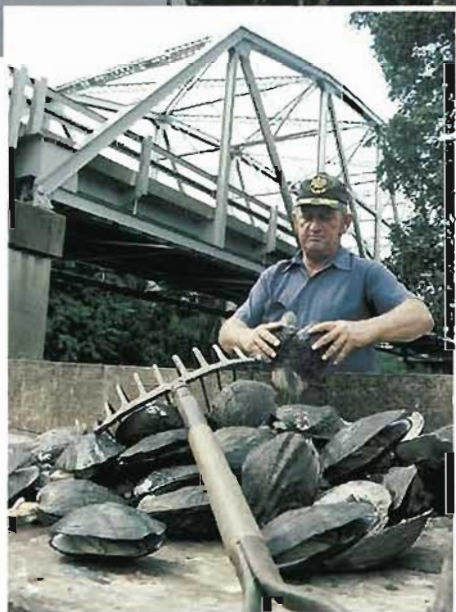


ARKANSAS MUSSELS





KEITH SUTTON



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Top Photo: Biologists examine mussels collected during a stream survey. Middle Photo: A commercial sheller prepares mussels for sale. Bottom Photo: Arkansas pearls and mussel shell jewelry. Cover photo of bleufer shells by Keith Sutton.

ARKANSAS MUSSELS

Written by
John L. Harris, Ph.D. and Mark E. Gordon, Ph.D.

Freshwater mussels are bottom-dwelling (benthic) animals often found in great abundance in Arkansas lakes and streams. Mussels, also known as clams or naiades, occur in virtually every aquatic habitat from the smallest streams to the largest rivers and the murkiest swamps to monstrous reservoirs. They can occur in dense concentrations called "beds", where mussels may number more than 100 per square yard.

There are approximately 300 species of freshwater mussels belonging to the family Unionidae in North America, and many look alike to the untrained eye. Approximately 70 different kinds of unionid mussels are known from Arkansas, though some may have been eliminated due to pollution, impoundments, dredging, and/or natural processes.

The most often asked question about mussels is "What good are they?" Native American Indians found mussels a steady, easily obtained food source. Numerous prehistoric Indian sites buried along major Arkansas rivers contain thousands of mussel shells that were dumped in village trash heaps called "middens". Indians also used mussel shells for tools, utensils, and ornaments.

Without the advent of plastics during World War II, all of us would be more familiar with mussels. From the late 1800s until the late 1940s, most buttons on clothing were made from mussel shells. In fact, mussel harvesting and the button-making industry were big business in Arkansas and the upper Mississippi Valley. Many river families made a living fishing mussels from the bottoms of the Black, White, Spring, St. Francis, and Ouachita rivers. Once collected, the mussels were "cooked-out" along the river banks. Mussels were dumped in cauldrons of hot water so the fleshy insides could be easily separated from the valuable outer

shell. The shells were then shipped to factories at Newport, Pocahontas, Clarendon, and Black Rock for processing into buttons.

Shells were separated by species, graded according to thickness and quality, and then "button blanks" were punched from shells using hollow cylinder bits or hole saws of different diameters. Different size buttons were then ground to the appropriate thickness and soaked several days in water before the eyeholes were finally shaped and drilled. Finishing consisted of tumbling buttons in large wooden buckets, first with pumice, then a weak acid, and finally sawdust.

Mussel Anatomy

Freshwater mussels have two major parts - the hard outer shell and the soft inner body, commonly called the "meat". The shell has four layers of non-living material made primarily of calcium carbonate. The outside shell layer - the periostracum - contains the color, stripes, spots, and other markings helpful in identifying different species. The innermost shell layer touching the soft parts is called the "nacre".

The four shell layers are secreted by part of the soft body mass called the "mantle". The mantle surrounds all other soft parts and lies between them and the inside of the shell. Other soft body parts include a muscular foot, heart, stomach, kidney, gonad, digestive gland or "liver", mouth, two pairs of labial palps, and two pairs of gills (see Figure 1). The most conspicuous of these is the foot, a large, muscular organ used for movement and for anchoring the mussel on the stream or lake bottom. Two gills are on each side of the foot and are used for respiration, food collection, and as storage and growth chambers for larval mussels.

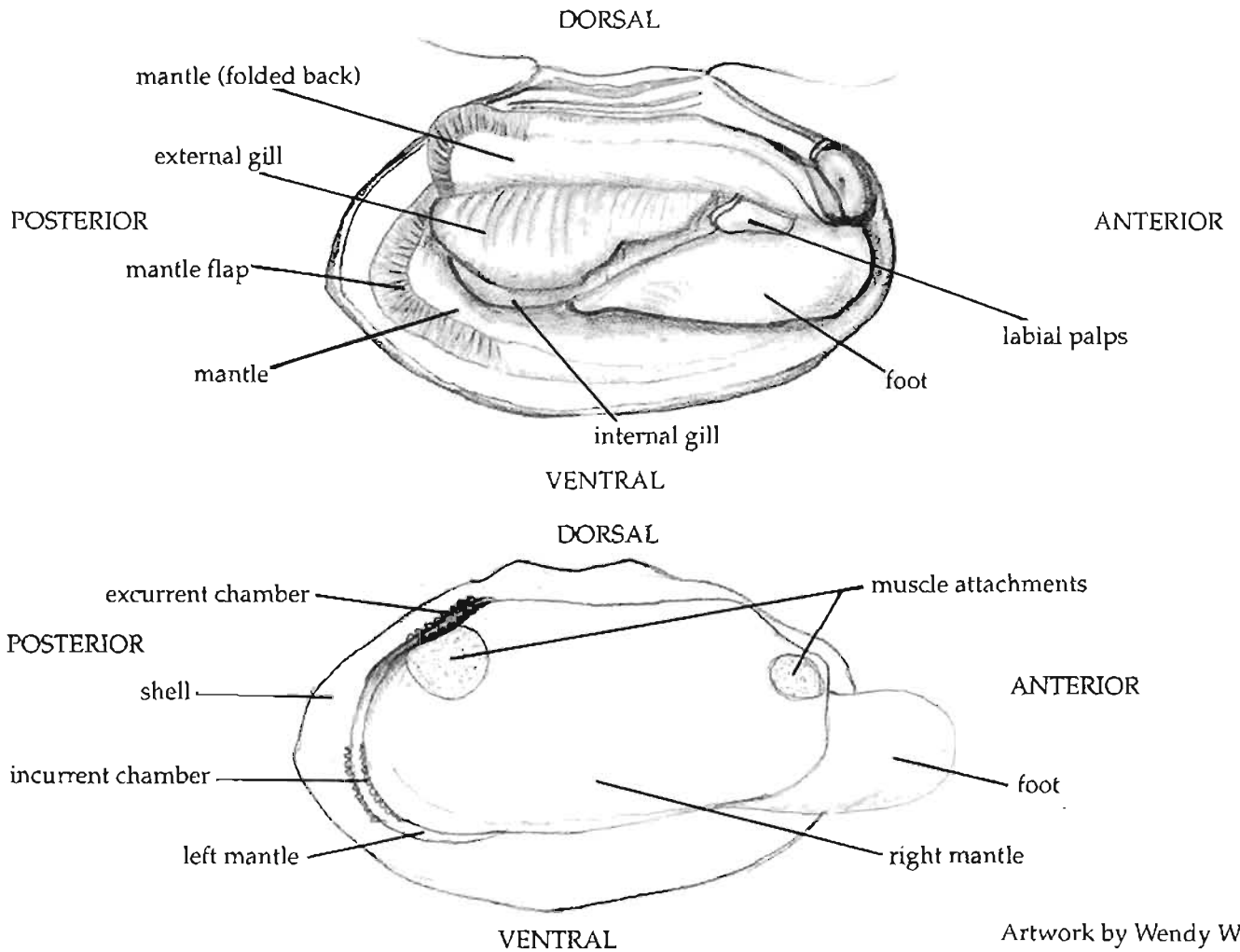


Figure 1. Internal mussel anatomy

Reproduction

Freshwater mussels have an unusual reproductive process. Most species have separate male and female individuals, although a few species are known to be hermaphroditic (both sexes in a single individual). The differences between sexes are seen in the shells of some species (particularly members of the genera *Lampsilis* and *Epioblasma*), because females are enlarged posteriorly to accommodate young during reproduction.

Males release sperm into the water during spring, summer or early fall. Eggs are fertilized within the female's suprabranchial chamber. The female's gills then act as a brood pouch or nursery for young that eventually develop into larvae called "glochidia". Females with brood pouches filled with glochidia are called "gravid". Some mussels use both gill pairs as brood pouches, and in others, only the outer gills are used.

Two distinctly different reproductive timing patterns exist in freshwater mussels. Long term brooders (also called winter brooders or "bradytic") spawn in late summer to early autumn and carry embryos or developing glochidia through the winter into spring. Short term brooders (also called summer brooders or "tachytic") reproduce during

summer, and females do not carry embryos or young for more than a few weeks.

Once the tiny glochidia (just microns in diameter) reach a certain stage of maturity, they are expelled from brood pouches to become parasites on fish gills, fins or external surfaces. One mussel species even parasitizes a salamander called the mudpuppy. The encysted glochidia are generally not visible to the naked eye while attached to fish but sometimes appear as tiny white dots on gills or fins.

Some mussels have mantle "flaps" which imitate small fish, crayfish, or insects, and may act as fish attractors. When these flaps are nibbled by fish, glochidia are shot in the fish's face and gills. Other mussels produce glochidial masses called "conglutinates" that resemble worms, grubs, or insects. Fish are infected with glochidia after eating conglutinates.

The parasitic stage may last from one to six weeks depending on the species of mussel and environmental conditions. The glochidia do not increase appreciably in size while on fish and apparently do not harm the host. Once the glochidia mature and transform into the juvenile form, the young mussel breaks through the fish tissue and

falls to the lake or stream bottom to begin life as a free-living mussel.

Not much is known of mussel early life history, and some species are difficult to find in juvenile stages. Some scientists speculate that perhaps the young burrow deep into the stream bottom and emerge when reproductively mature or when sub-surface conditions no longer support them.

Physiology and Behavior

Adult mussels spend most of their life passively entrenched in a stream or lake bottom with 30 to 100 percent of the shell buried. The anterior end is buried, and the posterior end, with the incurrent and excurrent siphons, is usually partially exposed. The shell is normally partially open allowing intake of water and nutrients, excretion of wastes, and protrusion of the foot to anchor the shell to the bottom.

Many species remain in the same location for their lifetime if environmental conditions are favorable, but mussels can move a limited distance by extending and contracting their muscular foot. "Mussel trails" are often seen on shallow sandbars when mussels seek deeper water to avoid death by drying, high temperatures or predation. This movement is slow and tedious, about like a person pulling a camper trailer through the woods without aid of a vehicle.

Mussels in the genus *Anodonta* (collectively called "the floaters") apparently trap air bubbles inside their thin, light shell causing them to float in water. The reason for floating behavior is unknown but may be related to avoiding environmental stress.

Mussels breathe by taking water through the incurrent siphon into the mantle cavity and passing it through tiny pores into small water tubes within the gills. Gas exchange occurs within the gill tubes and on the outer tissue surface. From the gills, water passes to the suprabranchial chamber then out the excurrent siphon.

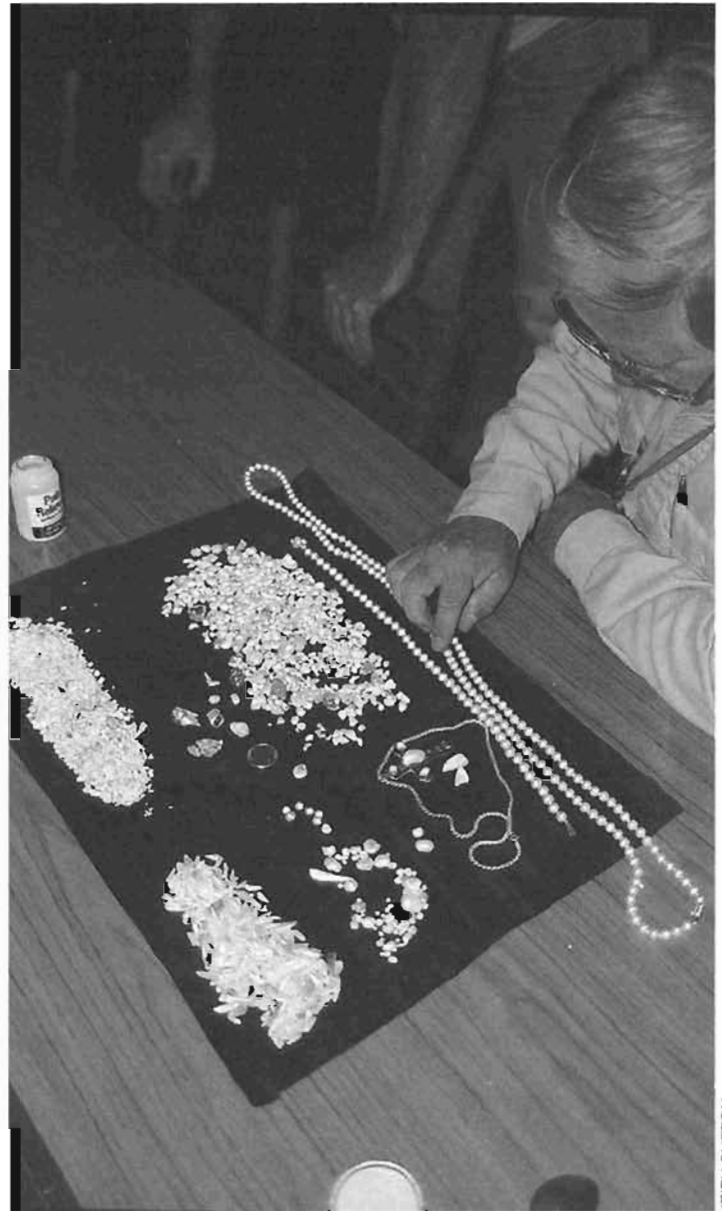
Mussels also feed by bringing water through the incurrent siphon and passing it over the gills. Food particles are trapped in mucus secreted by the gills, and the mucus-food mixture is moved by tiny hairlike structures (cilia) to flaps called "labial palps" located near the mouth. The labial palps separate food from junk and pass food into the mouth. Digestion occurs in the stomach, and waste passes from the anus to the excurrent siphon and out of the shell.

Commercial Value

Pearls are mussels' defense against invading material. If an irritant such as a sand grain lodges in mussel tissue adjacent the mantle and cannot be expelled, the mussel secretes mother-of-pearl to encyst the irritant. Many shell harvesters dream of finding a valuable freshwater pearl. This rarely happens, and pearls are found in less than five percent of mussels.

Most natural pearls are not round but occur in a wide variety of shapes and sizes. The imperfects are called "slugs" or "baroques". Round or semi-round pearls of any size are rare and not as valuable as might be thought.

The largest pearl known from Arkansas waters was about 20 millimeters (5/6 inch) in diameter and sold for about \$3,000.



Game & Fish Commission biologist Ken Shirley examines Arkansas pearls and pearl jewelry collected by Lester Gaither of DeValls Bluff. Fewer than five mussels out of every hundred contain pearls, and most of these are irregular in shape and of little value. Round or semi-round freshwater pearls are especially rare and may sell for several hundred dollars apiece.

Freshwater mussel shells are still important moneymakers for some Arkansans. Today, mussel shells are used primarily in the cultured pearl industry centered in Japan. Arkansas mussel shells are shipped overseas and processed into pearl nuclei by stripping the outer layer and punching appropriate-sized blanks into round pellets. These round, mother-of-pearl nuclei are then inserted into pearl oysters suspended in cages in a suitable estuary or ocean bay.

The actual nucleus insertion procedure is a closely guarded secret of the Japanese cultured pearl industry. Oysters are allowed to secrete their own mother-of-pearl around the nucleus for six months to three years, depending on the quality of pearl desired. Pearls are then harvested, graded, and sold for jewelry.

Because larger pearls are most costly, Japanese producers seek large, solid, thick freshwater shells from the United States to produce large nuclei. Most implanted nuclei range from 4 to 10 millimeters (1/6 to almost 1/2 inch) in diameter, and any mussel species thick enough to yield high quality nuclei this size can be sold to commercial buyers. Mussels yielding the highest prices at 1989 market values are the washboard, threeridge, mapleleaf, and ebonyshell. Other commercially valuable species include the butterfly, pimpleback, monkeyface, wartyback, rabbitsfoot, hickorynut, pigtoes, and muckets.

Market prices for mussel shells are highly variable depending on species, size, and grade of individual shells. Generally, lake-grown mussel shells are higher quality than river shells, because they develop in a more stable, less harsh environment, producing thicker shells with fewer imperfections. Shell buyers judge shell quality by size and thickness, shell strength (whether it breaks cleanly or in brittle pieces), and the purity of shell color (whether streaked with layered color or pure white). No precise records are available, but estimates indicate between 500 to 1000 tons of mussel shells were harvested annually from Arkansas waters in 1987-1988. At 1988 market prices, this made the Arkansas' shell industry a multimillion dollar business.

A smaller market exists for shells used in shell jewelry. Polished chips are cut or broken from mussel shells, polished to the desired finish, and put in rings, necklaces, and earrings. Especially desirable are mussel shells with colored purple nacre such as the bleufer, spike, and purple wartyback.

Mussel Harvest

Mussel shell harvest methods are quite variable. Some professional shellers use state-of-the-art boats and motors with radio communications and power winches for pulling heavy bags of shells up from the bottom. Most of these shellers, especially during warm water months, use diving equipment with surface air compressors feeding air through hoses to divers with hookah regulators. Sometimes regular SCUBA gear with tanks is used.

Dive methods have the advantage of allowing the sheller to actively find dense mussel concentrations and selectively harvest only commercially valuable species. Larger shelling operations send scouts throughout the eastern United States searching for high-quality, high-density shell beds. Aerial

At one time, crowsfoot dredges or "brails" provided the main means for harvesting mussels year-round. Brails are dragged along the bottom, and open mussels clamp down on the hooks. The rig is then hauled to the surface, mussels are removed, and non-commercial species are returned to the water. Today, this harvest method is used primarily during winter when water temperature is too cold for comfortable diving.



LERROY M. KOCH



LERROY M. KOCH



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Commercial shellers devise many ingenious diving rigs. This 175-pound diving helmet was constructed from a bomb casing. Pushed to the bottom by the helmet's weight, the diver scoots around on his rear, collecting shells by hand and placing them in a bag or net that is lifted to the surface with a rope or motor-powered winch. Air is supplied by a topside compressor, and a two-way radio allows communication with the boat crew.

Today, most commercial shellers use modern SCUBA gear when harvesting mussels during warm months. A wet suit provides warmth in chilly waters, and air is supplied by regular SCUBA tanks or a surface air compressor. Using this method, shellers can actively find dense mussel concentrations and harvest only commercially valuable species.



KEITH SUTTON

reconnaissance is sometimes used to locate potential shell locations. Once beds are located, a commercial shell operation's entire fleet may descend on the river or lake to harvest shells.

Many river shellers still harvest mussels the way it was done at the turn of the century using crowfoot dredges, also called "brails". These consist of a metal or wooden bar, usually 8 to 16 feet long, with long cotton, nylon, or chain stringers attached every 6 to 12 inches along the bar's length. The stringers have many four-pronged, blunt or bead tipped hooks called "crowsfeet" attached along their length. The entire unit is attached to a rope, lowered into the river and slowly pulled downstream. The crowsfeet drag along the bottom and touch open mussels which promptly close on the hooks. The hooks don't bury in the mussel's flesh, instead, the mussel captures itself by clamping down on the hook. Captured mussels are then hauled to the surface, removed from the brail, and non-commercial species are returned to the water. This method

allows work during cold water periods uncomfortable for diving. Disadvantages include a relatively inefficient "hit or miss" harvest and take of non-commercial species. Many individuals taken by brail and released will eventually die because mantle tissue is damaged during removal, and/or the shell cannot re-bury itself in the substrate. They roll along with the current, remaining tightly closed. Thus they can't feed and are presumed to starve to death.

Some shellers wade, dive, or snorkel in shallow waters to harvest mussels. Many small river shoals and lake fringes have commercial shell concentrations making this profitable and enjoyable for part-time shellers.

Shell Processing

Mussels are still processed much as they were during the industry's early days. Most are brought to the river bank or lake edge to be "cooked out" in hot water baths, although shell buyers will purchase "green shells" (the meat still inside) for a reduced price. The flesh is removed and examined for pearls. An exception to the cooking-out process is the bleufer. Bleufer meat is usually removed by knife, because cooking dulls the luster of the beautiful purple nacre.

Shells are sorted by size and species using a tubular tumbler with holes drilled to appropriate sizes. Small shells fall through the holes, and larger shells are retained. A conveyer belt piles mussels into stacks before loading for shipment. The shell buyer grades and sorts shells, puts them in burlap bags, and then they are ready to ship to cultured pearl producers.

Mussels, the Environment, and the Future

Mussels are excellent indicators of environmental health, just as body temperature is a gauge for your physical well being. Since mussels are stationary, filter-feeding organisms often occurring in dense colonies, they are subjected to many abuses heaped on them by man and the environment.

Chemicals and municipal wastes dumped in receiving waters are filtered through mussels' feeding, reproductive, and respiratory systems. Cold water released below impoundments cannot be avoided, only tolerated. Reduced water temperatures can eliminate fish hosts for the glochidia, severely limit mussel reproduction and feeding, or result in death from thermal shock. Sand and sediment from erosion, construction, and dredging cover river and lake bottoms, often at rates slow-moving mussels cannot avoid. The results are often disastrous.

Some species such as the turgid blossom and the spectaclecase apparently no longer occur in the state. The Ouachita River supported a thriving commercial shell business early in this century, but now there are few, if any, commercially valuable shell beds remaining. The same can be said for most Arkansas rivers — mussel numbers have dramatically declined.

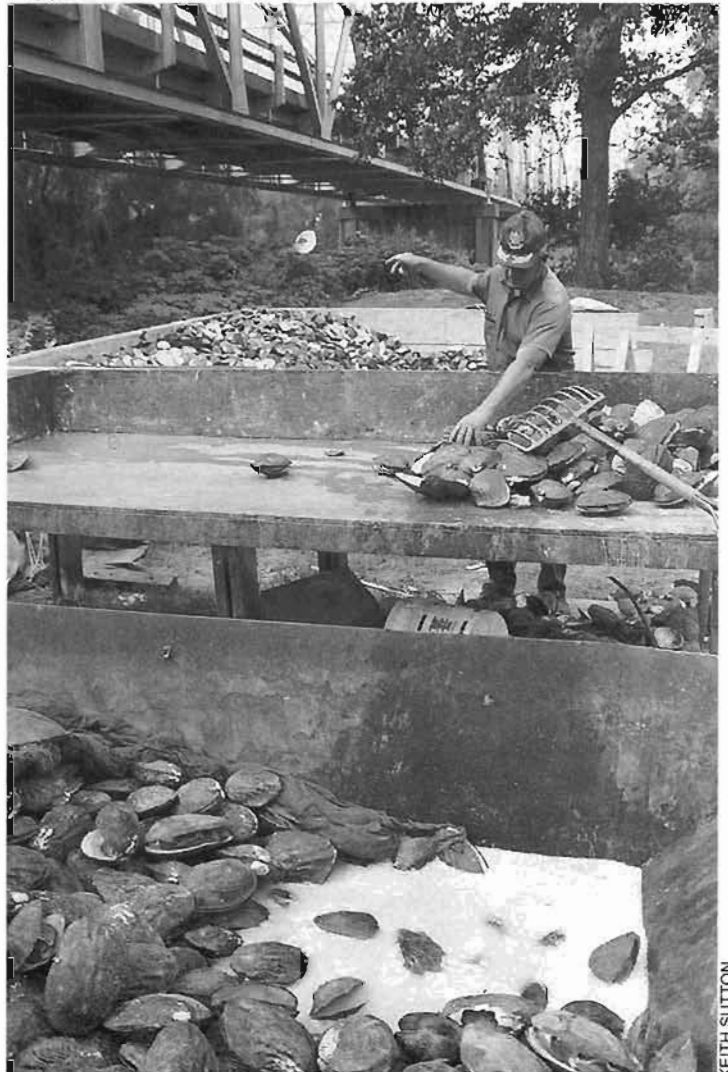
It is simplistic to blame mussel decline on chemicals, dredging, and impoundments. It is probably a complex interaction of these factors along with natural die-offs, viral or bacterial infections, over harvesting, and natural hardships that brought us to this point. Fortunately, it is not too late to preserve this valuable natural resource. The primary weapons at our disposal are education, research, and management. This brochure attempts to inform



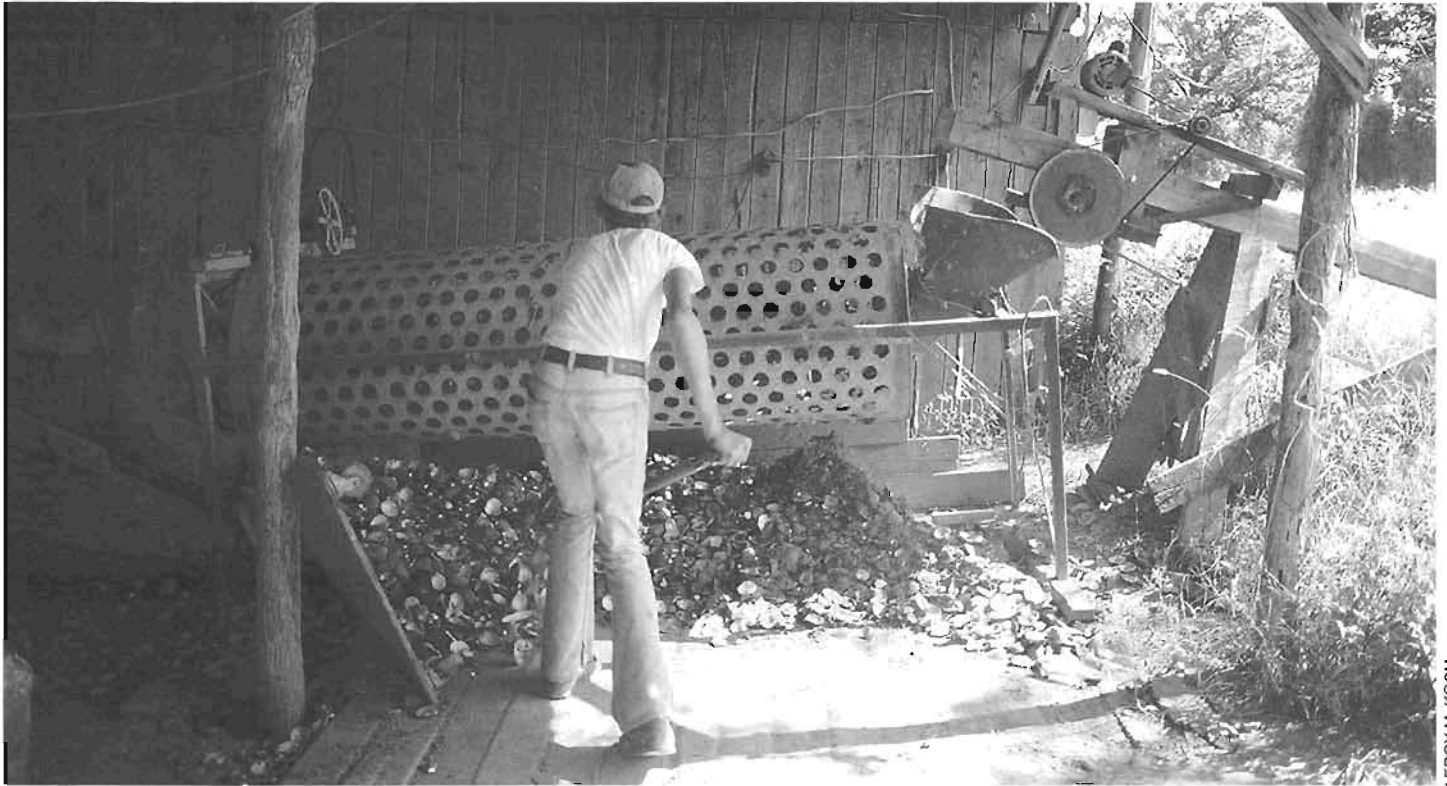
LEROY M KOCH

Cooking the mussels is the first step in shell processing. This is done in large metal vats or makeshift cookers like this one made from an old automobile hood. Gas or wood fuel is used to produce steam or a hot water bath that opens the shells.

When the shells have opened, they are allowed to cool, and the meat is then removed by hand and examined for pearls. The flesh, though edible, is extremely tough and rubbery. Most is used for hog feed.



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LERROY M. KOCH

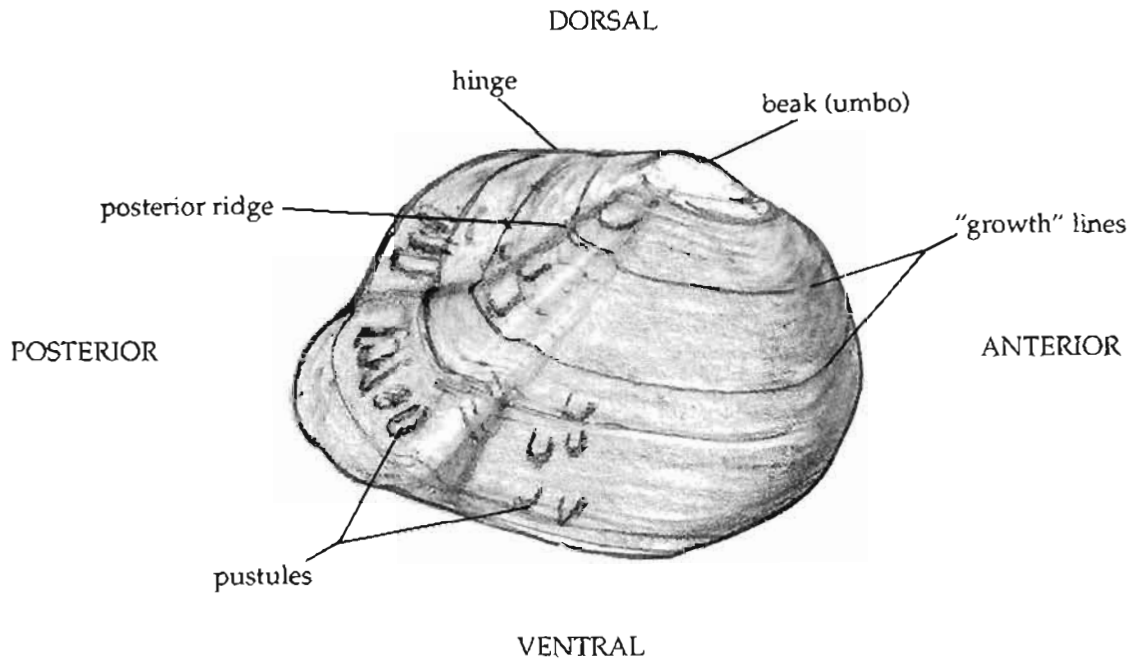
A tubular tumbler is used to sort shells by size and species. Small shells fall through holes in the tumbler, and larger shells remain inside. Sorted shells are then graded and packed in bags and are ready for sale.

Processed shells are sold to buyers who ship them to cultured pearl and shell jewelry producers. Although most Arkansans are unfamiliar with the mussel industry, this important business contributes millions of dollars to the state's economy each year. Protection of this valuable resource is a major concern of the Arkansas Game & Fish Commission and other state and federal agencies.

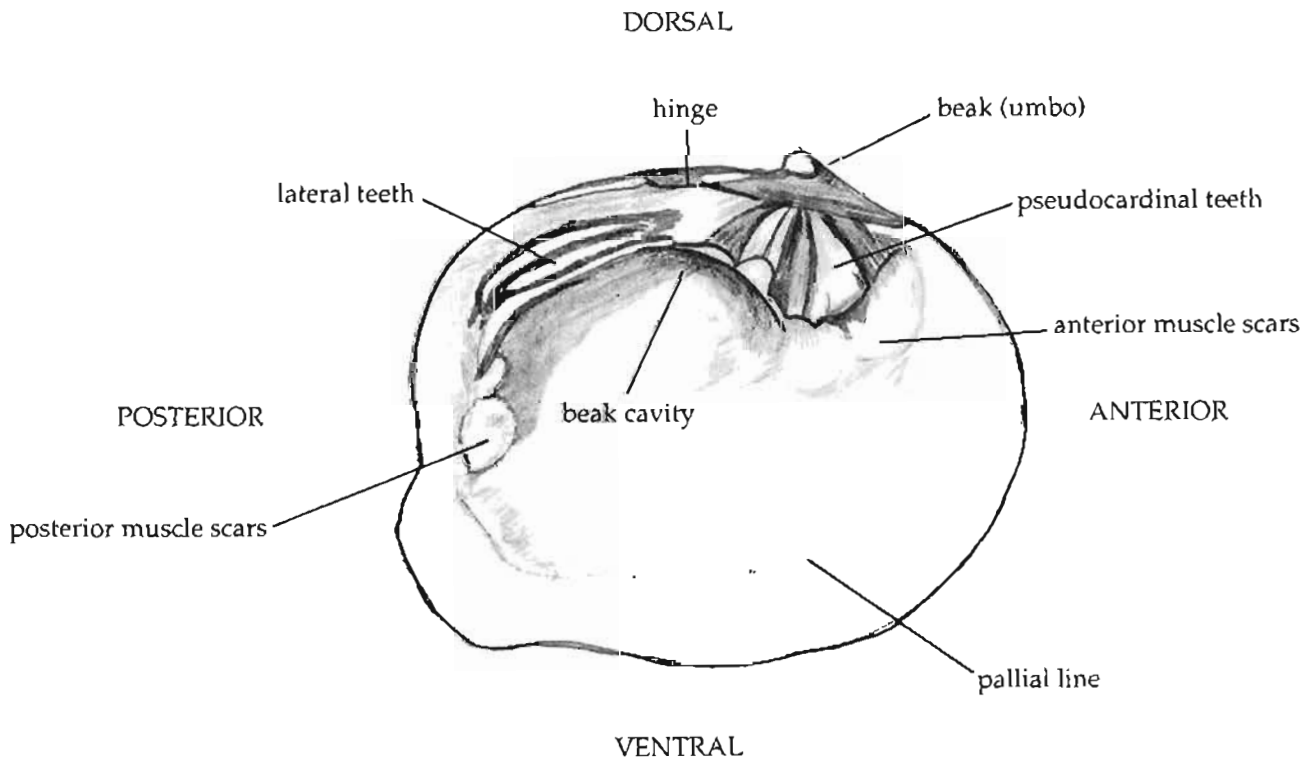


LERROY M. KOCH

SHELL ANATOMY



A. External shell anatomy.



B. Internal shell anatomy.

Figure 2.

Artwork by Wendy Welch

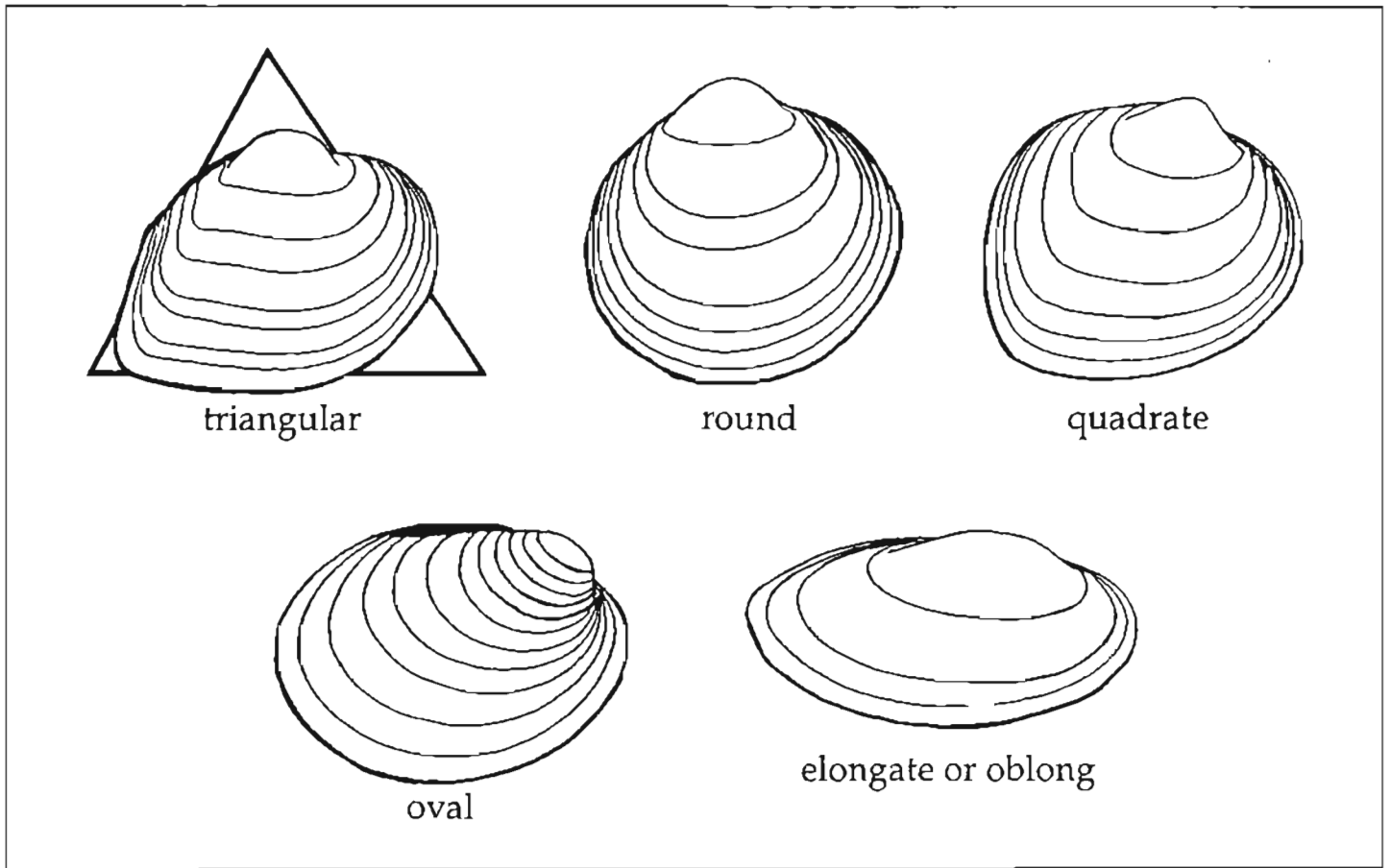


Figure 3. General shell shapes.

Arkansans of this important natural resource. With the support of Arkansans, the Arkansas Game and Fish Commission will continue research and preservation efforts to assure freshwater mussels are present for future generations.

Additional Reading

Several articles and books are suggested for those wanting to learn more about freshwater mussels. An enlightening article concerning the shell and cultured pearl industries appeared in *National Geographic* (Ward, 1985). Aspects of mussel reproduction were discussed in *Natural History* magazine (Welch, 1969). S. L. H. Fuller (1974) summarized much data regarding fish hosts of mussels. An identification manual for North American freshwater mussels was published by the Environmental Protection Agency (Burch, 1973) and reprinted by J. B. Burch (1975). Mussel books for the states of Missouri (Oesch, 1984), Kansas (Murray and Leonard, 1962), Illinois (Parmalee, 1967), and Wisconsin (Mathiak, 1979) are also available. The Missouri book has many of the same species occurring in Arkansas and goes into much more depth than this brochure allows. Technical papers dealing with the species and distribution of Arkansas mussels (Gordon, 1981; Gordon, et al, 1980) and rare and endangered Arkansas mussels (Harris and Gordon, 1987) may also be of interest.

Mussel Identification

A certain amount of technical terminology is necessary when describing how to identify mussel shells. Figure 2

illustrates a common mussel species and shows the location of shell parts and regions discussed in the Description section of each species account. Figure 3 shows general shell shapes and the term used in the Description for a particular shape. The accounts on the following pages begin with the accepted Common Name of the species as given in *American Fisheries Society Special Publication 16* (Turgeon, et al, 1988). Each mussel's Species Name (Latin or scientific mussel's name) is followed by the author and year of the original description. This is followed by the Local Name(s), common names for Arkansas mussels used by Arkansas shellers and shell buyers.

In the Description, we try to note identifying species characteristics without being too technical. The most common Habitat for each species and the river, creek, or lake where commonly found is listed. Reproductive season and known fish hosts are presented in the Biology section, and the Commercial Value section is self explanatory. Similar Species should be compared and contrasted when positive identification based on the description is not possible. The photographs are intended to represent typical shells, but no two shells of the same species are exactly alike. Like people, some are long, some short, some fat, some skinny. There is much variation among members of the same species.

Seven species found in Arkansas that are either currently on the Federal Endangered Species list or are candidate species likely to be added soon are discussed. Following these, 36 common mussel species likely to be encountered on a lake or river outing are presented.

CURTIS PEARLYMUSSEL

Epioblasma florentina curtisi (Utterback, 1916)
(Federal Endangered Species)

LOCAL NAME(S): none

DESCRIPTION: This species has a small oval to oblong shell, slightly to moderately inflated, with thin to moderately thick individual valves. External coloration is yellow-tan to yellow-green with many fine green pigment rays extending from the umbo to the ventral and posterior margins. The females are quite distinctive with a swollen shell at the posterior-ventral margin allowing space for the glochidia-filled gills during reproduction. Maximum length is approximately two inches.

HABITAT: Curtis pearlymussel inhabits large creeks to medium rivers with clean gravel or gravel-sand substrate, slow flow in or adjacent to riffles, and good water quality. Within Arkansas, the Curtis pearlymussel has been found only in the Spring River system at Hardy, Salem, and near the confluence with the Black River.

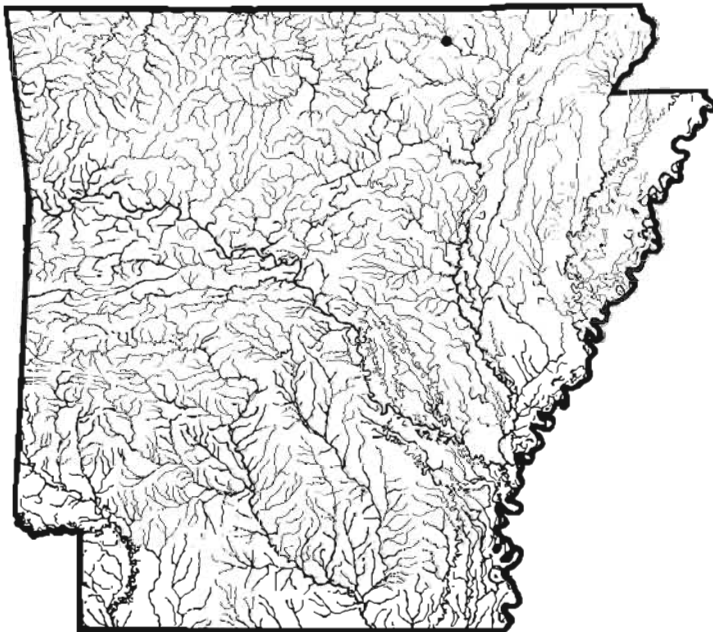
BIOLOGY: essentially unknown

COMMERCIAL VALUE: none

SIMILAR SPECIES: turgid blossom, small specimens of Arkansas broken-ray, several small species not covered in this brochure



*Historical distribution of
Curtis pearlymussel in Arkansas*



*Historical distribution of
turgid blossom in Arkansas*

TURGID BLOSSOM

Epioblasma turgidula (Lea, 1858)
(Federal Endangered Species)

LOCAL NAME(S): none

DESCRIPTION: The turgid blossom is almost identical to Curtis pearlymussel.

HABITAT: The turgid blossom has historically inhabited small to medium rivers and probably was associated with shallow riffle and shoal areas. Habitat is probably similar to that for Curtis pearlymussel. The only known state record for this species is from the Spring River at Hardy. This species may be extinct.

BIOLOGY: unknown

COMMERCIAL VALUE: none

SIMILAR SPECIES: Curtis pearlymussel, small Arkansas broken-ray, several small species not covered in this brochure

PINK MUCKET
Lampsilis abrupta (Say, 1831)
(Federal Endangered Species)

LOCAL NAME(S): grandmaw, alkali mucket, Higgins eye

DESCRIPTION: The pink mucket is slightly rounded to broadly elongate in outline and moderately to greatly inflated. Females are squared on the posterior end. The shell is usually stout and very thick, and base color is yellow, tan, or brown, occasionally with greenish or brown rays (usually in younger individuals). The lateral and pseudocardinal teeth are stout. Nacre color is solid white, solid pink, or washed with pink in the beak cavity area. Maximum size is about 6-7 inches in length.

HABITAT: This species inhabits medium to large rivers and their backwaters that receive annual flushing. It is found in substrates ranging from pure gravel to mud, with water depth from 2-30 feet. The largest Arkansas populations appear to be in the Spring and White rivers.

BIOLOGY: The pink mucket is a long term brooder with glochidia present from September through June. The fish host(s) is unknown.

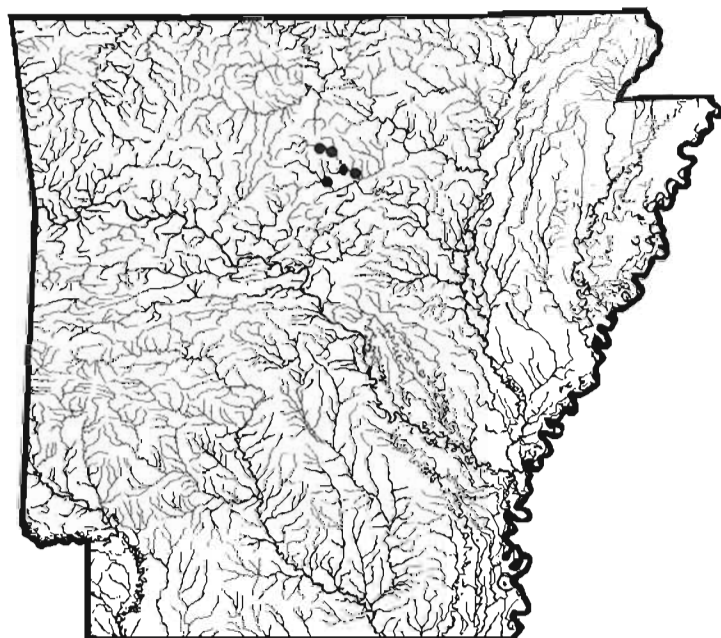
COMMERCIAL VALUE: The shell is thick enough and of sufficient quality to be used in the cultured pearl industry. Shells are often taken by commercial fishermen and mistaken for the ebony shell or mucket.

SIMILAR SPECIES: Plain pocketbook, hickorynut, mucket, and ebony shell. Some confusion exists as to the



Historical distribution of pink mucket in Arkansas

proper identification of this species from Arkansas. Some individuals believe this species is properly identified as *Lampsilis higginsii* (Lea, 1857), while others contend there are one or two undescribed species in Arkansas and Missouri.



Historical distribution of speckled pocketbook in Arkansas

SPECKLED POCKETBOOK
Lampsilis streckeri Frierson, 1927
(Federal Endangered Species)

LOCAL NAMES: none

DESCRIPTION: This oblong to quadrate shaped mussel is moderately inflated with thin to moderately thick valves. Pseudocardinal and lateral teeth are thin but well developed. External color ranges from yellow to green to tan, with numerous thin, broken green rays and flecks extending from the umbo to the posterior margin. The nacre is grayish to iridescent, and maximum length is about four inches.

HABITAT: The speckled pocketbook is found only in the Little Red River system in central Arkansas. Its preferred habitat is small to medium rivers with rock, cobble, gravel, and sand substrate and clear flowing water.

BIOLOGY: Gravid females have been found in October. It is apparently a long term brooder, but no fish hosts are known.

COMMERCIAL VALUE: none

SIMILAR SPECIES: Arkansas broken-ray, Louisiana fatmucket

FAT POCKETBOOK
Potamilus capax (Green, 1832)*
 (Federal Endangered Species)

LOCAL NAME(S): grandmaw

DESCRIPTION: This shell is generally rounded, sometimes squared on the posterior end, and very inflated. It is usually moderately thin with a base coloration of yellow or tan, sometimes brown. Exterior rays are always absent, and the nacre is usually white with occasional pink in the beak cavity. Maximum length is about six inches.

HABITAT: The fat pocketbook is found in the St. Francis River drainage in streams ranging from small ditches to the main channel at the lower end of the river. It has been found in a variety of substrates ranging from sand-gravel in the main river to mud-sand in ditches and in water from a few inches to 10 feet in depth. No specimens have been taken from the White River since the 1960's.

BIOLOGY: The fat pocketbook is probably a long term brooder, with gravid specimens reported in June, July, August, and October. The fish host is unknown.

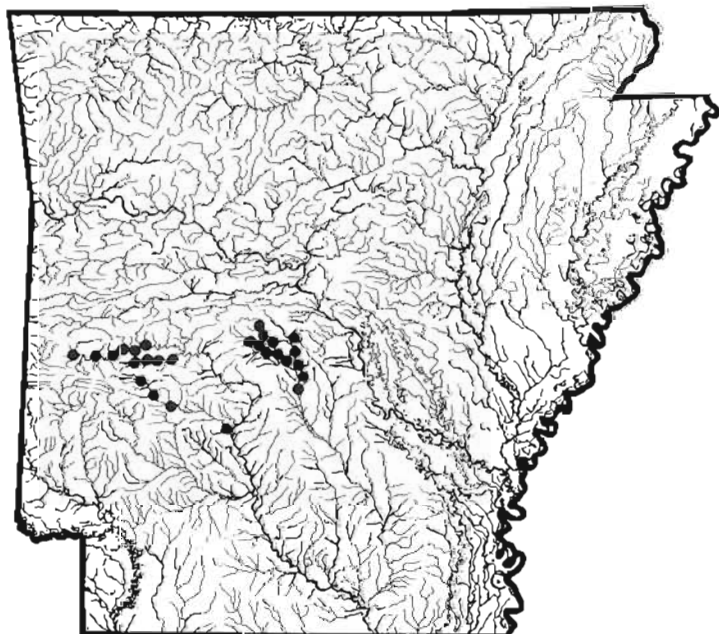
COMMERCIAL VALUE: The shell is too thin to be commercially valuable.

SIMILAR SPECIES: The fat pocketbook can be confused with the plain pocketbook but is distinguished by 1) the lack of color rays, 2) being more inflated and rounded especially at the umbo, and 3) the s-shaped outline of the dorsal surface where the lateral teeth, interdentum, and pseudocardinal teeth are located.

*TECHNICAL NOTE: M.E. Gordon has petitioned the International Commission of Zoological Nomenclature to rule that the generic name *Proptera* has priority over *Potamilus* for members of this genus.



Historical distribution of fat pocketbook in Arkansas



Historical distribution of Arkansas fatmucket in Arkansas

ARKANSAS FATMUCKET
Lampsilis powelli (Lea, 1852)
 (Federal Threatened Species)

LOCAL NAME(S): none

DESCRIPTION: This oblong to quadrate shell is slightly to moderately inflated, with thin to moderately thick valves. The external color is yellow to tan and color rays are always absent. However, there are lines of tiny pits running down the shell that sometimes appear to be rays. The nacre is white and both pseudocardinal and lateral teeth are thin but well developed. Maximum length is about six inches.

HABITAT: The Arkansas fatmucket inhabits small to medium size rivers with gravel-sand, gravel, sand, or cobble substrates. Preferred habitat is moderate to slow flowing water about three feet deep with gravel-sand substrate. This species is found only in the Ouachita River system in the Saline, Caddo, and upper Ouachita rivers.

BIOLOGY: Gravid females have been observed in January, February, and April. Glochidial hosts are unknown.

COMMERCIAL VALUE: none

SIMILAR SPECIES: Yellow sandshell, rayless Louisiana fatmuckets, young muckets

Arkansas Mussels Currently on the Federal Endangered Species List or Candidate Species Likely to be Added Soon.



1. *Epioblasma florentina curtisi*,
Curtis pearlymussel (male)



5. *Lampsilis powelli*, Arkansas fatmucket



2. *Lampsilis abrupta*, pink mucket (female)



6. *Arkansia wheeleri*, Ouachita rock-pocketbook



3. *Lampsilis streckeri*, speckled pocketbook



4. *Potamilus capax*, fat pocketbook

All mussels shown actual size

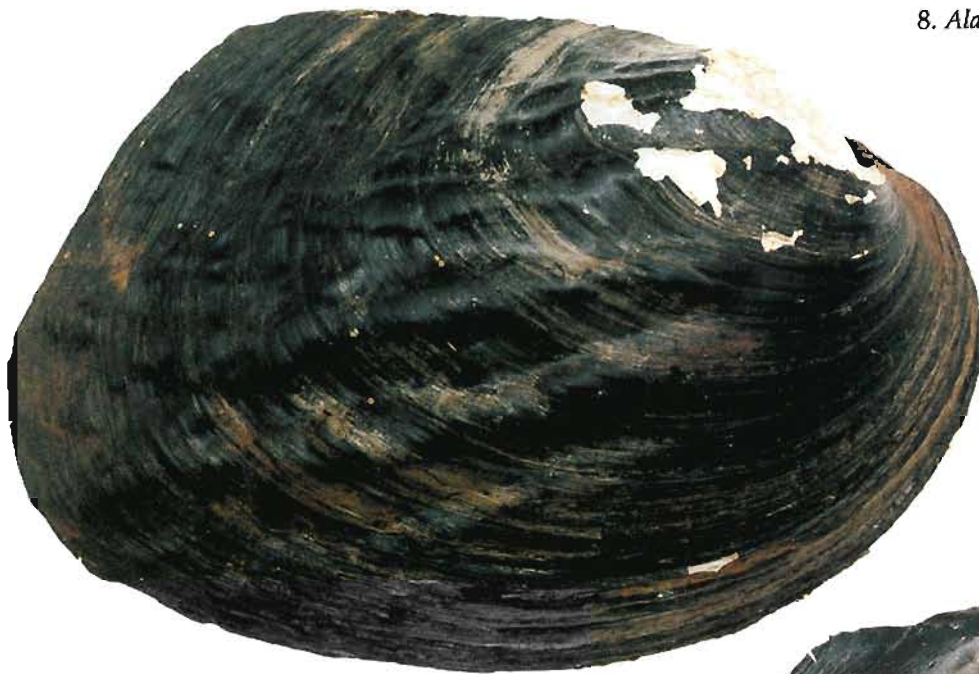
Common Arkansas Mussels



7. *Actinonaias ligamentina*, mucket



8. *Alasmidonta marginata*, elktoe



9. *Amblema plicata*, threeridge



10. *Anodonta grandis*, giant floater

All mussels shown actual size



11. *Anodonta imbecillis*, paper pondshell



12. *Anodonta suborbiculata*, flat floater



13. *Cyclonaias tuberculata*, purple wartyback



15. *Ellipsaria lineolata*, butterfly



14. *Cyprogenia aberti*, western fanshell

All mussels shown actual size



16. *Elliptio dilatata*, spike



17. *Epioblasma triquetra*, snuffbox



18. *Fusconaia ebena*, ebonyshell



19. *Fusconaia ebena*, ebonyshell



20. *Fusconaia flava*, Wabash pigtoe



21. *Lampsilis cardium*, plain pocketbook

All mussels shown actual size



22. *Lampsilia hydiana*, Louisiana fatmucket



23. *Lampsilis reeveiana*, Arkansas broken-ray



24. *Lampsilis satura*, sandbank pocketbook



25. *Lampsilis teres*, yellow sandshell



26. *Lasmigona costata*, fluted-shell

All mussels shown actual size



27. *Leptodea fragilis*, fragile papershell



29. *Obliquaria reflexa*, threehorn wartyback



28. *Megalonaias nervosa*, washboard



30. *Obovaria olivaria*, hickorynut



31. *Plectomerus dombeyanus*, bankclimber

All mussels shown actual size



32. *Potamilus purpuratus*, bleufer



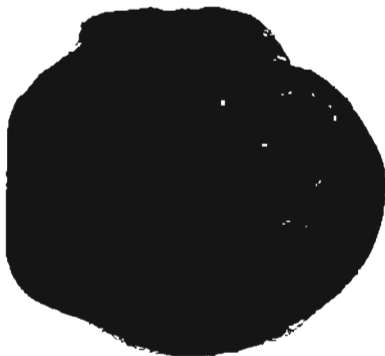
33. *Ptychobranthus occidentalis*, Ouachita kidneyshell



34. *Quadrula cylindrica*, rabbitsfoot



35. *Quadrula metanevra*, monkeyface



36. *Quadrula nodulata*, wartback



37. *Quadrula pustulosa*, pimpleback

All mussels shown actual size



38. *Quadrula quadrula*, mapleleaf



39. *Toxolasma* species, lilliput shells



40. *Tritogonia verrucosa*, pistolgrip



41. *Truncilla truncata*, deertoe



43. *Corbicula fluminea*, Asian clam



42. *Unio merus tetralasmus*, pondhorn



44. *Corbicula fluminea*, Asian clam

All mussels shown actual size

OUACHITA ROCK-POCKETBOOK
Arkansia wheeleri Ortmann and Walker, 1912
(Candidate - Federal Endangered Species)

LOCAL NAME(S): none

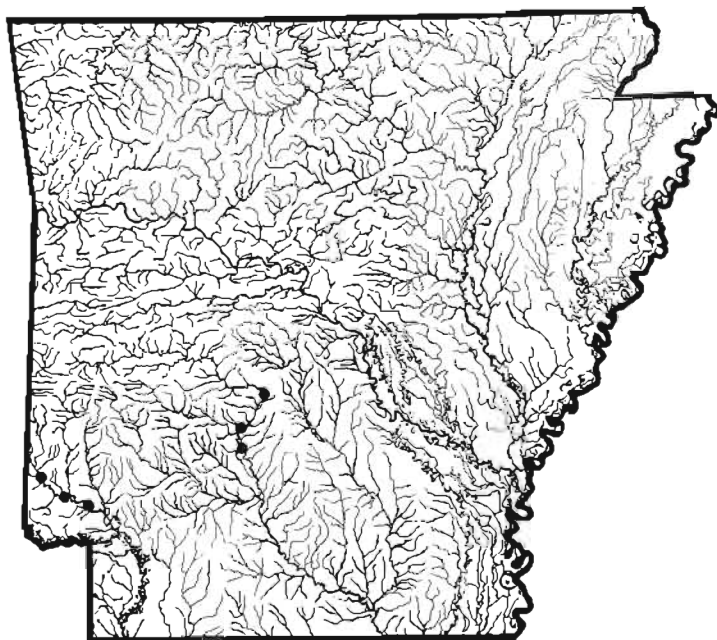
DESCRIPTION: This round to triangular shell is moderately inflated with moderately thick valves. The external coloration is brown or black, and the middle portion to posterior half of the shell is covered with slight undulations or flutings. Color rays are absent. The nacre is white, and the pseudocardinal teeth are well developed but not thick. The lower lateral tooth is shortened and raised into a high flange, and the upper tooth is reduced or absent. Maximum length is about three to four inches.

HABITAT: The Ouachita rock-pocketbook inhabits medium-sized rivers in backwater or slackwater areas adjacent the main channel with muddy or silty substrate. The shell formerly occurred in the Ouachita River near Arkadelphia but is currently known within Arkansas only from the Little River drainage in Sevier and Little River counties. Other known populations occur in the Kiamichi River in Oklahoma. This species is a candidate for Federal Endangered status.

BIOLOGY: unknown

COMMERCIAL VALUE: none

SIMILAR SPECIES: pimpleback, washboard, rock-pocketbook (not covered in this pamphlet)



*Historical distribution of
Ouachita rock-pocketbook in Arkansas*

Bridge construction presents a possible threat to populations of endangered and threatened mussels. To avoid such problems, Arkansas Highway and Transportation Department (AHTD) biologists survey streams targeted for bridge work to determine if rare species are present. If so, the mussels are relocated to safe waters upstream or downstream from the work site. Here, AHTD biologists John Harris (left) and John Fleming examine mussels collected at a survey site on the Saline River in Grant County.



KEITH SUTTON

MUCKET

Actinonaias ligamentina (Lamarck, 1819)

LOCAL NAME(S): brass mucket, niggerhead, steamboat mucket, grass mucket, Saline mucket

DESCRIPTION: The shell outline ranges from elongate to almost round, and color is yellow to black. Broad, dark green rays are occasionally visible. The pseudocardinal and lateral teeth are large and well developed, and the nacre color is white or occasionally pink. Shell thickness ranges from moderate in young specimens to very thick in large, big-river specimens. This shell has little in the way of defining characters, as it is drab colored and has no pustules, ridges, or unusual shape. Maximum length is about eight inches.

HABITAT: This species is generally found in large creeks, and small to medium rivers with gravel, gravel-sand, or gravel-silt substrates and moderate to swift current. It is occasionally found in large rivers, but population size is usually small. The mucket is abundant in the Spring, Strawberry, Saline, and Ouachita rivers.

BIOLOGY: The mucket carries glochidia from July until the following June. Fish hosts include the American eel, smallmouth bass, largemouth bass, green sunfish, bluegill, white and black crappie, white bass, rock bass, sauger, and tadpole madtom.

COMMERCIAL VALUE: The mucket is of sufficient quality and thickness for use in the foreign cultured pearl industry. Specimens are usually lumped and sold with the ebony shell.

SIMILAR SPECIES: plain pocketbook, sandbank pocketbook, Wabash pig-toe, pink mucket, Arkansas fatmucket

ELKTOE

Alasmidonta marginata Say, 1818

LOCAL NAME(S): none

DESCRIPTION: This elongate shell has a sharp dorsal ridge that drops straight to the meeting of the two valves at the dorsal margin. The shell is moderately fat, so when the dorsal margin is viewed straight on, the outline appears shaped like an elk or deer track. Pseudocardinal teeth are present, but lateral teeth are greatly reduced. The shell is usually yellow to light brown in color with numerous greenish zig-zag rays and dots on the outer surface. Internal color is white or iridescent. Maximum length is about four inches.

HABITAT: The elktoe is found in large creeks and small to medium rivers with gravel or gravel-sand substrate and moderate to swift current. It is found in the upper Ouachita, Buffalo, Caddo, Illinois, and Spring rivers but never in great abundance.

BIOLOGY: Females of this long term brooder possess glochidia from mid-July until the following May. Fish hosts include the white sucker, northern hogsucker, shorthead rehorse, rock bass, and warmouth.

COMMERCIAL VALUE: The shell is too thin to be commercially valuable.

SIMILAR SPECIES: deertoe, snuffbox

THREERIDGE

Amblema plicata (Say 1817)

LOCAL NAME(S): bluepoint

DESCRIPTION: The shell is rectangular to quadrate in

outline with moderately thick to very thick valves and is moderately compressed to moderately inflated. Outside shell coloration ranges from tan to black, and nacre is most often white with headwater forms displaying a purple or pink tinge at the posterior point. The most prominent external feature is a series of three to six undulating ridges from which the common name is derived. This feature is highly variable, with headwater forms having many low ridges producing a bumpy appearance, and big river forms having three or four large ridges. Maximum length is approximately six to seven inches.

HABITAT: The threeridge inhabits large creeks to large rivers but is also found in oxbows and reservoirs. It is found in varying substrates but usually prefers gravel-mud, gravel-sand, or firm mud substrates. It is sometimes found in dense beds numbering more than 100 per square yard and occurs in all drainages within the state.

BIOLOGY: The threeridge is a short term brooder. Glochidial hosts include shortnose gar, white and black crappie, rock bass, green sunfish, bluegill, highfin carpsucker, channel and flathead catfish, white bass, warmouth, largemouth bass, and sauger.

COMMERCIAL VALUE: The threeridge is one of the top four shells harvested for the cultured pearl industry.

SIMILAR SPECIES: washboard (see washboard account for key characters to separate the two species.)

GIANT FLOATER

Anodonta grandis Say, 1829

LOCAL NAMES: hogshell

DESCRIPTION: The large, inflated shell lacks both pseudocardinal and lateral teeth. Shell thickness ranges from thin to moderate, and maximum length is about 12 inches. Shell coloration is usually greenish to tan or brown and rays are generally lacking. There are two forms in Arkansas, the giant floater which has a sharper posterior end, and the stout floater which is fatter and more rounded on the posterior end.

HABITAT: The floater prefers backwaters, oxbows, and lakes with mud, silt, or mud-gravel bottoms. It can occasionally be found in sheltered portions of creeks and rivers.

BIOLOGY: In this long term brooder, reproduction extends from August through May. Reported fish hosts include carp, bluegill, white and black crappie, gizzard shad, skipjack herring, alligator gar, golden shiner, common shiner, creek chub, white sucker, yellow bullhead, green and longear sunfish, largemouth bass, and freshwater drum.

COMMERCIAL VALUE: The shell is too thin to be commercially valuable.

SIMILAR SPECIES: flat floater

PAPER POND SHELL

Anodonta imbecillis Say, 1829

LOCAL NAME(S): papershell

DESCRIPTION: This elongate, moderately inflated, paper thin shell lacks both pseudocardinal and lateral teeth. The beaks do not rise above the hingeline. External coloration is usually green or yellowish-green and nacre color is iridescent. This is a small shell with a maximum length of about three inches.

HABITAT: The paper pondshell inhabits backwaters,

oxbows, reservoirs, sluggish streams, and roadside ditches with permanent water. It prefers a mud bottom with little or no water current.

BIOLOGY: Gravid females may be found year-round. It apparently spawns throughout warmer months but may retain the last fall brood until the next spring. Fish hosts include the creek chub, green sunfish, mosquitofish, rock bass, warmouth, bluegill, longear sunfish, and largemouth bass. However, one author reports the species is hermaphroditic (both sexes in one individual), and the parasitic stage of development is omitted.

COMMERCIAL VALUE: none

SIMILAR SPECIES: young giant floaters

FLAT FLOATER

Anodonta suborbiculata Say, 1831

LOCAL NAME(S): pearl leader, heel-splitter

DESCRIPTION: The shell is rounded, almost saucer-like in outline, with a low wing on the dorsal margin. Shell thickness ranges from extremely to moderately thin and maximum length is about 10 inches. Teeth are absent. Color ranges from yellow to tan to almost brown and some specimens, especially juveniles, have faint green rays.

HABITAT: The flat floater prefers backwaters of large rivers, oxbows, and ponds or lakes with muddy bottoms. It probably occurs in all major river systems in Arkansas, but collection records are relatively rare, because few individuals search mucky backwaters. Most records are from dried up oxbows and lakes where draw downs have occurred.

BIOLOGY: The flat floater is a long term brooder, but the glochidial host is unknown.

COMMERCIAL VALUE: The shell is too thin to be commercially valuable.

SIMILAR SPECIES: compressed giant floaters

PURPLE WARTYBACK

Cyclonaias tuberculata (Rafinesque, 1820)

LOCAL NAME(S): walnut, purple pimpleback

DESCRIPTION: The shell is nearly round in outline, with pustules and flutings restricted to the posterior two thirds of the shell's exterior. It is compressed laterally, and each valve is moderately thick. External shell coloration is yellowish to tan, and rays are absent. The nacre is deep purple, sometimes lighter purple in the center and around the edges. Maximum length is about four inches.

HABITAT: This species prefers medium to large rivers with gravel or gravel-sand bottom. In Arkansas, it is restricted to the White River system and can be found in the Spring, Current, and Strawberry rivers in moderate abundance.

BIOLOGY: The purple wartyback has a short reproductive season (tachytictic) from June to August. The fish host(s) is unknown.

COMMERCIAL VALUE: none

SIMILAR SPECIES: pimpleback, mapleleaf

WESTERN FANSHELL

Cyprogenia aberti (Conrad, 1850)

LOCAL NAME(S): western fanshell, mapleleaf

DESCRIPTION: The shell is almost round to triangular in outline, usually flattened laterally, and ranges from about

the size of a half dollar up to the size of a silver dollar. Extremely large individuals can be up to three inches in length. Two features distinguish this shell from others: 1) there is a shallow sulcus (depression) running from the umbo to the center of the ventral margin and the middle of the sulcus is wrinkled and somewhat bumpy; 2) the shell has distinctive rays formed from bands of tiny pigment spots. The shell's interior is usually white to iridescent.

HABITAT: This species inhabits large creeks to large rivers with good water quality, moderate to swift current, and sand-gravel or sand-rock substrates. It is found in greatest abundance in the Spring, Caddo, and upper Ouachita rivers and is usually rare to only moderately abundant.

BIOLOGY: This is a long term brooder with glochidia released from early January until early spring. Glochidia are released in reddish masses called "conglutinates" which resemble earthworms.

COMMERCIAL VALUE: none

SIMILAR SPECIES: mapleleaf, pimpleback, butterfly

BUTTERFLY

Ellipsaria lineolata (Rafinesque, 1820)

LOCAL NAME(S): butterfly

DESCRIPTION: The shell is low triangular in shape with a swept back umbo. Valves are thick to moderately thick but the shell is very to moderately compressed. External shell color is usually yellow to tan and covered with discontinuous dark rays composed of dots, dashes, and chevrons. Maximum length is approximately five inches.

HABITAT: The butterfly is found in medium to large rivers with gravel or gravel-sand bottom and good current. In Arkansas, it is found in the Ouachita, White, and St. Francis river drainages and occurs in good numbers in the White River below Newport.

BIOLOGY: The brooding season lasts from August to June or July.

COMMERCIAL VALUE: Large specimens are used in the cultured pearl industry.

SIMILAR SPECIES: mucket, western fanshell

SPIKE

Elliptio dilatata (Rafinesque, 1820)

LOCAL NAME(S): ladyfinger, spike

DESCRIPTION: This is a laterally compressed, elongate shell (twice as long as tall) with moderately thick valves. External color is tan to black with rays absent, and the nacre is white to occasionally pink (Ouachita River drainage) or purple (White River drainage) or somewhere in between. Maximum length is approximately six inches.

HABITAT: The spike inhabits small to large rivers with gravel or gravel-sand substrates and moderate to swift current. The species is found in all river drainages within the state and is abundant in the Caddo, Ouachita, and Spring rivers.

BIOLOGY: A short reproductive season is reported from mid-May through August. Fish hosts include gizzard shad, flathead catfish, and white and black crappies.

COMMERCIAL VALUE: none

SIMILAR SPECIES: Ouachita kidneyshell, young black sandshell

SNUFFBOX

Epioblasma triquetra (Rafinesque, 1820)

LOCAL NAME(S): none

DESCRIPTION: This is a small, low-triangular shaped shell that is moderately to greatly inflated with thin to moderately thick individual valves. The posterior ridge drops sharply to the shell hingeline. Females are swollen posteriorly (to house glochidia) and have small serrations or "teeth" at the posterior edge of each valve. External color is yellow to tan with green chevrons and splotches in the umbo region. The nacre is white and the teeth well developed. Maximum length is about two inches.

HABITAT: The snuffbox occurs in small to medium rivers with gravel or gravel-sand substrate and clean flowing water. The snuffbox is widely distributed in the eastern United States but is not very common. In Arkansas, it has been found in the Spring, Strawberry, and White rivers and is quite rare.

BIOLOGY: The snuffbox is a long term brooder with gravid females found from August through June. Logperch and banded sculpins are fish hosts.

COMMERCIAL VALUE: none

SIMILAR SPECIES: deertoe, elktoe

EBONY SHELL

Fusconaia ebena (Lea, 1831)

LOCAL NAME(S): niggerhead, sheep's toe

DESCRIPTION: This is an almost circular shell with a swept back umbo that is very thick at the anterior end and somewhat less thick at the posterior end. The lateral and pseudocardinal teeth are well developed and aligned with parallel long axes. External color ranges from yellowish tan to almost black and rays are seldom evident. Maximum length is approximately six inches.

HABITAT: The ebony shell inhabits medium to large rivers in gravel, gravel-sand, or hard mud substrates with moderate to swift stream flow and occurs at depths up to 60 feet. This species occurs in the Ouachita, White, and St. Francis drainages. It is somewhat abundant, primarily in the White River below Newport.

BIOLOGY: The short brooding season lasts from May to September. Reported hosts include skipjack herring, green sunfish, largemouth bass, white crappie, and black crappie.

COMMERCIAL VALUE: Once king of button industry shells, the ebony shell is still coveted for use in cultured pearl production.

SIMILAR SPECIES: wabash pigtoe, pink mucket, hickorynut

WABASH PIGTOE

Fusconaia flava (Rafinesque, 1820)

LOCAL NAME(S): sheep's nose, pigtoe

DESCRIPTION: The shell is broadly to sharply triangular and ranges from very compressed laterally in the headwater form to very inflated in the big river form. The individual valves are moderately thick, and teeth are well developed. Color ranges from tan to dark brown, and rays are usually absent except in young individuals. Nacre color is usually white but can be pink or pinkish orange. Maximum length is about three inches.

HABITAT: This species is found in large creeks to large rivers with stream bottoms ranging from gravel to compacted mud with moderate to swift stream flow. This

species is found in all drainages within the state and is abundant in its preferred habitat.

BIOLOGY: The Wabash pigtoe is reported to reproduce from May through August. Fish hosts include the bluegill, black crappie, and white crappie.

COMMERCIAL VALUE: When large enough, Wabash pigtoes are lumped with the ebony shell and sold for use in the cultured pearl industry.

SIMILAR SPECIES: Ohio pigtoe, small muckets, ebonyshell

PLAIN POCKETBOOK

Lampsilis cardium Rafinesque, 1820

LOCAL NAME(S): grandmaw

DESCRIPTION: The shell outline is quadrate to oval and is usually quite inflated (fat). Females tend to be squared off on the posterior end. Shell thickness ranges from thin (almost fragile) to moderately thick and solid. Base color is yellowish or tan with greenish to brown pigment rays (sometimes absent) on the shell. The shell interior is usually white but is sometimes iridescent or occasionally pinkish at the posterior edge. Maximum length is approximately eight inches.

Habitat: The plain pocketbook is found in a wide variety of flowing waters and occasionally in oxbows associated with rivers or creeks. It inhabits medium to large creeks like Myatt Creek and the South Fork Spring River and large rivers such as the White and St. Francis. It is usually not found in dense beds but as scattered individuals (usually no more than 2-3 per square meter). Substrates inhabited include sand, sand-gravel, and sand-mud. This species is often found in slackwater areas of large sandy rivers when water levels are low, and it occasionally inhabits reservoirs.

BIOLOGY: This long term brooder has glochidia from early August to the following July. Reported fish hosts include white crappie, sauger, largemouth and smallmouth bass, and bluegill.

COMMERCIAL VALUE: Generally, shells are too thin to be commercially valuable.

SIMILAR SPECIES: The plain pocketbook can be confused with an endangered species, the fat pocketbook (*Potamilus capax*), in the St. Francis River drainage. Specimens from the lower White and Black rivers also can be mistaken for the fat pocketbook.

LOUISIANA FATMUCKET

Lampsilis hydiana (Lea, 1838)

LOCAL NAME(S): grass mucket

DESCRIPTION: This is a moderately inflated, elongate shell with external base color ranging from yellow to tan or brown and usually with well defined, thick, greenish rays on the posterior two thirds of the shell. Rays are occasionally absent. Shell thickness ranges from thin to moderately thick and is usually uniform throughout the shell's length. Maximum length is about five inches.

HABITAT: The Louisiana fatmucket inhabits medium creeks to large rivers from the Arkansas River Valley south. It is usually found in slower moving segments or backwaters with rock, gravel, gravel-sand, or mud substrates. It is particularly abundant in the upper Ouachita River above Mt. Ida, the forks of the Saline River, and the Saline River of west Arkansas that is a tributary of the Red River system.

BIOLOGY: Glochidial hosts of this long term brooder are unknown.

COMMERCIAL VALUE: none

SIMILAR SPECIES: Arkansas fatmucket, yellow sandshell, mucket

ARKANSAS BROKEN-RAY

Lampsilis reeveiana (Lea, 1852)

LOCAL NAME(S): grass mucket

DESCRIPTION: This elongate to rounded species is moderately inflated. Individual valves are thin to moderately thick, and external color is yellow to tan with thin, dark broken rays over the posterior three quarters of the shell. Lateral teeth are thin, but pseudocardinals may be relatively heavy. Internal shell color is iridescent, and maximum length is about four inches.

HABITAT: The Arkansas broken-ray is typically found in large creeks to medium rivers with gravel, gravel-sand, or sand bottom. It is often very abundant in preferred habitat and Arkansas' distribution is restricted to the White River drainage. The Arkansas broken-ray is common in the South Fork of the Spring River, Eleven Point River, and War Eagle Creek.

BIOLOGY: The species is a long term brooder, but the fish host(s) is unknown.

COMMERCIAL VALUE: none

SIMILAR SPECIES: Louisiana fatmucket,

speckled pocketbook

SANDBANK POCKETBOOK

Lampsilis satura (Lea, 1852)

LOCAL NAME(S): grandmaw

DESCRIPTION: The shell is greatly (in females) to moderately (in males) inflated, but valves are only moderately thick. The posterior edge of the female shell is square to almost round and often indented in older individuals. The nacre is white and the pseudocardinal and lateral teeth are well developed. External shell color ranges from tan to almost black with rays usually present but often covered by sludge deposits. Maximum length is about six inches.

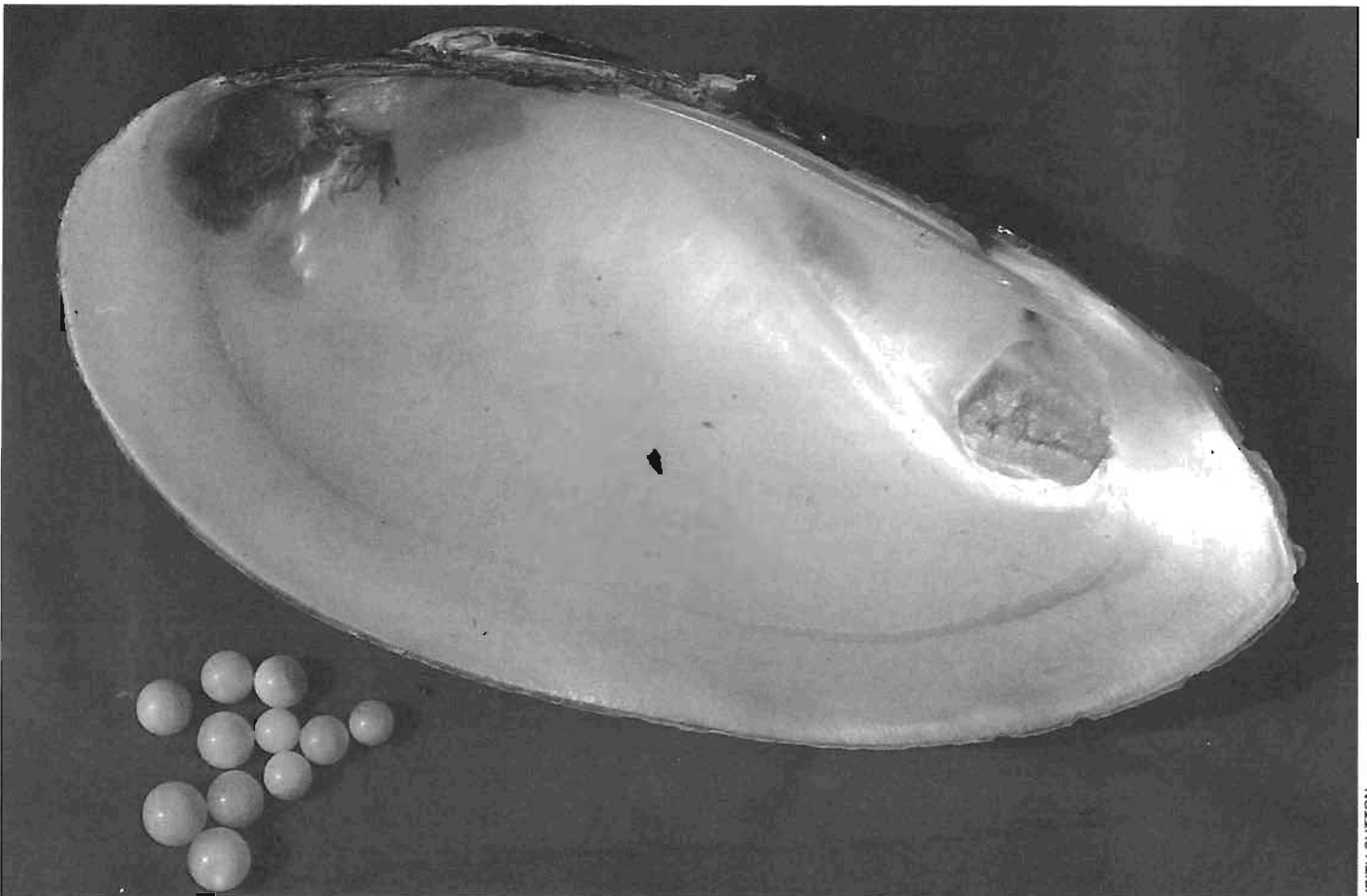
HABITAT: This species inhabits small to large rivers south of the Arkansas River with gravel, gravel-sand, or sand substrates and moderate flow. It is common to moderately common in the Ouachita, Saline (Ouachita drainage), Little, and Saline (Red River drainage) rivers.

BIOLOGY: The sandbank pocketbook is a long term brooder, as are other species of *Lampsilis*. The fish host(s) is unknown.

COMMERCIAL VALUE: The shell is too thin to be commercially valuable.

SIMILAR SPECIES: fat pocketbook, plain pocketbook, mucket

Most Arkansas mussel shells marketed today are manufactured into pearl nuclei, like those in the photo below. These nuclei are inserted in caged saltwater pearl oysters in Japan. The oysters secrete mother-of-pearl around the spherical pieces of shell, and after a period of six months to three years, the resulting cultured pearls are harvested, graded and sold for jewelry.



YELLOW SANDSHELL

Lampsilis teres (Rafinesque, 1820)

LOCAL NAME(S): creeper, sandshell

DESCRIPTION: This is an elongate, moderately inflated species with a smooth, shiny outer surface ranging from yellow to yellow-tan in color. One form, the slough sand shell, has faint greenish rays on the epidermis, while the other form, the yellow sandshell is without rays. The valves are only moderately thick, but uniformly so throughout the shell's length. Nacre color is white, and maximum length is about eight inches.

HABITAT: The yellow sandshell is found in small to large rivers in sections with slow current and sand, sand-gravel, or mud substrate. It also occurs in oxbows and reservoirs. It can often be seen in shallows of sand bars where it leaves "trails" when moving across the bottom. The yellow sandshell is found in all drainages of the state and is relatively common in all larger rivers.

BIOLOGY: Fish hosts of this long term brooder include alligator, longnose, and shortnose gar, green sunfish, orange-spotted sunfish, largemouth bass, black and white crappie, and shovelnose sturgeon.

COMMERCIAL VALUE: The yellow sandshell is reportedly used for inlay on pearl-handled knives but is probably too thin for extensive use in the cultured pearl industry.

SIMILAR SPECIES: Arkansas fatmucket, rayless Louisiana fatmucket, black sandshell

FLUTED-SHELL

Lasmigona costata (Rafinesque, 1820)

LOCAL NAME(S): none

DESCRIPTION: This species is thin to moderately thick shelled, elongate to quadrate in shape, with reduced pseudocardinal teeth and no lateral teeth. The nacre is white to iridescent, and external color ranges from tan to black with indistinct broad green rays often present (sometimes absent). Dorsal to the posterior ridge, the shell is covered by prominent to sometimes indistinct flutings or small ridges.

HABITAT: The fluted-shell is found in small to large rivers with gravel or gravel-sand substrate and moderately to swiftly flowing water. It is present in all river drainages within the uplands of Arkansas but is absent from the delta regions. It is especially common in the Caddo River between Glenwood and Lake DeGray.

BIOLOGY: This long term brooder has glochidia from August through May, and the reported fish host is the carp.

COMMERCIAL VALUE: none

SIMILAR SPECIES: washboard, threeridge, mucket, spike

FRAGILE PAPERSHELL

Leptodea fragilis (Rafinesque, 1820)

LOCAL NAME(S): papershell

DESCRIPTION: This is a very thin shell, ovate to quadrate in shape, with a moderate to sometimes prominent dorsal wing present. Pseudocardinal and lateral teeth are thin and elongate, and the nacre is usually iridescent. External shell color is yellow to tan and indistinct green rays may be present. Maximum length is approximately eight inches.

HABITAT: The fragile papershell is found in small to large rivers and reservoirs in virtually all bottom types and

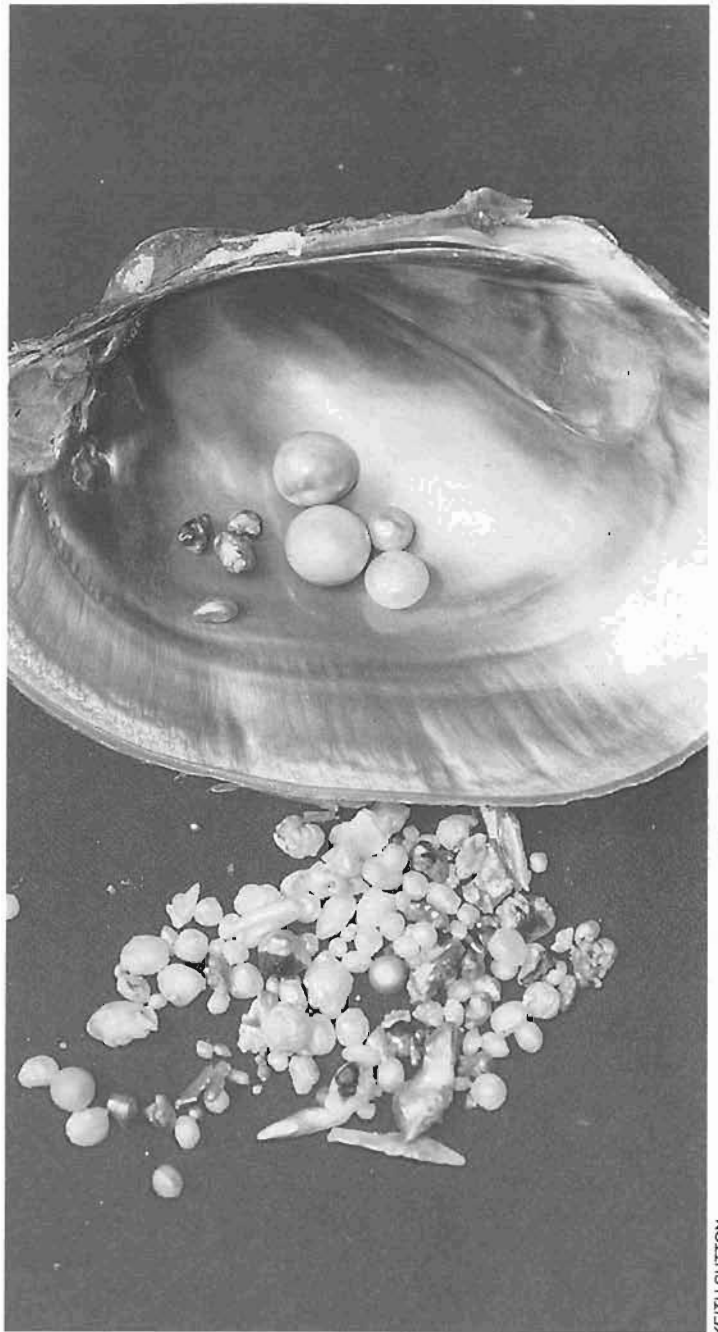
flow regimes. It is especially common in stable sand bottom areas. It inhabits all river drainages within Arkansas and is especially prominent in the White and St. Francis rivers.

BIOLOGY: Glochidia have been found from August to mid-July (long term brooder). The freshwater drum is the only reported fish host.

COMMERCIAL VALUE: none

SIMILAR SPECIES: white heelsplitter, pink papershell (not included in this brochure)

Freshwater pearls are among nature's most beautiful creations. When a grain of sand or other irritant becomes lodged inside its shell, a mussel secretes mother-of-pearl to encyst the intruder, thus forming these lustrous semi-precious gems. Arkansas pearls may be white, black, purple or bronze. Some are round, but most are irregularly shaped "baroques" or "slugs." The largest known Arkansas pearl was almost an inch in diameter and sold for about \$3,000.



KEITH SUTTON

WASHBOARD

Megalonaias nervosa (Rafinesque, 1820)

LOCAL NAME(S): washboard

DESCRIPTION: The shell is quadrate to slightly elongate in outline and compressed to moderately inflated laterally. The washboard is a large (10-12 inches in length), thick shell with a corrugated outer surface. It can be confused with the threeridge but the washboard usually has undulations or pustules on the shell anterior to the umbo and much smaller pseudocardinal teeth.

HABITAT: This species inhabits medium to large rivers with sand-gravel to mud substrates in water ranging 10 to 60 feet deep. It can also be found in impoundments but usually not in large numbers. Washboards can be the dominant species in mussel beds if conditions are favorable. Good populations are still present in the White, St. Francis, and Black rivers and can be found in most large rivers throughout the state.

BIOLOGY: The washboard's reproductive cycle is not clear. It has been considered a long term brooder with gravid females found September through February and also in April and May. However, some have speculated it may be a short term brooder that reproduces in the fall and again in the spring. Fish hosts include gizzard shad, black and white crappie, white bass, bowfin, flathead and channel catfish, American eel, skipjack herring, highfin carpsucker, black and brown bullhead, bluegill, largemouth bass, sauger, and freshwater drum.

COMMERCIAL VALUE: The washboard ranks among the top three mussels in commercial importance. The large size and thick shell make it ideal for producing large nuclei for the Japanese cultured pearl industry.

SIMILAR SPECIES: threeridge, bankclimber

THREEHORN WARTYBACK

Obliquaria reflexa (Rafinesque, 1820)

LOCAL NAME(S): three dot, hornyback, three knot

DESCRIPTION: The shell is round to low triangular in outline with one to four (usually three) prominent knobs on a series of ridges on the posterior slope. Nacre color is white to iridescent, and external color is yellow, yellow-green, or tan with fine green rays covering most of the shell. Valves are thick with well developed teeth. Maximum size is about four inches. This is one of the easiest shells to identify.

HABITAT: The threehorn wartyback inhabits medium to large rivers with gravel or gravel-sand substrates and constant flow. Reports indicate it may adapt to reservoir conditions. The species is common in the White River below Newport and can be found in Lake Dardanelle.

BIOLOGY: The females of this short term brooder possess young May through September. No fish host has been recorded, and larvae may not require a fish host.

COMMERCIAL VALUE: Large specimens of this shell are used in the cultured pearl industry.

SIMILAR SPECIES: mapleleaf

HICKORYNUT

Obovaria olivaria (Rafinesque, 1820)

LOCAL NAME(S): eggshell, eggshell niggerhead

DESCRIPTION: This shell is round to oval and

moderately thick to thick. The nacre is white, and external shell color is yellow to tan with indistinct, closely-spaced green rays extending only halfway down the shell. The pseudocardinal teeth are moderately thick, and the lateral teeth are well developed. Maximum length is about four inches.

HABITAT: The hickorynut inhabits medium to large rivers with gravel, gravel-sand, or gravel-mud substrates. It is most common in the middle to lower reaches of the White River.

BIOLOGY: This long term brooder has glochidia from August to June. The shovelnose sturgeon is the only reported fish host.

COMMERCIAL VALUE: Larger, thicker shells are sold with ebony shells for use in the cultured pearl market.

SIMILAR SPECIES: ebonyshell, pink mucket, Ohio pigtoe, mucket

BANKCLIMBER

Plectomerus dombeyanus (Valenciennes, 1827)

LOCAL NAME(S): bankclimber, washboard

DESCRIPTION: This large, quadrate shell is compressed to moderately inflated with moderately thick valves. It has a prominent posterior ridge and numerous small, low undulations both anterior and posterior to the ridge. The nacre is purple to copper colored and often grades to lighter colors outside the pallial line. The external color is brown to black, and no rays are evident.

HABITAT: The bankclimber is often found in large creeks to large rivers and their backwaters with sluggish flow and mud, mud-gravel, or mud-sand substrates. It often burrows into vertical mud banks of large rivers. This species is common in lowland rivers such as the lower Ouachita, Cache, and White rivers.

BIOLOGY: Although no published accounts exist, this species is probably a short term brooder. The glochidial host(s) is not known.

COMMERCIAL VALUE: The bankclimber is occasionally used in jewelry.

SIMILAR SPECIES: washboard, pistolgrip, threeridge

BLEUFER

Potamilus purpuratus (Lamarck, 1819)

LOCAL NAME(S): bleufer, blooper, blue mucket, blue hen

DESCRIPTION: The bleufer is a large quadrate to ovate shell, moderately to greatly inflated, and of medium thickness. A low wing may be present posterior to the umbo. The nacre is a deep, rich purple, and external color ranges from brown to black with generally no evidence of rays. Maximum length is about eight inches.

HABITAT: The bleufer is found in large creeks to large rivers in substrates ranging from gravel to mud-gravel with moderate flow. It is found in all drainages of the state and is common in the St. Francis River.

BIOLOGY: The bleufer is a long term brooder, and the only reported fish host is the freshwater drum.

COMMERCIAL VALUE: The bleufer is used extensively in colored jewelry production.

SIMILAR SPECIES: plain pocketbook, fat pocketbook

OUACHITA KIDNEYSHELL

Ptychobranhus occidentalis (Conrad, 1836)

LOCAL NAME(S): ladyfinger, spike

DESCRIPTION: This is an elongate, compressed shell with thick to moderately thick valves. The nacre is white, the pseudocardinal teeth are small and postlike, and the lateral teeth are well developed but short. External color ranges from yellow to tan to brown with very fine, wavy green rays over most of the shell. Maximum length is approximately six inches.

HABITAT: This shell is most often found in large creeks to medium rivers with gravel or gravel-sand substrate and moderate to swift flow. It is seldom found in sluggish, low-gradient streams. It is common in the Spring, upper Ouachita, Caddo, and upper Saline rivers.

BIOLOGY: The Ouachita kidneyshell is a long term brooder, but the glochidial host(s) is unknown.

COMMERCIAL VALUE: Generally, the shell is too thin and the population numbers too low to warrant commercial harvest.

SIMILAR SPECIES: spike

RABBITSFOOT

Quadrula cylindrica (Say, 1817)

LOCAL NAME(S): cucumber, corncob

DESCRIPTION: An elongated, quadrate shaped shell, moderately inflated, with thick to moderately thick valves. The posterior ridge has large, distinctive knobs. External coloration is yellow to tan with extensive green chevrons covering the shell. The nacre is white and the teeth well developed. Maximum length is about four inches.

HABITAT: The rabbitsfoot occurs in medium to large rivers with sand-gravel or gravel substrate and constant flow. It has a widespread distribution in Arkansas but is not abundant at any location. Large populations occur in the Spring and Black river drainages.

BIOLOGY: The rabbitsfoot is a short term brooder, but the fish host is unknown.

COMMERCIAL VALUE: none

SIMILAR SPECIES: Superficially similar to the spike, Ouachita kidneyshell, and other elongate species

MONKEYFACE

Quadrula metanevra (Rafinesque, 1820)

LOCAL NAME(S): monkeyface

DESCRIPTION: The monkeyface is a rather small, quadrate, moderately inflated shell with moderately thick valves. It has a very prominent posterior ridge with a series of large knobs or pustules. Smaller pustules are usually prominent on other parts of the shell. The nacre is white, and the external color is yellow, tan, or brown with numerous small to large, dark green, down-pointing triangles scattered randomly over the shell. Maximum length is about five inches.

HABITAT: The monkeyface inhabits small to large rivers with gravel or gravel-sand substrates and swift flowing water. It is a relatively uncommon species found in most river drainages within Arkansas. The largest populations are found in the upper Ouachita and Spring river systems.

BIOLOGY: This short term brooder reproduces from May to July. Hosts include the green sunfish, bluegill, and sauger.

COMMERCIAL VALUE: Larger specimens are used in the cultured pearl industry.

SIMILAR SPECIES: rabbitsfoot, purple wartyback, mapleleaf

WARTYBACK

Quadrula nodulata (Rafinesque, 1820)

LOCAL NAME(S): pimpleback, wartyback, mapleleaf

DESCRIPTION: This is a roundish, moderately inflated shell with moderately thick valves. The best identifying feature is two rows of large pustules beginning on the umbos and extending to the posterior-ventral margin. There is no furrow or sulcus between the two rows of pustules. The posterior slope often has very small bumps or pustules. The shell is small with a maximum length of three inches.

HABITAT: The species is usually found in medium to large rivers with gravel or gravel-sand substrate and constant flow. Generally, it is found in lowland rivers within the state and is most common in the St. Francis River and Lake Chicot.

BIOLOGY: This short term brooder reproduces from June to July. Hosts include the white and black crappie, channel catfish, flathead catfish, bluegill, and largemouth bass.

COMMERCIAL VALUE: Large shells are used in the cultured pearl industry.

SIMILAR SPECIES: pimpleback, mapleleaf, purple wartyback

PIMPLEBACK

Quadrula pustulosa (Lea, 1831)

LOCAL NAME(S): pimpleback

DESCRIPTION: The shell is mostly circular in outline and moderately inflated with moderately thick to thick individual valves. Outside shell color is tan to dark brown and often has a green shower of color extending from the umbo a short distance toward the shell's center. The nacre is white, the teeth well developed, and a well developed beak cavity is present. The shell exterior usually has few (sometimes absent) to many pustules and bumps. Maximum length is about three inches.

HABITAT: The pimpleback inhabits small to large rivers with flowing water and gravel or gravel-sand substrate and is occasionally found in oxbows or impoundments. The pimpleback can be numerically dominant in preferred habitat and is commonly found in the White, Spring, St. Francis, and Ouachita rivers.

BIOLOGY: The pimpleback broods from mid-June to August. Fish hosts include the shovelnose sturgeon, black bullhead, channel and flathead catfish, and white crappie.

COMMERCIAL VALUE: Larger specimens are sufficiently thick for use in the cultured pearl industry.

SIMILAR SPECIES: mapleleaf, wartyback, Wabash pigtoe, purple wartyback

MAPLELEAF

Quadrula quadrula (Rafinesque, 1820)

LOCAL NAME(S): mapleleaf

DESCRIPTION: The shell is quadrate to low triangular in outline, scarcely to moderately inflated, with moderately thick individual valves. The posterior ridge is well developed, and a depression or sulcus occurs between this

ridge and the mid-portion of the shell. Bumps or pustules usually occur on each ridge but are occasionally absent. Outer color ranges from tan to brown, and green color rays often occur near the pustules. The nacre is white, the teeth well developed, and a deep beak cavity is present. Maximum shell size is approximately five inches.

HABITAT: The mapleleaf is found in medium to large rivers with features ranging from flowing to standing water and substrates from gravel to mud. The mapleleaf is sometimes extremely abundant in impoundments or large oxbows.

BIOLOGY: The short reproductive season lasts from May to August. The only reported fish host is the flathead catfish.

COMMERCIAL VALUE: Large, thick specimens are used extensively in the cultured pearl industry.

SIMILAR SPECIES: wartyback, pimpleback, purple wartyback, western fanshell

LILLIPUT SHELLS

Toxolasma species

LOCAL NAME(S): none

DESCRIPTION: There are at least three species (probably more) of lilliput shells in Arkansas and a composite description is presented here. These are small, elongate to quadrate shells with brown to black external color and no rays. The external texture is almost fuzzy in appearance and to the touch. Lateral and pseudocardinal teeth are present, and nacre color ranges from white to iridescent to light purple. Maximum size is about two inches.

HABITAT: Lilliput shells inhabit small creeks to medium size rivers but tend to stay in backwaters. They also are

found in oxbows, natural lakes, impoundments and even farm ponds. Lilliput shells appear to adapt to almost any type of substrate from rock to mud.

BIOLOGY: essentially unknown

COMMERCIAL VALUE: none

SIMILAR SPECIES: Lilliput shells resemble the young of several species including the spike, spectacle case, and bleufer.

PISTOLGRIP

Tritogonia verrucosa (Rafinesque, 1820)

LOCAL NAME(S): pistolgrip, buckhorn

DESCRIPTION: This ovate to elongate shell has a prominent posterior ridge that terminates in a bulge at the ventral margin. The shell is compressed to slightly inflated, and the valves are thin to moderately thick. The shell exterior is covered with bumps, pustules, and flutings, especially anterior to the posterior ridge and has large undulating waves posterior to the ridge. The nacre is white, pink, or light purple, and external color is brown to black with occasional green colored triangles and splotches in very young individuals.

HABITAT: The pistolgrip occurs in large creeks to large rivers with flowing water over almost any kind of substrate. It is seldom found in lakes, impoundments, or oxbows.

BIOLOGY: The short reproductive period is reported to occur from April through August. The fish host(s) is unknown.

COMMERCIAL STATUS: Generally not desirable for commercial uses

SIMILAR SPECIES: bankclimber, washboard, threeridge, fluted shell

Before the advent of plastics, most buttons for clothing were made from mussel shells. Blanks were drilled from shells, then shaped and finished to produce the final product. Earlier this century, many river families made a living fishing mussels from Arkansas rivers and selling them to button factories in Newport, Clarendon, Pocahontas and Black Rock.



LEROY M. KOCH

DEERTOE

Truncilla truncata (Rafinesque, 1820)

LOCAL NAME(S): deertoe

DESCRIPTION: The deertoe is a rather small, triangular shell with a sharply angled posterior ridge that drops directly to the hingeline joining the two valves. The shell is slightly to moderately inflated for its size, and individual valves are relatively thin but solid. External color is tan to green with numerous thin, green pigment rays extending from umbo to ventral margin. Pigment rays are often bunched to form broad color bands. Chevrons, triangles, and splotches often occur on the umbonal region. Teeth are well developed but thin and blade-like.

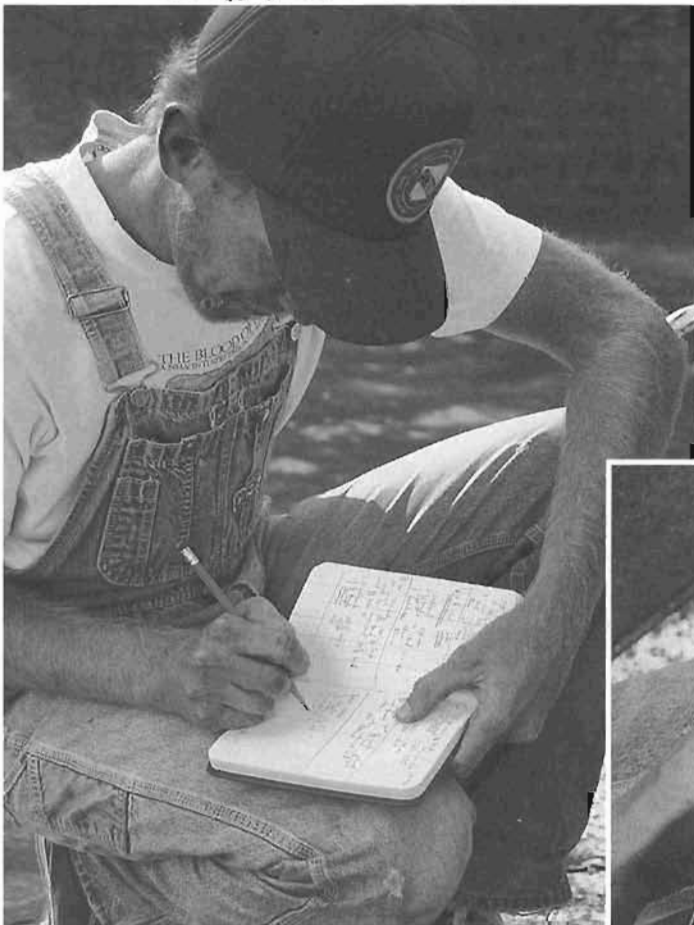
HABITAT: The deertoe inhabits medium to large rivers with sand-gravel or mud-gravel substrates and moderate to swift flow. It is fairly common in the Spring River and White River below Newport and may be locally abundant.

BIOLOGY: The deertoe is reportedly a long term brooder with fish hosts that include the freshwater drum and sauger.

COMMERCIAL VALUE: none

SIMILAR SPECIES: Wabash pigtoe, snuffbox, western fanshell

Mussels are threatened by water pollution, stream impoundments, dredging, soil erosion, overharvest and other factors. Some species have been entirely eliminated from Arkansas waters. In order to properly manage this valuable resource and prevent further population declines, biologists compile research data at survey sites throughout the state to help us better understand the ecology of these unusual animals.



KEITH SUTTON

PONDHORN

Unio merus tetralasmus (Say, 1831)

LOCAL NAME(S): none

DESCRIPTION: The shell is oblong, scarcely to moderately inflated, with relatively thin individual valves. External color ranges from yellow-tan to almost black, and color rays are absent. Nacre color is white to iridescent, and maximum length is approximately eight inches.

HABITAT: The pondhorn is most often found in oxbows, small sloughs, ditches, and lakes with little or no current and mucky substrates. It is somewhat abundant in the St. Francis and Cache river drainages.

BIOLOGY: Gravid females have been found in May and August. Fish hosts have not been identified.

COMMERCIAL VALUE: The pondhorn is too thin to be commercially valuable.

SIMILAR SPECIES: giant floater, yellow sandshell

ASIAN CLAM

Corbicula fluminea (Muller, 1774)

LOCAL NAME(S): none

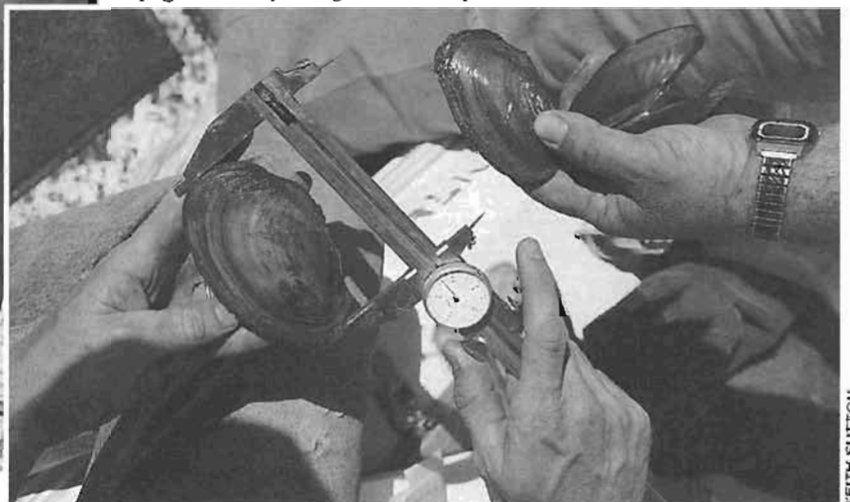
DESCRIPTION: The shell outline is triangular to slightly ovate and the valves are relatively thin to solid. The external surface is covered with coarse, concentric rings or ridges running posterior to anterior. Serrated lateral teeth run along each side of the pseudocardinals on each valve. Nacre color is white to deep purple and maximum length is about two inches. This species was introduced into the United States in the late 1930's from Asia and has spread rapidly into most parts of the country. It is a nuisance which clogs cooling tower intake valves at nuclear power plants, and some biologists suspect it competes with native species for stream substrate.

HABITAT: The Asian clam occurs in virtually all streams and lakes in Arkansas. It can occur in tremendous numbers in preferred habitat which appears to be areas with sand or sand-gravel substrate and slow to moderate flow.

BIOLOGY: This clam is not closely related to native mussels. It does not produce a parasitic larval form but instead produces a free-swimming larvae called a "pediveliger". These larvae develop into juvenile clams while still within the mantle cavity of the parent. Spawning periods occur in spring and autumn.

COMMERCIAL VALUE: none

SIMILAR SPECIES: Superficially similar to the Wabash pigtoe and young of other species.



KEITH SUTTON

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With the advent of the cultured pearl industry in Japan, Arkansas' shelling business regained new-found importance not seen since the days of the shell button industry. Today, many Arkansans depend on profits from shell sales for much of their annual income.



KEITH SUTTON

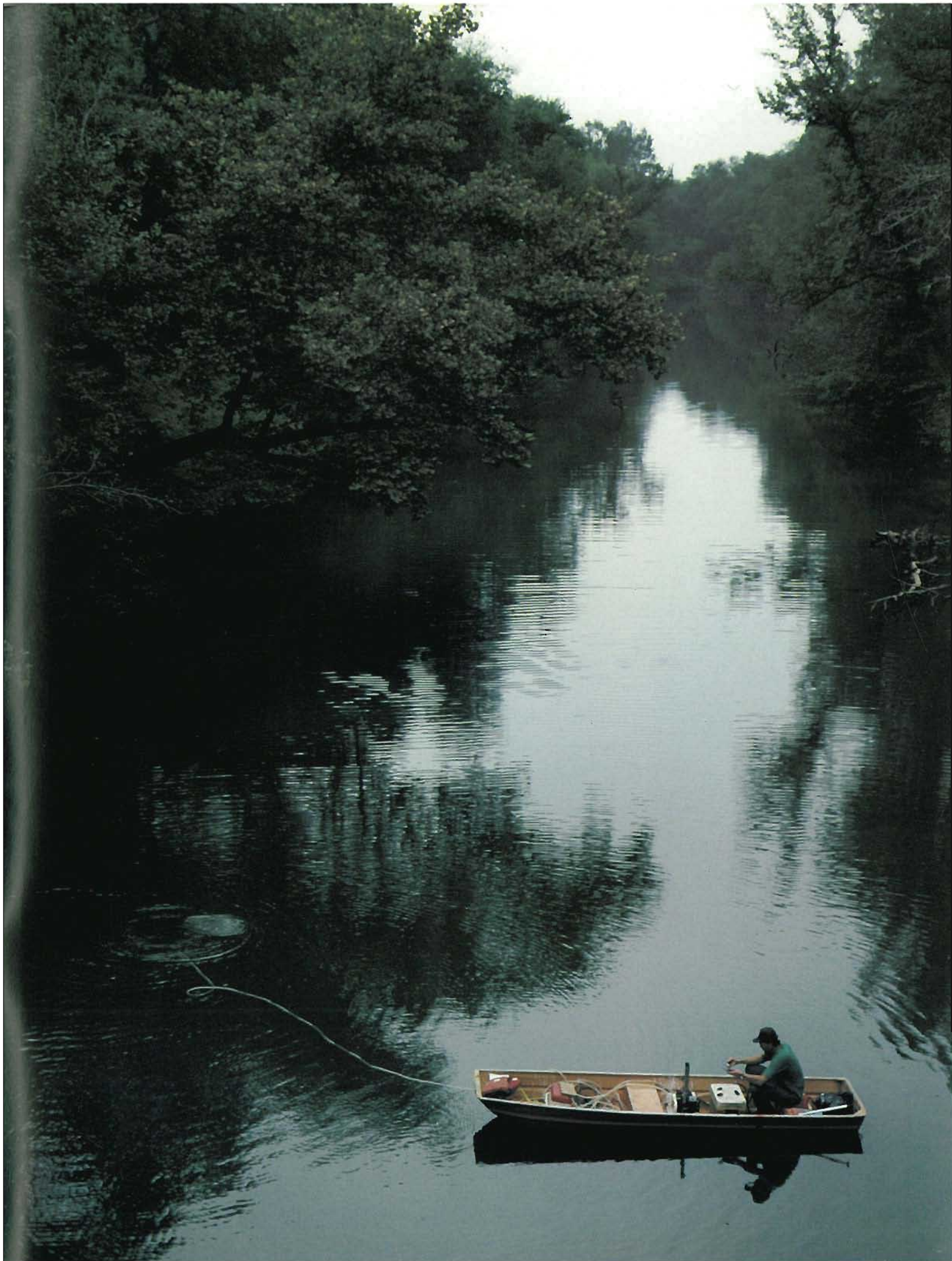
ARKANSAS MUSSEL SPECIES HISTORICAL CHECKLIST

<i>Scientific Name</i>	<i>Common Name</i>	<i>Scientific Name</i>	<i>Common Name</i>
Actinonaias ligamentina (Lamarck, 1819)	mucket	Megalonaias nervosa (Rafinesque, 1820)	washboard
Alasmidonta marginata Say, 1818	elktoe	Obliquaria reflexa Rafinesque, 1820	threehorn
Alasmidonta viridis (Rafinesque, 1820)	slippershell		wartyback
	mussel	Obovaria jacksoniana (Frierson, 1912)	southern
Amblema plicata (Say, 1817)	threeridge		hickorynut
Anodonta grandis Say, 1829	giant floater	Obovaria olivaria (Rafinesque, 1820)	hickorynut
Anodonta imbecillis Say, 1829	paper pondshell	Plectomerus dombeyanus (Valenciennes, 1827)	
Anodonta suborbiculata Say, 1831	flat floater		bankclimber
Anodontoides ferussacianus (Lea, 1834)	cylindrical	Pleurobema coccineum (Conrad, 1834)	round pigtoe
	papershell	Pleurobema cordatum (Rafinesque, 1820)	Ohio
Arcidens confragosus (Say, 1829)	rock-pocketbook		pigtoe
Arkansia wheeleri Ortmann and Walker, 1912	Arkansas	Pleurobema pyramidatum (Lea, 1840)	pyramid pigtoe
	rock-pocketbook	Potamilus alatus (Say, 1817)	pink heelsplitter
	spectaclecase		
Cumberlandia monodonta (Say, 1829)	purple wartyback	Potamilus capax (Green, 1832)	fat pocketbook
Cyclonaias tuberculata (Rafinesque, 1820)	western fanshell	Potamilus ohioensis (Rafinesque, 1820)	pink papershell
Cyprogenia aberti (Conrad, 1850)	butterfly	Potamilus purpuratus (Lamarck, 1819)	bleufer
Ellipsaria lineolata (Rafinesque, 1820)	spike	Ptychobranthus occidentalis (Conrad, 1836)	Ouachita
Elliptio dilatata (Rafinesque, 1820)			kidneyshell
Epioblasma florentina curtisi		Quadrula cylindrica (Say, 1817)	rabbitsfoot
(Utterback, 1916)	Curtis pearlymussel	Quadrula metanevra (Rafinesque, 1820)	monkeyface
Epioblasma triquetra (Rafinesque, 1820)	snuffbox	Quadrula nodulata (Rafinesque, 1820)	wartyback
Epioblasma turgidula (Lea, 1858)	turgid blossom	Quadrula pustulosa (Lea, 1831)	pimpleback
Fusconaia ebena (Lea, 1831)	ebonyshell	Quadrula quadrula (Rafinesque, 1820)	mapleleaf
Fusconaia flava (Rafinesque, 1820)	Wabash pigtoe	Simpsonaias ambigua (Say, 1825)	salamander
Fusconaia ozarkensis (Call, 1887)	Ozark pigtoe		mussel
Fusconaia subrotunda (Lea, 1831)	long-solid		squawfoot
Glebulia rotunda (Lamarck, 1819)	round pearlshell	Strophitus undulatus (Say, 1817)	
Lampsilis abrupta (Say, 1831)	pink mucket	Toxolasma lividus	
Lampsilis cardium (Rafinesque, 1820)	plain pocketbook	(Rafinesque, 1831)	purple lilliput
Lampsilis hydiana (Lea, 1838)	Louisiana fatmucket	Toxolasma parvum (Barnes, 1823)	lilliput
Lampsilis powelli (Lea, 1852)	Arkansas fatmucket	Toxolasma texasensis (Lea, 1857)	Texas lilliput
Lampsilis rafinesqueana Frierson, 1927	Neosho mucket	Tritogonia verrucosa (Rafinesque, 1820)	pistolgrip
Lampsilis reeveiana (Lea, 1852)	Arkansas broken-ray	Truncilla donaciformis (Lea, 1828)	fawnsfoot
Lampsilis satura (Lea, 1852)	sandbank pocketbook	Truncilla truncata Rafinesque, 1820	deertoe
Lampsilis siliquoidea (Barnes, 1823)	fatmucket	Uniomerus declivis (Say, 1831)	tapered pondhorn
Lampsilis streckeri Frierson, 1927	speckled pocketbook	Uniomerus tetralasmus (Say, 1831)	pondhorn
Lampsilis teres (Rafinesque, 1820)	yellow sandshell	Venustaconcha ellipsiformis (Conrad, 1836)	ellipse
Lasmigona complanata (Barnes, 1823)	white heelsplitter	Venustaconcha pleasii (Marsh, 1891)	bleedingtooth
Lasmigona costata (Rafinesque, 1820)	fluted-shell		mussel
Leptodea fragilis (Rafinesque, 1820)	fragile papershell	Villosa arkansasensis (Lea, 1862)	Ouachita
Leptodea leptodon (Rafinesque, 1820)	scaleshell		creekshell
Ligumia recta (Lamarck, 1819)	black sandshell	Villosa iris (Lea, 1829)	rainbow
Ligumia subrostrata (Say, 1831)	pondmussel	Villosa lienosa (Conrad, 1834)	little spectaclecase

It is a tranquil scene. A biologist waits topside as his partner dives below the mirrored surface of the Saline River, searching for rare mussels that might reside here. Their efforts will allow a bridge construction project to proceed without imperiling endangered or threatened mussels.

Some might ask why so lowly a creature merits such attention. The whys are many, and they go far beyond just economic values. The mussel's life history is uniquely fascinating, and concealed within these plain and simple shells are creations of uncommon beauty waiting to be revealed to all who will but look.

More importantly, perhaps, mussels are touchstones by which we can gauge the health of our environment. As we watch many species dwindle in number, we must ask ourselves, "Is this the true cost of progress? Or can we stem the tide of pollution, habitat destruction and exploitation threatening our planet?" Man's fate is inextricably linked to the world at large and to all other creatures that live upon it, even the lowly mussel. Until we affirm this kinship, our own destiny looks bleak indeed.





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