), White Bass (*Morone chrysops*), Green Sunfish (*Lepomis cyanellus*), Bluegill (*L. macrochirus*), Bay Anchovy (*Anchoa mitchilli*), and Common Carp (*Cyprinus carpio*).
STATUS: MNHP: G4G5S4.
Although we have specimens of the Round Pearlshell from 14 Mississippi counties, the majority of our collection records are from the Pascagoula, Pearl, Quiver, and Sunflower rivers.

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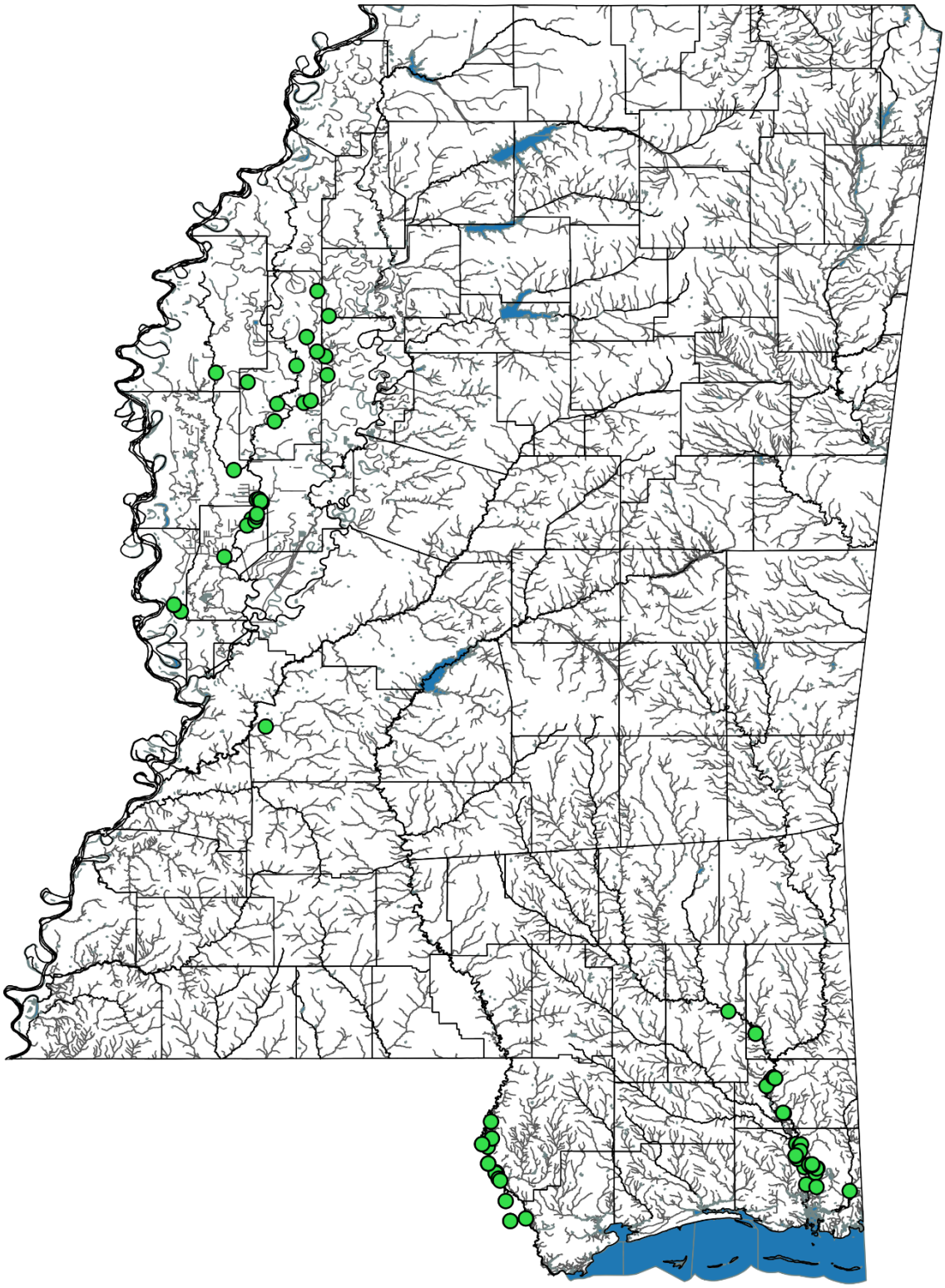

Distribution of *Glebula rotundata* in Mississippi.

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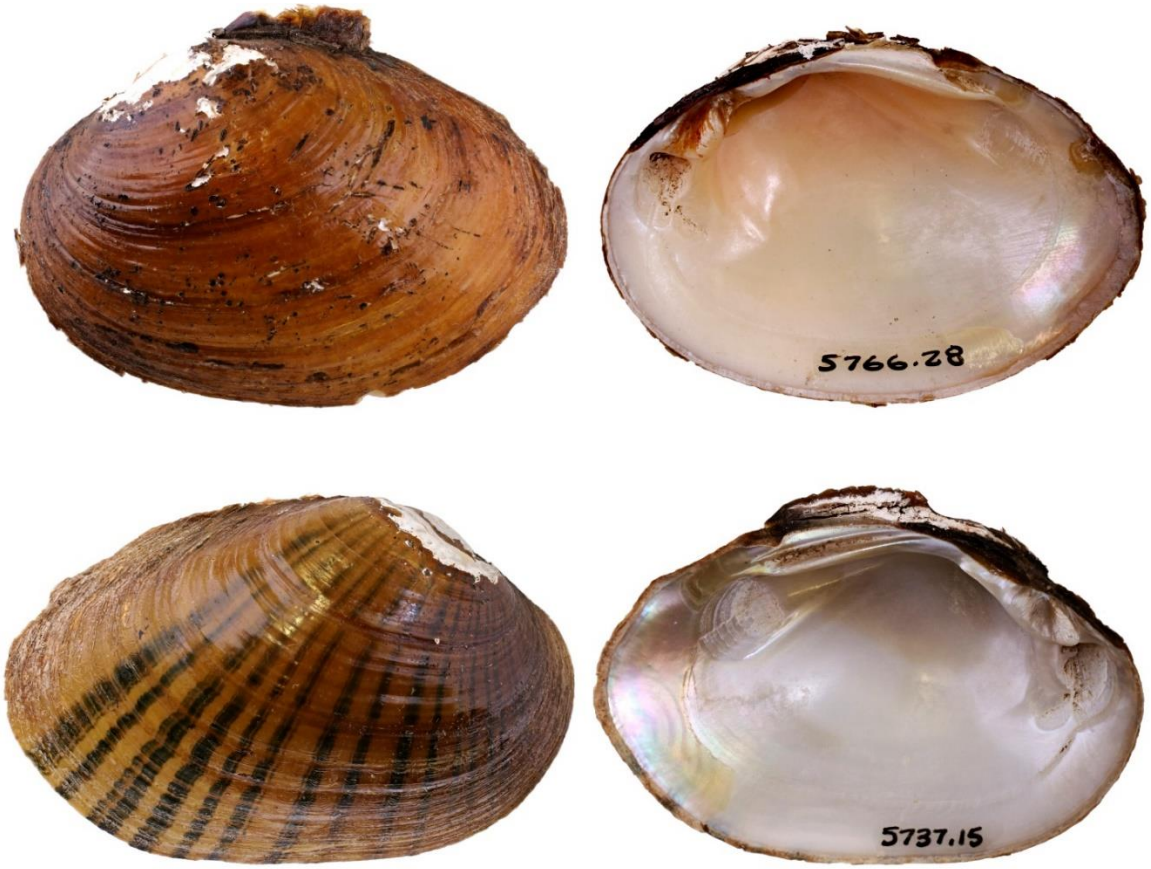
HAMIOTA PEROVALIS (CONRAD, 1834)
ORANGENACRE MUCKET



***Hamiota perovalis* – Top: MMNS 5766, Yellow Creek, Lowndes County, 69 mm (2.7 in.). Bottom: MMNS 5737, Yellow Creek, Lowndes County, 67 mm (2.6 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval to almost triangular to almost elliptical; shell moderately inflated, relatively thick, not fragile.
Posterior ridge: Very broadly rounded to absent.
Umbo: Above hinge line, not prominent.
Color and pattern: Reddish yellow to yellow to brownish yellow. Rays present or absent, if present, extend from the umbo down to the ventral edge of the shell, and may be thin, thick, faint, or prominent, and can cover the entire shell or only part of the shell. In a sample of dead shells found during a drought in Yellow Creek, Lowndes County, in 2000 (N = 277), 84% had rays and 16% lacked rays. Of the specimens with rays, 19% had very prominent rays covering the entire shell surface and 81% had rays covering only part of the shell or had faint rays.
Surface: Shiny, smooth, no ornamentation.
Nacre: Orange to peach to white, but there are fewer specimens with white nacre than any other color.

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Umbo cavity: Moderate to shallow.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth moderate in size.
Interdentum: Present, narrow.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 101 mm (4.0 in.) long.
DISTRIBUTION: Mobile Bay basin in Alabama and Mississippi.
MISSISSIPPI DISTRIBUTION: Occurs in the Tombigbee drainage in Mississippi, including the Buttahatchee and East Fork Tombigbee rivers and Luxapallila, Bull Mountain, and Yellow creeks.
SIMILAR SPECIES: Most similar in size and conformation to *Lampsilis straminea* with which it co-occurs, but differs in that *L. straminea* is usually more elliptical with a greater shell height to shell length ratio, usually does not have rays, has a white nacre, and is generally more inflated posterior to the umbo than *H. perovalis*. Some specimens from Mississippi strongly resemble *H. altilis* and were previously identified as such, but that species was restricted to eastern and southern reaches of the Mobile basin in Alabama by Williams et al. (2008) and thus does not occur in Mississippi.
NATURAL HISTORY:
Habitat: *Hamiota perovalis* occurs in gravel and gravel-sand substrates in moderate currents.
Reproduction: The MDWFP collection has nine gravid females from Alabama averaging 62.1 mm (5.8 in.) shell length and ranging from 53 – 75 mm (2.1 – 3.0 in.). Two of these females were collected in March, five in May, and two in September.
This species has a reproductive strategy that involves the release of a discrete mass of a glochida, referred to as a superconglutinate, which resembles a minnow and which is used as a lure for its fish hosts (Haag, et al., 1995).
Fish hosts: Known fish hosts are the Alabama Bass (*Micropterus henshalli*), Redeye Bass (*M. coosae*), and Largemouth Bass (*M. salmoides*).
STATUS: MNHP: G2S1; USFWS: Threatened; MDWFP: Endangered.
This species still occurs in the Buttahatchee River but was very abundant in Yellow Creek, a tributary of Luxapallila Creek, in Lowndes County. The 2000 drought resulted in the death of many individuals of this species in Yellow Creek and it is unclear if *H. perovalis* has recovered there since that time.

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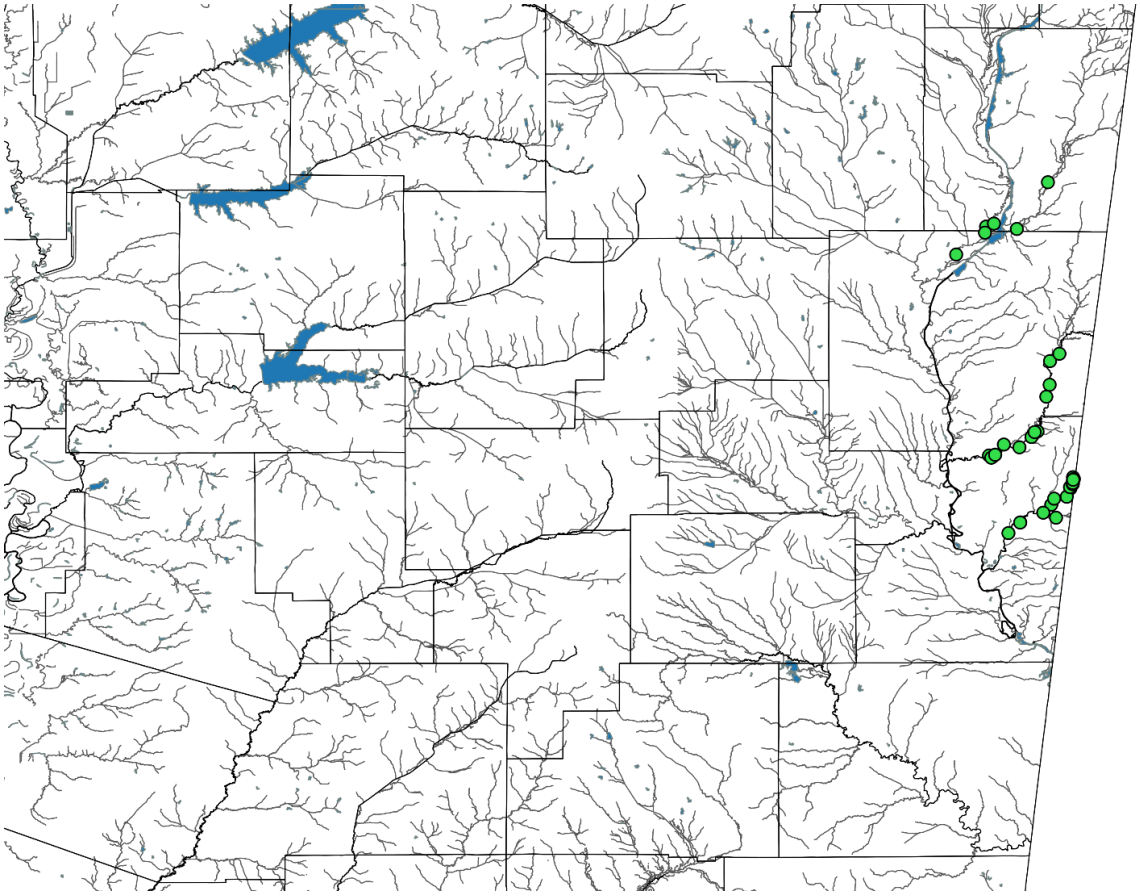

Distribution of *Hamiota perovalis* in Mississippi.

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LAMPSILIS CARDIUM RAFINESQUE, 1820
PLAIN POCKETBOOK

***Lampsilis cardium* – Top: MMNS 9157, female, Little Tallahatchie River, Panola County, 112 mm (4.4 in.). Bottom: MMNS 10909, male, Big Black River, Montgomery County, 95 mm (3.7 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval to quadrate, greatly inflated in females, moderately so in males. Shell moderately thick, not fragile, particularly in larger specimens.
Posterior ridge: Absent in most specimens, very broadly rounded in a few males.
Umbo: Above hinge line, prominent, swollen, directed toward midline.
Color and pattern: Yellowish brown to reddish brown to almost black in some specimens; rays usually present, narrow to wide, closer together anteriorly, usually widely space on posterior end of shell but then becoming more closely spaced on posterior slope. Rays very faint or obscure in darker specimens.
Surface: Smooth, shiny, no sculpturing.
Nacre: White with a silvery sheen.
Umbo cavity: Deep.
Teeth: Two pseudocardinals in each valve, left valve with 2 laterals, right with one. Teeth relatively small and thin, not thick nor particularly prominent.
Interdentum: Absent.

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Size: Shell length of largest Mississippi specimen in MDWFP collection is 143 mm (5.6 in.).

DISTRIBUTION: Widespread, from Minnesota east to New York, south to Tennessee, Louisiana, and Mississippi.

MISSISSIPPI DISTRIBUTION: Known from the Tennessee, Big Black, Lower Mississippi River North, Lower Mississippi River South, and Yazoo drainages, where it has been found in the Big Black, Mississippi, Bayou Pierre, Bogue Phalia, Sunflower, and Little Tallahatchie rivers as well as Bear (Tennessee River drainage), Chewalla, and Puskus creeks and the Tchula Lake cutoff canal.

SIMILAR SPECIES: Much larger and more inflated than either *Lampsilis siliquoidea* or *L. hydiana*. Occurs with *L. ovata*, which it resembles, in the Tennessee River drainage, but the latter is not as inflated, usually has a prominent posterior ridge which *L. cardium* lacks, is more triangular in shape, and usually has larger and thicker teeth than *L. cardium*. Some large males from the Big Black River have a dark periostracum and a shape that superficially resembles *Potamilus purpuratus*, but can be distinguished from that species because it has a purple nacre while that of *L. cardium* is white.

NATURAL HISTORY:

Habitat: This species occurs in streams and rivers in sand and gravel mixtures but is more commonly found in clay or silt in areas with little or no current.

Reproduction: Six gravid females in the MDWFP collection averaged 89.2 mm (3.5 in.) and ranged from 52 – 109 mm (2.0 – 4.3 in.) in shell length. One of these was collected in September from Bear Creek in Tishomingo County and the other five were found in October in the Big Black River, Montgomery County.

Fish hosts: Twelve species of fish in three families have been identified as hosts for this mussel, and nine of them occur in Mississippi, including the Green Sunfish (*Lepomis cyanellus*), Bluegill (*L. macrochirus*), Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*M. salmoides*), White Crappie (*Pomoxis annularis*), Black Crappie (*P. nigromaculatus*), Walleye (*Sander vitreus*), Sauger (*S. canadense*), and Yellow Perch (*Perca flavescens*).

STATUS: MNHP: G5S3S4.

Although we have specimens of this species from 18 Mississippi counties, it doesn't appear to be overly common in the state, but that may be due to a lack of sampling in appropriate habitats rather than to a genuine rarity. Most of our collection records and specimens are from the Big Black River.

TAXONOMIC NOTES: The precise taxonomic status of *L. cardium* is somewhat problematic. Parmalee and Bogan (1998) considered it a valid species in Tennessee, but Williams et al., (2008) questioned whether it was distinct from *L. ovata* in Alabama. However, the most recent taxonomic treatment (Williams et al., 2018) lists it as distinct species.

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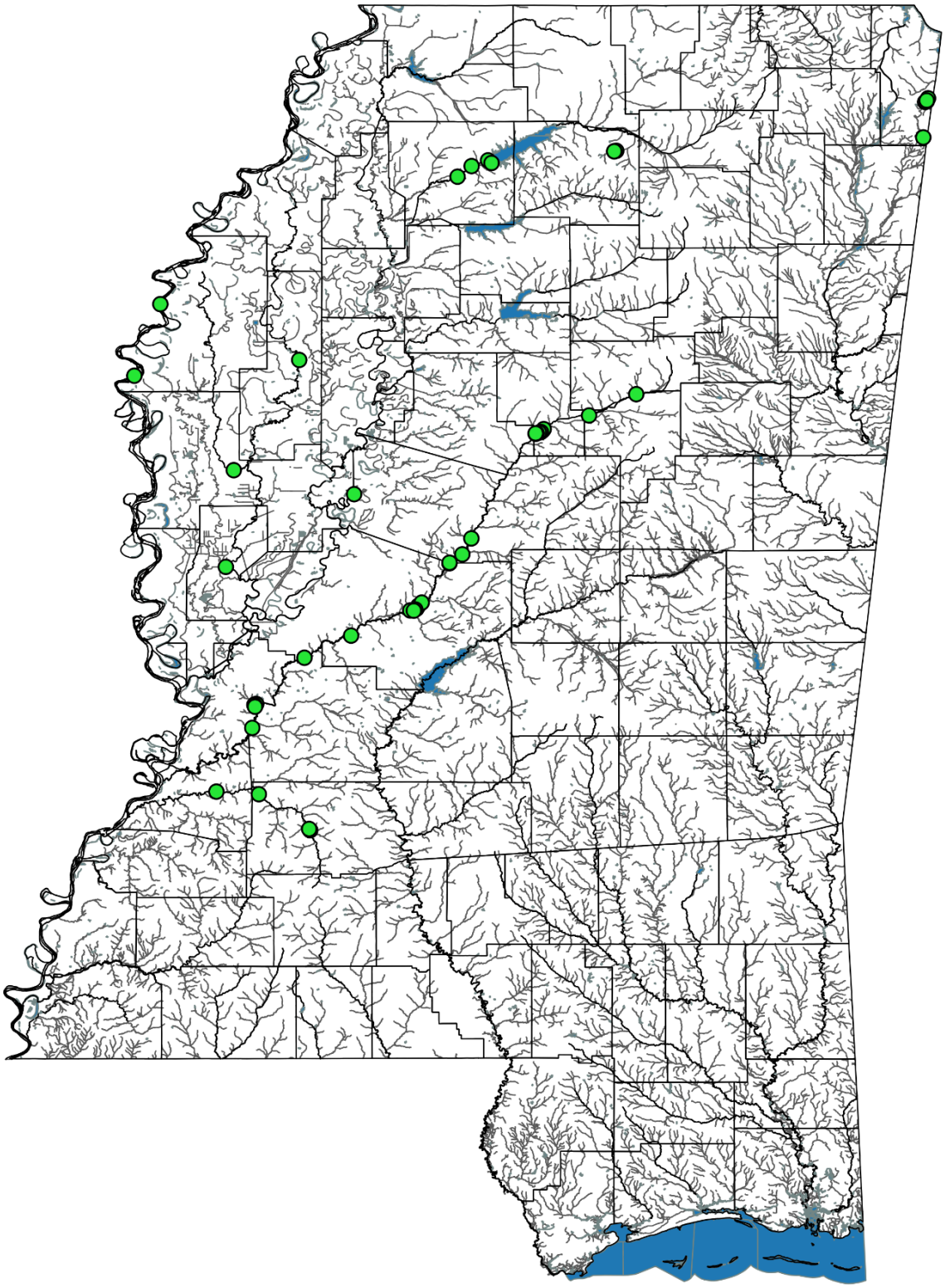

Distribution of *Lampsilis cardium* in Mississippi.

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LAMPSILIS FASCIOLA RAFINESQUE, 1820
WAVYRAYED LAMPMUSSEL

***Lampsilis fasciola* – Top: MMNS 8526, Little Pigeon River, Sevier County, Tennessee, 71 mm (2.8 in.). Bottom: MMNS 9740, Duck River, Maury County, Tennessee, 70 mm (2.7 in.)**

SHELL CHARACTERISTICS:
Shape and structure: Round to oval, nearly quadrate in females. Shell relatively thin, particularly along the posterior edge. Females moderately inflated, males moderately compressed.
Posterior ridge: Absent.
Umbo: Even with or just slightly above hinge line.
Color and pattern: Yellowish brown to light yellowish brown, with rays on most of the shell, extending from the umbo to the ventral margin. Rays numerous, usually very thin, but may coalesce into wider rays near the ventral margin of the shell.
Surface: Smooth, no ornamentation.
Nacre: White with bluish wash.
Umbo cavity: Moderately deep.
Teeth: Two pseudocardinals in each valve, two laterals in left valve, one in right. Teeth relatively large but thin, not heavy.
Interdentum: Present, narrow.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 67

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mm (2.6 in.). Alabama specimens in the MDWFP collection are up to 86 mm (3.4 in.) in shell length.

DISTRIBUTION: Great Lakes east to Pennsylvania and New York, south to Alabama, Tennessee, Georgia, and Mississippi.

MISSISSIPPI DISTRIBUTION: Only known from Bear Creek, Tennessee River drainage, Tishomingo County.

SIMILAR SPECIES: Unlikely to be confused with other mussels in Bear Creek except for juvenile *L. cardium* or *L. ovata*. Both of those species are likely to be more inflated than *L. fasciola*, and both, although they may have rays, do not have the numerous, thin rays characteristic of *L. fasciola*. *Lampsilis ovata* also has a prominent posterior ridge that *L. fasciola* lacks.

NATURAL HISTORY:

Habitat: This species seems to prefer stable sandy-gravel substrates in flowing water (Williams et al., 2008).

Reproduction: Nothing is known about its reproduction in Mississippi, but a gravid female from Shoal Creek, Tennessee, in the MDWFP collection is 72 mm (2.8 in.) long and was collected in October.

Fish hosts: Identified fish hosts which occur in Mississippi include the Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*M. salmoides*), Longear Sunfish (*Lepomis megalotis*), and Bluntnose Minnow *(Pimephales notatus*).

STATUS: MNHP: G5S1.

Lampsilis fasciola was formerly more abundant in Bear Creek than it is today. Isom and Yokley (1968) collected it from both Bear and Cedar creeks in Tishomingo County in 1965, which were the last know records until a recently dead specimen was found by MDWFP biologists in Bear Creek near Golden, MS, in 2005.

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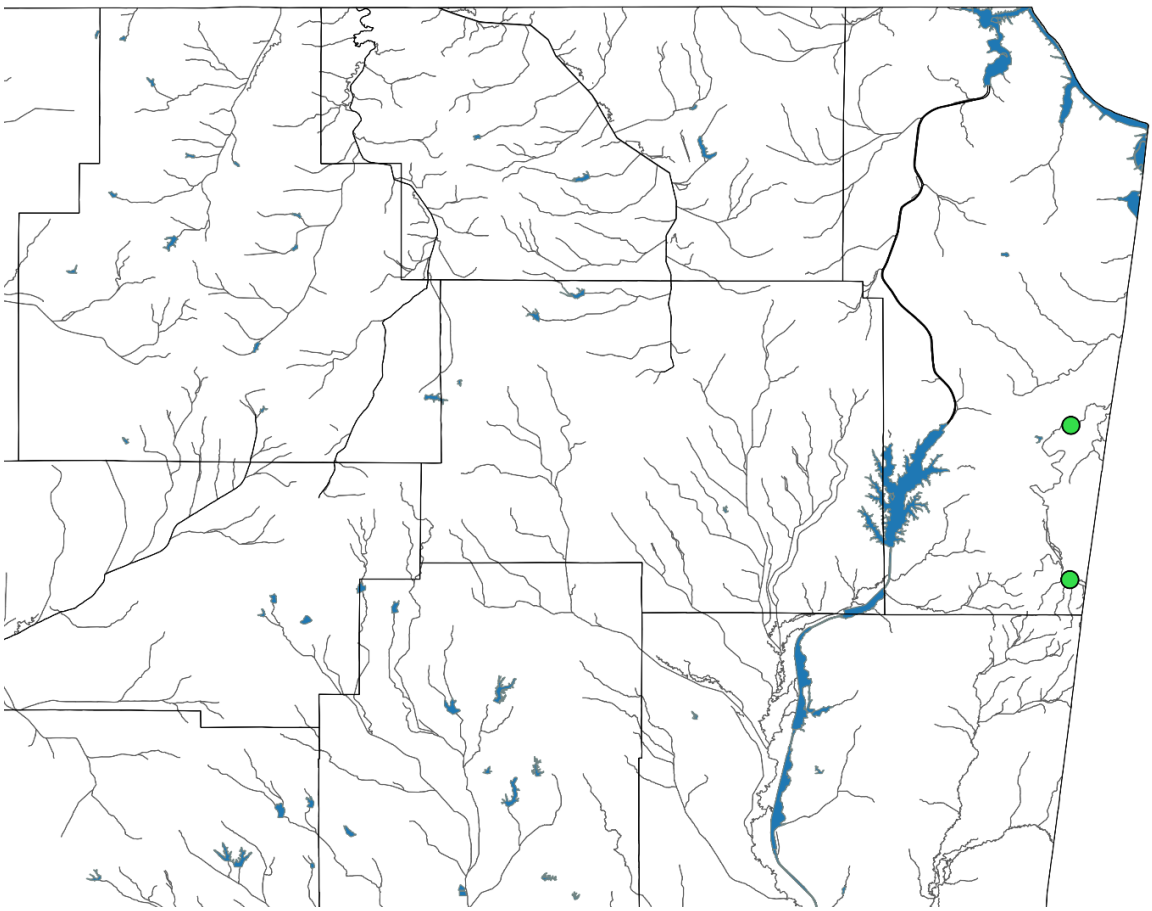

Distribution of *Lampsilis fasciola* in Mississippi.

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LAMPSILIS HYDIANA (LEA, 1838)
LOUISIANA FATMUCKET

***Lampsilis hydiana* – Top: MMNS 7098, male, Bogue Phalia, Bolivar County, 54 mm (2.1 in.). Bottom: MMNS 4315, female, Tensas River, Madison Parish, Louisiana, 74 mm (2.9 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval in males, nearly quadrate in females. Relatively inflated, particularly in females; shell relatively thick.
Posterior ridge: Absent, occasionally present but very broadly rounded.
Umbo: Above hinge line but not prominent.
Color and pattern: Yellow to yellowish orange; rays present, usually relatively wide, extending from umbo to the ventral edge of the shell, although a few specimens lack rays.
Surface: Smooth, no sculpturing.
Nacre: Creamy white, glossy.
Umbo cavity: Relatively deep.
Teeth: Two pseudocardinals in each valve, two laterals in left valve, one in right. Teeth moderately thick but not exceptionally large.
Interdentum: Present or absent, usually narrow if present.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 102 mm (4.0 in.).
DISTRIBUTION: Arkansas and Oklahoma south to Texas and Louisiana, east to Mississippi. Occurs primarily on the west side of the Mississippi River.
MISSISSIPPI DISTRIBUTION: Found in the Yazoo Drainage, where it has been

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collected in the Hushpuckena, Sunflower, Little Sunflower, Quiver, and Yazoo rivers as well as in Steele Bayou and Bogue Phalia.

SIMILAR SPECIES: *Lampsilis hydiana* is most similar to *L. siliquoidea* and it can often be difficult to distinguish the two. Vidrine (1993) found that the two species were best separated in Louisiana based on whether or not rays extended up onto the umbo, which was characteristic of *L. hydiana* but not *L. siliquoidea*. This seems to hold up in Mississippi as well, where *L. siliquoidea* rays usually extend from the ventral margin of the shell to near but not to the top of the umbo, while rays in *L. hydiana* extend further to almost the top of the umbo. This character is not useful, however, in those specimens which lack rays or those whose umbos have been extensively eroded, which is relatively common in older, larger specimens of both species. In both cases, separation of the two is best done using a combination of morphology and distribution. *Lampsilis siliquoidea* is usually larger and slightly more compressed than *L. hydiana* and seems to be characteristic of streams outside of the Mississippi Delta (Mississippi River alluvial plain). *Lampsilis hydiana* tends to be more inflated than *L. siliquoidea*, is usually smaller, and is more characteristic of streams and oxbows within the Mississippi Delta than in other areas of Mississippi. Depth of the umbo cavity appears to be greater in *L. hydiana* than in *L. siliquoidea*, but this character is qualitative and relative, and is sometimes difficult to evaluate.

NATURAL HISTORY:

Habitat: *Lampsilis hydiana* occurs in sandy-clay, clay, and sandy gravel habitats in creeks and rivers, generally in slow to moderate currents.

Reproduction: There is no information on reproduction in Mississippi, but in Texas this species has been found gravid in May, June, and late August (Howell et al., 1966).

Fish hosts: Identified fish hosts are the Green Sunfish (*Lepomis cyanellus*), Blue Catfish (*Ictalurus furcatus*), and Channel Catfish (*I. punctatus*).

STATUS: MNHP: G4S2.

Although very common in Louisiana (Vidrine, 1993), this species is uncommon to rare in Mississippi and appears to be declining. We have specimens from 9 counties in the state. It was apparently formerly relatively abundant in the Sunflower River as many of our specimens and collection records are from that river. However, many of these specimens are relict shells and only a few live specimens have been encountered in the last few years.

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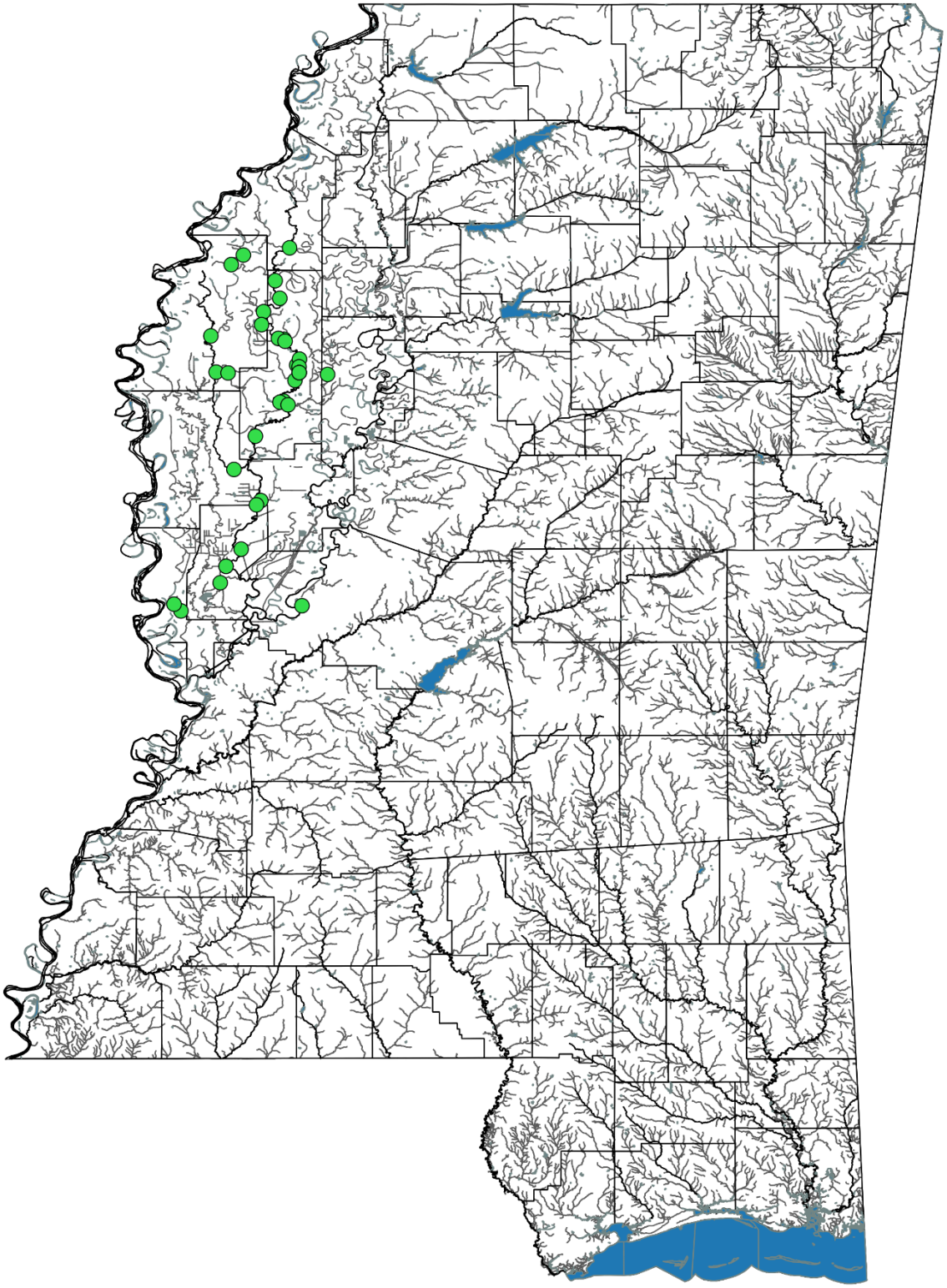

Distribution of *Lampsilis hydiana* in Mississippi.

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LAMPSILIS ORNATA (CONRAD, 1835)
SOUTHERN POCKETBOOK

***Lampsilis ornata* – Top: MMNS 5980, male, Leaf River, Forrest County, 101 mm (4.0 in.). Bottom: MMNS 2644, East Fork Tombigbee River, female, Monroe County, 85 mm, (3.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval to triangular, inflated. Shell moderately thick in adults, thin in juveniles.
Posterior ridge: Broadly rounded, not prominent.
Umbo: Above hinge line, prominent, inflated, turned strongly toward midline of the shell.
Color and pattern: Yellow in juveniles, yellowish brown to brown to dark brown in older specimens. Rays usually present, wide to narrow, numerous to sparse or absent. If present, rays extend from the umbo down to ventral edge of shell.
Surface: Smooth, shiny, no ornamentation.
Nacre: White to white with a pinkish wash, particularly in the region of the umbo cavity.
Umbo cavity: Deep to moderately deep.
Teeth: Two pseudocardinals in each valve, two laterals in the left valve, one in the right valve. Teeth moderately thick to moderately thin.

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Interdentum: Present, usually narrow.
Size: Shell length of largest Mississippi specimen in the MDWFP collection 121 mm (4.8 in.).
DISTRIBUTION: Gulf of Mexico drainages from Florida west to Louisiana.
MISSISSIPPI DISTRIBUTION: Tombigbee, Pascagoula, Pearl, and Lake Pontchartrain drainages, where it has been found in the Amite, Tangipahoa, Pearl, Strong, Pascagoula, Chickasawhay, Leaf, Escatawpa, Bowie, Tombigbee, Noxubee, and Buttahatchee rivers, as well as in Okatoma, Tallahala, Luxapallila, Yellow, Tibbee, Bull Mountain, and Mill creeks.
SIMILAR SPECIES: *Lampsilis ornata* is one of three large *Lampsilis* in Mississippi that are similar in appearance. It differs from *L. ovata*, which has a pronounced posterior ridge while *L. ornata* has a broadly rounded posterior ridge. It also differs from *L. cardium*, which has relatively smaller teeth than *L. ornata*. Additionally, *L. ornata* does not occur in the same drainages as *L. ovata* or *L. cardium*.
NATURAL HISTORY:
Habitat: *Lampsilis ornata* occurs in gravel, sand, or a mixture of the two in large streams and smaller rivers.
Reproduction: There are 15 gravid females of this species in the MDWFP collection, some from Mississippi and some from Alabama, which averaged 74 mm (2.9 in.) and ranged from 55 - 91 mm (2.2 – 3.6 in.) in shell length. One of these females was collected in April from the Pascagoula drainage in Jackson County, Mississippi. Six other gravid females were found in June and were from the Pascagoula, Pearl, and Cahaba (Alabama) drainages. Five gravid females were encountered in September and were from Tombigbee River drainage in Mississippi and Alabama. Three gravid females were collected in October, one from the Leaf River in Jones County, Mississippi, and the other two from the Amite River in Louisiana.
Fish hosts: The only known fish host is the Largemouth Bass (*Micropterus salmoides*).
STATUS: MNHP: G5S5.
This species is widespread and relatively abundant in Mississippi, as we have specimens from 24 counties in the state. Most are from the Buttahatchee and East Fork Tombigbee rivers, but a substantial number of specimens are from the Leaf River.

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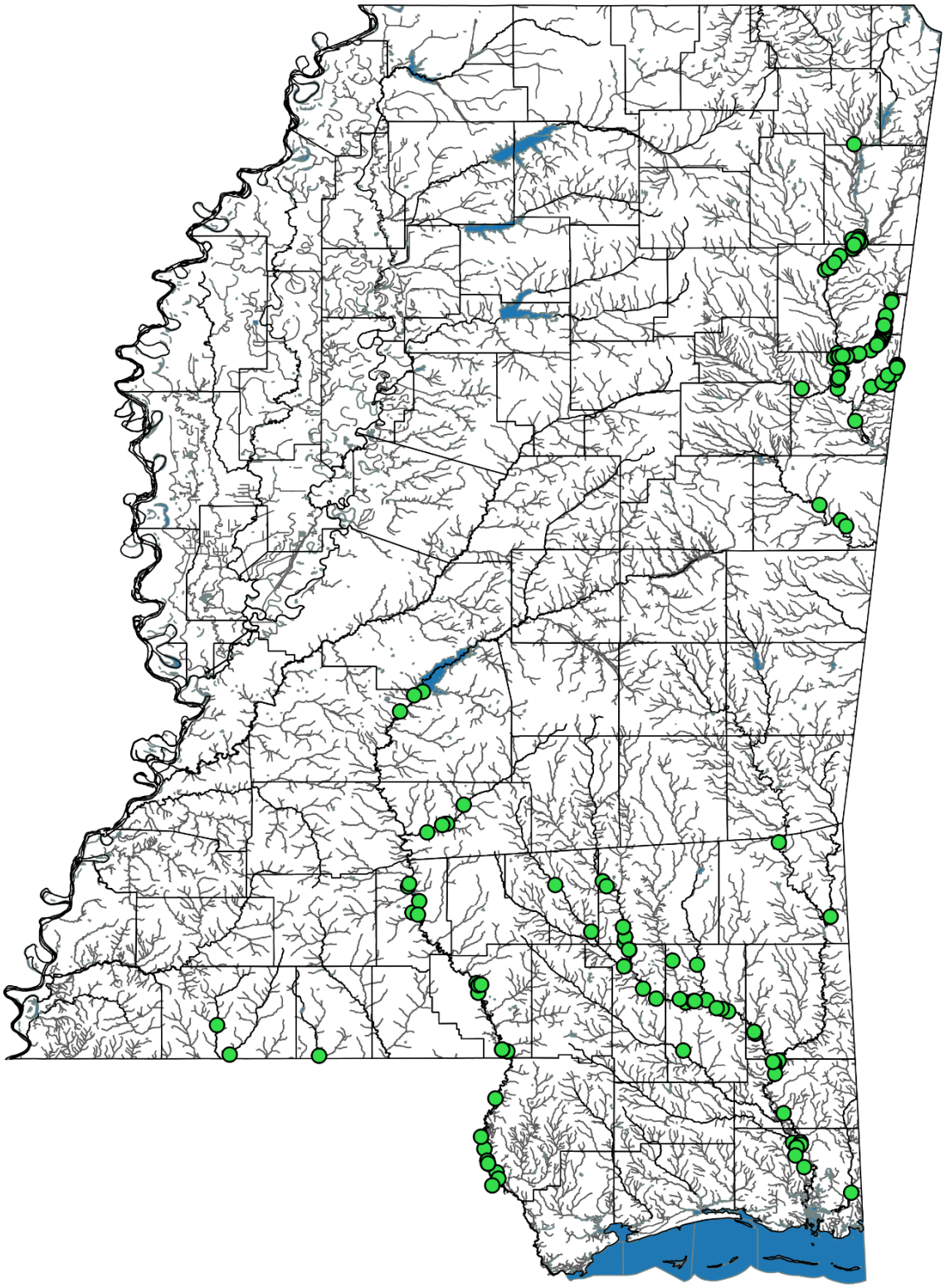

Distribution of *Lampsilis ornata* in Mississippi.

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LAMPSILIS OVATA (SAY, 1817)
POCKETBOOK

***Lampsilis ovata* – Top: MMNS 1550, male, Bear Creek, Tishomingo County, 109 mm (4.3 in.). Bottom: MMNS 5573, female, Bear Creek, Tishomingo County, 107 mm (4.2 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval to triangular to almost quadrate in females. Shell inflated, relatively thick.
Posterior ridge: Prominent, sometimes broadly rounded in females.
Umbo: Above hinge line, relatively prominent, turned inward toward center line.
Color and pattern: Yellowish brown to dark brown; rays usually absent, but if present, usually very narrow and obscure, extending from about the mid-point of the shell to the posterior slope.
Surface: Smooth but not shiny; no ornamentation.
Nacre: White.
Umbo cavity: Relatively deep.
Teeth: Two pseudocardinal teeth in both the left and right valve, two lateral teeth in left valve, one fairly wide lateral tooth in right valve. Teeth moderately well-developed but not heavy.
Interdentum: Present, narrow to moderately wide.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 120 mm (4.7 in.).

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DISTRIBUTION: Illinois south to Missouri, east to Mississippi, north to New York and Pennsylvania.
MISSISSIPPI DISTRIBUTION: Tennessee River drainage in Bear and Cedar creeks, Tishomingo County.
SIMILAR SPECIES: *Lampsilis ovata* is one of the three large *Lampsilis* in Mississippi (*L. cardium*, *L. ornata*, *L. ovata*) which are similar in appearance. It differs from *L. ornata* and *L. cardium*, which have broadly rounded posterior ridges, by having a pronounced, somewhat sharp, posterior ridge. *Lampsilis ovata* also has relatively larger teeth, usually lacks rays, and is generally more triangular in shape than *L. cardium*. *Lampsilis ovata* is also separated geographically from *L. ornata*, which does not occur in the Tennessee drainage in Mississippi.
NATURAL HISTORY:
Habitat: In Mississippi, this species occurs in relatively large creeks in sand and gravel substrates.
Reproduction: One gravid female from Bear Creek, Tishomingo County, was 82 mm (3.2 in.) shell length and was collected in October.
Fish hosts: Largemouth Bass (*Micropterus salmoides*), Spotted Bass (*M. punctulatus*), and Smallmouth Bass (*M. dolomieu*) are known fish hosts.
STATUS: G5S3.
Although widespread nationally, this species is restricted to only a small area in northeastern Mississippi.
TAXONOMIC NOTES: The precise taxonomic status of *L. ovata* is somewhat problematic. Parmalee and Bogan (1998) considered it a valid species in Tennessee, but Williams et al., (2008) questioned whether it was distinct from *L. cardium* in Alabama. However, the most recent taxonomic treatment (Williams et al., 2017) lists it as a distinct species.

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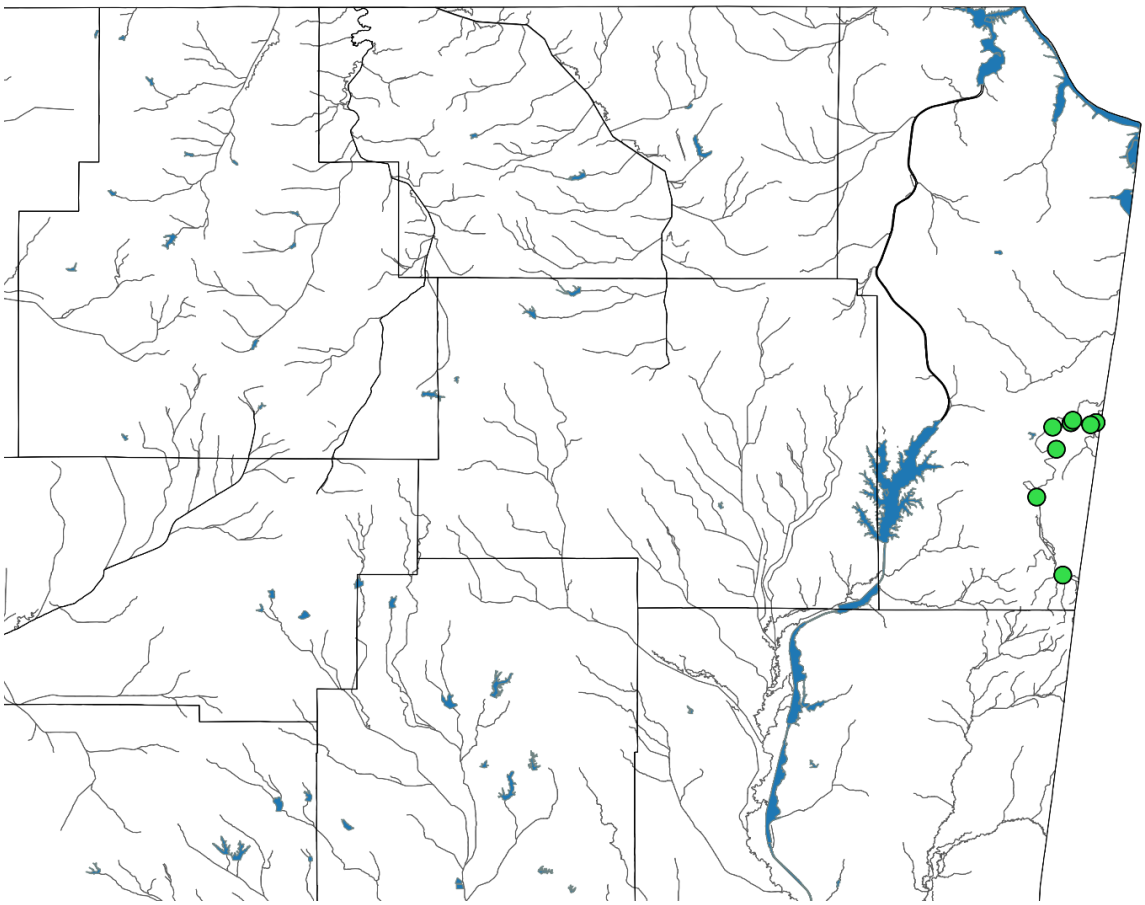

Distribution of *Lampsilis ovata* in Mississippi.

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LAMPSILIS SILIQUOIDEA (BARNES, 1823)
FATMUCKET

***Lampsilis siliquoidea* – Top: MMNS 10759, female, Big Black River, Webster County, 71 mm (2.8 in.). Bottom: MMNS 1711, male, Clear Springs, Franklin County, 83 mm (3.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to elliptical, moderately inflated, and relatively thick.
Posterior ridge: Absent.
Umbo: Slightly above hinge line, not prominent.
Color and pattern: Orange-brown, yellow-brown, to greenish-brown. Rays usually present but occasionally absent, wide to narrow, extending from just below umbo to the ventral margin of shell.
Surface: Smooth, without ornamentation, usually shiny, particularly in smaller individuals.
Nacre: White
Umbo cavity: Moderately shallow to shallow.
Teeth: Two pseudocardinals in each valve, two laterals in the left valve, one in the right. Teeth moderate in size.
Interdentum: Present or absent, if present, very narrow.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 112 mm (4.4 in.) long.
DISTRIBUTION: New York and Pennsylvania west to North Dakota, south to Louisiana, and east to Mississippi.

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MISSISSIPPI DISTRIBUTION: Found in the Big Black, Mississippi River South, and Yazoo drainages, where it has been collected in the Big Black, Homochitto, Bayou Pierre, Tippah, Yazoo, Yocona, and Skuna rivers. It has also been found in a large number of creeks and in both Clear Springs Lake and Puskus Lake.

SIMILAR SPECIES: *Lampsilis siliquoidea* is most similar to *L. hydiana* and it can often be difficult to distinguish the two. Vidrine (1993) found that the two species were best separated in Louisiana based on whether or not rays extended up onto the umbo, which was characteristic of *L. hydiana* but not *L. siliquoidea*. This seems to hold up in Mississippi as well, where *L. siliquoidea* rays usually extend from the ventral margin of the shell to near but not on the umbo, while rays in *L. hydiana* extend to almost the top of the umbo. This character is not useful, however, in those specimens which lack rays or those whose umbos have been extensively eroded, which is relatively common in older, larger specimens of both species. In that case, separation of the two species is best done using a combination of morphology and distribution. *Lampsilis siliquoidea* is usually larger and slightly more compressed that *L. hydiana* and seems to be characteristic of streams outside of the Mississippi Delta (Mississippi River alluvial plain). *Lampsilis hydiana* tends to be more inflated than *L. siliquoidea*, is usually smaller, and is more characteristic of streams and oxbows within the Mississippi Delta than in other areas of Mississippi. Depth of the umbo cavity appears to be greater in *L. hydiana* than in *L. siliquoidea*, but this character is qualitative and relative, and is sometimes difficult to evaluate.

NATURAL HISTORY:

Habitat: *Lampsilis siliquoidea* is largely a species of creeks, where it is found in gravel, sand, clay, and mixtures of those substrates in slow moving water, or in ponds or reservoirs.

Reproduction: Ten gravid females from Mississippi in the MDWFP collection average 71.5 mm (2.8 in.) and range from 52 – 92 mm (2.0 – 3.6 in.) in shell length. Three of these females were collected in May from Sand Creek in Webster County, one was collected in July from Bayou Pierre in Copiah County, two were collected in September from Bayou Pierre in Copiah County, three, also collected in September, were from the Yocona River in Lafayette County, and one was collected in October from the Big Black River in Montgomery County.

Fish hosts: There are 22 fish species in nine families that are known as hosts for the Fatmucket. Fourteen of these occur in Mississippi, including the Largemouth Bass (*Micropterus salmoides*), Smallmouth Bass (*M. dolomieu*), Warmouth (*Lepomis gulosus*), Green Sunfish (*L. cyanellus*), Longear Sunfish (*L. megalotis*), Bluegill (*L. macrochirus*), White Crappie (*Pomoxis annularis*), Black Crappie (*P. nigromaculatus*), Bluntnose Minnow (*Pimephales notatus*), Yellow Perch (*Perca flavescens*), Walleye (*Sander vitreus*), Sauger (*S. canadense*), White Bass (*Morone chrysops*), and Tadpole Madtom (*Noturus gyrinus*).

STATUS: MNHP: G5S3S4.

This species was probably more widespread in the past given the extensive alteration of creeks within its range. We have specimens from 13 counties in the state, but most of our collection records and specimens are from Bayou Pierre, Clear Springs Lake (Franklin County), the Big Black River,

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and the Yocona River. It is not known to occur with *L. hydiana* in Mississippi.

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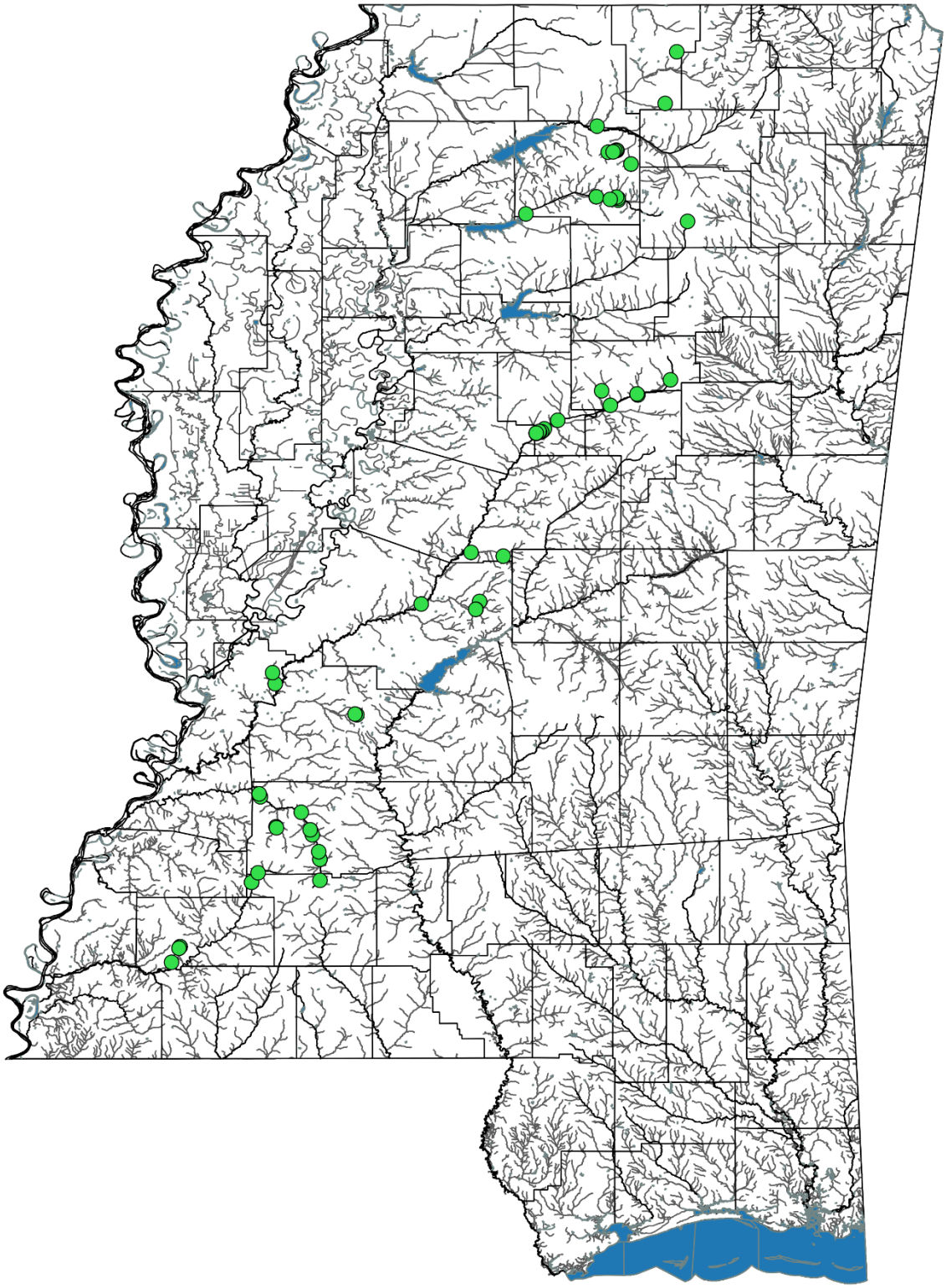

Distribution of *Lampsilis siliquoidea* in Mississippi.

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LAMPSILIS STRAMINEA (CONRAD, 1834)
ROUGH FATMUCKET

***Lampsilis straminea* – Top: MMNS 5774, *claibornensis* form, male. Yellow Creek, Lowndes County, 64 mm (2.5 in.). Bottom: MMNS 2930, *straminea* form, female. Houlka Creek, Chickasaw County, 67 mm (2.6 in).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to elliptical, relatively inflated, moderately thick to thin.
Posterior ridge: Absent.
Umbo: Above hinge line, but not prominent.
Color and pattern: Greenish yellow to yellow with chestnut coloration around, below, and posterior to umbo. Rays usually absent but occasionally juveniles may have very faint rays. Sometimes scattered small spots randomly located around the upper part of the shell.
Surface: Smooth, fairly shiny except in populations formerly designated as the nominate subspecies *L. s. straminea*, which has elevated and very prominent growth lines.
Nacre: White but sometimes with yellow or pink wash in the umbo.
Umbo cavity: Shallow to moderately deep.
Teeth: Two pseudocardinals in each valve, two laterals in the left valve, one in the right valve. Teeth, particularly pseudocardinals, moderately large.
Interdentum: Present, usually narrow.

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Size: Shell length of largest Mississippi specimen in MDWFP collection is 110 mm (4.3 in.).

DISTRIBUTION: From extreme southeastern Tennessee into Florida and Georgia and west to Louisiana in streams draining into the Gulf of Mexico.

MISSISSIPPI DISTRIBUTION: Found in the Coastal Rivers, Lake Pontchartrain, Pascagoula, Pearl, and Tombigbee drainages in the Little Biloxi, Wolf, Amite, Tangipahoa, Tickfaw, Chickasawhay, Chunky, Bowie, Leaf, Pascagoula, East Pearl, Strong, Yockanookany, Buttahatchee, Noxubee, Sucarnoochee, and East Fork Tombigbee rivers, numerous creeks, and in Ross Barnett Reservoir.

SIMILAR SPECIES: Resembles *L. hydiana* and *L. siliquoidea* but usually does not have rays, occurs in different drainages, and generally has relatively larger pseudocardinal teeth than do those two species. Occurs in the same streams as *L. teres*, which is usually less inflated and has a more pointed posterior than *L. straminea*.

NATURAL HISTORY:

Habitat: This species is found in gravel, sand, mud, and mixtures of those substrates usually in moderate to slow flowing water, in both creeks and rivers, and occasionally in reservoirs.

Reproduction: There are 45 gravid specimens of this species in the MDWFP collection ranging from 49 - 105 mm (1.9 – 4.1 in.) and averaging 69.6 mm (2.7 in.) in shell length. One of these was collected in February, three in March, three in April, 10 in May, four in June, six in August, 15 in September, and three in October.

Fish hosts: Known fish hosts include the Bluegill (*Lepomis macrochirus*), Largemouth Bass (*Micropterus salmoides*), Golden Shiner (*Notemigonus crysoleucas*), Weed Shiner (*Notropis texanus*), Channel Catfish (*Ictalurus punctatus*), and the Western Mosquitofish (*Gambusia affinis*).

STATUS: MNHP: G5S5.

This species is one of the most widespread and common mussels in Mississippi. We have specimens from 43 counties in the state. Most of our specimens are from the Tangipahoa, Leaf, Pearl, and Buttahatchee rivers.

TAXONOMIC NOTES: *Lampsilis straminea* was formerly considered to be composed of two subspecies, *L. s. straminea* and *L. s. claibornensis*, but these designations were considered invalid by Williams et al., (2008). The *claibornensis* form is the most widespread in Mississippi, found over much of the state except for the Black Belt Prairie. The *straminea* form occurs in small creeks with clay or chalk substrates and is usually a pale milky yellow with very elevated growth lines. Most of our collection records and specimens of this form are from Catalpa Creek in Lowndes County, Chewawah Creek in Chickasaw County, and Johnson and Houlka creeks in Clay County.

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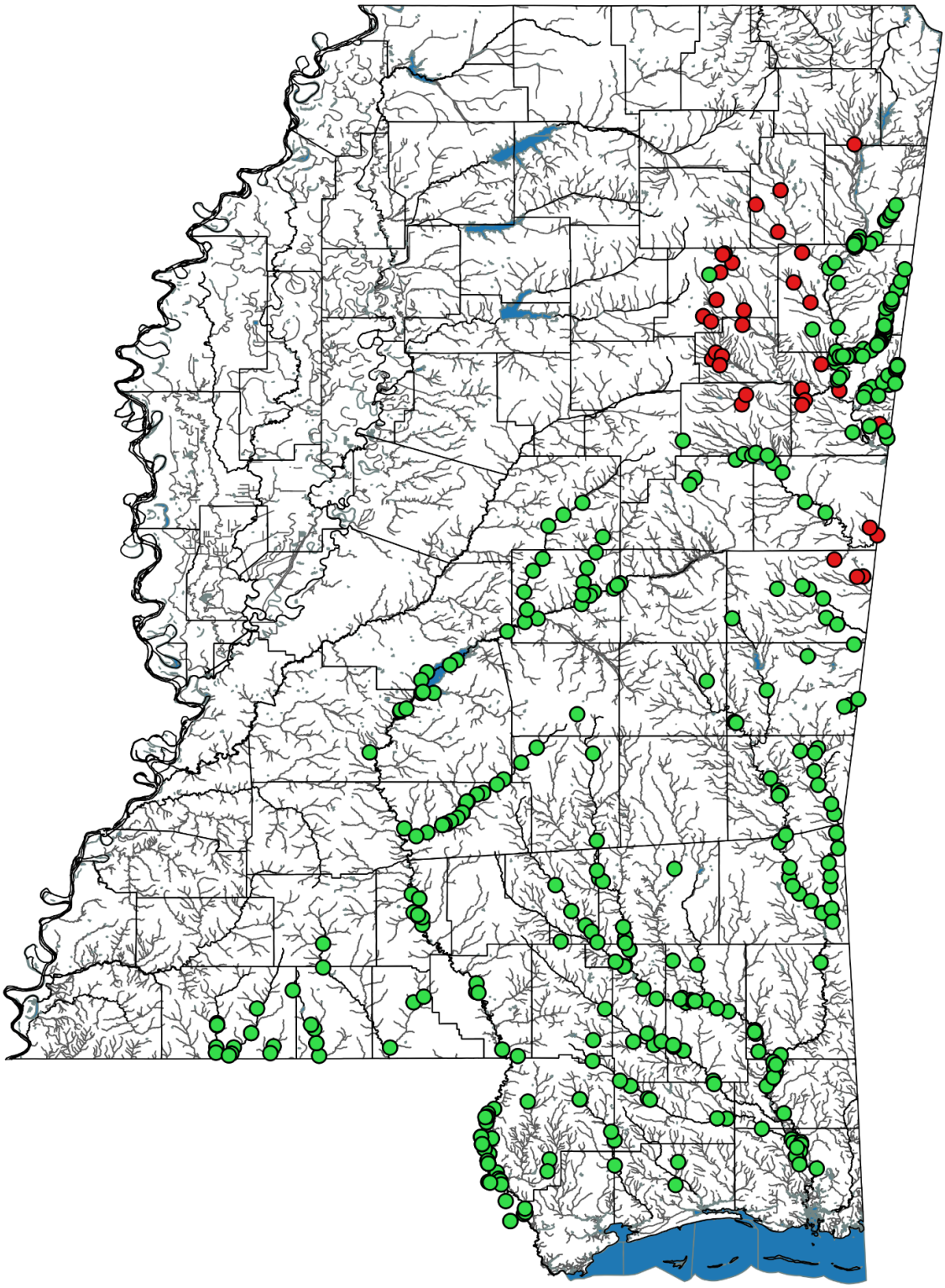

Distribution of *Lampsilis straminea* in Mississippi. Green circles represent the form *claibornensis*, red circles the form *straminea* (See text).

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LAMPSILIS TERES (RAFINESQUE, 1820)
YELLOW SANDSHELL

***Lampsilis teres* – Top: MMNS 5565, Coldwater River, Quitman County, 116 mm (4.6 in.). Bottom: MMNS 3760, Pascagoula River, George County, 76 mm (3.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, slightly to moderately inflated, relatively thick, posterior usually somewhat pointed but expanded vertically in some large females.
Posterior ridge: Very broadly rounded.
Umbo: Slightly above hinge line, not prominent.
Color and pattern: Yellow is the predominant ground color, although some shells have either an orange or brown tint. Rays rarely present, usually faint and on the posterior end of the shell, more common in Mississippi River basin than Gulf of Mexico Basin specimens.
Surface: Smooth, without ornamentation, usually shiny, particularly in smaller individuals.
Nacre: White, a few specimens with a pink wash in the umbo cavity.
Umbo cavity: Relatively shallow.
Teeth: Two pseudocardinals in each valve, two laterals in the left valve, one in the right. Teeth thin, usually rather small.
Interdentum: Absent.
Size: Shell length of the largest Mississippi specimen in the MDWFP collection is 143 mm (5.6 in.).
DISTRIBUTION: New York west to Minnesota, south to Mississippi and Louisiana, east to Georgia.
MISSISSIPPI DISTRIBUTION: Found in the Big Black, Lake Pontchartrain, Mississippi River North, Mississippi River South, Pascagoula, Pearl, Tombigbee, and Yazoo drainages, where it occurs in rivers, creeks, oxbow lakes, and sometimes in drainage ditches.

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SIMILAR SPECIES: Most similar to *L. straminea*, which is also commonly without rays, but the latter is generally smaller, more oval and not as elliptical, and more inflated.

NATURAL HISTORY:

Habitat: *Lampsilis teres* occurs in creeks, rivers, and oxbow lakes both in current and in slower moving water, generally in sand but also in gravel substrates as well as substrates composed primarily of clay.

Reproduction: The MDWFP collection has 54 gravid females averaging 89 mm (3.5 in.) and ranging from 71 - 118 mm (2.8 – 4.6 in.) in shell length. Of these 54 specimens, 19 were collected in April, five in May, nine in June, five in July, eight in September, 12 in October, and one in November.

Fish hosts: Eighteen species of fish in five families are known to be hosts for the Yellow Sandshell. Fifteen of these occur in Mississippi, including 10 species of sunfishes (Centrarchidae), the Longnose Gar (*Lepisosteus osseus*), Shortnose Gar (*L. platostomus*), Alligator Gar (*Atractosteus spatula*), and the Shovelnose Sturgeon (*Scaphirhynchus platorynchus*).

STATUS: MNHP: G5S5.

One of the more common mussels found in Mississippi creeks and rivers, we have records from 63 counties within the state. Most of our specimens are from the Big Black, Pearl, and Sunflower rivers, but there are also substantial numbers of specimens from the Yazoo, East Fork Tombigbee, and Pascagoula rivers as well.

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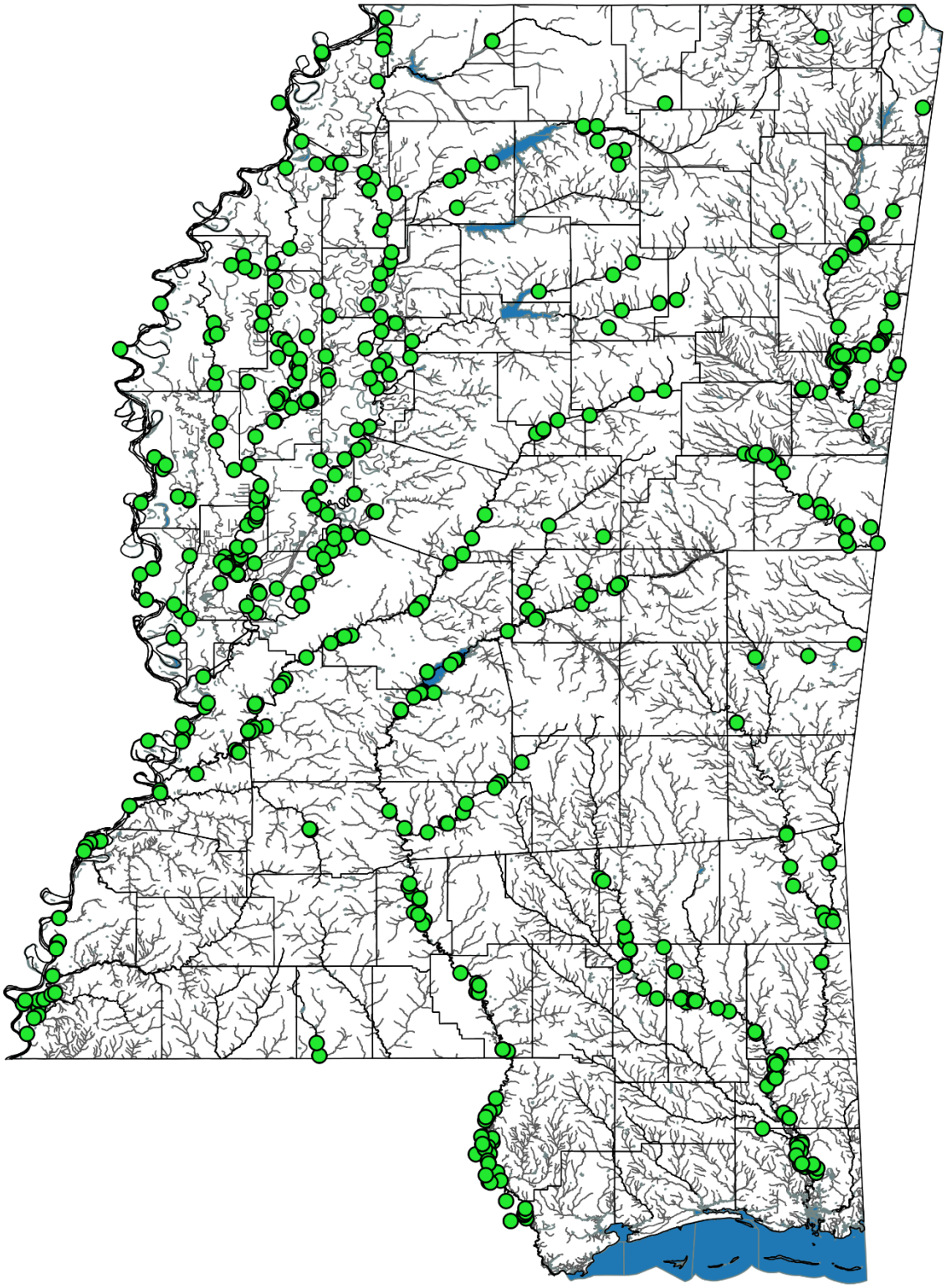

Distribution of *Lampsilis teres* in Mississippi.

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LASMIGONA ALABAMENSIS (CLARKE, 1985)
ALABAMA HEELSPLITTER

***Lasmigona alabamensis* – Top: MMNS 3117, East Fork Tombigbee River, Monroe County, 113 mm (4.5 in.). Bottom: MMNS 3645, Buttahatchee River, Monroe County, 100 mm (3.9 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval, compressed, usually with a prominent posterior wing, moderately thin to moderately thick.
Posterior ridge: Very broadly rounded or absent. If the ridge is present, there is usually a very shallow sulcus anterior to it.
Umbo: Either even with hinge or just slightly above hinge.
Color and pattern: Dark brown to black, no rays.
Surface: Corrugations on the posterior wing and posterior slope in distinct rows, generally small; additional corrugations or fused pustules on lateral slope of shell.
Nacre: White; faint purplish wash on posterior in some specimens.
Umbo cavity: Shallow.

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Teeth: Two pseudocardinals in left valve, one in right; one lateral in each valve, very short, poorly developed, additional short accessory ridge dorsal to lateral tooth in left valve; teeth fairly thick.
Interdentum: Present and wide.
Size: Shell length of largest Mississippi specimen in the MDWFP collection is 169 mm (6.6 in.).
DISTRIBUTION: Georgia, Alabama, and Mississippi.
MISSISSIPPI DISTRIBUTION: Tombigbee River drainage, where it has been collected in the Buttahatchee, Noxubee, and East Fork Tombigbee rivers and in Bull Mountain and Mill creeks.
SIMILAR SPECIES: Some small *Megalonaias nervosa* with compressed shells may be mistaken for *L. alabamensis*, but the former have longer, better developed lateral teeth, thicker shells, and larger and more extensive corrugations on the shell. *Potamilus alatus* of the Tennessee River drainage may resemble *L. alabamensis* but the former has a thinner shell, smaller pseudocardinal teeth, better developed lateral teeth, no interdentum, and a purple nacre.
NATURAL HISTORY:
Habitat: *Lasmigona alabamensis* is an inhabitant of rivers and larger creeks where it is most commonly found in sand and gravel substrates, usually in moderate currents.
Reproduction: There is only one gravid female in the MDWFP collection which was found in September in the East Fork Tombigbee River in Itawamba County. This female was 142 mm (5.6 in.) shell length. **Fish hosts:** These have not been reported for *L. alabamensis*.
STATUS: MNHP: G3S2.
This species has a rather limited distribution in Mississippi, as we have records from only six counties, and is relatively uncommon in the state. Most of our collection records and specimens are from the East Fork Tombigbee and Buttahatchee rivers.

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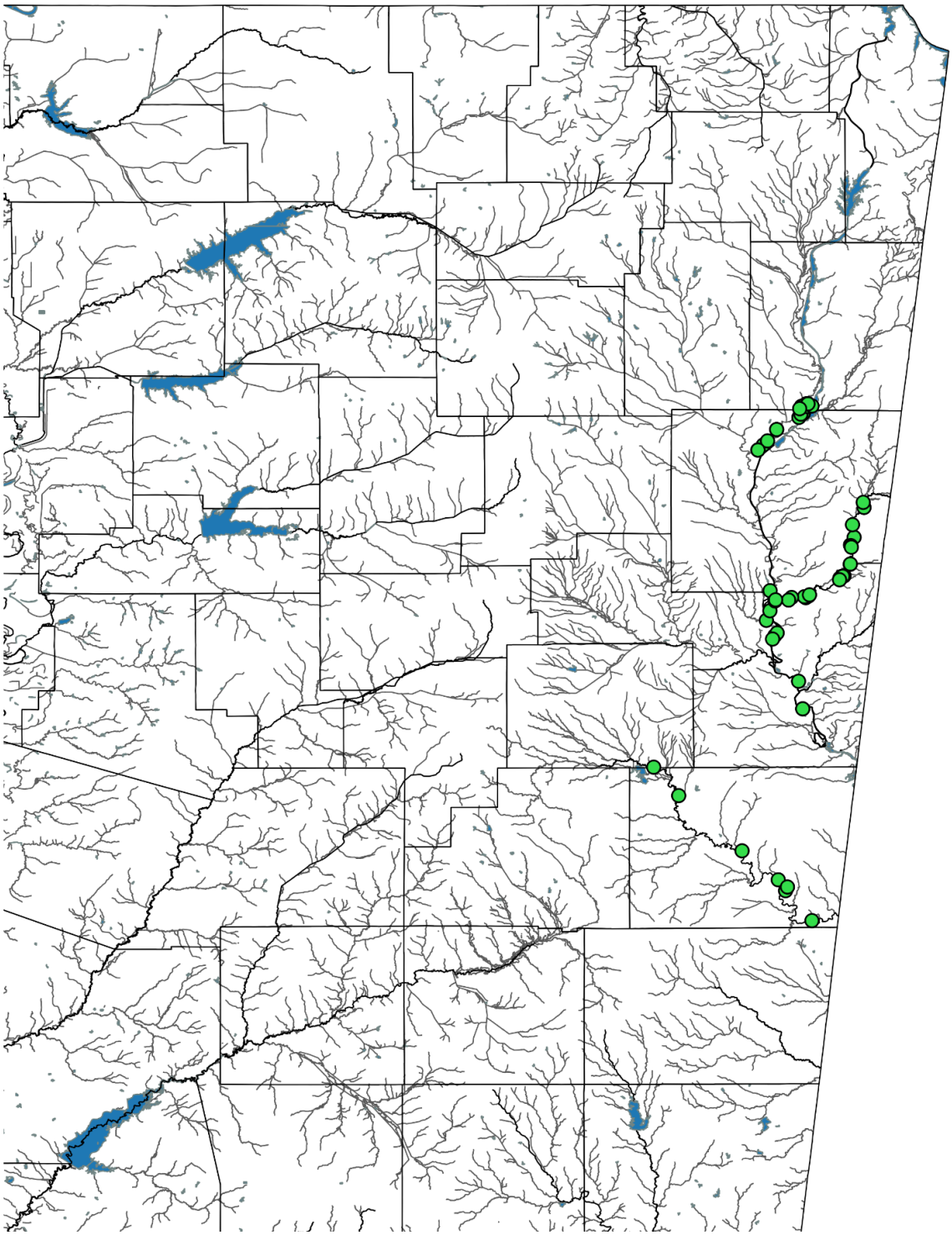

Distribution of *Lasmigona alabamensis* in Mississippi.

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LASMIGONA COMPLANATA (BARNES, 1823)
WHITE HEELSPLITTER

***Lasmigona complanata* – Top: MMNS 6686, Strong River, Simpson County, 86 mm (3.4 in.). Bottom: MMNS 11259, Pascagoula River, George County, 129 mm (5.8 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval, compressed, usually with a prominent posterior wing, thin to moderately thick.
Posterior ridge: Very broadly rounded with a shallow sulcus anterior to the ridge; sometimes the posterior ridge appears to be doubled at the posterior end of the shell; a few specimens lack a posterior ridge.
Umbo: Even with hinge, not prominent.
Color and pattern: Very dark brown to black; some smaller specimens from the Pascagoula drainage have bands of green laterally on the anterior end of the shell.
Surface: Usually minimal ornamentation except on the posterior wing where there are occasionally a few small corrugations.
Nacre: White but with a purplish or silver sheen near the posterior margin.
Umbo cavity: Shallow.
Teeth: Two pseudocardinals in left valve, one in right; one lateral in each valve, very short, poorly developed, additional short accessory ridge dorsal to

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lateral tooth in left valve; teeth fairly thick.
Interdentum: Present and wide.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 164 mm (6.5 in.).
DISTRIBUTION: New York and Pennsylvania west to Wyoming, south to Texas and Louisiana, east to Georgia.
MISSISSIPPI DISTRIBUTION: Known from the Big Black, Pascagoula, Pearl, and Tennessee drainages, where it has been collected in the Big Black, Leaf, Pascagoula, Pearl, and Strong rivers and from Bear Creek (Tennessee drainage) and Tallahala Creek (Pascagoula drainage). Also found in Caswell Lake and Dead River Lake which are oxbows of the Pascagoula River.
SIMILAR SPECIES: Some small *Megalonaias nervosa* with compressed shells may be mistaken for *L. complanata*, but *Megalonaias* have longer, better developed lateral teeth, thicker shells, and extensive corrugations on the shell. *Potamilus alatus* of the Tennessee River drainage may resemble *L. complanata* but the former has a thinner shell, smaller pseudocardinal teeth, better developed lateral teeth, no interdentum, and a purple nacre. Most similar to *Lasmigona alabamensis*, which was formerly considered a subspecies of *L. complanata*, but the former has more extensive sculpturing and is more compressed. Specimens of *L. complanata* from Bear Creek in the Tennessee drainage are more compressed than those from the rest of the state.

NATURAL HISTORY:
Habitat: *Lasmigona complanata* is an inhabitant of rivers and larger creeks but is also found in oxbow lakes. It occurs in both sand and gravel substrates but also in mud in areas with little or no current.
Reproduction: Three gravid females in the MDWFP collection averaged 94 mm (3.7 in.) and ranged from 86 -109 mm (3.4 – 4.3 in.) in shell length. One of these females was found in the Leaf River in George County in September and the other two were found in the Pascagoula River, also in George County, in October.
Fish hosts: Fish hosts for this mussel include 14 species from seven families. Twelve of those host species occur in Mississippi, including the River Redhorse *(Moxostoma carinatum*), Largemouth Bass (*Micropterus salmoides*), White Crappie (*Pomoxis annularis*), Black Crappie (*P. nigromaculatus*), Longear Sunfish (*Lepomis megalotis*), Green Sunfish (*L. cyanellus*), Orangespotted Sunfish (*L. humilis*), Common Carp (*Cyprinus carpio*), Yellow Perch (*Perca flavescens*), Sauger *(Sander canadense*), Longnose Gar (*Lepisosteus osseus*), and Gizzard Shad (*Dorosoma cepedianum*).
STATUS: MNHP: G5S2.
Although this species is more widely distributed in Mississippi than *L. alabamensis*, it still appears to be uncommon within the state, as we have specimens from only 15 counties. Most of our specimens are from the Pascagoula, Leaf, and Pearl rivers.

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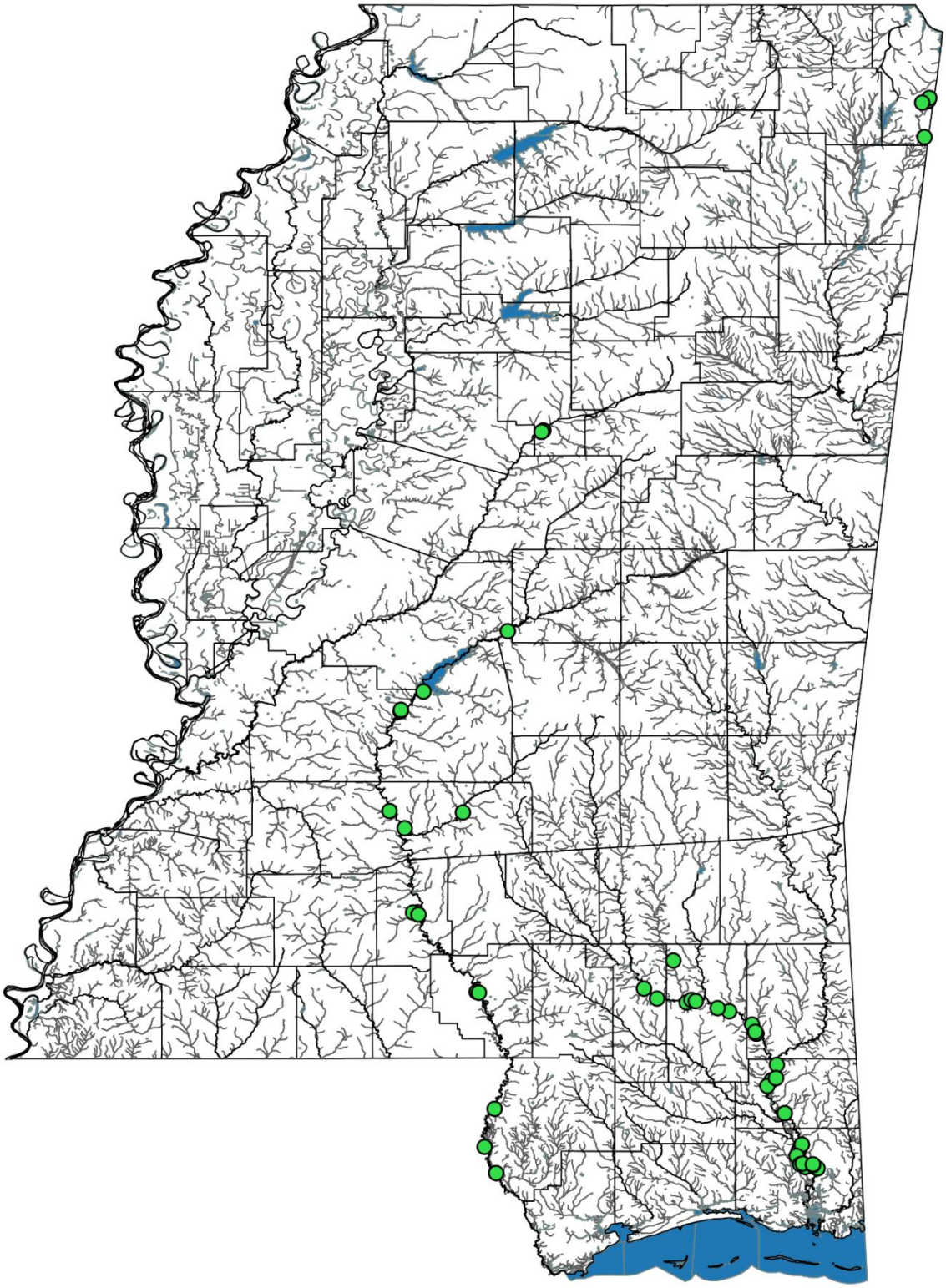

Distribution of *Lasmigona complanata* in Mississippi.

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LASMIGONA COSTATA (RAFINESQUE, 1820)
FLUTEDSHELL

***Lasmigona costata* – Top: MMNS 9728, Duck River, Maury County, Tennessee, 119 mm (4.7 in.). Bottom: MMNS 2226, Clinch River, Hancock County, Tennessee, 96 mm (3.8 in.)**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, relatively compressed, moderately thick, with a small posterior wing on some specimens.
Posterior ridge: Very broadly rounded.
Umbo: Slightly above hinge line, not prominent.
Color and pattern: Light to dark brown; very faint rays rarely present, running from umbo to mid-lateral part of shell.
Surface: Small corrugations confined mostly to posterior slope. Sometimes a slight indentation in the ventral edge of the shell.
Nacre: White, sometimes with a light blue wash.
Umbo cavity: Shallow.
Teeth: Two widely spaced pseudocardinals in left valve, one in right; one short lateral in each valve; teeth fairly thick.
Interdentum: Present and wide.
Size: Shell length of the largest Mississippi specimen in MDWFP collection is 121 mm (4.8 in.).
DISTRIBUTION: New York and Pennsylvania west to Minnesota and North Dakota, south to Arkansas, east to Georgia.
MISSISSIPPI DISTRIBUTION: Bear Creek, Tennessee River drainage, Tishomingo County.
SIMILAR SPECIES: The absence of a large posterior wing, corrugations on the

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posterior slope, and its elliptical shape should distinguish this species from all others in the Tennessee River drainage in Tishomingo County.

NATURAL HISTORY:

Habitat: This species is known from the state by two relicts collected in Bear Creek, so almost nothing is known about its natural history in Mississippi. In Alabama, it is found in sand and gravel riffles and in pools (Williams et al., 2008).

Reproduction: This species is gravid from as early as late summer until early summer of the following year (Williams et al., 2008).

Fish hosts: The Flutedshell has been reported to use at least 74 species of fish in 18 families as hosts, many of which occur in Mississippi.

STATUS: G5SH.

This species is still extant in the Alabama portion of Bear Creek both up- and downstream of the Alabama – Mississippi state line (Williams et al., 2008), so it is likely to still persist within the Mississippi portion of Bear Creek.

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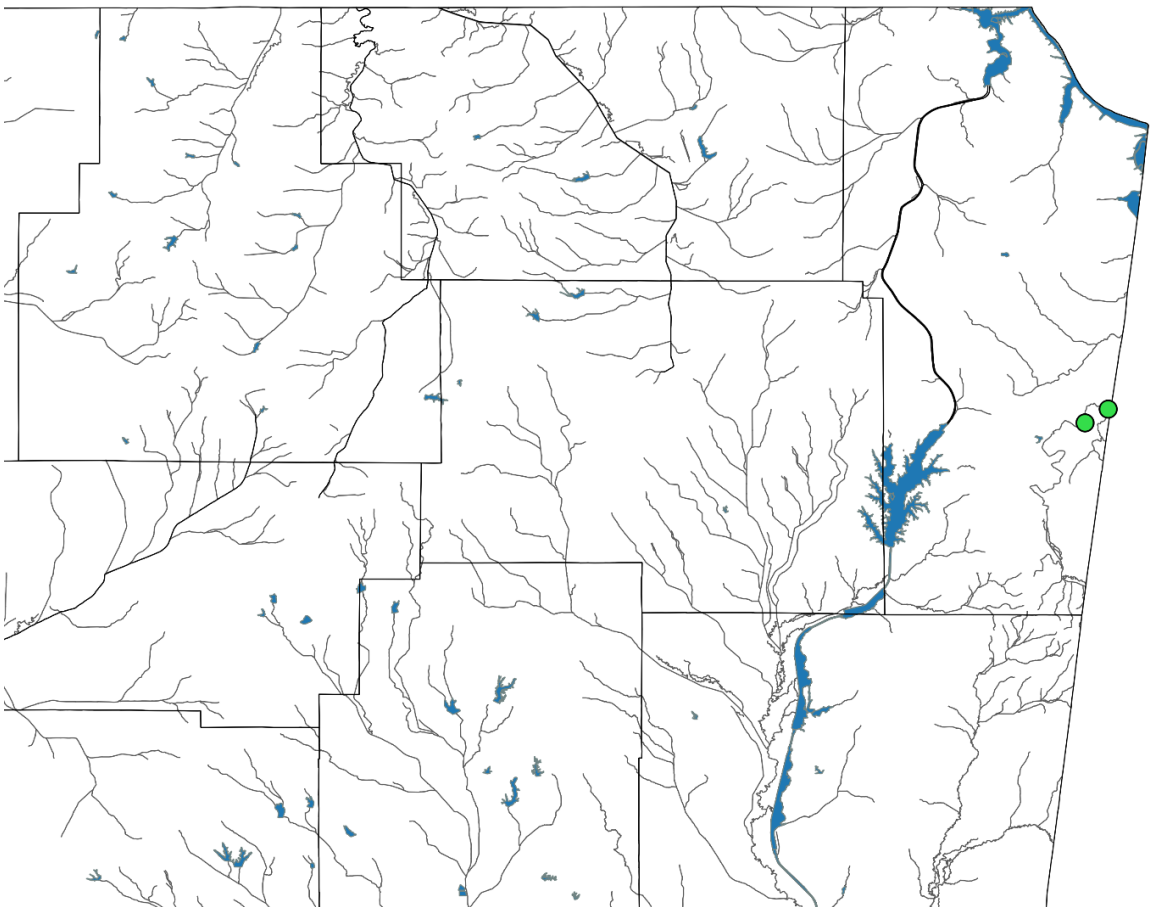

Distribution of *Lasmigona costata* in Mississippi.

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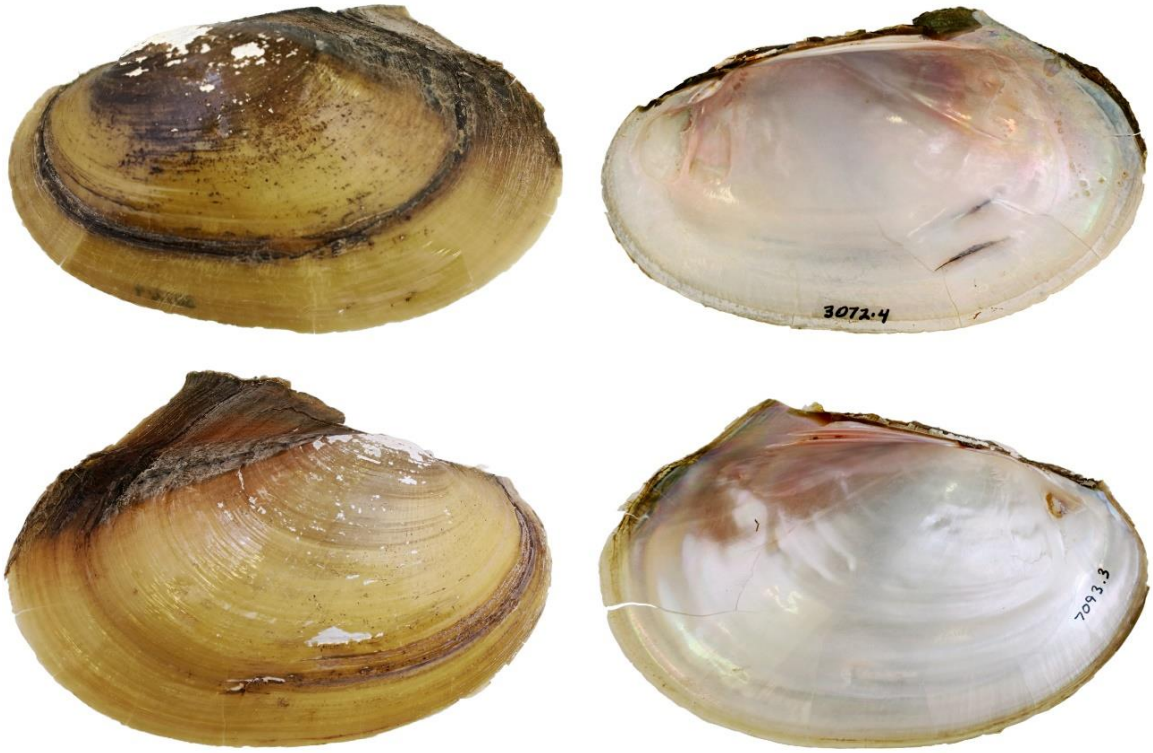
LEPTODEA FRAGILIS (RAFINESQUE, 1820)
FRAGILE PAPERSHELL



***Leptodea fragilis* – Top: MMNS 3072, East Fork Tombigbee River, Monroe County, 97 mm (3.8 in.). Bottom: MMNS 7093, Sunflower River, Sunflower County, 121 mm (4.8 in.)**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval, slightly inflated, very thin, with a small posterior wing.
Posterior ridge: Absent.
Umbo: Above hinge line, not prominent.
Color and pattern: Pale yellow to yellow to grayish yellow; smaller specimens greenish yellow in some populations. Rays present or absent; if present, a few faint rays on posterior part of shell or rarely covering the entire shell. Rays slant toward the posterior end of the shell from the umbo. Rays are usually narrow on the umbo and widen as they approach the ventral edge of the shell.
Surface: Usually rather smooth and shiny but can be rougher and duller in large specimens.
Nacre: White but sometimes with a pinkish wash particularly in the umbo cavity.
Umbo cavity: Shallow.
Teeth: Two widely spaced pseudocardinals in left valve, one in right; two laterals in the left valve, one in the right; teeth thin, relatively small.
Interdentum: Usually absent, but if present very narrow.

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Size: Shell length of the largest Mississippi specimen in MDWFP collection is 157 mm (6.2 in.).
DISTRIBUTION: New York and Pennsylvania west to South Dakota, south to Texas and Louisiana, east to Georgia.
MISSISSIPPI DISTRIBUTION: Widespread; found in all 10 drainage systems in Mississippi.
SIMILAR SPECIES: This species could be confused with some of the other thin shelled species in Mississippi, but most likely with *Potamilus ohiensis.* The latter usually has a brownish-gray base color of the periostracum while *L. fragilis* usually has at least some yellow. *Potamilus ohiensis* is also slightly more compressed that *L. fragilis*, and its nacre is generally purple while that of *L. fragilis* is usually white occasionally with pink highlights in the umbo cavity. Additionally, the shell of *P. ohiensis* posterior to the umbo tends to be slightly higher than in *L. fragilis*, and *P. ohiensis* usually has a small anterior wing that *L. fragilis* lacks.
NATURAL HISTORY:
Habitat: This species is found in large and small rivers, creeks, reservoirs, oxbow lakes, and ponds, where it occurs on a wide variety of substrates, including sand, gravel, and mud, in both slight current and in non-flowing waters.
Reproduction: There are 14 gravid females in the MDWFP collection averaging 79.4 mm (3.1 in.) and ranging from 51 – 125 mm (2.0 – 4.9 in.) in shell length. Three of the gravid females were collected in May from the East Fork Tombigbee River in Itawamba County, two were found in June in the Tallahatchie River in Leflore County, two in September, one from the Yocona River in Lafayette County and the second from Mill Creek in Itawamba County, and seven in October from the Big Black River in Claiborne County, the Pearl River in Hancock County, and the Mississippi River in Tunica County.
Fish hosts: The only know fish host of this species is the Freshwater Drum (*Aplodinotus grunniens*).
STATUS: MNHP: G5S5.
This species is widespread and abundant throughout Mississippi, with specimens in our collection from 42 counties. Most of these specimens are from the larger rivers in the state including the Big Black, Pearl, East Fork Tombigbee, Sunflower, and Yazoo rivers.

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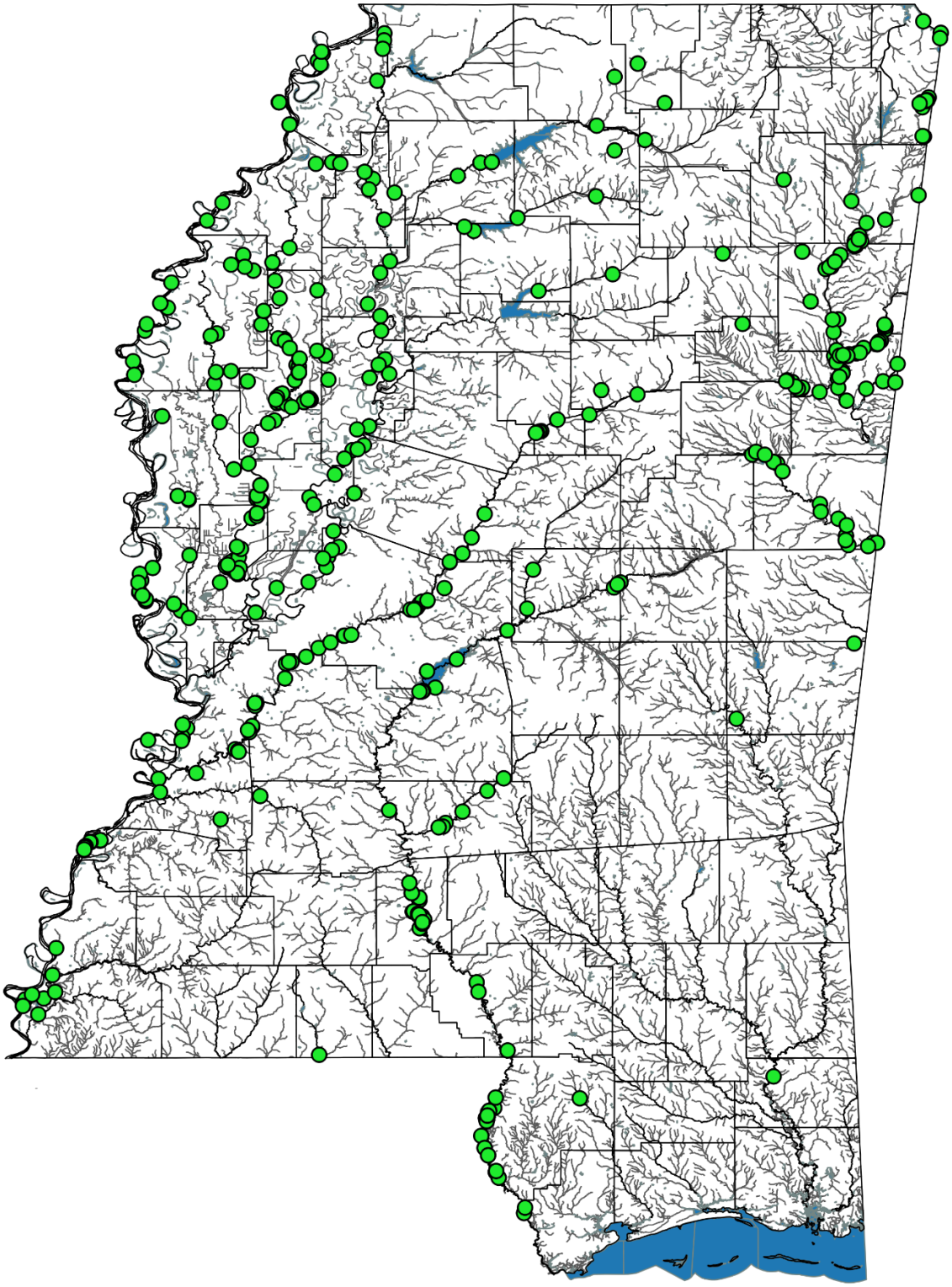

Distribution of *Leptodea fragilis* in Mississippi.

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LIGUMIA RECTA (LAMARK, 1819)
BLACK SANDSHELL

***Ligumia recta* – Top: MMNS 6473, East Fork Tombigbee River, Itawamba County, 177 mm (7.0 in.). Bottom: MMNS 2358, Strong River, Simpson County, 118 mm (4.6 in.).**

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SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, not inflated, thick, almost cylindrical.
Posterior ridge: Rarely occurs, but if present, very broadly rounded.
Umbo: Slightly above hinge line, not prominent.
Color and pattern: Chestnut brown to black, larger specimens usually black. A few specimens, usually smaller ones, have faint rays.
Surface: Usually rather smooth but not shiny.
Nacre: White in larger individuals, a pinkish wash in the umbo cavity in smaller specimens.
Umbo cavity: Shallow even in large specimens.
Teeth: Two pseudocardinals in each valve, in the right valve a smaller tooth anteriorly; two laterals in the left valve, one in the right. Teeth moderate in size.
Interdentum: Present but narrow.
Size: Shell length of the largest Mississippi specimen in MDWFP collection is 178 mm (7.0 in.).
DISTRIBUTION: New York and Pennsylvania west to South Dakota, south to Arkansas and Louisiana, east to Georgia.
MISSISSIPPI DISTRIBUTION: Occurs in the Pearl, Tennessee, and Tombigbee, where it has been found in the Strong River, East Fork Tombigbee River, Bear Creek (Tennessee drainage), and the Mississippi River in Bolivar County. Archaeological specimens are associated with the Sunflower River in Sunflower County, Coldwater River in Quitman County, the Yazoo River in Leflore County, and the Big Black River in Hinds County (Peacock et al., 2011).
SIMILAR SPECIES: Given the length and shape of this shell, it would be difficult to confuse this species with any other in the state except perhaps *Eurynia dilatata*. The two species do not occur in the same drainages in Mississippi, and the latter is more compressed, has a thinner shell, and has a rounded posterior ridge that is usually absent in *L. recta*.

NATURAL HISTORY:
Habitat: This species is found primarily in gravel and sand substrates in flowing water in larger rivers and creeks.
Reproduction: A gravid female, 151 mm (5.9 in.) shell length, was found in the East Fork of the Tombigbee River, Itawamba County, in September. This species is usually gravid from late summer of one year to summer of the following year (Williams et al., 2008).
Fish hosts: Twenty two species of fish in eight families have been identified as hosts for this mussel. Fifteen of those species occur in Mississippi, including the Rock Bass (*Ambloplites rupestris*) Largemouth Bass (*Micropterus salmoides*), White Crappie (*Pomoxis annularis*), Bluegill (*Lepomis macrochirus*), Green Sunfish (*L. cyanellus*), Redbreast Sunfish (*L. auritus*), Longear Sunfish (*L. megalotis*), Orangespotted Sunfish (*L. humilis*), Common Carp (*Cyprinus carpio*), Central Stoneroller (*Campostoma anomalum*), Redfin Shiner (*Lythrurus umbratilis*), Walleye (*Sander vitreus*), Sauger (*Sander canadense*), Yellow Perch (*Perca flavescens*), and the American Eel (*Anguilla rostrata*).
STATUS: MNHP: G4G5S2.
Ligumia recta was once found in the Pearl drainage in Mississippi, but the last time it was observed there was in 1980, so it may have been extirpated from that drainage. It still occurs in both Bear Creek and the East Fork Tombigbee River, but appears to be declining in the latter.

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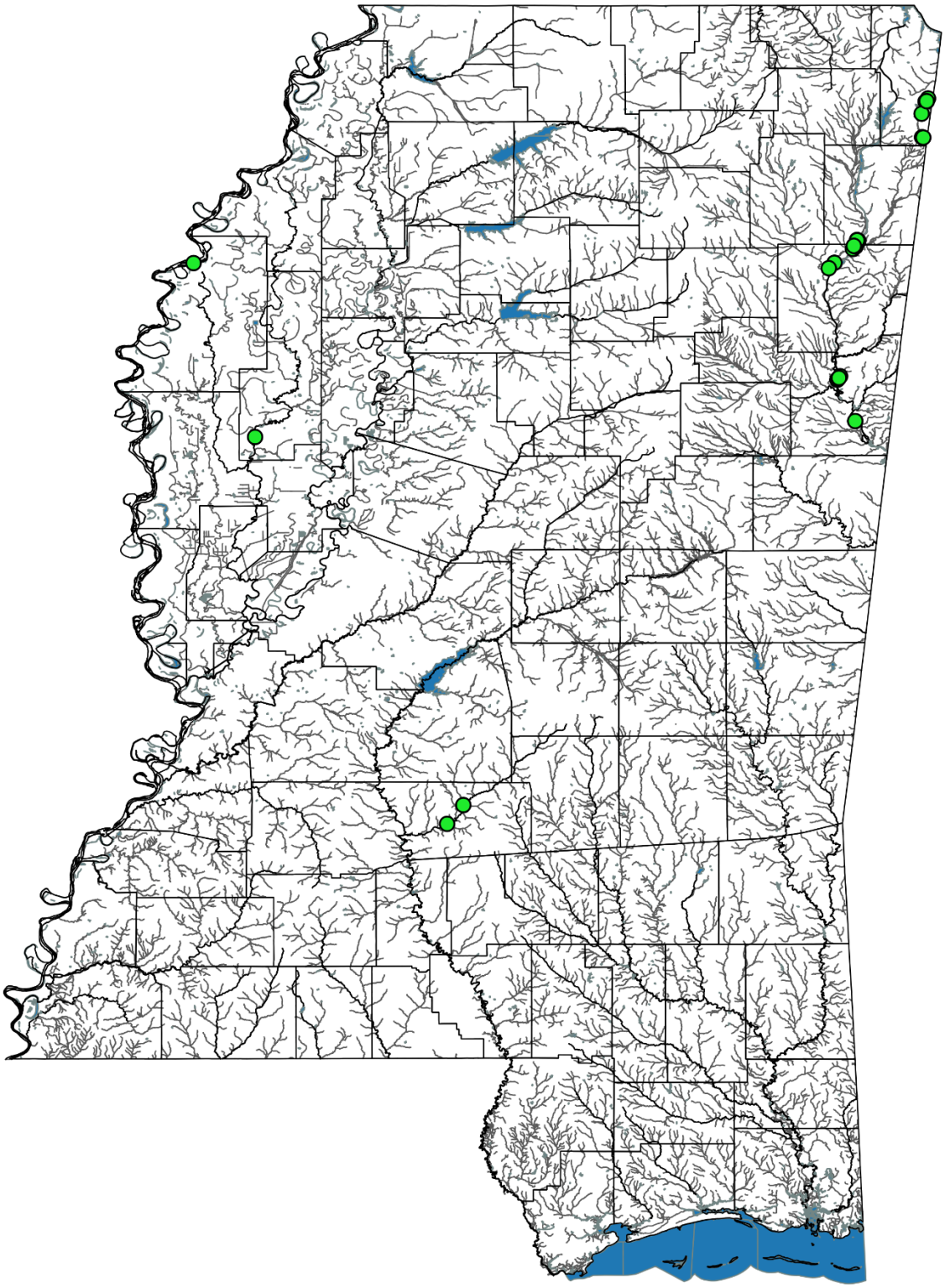

Distribution of *Ligumia recta* in Mississippi.

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LIGUMIA SUBROSTRATA (SAY, 1831)
PONDMUSSEL

***Ligumia subrostrata* – Top: MMNS 9419, male, Lake Cormorant Bayou, Desoto County, 79 mm (3.1 in.). Bottom: MMNS 13765, female, slough in Yazoo River drainage, Issaquena County, 78 mm (3.1 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, slightly inflated, and moderately thin. A small posterior wing is present, and the posterior end has a blunted point extending from the terminus of the posterior ridge.
Posterior ridge: Present and moderately rounded.
Umbo: Above hinge line, not prominent.
Color and pattern: Yellowish brown to black. Rays present, extending from umbo and slanted toward the posterior end of the shell; usually numerous, covering most of the shell. Some rays are wide, some narrow; rays increase in width as they approach the ventral edge of the shell. Some individuals have prominent rays, others have rays that are obscure.
Surface: Smooth, somewhat shiny.
Nacre: White.
Umbo cavity: Shallow.
Teeth: Two pseudocardinals in left valve, one in the right valve; two laterals in the left valve, one in the right. Teeth relatively thin.
Interdentum: Absent.
Size: Shell length of the largest Mississippi specimen in MDWFP collection is 115 mm (4.5 in.).
DISTRIBUTION: Ohio west to South Dakota, south to Texas and Louisiana, east to Tennessee, Mississippi, and Alabama.
MISSISSIPPI DISTRIBUTION: Found in all Mississippi drainages except the

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Tennessee, Lake Pontchartrain, and Coastal Rivers.

SIMILAR SPECIES: This species resembles *Lampsilis teres* and *Lampsilis straminea*, but those two have larger and more prominent teeth, usually don't have a posterior wing, nor do they have a posterior end that narrows to a point as does *Ligumia subrostrata*.

NATURAL HISTORY:

Habitat: *Ligumia subrostrata* inhabits substrates of sand and mud, usually in areas of little or no current, including sloughs, oxbows, and reservoirs.

Reproduction: Eleven gravid females in the MDWFP collection averaged 59.2 mm (2.3 in.) and ranged from 52 – 71 mm (2.0 – 2.8 in.) in shell length. One of these was found in a pond in February in Hinds County, four were found in April: two in Hinds County and two in Chickasaw County, one in June in Kemper County, one in August in Jackson County, and four in October: two in Yazoo County and two in Hinds County.

Fish hosts: Identified fish hosts include 13 species in seven families, of which nine occur in Mississippi. These include the Warmouth (*Lepomis gulosus*), Bluegill (*L. macrochirus*), Green Sunfish (*L. cyanellus*), Orangespotted Sunfish (*L. humilis*), Black Crappie (*Pomoxis nigromaculatus*), Largemouth Bass (*Micropterus salmoides*), Bowfin (*Amia calva*), Tadpole Madtom (*Noturus gyrinus*), and Bigmouth Buffalo (*Ictiobus cyprinellus*).

STATUS: MNHP: G5S5.

This species appears to be relatively widespread in Mississippi as we have specimen records from 30 counties. Most of our specimens are from the Big Black and Pascagoula drainages, with most from sloughs, ponds, and swampy creeks.

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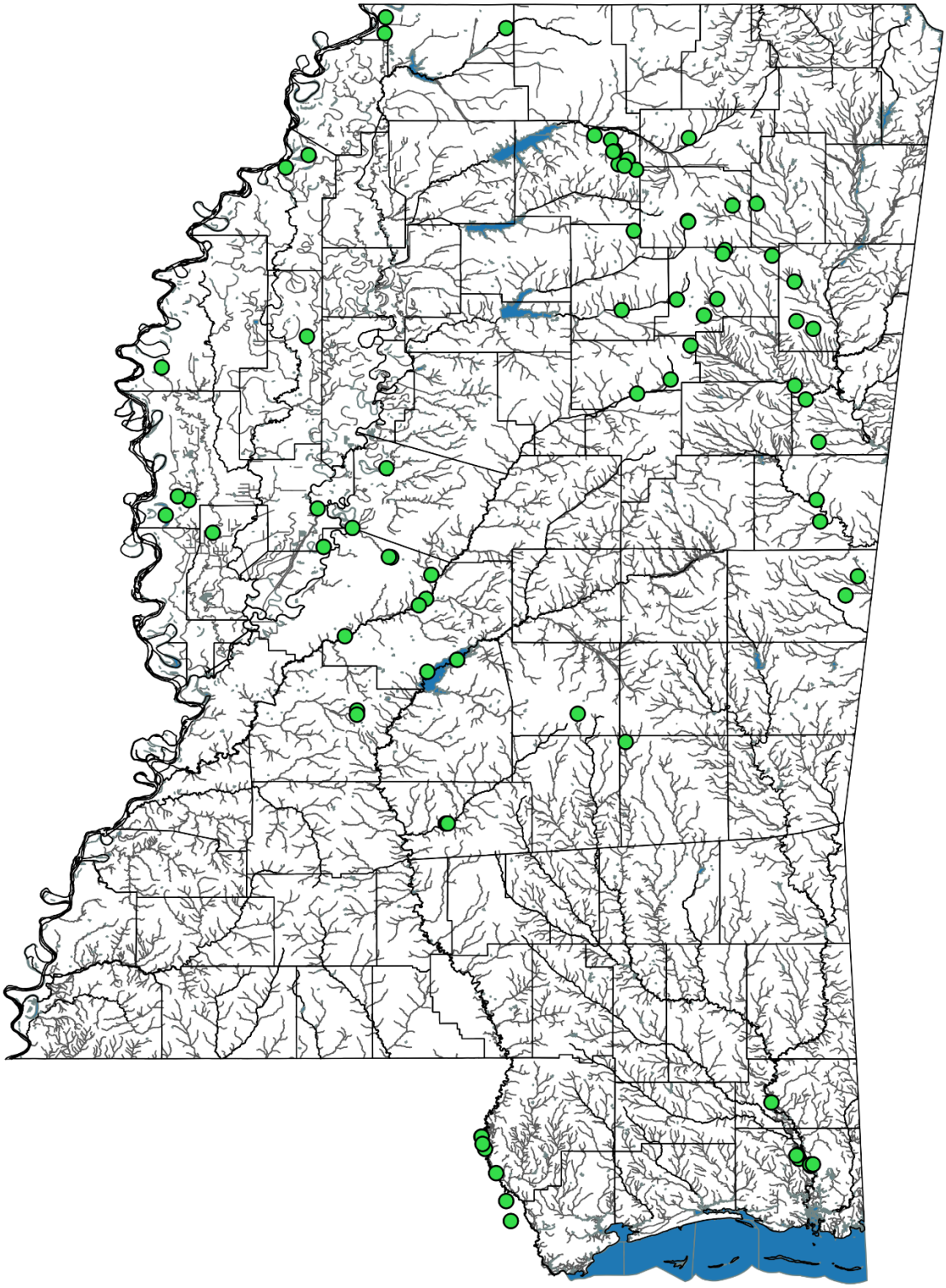

Distribution of *Ligumia subrostrata* in Mississippi.

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MEDIONIDUS ACUTISSIMUS (LEA, 1831)
ALABAMA MOCCASINSHELL

***Medionidus acutissimus* – Top: MMNS 5706, Yellow Creek, Lowndes County, 35 mm (1.4 in.). Bottom: MMNS 2075, Buttahatchee River, Monroe County, 32 mm (1.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, slightly inflated, thin, posterior end narrows to a relatively sharp point. Shallow sulcus anterior to posterior ridge, posterior slope broadly curved toward center of shell.
Posterior ridge: Present, prominent.
Umbo: Slightly above hinge line, not prominent.
Color and pattern: Light yellowish brown to reddish brown. Rays present, some wide, some narrow, usually covering entire shell except anterior end; extend from umbo toward posterior end.
Surface: Corrugations present, generally small, usually restricted to posterior slope.
Nacre: White with faint blue or yellow wash.
Umbo cavity: Very shallow.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth are small, relatively thin, and lateral teeth are short.
Interdentum: Absent to very narrow.
Size: Shell length of the largest Mississippi specimen in MDWFP collection is 45 mm (1.8 in.).
DISTRIBUTION: Tennessee, Alabama, Georgia, Mississippi, and Florida.
MISSISSIPPI DISTRIBUTION: Tombigbee drainage where it occurs in the Buttahatchee River and Luxapallila, Yellow, and Bull Mountain creeks. A single specimen was collected and released from Bull Mountain Creek upstream of the reservoir in both 1998 (Jones and Majure 1999) and 2019 (Wagner, unpublished data 2019).

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SIMILAR SPECIES: The small size of this species should eliminate confusion with most other species except perhaps *Truncilla donaciformis*. The latter is more triangular than elliptical and has proportionally a higher umbo whose halves are directed inward toward the hinge.

NATURAL HISTORY:

Habitat: *Medionidus acutissimus* usually is found in sand and gravel mixtures in moderately slow to moderately fast currents.

Reproduction: In studies of this species in Alabama and Mississippi, it was found gravid from October to June (Haag and Warren, 2003).

Fish hosts: There are 13 species in two families that serve as hosts for this mussel, 12 of which occur in Mississippi. These are the Naked Sand Darter (*Ammocrypta beani*), Southern Sand Darter (*A. meridiana*), Johnny Darter (*Etheostoma nigrum*), Speckled Darter (*E. stigmaeum*), Gulf Darter (*E. swaini*), Redspot Darter (*E. artesiae*), Rock Darter (*E. rupestre*), Blackbanded Darter (*Percina nigrofasciata*), Saddleback Darter (*P. vigil*), Logperch (*Percina caprodes*), and Blackspotted Topminnow (*Fundulus olivaceus*).

STATUS: MNHP: G2S1; USFWS: Endangered; MDWFP: Endangered. This species was very abundant in Yellow Creek, a tributary of Luxapallila Creek, in Lowndes County prior to a drought in 2000, but its current status in that stream is unknown. We have specimens from only two counties, Lowndes and Monroe.

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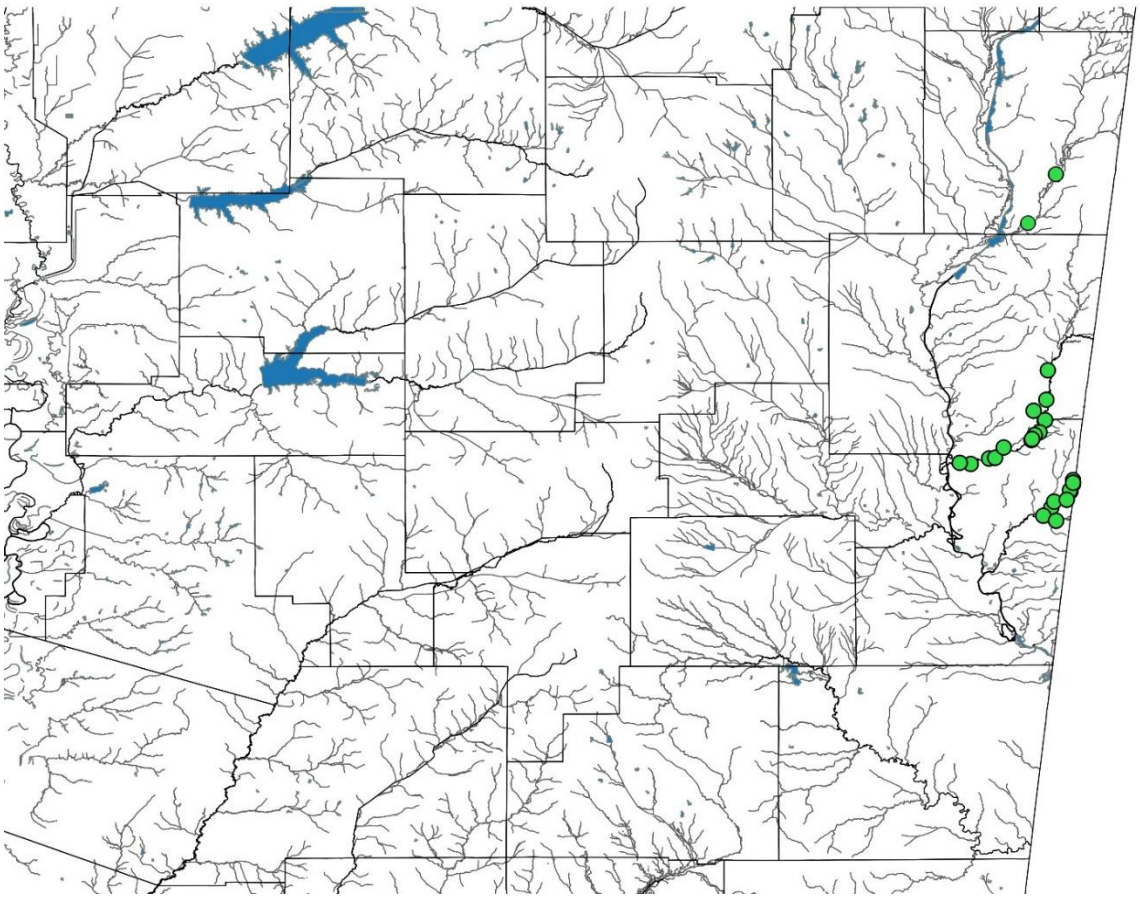

Distribution of *Medionidus acutissimus* in Mississippi.

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MEGALONAIAS NERVOSA (RAFINESQUE, 1820)
WASHBOARD

***Megalonaias nervosa* – Top: MMNS 5255, Sunflower River, Bolivar County, 181 mm (7.1 in.). Bottom: MMNS 3885, East Fork Tombigbee River, Itawamba County, 204 mm (8.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to nearly elliptical to almost quadrate, very thick and heavy, moderately inflated, although some individuals are slightly compressed. Small posterior wing present but may be broken, more evident in smaller individuals.
Posterior ridge: Absent. Large corrugations on the posterior part of the shell resemble a posterior ridge in some cases.
Umbo: Moderately above hinge line and slanted toward the hinge line.
Color and pattern: Dark chestnut brown to black; no rays.
Surface: Surface covered with both large and small corrugations, more prominent in smaller shells. Small corrugations present anterior to the umbo. Some corrugations appear to be large, flattened knobs where they are crossed by growth lines.
Nacre: White with faint blue wash in some individuals.
Umbo cavity: Very deep.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one

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lateral tooth; sometimes the pseudocardinal tooth has a small accessory tooth posterior to it. Teeth are large, thick, and prominent.
Interdentum: Present and wide.
Size: Largest Mississippi specimen in the MDWFP collection has a shell length of 230 mm (9.1 in.); this is the largest species of freshwater mussel in Mississippi.
DISTRIBUTION: Ohio west to North Dakota, south to Texas and Louisiana, east to Georgia and Florida.
MISSISSIPPI DISTRIBUTION: All drainages in Mississippi except Coastal Rivers and Lake Pontchartrain. Occurs in larger rivers like the Pearl and Pascagoula, smaller creeks, in oxbow lakes of the Mississippi River such as like Lake Chotard, as well as Pickwick Lake and other reservoirs.
SIMILAR SPECIES: This species might be mistaken for *Amblema plicata*, which also has a large shell with corrugations, but the latter does not have sculpturing anterior to the umbo. Smaller, more quadrate specimens might be confused with *Plectomerus dombeyanus*, but that species has a purple rather than white nacre and a pronounced posterior ridge.
NATURAL HISTORY:
Habitat: *Megalonaias nervosa* occurs in habitats with both moderate to fast current as well as in those with no current, on a variety of substrates, including gravel, sand, and mud.
Reproduction: Three gravid females from Mississippi averaged 165.7 mm (6.5 in.) and ranged from 164 – 167 mm (6.5 -6.6 in.) in shell length. Two of these females were collected in October: one from the Pascagoula River in George County and one from the Sunflower River in Sunflower County. The third was collected from the Sunflower River in Sunflower County in November.
Fish hosts: This species has a variety of fish hosts, including 32 species in 14 families, all of which occur in Mississippi. These include eight sunfishes (Centrarchidae), six catfishes (Ictaluridae), the White Bass (*Morone chrysops*), American Eel (*Anguilla rostrata*), Northern Studfish (*Fundulus catenatus*), Longnose Gar (*Lepisosteus osseus*), Goldeye (*Hiodon alosoides*), Gizzard Shad (*Dorosoma cepedianum*), Skipjack Herring (*Alosa chrysochloris*) , Central Stoneroller (*Campostoma anomalum*), Golden Shiner (*Notemigonus crysoleucas*), Bluntnose Minnow (*Pimephales notatus*), Shovelnose Sturgeon (*Scaphirhynchus platorynchus*), Yellow Perch (*Perca flavescens*), Logperch (*Percina caprodes*), Slenderhead Darter (*P. phoxocephala*), Sauger (*Sander canadense*), Highfin Carpsucker (*Carpiodes velifer*), and the Bowfin (*Amia calva*).
STATUS: MNHP: G5S5.
This is a relatively widespread species in Mississippi, occurring in at least 32 counties, and can be relatively common in some areas. Most of our collection records and specimens are from the Sunflower River, East Fork Tombigbee River, and Yazoo River.

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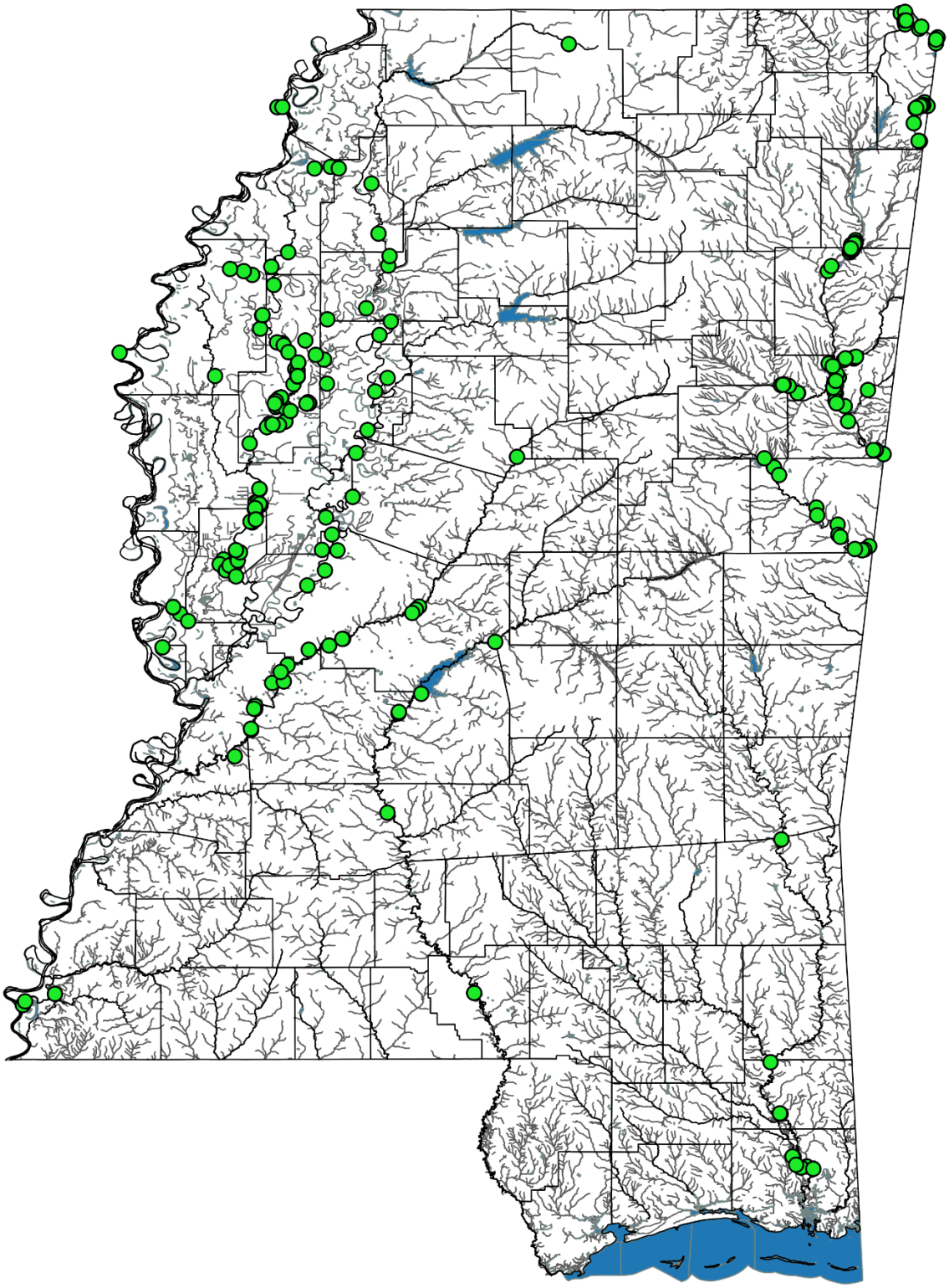

Distribution of *Megalonaias nervosa* in Mississippi.

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OBLIQUARIA REFLEXA RAFINESQUE, 1820
THREEHORN WARTYBACK

***Obliquaria reflexa* – Top: MMNS 4662, East Fork Tombigbee River, Itawamba County, 54 mm (2.1 in.). Bottom: MMNS 5231, Sunflower River, Yazoo County, 53 mm (2.1 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to triangular, moderately inflated, usually moderately thick and heavy. A relatively deep to a relatively shallow sulcus anterior to the posterior ridge.
Posterior ridge: Present, prominent, but rounded rather than sharp.
Umbo: Above the hinge line, prominent, directed toward the hinge line.
Color and pattern: Light brown to almost black. Mostly without rays but a few specimens, usually relatively small, with very faint, thin rays on the anterior end extending from the umbo to the ventral edge of the shell.
Surface: Usually three asymmetrically placed, relatively large knobs on each valve. Small thin corrugations in the sulcus, usually located posterior to the knobs. Larger corrugations on the

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posterior slope. In a few cases, there may be only two knobs on one or both sides of the shell.
Nacre: Usually white but some specimens have a dark pinkish nacre either covering the entirety of the shell's interior or limited to the umbo cavity.
Umbo cavity: Deep.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth are large relative to shell size, thick, and prominent.
Interdentum: Present and wide.
Size: Largest Mississippi specimen in the MDWFP collection has a shell length of 82 mm (3.2 in.).
DISTRIBUTION: Pennsylvania west to South Dakota, south to Texas and Louisiana, east to Alabama and Georgia.
MISSISSIPPI DISTRIBUTION: Big Black, Mississippi River North, Mississippi River South, Pearl, Tennessee, Tombigbee, and Yazoo drainages. Found in the Big Black, Homochitto, Pearl, Noxubee, and other large rivers as well as in larger creeks like Bull Mountain Creek. It is also found in Mississippi River oxbows like Lake Mary and Lake Cormorant and in reservoirs such as Pickwick Lake and Ross Barnett Reservoir.
SIMILAR SPECIES: *Obliquaria reflexa* might be confused with other oval to round species like *Quadrula* or *Cyclonaias*, but the three asymmetrical knobs on each side of the shell will differentiate this species from those in the latter two genera.
NATURAL HISTORY:
Habitat: *Obliquaria reflexa* occurs in habitats both with and without current in sand, gravel, and mud substrates.
Reproduction: The MDWFP collection contains 33 gravid females averaging 48.3 mm (1.9 in.) in length and ranging from 33 – 68 mm (1.3 - 2.7 in.). Five of these females were collected in May from the Pearl River in Pearl River County, 22 were found in June: two from the Big Black River in Warren County, six from the Black Warrior River in Alabama, nine from the Tallahatchie River in Leflore County, and five from the Yazoo River in Yazoo County, and eight were collected in July: six from the Pearl River in Hinds and Rankin counties, and two from the Sunflower River in Sunflower County.
Fish hosts: Eleven species in seven families are known to be hosts for this mussel. Seven of these species, the Goldeye (*Hiodon alosoides*), Gizzard Shad (*Dorosoma cepedianum*), Skipjack Herring (*Alosa chrysochloris*), Walleye (*Sander vitreus*), Largemouth Bass (*Micropterus salmoides*), Freshwater Drum (*Aplodinotus grunniens*), and Striped Shiner (*Luxilus chrysocephalus*), are native to Mississippi.
STATUS: MNHP: G5S5.
A relatively common and widespread species in Mississippi, but oddly absent from the Pascagoula drainage even though it occurs in the Tombigbee drainage to the east and the Pearl drainage to the west. Most of our collection records and specimens are from the Pearl, East Fork Tombigbee, and Sunflower rivers but we have specimens from 35 counties in Mississippi.

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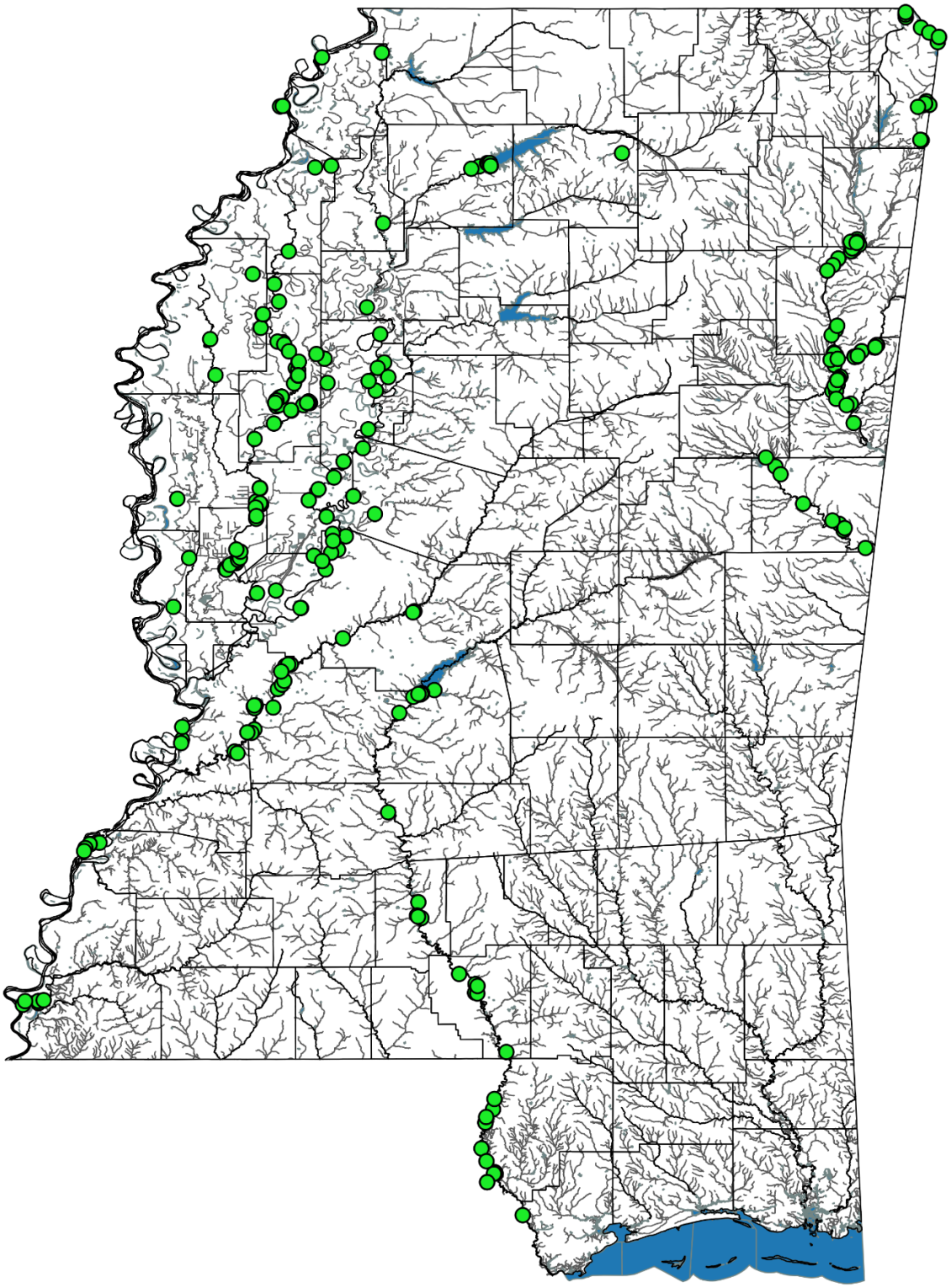

Distribution of *Obliquaria reflexa* in Mississippi.

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OBOVARIA ARKANSASENSIS (FRIERSON, 1912)
SOUTHERN HICKORYNUT

***Obovaria arkansasensis* – Top: MMNS 2143, Buttahatchee River, Lowndes County, 46 mm (1.8 in.). Bottom: MMNS 5719, Yellow Creek, Lowndes County, 30 mm (1.2 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval, moderately to greatly inflated, relatively thick. Posterior slope narrow, shallow sulcus anterior to the posterior ridge in a few specimens.
Posterior ridge: Usually absent, but when present, broadly rounded.
Umbo: Nearly terminal, even with or slightly above hinge line.
Color and pattern: Yellowish-orange to orange-brown to brown to almost black. Some juveniles may have a slightly greenish wash, particularly from the Pascagoula drainage, and adults from the Tangipahoa River in Pike County have a very distinct greenish coloration. Most adults do not have rays, but many juveniles do. These rays are mostly posterior to the umbo and range from narrow, faint, and broken to wide, prominent and unbroken. Rays are least evident in material from the Tombigbee drainage and most evident in specimens from the Tangipahoa River, where many adults have relatively prominent rays.

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Surface: Surface of shell generally smooth with no sculpturing.
Nacre: White, shading to bluish-white posteriorly.
Umbo cavity: Moderately shallow to moderately deep.
Teeth: One pseudocardinal in right valve, two in left. Right valve frequently has one large tooth and one small anterior peg-like tooth; left valve has two moderately large triangular to blade-like teeth. One short, straight lateral tooth with lower partial tooth in right valve; two lateral teeth in left valve.
Interdentum: Narrow.
Size: Shell length of largest Mississippi specimen in the MDWFP collection is 65 mm (2.6 in.).
DISTRIBUTION: Found from eastern Texas north to southeastern Missouri and east to the Tombigbee River drainage of Mississippi and Alabama.
MISSISSIPPI DISTRIBUTION: Known from the Tombigbee, Pascagoula, Pearl, Lake Pontchartrain, and Mississippi River South drainages. The largest specimens with the thickest shells were found in the main channel of the Tombigbee River prior to construction of the Tennessee-Tombigbee Waterway.
SIMILAR SPECIES: This species may be confused with *Obovaria unicolor*, which has a more centrally located umbo and whose shell height is almost as great as its shell length. It may also be confused with *Pleurobema curtum*, which also has a nearly terminal umbo and a dark periostracum like *O. arkansasensis*, but the former usually has a smoother shell surface and more delicate teeth. *Pleurobema perovatum* might be confused with this species, but it has a more centrally located umbo, is usually much lighter in color, and has a smoother periostracum and more delicate teeth.
NATURAL HISTORY:
Habitat: This species is usually found in gravel or sandy-gravel substrates in larger creeks and rivers with current.
Reproduction: The MDWFP collection has a gravid female 38 mm (1.5 in.) long collected in September from the Sipsey River in Alabama. Very little is known about reproduction in this species (Williams et al., 2008).
Fish hosts: Unknown.
STATUS: MNHP: G3S2.
This species was formerly relatively abundant in the Buttahatchee River (Yokley, 1978) but has declined there since the late 1970's for unknown reasons. We have specimens in the MDWFP collection from 15 Mississippi counties.
TAXONOMIC NOTES: This species was formerly considered to be *O. jacksoniana*, but that species was determined to be conspecific with *Villosa arkansasensis* (Inoue et al., 2013), which was then moved to the genus *Obovaria* (Williams et al., 2017).

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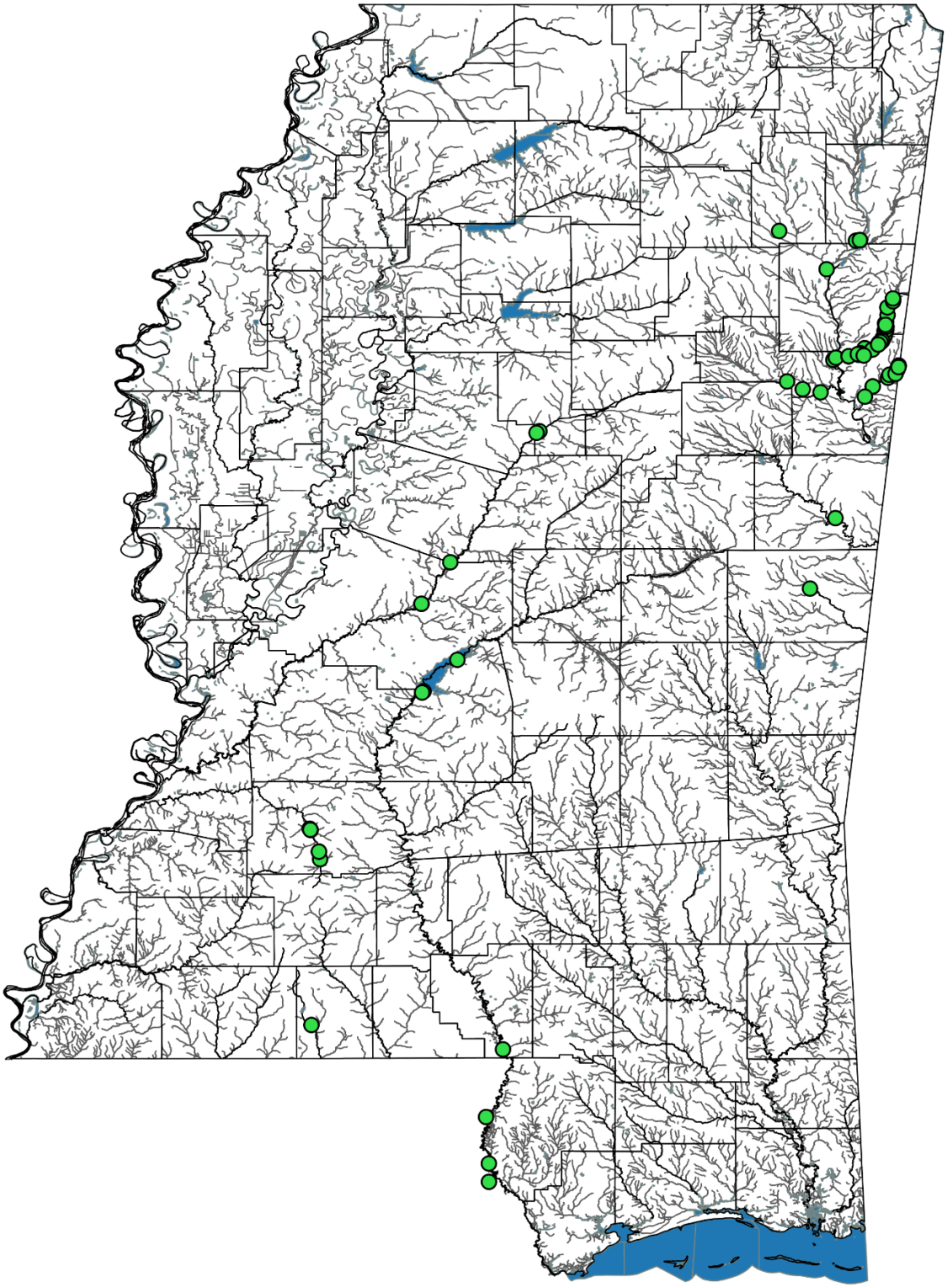

Distribution of *Obovaria arkansasensis* in Mississippi.

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OBOVARIA SUBROTUNDA (RAFINESQUE, 1820)
ROUND HICKORYNUT

***Obovaria subrotunda* – Top: MMNS 1912, Bayou Pierre, Copiah County, 39 mm (1.5 in.). Bottom: MMNS 13973, Big Black River, Montgomery County, 45 mm (1.8 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell varies from almost round to oval, is relatively thick, and is inflated.
Posterior ridge: Absent.
Umbo: Slightly above hinge line, somewhat higher in a few specimens.
Color and pattern: Black to greenish yellow to yellow to yellowish red. Rays usually absent; some specimens with thin, faint rays on posterior of shell from umbo to posterior and ventral margins.
Surface: Smooth, no ornamentation.
Nacre: White to pearly white, sometimes slightly iridescent along posterior margin.
Umbo cavity: Moderately deep.
Teeth: Relatively large, triangular pseudocardinal with blade-like accessory tooth above it in the right valve, two relatively large, triangular pseudocardinals in the left. Relatively short but thick lateral tooth in the right valve, two in the left valve, ventral-most tooth in the left valve nearly straight.
Interdentum: Relatively wide, short.

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Size: Shell length of the largest Mississippi specimen in the MDWFP collection is 54 mm (2.1 in.).

DISTRIBUTION: New York and Pennsylvania west to Arkansas, south to Mississippi, east to Alabama and Georgia.

MISSISSIPPI DISTRIBUTION: Found in the Big Black, Mississippi River South, and Yazoo drainages in the western part of the state.

SIMILAR SPECIES: This species is similar in appearance to *O. unicolor* but the two species are not found in the same drainages. It may be confused with *Pleurobema beadleianum*, but the latter usually has a fairly distinct posterior ridge, smaller pseudocardinal teeth, a shallower umbo cavity, and is more elongated than *O. subrotunda*.

NATURAL HISTORY:

Habitat: This species is found in sand and gravel substrates in medium sized creeks to larger rivers, usually in slow to moderate currents.

Reproduction: The average size of 19 gravid females in the MDWFP collection ranging from 23 - 45 mm (0.9 – 1.8 in.) in shell length was 35.4 mm (1.4 in.). One of these females was collected in April from the Homochitto River in Franklin County, one was collected in July from Bayou Pierre in Copiah County, five were found in September in the Big Black River, Montgomery County, three were found in September in Bayou Pierre, Copiah County, and nine were collected in October from the Big Black River, Montgomery County.

Fish hosts: There are six fish species in two families known to be hosts for this mussel, including four species in Mississippi. These are the Banded Sculpin (*Cottus carolinae*), Fantail Darter (*Etheostoma flabellare*), Greenside Darter (*E. blennioides*), and Blackside Darter (*Percina maculata*).

STATUS: MNHP: G4S2.

Although there are records of this species in a number of streams in Mississippi and we have specimens from 9 counties in the state, it is nowhere abundant except in a small reach of the Big Black River in Montgomery County.

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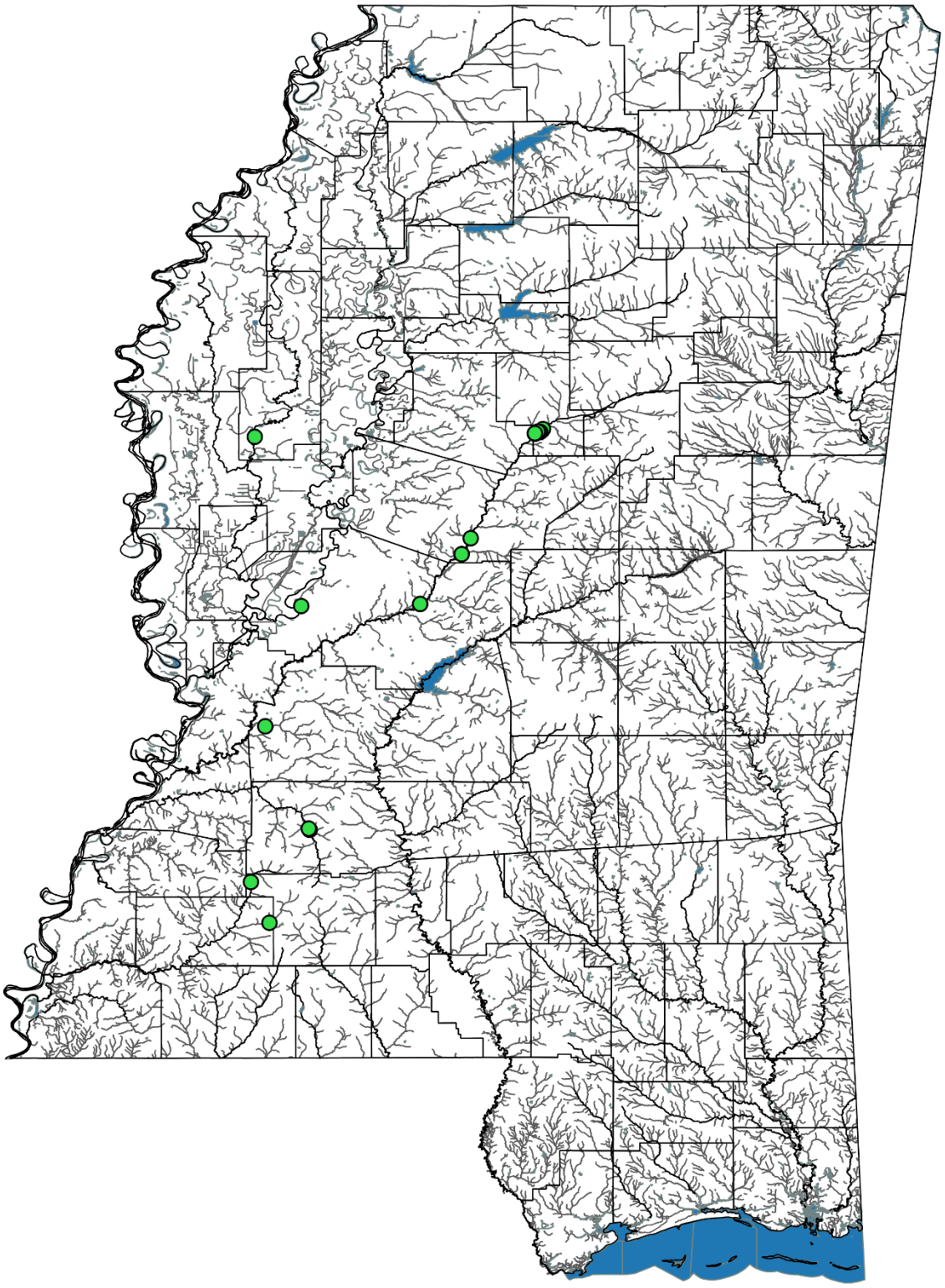

Distribution of *Obovaria subrotunda* in Mississippi.

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OBOVARIA UNICOLOR (LEA, 1845)
ALABAMA HICKORYNUT

***Obovaria unicolor* – Top: MMNS 2648, East Fork Tombigbee River, Monroe County, 65 mm (2.6 in.). Bottom: MMNS 6472, East Fork Tombigbee River, Itawamba County, 61 mm (2.4 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to round, very thick in large individuals to moderately thick in smaller specimens, inflated to moderately compressed.
Posterior ridge: None, posterior slope broad.
Umbo: Above hinge line, centrally located on dorsal margin

Color and pattern: Yellow to chestnut brown to dark brown to almost black. Specimens from the Mississippi River basin are the lightest in color, with yellow to greenish yellow at the margins grading to brown at the umbo. Tombigbee River drainage specimens are the darkest, with many that are dark brown or black even at small sizes. Rays present in a few small specimens,

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extending from the umbo downward to the ventral margin, sometimes limited to the posterior half of the shell. Rays may be relatively wide with diffuse pigment to narrow and densely pigmented, and either complete or broken.
Surface: Smooth, no ornamentation.
Nacre: Usually white, but may have a yellow, rose, salmon, or purple wash.
Umbo cavity: Deep in large specimens to moderately deep in smaller individuals.
Teeth: One large, triangular pseudocardinal tooth in the right valve, two in the left. One long, straight to slightly curved lateral tooth with a partial tooth just below it in the right valve, two in the left valve.
Interdentum: Relatively wide.
Size: Shell length of the largest Mississippi specimen in the MDWFP collection is 69 mm (2.7 in.).
DISTRIBUTION: Louisiana, Mississippi, and Alabama.
MISSISSIPPI DISTRIBUTION: Found in the Pearl, Pascagoula, Lake Pontchartrain, and Tombigbee drainages.
SIMILAR SPECIES: This species is often confused with *Obovaria arkansasensis*, which differs by having a nearly terminal umbo and a shell length which is usually much greater than its height. However, some specimens are still very difficult to assign to one species or the other. *Glebula rotundata* also has a centrally located umbo and is essentially equal in shell length and width, but it has a much rougher and more cloth-like periostracum and a satiny pearl-like nacre which *O. unicolor* lacks.
NATURAL HISTORY:
Habitat: Usually found in gravel or sandy gravel in large creeks and rivers with relatively substantial current.
Reproduction: This species is gravid from late summer of one year until early summer of the following year (Haag and Warren, 2003). Ten gravid females in the MDWFP collection ranged from 25 to 43 mm (1.0 – 1.7 in.) and averaged 33.8 mm (1.3 in.) in length. One was found in June in the Pearl River, Rankin County, two were collected in August from the Amite River in Louisiana, four were from the Sipsey River in Alabama in September, two were collected in the Pascagoula River, George County in October, and one was found in December in Lubbub Creek in Alabama.
Fish hosts: Primary fish hosts include the Naked Sand Darter (*Ammocrypta beani*), Southern Sand Darter (*A. meridiana*), and Redspot Darter (*Etheostoma artesiae*). Secondary hosts include the Johnny Darter (*Etheostoma nigrum*), Gulf Darter (*E. swaini*), Blackbanded Darter (*Percina nigrofasciata*), and Dusky Darter (*P. sciera*) (Haag and Warren, 2003).
STATUS: MNHP: G3S3.
The largest individuals of this species formerly occurred in the main channel of the Tombigbee River prior to construction of the Tennessee-Tombigbee Waterway, and a few large individuals still persist in the East Fork Tombigbee River in Monroe and Itawamba counties. It has declined in the Buttahatchee River where it was relatively abundant in the late 1970s (Yokley, 1978). We have specimens of this species from 26 counties in Mississippi.

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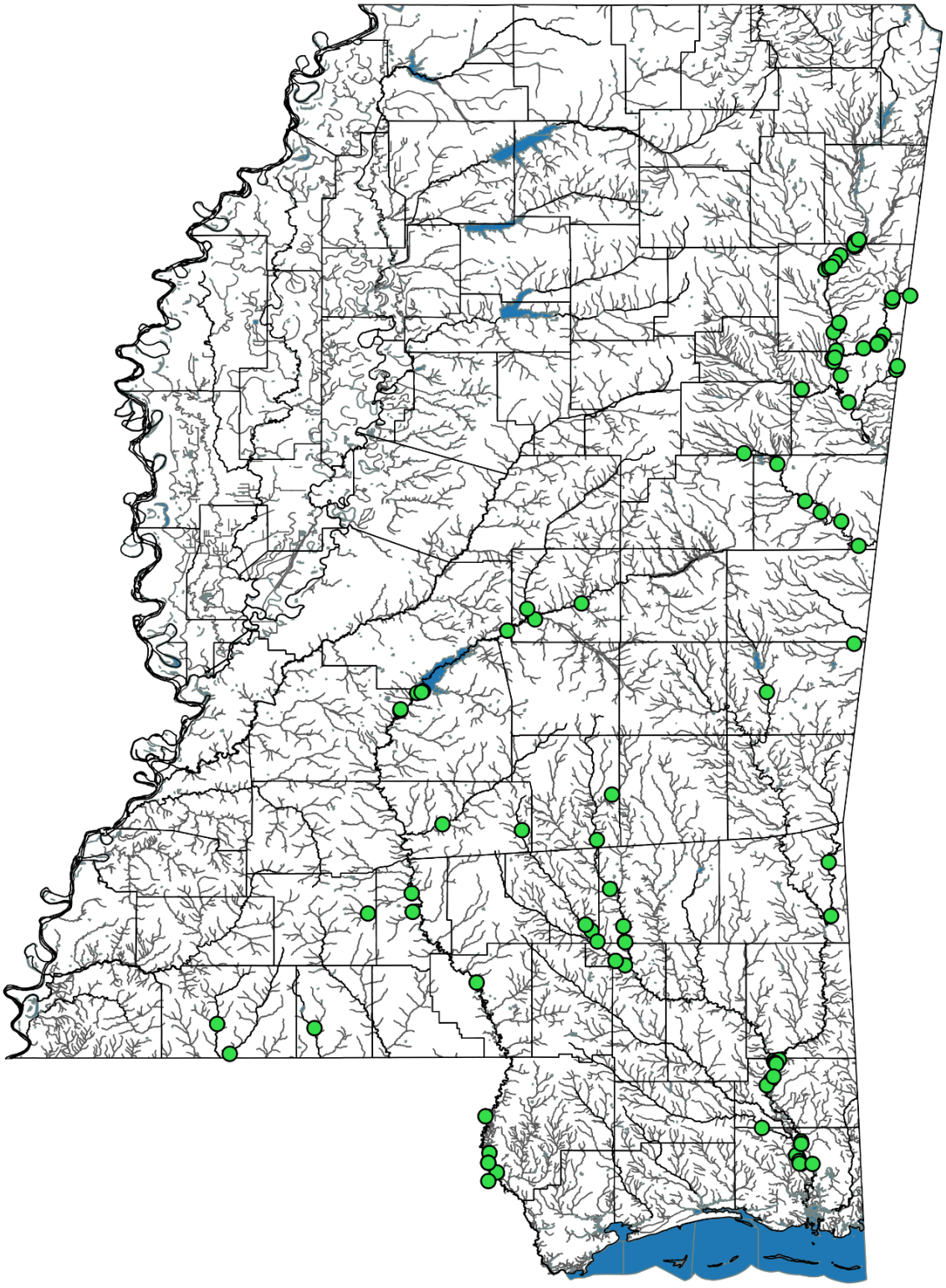

Distribution of *Obovaria unicolor* in Mississippi.

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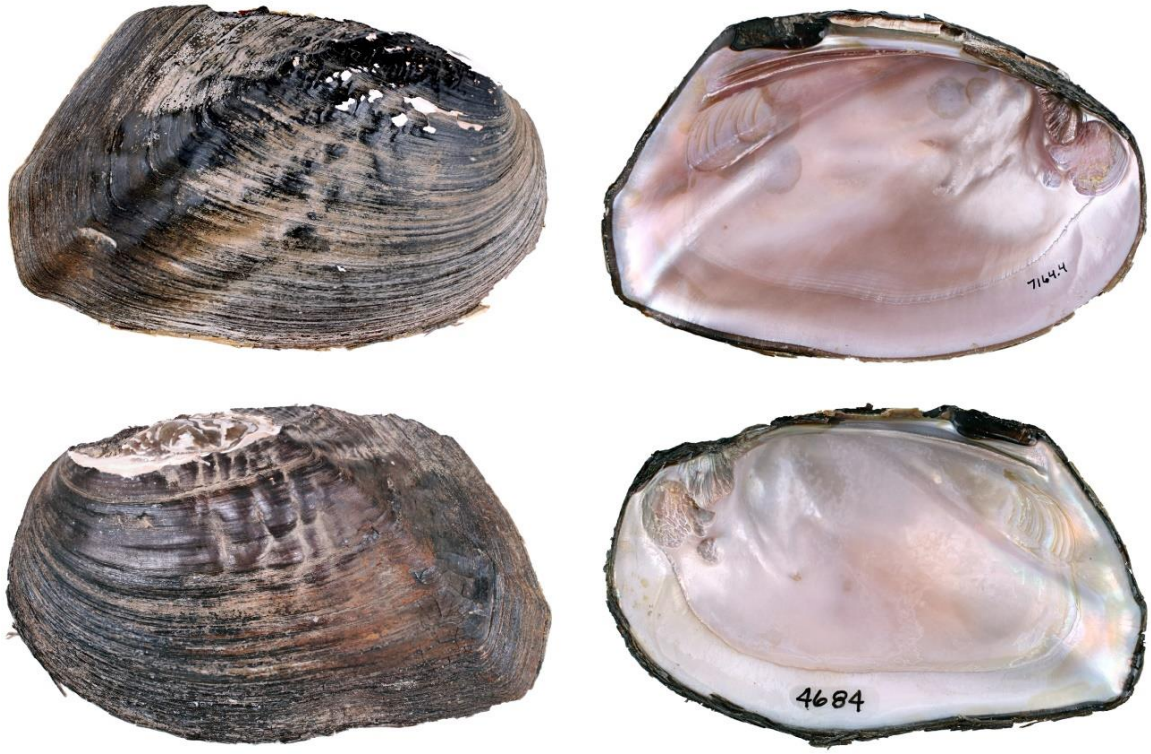
PLECTOMERUS DOMBEYANUS (VALENCIENNES, 1827)
BANKCLIMBER



***Plectomerus dombeyanus* – Top: MMNS 7164, Sunflower River, Sunflower County, 140 mm (5.5 in.). Bottom: MMNS 4684, Leaf River, George County, 115 mm (4.5 in.)**

SHELL CHARACTERISTICS:
Shape and structure: Shell thick, heavy, rhomboidal, moderately inflated, with a small posterior wing.
Posterior ridge: Present, prominent, relatively sharp.
Umbo: Above the hinge line but not prominent.
Color and pattern: Dark brown to black, no rays.
Surface: Corrugations or small pustules around umbo but not usually anterior to the umbo. Relatively large corrugations on sides anterior to the posterior ridge, posterior slope with scattered small corrugations.
Nacre: Purple or bronzy purple.
Umbo cavity: Deep.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth are relatively large but appear thin relative to the size of the species and thickness of its shell.
Interdentum: Present, relatively narrow to relatively wide.
Size: Shell length of the largest Mississippi specimen in MDWFP collection is 163 mm (6.4 in.).

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DISTRIBUTION: Indiana west to Oklahoma and Arkansas, south to Texas and Louisiana, east to Alabama and Florida.

MISSISSIPPI DISTRIBUTION: Found in all drainages except Lake Pontchartrain, Coastal Rivers, and the Tennessee River. This species occurs in many of the larger rivers in Mississippi, including the Mississippi, Pascagoula, Pearl, Noxubee, Coldwater and Homochitto rivers, a few larger creeks and oxbow lakes in these drainages, and in both the Ross Barnett Reservoir and the Tenn-Tom Waterway.

SIMILAR SPECIES: This species could be mistaken for *Megalonaias nervosa* or *Amblema plicata*, two of the larger, heavier-shelled mussels in Mississippi, but those two species are usually more round or oval than *Plectomerus*, lack a strongly defined posterior ridge, and have white nacre.

NATURAL HISTORY:

Habitat: *Plectomerus dombeyanus* is found in gravel, sandy-gravel, and mud substrates in areas with current as well as those with little or no current. It is often found in relatively shallow water on the edge of rivers or creeks.

Reproduction: The MDWFP collection contains 26 gravid females which averaged 115 mm (4.5 in.) in shell length and ranged from 63 – 146 mm (2.5 - 5.8 in.). Seventeen of these were collected in June: two from the Pearl River in Hinds County, 11 from the Tallahatchie River in Leflore County, one from the Tallahatchie River in Tallahatchie County, and three from Tchula Lake in Holmes County. Three were collected in July: two from the Noxubee River in Noxubee County, and one from the Pearl River in Rankin County; four were collected in August: one from the Big Black River in Madison County, one from Steele Bayou in Sharkey County, and two from the Sunflower River in Humphreys County; and two were collected in September from the Quiver River in Sunflower County.

Fish hosts: Host fish are the Red Shiner (*Cyprinella lutrensis*) and Blackstripe Topminnow (*Fundulus notatus*).

STATUS: MNHP:G5S5.

Plectomerus dombeyanus is a common and relatively widespread species in Mississippi, with specimens from 38 counties in the MDWFP collection. Most of our records are from the Pearl River, the Sunflower River, and the Yazoo River.

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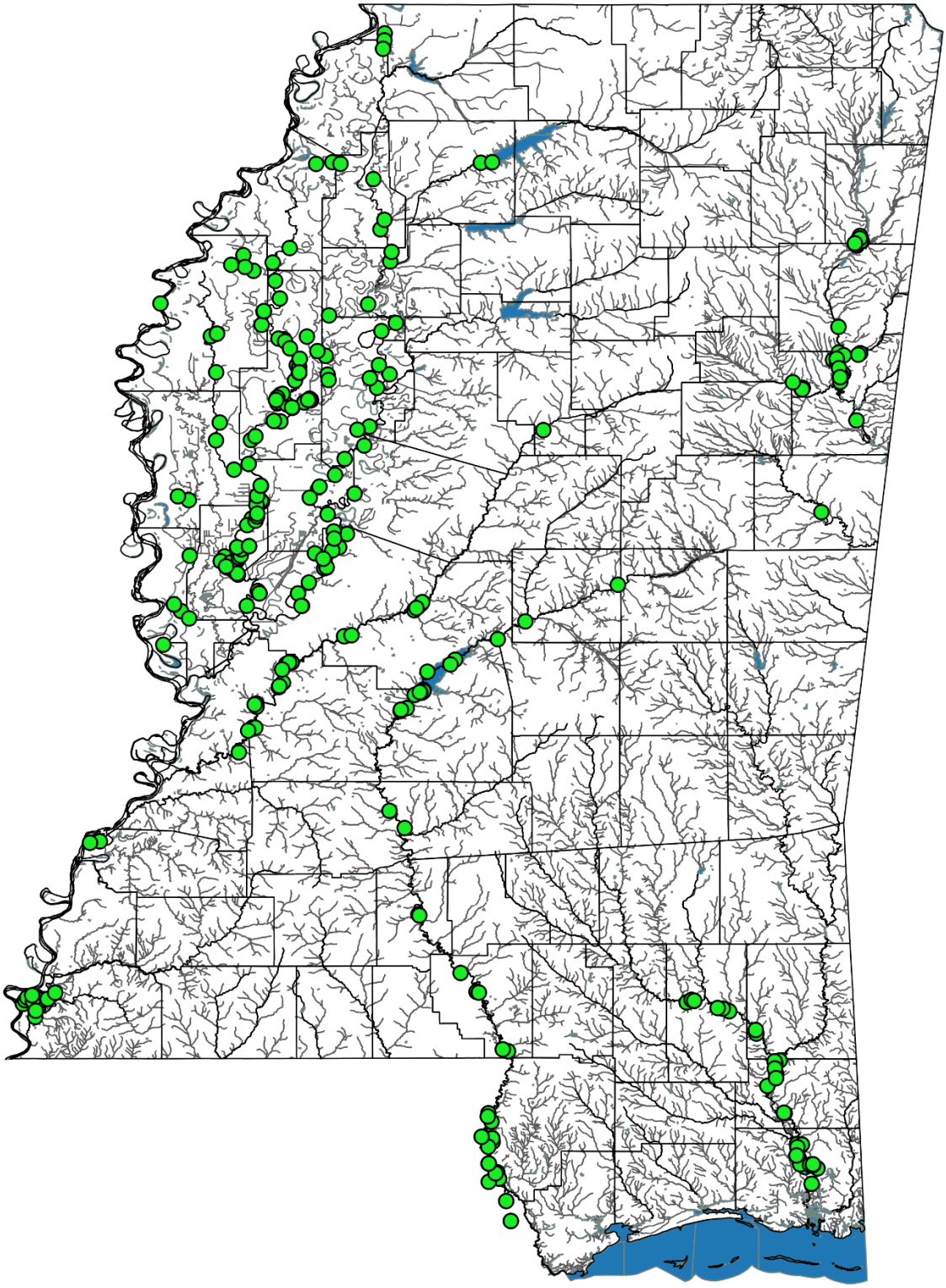

Distribution of *Plectomerus dombeyanus* in Mississippi.

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PLETHOBASUS CYPHYUS (RAFINESQUE, 1820)
SHEEPNOSE

***Plethobasus cyphyus* – Top: MMNS 5511, Sunflower River, Sunflower County, 90 mm (3.6 in.) Bottom: MMNS 5483, Sunflower River, Sunflower County, 91 mm (3.6 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical to quadrate-elliptical, thick, slightly inflated, shallow sulcus sometimes present anterior to posterior ridge.
Posterior ridge: Broadly rounded,
Umbo: Above hinge line, strongly folded inward.
Color and pattern: Yellowish brown in young specimens to dark reddish brown to almost black in adults. In older specimens, black coloration is usually on the anterior end of the shell grading to chestnut posteriorly.
Surface: Round to oblong pustules or small knobs, usually less than five in number, in a row extending from below umbo to above the ventral margin, lacking entirely in some specimens. Pustules expanded laterally at about mid-shell in some specimens.
Nacre: White, slightly iridescent posteriorly, purple wash posteriorly in juvenile shells.
Umbo cavity: Relatively shallow.
Teeth: One large, triangular pseudocardinal tooth in right valve, two pseudocardinal teeth in left valve,

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anterior tooth sharp, almost spade-like. One long, slightly curved, lateral tooth in each valve.

Interdentum: Absent.

Size: Shell length of the largest Mississippi specimen in MDWFP collection is 98 mm (3.9 in.).

DISTRIBUTION: New York west to Minnesota, south to northern Alabama and western Mississippi, west to northern Missouri.

MISSISSIPPI DISTRIBUTION: Living specimens are known only from the Sunflower River north of Indianola in Sunflower County. This species was formerly more widespread in Mississippi, with shells found in archaeological deposits along the Sunflower River in Coahoma and Sunflower counties, the Yazoo River in Holmes and Yazoo counties, the Big Black River in Hinds County (Peacock et al., 2011), and the Tallahatchie River in Leflore County (Peacock et al., 2016).

SIMILAR SPECIES: This species might be confused with *Actinonaias ligamentina, Elliptio crassidens, Reginaia ebenus* , or *Pleurobema rubrum*, but all of these species lack the small pustules characteristic of *P. cyphyus*.

NATURAL HISTORY:

Habitat: Found in relatively shallow water in clay and mixtures of clay and gravel in current in the Sunflower River.

Reproduction: Apparently limited reproduction is occurring in Mississippi as a freshly dead shell of a juvenile was found in the Sunflower River in 2003. This species has been reported to be gravid from May to July (Williams et al., 2008).

Fish hosts: The Sheepnose has an extensive list (30 species in four families) of host fish. Nineteen of these species occur in Mississippi, including 16 minnows (Cyprinidae), the Blackspotted Topminnow (*Fundulus olivaceus*), Western Mosquitofish (*Gambusia affinis*), and Sauger (*Sander canadense*).

STATUS: MNHP: G3S1; USFWS: Endangered; MDWFP: Endangered. This species was formerly abundant in the Sunflower River as indicated by the number of relict and subfossil shells found there. It is now restricted to only a few known localities where it is decidedly uncommon.

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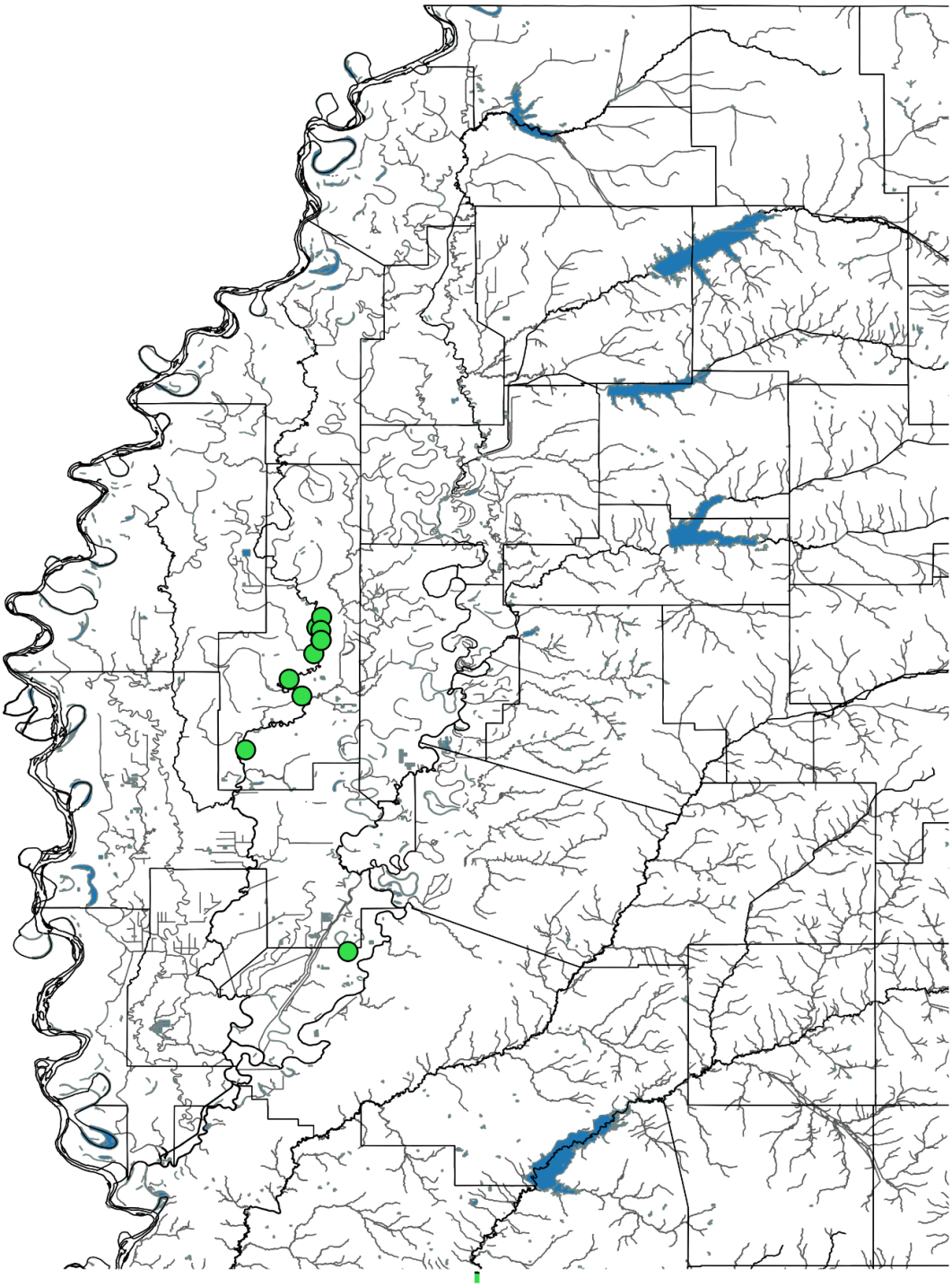

Distribution of *Plethobasus cyphyus* in Mississippi.

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PLEUROBEMA BEADLEIANUM (LEA, 1861)
MISSISSIPPI PIGTOE

***Pleurobema beadleianum* – Top: MMNS 1576, Red Creek, George County, 40 mm (1.6 in.). Bottom: MMNS 6810, East Fork Amite River, Amite County, 40 mm (1.6 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell round to moderately elliptical, moderately thick, larger specimens slightly inflated, smaller ones relatively compressed, posterior slope relatively wide.
Posterior ridge: Present and prominent in smaller individuals, broadly rounded in larger, inflated specimens.
Umbo: Slightly above hinge line.
Color and pattern: Very light yellow in small specimens, bright chestnut to dark brown in larger individuals. Rays wide, black to green, smudged, extending from near umbo to ventral margin, largest adjacent to and on posterior ridge, usually present only in smaller specimens.
Surface: Smooth, no ornamentation.
Nacre: White to bluish-white posteriorly, occasionally with an overall salmon wash, those from the Tangipahoa and Amite rivers occasionally have a violet tint.

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Umbo cavity: Shallow.
Teeth: One large, triangular pseudocardinal in the right valve, two wedge-shaped pseudocardinals in the left valve. One short, straight lateral tooth in the right valve, two in the left.
Interdentum: Present and relatively wide.
Size: Shell length of the largest Mississippi specimen in the MDWFP collection is 66 mm (2.6 in.).
DISTRIBUTION: Known only from Mississippi and Louisiana.
MISSISSIPPI DISTRIBUTION: This species occurs in the Coastal Rivers, Lake Pontchartrain, Mississippi River South, Pascagoula, and Pearl drainages, where it has been collected in the Wolf, Amite, Tangipahoa, Bayou Pierre, Chickasawhay, Leaf, Pearl, Pascagoula, Strong, and Yockanookany rivers and their tributaries.
SIMILAR SPECIES: Most likely to be mistaken for *Obovaria unicolor* or *Glebula rotundata*, neither of which has a posterior ridge, or *Fusconaia cerina*, which has a deep umbo cavity and a moderately to well-developed sulcusanterior to the posterior ridge that *P. beadleianum* lacks.
NATURAL HISTORY:
Habitat: Little is known of the biology of this species other than it occurs in small streams to relatively large rivers, usually in areas with good current and gravel or mixed gravel and sand bottoms.
Reproduction: Six gravid females in the MDWFP collection averaged 48.2 mm (1.9 in.) in shell length and ranged from 38 - 53 mm (1.5 – 2.1 in.). One of these females was collected from Bowie Creek in Covington County in April and five were collected in June: one from the Bogue Chitto River in Louisiana, one from East Hobolochitto Creek in Pearl River County, two from Red Creek in Stone County, and one from West Hobolochitto Creek in Pearl River County.
Fish hosts: Unknown.
STATUS: MNHP: G2G3S3?
Most of our specimens are from 19 Mississippi counties, where they were found in the Tangipahoa, Leaf, and Yockanookany rivers and in Buckatunna Creek.

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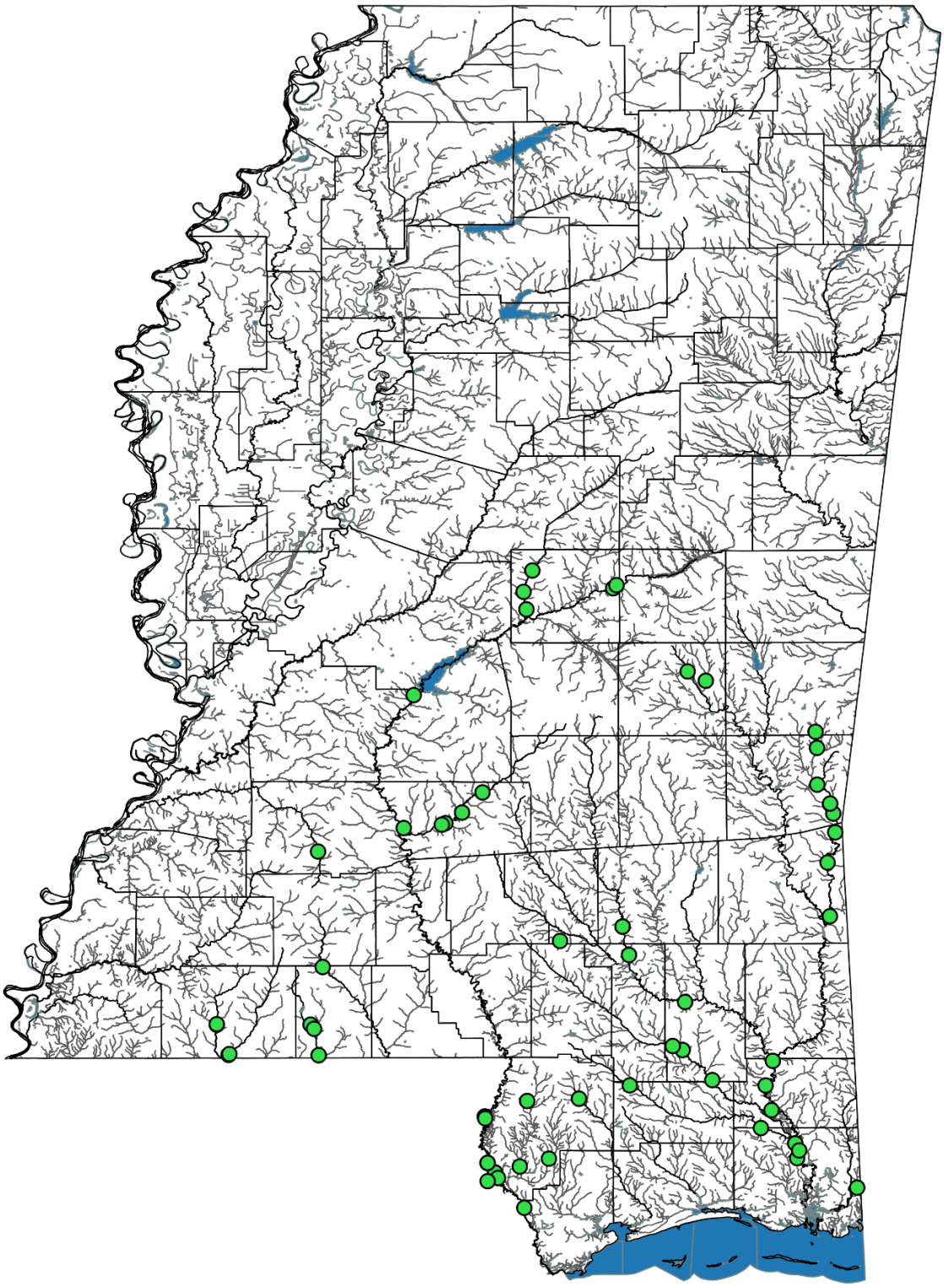

Distribution of *Pleurobema beadleianum* in Mississippi.

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PLEUROBEMA CURTUM (LEA, 1859)
BLACK CLUBSHELL

***Pleurobema curtum* – Top: MMNS 2956, East Fork Tombigbee River, Monroe County, 50 mm (2.0 in.). Bottom: MMNS 2957, East Fork Tombigbee River, Monroe County, 55 mm (2.2 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval, relatively thick, moderately inflated anteriorly, moderately compressed posteriorly, shallow sulcus anterior to posterior ridge on largest specimens
Posterior ridge: Very broadly rounded, not prominent.
Umbo: Nearly terminal and extending above hinge line.
Color and pattern: Chestnut anteriorly grading to light yellowish brown posteriorly, some individuals almost black. Smaller specimens are more brightly colored and are light yellowish brown with slight green wash.
Surface: Smooth, no ornamentation.
Nacre: White to bluish white posteriorly.
Umbo cavity: Very shallow.
Teeth: One large, triangular pseudocardinal in right valve, two in left valve, of which anterior is taller but narrower than posterior. One relatively straight lateral in right valve, two in left valve. Both extend approximately 1/3 length of valve.
Interdentum: Very narrow to absent.

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Size: Largest Mississippi specimen in MDWFP collection has a shell length of 58 mm (2.3 in.).

DISTRIBUTION: Mississippi and Alabama. Known from the Tombigbee River near Pickensville, Alabama and the East Fork Tombigbee River near Smithville, Mississippi.

MISSISSIPPI DISTRIBUTION: Tombigbee River drainage. Known only from the East Fork Tombigbee River in Itawamba and Monroe counties downstream from the mouth of Bull Mountain Creek.

SIMILAR SPECIES: May be confused with *Pleurobema decisum*, from which it differs by having a more rounded ventral margin and generally darker periostracum color. *Obovaria arkansasensis*, which may also have a nearly terminal umbo and dark periostracum, has larger teeth and a periostracum texture which is rougher and more cloth-like than that of *P. curtum*.

NATURAL HISTORY:

Habitat: The few specimens found in Mississippi all have come from a short segment of the East Fork Tombigbee River near the Itawamba-Monroe county line. This reach of the East Fork is composed of a series of deeper pools alternating with shallow gravel riffles. Most of the recent specimens of this species were found on a gravel bar just downstream from a long relatively deep channel section just below Bar's (sometimes spelled Barr's) Ferry.

Reproduction: Unknown. Assumed to be gravid in spring and summer (Williams et al., 2008).

Fish hosts: Unknown.

STATUS: MNHP: GHSH; USFWS: Endangered; MDWFP: Endangered. The last time fresh shells of this species were found in Mississippi was in the early 1990s. Eroded relict shells still turn up occasionally in the East Fork Tombigbee River, but no evidence of live or freshly dead specimens has been recently found in this area despite frequent searches. Because there are no recent records of this species, it is presumed to have been extirpated in Mississippi and may well be extinct throughout its range (Williams et al., 2008). Periodic searches of the East Fork should continue, however, in the off chance that at least a few individuals may still inhabit the area.

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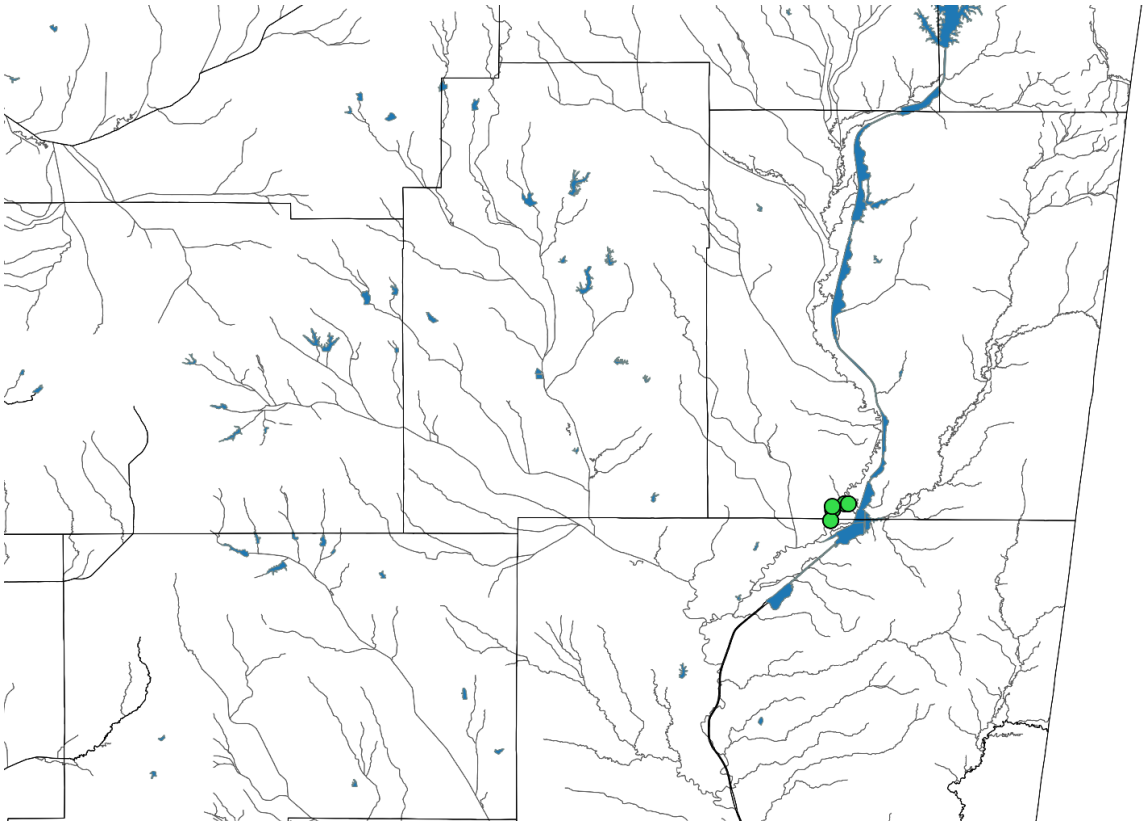

Distribution of *Pleurobema curtum* in Mississippi.

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PLEUROBEMA DECISUM (LEA, 1831)
SOUTHERN CLUBSHELL

***Pleurobema decisum* – Top: MMNS 3907, Buttahatchee River, Monroe County, 47 mm (1.8 in.). Bottom: MMNS 13717, East Fork Tombigbee River, Itawamba County, 51 mm (2.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval, moderately thick, inflated anteriorly, compressed posteriorly, very shallow sulcus sometimes present anterior to the posterior ridge.
Posterior ridge: Absent to very broadly rounded in a few individuals.
Umbo: Terminal to nearly terminal at anterior end, above hinge line.
Color and pattern: Bright yellow in young specimens to dull yellow to light brown in older individuals. Rays may be present or absent, if present, extending from umbo to ventral margin, may be broad or narrow, single or multiple, but never solid, usually composed of alternating series of light and dark pigment. Dark pigments vary from greenish to black in color.
Surface: Surface of shell smooth, no ornamentation.
Nacre: White, grading to bluish white to yellowish white posteriorly.
Umbo cavity: Shallow to very shallow.
Teeth: One well-developed, triangular, pseudocardinal tooth in the right valve, two in the left. In the latter, the anterior

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tooth is thinner, blade-like to subtriangular, the posterior tooth usually lower and thicker. One straight lateral tooth in right valve, two in left valve, lateral teeth approximately 2/3 length of shell.

Interdentum: Narrow, sometime lacking.

Size: Largest specimen in MDWFP collection from Mississippi has a shell length of 71 mm (2.8 in.).

DISTRIBUTION: Formerly widespread in the Mobile Basin in Tennessee, Georgia, Alabama, and Mississippi.

MISSISSIPPI DISTRIBUTION: Known from the Tombigbee drainage in Clay, Itawamba, Lowndes, Monroe, and Noxubee counties, in the Tombigbee, Buttahatchee, Noxubee, and East Fork Tombigbee rivers, and from Luxapallila, Bull Mountain, and Yellow creeks. This species is widespread in the Buttahatchee River. It no longer occurs in the Tombigbee River proper due to construction of the Tennessee-Tombigbee Waterway, but is still present in the East Fork Tombigbee River. The southern clubshell is rare in both Luxapallila and Yellow creeks, and very rare in Bull Mountain Creek upstream of the Tennessee-Tombigbee Waterway. However, in the tiny segment of Bull Mountain Creek on the west side of the waterway before it converges with the East Fork Tombigbee River this species appears to be relatively common. A single specimen from the Noxubee River was a relict shell collected from southeast of Macon during a mussel survey in 1990. As no other specimens, either alive or dead, were found during the survey, it is likely that the species is no longer present in that river.

SIMILAR SPECIES: *Obovaria arkansasensis* has a more rounded ventral margin, a rougher, more cloth-like and generally a darker periostracum, and has noticeably heavier, more robust hinge teeth than *P. decisum*. *Pleurobema curtum* usually has a much darker periostracum and a rounded ventral margin, and *Pleurobema perovatum* has an umbo that is more centrally located than in *P. decisum*.

NATURAL HISTORY:

Habitat: Found in shallow gravel riffles in large creeks and rivers.

Reproduction: This species is gravid from late spring to early summer (Haag and Warren, 2003). The smallest gravid female found in an Alabama population of this species had a shell length of 26.3 mm (1.0 in.; Haag and Staton, 2003).

Fish hosts: The only identified fish hosts of this species are the Blacktail Shiner (*Cyprinella venusta*) and the Striped Shiner (*Luxilus chrysocephalus*).

STATUS: MNHP: G2S1S2; USFWS: Endangered; MDWFP: Endangered. Although this species has apparently declined in its formerly relatively widespread distribution in the Tombigbee drainage in Mississippi, it is doing relatively well in the small segment of Bull Mountain Creek between the Tenn-Tom Waterway and the East Fork Tombigbee River, and appears to be spreading from there into the East Fork (Hamstead et al., in press). Archaeological remains indicate that this species was once found in headwater streams, including small tributaries on the west side of the Tombigbee River (Peacock et al., 2011). We have specimens from five counties in Mississippi.

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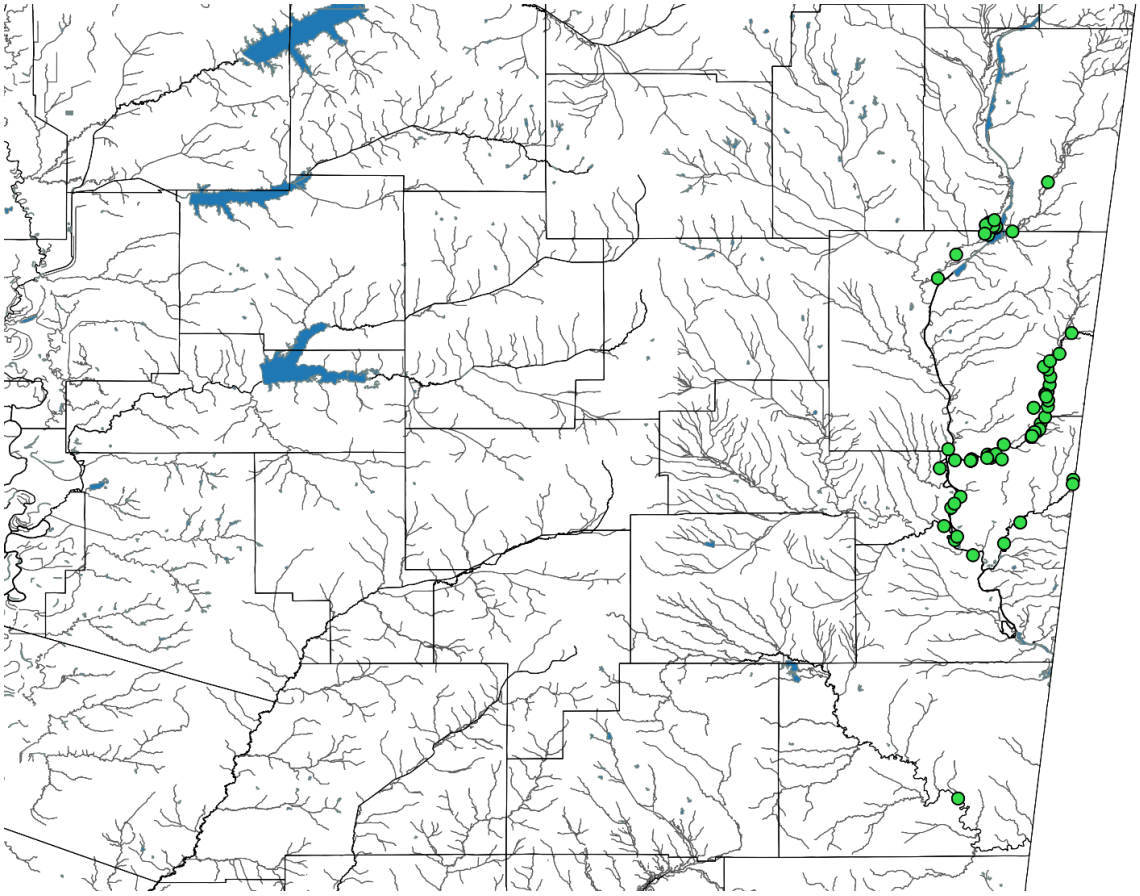

Distribution of *Pleurobema decisum* in Mississippi.

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PLEUROBEMA MARSHALLI FRIERSON, 1927
FLAT PIGTOE

***Pleurobema marshalli* – Top: MMNS 1186, Tombigbee River, Lowndes County, 65 mm (2.6 in.). Middle: Unknown locality. Bottom: MMNS 575, Tombigbee River, Greene County, Alabama, 49 mm (1.9 in.).**

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SHELL CHARACTERISTICS:
Shape and structure: Shell oval, thick, moderately compressed to slightly inflated, sulcus present to absent, if present very shallow, anterior to posterior ridge.
Posterior ridge: Broadly rounded.
Umbo: Located closer to anterior end of shell than middle of the dorsal margin and is above the hinge line.
Color and pattern: Light yellowish brown to dark brown. Rays usually absent, but occasionally narrow, faint rays occur laterally from the umbo down approximately three fourths of the way to the ventral margin.
Surface: Occasionally with a few large, drop-shaped pustules on mid-lateral surface of shell.
Nacre: White, trending to bluish white toward posterior end of shell.
Umbo cavity: Moderately to very shallow, cavity depth appears inversely related to size of shell.
Teeth: One large, triangular pseudocardinal in right valve, two in left. One straight lateral tooth in right valve, approximately one half length of valve, two in left valve.
Interdentum: Narrow.
Size: Maximum shell length of Mississippi specimens in the MDWFP collection is 75 mm (3 in.).
DISTRIBUTION: The Tombigbee River from the mouth of Tibbee Creek, Clay County, Mississippi, downstream to Epes, Alabama (U.S. Fish and Wildlife Service, 1989a).
MISSISSIPPI DISTRIBUTION: Tombigbee River in Monroe, Clay, and Lowndes counties.
SIMILAR SPECIES: Large *Obovaria arkansasensis* and *Reginaia ebenus* may be mistaken for this species, but both have deep umbo cavities. *Pleurobema taitianum* also has a shallow umbo cavity, but it is triangular in shape while *P. marshalli* is oval.
NATURAL HISTORY:
Habitat: This species inhabited shoals with gravel or gravel/sand substrates at depths of 0.3 - 1.5 m in moderate to swift currents (Williams, 1982).
Reproduction: Nothing is known about the life history of this species in Mississippi, but Williams et al. (2008) speculated that it was likely gravid during the spring and summer.
Fish hosts: The fish host for the Flat Pigtoe is unknown.
STATUS: MNHP: GHSH; USFWS: Endangered; MDWFP: Endangered. Apparently *Pleurobema marshalli* occurred only in the main stem of the Tombigbee River and not in any of its tributaries. As the main stem of the Tombigbee River in Mississippi has been converted into the Tennessee-Tombigbee Waterway, it is likely that this species has been extirpated in the state. The last collection record that we have for this species is from 1980.

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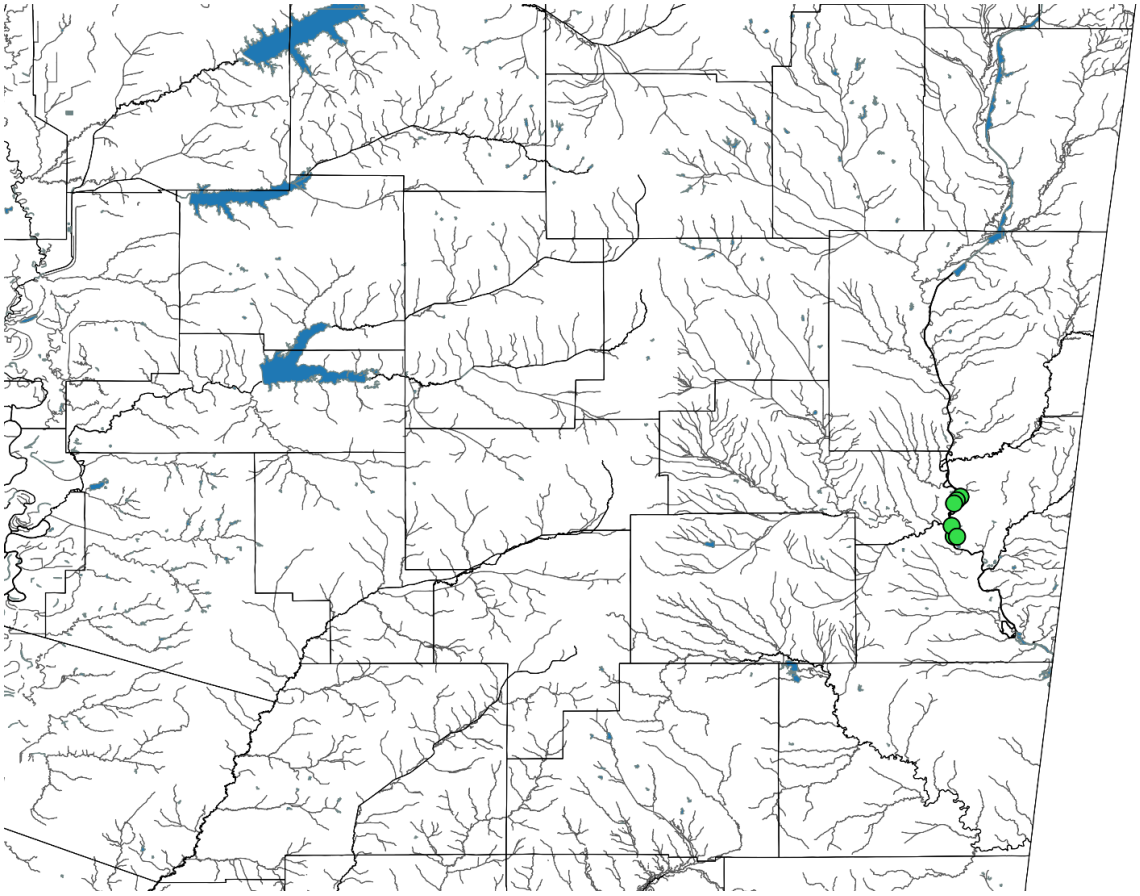

Distribution of *Pleurobema marshalli* in Mississippi.

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PLEUROBEMA PEROVATUM (CONRAD, 1834)
OVATE CLUBSHELL

***Pleurobema perovatum* – Top: MMNS 3461, Yellow Creek, Lowndes County, 46 mm (1.8 in.). Bottom: MMNS 5817, Buttahatchee River, Monroe County, 54 mm (2.1 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to broadly elliptical, moderately thick, some specimens slightly inflated anteriorly.
Posterior ridge: Very broadly rounded to broadly rounded.
Umbo: Above hinge line.
Color and pattern: Yellow to yellowish brown to dark brown. Some young individuals have a greenish-yellow wash. Most specimens have no markings, but a few have wide to narrow, faint, green, broken rays running from the umbo to about 2/3 of the distance to the ventral margin.
Surface: Shell surface smooth, no ornamentation.
Nacre: Usually white, fading to a bluish white posteriorly, somewhat iridescent. Specimens from Yellow Creek in Lowndes County tend to have a rosy wash.
Umbo cavity: Shallow to moderately shallow.
Teeth: One large triangular pseudocardinal in right valve, two in left. In the latter, the anterior tooth is blade-like and slanted anteriorly and downward, the posterior tooth is smaller and triangular. One straight, relatively

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long, lateral tooth in right valve, two in left.
Interdentum: Narrow.
Size: The largest specimen from Mississippi in the MDWFP collection has a shell length of 61 mm (2.4 in.).
DISTRIBUTION: Alabama River system of Alabama, Georgia, Mississippi, and Tennessee.
MISSISSIPPI DISTRIBUTION: Known from Lowndes and Monroe counties, where specimens have been found in the Buttahatchee River and in Luxapallila, Sipsey, and Yellow creeks.
SIMILAR SPECIES: May be confused with *Pleurobema decisum* or *Obovaria arkansasensis*. *Pleurobema decisum* has a more terminal umbo and a lighter colored periostracum than *P. perovatum*, and *O. arkansasensis* has larger, coarser teeth and a periostracum texture that is rougher and more cloth-like than that of *P. perovatum.*

NATURAL HISTORY:
Habitat: Usually found in stable gravel and sandy-gravel substrates in streams with good current and apparently prefers creeks and small rivers rather than large rivers.
Reproduction: Nothing is known about its reproduction in Mississippi. It is assumed to be gravid in late spring and early summer (Williams et al., 2008).
Fish hosts: Unknown.
Status: MNHP: G1S1; USFWS: Endangered; MDWFP: Endangered. Most of our collection records and specimens are from the Buttahatchee River and Yellow Creek, a tributary of Luxapallila Creek, in Lowndes County. This species does not appear to be very common in Mississippi, and is much less common than *P. decisum* in the Buttahatchee River where both occur.
TAXONOMIC NOTES: A recent study (Inoue et al., 2018) has suggested that, based on genetic data, *P. perovatum* and *P. taitianum* are the same species.

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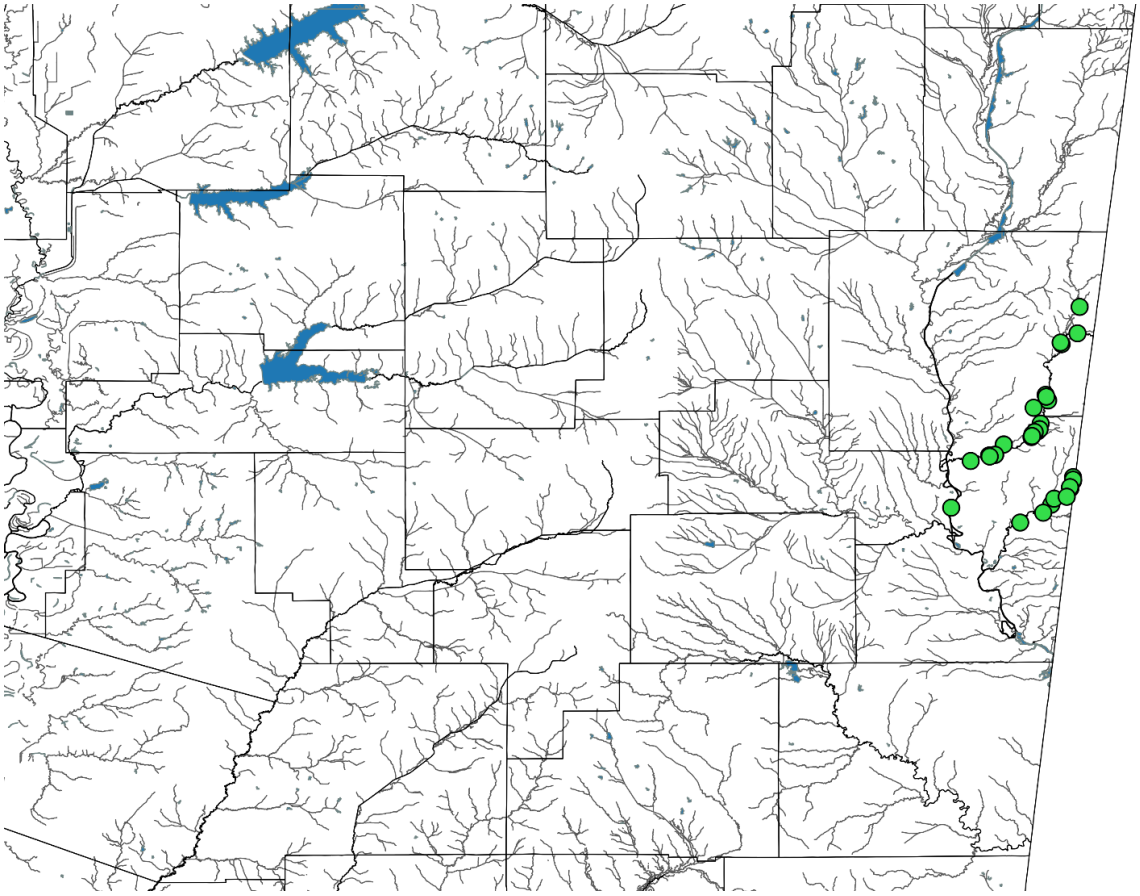

Distribution of *Pleurobema perovatum* in Mississippi.

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PLEUROBEMA RUBRUM (RAFINESQUE, 1820)
PYRAMID PIGTOE

***Pleurobema rubrum* – Top: MMNS 5515, Sunflower River, Sunflower County, 48 mm (1.9 in.). Bottom: MMNS 5486, Sunflower River, Sunflower County, 68 mm (2.7 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval to almost triangular, shell relatively thick, moderately inflated anteriorly and moderately to very compressed posteriorly.
Posterior ridge: Usually present but very broadly rounded.
Umbo: Directed anteriorly and folded inward, above hinge line, a very shallow sulcus anterior to posterior ridge usually present.
Color and pattern: Yellowish brown to dark chestnut brown to black. Juveniles tend to be lighter in color than adults. Darkest specimens are from the Big Sunflower River; those from the Big Black River tend to be lighter with greater amounts of yellow coloration. Rays usually present only in juvenile

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specimens, where they typically are faint, broken, narrow, and extend ventrally from the umbo, often disappearing before they reach the ventral margin of the shell. Very rarely a specimen may have one or two broad but relatively diffuse rays.
Surface: Smooth, but with a coarse texture.
Nacre: White to rose pink. Approximately half of the specimens from the Big Black River have pink nacres, while in the Sunflower River, approximately 75 percent have white nacres.
Umbo cavity: Varies from moderately deep to very shallow, with about 25 percent of specimens from both rivers with deep cavities.
Teeth: One very large pseudocardinal in the right valve, two in the left, with the posterior tooth the larger. One relatively long, straight to slightly curved, lateral tooth with a partial tooth below it in the right valve, two complete laterals in the left.
Interdentum: Present and relatively wide.
Size: Shell length of largest Mississippi specimen in the MDWFP collection is 85 mm (3.3 in.). Largest specimens are from the Sunflower River; those in the Big Black River are smaller, usually averaging 60 - 65 mm (2.4 - 2.6 in.).
DISTRIBUTION: Pennsylvania west to Kansas and Iowa, south to Louisiana and Mississippi, east to Alabama, Tennessee, and Virginia.
MISSISSIPPI DISTRIBUTION: Extant populations occur in the Big Black and Sunflower rivers, but this species appears, based on the presence of relict shells, to have been more widely distributed in the past. In the Big Black River, it occurs in Hinds and Warren counties, and in the Sunflower, *P. rubrum* is not uncommon in Sunflower County north of Indianola. It formerly was more widely distributed in the Sunflower watershed, as relict shells have been found in the Sunflower River in Coahoma County and the Hushpuckena River in Bolivar County south to the Little Sunflower River in Sharkey County. Archaeological specimens have been found associated with the Coldwater River in Quitman County, the Sunflower River in Coahoma and Sharkey counties, the Yazoo River in Yazoo, Holmes, and Humphreys counties, and the Tallahatchie River in Tallahatchie and Leflore counties (Peacock et al., 2011).
SIMILAR SPECIES: *Reginaia ebenus* closely resembles *P. rubrum*, but has a much deeper umbo cavity and more massive hinge teeth. *Fusconaia flava* and *F. cerina* might also be confused with this species, but both have a very pronounced posterior ridge, which *P. rubrum* lacks. *Plethobasus cyphyus*, which superficially resembles *P. rubrum*, usually has a more centrally located umbo and a few distinct pustules on each valve.
NATURAL HISTORY:
Habitat: Found in areas with current and mixed sand and gravel substrates in the Big Black River, but found in clay as well as in gravelly substrates in the Sunflower River.
Reproduction: Very little is known of the reproductive biology of this species in Mississippi. One gravid female, 68 mm (2.7 in.) in shell length, was found in the Big Black River in Warren County in August. It has been reported to be gravid from late May until late July (Williams et al., 2008).
Fish hosts: There are four known host fish, but only one, the Spotfin Shiner

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(*Cyprinella spiloptera*), occurs in Mississippi.

STATUS: MNHP: G2G3S1, MDWFP: Endangered.

Although populations of this species appear to be stable in some parts of the Sunflower River, it is apparently declining in the Big Black River. We have specimens from nine Mississippi counties.

TAXONOMIC NOTES: *Pleurobema rubrum* is closely related to and may only be a form of *Pleurobema cordatum* (Parmalee and Bogan, 1998). These two species are distinguished primarily by the depth of their umbo cavities, *P. rubrum* having a very shallow cavity while that of *P. cordatum* is moderately deep (Parmalee and Bogan, 1998). If that is indeed the case, then specimens referred to as *P. rubrum* in Mississippi may in fact represent two species, the Pyramid Pigtoe and the Ohio Pigtoe, *P. cordatum*, as approximately one quarter of the specimens in both the Big Black and Sunflower rivers have moderately deep umbo cavities. The taxonomic status of *P. rubrum* and other species related to it is currently under investigation by the U.S. Geological Survey. A recent paper (Inoue et al., 2018) has suggested that, based on genetic evidence, *P. rubrum* and *P. sintoxia* (Round Pigtoe) may be the same species.

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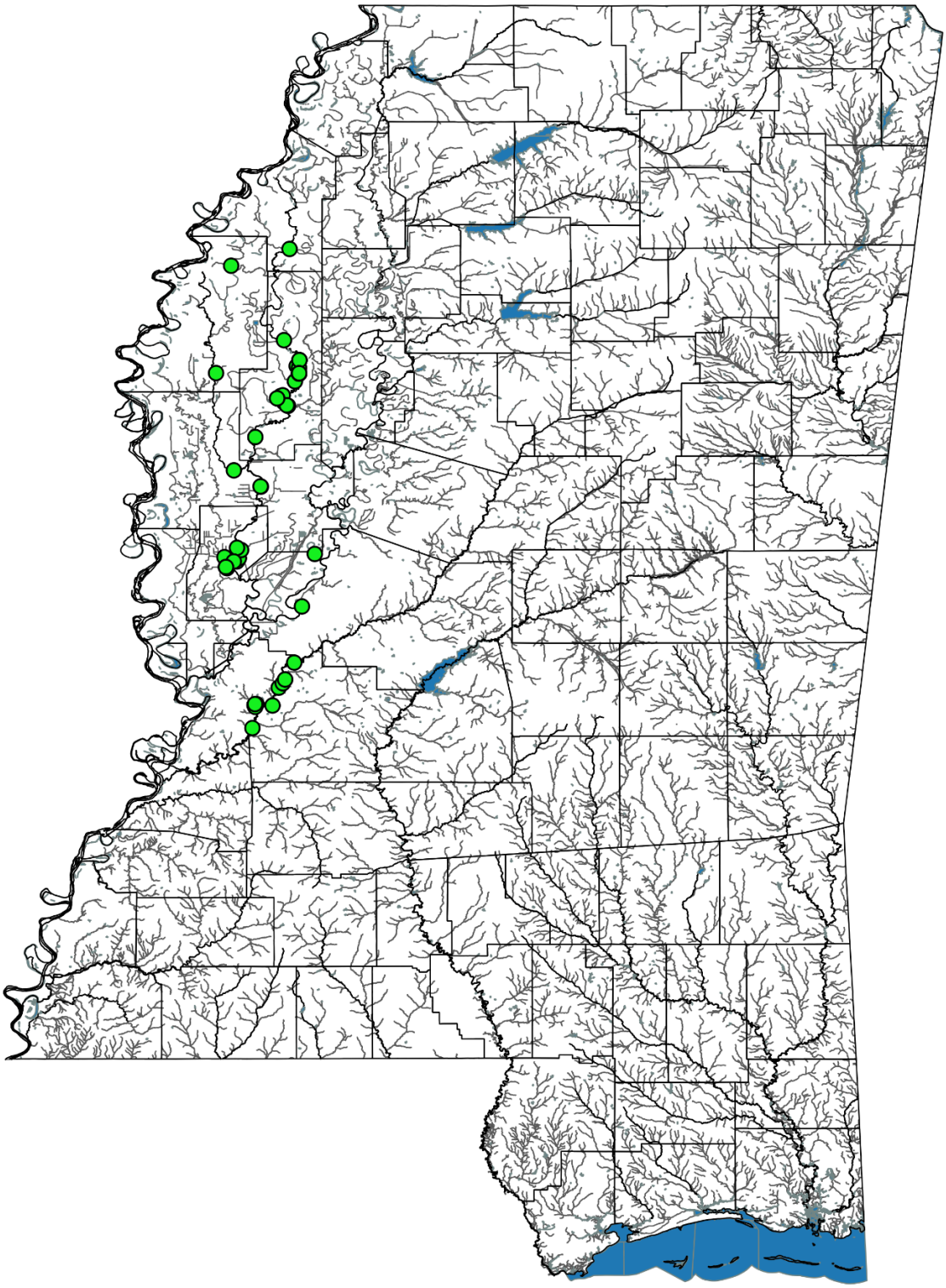

Distribution of *Pleurobema rubrum* in Mississippi.

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PLEUROBEMA TAITIANUM (LEA, 1834)
HEAVY PIGTOE

***Pleurobema taitianum* – Top: MMNS 921, Buttahatchee River, Lowndes County, 36 mm (1.4 in.). Bottom: MMNS 779, East Fork Tombigbee River, Itawamba County, 48 mm (1.9 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell triangular to oval; heavy; inflated anteriorly, compressed posteriorly. A well-developed but relatively shallow sulcus is present just anterior to posterior ridge.
Posterior ridge: Present but rounded to very broadly rounded.
Umbo: Prominent, located on anterior end and turned inward.
Color and pattern: Yellowish-brown to brown. A few specimens have scattered,

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narrow to moderately wide, obscure but complete rays extending from the umbo to the ventral edge of the shell.
Surface: Smooth, no sculpturing.
Nacre: White, sometimes with a rose or peach-colored wash.
Umbo cavity: Shallow to very shallow.
Teeth: One large, triangular pseudocardinal with small posterior accessory tooth in the right valve, two large pseudocardinal teeth in the left valve, the posterior-most larger and triangular, the anterior tooth smaller and blade-like. One relatively long, slightly to moderately curved lateral tooth in the right valve, which often has smaller tooth ridge below it, two long and moderately to slightly curved lateral teeth in the left valve.
Interdentum: Present and wide.
Size: Shell length of largest Mississippi specimen in the MDWFP collection is 50 mm (2 in.).
DISTRIBUTION: Formerly occurred in the Tombigbee River from Amory, Mississippi, downstream to Demopolis, Alabama; the Buttahatchee River in Mississippi; the Alabama River between Claiborne and Selma, Alabama; the Cahaba and possibly the Coosa rivers in Alabama (Williams et al, 2008).
MISSISSIPPI DISTRIBUTION: Occurred in the Tombigbee River from about the mouth of Tibbee Creek downstream presumably to the Alabama line, and in the East Fork of the Tombigbee River from the mouth of Bull Mountain Creek downstream to just below Bar's Ferry (Williams, 1982). It also occurred in the lower part of the Buttahatchee River from the mouth to a few miles upstream.
SIMILAR SPECIES: This species might be confused with small *Reginaia ebenus*, but the latter has a deep umbo cavity while *P. taitianum* has a very shallow cavity.
NATURAL HISTORY:
Habitat: This species has been found in gravel shoals in the main channel of the Tombigbee River and in an area of moderate current with a sand and gravel substrate (Williams, 1982). The specimens from the Buttahatchee River were found in shoal areas over a gravel substrate at a depth of less than a meter.
Reproduction: Almost nothing is known of the life history of this species in Mississippi. In Alabama, it is apparently gravid in the spring and summer (Williams et al., 2008).
Fish hosts: Unknown.
STATUS: MNHP: G1SH; USFWS: Endangered; MDWFP; Endangered. Most of the habitat for this species in the main channel of the Tombigbee River was destroyed by construction of the Tennessee-Tombigbee Waterway, and habitat in both the lower Buttahatchee and East Fork Tombigbee was also adversely affected by construction of the canal. The last live *Pleurobema taitianum* seen in the state was in the Buttahatchee River a few hundred meters above the old US Highway 45 bridge in 1987. It has not been seen in Mississippi since that time. This species, although still extant in Alabama, appears to have been extirpated in Mississippi.
TAXONOMIC NOTES: A recent study (Inoue et al., 2018) has suggested that, based on genetic data, *P. taitianum* and *P. perovatum* may be the same species.

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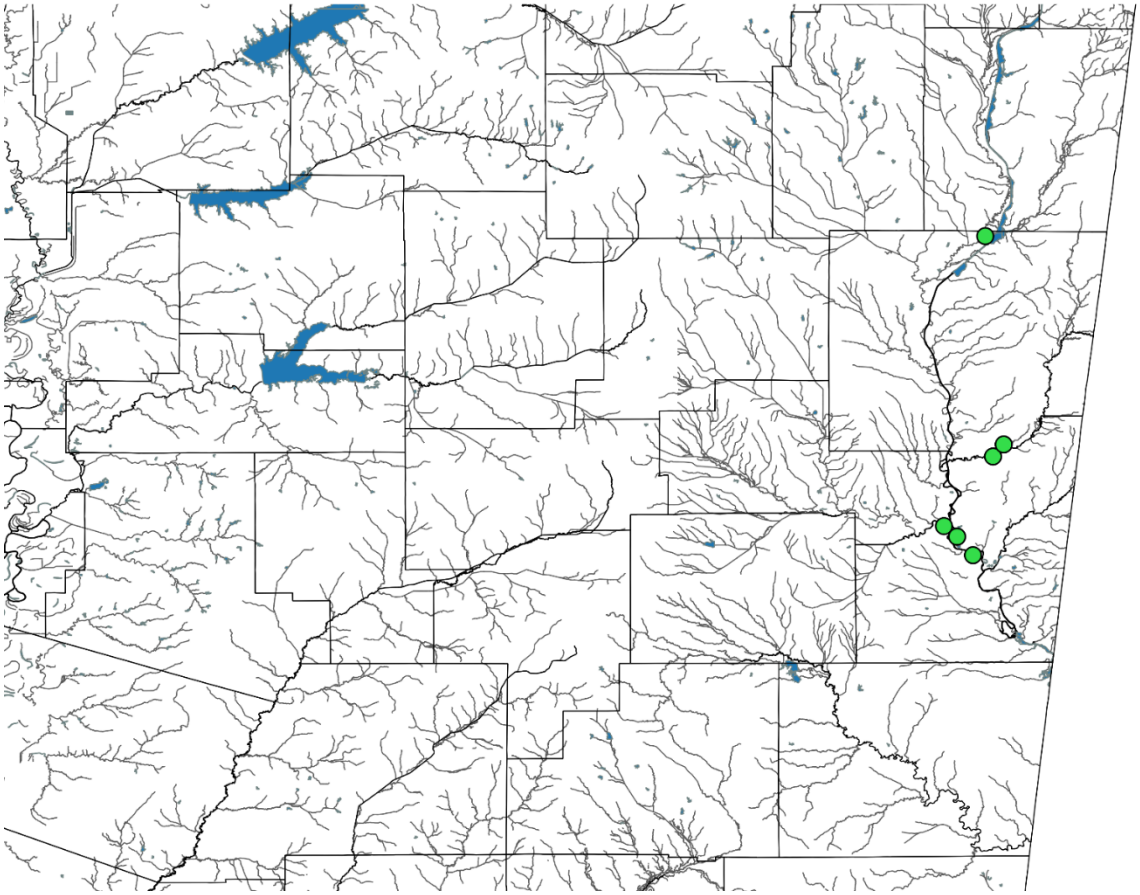

Distribution of *Pleurobema taitianum* in Mississippi.

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PLEURONAIA BARNESIANA (LEA, 1838)
TENNESSEE PIGTOE

***Pleuronaia barnesiana* – Top: MMNS 8513, Hiwassee River, Polk County, Tennessee, 53 mm (2.1 in.). Bottom: MMNS 2256, Little River, Blount County, Tennessee, 50 mm (2.1 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval to triangular, moderately to slightly inflated, some specimens rather compressed; shell moderately thin.
Posterior ridge: Present and broadly rounded, not prominent.
Umbo: Slightly above or even with the hinge line but not prominent.
Color and pattern: Brownish yellow to dark brown; rays present or absent, most lack rays but a few have relatively narrow rays extending from the umbo down toward the ventral edge of the shell. Rays are usually rather faint and thin, but a few may have broad rays, particularly close to the umbo.
Surface: Smooth to somewhat coarse, no sculpturing.
Nacre: Bluish white to white.
Umbo cavity: Fairly shallow.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth are moderate in size and are somewhat thin and compressed.
Interdentum: Present, relatively wide.

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Size: Largest Mississippi specimen in the MDWFP collection has a shell length of 47 mm (1.8 in.). Specimens in the MDWFP collection from Alabama are larger, with a shell length of 74 mm (2.9 in.) for the largest.

DISTRIBUTION: Virginia, North Carolina, Tennessee, Georgia, Alabama, and Mississippi.

MISSISSIPPI DISTRIBUTION: Known only from Bear Creek, Tishomingo County, in the Tennessee drainage.

SIMILAR SPECIES: A species in the Tennessee drainage in Mississippi that could be confused with *Pleuronaia barnesiana* is *Pleuronaia dolabelloides*, the Slabside Pearlymussel. The latter has a more angular posterior ridge that is ventrally curved, a posterior slope that is steeper, pseudocardinals that are less compressed, and a slightly deeper umbo cavity than in *P. barnesiana* (Williams et al., 2008).

NATURAL HISTORY:

Habitat: This species occurs in stable gravel in small streams to large rivers in flowing water.

Reproduction: Nothing is known of its reproduction in Mississippi, but it apparently spawns in spring and early summer and is gravid from mid-May to mid-July in Alabama (Williams et al., 2008).

Fish hosts: Unknown.

STATUS: MNHP: G2G3S1.

This species was present in Bear Creek in 1965 (Isom and Yokley, 1968), and the last known collection of *Pleuronaia barnesiana* in Mississippi was from Bear Creek northeast of Belmont, Tishomingo County, in 1981.

TAXONOMIC NOTES: This species was formerly in the genus *Fusconaia*, but was reassigned to *Pleuronaia* (Williams et al., 2008).

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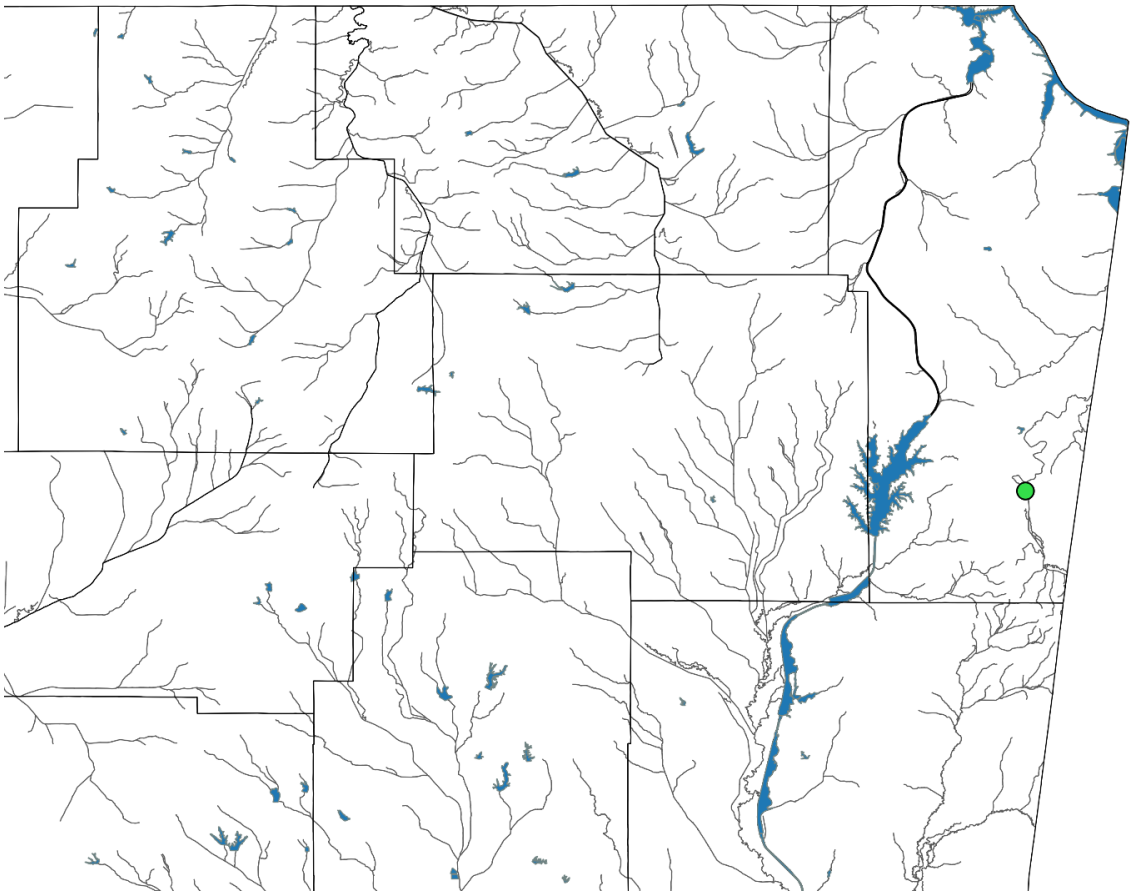

Distribution of *Pleuronaia barnesiana* in Mississippi.

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PLEURONAIA DOLABELLOIDES (LEA, 1840)
SLABSIDE PEARLYMUSSEL

***Pleuronaia dolabelloides* – Top: MMNS 6820, Bear Creek, Tishomingo County, 53 mm (2.3 in.). Bottom: MMNS 4764, Bear Creek, Tishomingo County, 59 mm (2.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Oval to triangular, slightly inflated to slightly compressed, shell relatively thick.
Posterior ridge: Present and somewhat rounded, curves toward the ventral edge of the shell, not prominent.
Umbo: Slightly above the hinge line but not prominent.
Color and pattern: Yellowish to brownish yellow to brown. Rays occasionally present, usually near umbo, wide rays alternate with narrow rays. Rays sometimes associated with growth lines and extending a small distance downward from them.
Ornamentation: Smooth to somewhat coarse, no ornamentation.
Nacre: White.
Umbo cavity: Moderately deep.
Teeth: Left valve with two pseudocardinals and two laterals, right

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valve with one pseudocardinal and one lateral tooth. Teeth are moderate in size but not massive.
Interdentum: Present, relatively wide.
Size: Shell length of largest Mississippi specimen in MDWFP collection is 74 mm (2.9 in.).
DISTRIBUTION: Alabama, Kentucky, Mississippi, North Carolina, Virginia, Tennessee.
MISSISSIPPI DISTRIBUTION: Bear and Cedar creeks, Tishomingo County, in the Tennessee drainage.
SIMILAR SPECIES: Most closely resembles *Pleuronaia barnesiana*, but that species has more compressed and less divergent pseudocardinal teeth, a less angular posterior ridge that is not curve ventrally, a less steep posterior slope, and a slightly shallower umbo cavity (Williams et al., 2008).
NATURAL HISTORY:
Habitat: *Pleuronaia dolabelloides* is found in flowing water in gravel and sandy gravel substrates in both Bear and Cedar creeks.
Reproduction: Nothing is known about its reproduction in Mississippi, but Williams et al. (2008) state that it is gravid from mid-May through mid-August.
Fish hosts: Six species serve as hosts for this mussel, five of which are minnows (Cyprinidae). The only host known to occur in Mississippi is the Smallmouth Bass (*Micropterus dolomieu*).
STATUS: MNHP: G2S1; USFWS: Endangered; MDWFP: Endangered.
Pleuronaia dolabelloides was not found during earlier surveys of the Bear Creek watershed (Ortmann, 1925; Isom and Yokley, 1968) in Mississippi and Alabama. Our earliest record of this species in Bear Creek is from 1980, where shells from freshly dead specimens were found west of the Mingo community. The next records we have from Bear Creek were from 1999, and specimens have been found rather frequently since that time. MacGregor and Garner (2004) reported this species from five localities downstream of the Mississippi state line in Colbert County, Alabama. The population of *P. dolabelloides* in Bear Creek is apparently one of only two extant populations downstream of the Paint Rock River in Alabama (MacGregor and Garner, 2004).
TAXONOMIC NOTES: This species was formerly placed in the genus *Lexingtonia*.

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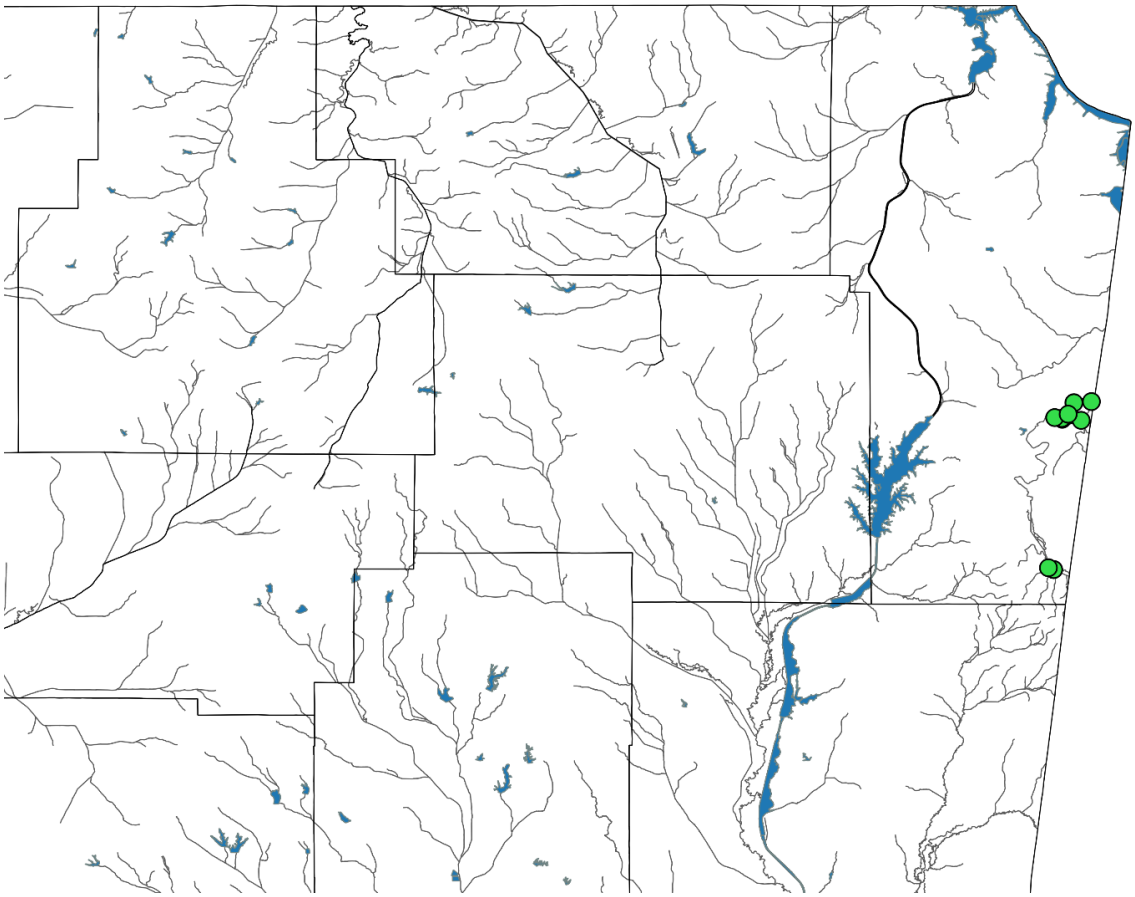

Distribution of *Pleuronaia dolabelloides* in Mississippi.

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POTAMILUS ALATUS (SAY, 1817)
PINK HEELSPLITTER

***Potamilus alatus* – Top: MMNS 9504, Mississippi River, Warren County, 128 mm (5.0 in.). Bottom: MMNS 5586, Bear Creek, Tishomingo County, 129 mm (5.1 in.)**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to elliptical, compressed, relatively thin. There is usually a relatively high posterior wing, a very small anterior wing, but both are usually broken.
Posterior ridge: Absent.
Umbo: Even with or slightly above hinge line.
Color and pattern: Brown with yellowish or greenish wash, particularly in smaller specimens; usually without rays but occasionally with faint, narrow rays on the posterior end of the shell extending from the umbo.
Surface: Shell surface generally rather smooth and shiny but somewhat roughened in larger specimens, as

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growth lines give the shell a roughened texture.
Nacre: Purple to a whitish purple.
Umbo cavity: Shallow.
Teeth: Two pseudocardinals in left valve, two in right, but anterior tooth usually very small; two laterals in the left valve, one in the right; teeth not exceptionally large, pseudocardinals somewhat thin, laterals well developed.
Interdentum: Usually absent, but if present very narrow.
Size: Largest Mississippi specimen in MDWFP collection is 172 mm (6.8 in.) long.
DISTRIBUTION: New York and Pennsylvania west to South Dakota, south to Arkansas, east to Alabama.
MISSISSIPPI DISTRIBUTION: Mississippi River North, Mississippi River South, and Tennessee drainages, where it has been found in the Mississippi River, Pickwick Lake, and both Cedar and Bear creeks in Tishomingo County. There are archaeological records of this species associated with the Big Black River in Hinds County and the Sunflower River in Sunflower County (Peacock et al., 2011).
SIMILAR SPECIES: This species could be confused with *Potamilus ohiensis,* but that species usually has a thinner shell and teeth that are much smaller and less developed. It might also be confused with *Potamilus purpuratus*, which is more inflated, has a heavier shell, and a darker purple nacre.
NATURAL HISTORY: Habitat: *Potamilus alatus* is found in both flowing and non-flowing water in both sandy-gravel substrates and in mud.
Reproduction: One gravid female from Bear Creek, Tishomingo County, was 100 mm (3.9 in.) shell length and was found in August. Gravid females can be found from fall until the following spring (Williams et al., 2008).
Fish hosts: The only known fish host is the Freshwater Drum (*Aplodinotus grunniens*).
STATUS: MNHP**:** G5S2.
Although relatively widespread nationally, this species is uncommon in Mississippi. Most of our collection records and specimens are from Bear Creek in Tishomingo County or from Pickwick Lake.

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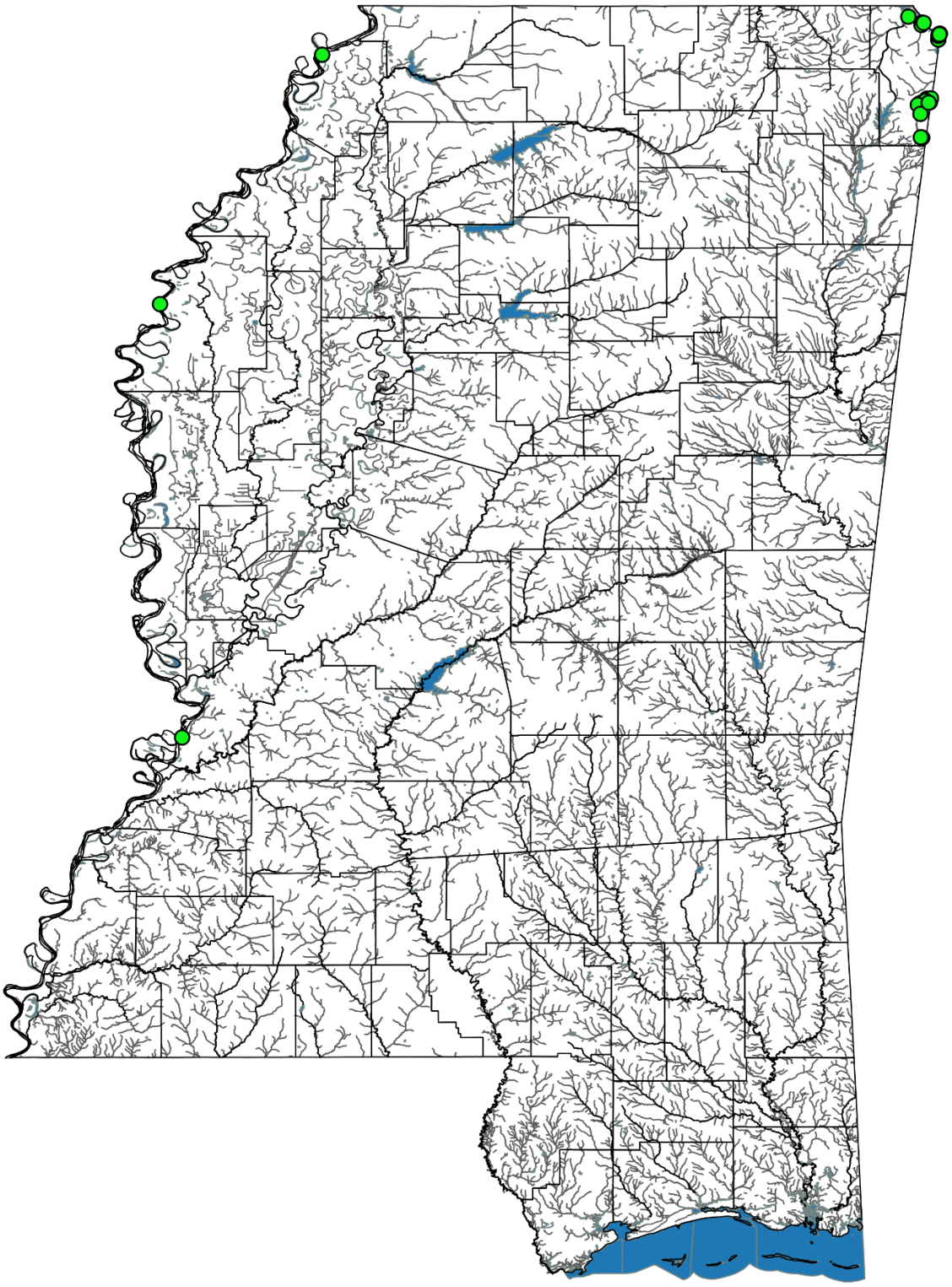

Distribution of *Potamilus alatus* in Mississippi.

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POTAMILUS CAPAX (GREEN, 1832)
FAT POCKETBOOK

***Potamilus capax* – Top: MMNS 8209, Mississippi River, Issaquena County, 109 mm (4.3 in.). Bottom: MMNS 3814, Gilliam Chute, Jefferson County, 102 mm (4.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to almost quadrate to nearly elliptical; very inflated, relatively thick.
Posterior ridge: Absent to broadly rounded.
Umbo: Above hinge line, prominent, tops strongly slanted toward hinge line.
Color and pattern: Chestnut, yellowish brown, greenish brown, reddish brown, to dark brown; no rays.
Surface: Shell generally smooth but occasionally some texture due to growth lines.
Nacre: Creamy white to white.
Umbo cavity: Very deep.
Teeth: One or two pseudocardinal and two laterals in left valve; two pseudocardinals and one lateral in right valve. Laterals relatively short, pseudocardinal in left valve relatively long with irregular surface; pseudocardinals in right valve positioned

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one above the other. Teeth well developed, not thin.
Interdentum: Present, relatively narrow.
Size: Largest Mississippi specimen in MDWFP collection is 122 mm (4.8 in.) long.
DISTRIBUTION: Minnesota south to Louisiana and Mississippi, east to Indiana.
MISSISSIPPI DISTRIBUTION: Mississippi River North, Mississippi River South, and Yazoo drainages.
SIMILAR SPECIES: *Potamilus capax* is most similar to and is often confused with *Lampsilis cardium*. The latter is more elliptical, not as inflated, and has a less prominent umbo. Additionally, the two pseudocardinals in the right valve of *L. cardium* are directed toward the anterior of the shell rather than positioned one above the other, the umbo is not as deep, and it may have rays, which *P. capax* lacks.

NATURAL HISTORY:
Habitat: *Potamilus capax* occurs in areas with gravel, sand, and mud in Mississippi, in water either with or without current.
Reproduction: Nothing is known about its reproduction in Mississippi, but gravid individuals have been found in summer through early fall (USFWS, 1989b).
Fish hosts: The only known host for this mussel is the Freshwater Drum (*Aplodinotus grunniens*).
STATUS: MNHP: G2S1; USFWS: Endangered; MDWFP: Endangered. This species, although relatively abundant at one locality in the state, is uncommon elsewhere, as we have specimens from only six Mississippi counties. Most of our specimens are from the Mississippi River and Gilliam Chute east of the Mississippi River near Rodney Lake in Jefferson County. Known from the Yazoo drainage by only a few relict shells.

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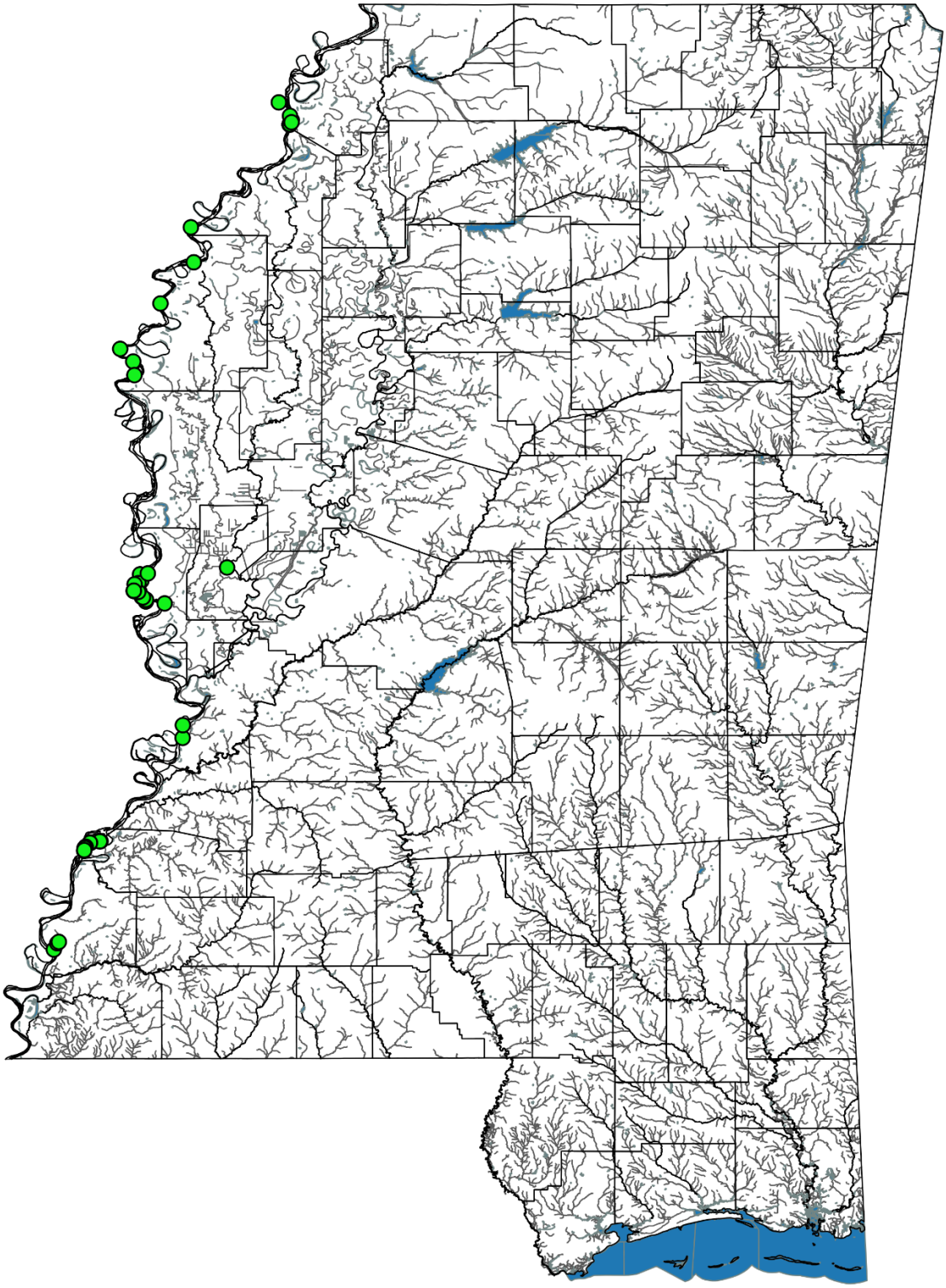

Distribution of *Potamilus capax* in Mississippi.

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POTAMILUS INFLATUS (LEA, 1831)
INFLATED HEELSPLITTER

***Potamilus inflatus* – Top: MMNS 2691, Tombigbee River, Greene County, Alabama, 121 mm (4.8 in.). Bottom: MMNS 4088, Black Warrior River, Tuscaloosa County, Alabama, 111 mm (4.4 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell rhomboidal to oval, moderately inflated, thin and somewhat fragile. Very prominent posterior wing, often broken, and small anterior wing.
Posterior ridge: Absent.
Umbo: Slightly above or even with hinge line, not prominent.
Color and pattern: Brown with green, yellow, or reddish orange highlights. Rays usually absent, but if present, generally narrow, faint, from below umbo directed toward posterior of shell.
Surface: Shell smooth with no sculpture.
Nacre: White with a purple wash or faintly purple.

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Umbo cavity: Very shallow.
Teeth: One pseudocardinal and two laterals in left valve; one pseudocardinals and one lateral in right valve. Teeth very thin, pseudocardinals not much more than a thin swelling on the hinge line, laterals present but poorly developed.
Interdentum: Absent.
Size: Largest Mississippi specimen in MDWFP collection is 138 mm (5.4 in.) long.
DISTRIBUTION: Alabama, Mississippi, and Louisiana.
MISSISSIPPI DISTRIBUTION: Known from the Tombigbee drainage in Mississippi but found in the Lake Pontchartrain and Pearl drainages in Louisiana.
SIMILAR SPECIES: *Potamilus inflatus* resembles *Leptodea fragilis*, which also has a thin and fragile shell, but the latter has a posterior wing that is smaller and not as well developed, lacks an anterior wing, usually has more yellow in the periostracum, more prominent pseudocardinals, and has a nacre that is more pink than purple. *Potamilus ohiensis* may also mistaken for *P. inflatus*, but it has smaller posterior and anterior wings, slightly larger pseudocardinals, is more elliptical, and usually has a thicker shell.
NATURAL HISTORY:
Habitat: *Potamilus inflatus* often occurs in very silty/fine mud substrates but may also be found in clay, gravel, and sand mixtures, usually in slow-moving water.
Reproduction: Nothing is known of its reproduction in Mississippi. It apparently is gravid from summer to the following year (Roe et al., 1997).
Fish hosts: The only know host species is the Freshwater Drum (*Aplodinotus grunniens*) (Roe et al., 1997).
STATUS: MNHP: G1G2S1; USFWS: Threatened; MDWFP: Endangered. This species was found in the Pearl River at Jackson in the past (Frierson, 1911) but no longer occurs there. There are recent records from the Pearl River in Louisiana, so it is likely that this species also occurs in the lower Pearl River in Mississippi. The few recent records we have of this species in Mississippi are primarily from the East Fork Tombigbee River in Itawamba, Lowndes, and Monroe counties.

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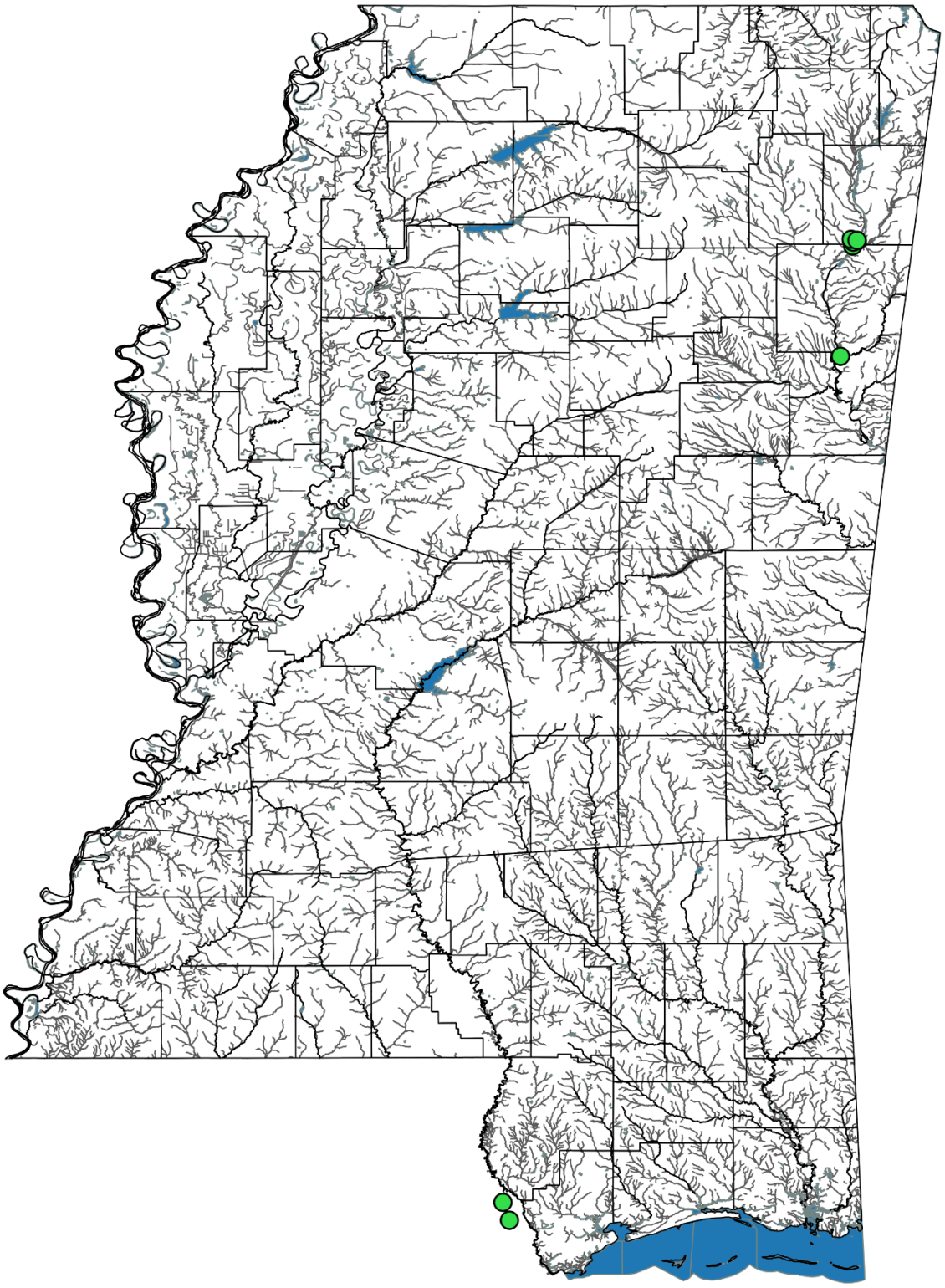

Distribution of *Potamilus inflatus* in Mississippi.

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POTAMILUS OHIENSIS (RAFINESQUE, 1820)
PINK PAPERSHELL

***Potamilus ohiensis* – Top: MMNS 10413, Mississippi River, Tunica County, 105 mm (4.1 in.). Bottom: MMNS 8448, Sunflower River, Sharkey County, 109 mm (4.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical to oval, inflated, relatively thin but not fragile. Large posterior wing, often broken, and small anterior wing.
Posterior ridge: Absent.
Umbo: Slightly above hinge line, not prominent.
Color and pattern: Brown to greenish brown to greenish gray. Usually without rays but occasionally very faint rays on posterior of shell.
Surface: Smooth, no sculpture, shell surface sometimes rough in larger specimens apparently associated with thinning of outer smooth layer of periostracum.
Nacre: Faint purplish white.
Umbo cavity: Very shallow.
Teeth: One pseudocardinal and two laterals in left valve; one

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pseudocardinals and one lateral in right valve. Pseudocardinals very thin, usually appear to be slightly elevated regions of the hinge, laterals relatively short, larger than pseudocardinals.

Interdentum: Absent.

Size: Largest Mississippi specimen in MDWFP collection is 158 mm (6.2 in.) long.

DISTRIBUTION: Ohio west to North and South Dakota, south to Louisiana and Texas, east to Mississippi and Alabama.

MISSISSIPPI DISTRIBUTION: Known from the Big Black, Mississippi River North, Mississippi River South, Yazoo, Tennessee, and the Tombigbee drainages. This species was not found in the Tombigbee drainage during extensive surveys beginning in the late 1980's, but was discovered in the East Fork of the Tombigbee River in 2010. It may have recently invaded the Tombigbee watershed via the Tenn-Tom Waterway.

SIMILAR SPECIES: *Potamilus ohiensis* resembles P. *inflatus*, but has smaller posterior and anterior wings, slightly larger pseudocardinals, is more elliptical, and usually has a thicker shell. *Leptodea fragilis* is also similar to *P. ohiensis*, but the former usually has a small posterior wing, yellow in the periostracum, and a nacre that is white or light pink rather than purple.

NATURAL HISTORY:

Habitat: *Potamilus ohiensis* occurs in large rivers, smaller creeks, and in oxbow lakes in sand, sand-gravel mixtures, and in mud.

Reproduction: Six gravid females from Mississippi averaged 80.5 mm (3.2 in.) shell length and ranged from 50 – 101 mm (2.0 – 4.0 in.). One of these was collected from the Yazoo River in Yazoo County in June, two were from the Quiver River in Sunflower County in September, and three were found in October in the Mississippi River, Tunica County.

Fish hosts: Fish hosts are the Freshwater Drum (*Aplodinotus grunniens*) and White Crappie (*Pomoxis annularis*).

STATUS: MNHP: G5S3.

Although relatively common in the Yazoo and Big Black drainages, this species appears to be uncommon elsewhere in Mississippi. We have specimens from 23 Mississippi counties, but most of our collection records are from the Big Black and Sunflower rivers.

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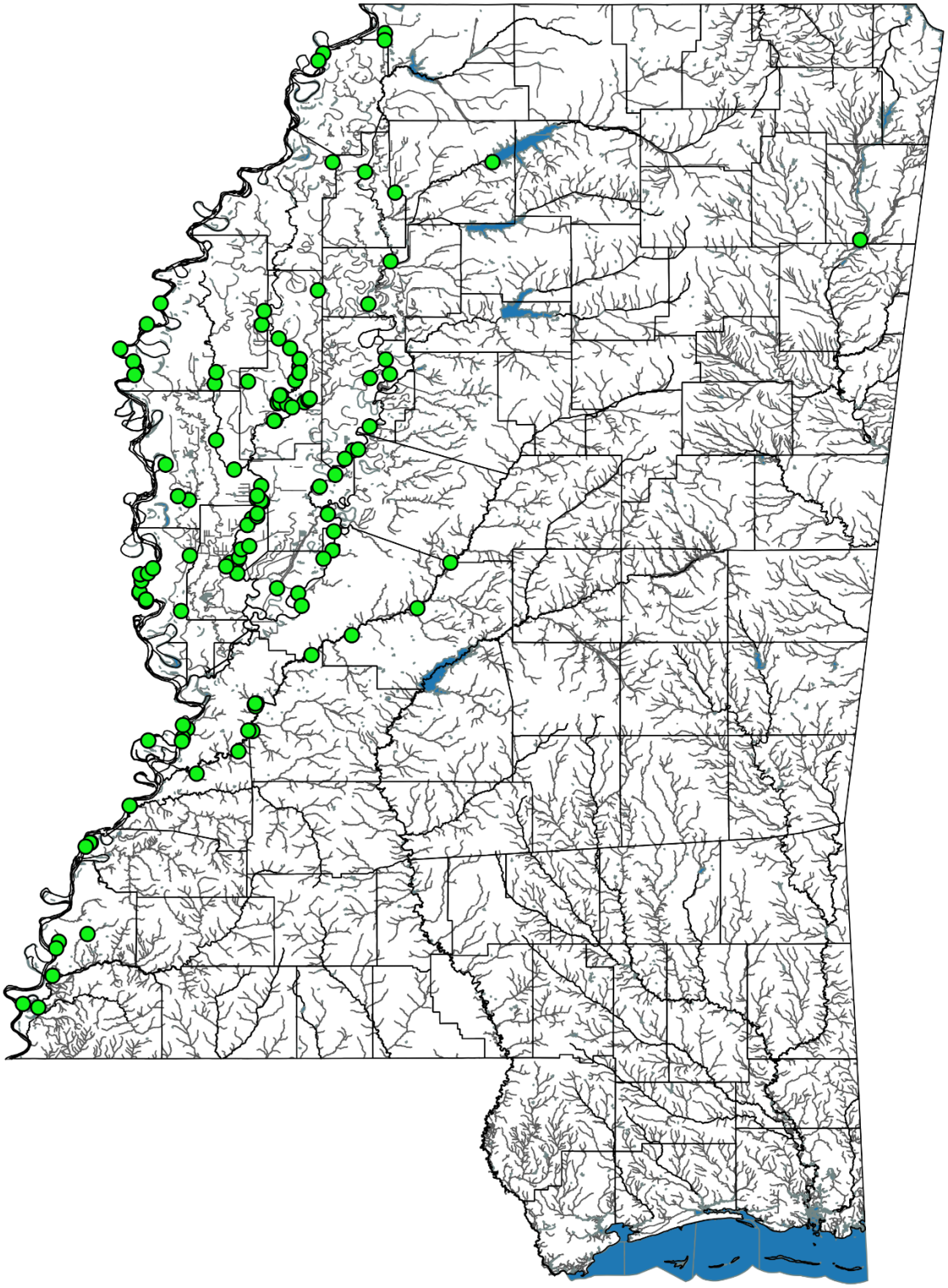

Distribution of *Potamilus ohiensis* in Mississippi.

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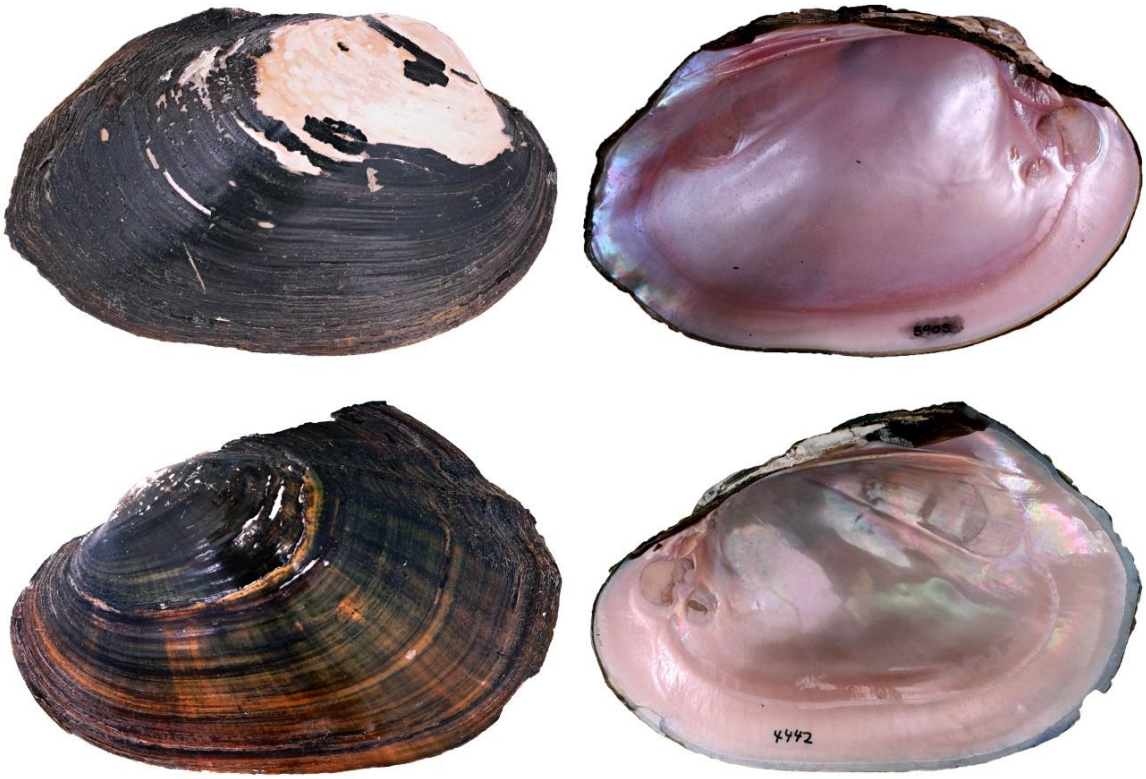
POTAMILUS PURPURATUS (LAMARK, 1819)
BLEUFER



***Potamilus purpuratus* – Top: MMNS 5905, Pearl River, Marion County, 175 mm (6.9 in.). Bottom: MMNS 4442, Tibbee Creek, Clay County, 125 mm (4.9 in.).**

SHELL CHARACTERISTICS:

Shape and structure: Shell quadrate to oval, inflated, and thick. Females have a pronounced marsupial swelling of the posterior part of the shell.

Posterior ridge: Present but usually broadly rounded. In some specimens there appears to be two parallel posterior ridges with a shallow sulcus between them.

Umbo: Above hinge line, somewhat prominent.

Color and pattern: Yellowish brown in smaller specimens, black or almost black in larger specimens. Rays usually present only on smaller specimens, may be narrow to moderately wide, are not prominent, and extend from the umbo to the ventral edge of the shell.

Surface: Smooth, no sculpture, shell surface sometimes rough in larger specimens.

Nacre: Medium to dark purple.

Umbo cavity: Moderately deep.

Teeth: Two pseudocardinals and two laterals in left valve; two pseudocardinals (anterior tooth very small) and one lateral in right valve. Teeth relatively large and moderately thick.

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Interdentum: Present, particularly in larger shells; usually narrow.
Size: Largest Mississippi specimen in MDWFP collection is 175 mm (6.9 in.) shell length.
DISTRIBUTION: Kentucky and Tennessee west to Arkansas, Texas, and Oklahoma, south to Louisiana and Texas, and east to Georgia and Alabama.
MISSISSIPPI DISTRIBUTION: Known from all Mississippi drainages except the Coastal Rivers and the Tennessee River. Occurs in larger rivers, creeks, and reservoirs, including Ross Barnett Reservoir, Arkabutla Lake, and Enid Lake.
SIMILAR SPECIES: *Potamilus purpuratus* resembles other *Potamilus* in Mississippi but can be distinguished from them by its thicker shell, larger teeth, and dark purple nacre. It may also be mistaken for *Plectomerus dombeyanus*, another species with a thick shell and dark purple nacre, but the latter has a prominent posterior ridge that *Potamilus purpuratus* lacks.

NATURAL HISTORY:
Habitat: *Potamilus purpuratus* inhabits rivers, creeks, and lakes in a variety of substrates, including sand, gravel, or mud, in both flowing and non-flowing water.
Reproduction: Thirty gravid females from Mississippi averaged 98.2 mm (3.9 in.) shell length and ranged from 65 – 121 mm (2.6 – 4.8 in.). One of these was found in March, two in June, 17 in September, and 10 in October.
Fish hosts: Known hosts include the Freshwater Drum (*Aplodinotus grunniens*), Warmouth (*Lepomis gulosus*), and Red Shiner (*Cyprinella lutrensis*).
STATUS: MNHP: G5S5.
This species is widespread and abundant in Mississippi, occurring in at least 56 counties. Most of our collection records are from the Big Black, Pearl, East Fork Tombigbee, and Sunflower rivers.

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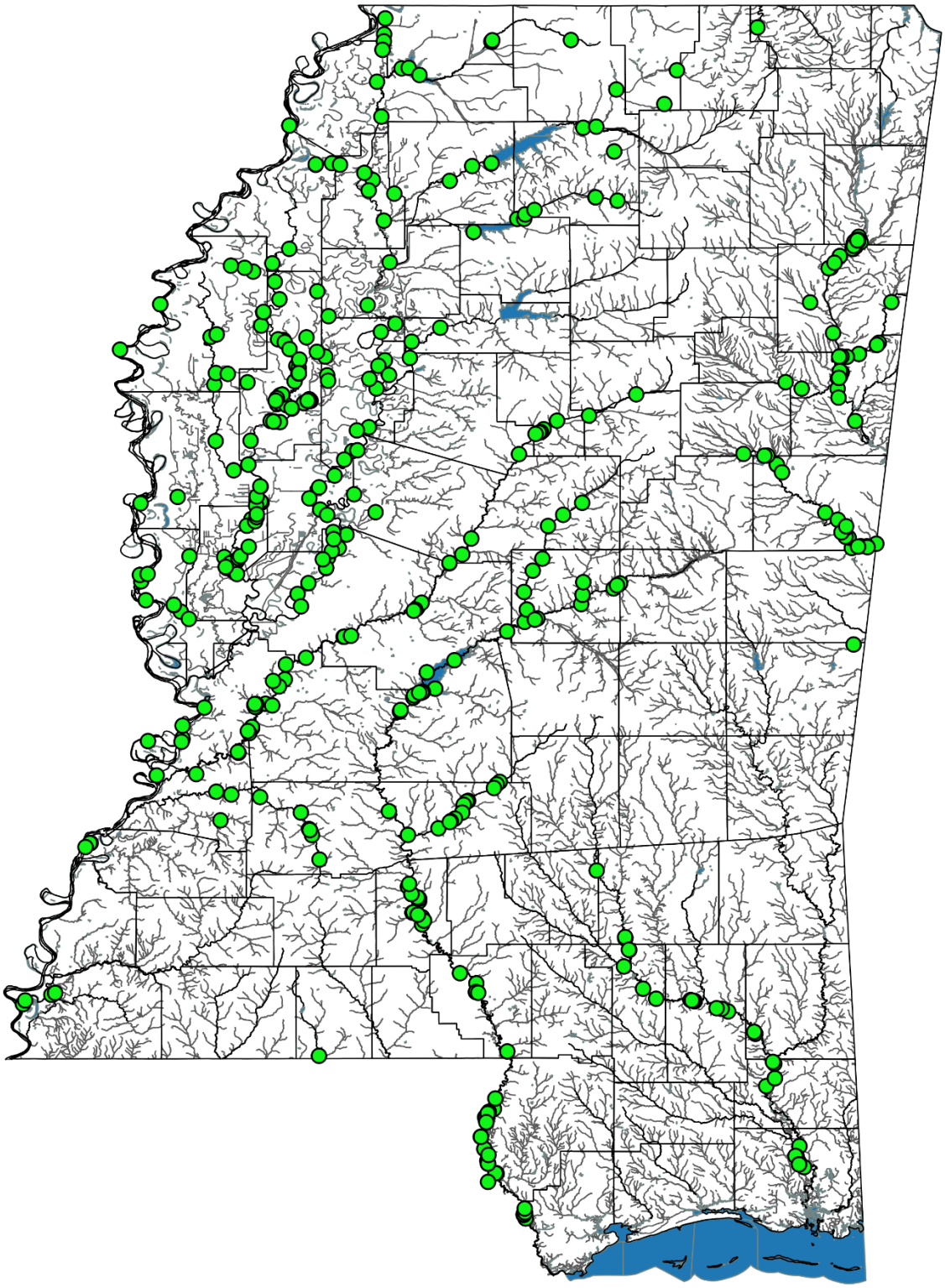

Distribution of *Potamilus purpuratus* in Mississippi.

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PSEUDODONTOIDES SUBVEXUS (CONRAD, 1834)
SOUTHERN CREEKMUSSEL

***Pseudodontoides subvexus* – Top: MMNS 2073, Buttahatchee River, Monroe County, 73 mm (2.9 in.). Bottom: MMNS 5711, Yellow Creek, Lowndes County, 88 mm (3.5 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell nearly quadrate, relatively strongly inflated, thin in smaller specimens, thicker in larger ones but still relatively thin. The posterior end of the shell is inflated and higher than the anterior end, is broadly rounded to almost square, and is approximately equal in height to the umbo.
Posterior ridge: Broadly rounded.
Umbo: Above the hinge line, relatively prominent, turned very sharply inward and posteriorly toward the hinge line.
Color and pattern: Shell greenish to greenish black to almost black. Rays not obvious in most larger shells, but when present, most are narrow, although a few are wide to very wide. Rays extend from the umbo to the posterior end of the shell, and in a few smaller individuals, narrow rays may be present on the anterior end of the shell.
Surface: Shell relatively smooth, no sculpture.
Nacre: Blueish white to white.
Umbo cavity: Moderately shallow.
Teeth: One pseudocardinal and no laterals in left valve; one pseudocardinal and no laterals in right valve. Pseudocardinal teeth are not much more than swellings on the hinge line.
Interdentum: Absent.
Size: Largest Mississippi specimen in MDWFP collection is 110 mm (4.3 in.) shell length.

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DISTRIBUTION: Alabama, Louisiana, Mississippi, Texas.
MISSISSIPPI DISTRIBUTION: Known only from the Tombigbee drainage, where it has been found in the Buttahatchee and East Fork Tombigbee rivers and in Yellow, Pawticfaw, Bull Mountain, and Luxapallila creeks.
SIMILAR SPECIES: The absence of lateral teeth, the nearly quadrate shape, and the broadly rounded to almost square posterior margin in this species should separate it from other thin shelled species lacking lateral teeth in Mississippi.
NATURAL HISTORY:
Habitat: This species is found in sand, sand and gravel, and mud substrates in areas with moderate to no current.
Reproduction: One gravid female from the Buttahatchee River in Monroe County was 74 mm (2.9 in.) shell length and was collected in September. Haag and Warren (1997) found gravid females in March and April.
Fish hosts: *Pseudodontoides subvexus* has 10 host species in five families, eight of which occur in Mississippi. These include the Largescale Stoneroller (*Campostoma oligolepis*), Alabama Shiner (*Cyprinella callistia*), Creek Chub (*Semotilus atromaculatus*), Alabama Hog Sucker (*Hypentelium etowanum*), Blackspotted Topminnow (*Fundulus olivaceus*), Longear Sunfish (*Lepomis megalotis*), Largemouth Bass (*Micropterus salmoides*), and Blackbanded Darter (*Percina nigrofasciata*).
STATUS: MNHP: G3S2.
Most of our collection records and specimens are from Lowndes and Monroe counties, either from the Buttahatchee River or from Yellow Creek, a tributary of Luxapallila Creek. However, this species is not particularly common in any of those streams.
TAXONOMIC NOTES: This species was recently moved from the genus *Strophitus* to *Pseudodontoides* (Smith et al., 2018). Vidrine (1993) indicates a record of this species from southwest Mississippi and from the Lake Pontchartrain drainage in Louisiana, but we have no records of this species from those areas. These records may actually represent an undescribed species (Smith et al., 2018).

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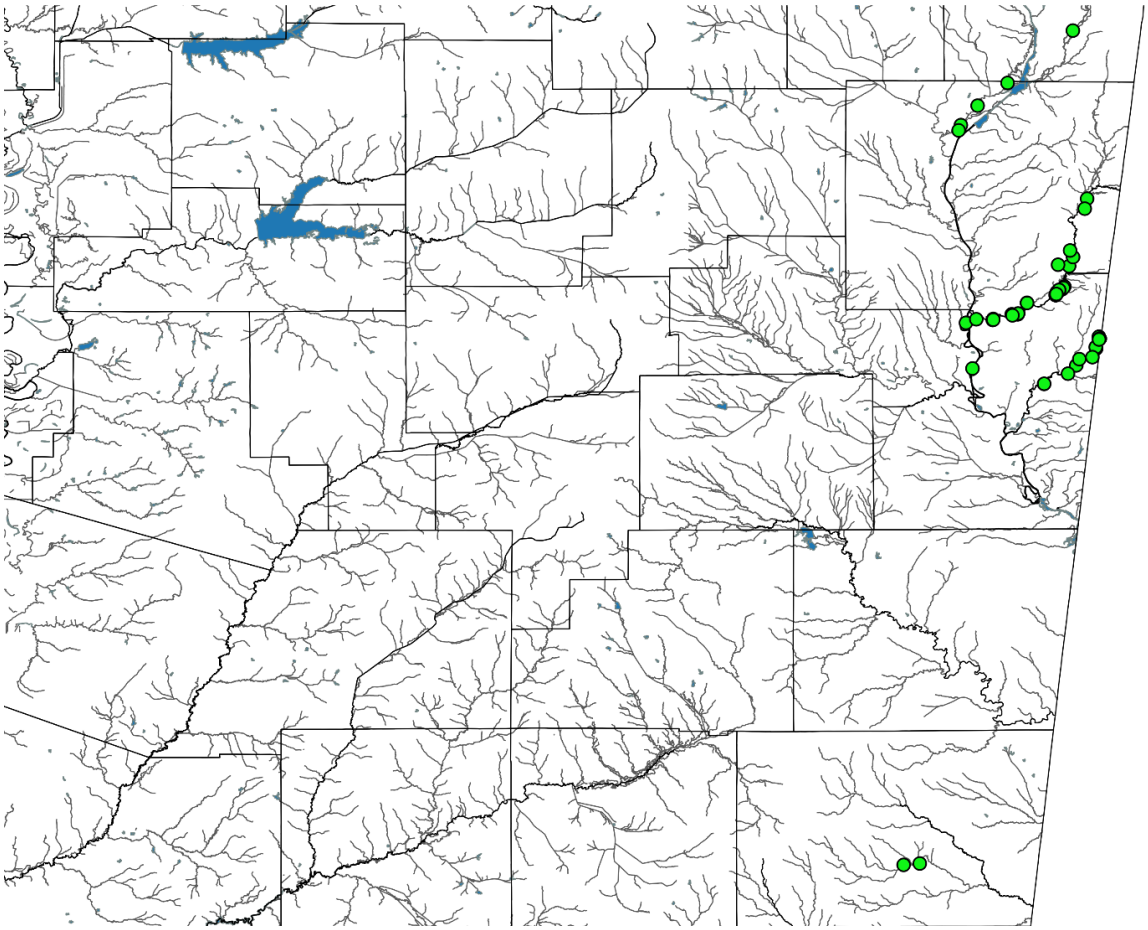

Distribution of *Pseudodontoides subvexus* in Mississippi.

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PTYCHOBRANCHUS FASCIOLARIS (RAFINESQUE, 1820)
KIDNEYSHELL

***Ptychobranchus fasciolaris* – Top: MMNS 5570, Bear Creek, Tishomingo County, 85 mm (3.3 in.). Bottom: MMNS 4745, Bear Creek, Tishomingo County, 127 mm (5.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, compressed, moderately thick. In larger specimens, the ventral edge of the shell is slightly indented at its midpoint, forming a shallow sulcus which extends toward the anterior end of the shell. Sulcus and indention are not present in smaller specimens.
Posterior ridge: Broadly rounded in larger shells, not present in smaller specimens.
Umbo: Even with or slightly above the hinge line, not prominent.
Color and pattern: Yellow to brownish- yellow. Rays usually absent, at least in most Mississippi specimens, but some individuals may have a few thin to wide rays extending from the umbo downward to the ventral margin of the shell.
Surface: Shell relatively smooth, no ornamentation; shell surface rougher in larger specimens because of elevated growth rings.
Nacre: White.
Umbo cavity: Shallow.
Teeth: Two pseudocardinals and two laterals in left valve; one pseudocardinal and one lateral in right valve. Teeth moderately thick but not massive.
Interdentum: Present and wide.
Size: Largest Mississippi specimen in MDWFP collection is 136 mm (5.4 in.) shell length.
DISTRIBUTION: New York and Pennsylvania west to Illinois, south to Mississippi, east to Georgia, north to Virginia.

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MISSISSIPPI DISTRIBUTION: Known only from Bear Creek in the Tennessee drainage, Tishomingo County.

SIMILAR SPECIES: *Ptychobranchus fasciolaris* might be confused with *Eurynia dilatata* but the periostracum in the latter is usually darker, its hinge teeth are larger, and it is more likely to have prominent rays. *Eurynia dilatata* also has a more pronounced posterior ridge, which curves toward the posterior end of the shell, and has a purple rather than a white nacre.

NATURAL HISTORY:

Habitat: This species is found in mixed sand and gravel substrates in current in Bear Creek.

Reproduction: Nothing is known about its reproduction in Mississippi. It has been reported to be gravid from August until the following summer (Williams et al., 2008).

Fish hosts: Identified hosts for this species include three species of fish from two families. Two of these species, the Rainbow Darter (*Etheostoma caeruleum*) and the Fantail Darter (*E. flabellare*), occur in Mississippi.

STATUS: MNHP: G4G5S1; MDWFP: Endangered.

This species has a very restricted range in Mississippi and only a few specimens have been found within the state. Although it was not found in the Mississippi portion of Bear Creek in 1965 (Isom and Yokley, 1968), a weathered dead specimen was reported from that area as well as from a downstream segment of the creek between 1996 and 2001 (McGregor and Garner, 2004). MDWFP biologists found several live and freshly dead specimens of this species in the Mississippi segment of Bear Creek between 1999 and 2006.

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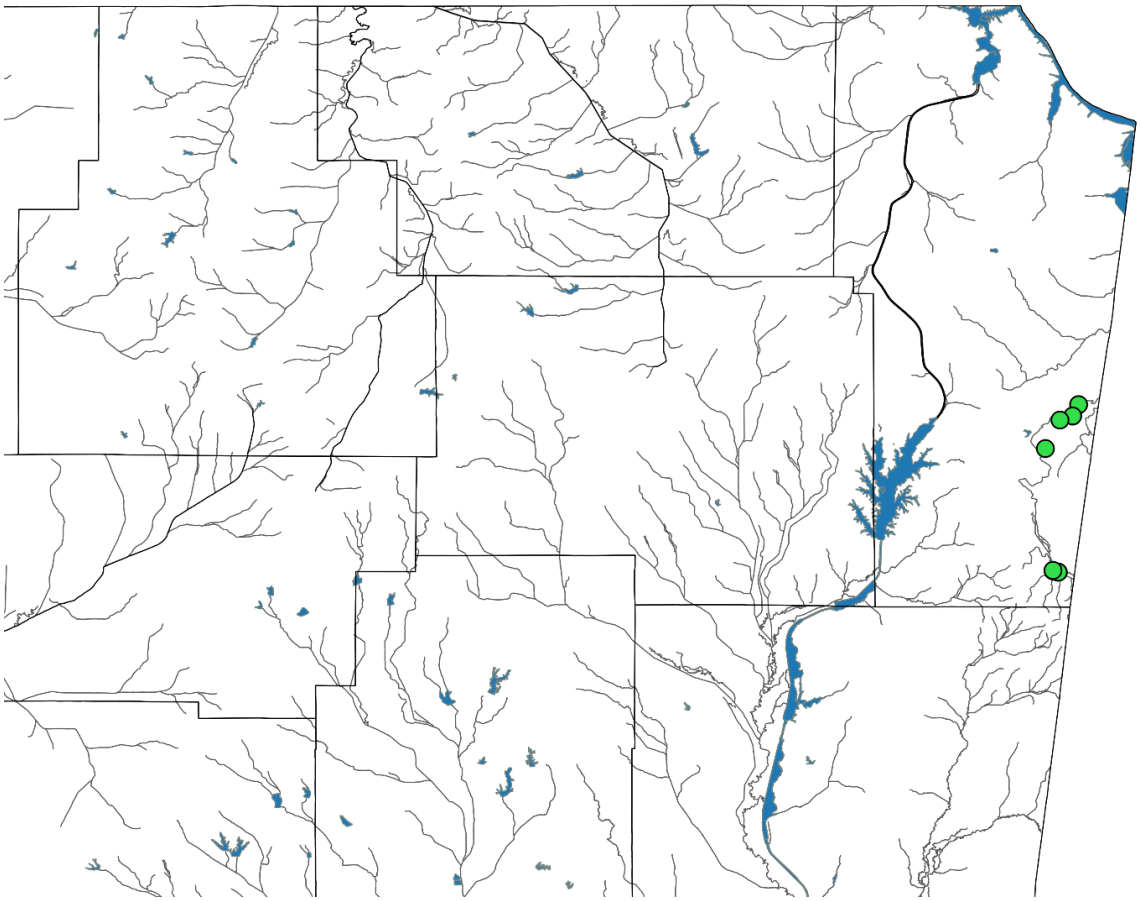

Distribution of *Ptychobranchus fasciolaris* in Mississippi.

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PYGANODON GRANDIS (SAY, 1829)
GIANT FLOATER

***Pyganodon grandis* – Top: MMNS 6010, Pascagoula River, Jackson County, 98 mm (3.9 in.). Bottom: MMNS 5904, Ditch on Morgan Brake National Wildlife Refuge, Holmes County, 124 mm (4.9 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, some smaller shells almost oval; inflated, relatively thin and fragile in smaller individuals, thicker in larger individuals but still fragile; small posterior wing, usually broken.
Posterior ridge: Absent.
Umbo: Above the hinge line, prominent, turned inward toward hinge line.
Color and pattern: Green, yellow, or greenish-yellow to almost black. Usually no rays, but some specimens have very faint, thin rays extending from the umbo to the ventral margin of the shell.
Surface: Shell relatively smooth, no ornamentation; surface roughness associated with growth lines occurs in some specimens.
Nacre: White with either a blue or yellow wash in some individuals.
Umbo cavity: Moderately deep.
Teeth: None.
Interdentum: Absent.
Size: Largest Mississippi specimen in MDWFP collection is 170 mm (6.7 in.) shell length.
DISTRIBUTION: New York and Pennsylvania west to Colorado, south to Arizona and Texas, east to Georgia and Florida.
MISSISSIPPI DISTRIBUTION: Known from all drainages in Mississippi except Coastal Rivers. Found in relatively large rivers like the Big Black and

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Homochitto, in smaller creeks, in ditches, in oxbow lakes along the Mississippi River, such as Lake Bolivar and Lake Mary, and in reservoirs such as Pickwick Lake and Ross Barnett Reservoir.

SIMILAR SPECIES: Four species in Mississippi lack hinge teeth. Two of these, *Utterbackiana suborbiculata* and *U. hartfieldorum*, are more round than elliptical and have a very broadly rounded ventral margin rather than a relatively straight or slightly rounded ventral margin as in *Pyganodon grandis*. *Utterbackia imbecillis* also has a relatively straight ventral margin but has an umbo that is even with or below the hinge line, while *P. grandis* has a prominent umbo that extends well above the hinge line.

NATURAL HISTORY:

Habitat: *Pyganodon grandis* is almost always found in soft, muddy substrates in habitats with little or no current such as ponds, ditches, oxbow lakes, or backwaters of streams.

Reproduction: Seven gravid females found in Mississippi averaged 105.9 mm (4.2 in.) shell length and ranged from 67 – 144 mm (2.6 – 5.7 in.). One of these was found in February in a pond in Hinds County, five were found in October, one from the Big Black River in Claiborne County, one from the Pascagoula River in George County, two from Pickwick Lake in Tishomingo County, and one from the Yazoo River in Yazoo County, and one was found in November in the Sunflower River in Sunflower County. **Fish hosts:** This species has 39 identified hosts from 14 families of fish and 27 of those species occur in Mississippi. This includes seven minnows (Cyprinidae), eight sunfishes (Centrarchidae), three darters (Percidae), plus the River Carpsucker (*Carpiodes carpio*), Yellow Bullhead (*Ameiurus natalis*), Golden Topminnow (*Fundulus chrysotus*), White Bass (*Morone chrysops*), Freshwater Drum *Aplodinotus grunniens*), Longnose Gar (*Lepisosteus osseus*), Gizzard Shad (*Dorosoma cepedianum*), and Skipjack Herring (*Alosa chrysochloris*).

STATUS: MNHP: G5S5.

This species is widespread and occurs in habitats that are common throughout Mississippi. We have specimens from 53 counties in the state, and the majority of our collection records are from the Yazoo drainage.

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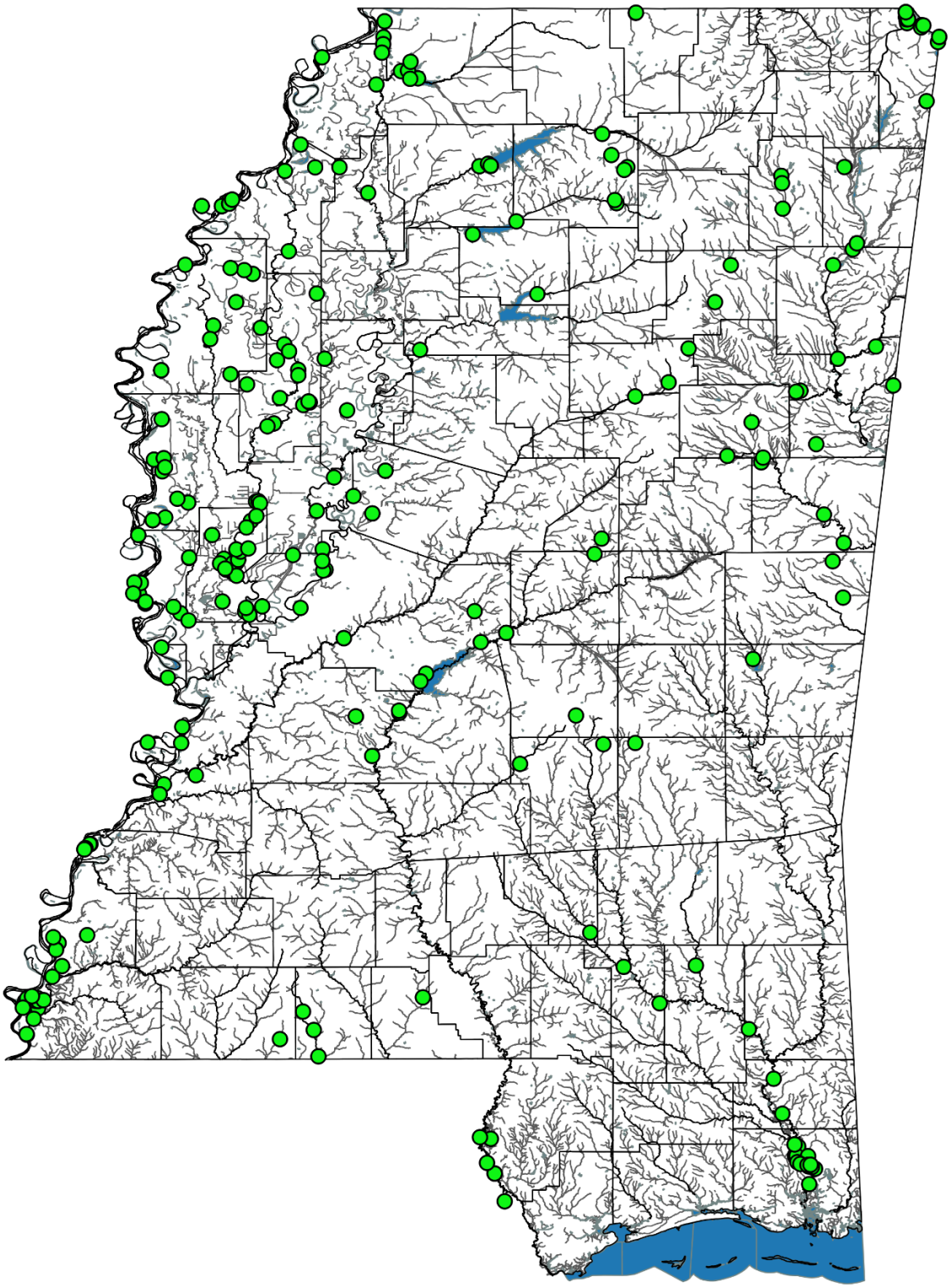

Distribution of *Pyganodon grandis* in Mississippi.

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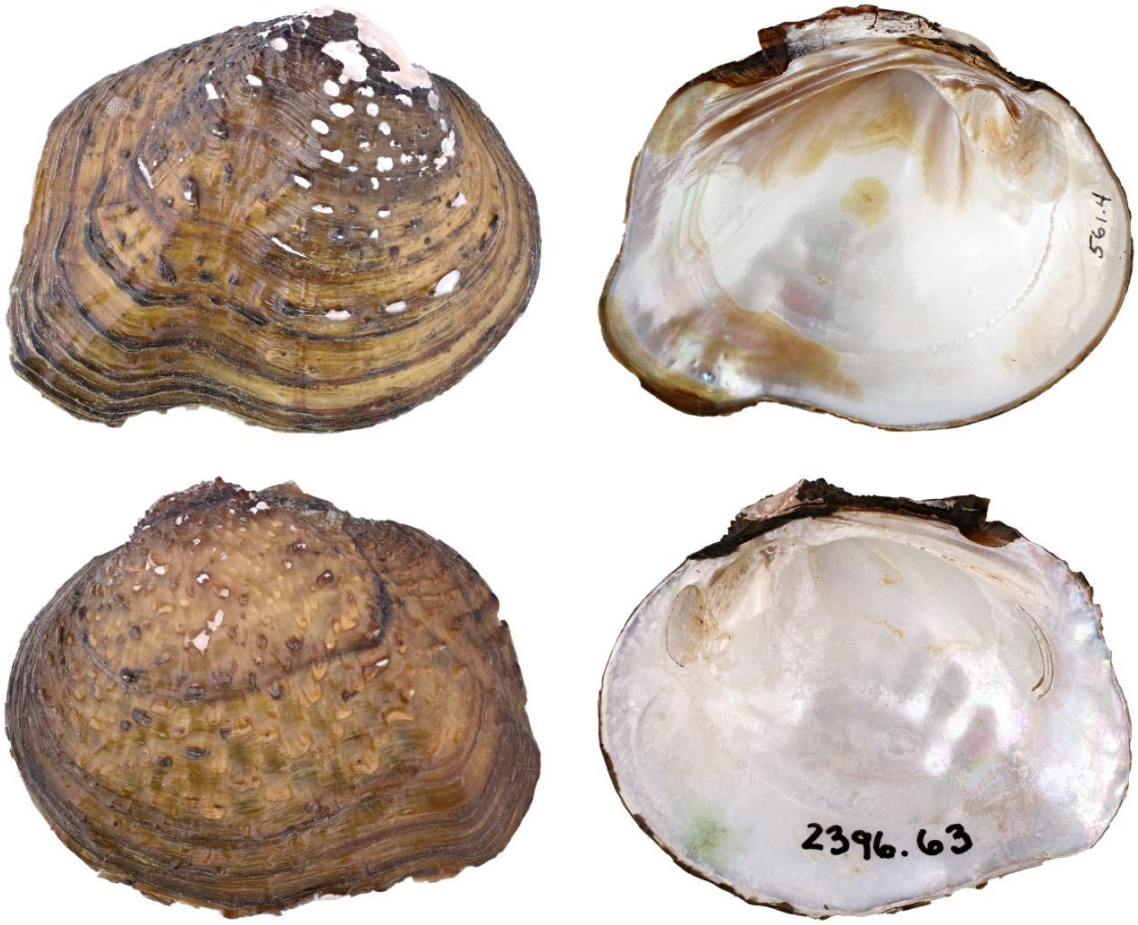
QUADRULA APICULATA (SAY, 1829)
SOUTHERN MAPLELEAF



***Quadrula apiculata* – Top: MMNS 561, Tombigbee River, Lowndes County, 91 mm (3.6 in.). Bottom: MMNS 2396, Pearl River, Pearl River County, 61 mm (2.4 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to quadrate to almost elliptical, moderately inflated to somewhat compressed, relatively thick, with a broad sulcus anterior to the posterior ridge.
Posterior ridge: Present, wide, and conspicuous, sometimes widens at the posterior terminus.
Umbo: Above hinge line, not exceptionally high nor prominent.
Color and pattern: Medium to dark brown, no rays.
Surface: Generally large numbers of small pustules in both the sulcus and on the posterior ridge; sometimes the rest of the shell has moderate numbers of pustules or is almost completely covered with pustules.
Nacre: White.
Umbo cavity: Moderately deep to deep.
Teeth: Left valve with two pseudocardinals and two laterals, right

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valve with one pseudocardinal and one lateral tooth. Teeth are relatively large. Usually the anterior most pseudocardinal in the left valve is the larger of the two.
Interdentum: Present and moderately wide.
Size: Largest Mississippi specimen in MDWFP collection is 108 mm (4.3 in.) shell length.
DISTRIBUTION: Gulf of Mexico drainages from Texas east to Alabama, introduced into the Tennessee River drainage (Parmalee and Bogan, 1998).
MISSISSIPPI DISTRIBUTION: Found in the Big Black, Mississippi River North, Mississippi River South, Pascagoula, Pearl, Tennessee, Tombigbee, and Yazoo drainages, including Pickwick Lake, a reservoir on the Tennessee River, and Lake Ferguson, a Mississippi River oxbow lake.
SIMILAR SPECIES: This species resembles *Q. quadrula*, *Q. rumphiana*, and *Q. nobilis*, and it co-occurs with all three. It can be separated from those species by the presence of numerous pustules in the sulcus, which the other species normally lack, although occasionally *Q. nobilis* may have a few pustules in the sulcus.

NATURAL HISTORY:
Habitat: The Southern Mapleleaf occurs in mud or mixtures of sand, gravel, and mud in creeks, river, reservoirs, and oxbow lakes with or without substantial current. It has also been observed in what is probably brackish water in the Mobile River delta in Alabama (Williams et al., 2008).
Reproduction: Seven gravid females, which averaged 63.3 mm (2.5 in.) shell length and ranged from 54-69 mm (2.1 - 2.7 in.) are in the MDWFP collection. Six of these were found in May in the Pearl River, two were found in July, one in the Pearl River and one in the Noxubee River.
Fish hosts: Unknown.
STATUS: MNHP: G5S5.
The Southern Mapleleaf is found rather sporadically over much of Mississippi but appears to be most abundant in the southern part of the state. We have records from 26 counties in Mississippi, with most of our collection records and specimens from the Pascagoula and Pearl drainages.
TAXONOMIC NOTES: Lopes-Lima et al., (2019), have suggested, based on genetic data, that this species is conspecific with *Quadrula quadrula* (Mapleleaf) and *Q. rumphiana* (Ridged Mapleleaf).

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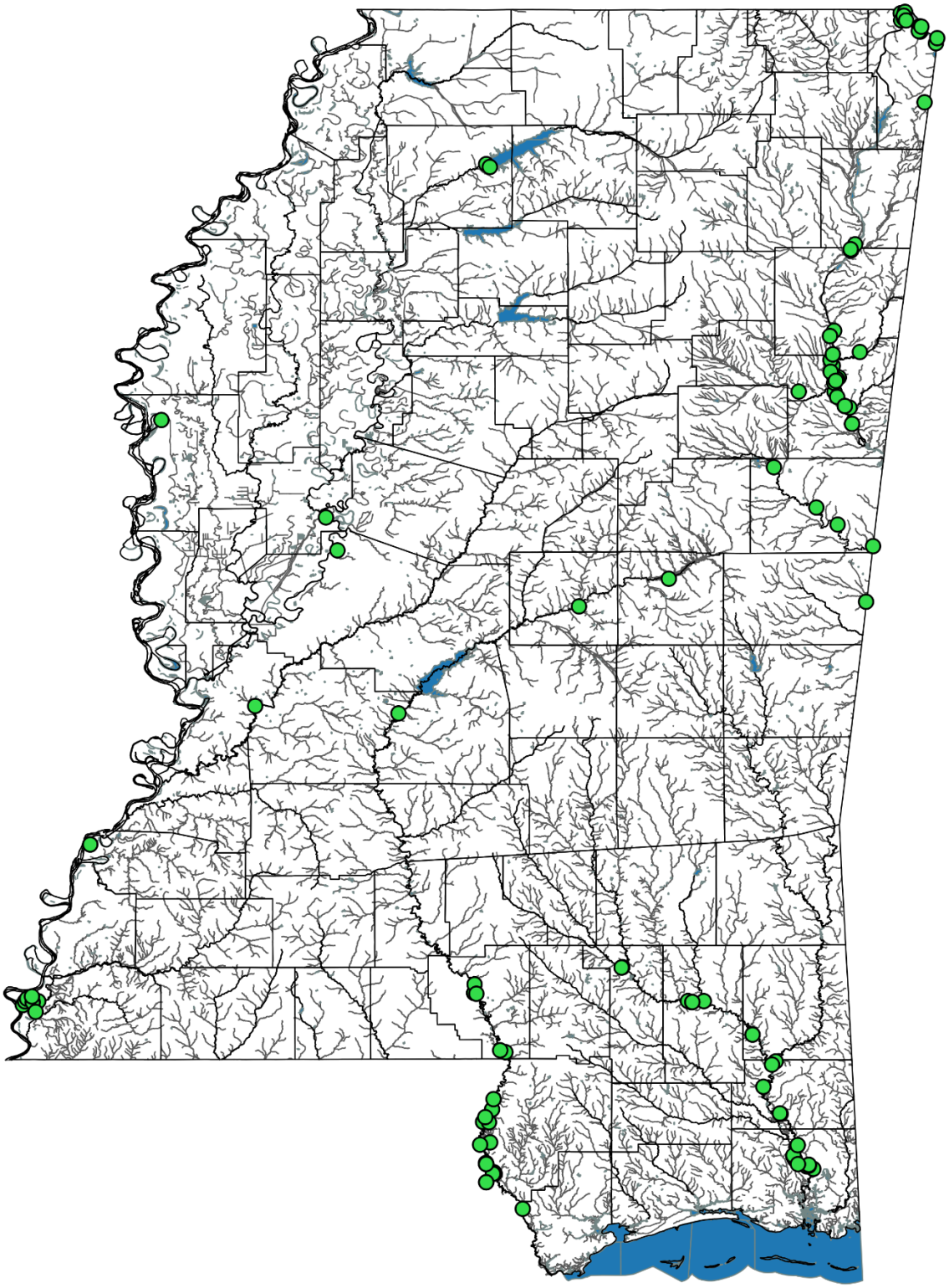

Distribution of *Quadrula apiculata* in Mississippi.

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QUADRULA NOBILIS (CONRAD, 1854)
GULF MAPLELEAF

***Quadrula nobilis* – Top: MMNS 3762, Pascagoula River, George County, 69 mm (2.7 in.). Bottom: MMNS 4039, Ross Barnett Reservoir, Madison County, 55 mm (2.2 in.).**

SHELL CHARACTERISTICS:

Shape and structure: Shell rhomboidal to oval to quadrate; a sulcus, which may contain a few pustules, anterior to the posterior ridge.

Posterior ridge: Prominent.

Umbo: Above hinge line but relatively low.

Color and pattern: Dark brown with a chestnut hue, no rays.

Surface: Pustules may be sparsely distributed on the shell or may cover much of its surface, and occasionally there may be small corrugations on the posterior slope. There are usually two rows of pustules, one row on either side of a sulcus anterior to the posterior ridge, extending from the umbo to the ventral edge of the shell. These rows may be complete or present only near the umbo.

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Nacre: White with a silvery hue.
Umbo cavity: Moderately deep.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth relatively large. Usually the anterior most pseudocardinal in the left valve is the larger of the two.
Interdentum: Present, narrow to wide.
Size: Largest Mississippi specimen in MDWFP collection is 88 mm (3.5 in.) shell length.
DISTRIBUTION: Gulf of Mexico drainages from Texas east to Alabama (Howells et al., 1996); may have been introduced into the Tennessee River drainage (Williams et al., 2008).
MISSISSIPPI DISTRIBUTION: Found in the Pearl, Pascagoula, and Tombigbee drainages, where it occurs in the Leaf, Chickasawhay, Pascagoula, Pearl, and East Fork Tombigbee rivers.
SIMILAR SPECIES: *Quadrula nobilis* tends to be more quadrate than *Q. apiculata* or *Q. rumphiana.* Additionally, the Gulf Mapleleaf often has pustules along the posterior ridge, which *Q. rumphiana* usually lacks, and many fewer pustules in its sulcus than occurs in *Q. apiculata*.
NATURAL HISTORY:
Habitat: This species occurs in larger rivers in sand, gravel, and mud substrates, generally in current.
Reproduction: Nothing is known about reproduction of this species in Mississippi. It is apparently gravid in spring and summer (Williams et al., 2008).
Fish hosts: The only known hosts for this species are the Channel Catfish (*Ictalurus punctatus*) and Flathead Catfish (*Pylodictis olivaris*).
STATUS: MNHP: G4S3.
This species is not particularly common in Mississippi. Although we have records from 12 counties in the state, the majority of our specimens are from the Pascagoula River in Jackson County.
TAXONOMIC NOTES: Lopes-Lima et al. (2019) have suggested, based on genetic data, that this species should be placed in the genus *Tritogonia*.

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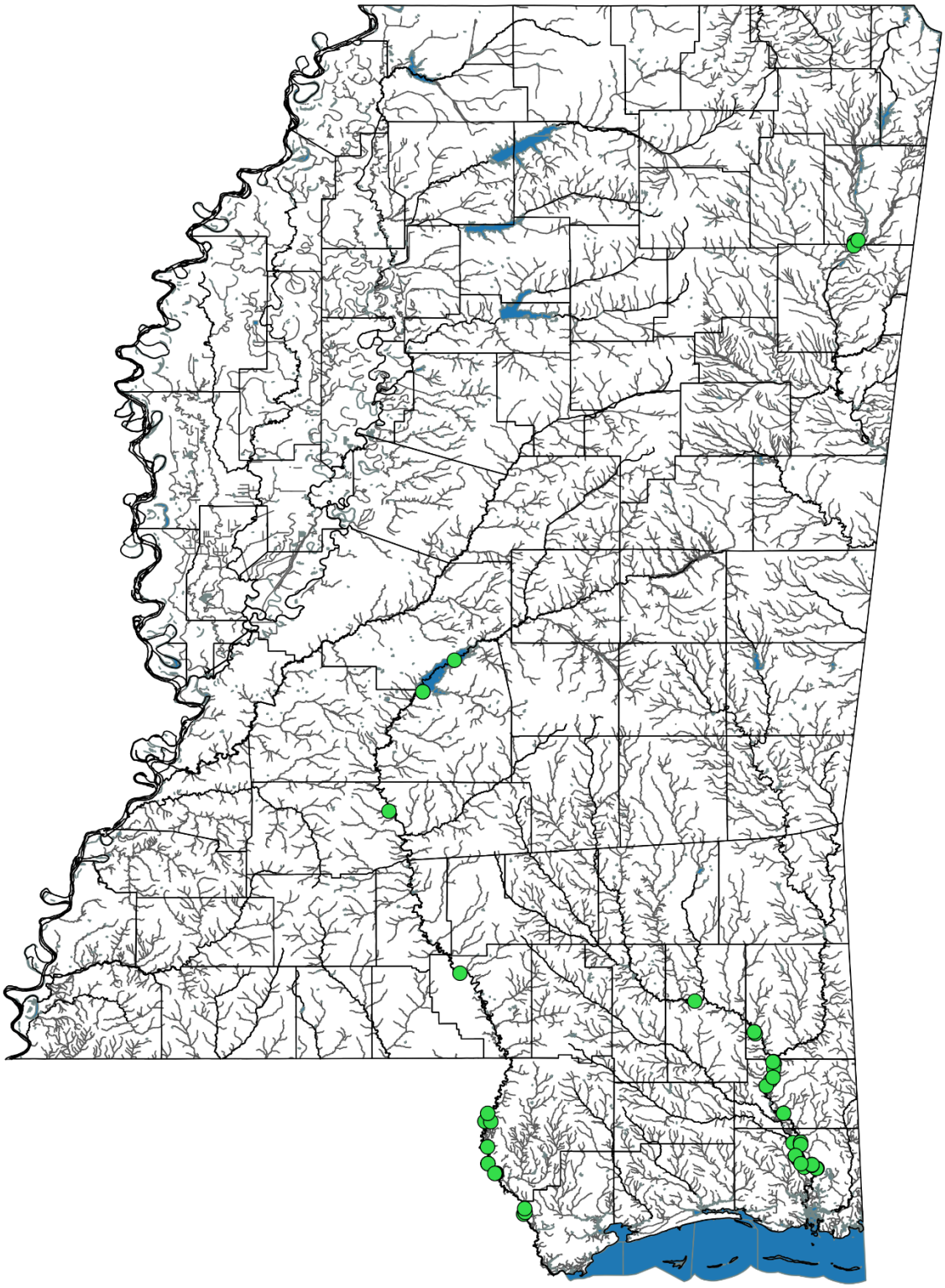

Distribution of *Quadrula nobilis* in Mississippi.

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QUADRULA QUADRULA (RAFINESQUE, 1820)
MAPLELEAF

***Quadrula quadrula* – Top: MMNS 3809, Gilliam Chute, Jefferson County, 61 mm (2.4 in.). Bottom: MMNS 4124, Yellow Creek Embayment, Tishomingo County, 77 mm (3.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell rhomboidal to oval to triangular; wide, deep to shallow sulcus anterior to the posterior ridge.
Posterior ridge: Prominent.
Umbo: Above hinge line, prominent, turned inward toward center line.
Color and pattern: Brown to yellow brown; occasionally with one to as many as six relatively wide green rays anterior to the sulcus.
Surface: Usually two rows of elongated pustules on either side of the sulcus, with scattered to numerous pustules on the

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rest of the shell surface; usually no pustules in the sulcus.
Nacre: White
Umbo cavity: Deep.
Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth relatively large. Usually the anterior most pseudocardinal in the left valve is the larger of the two.
Interdentum: Present, relatively wide.
Size: Largest Mississippi specimen in MDWFP collection has a shell length of 105 mm (4.1 in.).
DISTRIBUTION: Widespread from the Great Lakes basin south to Louisiana and Texas, east to Pennsylvania, and west to Nebraska.
MISSISSIPPI DISTRIBUTION: Found in the Big Black, Mississippi River North, Mississippi River South, Tennessee, and Yazoo drainages, where it has been collected in a variety of water bodies including the Big Black River, Mississippi River, Homochitto River, Gilliam Chute, Coldwater River, Little Tallahatchie River, Sunflower River, Pickwick Lake, Lake Washington, and Wolf Lake.
SIMILAR SPECIES: *Quadrula quadrula* resembles *Q. apiculata*, but the latter usually has pustules in the sulcus that *Q. quadrula* lacks. It differs from *Q. rumphiana*, which usually lacks pustules on the posterior ridge, and from *Q. nobilis*, which is usually more quadrate, has a darker, more chestnut-colored periostracum, and usually has at least a few pustules in the sulcus.

NATURAL HISTORY:
Habitat: This species occurs in rivers, creeks, oxbow lakes, and reservoirs in substrates of gravel, sand, and mud, and in areas with and without currents.
Reproduction: Five gravid female *Q. quadrula* from Mississippi in the MDWFP collection averaged 80.6 mm (3.2 in.) shell length and ranged from 55 – 93 mm (2.2 – 3.7 in.). Four of the five females were collected in June: one from Tchula Lake in Holmes County, two from the Sunflower River in Sunflower County, and one from the Little Tallahatchie River in Leflore County; and one gravid female was collected in Porter Bayou, Sunflower County, in November.
Fish hosts: The Flathead Catfish (*Pylodictis olivaris*), Channel Catfish (*Ictalurus punctatus*), and Yellow Bullhead (*Ameiurus natalis*) have been reported as hosts for this species.
STATUS: MNHP: G5S5.
This species, although not particularly widespread in Mississippi, is relatively abundant where it does occur. We have records from 26 counties in the state, but most of our collection records and specimens are from the Yazoo and Sunflower rivers in the Yazoo drainage.
TAXONOMIC NOTES: Lopes-Lima et al. (2019) have suggested, based on genetic data, that his species is conspecific with *Quadrula apiculata* (Southern Mapleleaf) and *Q. rumphiana* (Ridged Mapleleaf).

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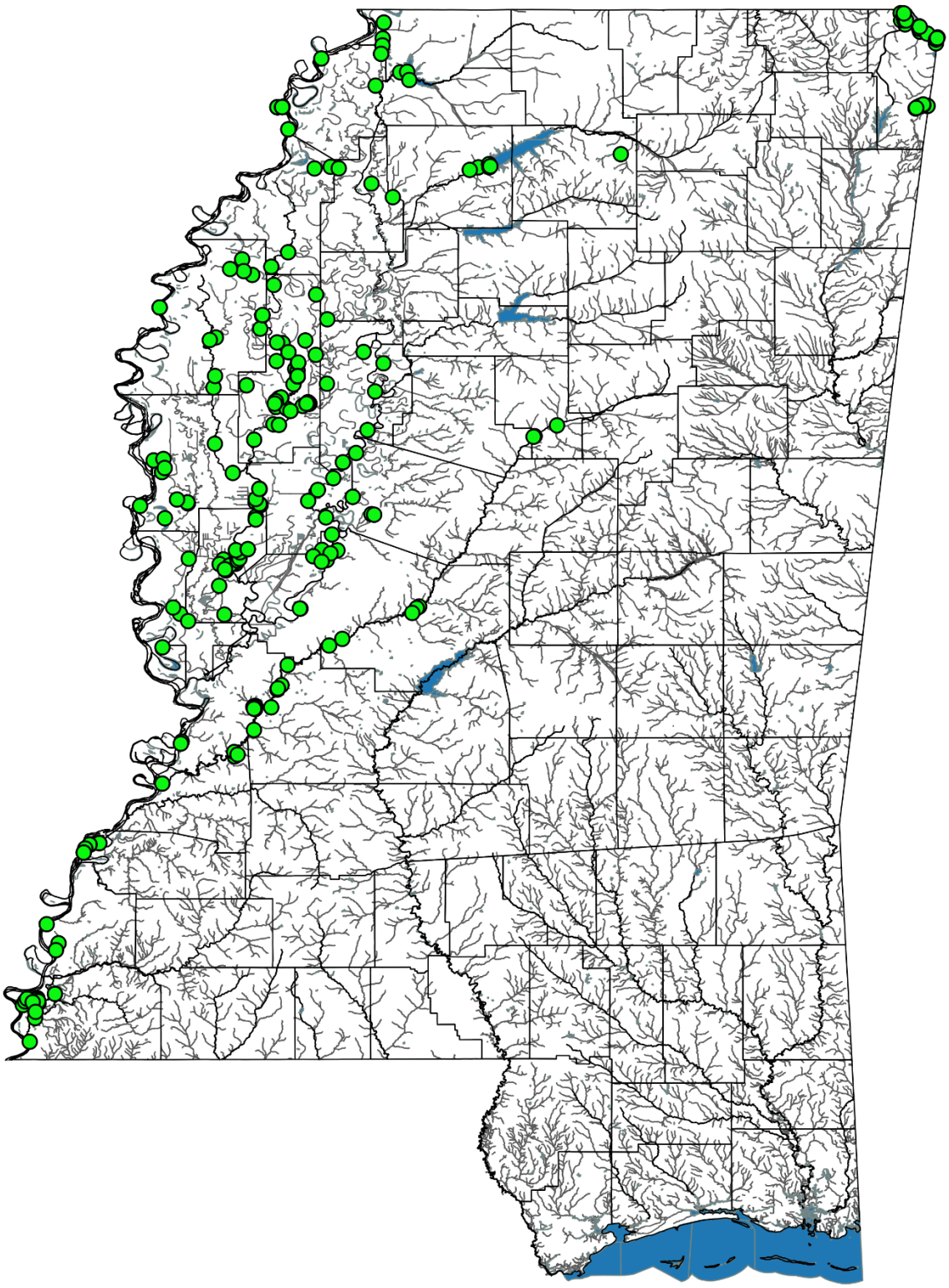

Distribution of *Quadrula quadrula* in Mississippi.

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QUADRULA RUMPHIANA (LEA, 1852)
RIDGED MAPLELEAF

***Quadrula rumphiana* – Top: MMNS 2077, Buttahatchee River, Monroe County, 40 mm (1.6 in.). Bottom: MMNS 711, Tibbee Creek, Clay County, 73 mm (2.9 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell round to oval to almost quadrate, moderately inflated, relatively thick; shallow sulcus anterior to the posterior ridge.
Posterior ridge: Prominent, fairly wide.
Umbo: Above hinge line, prominent, turned inward toward center line.
Color and pattern: Dark to light brown, no rays.
Surface: Sparsely to heavily covered by pustules, but usually none on the posterior ridge.
Nacre: White
Umbo cavity: Deep.

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Teeth: Left valve with two pseudocardinals and two laterals, right valve with one pseudocardinal and one lateral tooth. Teeth relatively large.
Interdentum: Present, usually wide.
Size: Largest Mississippi specimen in MDWFP collection has a shell length of 104 mm (4.1 in.).
DISTRIBUTION: Georgia, Alabama, and Mississippi.
MISSISSIPPI DISTRIBUTION: Occurs in the Tombigbee drainage in Mississippi including the East Fork Tombigbee River, Buttahatchee River, Luxapallila Creek, Oktoc Creek, and Tibbee Creek.
SIMILAR SPECIES: *Quadrula rumphiana* resembles *Q. apiculata*, *Q. quadrula*, and *Q. nobilis* but differs from those species because it lacks pustules on the posterior ridge.
NATURAL HISTORY:
Habitat: This species occurs in gravel and mixed sand and gravel substrates in current in both large creeks and small rivers.
Reproduction: Nothing is known about its reproduction in Mississippi. It is presumed to be gravid in spring and summer (Williams et al., 2008).
Fish hosts: Unknown.
STATUS: MNHP: G4S2.
We have specimens of this species from six Mississippi counties, but most of our collection records and specimens are from the East Fork Tombigbee and Buttahatchee rivers. This species seems to have declined in those two rivers over the last approximately 25 years.
TAXONOMIC NOTES: Lopes-Lima et al. (2019) have suggested, based on genetic data, that this species is conspecific with both *Quadrula apiculata* (Southern Mapleleaf) and *Q. quadrula* (Mapleleaf).

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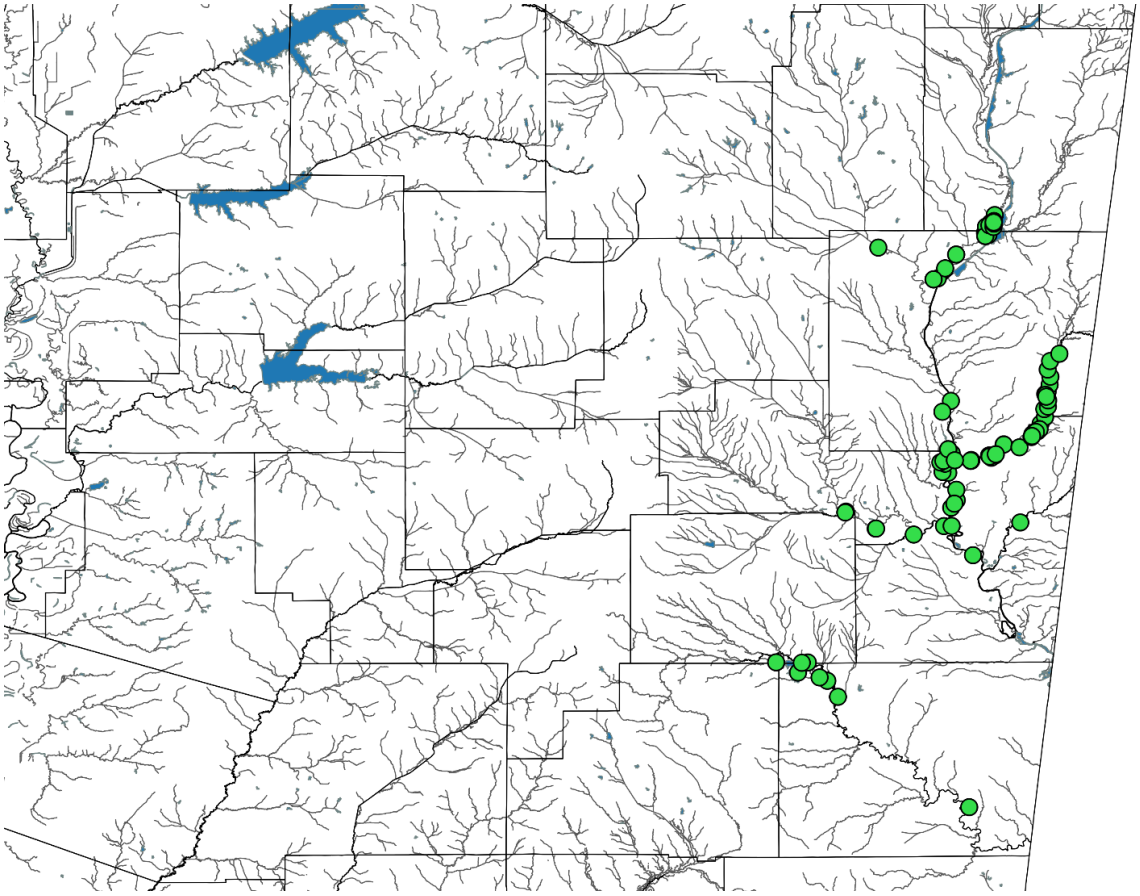

Distribution of *Quadrula rumphiana* in Mississippi.

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REGINAIA EBENUS (LEA, 1831)
EBONYSHELL

***Reginaia ebenus* – Top: MMNS 1671, Chickasawhay River, George County, 75 mm (3.0 in.). Bottom: MMNS 4659, East Fork Tombigbee River, Itawamba County, 100 mm (3.9 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to round, moderately inflated, thick, and heavy. Shells from the Tombigbee drainage are more oval and larger than those from the Pearl drainage.
Posterior ridge: Most specimens lack a posterior ridge, but a few have a very broadly rounded ridge.
Umbo: Above hinge line and prominent.
Color and pattern: Dark chestnut to almost black; lighter specimens sometime have dark pigment along the growth lines, no rays.
Surface: Shell smooth, no ornamentation. Larger specimens have a coarse, cloth-like periostracum.
Nacre: White
Umbo cavity: Very deep.
Teeth: Left valve with two pseudocardinals and two laterals, right

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valve with one pseudocardinal and one lateral tooth. Teeth large, wide, and thick.

Interdentum: Very wide.

Size: Largest Mississippi specimen in MDWFP collection has a shell length of 114 mm (4.5 in.).

DISTRIBUTION: Minnesota east to Ohio, south to Alabama and Mississippi, west to Louisiana.

MISSISSIPPI DISTRIBUTION: Occurs in the Pascagoula, Big Black, Pearl, Mississippi River North, Mississippi River South, Tennessee, Yazoo, and Tombigbee drainages, where it is found in the Big Black, Mississippi, Homochitto, Chickasawhay, Leaf, Pascagoula, Pearl, Strong, Buttahatchee, Noxubee, Tombigbee, and Tallahatchie rivers as well as Pickwick Lake (Tennessee River) and a few larger creeks and canals.

SIMILAR SPECIES: *Reginaia ebenus* co-occurs with two species, *Fusconaia cerina* and *F. flava* and both might be mistaken for it. However, both have a prominent and relatively sharp posterior ridge which *R. ebenus* lacks. The Ebonyshell also resembles some species of *Pleurobema*, but the latter usually have shallow umbo cavities while *Reginaia* has a much deeper cavity.

NATURAL HISTORY:

Habitat: This species occurs in gravel, sand, and clay, usually in current but also in some water bodies without current.

Reproduction: Four gravid specimens from Mississippi in the MDWFP collection averaged 67.3 mm (2.7 in.) in shell length and ranged from 59 – 75 mm (2.3 – 3.0 in.) One of these was found in the Tombigbee River in Monroe County in May, and three were found in the Pearl River in Hinds County: one in April, one in June, and one in July.

Fish hosts: Identified hosts include Black Crappie (*Pomoxis nigromaculatus*), White Crappie (*P. annularis*), Largemouth Bass (*Micropterus salmoides*), Goldeye (*Hiodon alosoides*), and Skipjack Herring (*Alosa chrysochloris*).

STATUS: MNHP: G4G5S4.

We have records of this species from 34 counties in Mississippi, but most of our collection records and specimens are from the Pearl and Tombigbee rivers.

TAXONOMIC NOTES: This species was formerly in the genus *Fusconaia* but has now been placed in the genus *Reginaia* (Williams et al. 2017).

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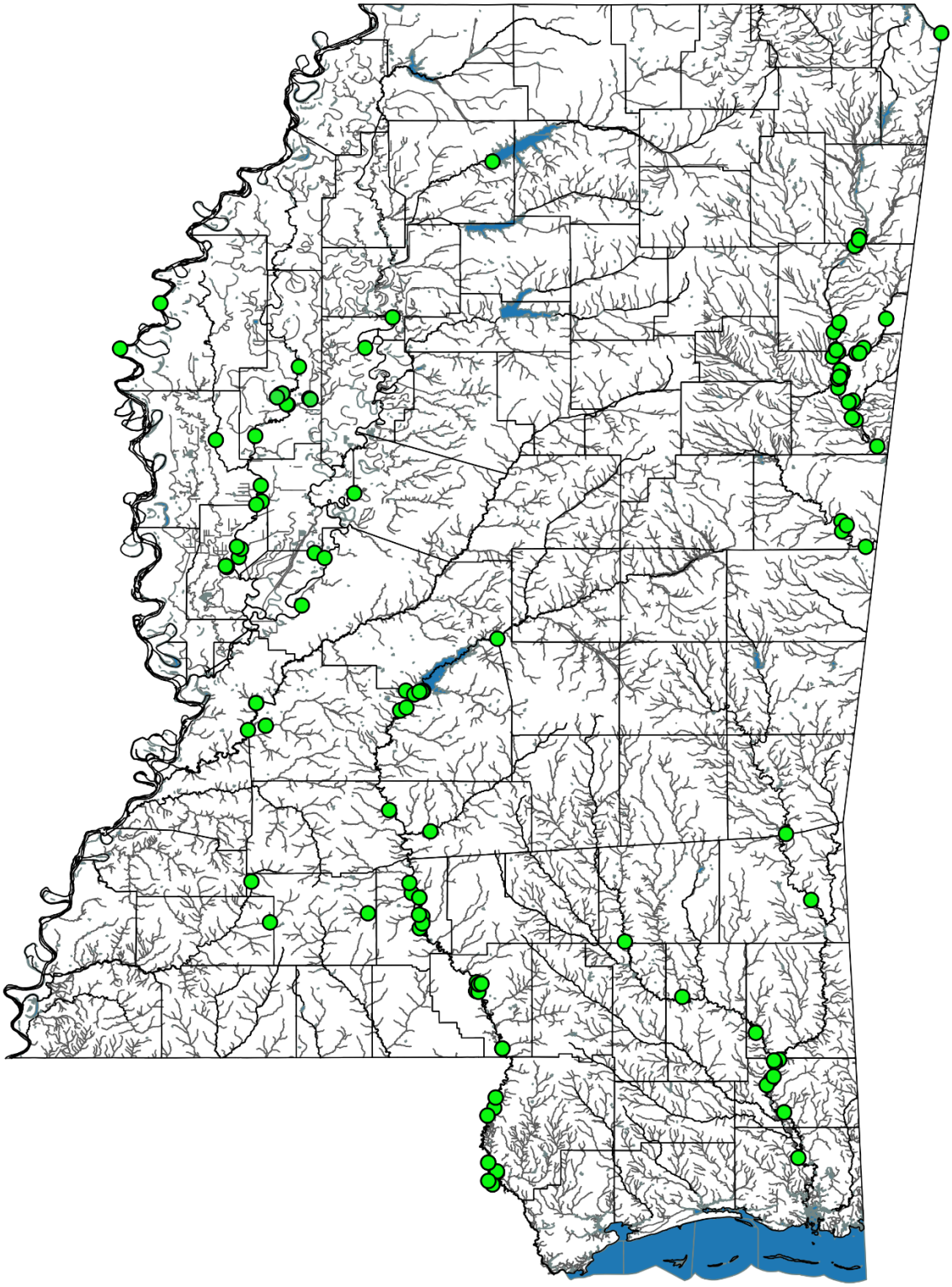

Distribution of *Reginaia ebenus* in Mississippi.

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STROPHITUS PASCAGOULAENSIS SMITH, JOHNSON, PFEIFFER, AND GANGLOFF, 2018
PASCAGOULA CREEKSHELL

***Strophitus pascagoulaensis* – Top: MMNS 2377, Howards Creek, Rankin County, 80 mm (3.2 in.). Bottom: MMNS 10090, Buckatunna Creek, Clarke County, 37 mm (1.4 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, moderately inflated, thin. Posterior slope modestly developed. Dorsal margin nearly straight.
Posterior ridge: Broadly rounded.
Umbo: Slightly above hinge line, not prominent.
Color and pattern: Shell yellowish to greenish to dark brown; rays present, narrow to broad, usually at least some broad rays present. Some rays may be obscured by dark ground color but others are prominent. Sometimes dark bands associated with growth rings are present.
Surface: Shell relatively smooth, no ornamentation; shiny.
Nacre: White, sometimes with a faint blue wash.
Umbo cavity: Shallow and wide.
Teeth: One pseudocardinal in the left valve, one in the right. No lateral teeth. Pseudocardinals are small, insignificant, and appear to be swellings on the hinge line.
Interdentum: Absent.
Size: Largest Mississippi specimen in the MDWFP collection is 78 mm (3.2 in.) long.
DISTRIBUTION: Mississippi, Louisiana, and perhaps Alabama.
MISSISSIPPI DISTRIBUTION: This species occurs in the Pascagoula, Pearl, and

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Lake Pontchartrain drainages (Smith et al., 2018).

SIMILAR SPECIES: Four species in Mississippi have pseudocardinal teeth but lack lateral teeth. *Pseudodontoides subvexus* differs from *S. pascagoulaensis* by having a nearly quadrate shape, a broadly rounded to almost square posterior margin, a wide posterior slope, and a posterior dorsal margin level with or higher than the umbo. *Strophitus pascagoulaensis* is virtually identical to *S. radiatus* (Smith et al., 2018). Identification of these two species is best done by locality, as the latter is restricted to the Tombigbee and Yazoo drainages in Mississippi and does not overlap geographically with *S. pascagoulaensis* (Smith et al., 2018). A species very similar to *S. pascagoulaensis* is *S. undulatus*. The latter differs from *S. pascagoulaensis* in the following ways (based on Williams et al., 2008): the dorsal margin of *S. undulatus* is sinuous while that of *S. pascagoulaensis* is straight; the posterior slope of *S. undulatus* is moderately steep while that of *S. pascagoulaensis* is low and relatively flat; the umbo of *S. undulatus*, although not prominent, is elevated above the hinge line while that of *S. pascagoulaensis* is elevated just slightly above the hinge line; and the umbo cavity in *S. undulatus* is moderately deep while that of *S. pascagoulaensis* is wide and very shallow. Even though these characters are useful in separating the two species, in some cases it is very difficult to differentiate them.

NATURAL HISTORY:

Habitat: *Strophitus pascagoulaensis* is a species of relatively smaller rivers and creeks where it occurs in sandy – gravel substrates in current.

Reproduction: A single female of this species, shell length 75 mm (2.9 in.) in the MDWFP collection, was found in August in the West Fork Amite River in Amite County, Lake Pontchartrain drainage.

Fish hosts: Unknown.

STATUS: MNHP: Not ranked. *Strophitus pascagoulaensis* is a recently described species and although it appears to be relatively uncommon, not enough information is available to give it a formal rank.

TAXONOMIC NOTES: This species was described by Smith et al (2018) using a combination of morphology and genetics. Specimens within the range of this species were originally identified as *Anodontoides radiatus*. In their study, Smith et al. (2018) indicated that populations in the Pearl and Lake Pontchartrain drainages in Mississippi and Louisiana might be a species different from *S. pascagoulaensis*. However, until the taxonomic status of those populations is resolved, specimens from both the Pearl and Lake Pontchartrain drainages in Mississippi are best considered to be *S. pascagoulaensis*.

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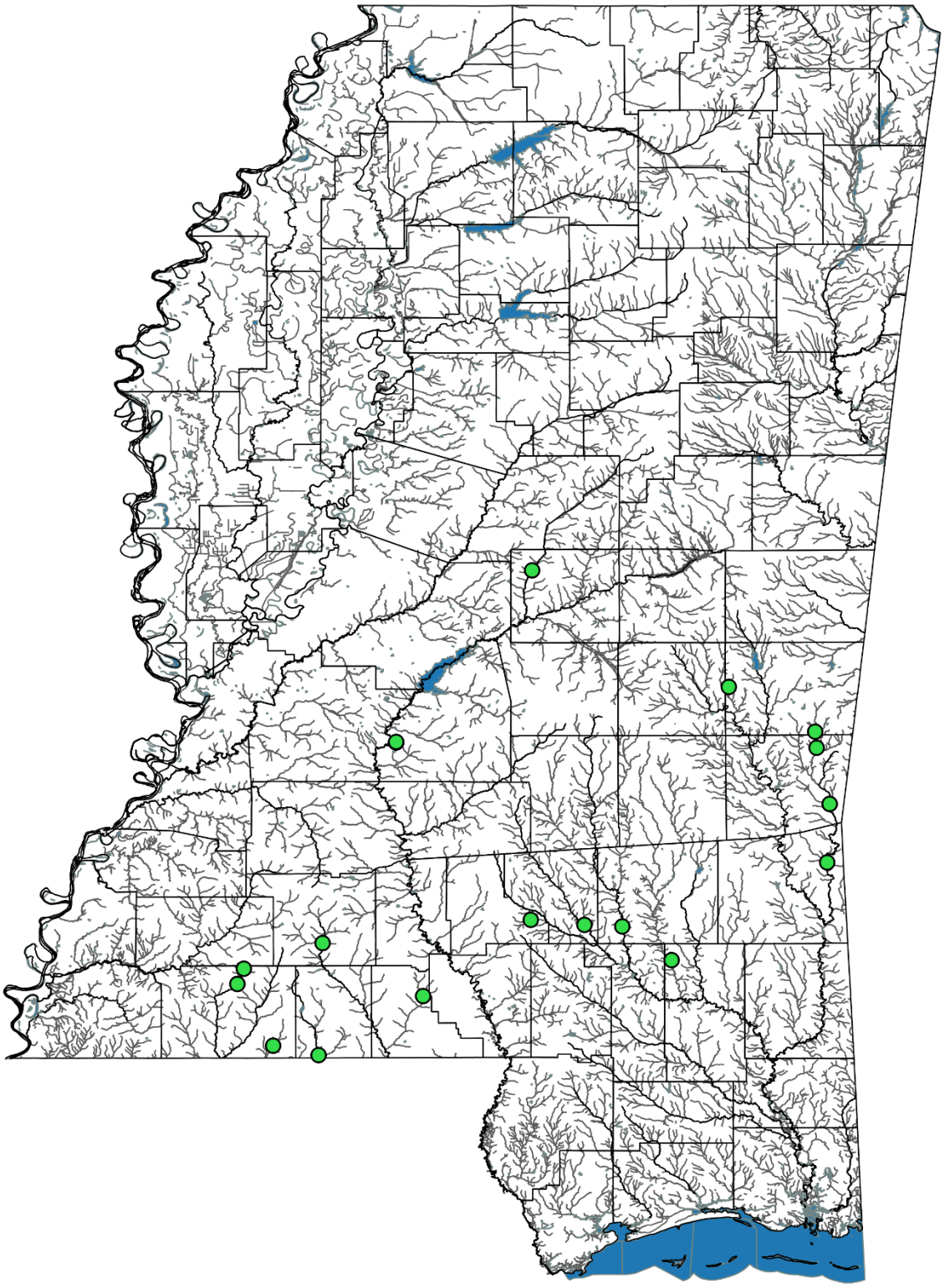

Distribution of *Strophitus pascagoulaensis* in Mississippi.

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STROPHITUS RADIATUS (CONRAD, 1834)
RAYED CREEKSHELL

***Strophitus radiatus* – Top: MMNS 8909, Boughenia Creek, Oktibbeha County, 60 mm (2.4 in.). Bottom: MMNS 7769, Alamucha Creek, Lauderdale County, 57 mm (2.2 in.).**

DESCRIPTION:
Shape and structure: Shell elliptical, moderately inflated, very thin. Posterior slope relatively low, slopes gradually toward posterior end of shell.
Posterior ridge: Broadly rounded.
Umbo: Slightly above the hinge line, not prominent, turned inward toward hinge line.
Color and pattern: Shell is yellowish to greenish to dark brown; rays present, narrow to broad, usually at least some broad rays present. Some rays may be obscured by dark ground color but others can be prominent. Sometimes dark bands are present which are associated with growth rings.
Surface: Shell relatively smooth, no ornamentation; shiny.
Nacre: White, sometimes with a faint blue wash.
Umbo cavity: Shallow to very shallow, wide.
Teeth: One pseudocardinal in the left valve, one in the right. No lateral teeth. Pseudocardinals are small, insignificant, appear to be swellings on the hinge line.
Interdentum: Absent.
Size: Largest Mississippi specimen in the MDWFP collection has a shell length of 85 mm (3.3 in.).
DISTRIBUTION: Alabama, Mississippi, and Georgia (Smith et al., 2018).
MISSISSIPPI DISTRIBUTION: This species occurs in the Big Black, Mississippi

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River South, Tombigbee, and Yazoo drainages.

SIMILAR SPECIES: Four species in Mississippi have pseudocardinal teeth but lack lateral teeth. *Pseudodontoides subvexus* differs from *S. radiatus* by having a nearly quadrate shape, a broadly rounded to almost square posterior margin, a wide posterior slope, and a posterior dorsal margin level with or higher than the umbo. *Strophitus pascagoulaensis*, a recently described species of the Pascagoula drainage, is morphologically virtually identical to *S. radiatus* (Smith et al., 2018). Identification of these two species is best done by locality. These two species do not overlap geographically, as *S. pascagoulaensis* occurs in the Pearl, Pascagoula, and Lake Pontchartrain drainages in Mississippi and *S. radiatus* occurs in the Tombigbee, Big Black, Mississippi River South, and Yazoo drainages. The species most similar to *S. radiatus* is *S. undulatus.* The latter differs from S. radiatus in the following ways (based on Williams et al., 2008): (1) the dorsal margin of *S. undulatus* is sinuous while that of *S. radiatus* is straight; (2) the posterior slope of *S. undulatus* is moderately steep while that of *S. radiatus* is low and relatively flat; (3) the umbo of *S. undulatus*, although not prominent, is elevated above the hinge line while that of *S. radiatus* is elevated just slightly above the hinge line; and (4) the umbo cavity in *S. undulatus* is moderately deep while that of *S. radiatus* is wide and very shallow. Even though these characters are useful in separating the two species, in some cases it is very difficult to differentiate them.

NATURAL HISTORY:

Habitat: *Strophitus radiatus* is a species of relatively smaller rivers and creeks where it occurs in sandy – gravel substrates in current.

Reproduction: A gravid female from Webster County, Mississippi was 53 mm (2.1 in.) shell length and was collected in May from Sand Creek in the Big Black drainage. Little else is known about reproduction in this species.

Fish hosts: Unknown.

STATUS: MNHP: G3S3.

Although we have records from 16 Mississippi counties, this species is relatively uncommon in the state, with only one or two specimen records from any particular stream.

TAXONOMIC NOTES: This species was formerly in the genus *Anodontoides* until Smith et al (2018), using a combination of morphology and genetics, moved it to *Strophitus*.

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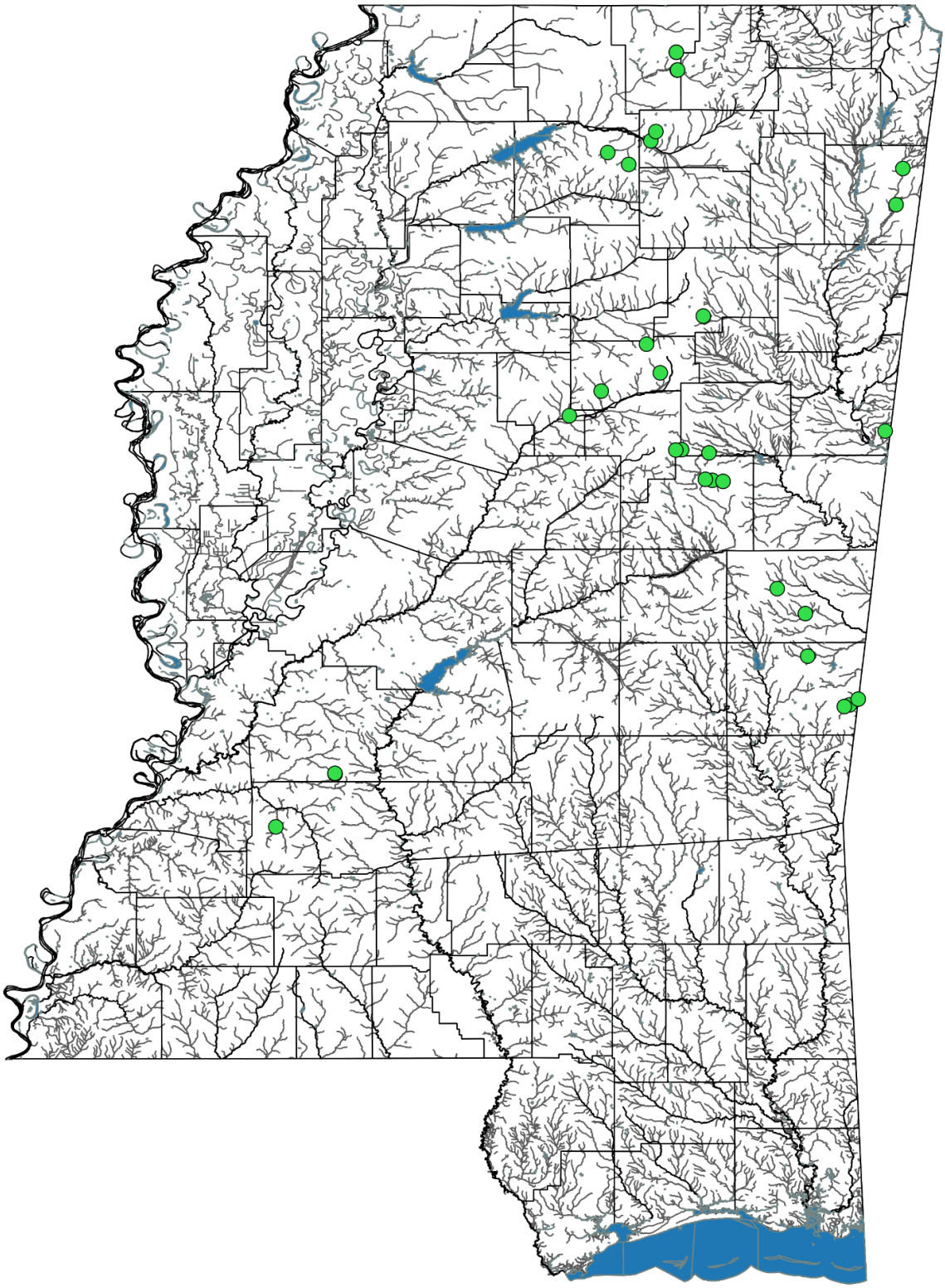

Distribution of *Strophitus radiatus* in Mississippi.

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STROPHITUS UNDULATUS (SAY, 1817)
CREEPER

***Strophitus undulatus* – Top: MMNS 5314, Sunflower River, Coahoma County, 92 mm (3.6 in.). Bottom: MMNS 9729, Duck River, Maury County, Tennessee, 103 mm (4.1 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to elliptical, thin in smaller shells and thicker in larger ones, inflated to compressed.
Posterior ridge: Rounded, not sharp, but apparent.
Umbo: Above the hinge line, relatively prominent, turned inward toward hinge line.
Color and pattern: Light to dark brown, usually without rays but some individuals may have either very faint rays or somewhat prominent rays.
Surface: Shell relatively smooth, no sculpturing.
Nacre: White with a yellowish or bluish wash.
Umbo cavity: Moderately deep.
Teeth: One pseudocardinal in the left valve, one in the right. No lateral teeth. Pseudocardinals are small, insignificant, appear to be swellings on the hinge line.
Interdentum: Absent.
Size: Largest Mississippi specimen in MDWFP collection has a shell length of 93 mm (3.7 in.).
DISTRIBUTION: New York, Rhode Island, and Connecticut west to North Dakota and Minnesota, south to Texas and Louisiana, east to North and South Carolina.

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MISSISSIPPI DISTRIBUTION: This species occurs in the Big Black, Mississippi River North, Mississippi River South, Tennessee, and Yazoo drainages.

SIMILAR SPECIES: Four species in Mississippi have pseudocardinal teeth but lack lateral teeth. *Pseudodontoides subvexus* differs from *S. undulatus* by having a nearly quadrate shape, a broadly rounded to almost square posterior margin, a wide posterior slope, and a posterior dorsal margin level with or higher than the umbo. *Strophitus pascagoulaensis*, a recently described species of the Pascagoula drainage, (Smith et al., 2018) is very similar to both *S. radiatus* and *S. undulatus*, but does not occur in the same drainages as *S. undulatus*. The species most similar to *S. radiatus* is *S. undulatus*. The latter differs from *S. radiatus* in the following ways (based on Williams et al., 2008): (1) the dorsal margin of *S. undulatus* is sinuous while that of *S. radiatus* is straight; (2) the posterior slope of *S. undulatus* is moderately steep while that of *S. radiatus* is low and relatively flat; (3) the umbo of *S. undulatus*, although not prominent, is elevated above the hinge line while that of *S. radiatus* is elevated just slightly above the hinge line; and (4) the umbo cavity in *S. undulatus* is moderately deep while that of *S. radiatus* is wide and very shallow. Additionally, this species often has a thicker shell, is larger, and usually doesn't have rays, at least in Mississippi. Even though these characters are useful in separating the two species, in some cases it is very difficult to differentiate them.

NATURAL HISTORY:

Habitat: *Strophitus undulatus*, although a species of creeks and rivers, appears to occur in larger streams than *S. radiatus*. It is found in sand/gravel/mud substrates, usually in current.

Reproduction: There are no data on reproduction of this species in Mississippi, but Williams et al. (2008) stated that gravid females may be found in July to June of the next year.

Fish hosts: The Creeper has been reported to use at least 46 species of fish in 11 families as hosts. Of the reported hosts, 29 species occur in Mississippi, including eight sunfishes (Centrarchidae), nine perches and darters (Percidae), seven minnows (Cyprinidae), Yellow Bullhead (*Ameiurus natalis*), Black Bullhead (A. melas), Brown Bullhead (*A. nebulosus*), Channel Catfish (*Ictalurus punctatus*) and Flathead Catfish (*Pylodictis olivaris*).

STATUS: MNHP: G3S1.

This species is relatively widespread in Mississippi but uncommon throughout the state. We have records from six Mississippi counties, but most of our records are from Bear Creek in the Tennessee drainage.

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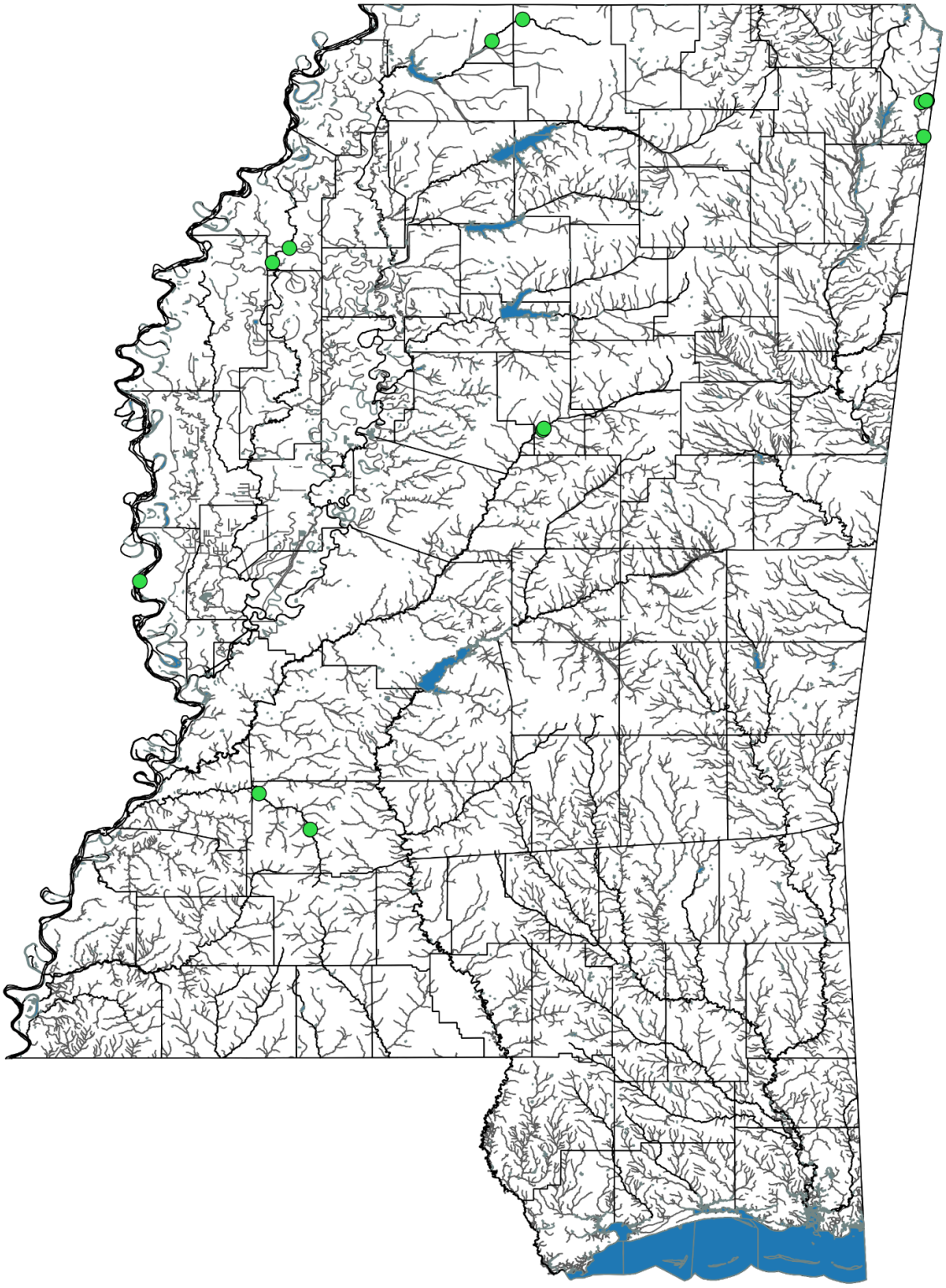

Distribution of *Strophitus undulatus* in Mississippi.

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THELIDERMA CYLINDRICA (SAY, 1817)
RABBITSFOOT

***Theliderma cylindrica* – Top: MMNS 6819, Bear Creek, Tishomingo County, 104 mm (4.1 in.). Bottom: MMNS 8550, Sunflower River, Sunflower County, 98 mm (3.9 in.).**

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SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, thick, and moderately inflated. Posterior slope well developed, dorsal margin of the shell almost straight.
Posterior ridge: Moderate, rounded.
Umbo: Above the hinge line, located on the anterior end of the shell, slanted inward.
Color and pattern: Shell yellowish brown to chestnut to dark brown. Some specimens so not have rays, but in those that do, the rays come in a variety of patterns. Some individuals have rays that may be narrow or wide on the anterior end of the shell, some have wide rays slanted toward the posterior end of the shell, still others have v-shaped rays extending from growth rings downward toward the next lower growth ring. Some specimens with rays may also have variously sized spots of dark pigment on the posterior slope.
Surface: The posterior slope generally has wide corrugations directed toward the dorsal edge of the shell. There are also smaller corrugations and pustules on the posterior end of the posterior slope, and three to five large knobs along the posterior slope extending from the umbo toward the end of the shell.
Nacre: White.
Umbo cavity: Deep.
Teeth: Two pseudocardinals in the left valve, two in the right. Two laterals in the left valve, one in the right. Teeth prominent, moderately thick, tops of pseudocardinals relatively ragged.
Interdentum: Present, moderately wide.
Size: The largest Mississippi specimen in the MDWFP collection has a shell length of 104 mm (4.1 in.).
DISTRIBUTION: Pennsylvania and Ohio west to Kansas and Nebraska, south to Arkansas and Louisiana, east to Alabama and Georgia.
MISSISSIPPI DISTRIBUTION: This species occurs in the Tennessee, Big Black, and Yazoo drainages, where it has been found in Bear Creek, the Big Black River, and Sunflower River, respectively. Archaeological specimens have been found assocaited with the Coldwater River in Quitman County, the Sunflower River in Coahoma and Yazoo counties, the Yazoo River in Yazoo and Holmes counties (Peacock et al., 2011), the Tallahatchie River in Leflore County (Peacock et al., 2016), and the Yazoo River in Humphreys County (Peacock et al., 2017).
SIMILAR SPECIES: This species would be hard to confuse with any other species occurring in Mississippi. Any greatly elongated species except *T. cylindrica* would not have a combination of a posterior ridge with knobs nor an anteriorly located umbo.
NATURAL HISTORY:
Habitat: *Theliderma cylindrica* appears to be a species of large creeks and rivers in Mississippi where it has been found in sandy gravel and sandy clay substrates, usually in areas with current.
Reproduction: Nothing is known about its reproduction in Mississippi, but it is apparently gravid during spring and summer in other areas (Williams et al., 2008).
Fish hosts: Twelve species in four families have been identified as hosts for the Rabbitsfoot. Ten of these species occur in Mississippi, including Spotfin Shiner (*Cyprinella spiloptera*), Whitetail Shiner (*C. galactura*), Blacktail Shiner (*C. venusta*), Red Shiner (*C. lutrensis*), Emerald Shiner (*Notropis atherinoides*), Striped Shiner (*Luxilus chrysocephalus*), Rainbow Darter (*Etheostoma caeruleum*), Golden Redhorse (*Moxostoma erythrurum*) and

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Blackstripe Topminnow (*Fundulus notatus*).

STATUS: MNHP: G3G4S1; USFWS: Threatened; MDWFP: Endangered. This species is known from only three streams in four counties of Mississippi and appears to be declining in all of them. The latest records we have of when this species was found alive were in the Big Black River in 1980, in Bear Creek in 2003, and in the Sunflower River in 2017 (Slack, unpublished data).

TAXONOMIC NOTES: This species was formerly considered to be a member of the genus *Quadrula* but was moved to the genus *Theliderma* by Williams et al, (2017).

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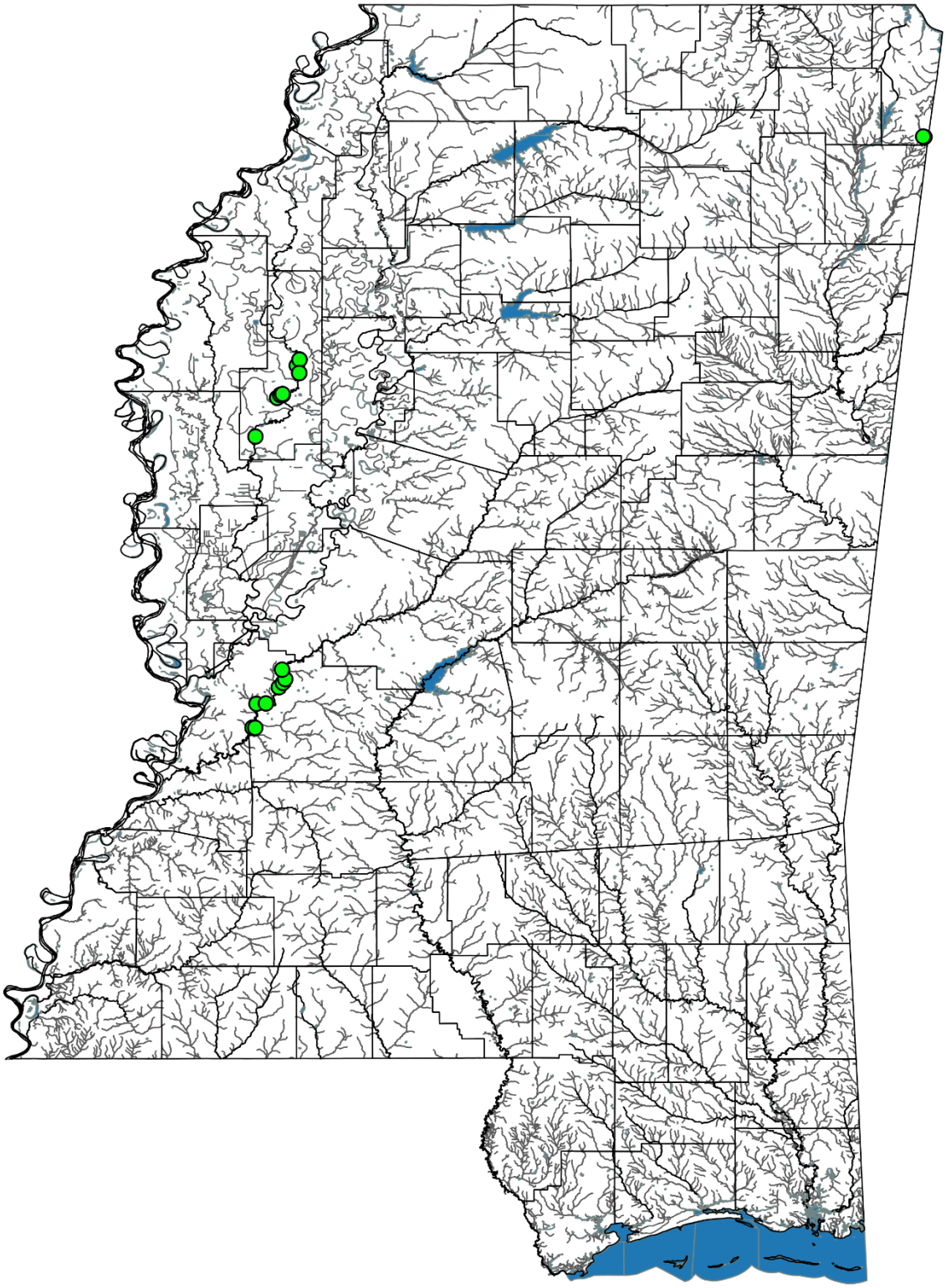

Distribution of *Theliderma cylindrica* in Mississippi.

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THELIDERMA METANEVRA (RAFINESQUE, 1820)
MONKEYFACE

***Theliderma metanevra* – Top: MMNS 492, Tombigbee River, Clay County, 39 mm (1.5 in.). Bottom: MMNS 801, Tombigbee River, Lowndes County, 72 mm (2.8 in.).**

SHELL CHARACTERISTICS:

Shape and structure: Shell round to oval to quadrate, moderately to slightly inflated, thick. Posterior slope wide, well developed. Shallow sulcus anterior to posterior ridge, which may or may not contain pustules.

Posterior ridge: Posterior ridge high and wide, curves slightly at its posterior terminus, usually extends beyond the posterior edge of the shell.

Umbo: Prominent, but not exceptionally large; above the hinge line.

Color and pattern: Light to dark brown; no rays.

Surface: Pustules scattered but abundant from anterior edge of shell to posterior ridge, including the sulcus in some cases. Posterior ridge with few to numerous low knobs from umbo to posterior end of shell. Posterior slope has relatively small corrugations

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extending from posterior ridge to dorsal edge of posterior slope.
Nacre: White.
Umbo cavity: Deep.
Teeth: Two pseudocardinals in the left valve, two in the right. Two laterals in the left valve, one in the right. Teeth prominent, relatively large, well developed, and thick.
Interdentum: Present, wide.
Size: Largest Mississippi specimen in MDWFP collection has a shell length of 91 mm (3.6 in.).
DISTRIBUTION: Pennsylvania and Ohio west to Kansas and Nebraska, south to Louisiana, east to Alabama and Georgia.
MISSISSIPPI DISTRIBUTION: Known only from the Tombigbee drainage where it has been found in both the Tombigbee and Buttahatchee rivers. Archaeological specimens have been found associated with the Coldwater River in Quitman County, the Sunflower River in Coahoma County, and the Yazoo River in Yazoo County (Peacock et al., 2011).
SIMILAR SPECIES: This species may be confused with *Quadrula rumphiana*, but the latter lacks knobs on its posterior ridge, which is relatively straight and not curved as in *T. metanevra*.
NATURAL HISTORY:
Habitat: *Theliderma metanevra* appears to have been a species of large to small rivers in Mississippi. It apparently occupied areas with a gravel substrate and moderate current.
Reproduction: Nothing is known about its reproduction in Mississippi, but it is apparently gravid from May through July in other areas (Williams et al., 2008).
Fish hosts: The known hosts for the Monkeyface are 24 species of fish in three families. Fifteen of these occur in Mississippi, including the Bluegill (*Lepomis macrochirus*), Green Sunfish (*L. cyanellus*), Sauger (*Sander canadense*), and 12 species of minnows (Cyprinidae).
STATUS: MNHP: G4SH?; MDWFP: Endangered.
All of our collection records and specimens are from three counties, primarily in the main channel of the Tombigbee River, where this species was relatively common prior to the construction of the Tenn-Tom Waterway. It also occurred infrequently in the lower reaches of the Buttahatchee River based on a specimen in the MDWFP collection that was found there in 1980 and as indicated in a report of surveys conducted on the Buttahatchee in 1977 (Yokley, 1978). Our last specimen from Mississippi was collected in 1980. A single specimen was reported during surveys of the East Fork Tombigbee River in 2010 – 2011 (Hamstead et al., in review), although whether this indicates that the species is potentially re-establishing itself in Mississippi is unknown.
TAXONOMIC NOTES: This species was formerly considered to be a member of the genus *Quadrula* but was moved to the genus *Theliderma* by Williams et al, (2017). Lopes-Lima et al. (2019) consider it, based on genetic data, to be an undescribed species distinct from populations of *T. metanevra* in the Mississippi River Basin.

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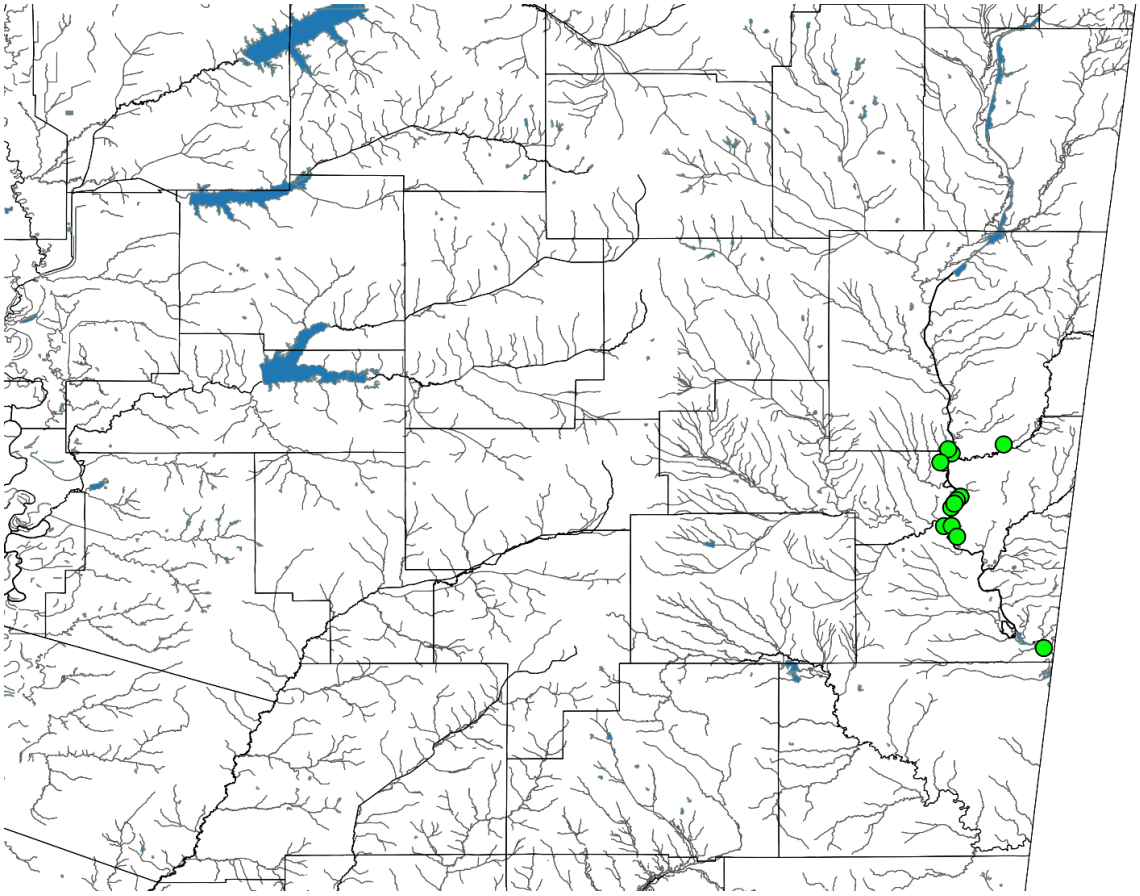

Distribution of *Theliderma metanevra* in Mississippi.

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THELIDERMA STAPES (LEA, 1831)
STIRRUPSHELL

***Theliderma stapes* – Top: MMNS 428, Tombigbee River, Lowndes County, 57 mm (2.2 in.). Bottom: MMNS 2085, Sipsey River, Greene County, Alabama, 50 mm (2.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell round to oval, thick, and moderately inflated; posterior slope very narrow, shallow sulcus anterior to posterior ridge.
Posterior ridge: Prominent; extends very steeply from umbo to and slightly beyond ventral edge of shell.
Umbo: Above hinge line, prominent.
Color and pattern: Yellow to brown, no rays.
Surface: Pustules anterior to the posterior ridge, usually clustered closer to the umbo than to ventral edge; some pustules enlarged, resembling flattened knobs; small corrugations near the upper part of posterior ridge extending to its terminus.

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Nacre: White.
Umbo Cavity: Very deep.
Teeth: Pseudocardinal teeth prominent, two in right valve, two in left. Lateral teeth present, one in right valve, two in left valve. Teeth large and thick.
Interdentum: Very wide.
Size: Largest Mississippi specimen in MDWFP collection has a shell length of 57 mm (2.2 in.).
DISTRIBUTION: Alabama and Mississippi.
MISSISSIPPI DISTRIBUTION: Tombigbee drainage, where it was found primarily in the main channel of the Tombigbee River.
SIMILAR SPECIES: The very narrow posterior slope and round to oval shape will distinguish this species from any others in the Tombigbee drainage in Mississippi.
NATURAL HISTORY:
Habitat: This species was found on gravel substrates in moderate to fast currents in the Tombigbee River.
Reproduction: There are no data available on its reproduction in Mississippi.
Fish hosts: Unknown.
STATUS: MNHP: GHSH; USFWS; Endangered; MDWFP: Endangered.
We have only five specimens from Mississippi in our collection, the last from 1980. All of our specimens are from what was once the main channel of the Tombigbee River on a gravel bar below the mouth of Tibbee Creek. This site was destroyed by construction of the Tenn-Tom Waterway. This species has not been seen for several decades and is presumed extirpated from Mississippi and may well be extinct throughout its range.
TAXONOMIC NOTES: This species was formerly considered a member of the genus *Quadrula* but was placed in *Theliderma* by Williams et al. (2017).

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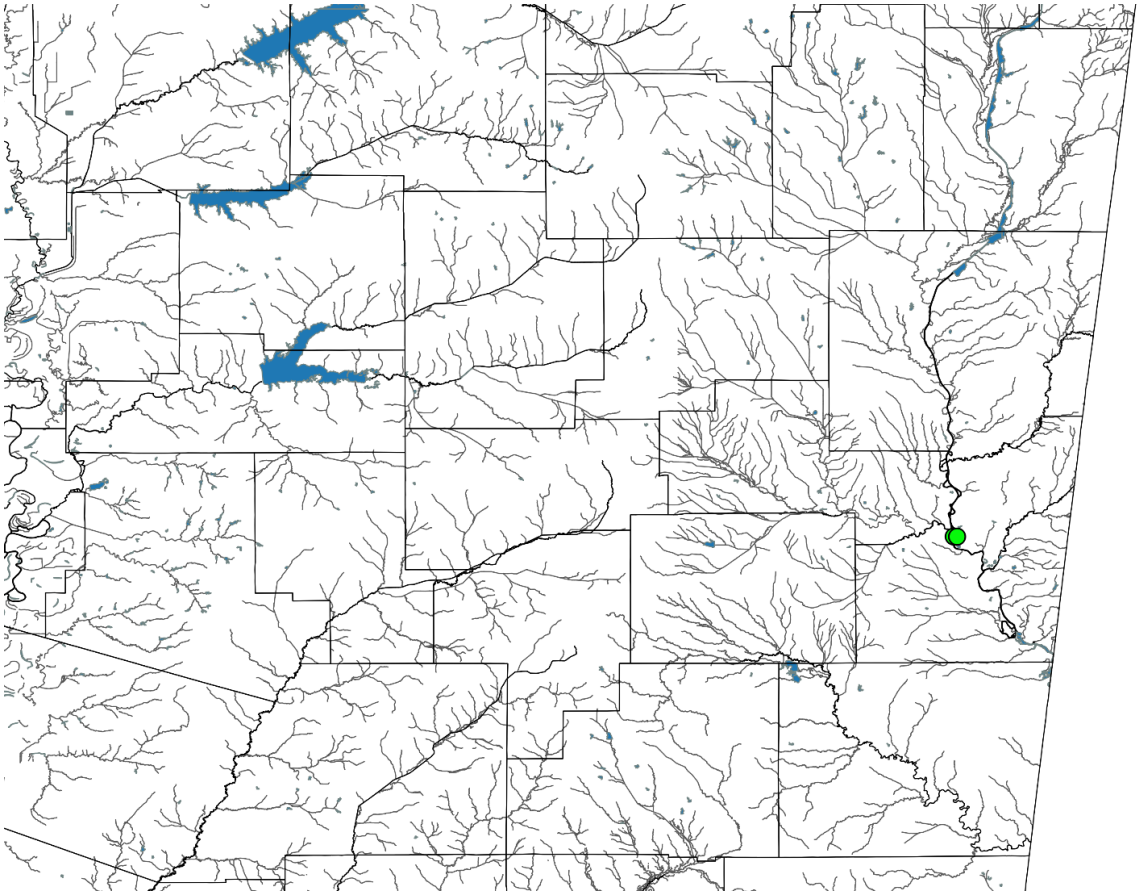

Distribution of *Theliderma stapes* in Mississippi.

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TOXOLASMA PARVUM (BARNES, 1823)
LILLIPUT

***Toxolasma parvum* – Top: MMNS 1471, Sunflower River, Sunflower County, 21 mm (0.8 in.). Bottom: MMNS 8963, Town Creek, Lee County, 20 mm (0.8 in.).**

SHELL CHARACTERISTICS:

Shape and structure: Shell oval, moderately inflated, and moderately thick. This species resembles a small bean, as the ventral edge of the shell is relatively straight, the dorsal edge both posterior and anterior to the umbo is relatively straight, and the anterior and posterior ends of the shell are broadly rounded except in adult females, which have a slight marsupial swelling, resulting in a slightly broadened posterior end in those individuals.

Posterior ridge: Absent in most specimens, but may be very broadly rounded in a few individuals.

Umbo: Usually even with or just slightly above the hinge line.

Color and pattern: Shell light to dark brown but occasionally an individual may have a greenish tinge. No rays.

Surface: Smooth with no ornamentation. The shell's texture is usually smooth but has been described as cloth-like in larger specimens.

Nacre: White with a bluish wash.

Umbo Cavity: Shallow.

Teeth: Two pseudocardinals and two laterals in the left valve, one pseudocardinal and one lateral in the right valve. Teeth small but well developed.

Interdentum: Absent.

Size: Largest specimen from Mississippi in MDWFP collection has a shell length of 31 mm (1.2 in.).

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DISTRIBUTION: New York and Pennsylvania west to Minnesota and South Dakota, south to Texas and Louisiana, east to Georgia and Florida.
MISSISSIPPI DISTRIBUTION: Found in all Mississippi drainages except Coastal Rivers.
SIMILAR SPECIES: The species in Mississippi which *Toxolasma parvum* resembles most closely is *T. texasiense,* and the two are often confused. *Toxolasma texasiense* is the larger of the two, tends to be more elliptical in shape while *T. parvum* is more oval, and has a broadly rounded posterior ridge while *T. parvum* usually lacks a posterior ridge. The anterior and posterior ends of the shell are relatively similar in size in *T. parvum* but are much different in size in *T. texasiense*, particularly in females. The dorsal edge of the shell posterior to the umbo in male *T. texasiense* slopes downward to the posterior end of the shell, making the end look pointed. The dorsal edge of the shell posterior to the umbo in *T. parvum* males is relatively straight, resulting in a rounded posterior end of the shell rather than a pointed posterior end as in *T. texasiense*. In females, the marsupial swelling in *T. texasiense* is very pronounced, forming an angled posterior end which ends in a point close to the dorsal margin of the shell. *Toxolasma parvum* females also have a marsupial swelling posteriorly, but it is much less pronounced than in *T. texasiense* and results in only a moderately broadened posterior end of the shell with no angles or points.
NATURAL HISTORY:
Habitat: This species occurs in a variety of habitats including rivers, creeks, sloughs, ponds, and ditches. It is usually found in slow moving or static water in mud or silt.
Reproduction: There are 8 gravid females in the MDWFP collection averaging 18.6 mm (0.7 in.) in shell length and ranging from 14 – 27 mm (0.6 – 1.1 in.). Seven of these females were found in April and one was found in June.
Fish hosts: Hosts for the Lilliput include the Bluegill (*Lepomis macrochirus*), Green Sunfish (*L. cyanellus*), Orangespotted Sunfish (*L. humilis*), Warmouth (*L. gulosus*), White Crappie (*Pomoxis annularis*), and the Johnny Darter (*Etheostoma nigrum*).
STATUS: G5S5.
This species is widespread in Mississippi, with specimens from 41 counties in our collections. It probably occurs in all counties in the state, but often may be overlooked because of its small size.

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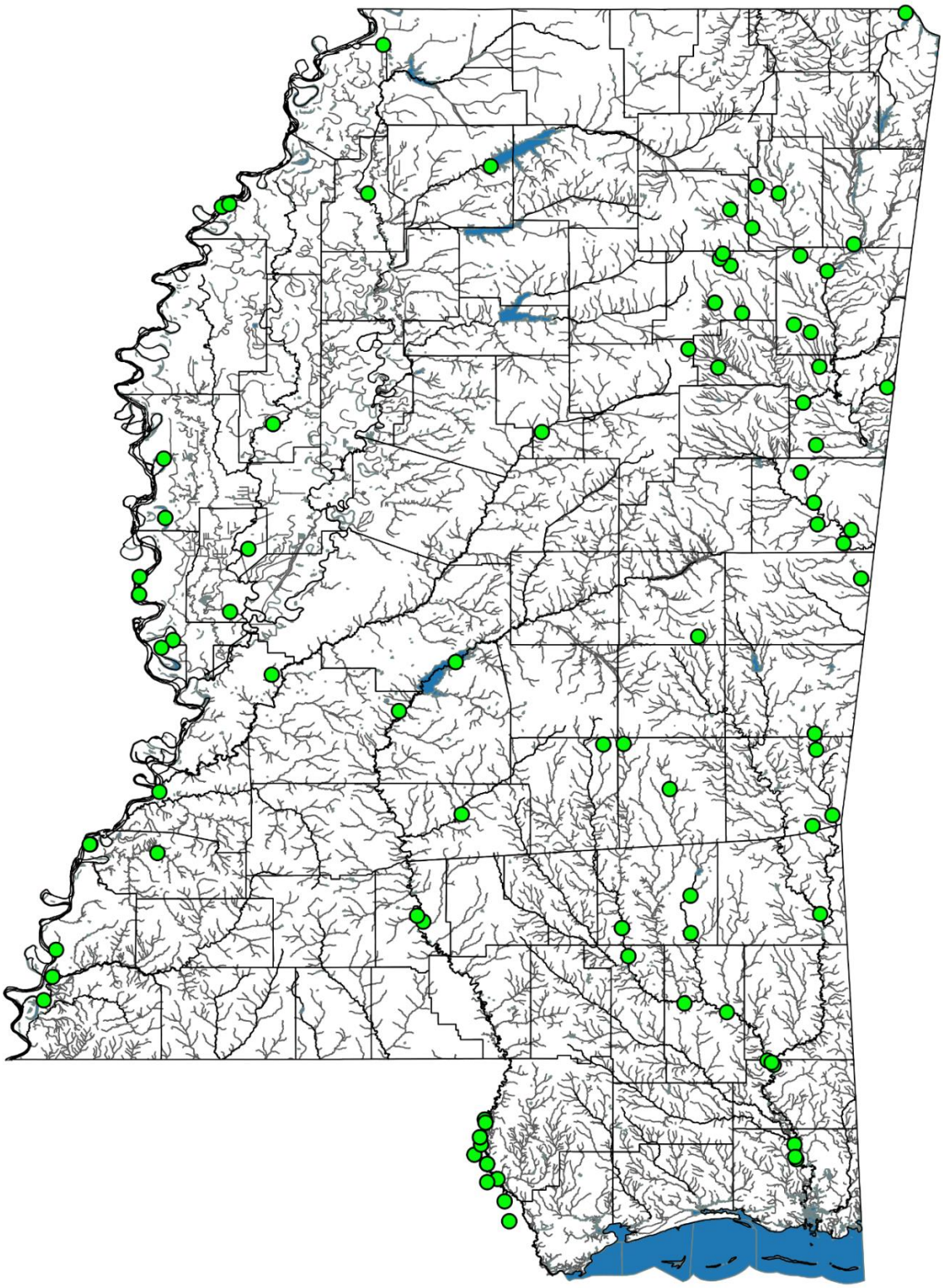

Distribution of *Toxolasma parvum* in Mississippi.

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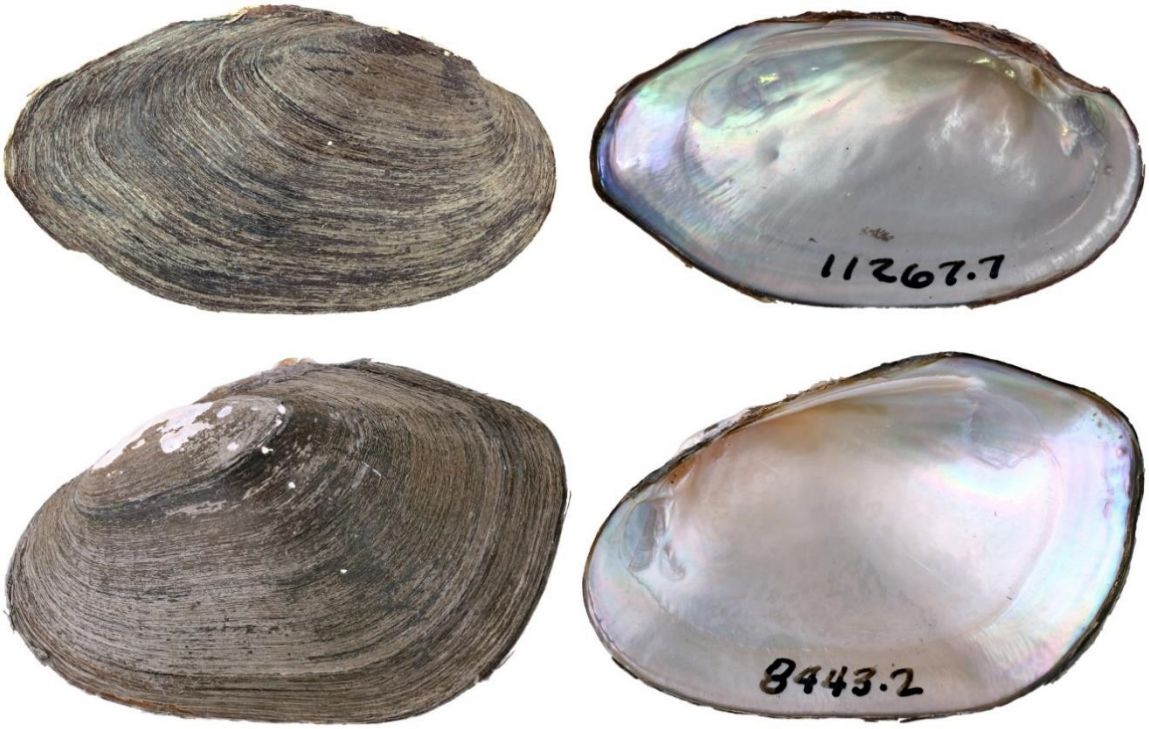
TOXOLASMA TEXASIENSE (LEA, 1857)
TEXAS LILLIPUT



***Toxolasma texasiense* – Top: MMNS 11267, male, Dead River Oxbow, Jackson County, 42 mm, (1.6 in.). Bottom: MMNS 8443, female, Sunflower River, Sharkey County, 53 mm (2.1 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, moderately to greatly inflated, moderately thick. In males, the dorsal edge of the shell posterior to the umbo slopes down to the end of the shell which results in a relatively pointed posterior relative to the anterior. In females, the posterior end of the shell has a greatly inflated marsupial swelling, such that the posterior end is slanted at an angle from the ventral margin to the posterior dorsal edge of the shell.
Posterior ridge: Present, broadly rounded, not prominent.
Umbo: Above the hinge line.
Color and pattern: Shell dark brown to black, no rays.
Surface: Exterior of shell smooth, no ornamentation.
Nacre: White.
Umbo Cavity: Relatively shallow.
Teeth: Two pseudocardinals and two laterals in the left valve, one pseudocardinal and one lateral in the right valve. Teeth small, relatively thin, but well developed.
Interdentum: Absent.
Size: Largest specimen from Mississippi in the MDWFP collection has a shell length of 72 mm (2.8 in.).

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DISTRIBUTION: Indiana, Illinois, and Missouri south to Texas and Louisiana, east to Mississippi and Tennessee.
MISSISSIPPI DISTRIBUTION: Found in all Mississippi drainages except Coastal Rivers and Tennessee drainages.
SIMILAR SPECIES: Most similar to *Toxolasma parvum*, which is smaller, is most often oval in outline, usually lacks a posterior slope, has a nearly straight dorsal edge posterior to the umbo, has posterior and anterior ends that are similar in size, and lacks an expansive marsupial swelling in females. *Toxolasma texasiense* is larger, tends to be more elliptical in shape, has a broadly rounded posterior ridge, the anterior and posterior ends of the shell are much different in size, the dorsal edge of the shell posterior to the umbo in males slopes to the end of the shell, making it look pointed, the posterior marsupial swelling in females is much more pronounced, resulting in an angled posterior end which comes to a point close to the dorsal margin of the shell. Very large *T. texasiense* might be mistaken for *Villosa lienosa*, but the latter has a purple rather than a white nacre and larger and more robust teeth.
NATURAL HISTORY:
Habitat: *Toxolasma texasiense* has been found in a variety of habitats in Mississippi, including rivers, oxbow lakes, creeks, sloughs, ponds, ditches, and reservoirs. It occurs primarily in lentic water in substrates composed of mud or a mixture of mud and sand.
Reproduction: Fifteen gravid females from Mississippi averaged 38.5 mm (1.5 in.) shell length and ranged from 28 - 49 mm (1.1 – 1.9 in.). Two of these females were found in June in the Chickasawhay River in Clarke County, 12 were found in August: one in Black Creek, Jackson County; seven in the Pascagoula River, Jackson County; one in Steele Bayou, Issaquena County; three in the Sunflower River in Humphreys and Sunflower counties, and one was found in October in the Pascagoula River, George County.
Fish hosts: Known fish hosts include Bluegill (*Lepomis macrochirus*) and Warmouth (*L. gulosus*).
STATUS: MNHP: G4S4.
We have specimens of this species from 48 counties in Mississippi, with relatively larger numbers from Delta counties than elsewhere in the state. As with *T. parvum*, this species is widespread, occupies a variety of habitats in the state, and is relatively abundant, but is often overlooked because of its small size.

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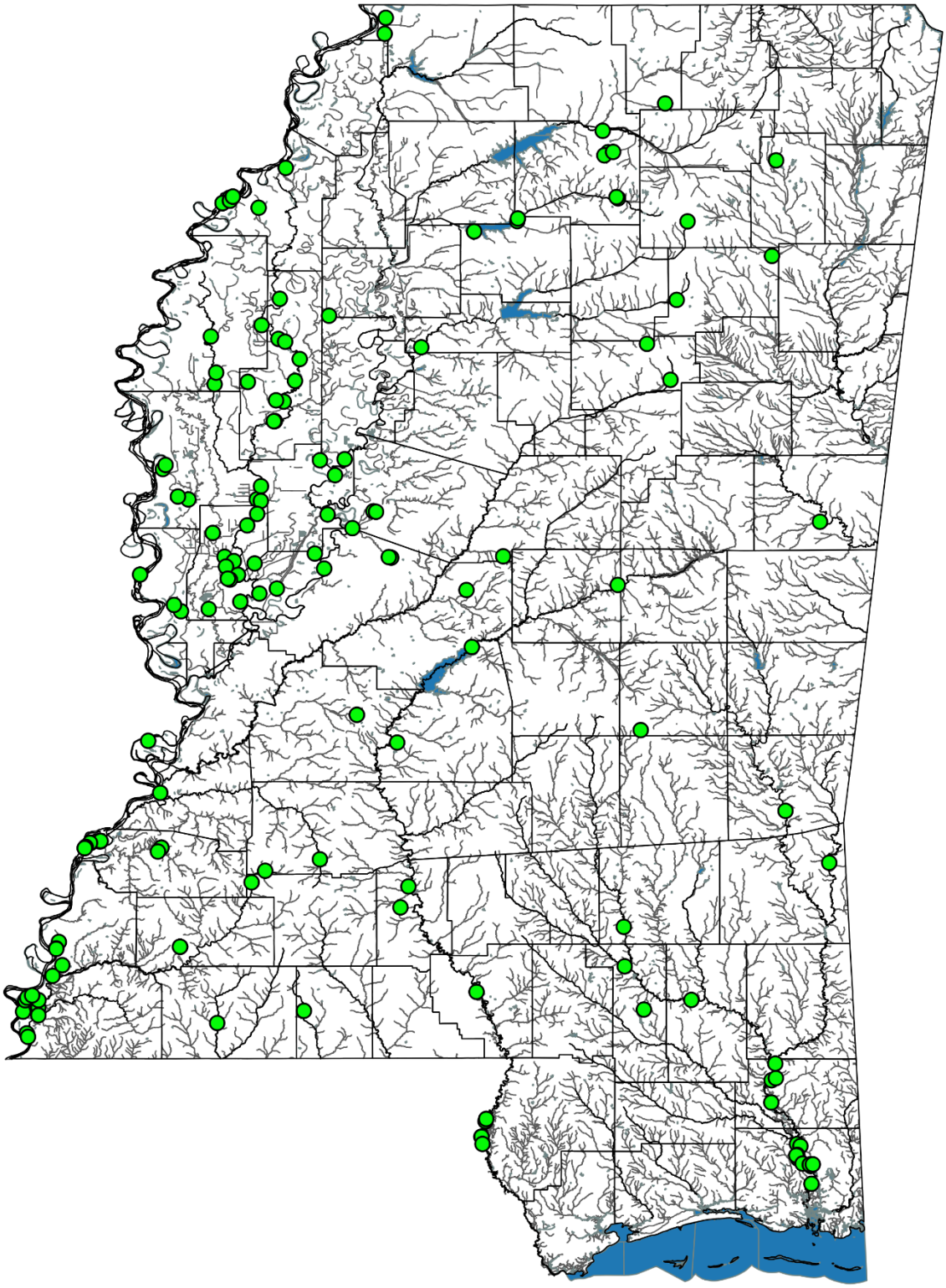

Distribution of *Toxolasma texasiense* in Mississippi.

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TRITOGONIA VERRUCOSA (RAFINESQUE, 1820)
PISTOLGRIP

***Tritogonia verrucosa* – Top: MMNS 5713, Yellow Creek, Lowndes County, 106 mm (4.2 in.). Bottom: MMNS 5516, Sunflower River, Sunflower County, 138 mm (5.4 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical to almost quadrate in some specimens, moderately to slightly compressed, and relatively thick. There is a shallow sulcus anterior to the posterior ridge.
Posterior ridge: Prominent, usually relatively well developed, appears to widen into the posterior slope and in some cases appears doubled. Posterior end of the shell sometimes appears to be widened because of the posterior ridge.
Umbo: Above hinge line, prominent.
Color and pattern: Shell is brown, yellowish brown, chestnut, or greenish brown. No rays.
Surface: Round to drop-shaped pustules of various sizes are sometimes numerous and distributed over the entire surface of the shell, but sometimes are restricted primarily to the anterior end of the shell; flattened pustules of various sizes are often on the posterior ridge; corrugations of various sizes, some almost knob-like, are sometimes found on the posterior slope.
Nacre: Usually white, but sometimes with a pinkish or purplish wash.
Umbo Cavity: Deep.
Teeth: Pseudocardinal teeth prominent, one or two in right valve, two in left. Lateral teeth present, one in right valve, two in left valve. Teeth large and thick.
Interdentum: Wide to moderate.

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Size: The largest specimen from Mississippi in the MDWFP collection has a shell length of 172 mm (6.8 in.).
DISTRIBUTION: Pennsylvania west to Nebraska and South Dakota, south to Texas and Louisiana, east to Georgia and North Carolina.
MISSISSIPPI DISTRIBUTION: Found in all drainages in Mississippi except the Coastal Rivers.
SIMILAR SPECIES: This species might be confused with *Plectomerus dombeyanus*, but the latter is usually more quadrate than *T. verrucosa*. The Pistolgrip is more elliptical, has relatively larger teeth, a deeper umbo cavity, is more compressed, has a sulcus associated with the posterior ridge, and usually has a white nacre rather than the strong purple or bronzy purple nacre of *P. dombeyanus*.
NATURAL HISTORY:
Habitat: This species occurs in a variety of water bodies in Mississippi ranging from large rivers to larger creeks. It also occurs in lentic habitats including Pickwick Lake and Wolf Lake, an old oxbow of the Yazoo River, in Yazoo County. It occurs most often in areas with current in gravel or sandy gravel to mud substrates.
Reproduction: No data on its reproduction in Mississippi are available, but it apparently is gravid from April to July or August (Williams et al., 2008).
Fish hosts: Fish serving as hosts for this mussel include Yellow Bullhead (*Ameiurus natalis*), Brown Bullhead (*A. nebulosus*), and Flathead Catfish *(Pylodictis olivaris*).
STATUS: MNHP: G4G5S4.
We have specimens of this species from 53 Mississippi counties. Most of our collecting localities and specimens are from larger rivers including the Big Black, Buttahatchie, and East Fork Tombigbee. In the late 1980s, this species was very common in the East Fork Tombigbee River but it has declined greatly there since that time (Hamstead et al., *in press*).
TAXONOMIC NOTES: This species was moved from the genus *Tritogonia* to *Quadrula* by Williams et al. (2008), but then back again to *Tritogonia* nine years later (Williams et al., 2017).

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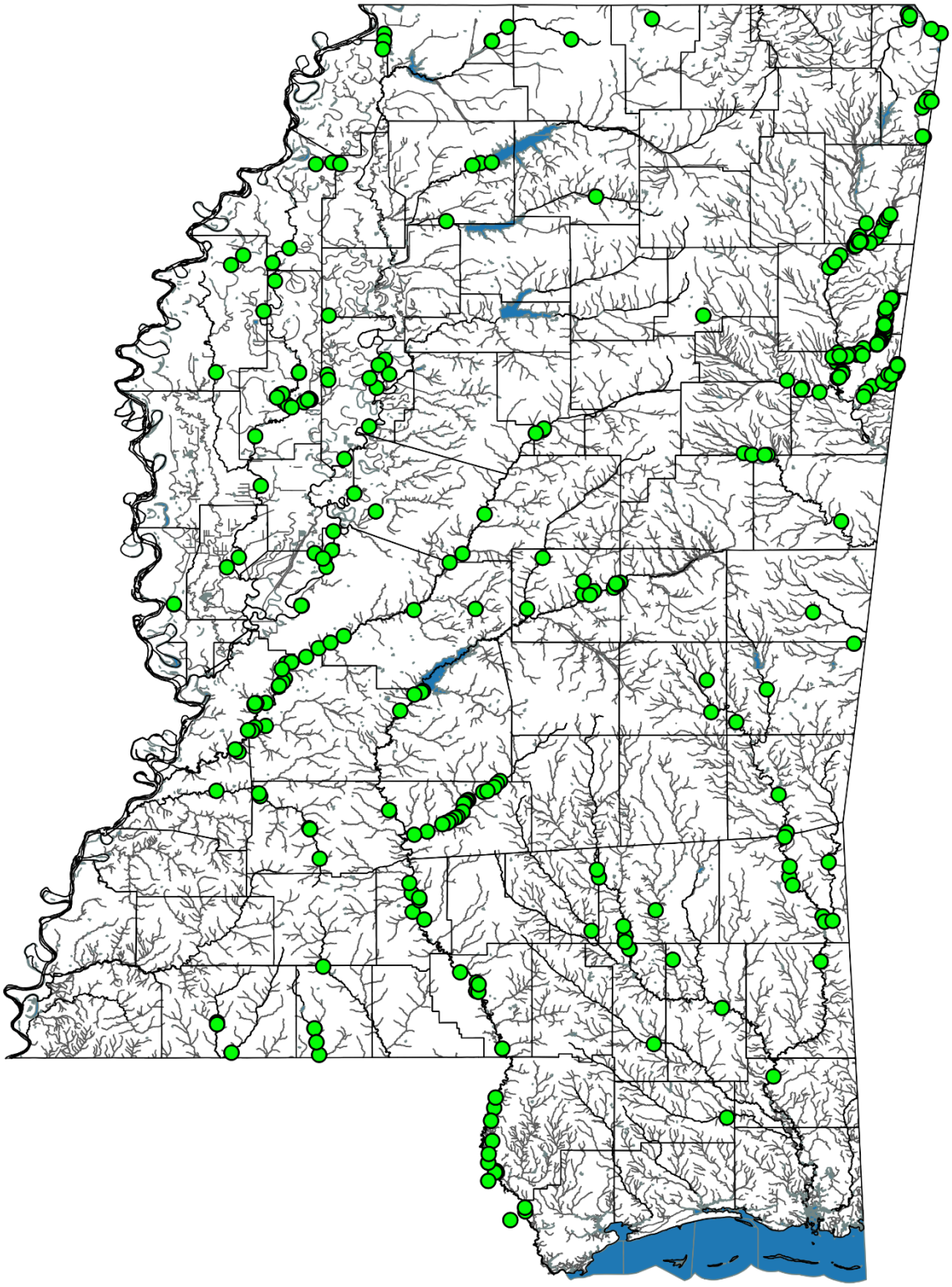

Distribution of *Tritogonia verrucosa* in Mississippi.

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TRUNCILLA DONACIFORMIS (LEA, 1827)
FAWNSFOOT

***Truncilla donaciformis* – Top: MMNS 2390, Pearl River, Pearl River County, 55 mm (2.2 in.). Bottom: MMNS 2067, East Fork Tombigbee River, Itawamba County, 33 mm (1.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell triangular, sometimes almost elliptical, moderately inflated, and relatively thin in smaller specimens but thicker in larger ones. There is a very shallow sulcus anterior to the posterior ridge.
Posterior ridge: Rounded to relatively pronounced.
Umbo: Above hinge line, relatively prominent and turned inward toward hinge line.
Color and pattern: Shell is yellowish brown, yellowish green, or medium brown. Rays are present and vary from wide to narrow, although are absent in a few specimens. Rays extend from the umbo to the posterior edge of the shell and are often present over the entire shell surface. Although some rays are faint, most are relatively prominent and can be either solid, broken into a series of small dots, or composed of stacked chevrons.
Surface: Shell smooth with no ornamentation.
Nacre: Usually white, sometimes a bluish or yellowish wash in region of the umbo cavity.
Umbo cavity: Moderately deep.
Teeth: Two pseudocardinals and two laterals in the left valve; one

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pseudocardinal and one lateral in the right valve. Teeth relatively thin, not large nor prominent.
Interdentum: Narrow.
Size: Largest specimen from Mississippi in MDWFP collection has a shell length of 52 mm (2.0 in.).
DISTRIBUTION: New York and Pennsylvania west to Nebraska, Wisconsin, and South Dakota, south to Texas and Louisiana, east to Alabama and Georgia.
MISSISSIPPI DISTRIBUTION: Found in the Mississippi River South, Pearl, Tennessee, Yazoo, and Tombigbee drainages, where it has been collected in the Pearl, Strong, Buttahatchee, Noxubee, East Fork Tombigbee, Quiver, and Sunflower rivers as well as Bear Creek and the Yellow Creek embayment of the Tennessee drainage.
SIMILAR SPECIES: This species is most similar to *Truncilla truncata*. The latter is usually more inflated, has a posterior slope that is relatively wider, is more triangular than elliptical, and is larger than *T. donaciformis*. Additionally, *T. truncata* has a sharper posterior ridge and a posterior slope that makes a nearly 90 degree angle to the rest of the shell, while *T. donaciformis* has a broadly rounded posterior ridge and a posterior slope that is at a 50 – 60 degree angle to the rest of the shell.
NATURAL HISTORY:
Habitat: This species inhabits rivers and larger creeks in areas with sand and gravel substrates and current, but can also be found in sandy clay substrates in the Yazoo drainage and in lentic habitats in the Yellow Creek embayment of Tishomingo County.
Reproduction: There are no data on reproduction for this species in Mississippi, but it is apparently gravid from fall to the following summer in other areas (Williams et al., 2008).
Fish hosts: Known fish hosts include Freshwater Drum (*Aplodinotus grunniens*) and Sauger (*Sander canadense*).
STATUS: MNHP: G5S4.
We have records of this species from 16 Mississippi counties, so it is relatively widely distributed and can be common in some areas. Most of our collecting records and specimens are from the Pearl, Buttahatchee, and East Fork Tombigbee
rivers.

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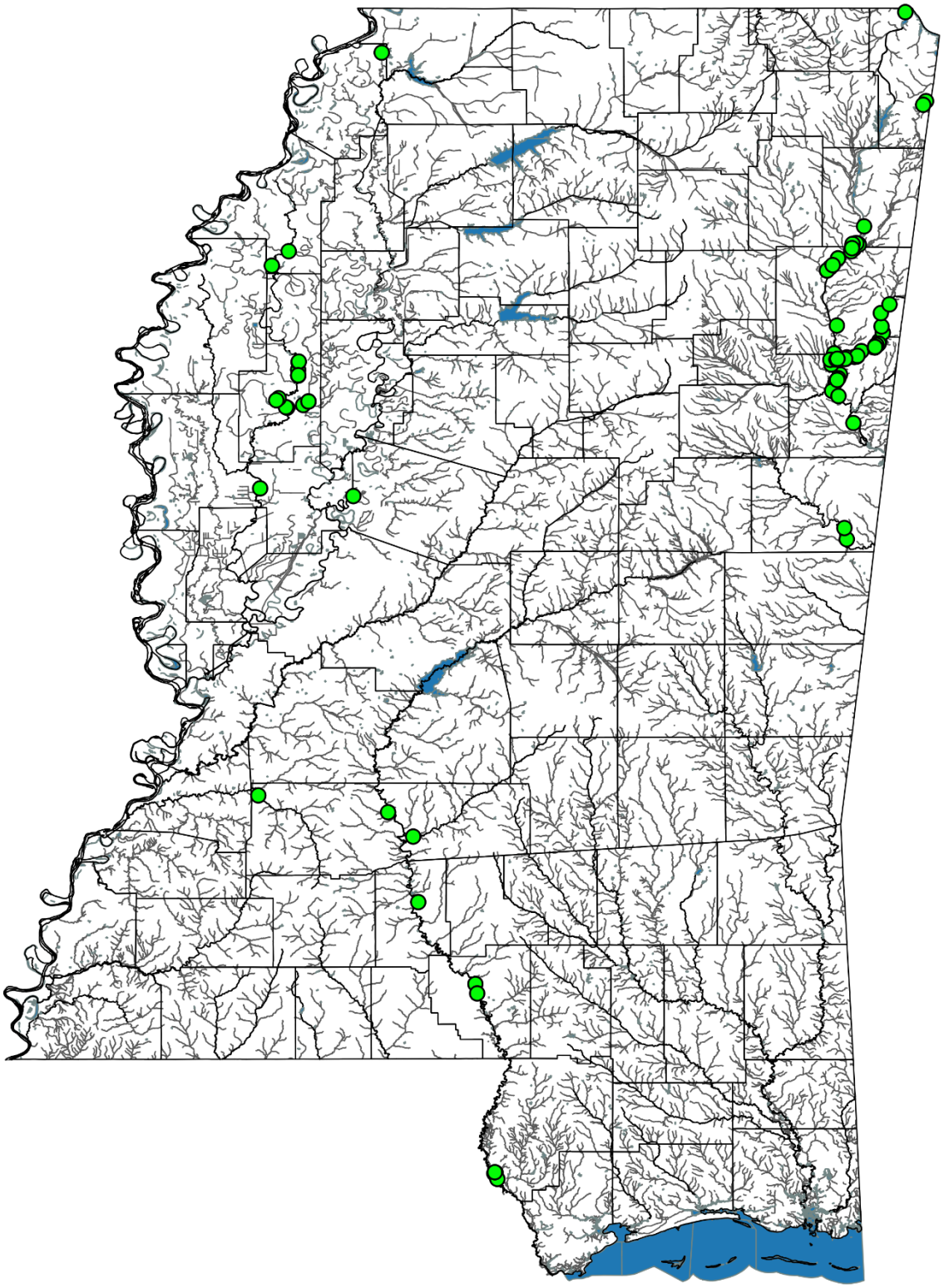

Distribution of *Truncilla donaciformis* in Mississippi.

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TRUNCILLA TRUNCATA RAFINESQUE, 1820
DEERTOE

***Truncilla truncata* – Top: MMNS 6999, Quiver River, Sunflower County, 75 mm (3.0 in.). Bottom: MMNS 4746, Bear Creek, Tishomingo County, 44 mm (1.7 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell triangular, rarely somewhat elliptical, moderately inflated, relatively thick. Shallow to relatively deep sulcus anterior to the posterior ridge.
Posterior ridge: Relatively prominent and sharp
Umbo: Above hinge line, prominent, turned sharply inward toward hinge line.

Color and pattern: Shell greenish brown to brown to dark brown. Most specimens have rays but a few individuals lack them. Rays range from relatively prominent to relatively faint, may be wide to narrow, and are solid, composed of rows of broken lines or dots, or rows of chevrons. Faint rays appear to be more common than prominent rays.

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Surface: Smooth, no ornamentation.
Nacre: White.
Umbo Cavity: Relatively shallow to relatively deep.
Teeth: Two pseudocardinals and two laterals in the left valve; one to two pseudocardinals and one lateral in the right valve. Anterior pseudocardinal tooth in right valve usually much smaller than posterior pseudocardinal. Teeth prominent but not thick.
Interdentum: Narrow.
Size: Largest specimen from Mississippi in MDWFP collection has a shell length of 83 mm (3.3 in.).
DISTRIBUTION: New York and Pennsylvania west to Wisconsin and South Dakota, south to Texas and Louisiana, east to Alabama and Mississippi, north to Virginia.
MISSISSIPPI DISTRIBUTION: Found in the Mississippi River South, Tennessee, Yazoo, and Big Black drainages.
SIMILAR SPECIES: *Truncilla truncata* is most similar to *T. donaciformis*. The former is usually more inflated, has a posterior slope that is relatively wider, is more triangular than elliptical, and is larger than *T. donaciformis*. Additionally, *T. truncata* has a sharper posterior ridge and a posterior slope that makes a nearly 90 degree angle to the rest of the shell, while *T. donaciformis* has a broadly rounded posterior ridge and a posterior slope that is at a 50 – 60 degree angle to the rest of the shell. Generally, *T. truncata* is not as prominently rayed as *T. donaciformis*, except in Bear Creek of the Tennessee drainage in Tishomingo County, where it is rather strongly marked. This species may also be confused with small specimens of *Fusconaia flava* from the Yazoo River drainage where both occur. Some smaller individuals of the latter superficially resemble *T. truncata* in shape, but usually have a few broad but faint rays, a slightly deeper umbo cavity, and slightly larger pseudocardinal teeth.
NATURAL HISTORY:
Habitat: This species inhabits rivers and larger creeks in areas with sand and gravel substrates and current, but can also be found in sandy clay and clay substrates.
Reproduction: There are no data on reproduction for this species in Mississippi, but it is apparently gravid from fall to the following summer in other areas (Williams et al., 2008).
Fish hosts: Known hosts include Freshwater Drum (*Aplodinotus grunniens*) and Sauger (*Sander canadense*).
STATUS: MNHP:G5S3.
Most of our collection records and specimens are from the Sunflower River in the Yazoo drainage, where the species can be quite common, but it appears to be rather uncommon in other parts of its range in the state. We have collections of the Deertoe from 20 Mississippi counties.

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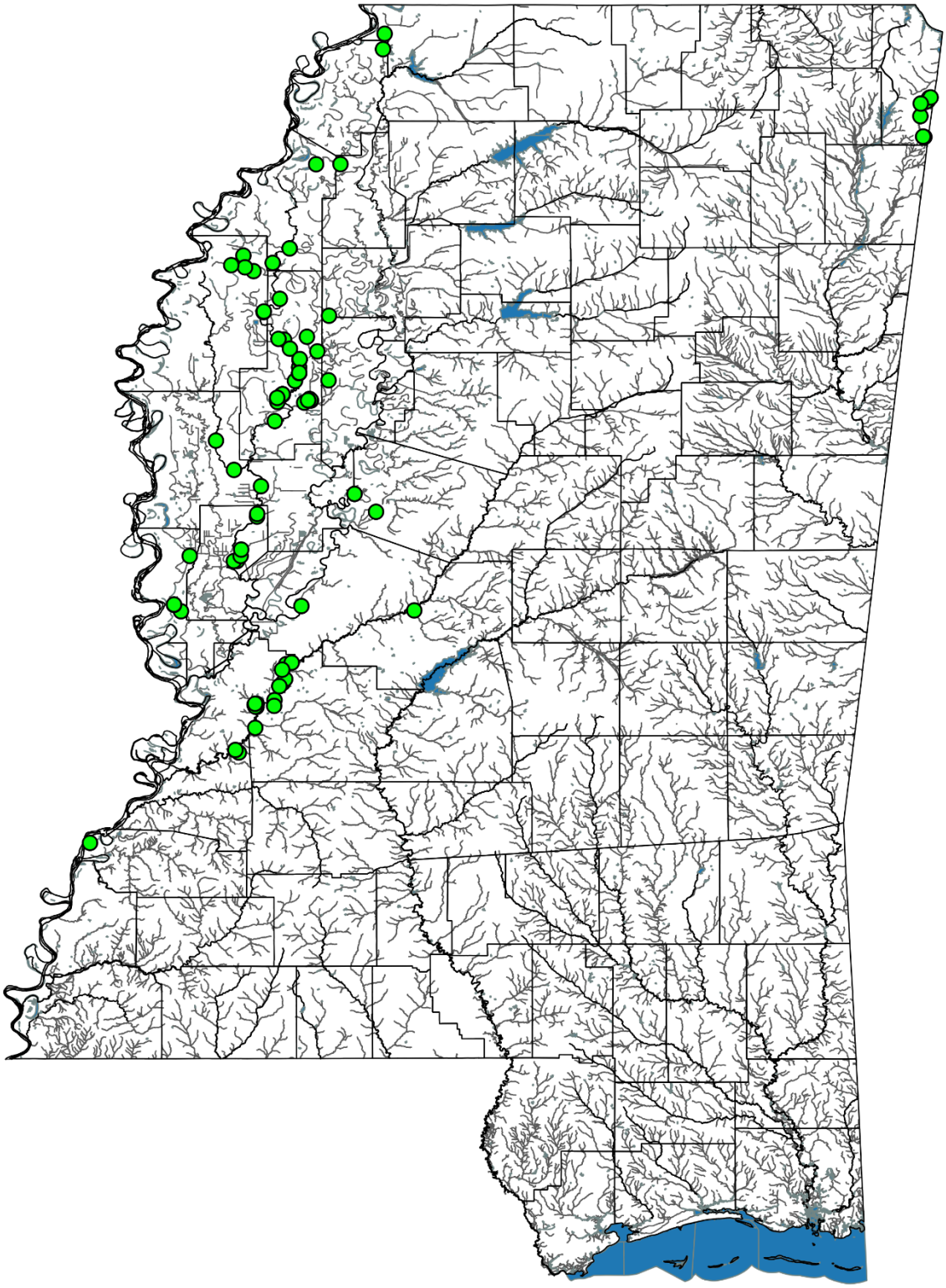

Distribution of *Truncilla truncata* in Mississippi.

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UNIOMERUS DECLIVIS (SAY, 1831)
TAPERED PONDHORN

***Uniomerus declivis* – Top: MMNS 1410, Coldwater River, Quitman County, 71 mm (2.8 in.). Bottom: MMNS 2263, Tchula Lake, Holmes County.**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, moderately inflated; thin to moderately thick. Relatively narrow posterior slope; shell narrows to a relatively blunt point at posterior end.
Posterior ridge: Rounded, not prominent, but obvious.
Umbo: Above hinge line but not prominent.
Color and pattern: Shell is dark brown to almost black, rays absent.
Surface: No ornamentation; texture of shell surface relatively coarse, not smooth.
Nacre: White.
Umbo Cavity: Shallow.
Teeth: One or two pseudocardinals in the left valve, most posterior resembles a wavy segment of the hinge line; two laterals. One pseudocardinal and one lateral in the right valve. Teeth moderately small, not prominent; pseudocardinals somewhat peg-like.
Interdentum: Moderate.
Size: Largest specimen from Mississippi in MDWFP collection has a shell length of 124 mm (4.9 in.).
DISTRIBUTION: Arkansas, Louisiana, Texas, Mississippi, and Tennessee.
MISSISSIPPI DISTRIBUTION: Occurs in the Mississippi River South, Big Black, Pearl, and Yazoo drainages.
SIMILAR SPECIES: This species most closely resembles and is sometimes difficult to differentiate from *Uniomerus tetralasmus*. The latter usually has a somewhat thinner shell, a wider posterior slope, a posterior end that is not as pointed, and a posterior ridge that is more rounded than in *U. declivis*. The pseudocardinal teeth in *U. declivis* are

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somewhat peg-like while those in *U. tetralasmus* are more blade-like.

NATURAL HISTORY:

Habitat: *Uniomerus declivis* occurs in rivers and creeks, usually in backwater areas with little or no current, but also inhabits ditches, ponds, and other lentic habitats. In these areas, it is normally found in mud or clay substrates.

Reproduction: No data are available on reproduction in this species in Mississippi, but gravid females have been found in May and June in Texas (Howells et al., 1996).

Fish hosts: Unknown.

STATUS: MNHP: G5S2.

This species appears to be uncommon in Mississippi, which in part may result from a lack of sampling in the muddy habitats without currents where it most commonly occurs. We have specimens from 16 counties in Mississippi, but most of our collection records and specimens are from the Yazoo drainage.

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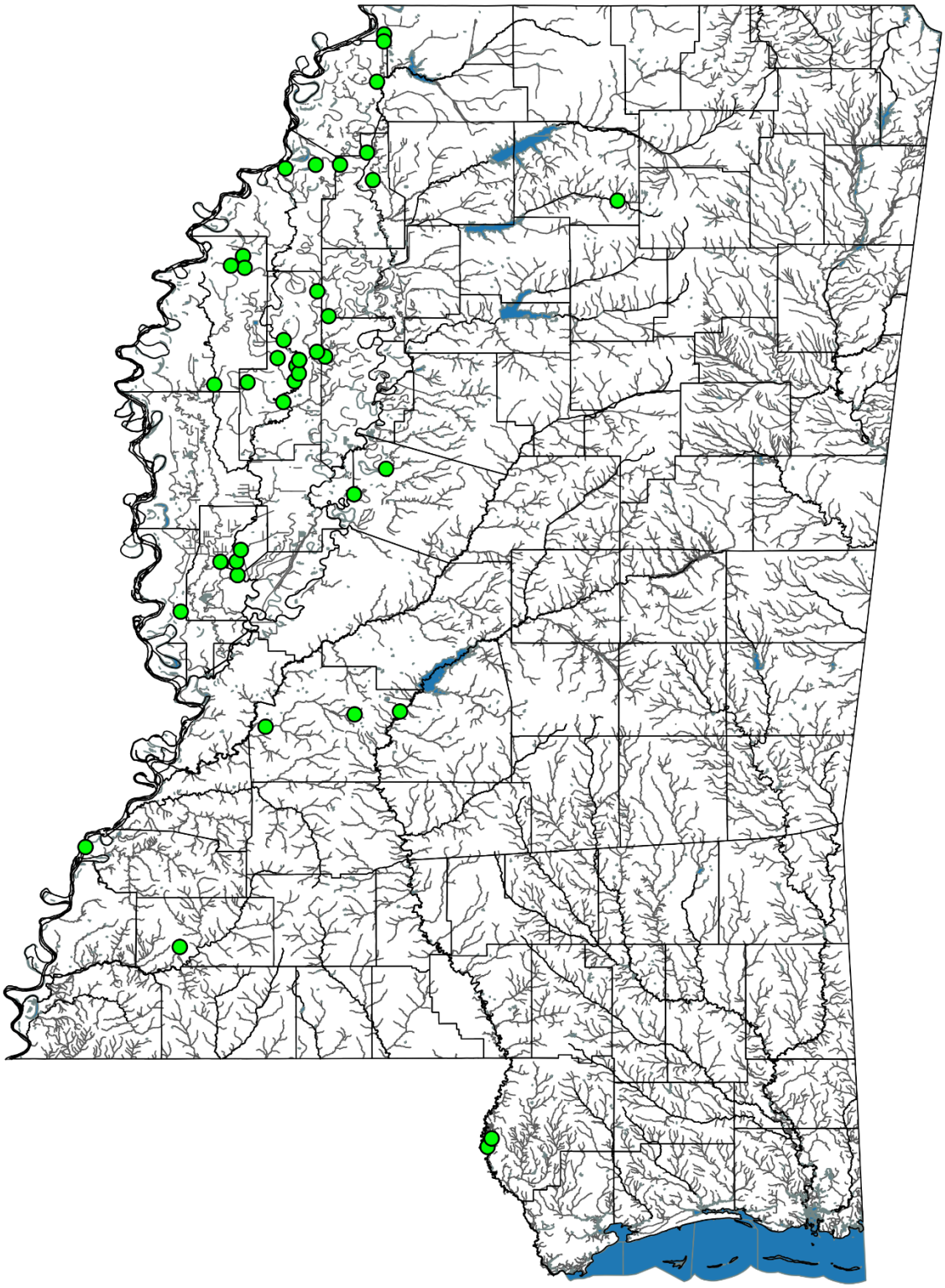

Distribution of *Uniomerus declivis* in Mississippi.

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UNIOMERUS TETRALASMUS (SAY, 1831)
PONDHORN

***Uniomerus tetralasmus* – Top: MMNS 9532, Pond in Wilkinson County, 126 mm (5.0 in.). Bottom: MMNS 238, Unnamed tributary of the Big Black River, Yazoo County, 114 mm (4.5 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, moderately inflated, relatively thin. Posterior slope is moderately wide; posterior end of shell is broadly rounded, not pointed.
Posterior ridge: Rounded, not prominent, but obvious.
Umbo: Above hinge line but not prominent.
Color and pattern: Shell is chestnut brown, yellowish brown, or greenish brown; rays absent.
Surface: No ornamentation; texture of surface is relatively smooth except on very large specimens.
Nacre: White; some specimens with a faint blue wash in the umbo cavity.
Umbo cavity: Shallow to moderately shallow.
Teeth: One or two pseudocardinals in the left valve, most posterior resembles a wavy segment of the hinge line; two laterals. One pseudocardinal and one lateral in the right valve. Teeth moderately small, not prominent; pseudocardinals blade-like.
Interdentum: Narrow but not obvious in many specimens.
Size: Largest specimen from Mississippi in MDWFP collection has a shell length of 126 mm (5.0 in.).
DISTRIBUTION: New York west to Kansas and Oklahoma, south to Texas and Louisiana, east to Florida and Georgia, north to West Virginia.

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MISSISSIPPI DISTRIBUTION: Found throughout Mississippi except in the Tennessee and Lake Pontchartrain drainages.

SIMILAR SPECIES: This species most closely resembles and is sometimes difficult to differentiate from *U. declivis*. *Uniomerus tetralasmus* usually has a somewhat thinner shell, a wider posterior slope, a posterior end that is not as pointed, and a posterior ridge that is more rounded than in *U. declivis*. The pseudocardinal teeth of *U. declivis* are somewhat peg-like while those in *U. tetralasmus* appear to be more blade-like.

NATURAL HISTORY:

Habitat: *Uniomerus tetralasmus* occurs primarily in lentic waters such as ponds, roadside ditches, sloughs, temporary ponds, and reservoirs, but also occurs in backwater areas of small rivers and large creeks. In these areas, it usually is found in silt or mud substrates.

Reproduction: Ten gravid females found in Mississippi average 82.0 mm (3.2 in.) shell length and range from 56 – 106 mm (2.2 – 4.2 in.) One of these females was collected in March from a creek in Chickasaw County, five were collected in April from Madison and Scott counties, three were found in May in Jefferson and Neshoba counties, and one was found in June in Madison County.

Fish hosts: The Golden Shiner (*Notemigonus crysoleucas*) is the only known fish host.

STATUS: MNHP: G5S5.

This species appears to be relatively wide-spread and common in Mississippi, as we have specimens from 52 counties. Most of our collection records and specimens are from the Tombigbee, Mississippi River South, and Yazoo drainages.

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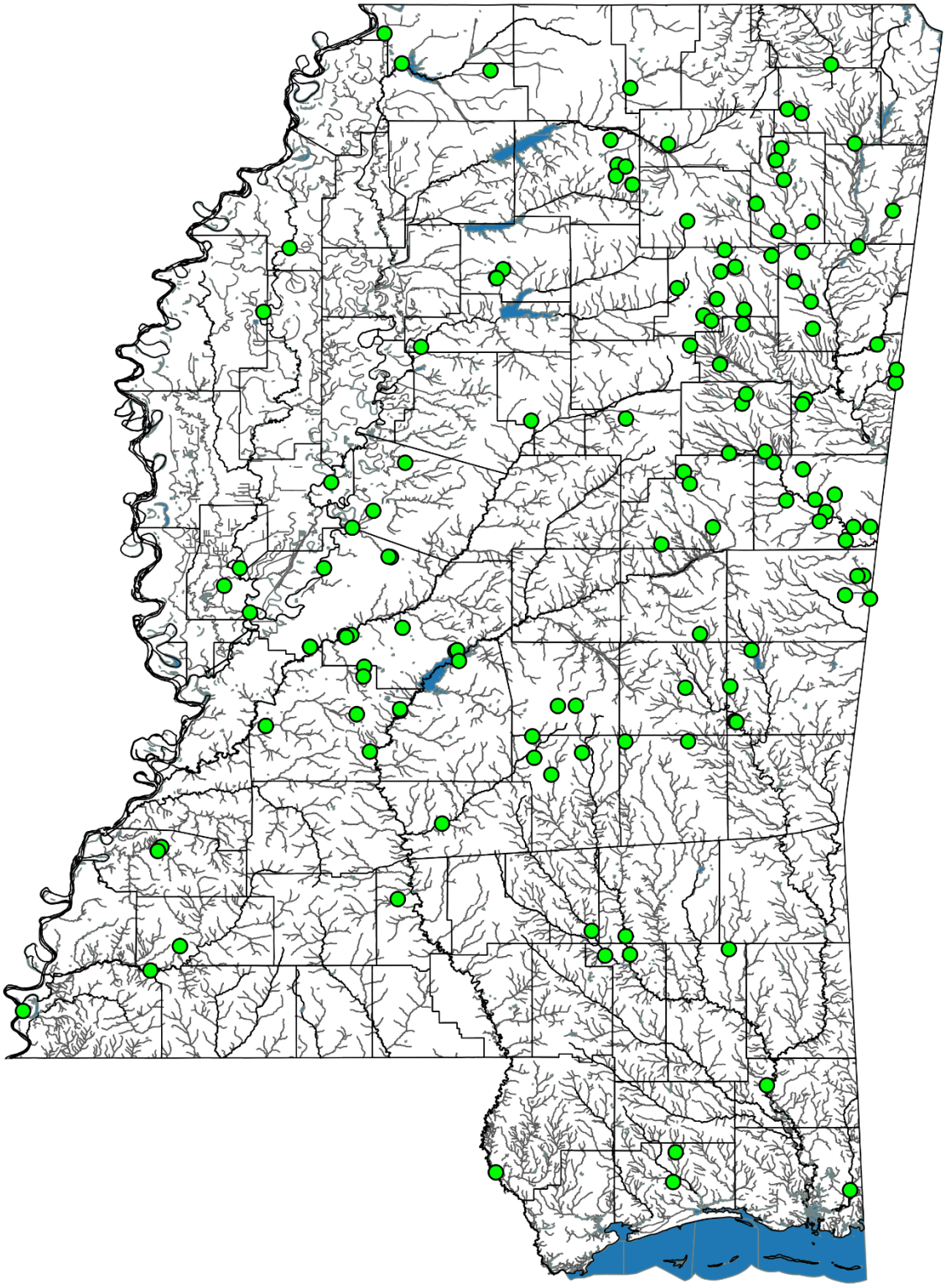

Distribution of *Uniomerus tetralasmus* in Mississippi.

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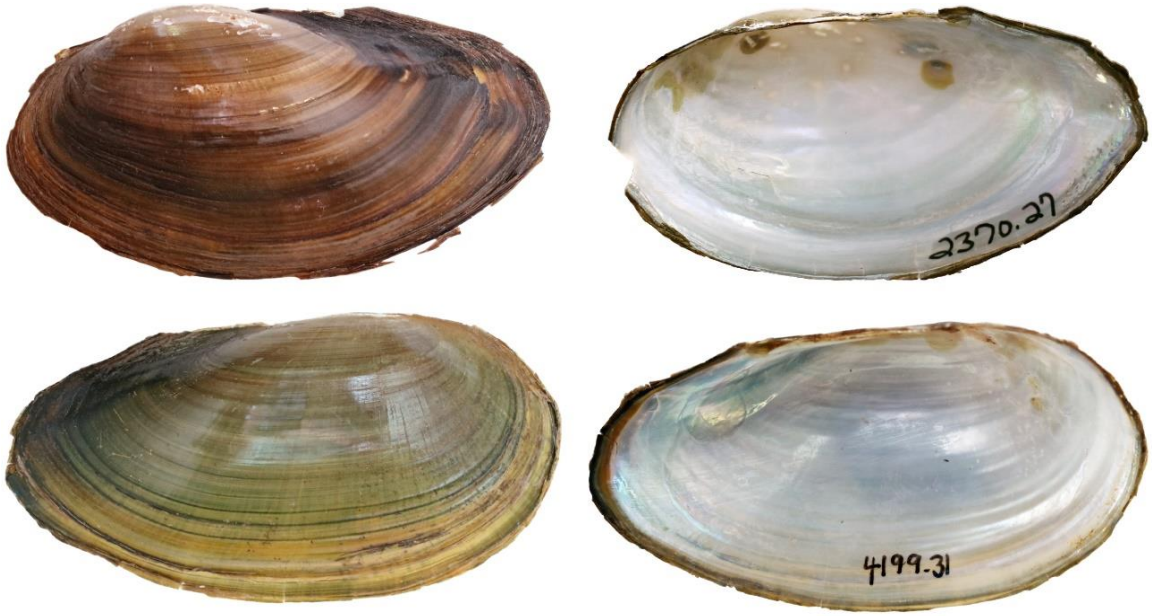
UTTERBACKIA IMBECILLIS (SAY, 1829)
PAPER PONDSHELL



***Utterbackia imbecillis* – Top: MMNS 2370, Lake Bill Waller, Marion County, 81 mm (3.2 in.). Bottom: MMNS 4199, Davis Lake, Chickasaw County, 76 mm (3.0 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell elliptical, moderately inflated to compressed, very thin and fragile. Posterior slope narrow to moderately wide.
Posterior ridge: Very broadly rounded, not prominent.
Umbo: Below hinge line; very small and insignificant.
Color and pattern: Shell greenish to light brown to medium brown. Faint rays present on a few individuals, but most specimens without rays. Sometimes there is dark pigment along the growth lines or narrow rays along the posterior ridge from the umbo to the posterior end of the shell.
Surface: The shell surface is smooth with no ornamentation.
Nacre: Pale bluish white.
Umbo cavity: Very shallow.
Teeth: None.
Interdentum: Absent.
Size: Largest specimen from Mississippi in MDWFP collection has a shell length of 103 mm (4.0 in.).
DISTRIBUTION: New York west to South Dakota, south to New Mexico and Texas, east to Georgia and South Carolina, north to Virginia and Pennsylvania.
MISSISSIPPI DISTRIBUTION: Found throughout Mississippi in all ten of our drainages.
SIMILAR SPECIES: The only other elliptical species without teeth in Mississippi is *Pyganodon grandis*, but the umbo in that species is above the hinge line rather than below it as in *U. imbecillis.*

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NATURAL HISTORY:
Habitat: *Utterbackia imbecillis* occurs in a variety of aquatic habitats including rivers, lakes, reservoirs, borrow pits, ponds, and ditches. It is almost always found in areas without current and with mud or mud and sand substrates.
Reproduction: There are 41 gravid female *U. imbecillis* in the MDWFP collection which average 59.8 mm (2.3 in.) shell length and range from 36 – 83 mm (1.4 – 3.3 in.) in length. Two of these were collected in March, four in April, three in June, one in July, 11 in August, one in September, and 19 in October.
Fish hosts: This species has 18 host fish in five families. Fifteen of these occur in Mississippi, including the Goldfish (*Carassius auratus*), Creek Chub (*Semotilus atromaculatus*), Spotfin Shiner (*Cyprinella spiloptera*), Golden Shiner (*Notemigonus crysoleucas*), Largemouth Bass (*Micropterus salmoides*), Rock Bass (*Ambloplites rupestris*), Black Crappie (*Pomoxis nigromaculatus*), Bluegill (*Lepomis macrochirus*), Longear Sunfish (*L. megalotis*), Green Sunfish (*L. cyanellus*), Dollar Sunfish (*L. marginatus*), Warmouth (*L. gulosus*), Yellow Perch (*Perca flavescens*), Channel Catfish *(Ictalurus punctatus*), and Western Mosquitofish (*Gambusia affinis*).
STATUS: MNHP: G5S5.
Utterbackia imbecillis is very widespread and common in Mississippi. We have specimens from 49 counties, with most of our collection records and specimens from the Pascagoula, Tombigbee, and Pearl drainages.

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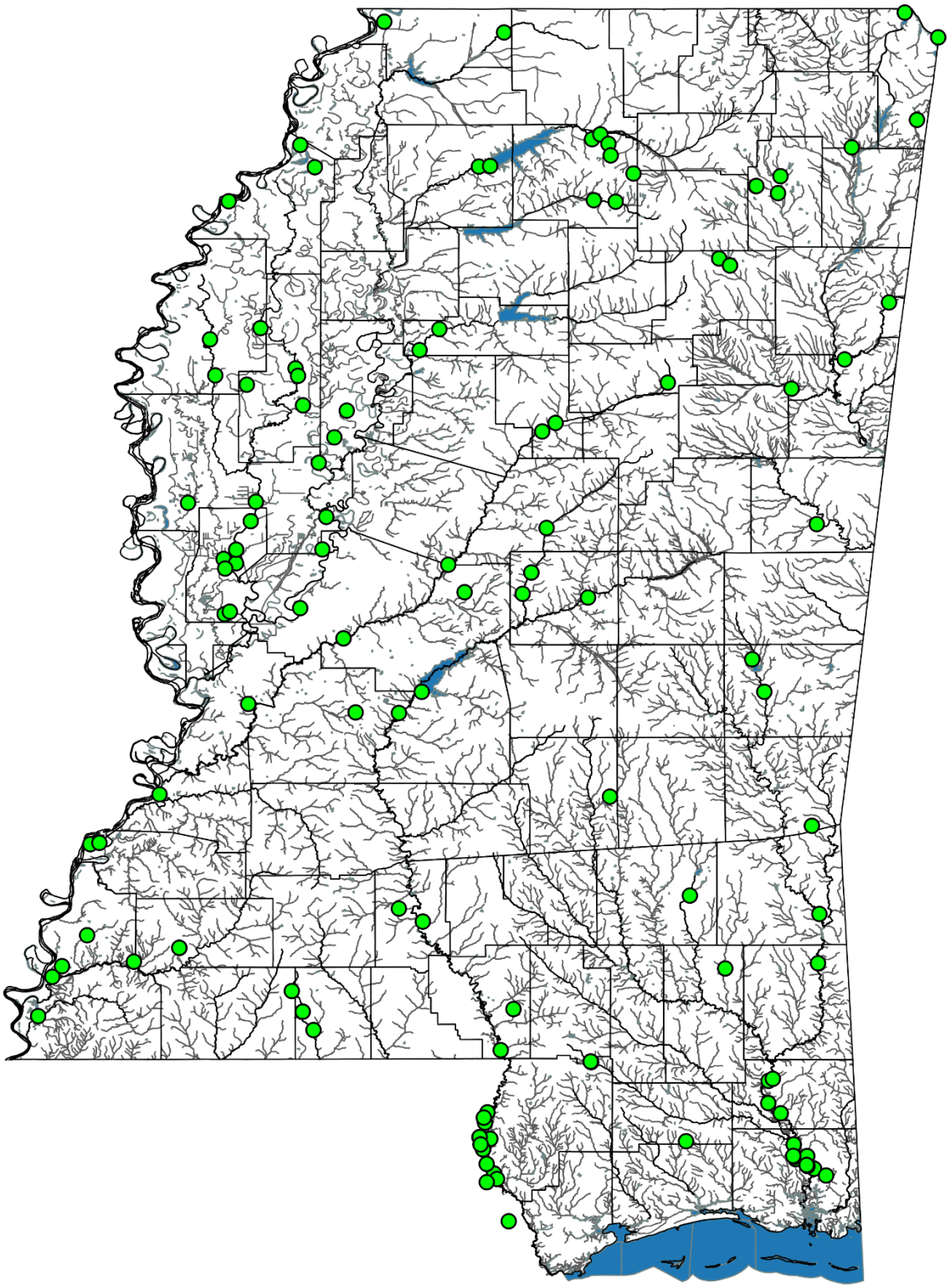

Distribution of *Utterbackia imbecillis* in Mississippi.

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UTTERBACKIANA HARTFIELDORUM (WILLIAMS, BOGAN, AND GARNER, 2009)
CYPRESS FLOATER

***Utterbackiana hartfieldorum* – Top: MMNS 5503, McCrea Dead River, George County, 105 mm (4.1 in.). Bottom: MMNS 10970, Oktibbee Reservoir, Lauderdale County, 95 mm (3.7 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval, moderately inflated and thin. Posterior slope narrow to moderately wide.
Posterior ridge: None.
Umbo: Slightly to moderately above the hinge line.
Color and pattern: Smaller specimens are light greenish to yellowish, larger ones are dark yellowish brown. Rays are faint on the posterior slope in smaller specimens and may be narrow and broken. Some individuals may have faint rays anteriorly.
Surface: Shell surface smooth, no ornamentation.
Nacre: Dull white, slightly iridescent in small specimens.
Umbo cavity: Shallow.
Teeth: Absent.
Interdentum: Absent.
Size: Maximum shell length of specimens from Mississippi in the MDWFP collection is 149 mm (5.9 in.)

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DISTRIBUTION: Florida, Alabama, Mississippi, and Louisiana.
MISSISSIPPI DISTRIBUTION: Occurs in the Tombigbee, Pascagoula, and Pearl drainages.
SIMILAR SPECIES: Most closely resembles *Utterbackiana suborbiculata*, which is more rounded, has an umbo that does not extend above the hinge line, and is less inflated. *Utterbackia imbecillis* and *Pyganodon grandis* both lack teeth, but the former has an umbo that does not extend above the hinge line and the latter is not as rounded as *U. hartfieldorum*.
NATURAL HISTORY:
Habitat: Found in ponds, sloughs, oxbows, reservoirs, or backwaters of streams and rivers. These areas usually have soft, mucky substrates and little or no current.
Reproduction: Four gravid females have been found in Mississippi, all in October. Three were found in the Pascagoula drainage, two in George County and one in Jackson County. A single gravid female was found in the Pearl drainage in Madison County. The shell length of the four females averaged 68.8 mm (2.7 in.) and ranged from 58 to 82 mm (2.3 – 3.2 in.).
Fish hosts: Unknown.
STATUS: MNHP: G4S4.
We have collection records from 11 Mississippi counties, and most of our specimens are from the Pascagoula and Pearl drainages. The distribution of this species in Mississippi may be more extensive than currently known because it occurs in habitats that are sometimes difficult to access and that are not the most desirable places to look for mussels in the state (Williams et al., 2014).
TAXONOMIC NOTES: Formerly known as *Anodonta hartfieldorum* but was recently moved to the genus *Utterbackiana* (Williams et al., 2017).

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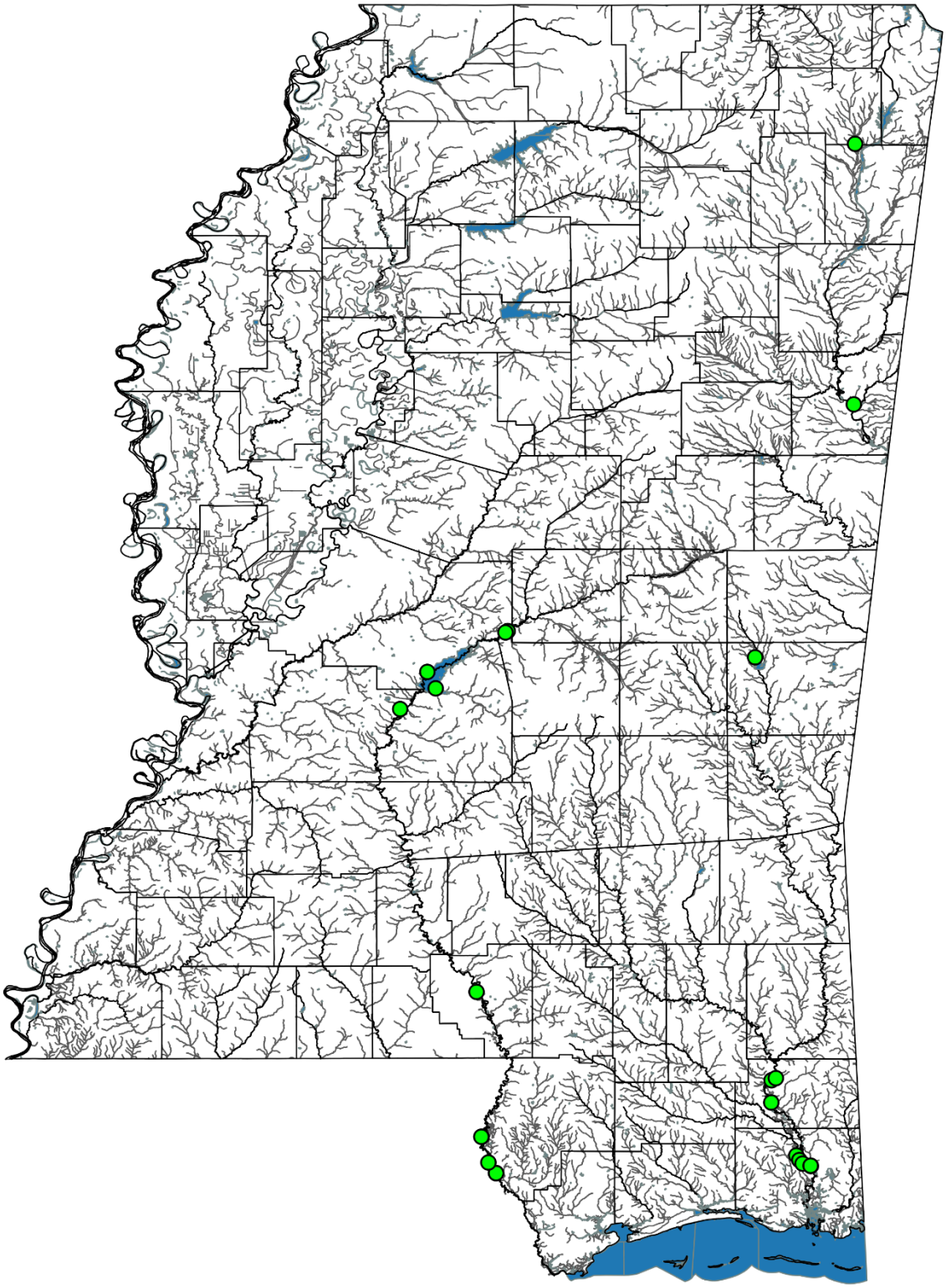

Distribution of *Utterbackia hartfieldorum* in Mississippi.

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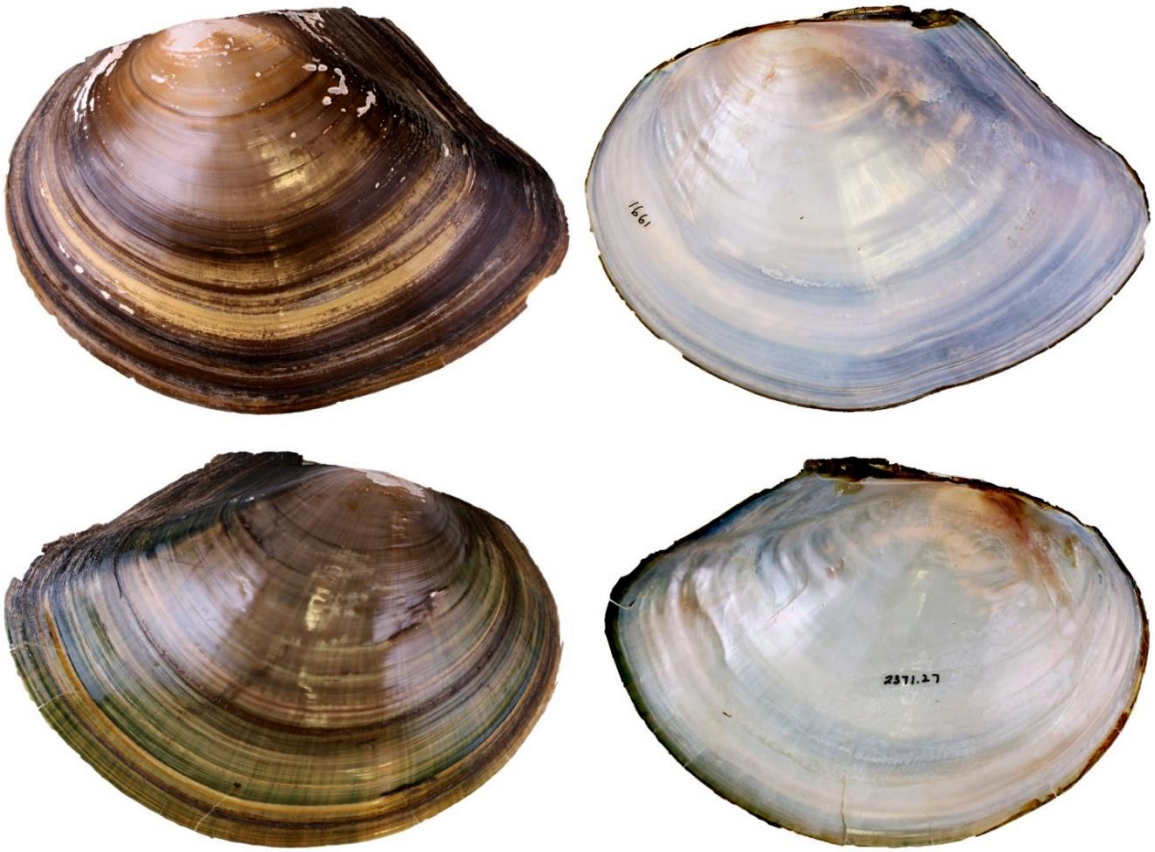
UTTERBACKIANA SUBORBICULATA (SAY, 1831)
FLAT FLOATER



***Utterbackiana suborbiculata* – Top: MMNS 1661, Lake Jackson, Washington County, 171 mm (6.7 in.). Bottom: MMNS 2371, Roadside ditch, Malmaison Wildlife Management Area, Grenada County, 135 mm (5.3 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell broadly oval to round, compressed and thin, usually with a small dorsal wing posterior to the umbo.
Posterior ridge: Broadly rounded and usually indistinct.
Umbo: Below hinge line.
Color and pattern: Shell greenish yellow to yellowish white in young specimens, older specimens are grayish to brownish yellow. Some specimens from the Mississippi River drainage have alternating bands of dark gray and yellowish brown following growth lines on the sides of the shell. Rays, if present, are faint, very thin, often broken, and are obscure in larger specimens. Some populations have distinct rays, others lack rays altogether. A few specimens from the Tennessee drainage and from areas in the Mississippi River alluvial plain have two relative thick, dark rays extending from the base of the umbo past the dorsal wing.

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Surface: Shell surface smooth, no ornamentation.
Nacre: Dull white, iridescent around edges of shell.
Umbo cavity: Very shallow.
Teeth: Absent, although there may be a slight thickening of the hinge line.
Interdentum: Absent.
Size: Maximum shell length of Mississippi specimens in the MDWFP collection is 169 mm (6.6 in.).
DISTRIBUTION: Ohio and Indiana south to Texas and Alabama.
MISSISSIPPI DISTRIBUTION: Widely scattered throughout the state, but not found in the Big Black, Coastal, nor Lake Pontchartrain drainages in Mississippi, although reported from the latter in Louisiana (Vidrine, 1993).
SIMILAR SPECIES: *Utterbackiana suborbiculata* most closely resembles *U. hartfieldorum*, the Cypress Floater. The latter is not as rounded, has an umbo slightly above the hinge line, and is more inflated than the *U. suborbiculata* (Williams, et al., 2008). *Pyganodon grandis* and *Utterbackia imbecillis* also lack teeth but the former has an umbo much higher than the hinge line, and the latter is elliptical rather than oval like *U. suborbiculata*.
NATURAL HISTORY:
Habitat: *Utterbackiana suborbiculata* is most often found in ponds, sloughs, oxbows, reservoirs, or backwaters of streams and rivers with little to no current and soft, mucky substrates.
Reproduction: Nothing is known of the reproduction of this species in Mississippi, but in other areas it is apparently gravid from the fall of one year to spring the next year (Williams et al., 2008).
Fish hosts: Seven species of fish in three families, all of which occur in Mississippi, are known hosts of this mussel. These include the White Crappie (*Pomoxis annularis*), Largemouth Bass (*Micropterus salmoides*), Warmouth (*Lepomis gulosus*), Longear Sunfish (*L. megalotis*), Green Sunfish (*L. cyanellus*), Golden Shiner (*Notemigonus crysoleucas*), and Channel Catfish (*Ictalurus punctatus*).
STATUS: MNHP: G5S3S4.
We have specimens in our collection from 23 Mississippi counties, but most are from the Yazoo drainage. As with *U. hartfieldorum*, our records are probably more representative of under-collecting rather than of the scarcity of this species in Mississippi, largely because of the difficulty of accessing appropriate habitat and the nature of that habitat.
TAXONOMIC NOTES: Formerly in the genus *Anodonta* but was recently moved to the genus *Utterbackiana* by Williams et al. (2017).

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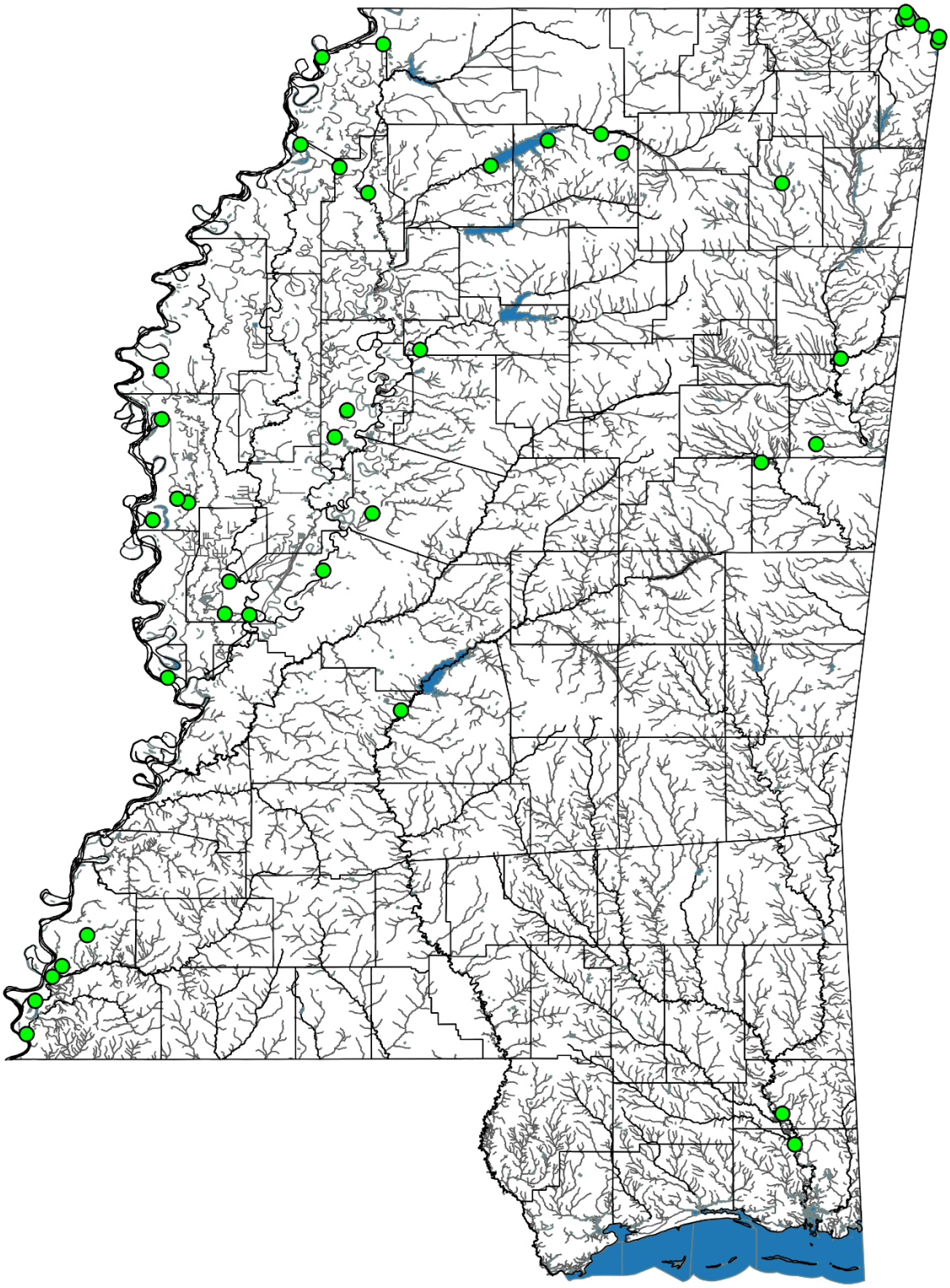

Distribution of *Utterbackiana suborbiculata* in Mississippi.

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VILLOSA LIENOSA (CONRAD, 1834)
LITTLE SPECTACLECASE

***Villosa lienosa* – Top: MMNS 9996, female, Yockanookany River, Attala County, 56 mm (2.2 in.). Bottom: MMNS 5714, male, Yellow Creek, Lowndes County, 55 mm (2.2 in.).**

SHELL CHARACTERISTICS:

Shape and structure: Shell oval to elliptical, moderately inflated, rarely moderately compressed, moderately thick. Marsupial swelling of posterior end in adult females.

Posterior ridge: Broadly rounded, not prominent.

Umbo: Above hinge line but not prominent.

Color and pattern: Shell yellowish brown to dark brown to black. Rays usually absent, but do occur in some individuals. Rays, if present, are usually faint, but in some populations in the Tombigbee drainage they are fairly prominent. Rays are usually more prevalent on the posterior end of the shell but sometimes occur over the entire shell.

Surface: Shell smooth, no ornamentation, but texture of the shell is generally coarser in larger shells than in smaller ones.

Nacre: Usually purple, ranging from light purplish white restricted to the umbo cavity to darker purple over the entire nacre. Rarely orange to peach.

Umbo cavity: Relatively shallow.

Teeth: Two pseudocardinals and two laterals in the left valve, one pseudocardinal and one lateral in the right valve. Teeth moderately well-developed but not massive.

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Interdentum: Present but narrow.
Size: Largest specimen from Mississippi in the MDWFP collection has a shell length of 90 mm (3.5 in.).
DISTRIBUTION: Ohio and West Virginia west to Missouri and Oklahoma, south to Texas and Louisiana, east to Florida and Georgia.
MISSISSIPPI DISTRIBUTION: Found throughout Mississippi in all ten drainages of the state.
SIMILAR SPECIES: This species resembles *Villosa vibex*, but that species has a much thinner and more fragile shell and usually has rays while *V. lienosa* usually does not. *Villosa lienosa* might be mistaken for *Strophitus undulatus*, but the latter lacks well-developed hinge teeth. Larger individuals of *Toxolasma texasiense* might also be mistaken for *V. lienosa*, but the former is usually more elliptical, has less developed and smaller hinge teeth, and has a white rather than purplish nacre.
NATURAL HISTORY:
Habitat: *Villosa lienosa* occurs in some rivers and reservoirs, but is much more common in creeks where it is found in sand, gravel, and mud substrates in areas with current.
Reproduction: There are 32 gravid females in the MDWFP collections which averaged 49.0 mm (1.9 in.) in shell length and ranged from 37 – 68 mm (1.5 – 2.7 in.). One of these was found in May, four were found in June, one was found in July, 14 were found in September, and 12 were found in October.
Fish hosts: There are eight known fish hosts in two families for *V. lienosa*, all of which are found in Mississippi. These include Green Sunfish (*Lepomis cyanellus*), Longear Sunfish (*L. megalotis*), Orangespotted Sunfish (*L. humilis*), Redear Sunfish (*L. microlophus*), Bluegill (*L. macrochirus*), Largemouth Bass (*Micropterus salmoides*), and Channel Catfish (*Ictalurus punctatus*).
STATUS: MNHP: G5S5.
This is a common and relatively widespread species in Mississippi with records from 62 counties. Most of our collection records and specimens are from the Tombigbee, Pearl, and Pascagoula drainages.

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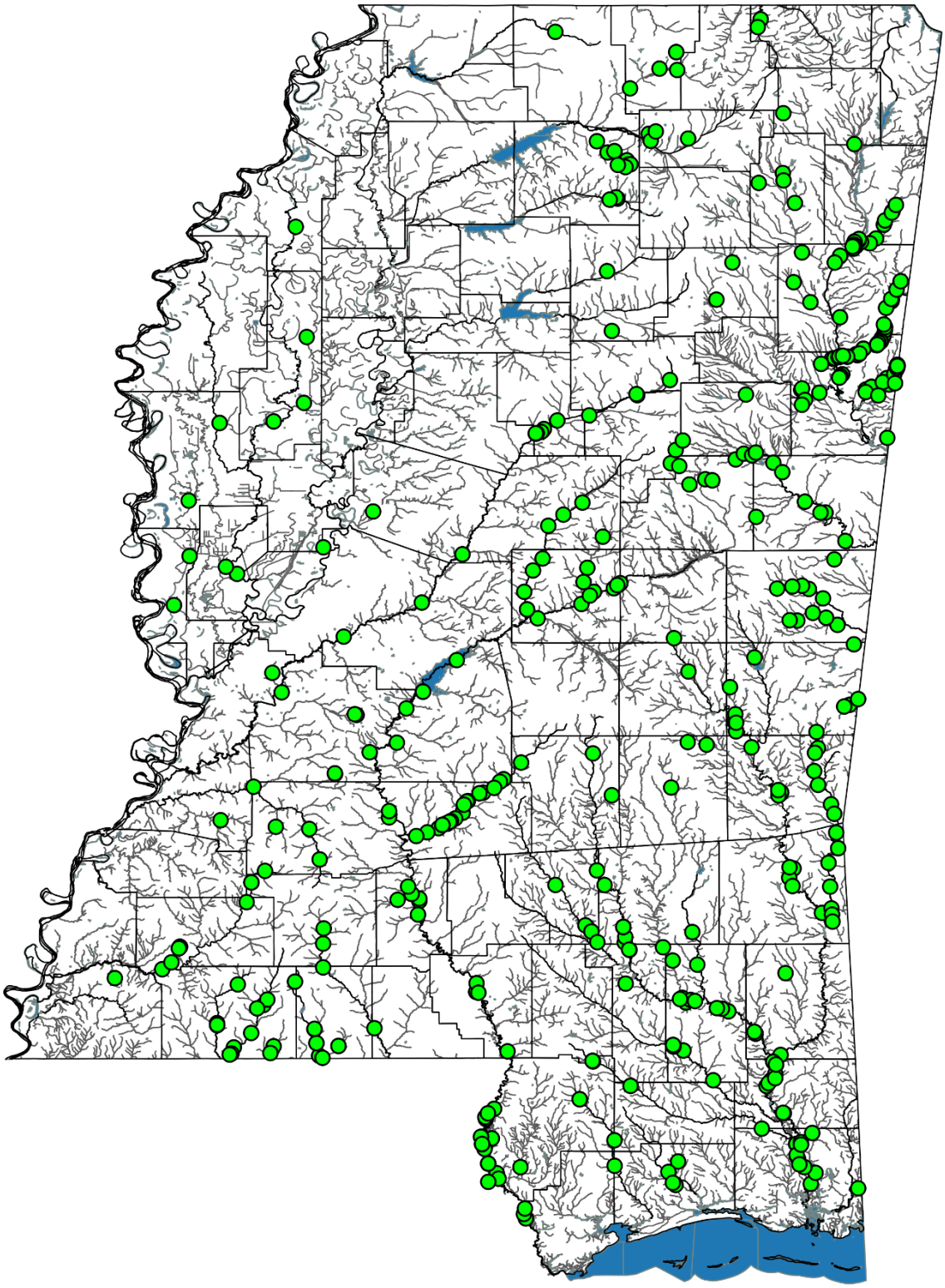

Distribution of *Villosa lienosa* in Mississippi.

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VILLOSA VIBEX (CONRAD, 1834)
SOUTHERN RAINBOW

***Villosa vibex* – Top: MMNS 919, Buttahatchee River, Lowndes County, 70 mm (2.8 in.). Bottom: MMNS 1547, Wolf River, Pearl River County, 62 mm (2.4 in.).**

SHELL CHARACTERISTICS:
Shape and structure: Shell oval to broadly elliptical, slightly inflated to slightly compressed, relatively thin in smaller specimens, thicker in larger ones. Females with a marsupial swelling posteriorly.
Posterior ridge: Broadly rounded, not prominent.
Umbo: Just above hinge line but not prominent.
Color and pattern: Shell light brown or chestnut to dark brown. Rays present on most specimens, thin to wide, prominent to faint, concentrated in one part of the shell or over entire shell. Prominent rays are more common than faint ones.
Surface: Shell surface smooth, no ornamentation, texture smooth even in large shells.
Nacre: Generally white but faint purple wash in umbo of larger specimens.
Umbo cavity*:* Shallow.
Teeth: Two pseudocardinals and two laterals in the left valve, one pseudocardinal and one lateral in the right valve. Teeth relatively small and not prominent.
Interdentum: Present but narrow.
Size: Largest specimen from Mississippi in MDWFP collection has a shell length of 84 mm (3.3 in.).
DISTRIBUTION: Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, and Tennessee.

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MISSISSIPPI DISTRIBUTION: Found in all Mississippi drainages except the Big Black and Tennessee.

SIMILAR SPECIES: This species is similar to *Villosa lienosa*, which has a thicker shell and usually lacks rays. The hinge teeth of *V. vibex* are smaller and less developed than in *V. lienosa*, the marsupial swellings in females of *V. lienosa* are larger than in females of *V. vibex* of similar size, and rays in *V. lienosa*, if present, are generally not as prominent as those of *V. vibex*.

NATURAL HISTORY:

Habitat: This species is found primarily in creeks and small rivers, where it can be found in sandy gravel, gravel, or sand and silt substrates.

Reproduction: Eleven gravid females from Mississippi and Alabama in the MDWFP collection averaged 49.7 mm (2.0 in.) in shell length and ranged from 33 – 63 mm (1.3 – 2.5 in.). One of these females was found in January, three in March, two in April, two in May, and three in September.

Fish hosts: There are six species of fish in two families that are known hosts of the Southern Rainbow. Five of these, the Blackspotted Topminnow (*Fundulus olivaceus*), Largemouth Bass (*Micropterus salmoides*), Spotted Bass (*M. punctulatus*), Longear Sunfish (*Lepomis megalotis*), and Green Sunfish (*L. cyanellus*), occur in Mississippi.

STATUS: MNHP: G5S4.

We have specimens of this species from 25 Mississippi counties. Even though the Southern Rainbow is found over much of the state, it does not appear to be common anywhere. Most of our collection records and specimens are from the Pascagoula, Tombigbee, and Coastal Rivers drainages.

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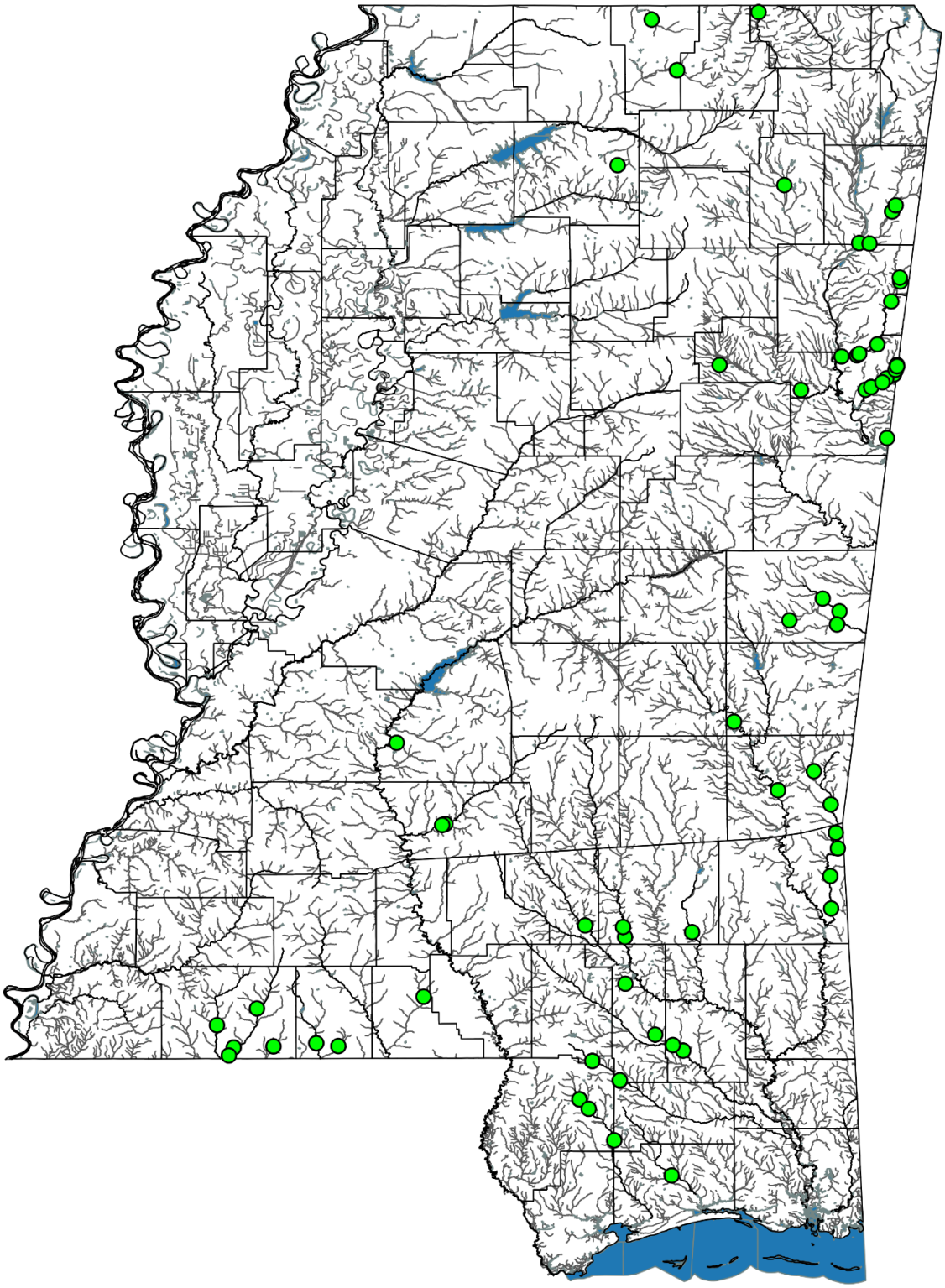

Distribution of *Villosa vibex* in Mississippi.

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APPENDIX 1

Species of freshwater mussels in Mississippi by drainage. Scientific names in red indicate those species which are listed by the MDWFP as endangered within the state and those with an asterisk are listed nationally by the USFWS as threatened or endangered.

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SPECIES	BIG BLACK	COASTAL RIVERS	LAKE PONTCHA-TRAIN	MS RIVER NORTH	MS RIVER SOUTH	PASCA-GOULA	PEARL RIVER	TENNESSEE RIVER	TOMBIGBEE RIVER	YAZOO RIVER
Actinonaias ligamentina										X
Amblema plicata	X			X	X	X	X	X	X	X
Arcidens confragosus	X						X	X	X	X
Cyclonaias asperata									X	
Cyclonaias nodulata	X				X					X
Cyclonaias pustulosa	X			X	X			X		X
Cyclonaias refulgens			X			X	X			
Cyclonaias tuberculata								X		
Cyprogenia aberti										X
Ellipsaria lineolata	X			X				X	X	X
Elliptio arca						X	X		X	
Elliptio arctata						X	X		X	
Elliptio crassidens	X		X	X	X	X	X	X	X	
*Epioblasma brevidens**								X		
*Epioblasma penita**									X	
*Epioblasma triquetra**								X		
Eurynia dilatata				X						X

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SPECIES	BIG BLACK	COASTAL RIVERS	LAKE PONTCHA-TRAIN	MS RIVER NORTH	MS RIVER SOUTH	PASCA-GOULA	PEARL RIVER	TENNESSEE RIVER	TOMBIGBEE RIVER	YAZOO RIVER
Fusconaia cerina		X	X			X	X		X	
Fusconaia flava	X			X	X					X
Glebula rotundata	X					X	X			X
*Hamiota perovalis**									X	
Lampsilis cardium	X			X	X			X		X
Lampsilis fasciola								X		
Lampsilis hydiana										X
Lampsilis ornata			X			X	X		X	
Lampsilis ovata								X		
Lampsilis siliquoidea	X				X					X
Lampsilis straminea		X	X			X	X		X	
Lampsilis teres	X		X	X	X	X	X	X	X	X
Lasmigona alabamensis									X	
Lasmigona complanata	X					X	X	X		
Lasmigona costata								X		
Leptodea fragilis	X	X	X	X	X	X	X	X	X	X
Ligumia recta							X	X	X	X

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SPECIES	BIG BLACK	COASTAL RIVERS	LAKE PONTCHA-TRAIN	MS RIVER NORTH	MS RIVER SOUTH	PASCA-GOULA	PEARL RIVER	TENNESSEE RIVER	TOMBIGBEE RIVER	YAZOO RIVER
Ligumia subrostrata	X			X	X	X	X		X	X
*Medionidus acutissimus**									X	
Megalonaias nervosa	X			X	X	X	X	X	X	X
Obliquaria reflexa	X			X	X		X	X	X	X
Obovaria arkansasensis	X		X		X	X	X		X	
Obovaria subrotunda	X				X					X
Obovaria unicolor			X			X	X		X	
Plectomerus dombeyanus	X			X	X	X	X		X	X
*Plethobasus cyphyus**										X
Pleurobema beadleianum		X	X		X	X	X			
*Pleurobema curtum**									X	
*Pleurobema decisum**									X	
*Pleurobema marshalli**									X	
*Pleurobema perovatum**									X	
Pleurobema rubrum	X									X
*Pleurobema taitianum**									X	
Pleuronaia barnesiana								X		

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*Pleuronaia dolabelloides**								X		
Potamilus alatus				X	X			X		
*Potamilus capax**				X	X					X
*Potamilus inflatus**							X		X	
Potamilus ohiensis	X			X	X				X	X
Potamilus purpuratus	X		X	X	X	X	X		X	X
Pseudodontoides subvexus									X	
Ptychobranchus fasciolaris								X		
Pyganodon grandis	X		X	X	X	X	X	X	X	X
Quadrula apiculata	X			X	X	X	X	X	X	X
Quadrula nobilis						X	X		X	
Quadrula quadrula	X			X	X			X		X
Quadrula rumphiana									X	
Reginaia ebenus	X			X	X	X	X	X	X	X
Strophitus pascagoulaensis			X			X	X			
Strophitus radiatus	X				X				X	X
Strophitus undulatus	X			X	X			X		X

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*Theliderma cylindrica**	X							X		X
Theliderma metanevra									X	
*Theliderma stapes**									X	
Toxolasma corvunculus									X	
Toxolasma parvum	X			X	X	X	X	X	X	X
Toxolasma texasiense	X		X	X	X	X	X		X	X
Tritogonia verrucosa	X		X	X	X	X	X	X	X	X
Truncilla donaciformis					X		X	X	X	X
Truncilla truncata	X				X			X		X
Uniomerus declivis	X				X		X			X
Uniomerus tetralasmus	X	X		X	X	X	X		X	X
Utterbackia imbecillis	X	X	X	X	X	X	X	X	X	X
Utterbackiana hartfieldorum						X	X		X	
Utterbackiana suborbiculata				X	X	X	X	X	X	X
Villosa lienosa	X	X	X	X	X	X	X		X	X
Villosa vibex		X	X	X		X	X		X	X
TOTAL SPECIES	**37**	**8**	**18**	**30**	**37**	**33**	**39**	**34**	**51**	**44**

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SPECIES	BIG BLACK	COASTAL RIVERS	LAKE PONTCHA-TRAIN	MS RIVER NORTH	MS RIVER SOUTH	PASCA-GOULA	PEARL RIVER	TENNESSEE RIVER	TOMBIGBEE RIVER	YAZOO RIVER
NUMBER LISTED BY USFWS OR MDWFP	1	0	0	2	1	1	2	6	11	5
PROPORTION OF MUSSELS LISTED	3%	0	0	7%	3%	3%	5%	18%	22%	11%

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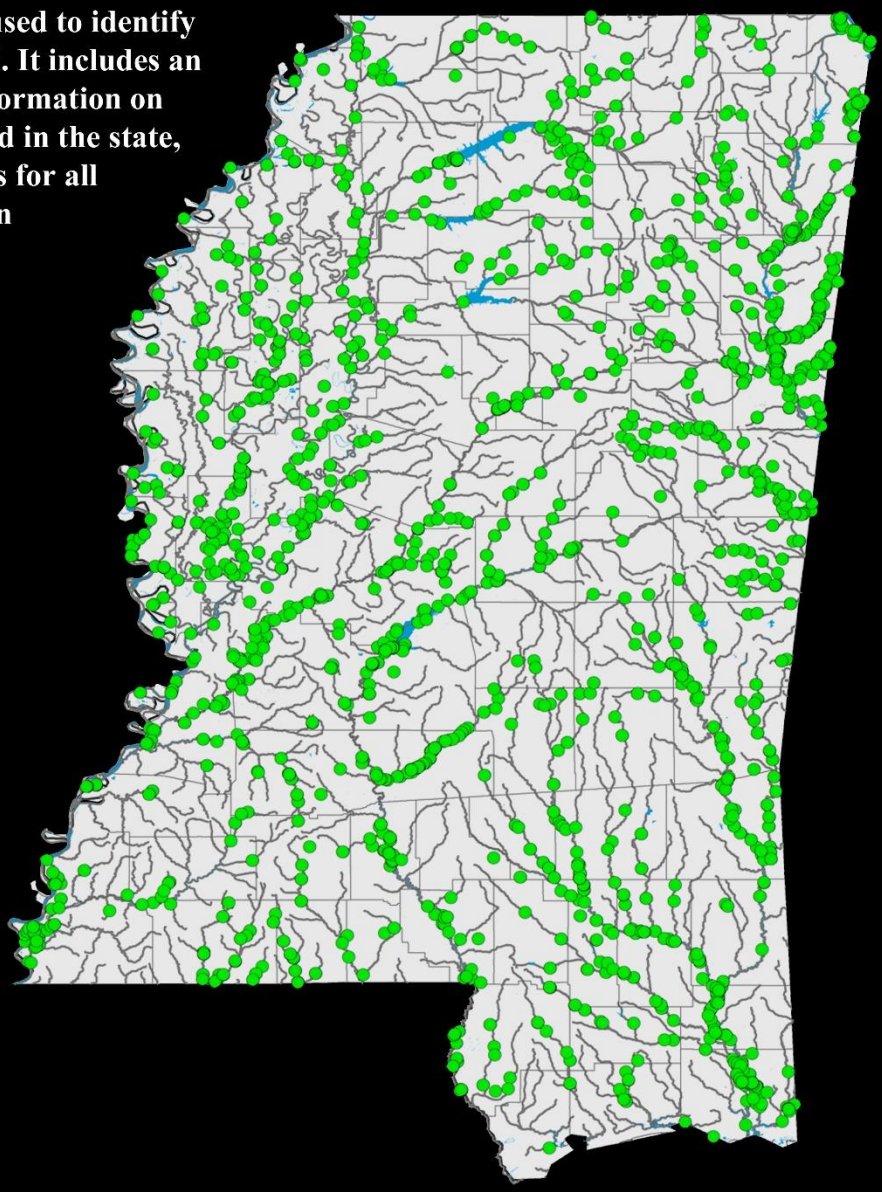
This book provides a resource that can be used to identify the freshwater mussels found in Mississippi. It includes an introduction to freshwater mussels with information on identification, a checklist of all species found in the state, a key to those species, and detailed accounts for all species of freshwater mussels that have been documented in Mississippi.



The species accounts include:

- External and internal color photographs of shells
- Mississippi distribution maps
- Mississippi distribution information
- National distribution information
- Information on how the species can be differentiated from similar species
- Details of shell characteristics
- Natural history information
- Information on the status of the species
- Taxonomic notes