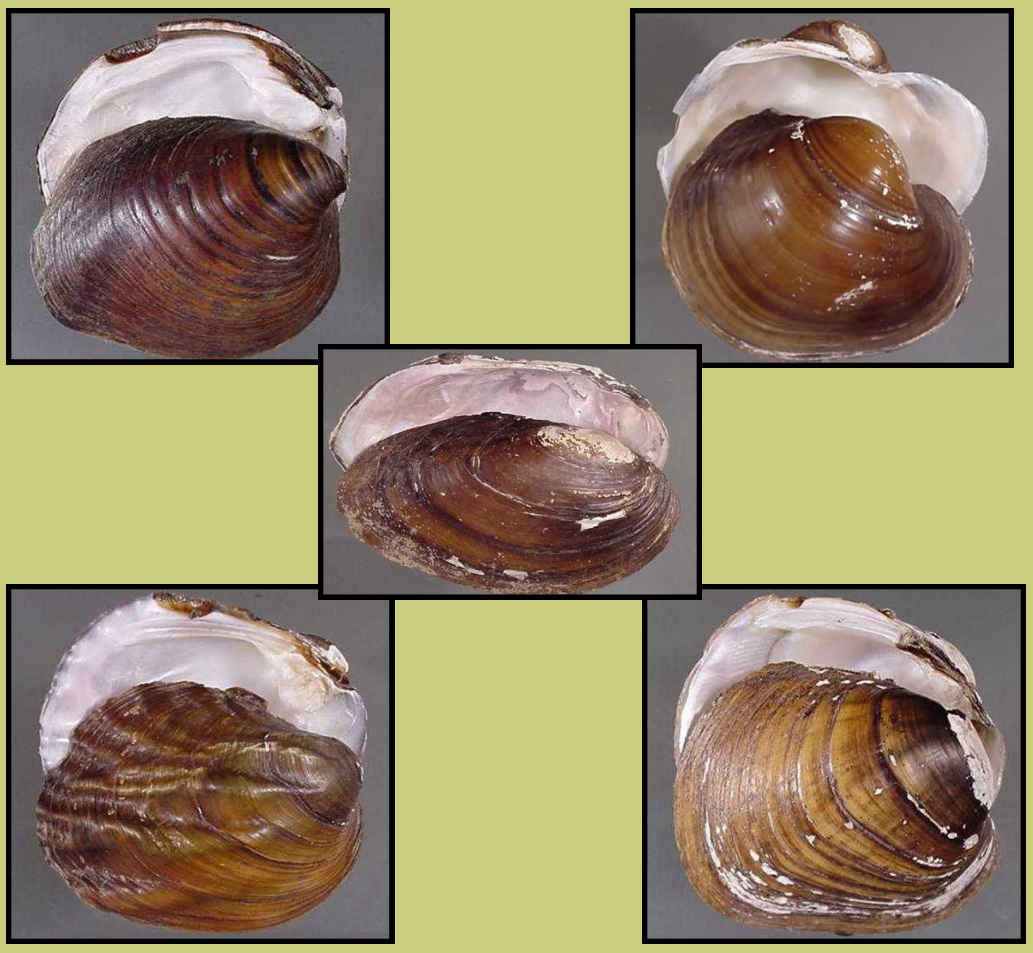
FIELD IDENTIFICATION NOTEBOOK

MUSSELS OF THE ST. FRANCIS RIVER BASIN ARKANSAS AND MISSOURI



March 2004
Version 2.0

Prepared by:
John L. Harris, Ph.D.
And
Cristin D. Milam

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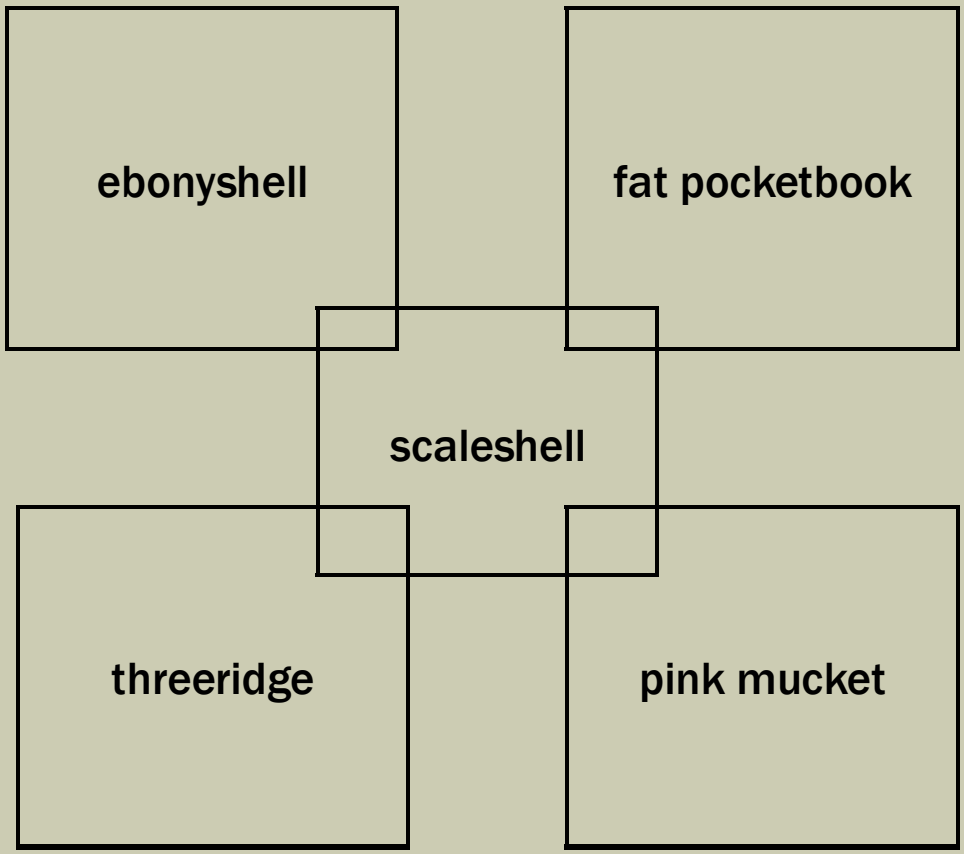

Mussels on the front cover.

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Mussels of the St. Francis River Basin
Arkansas and Missouri

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Mussels of the St. Francis River Basin, Arkansas and Missouri

Introduction

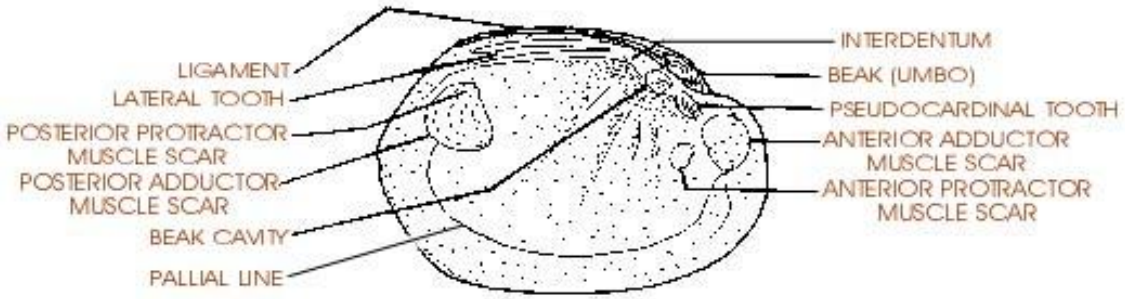
The purpose of this field notebook is to provide assistance in identification of freshwater mussels known to occur in the St. Francis River and tributaries in Arkansas and Missouri. Also, this document provides guidance regarding procedures to implement should mussel resources be encountered during maintenance activities.

Freshwater mussels are sedentary, bottom-dwelling inhabitants of rivers and lakes. When conditions are favorable, they occur in very dense, multi-species aggregations called mussel beds or beds. Sometimes these beds may encompass an area of 10,000 square meters, and the mussels may occur in densities exceeding 100 individuals per square meter.

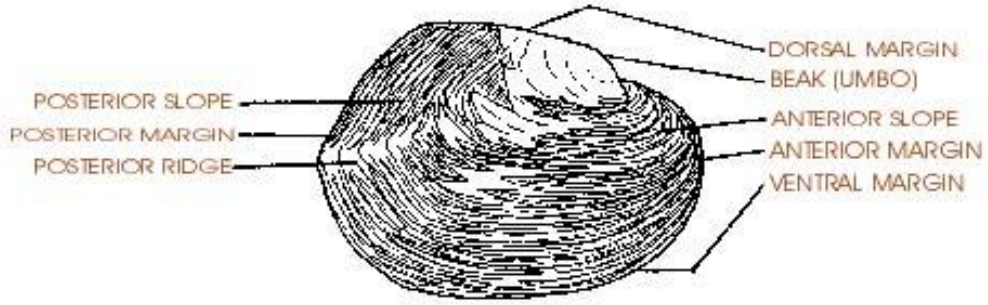
Mussels spend most of their lives with the majority of the shell buried in the river or lake bottom, and they obtain food, breathe, and reproduce by circulating water through the interior of the shell where the animal resides. In most species the sexes are separate, that is there are male and female individuals. Reproduction occurs when the female circulates sperm laden water through the gills where the eggs have been stored. The fertilized eggs called glochidia are stored in brood pouches on the gills until they are released to inhabit fish as a short term parasite. This parasitic stage is apparently required for the glochidia to metamorphose into juvenile mussels. After residing on the fish for a short period (one to usually three weeks), the juvenile mussels drop off and begin their free-living stage in the substrate.

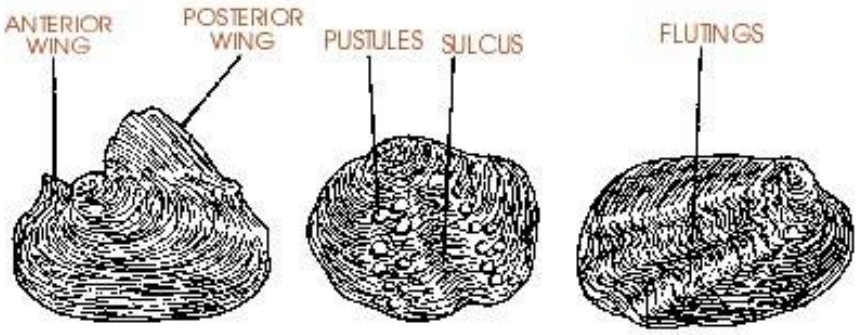
The most obvious characteristic of all freshwater mussels is the shell which is composed of left and right valves. Externally the shell may be virtually smooth or heavily sculptured with small pimples, larger pustules, heavy ridges and grooves, and a variety of other features. Figures 1-3 illustrate various features of the shell and the specialized terminology. The terminology is defined in the glossary at the back of the notebook. These figures are used courtesy of R. G. Howells, senior author of the Freshwater Mussels of Texas (Howells *et al*., 1996).

INTERNAL SHELL FEATURES



EXTERNAL SHELL FEATURES





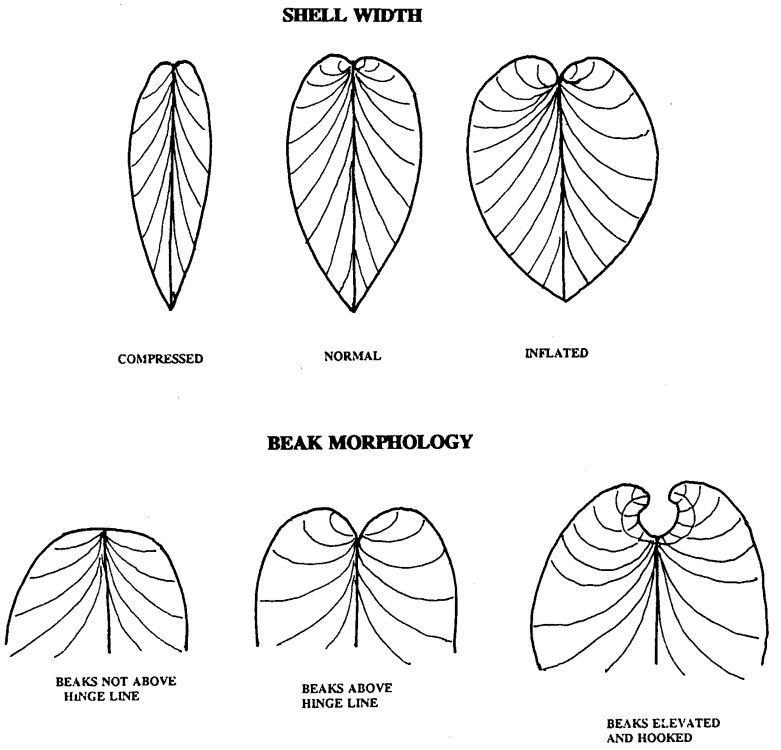


Figure 2. Examples of shell width and beak morphology of freshwater mussel shells and shell features of non-unionid bivalves.

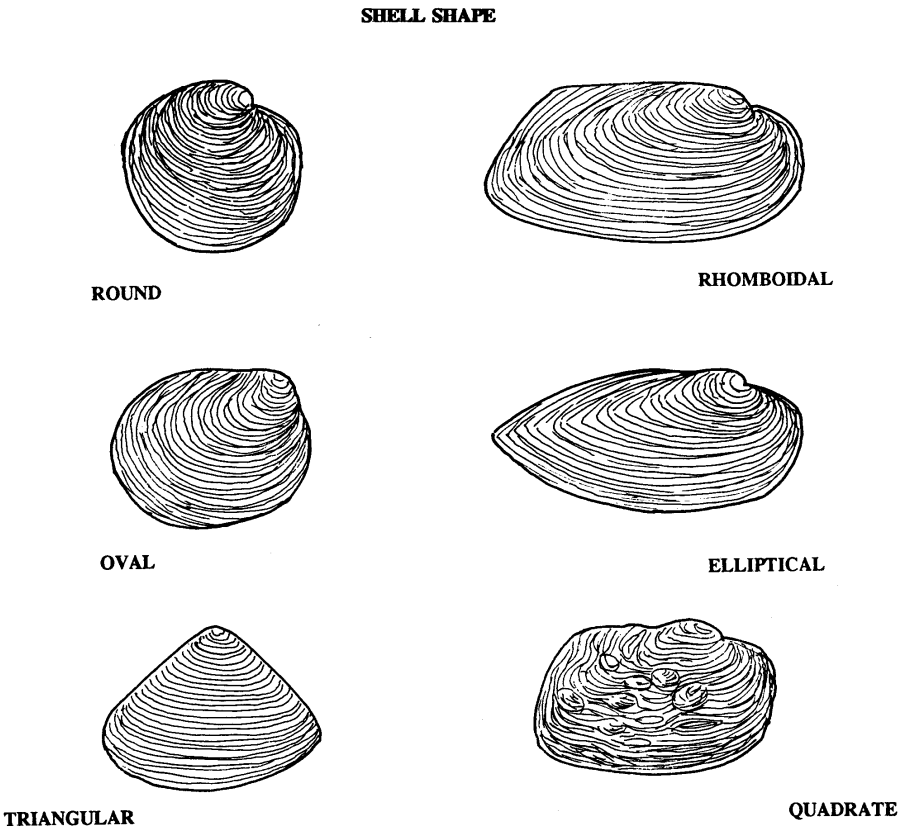


Figure 3. Examples of freshwater mussel shell shape and beak sculpturing.

The remainder of the field notebook consists of a key to the species occurring in the St. Francis River Basin, followed by more detailed descriptions of individual species. The individual descriptions contain a discussion of abundance in the river, a color photograph of a "typical specimen", and a comparison of similar species with characters to discriminate between them. The scale bar below each photograph is metric with the smallest divisions in millimeters. The individual species accounts are divided into three groups based on similarities in appearance. These three groups are the sculptured shells (14 species), the smooth, elongate shells (16 species), and the smooth, non-elongate shells (24 species). The key characteristics used for discrimination between and among species are highlighted in bold within each species description. I hope you find this format user friendly.

Key to Mussels

St. Francis River Basin

Arkansas and Missouri

Key to Freshwater Mussels in the St. Francis River Basin Arkansas and Missouri

1. a. External portion of shell having knobs, pustules or parallel ridges 2
   b. External portion of the shell mostly smooth; (posterior wing may have ridges).... 12

2. a. Shell with single row of knobs on the posterior ridge or on the middle portion of the shell 3
   b. Shell not as above 4

3. a. Shell elongate, more than twice as long as deep . rabbitsfoot (*Quadrula cylindrica*)
   b. Shell not elongate, knobs prominent and high ....threehorn wartyback(*Obliquaria reflexa*)
   c. Posterior ridge with large knobs, ridge extends to margin of the shell; external shell coloration usually with down-pointing pigmented markings (sometimes absent in larger specimens).....monkeyface (*Quadrula metanevra*)

4. a. Shell with two rows of knobs or pustules in the umbo region, more distinct in smaller specimens; shell sculptured with a rough texture; lateral teeth poorly developed .....rock pocketbook (*Arcidens confragosus*)
   b. Shell with two prominent rows of knobs or pustules; pseudocardinal teeth and lateral teeth well developed..... 5
   c. Not as above 6

5. a. A definite sulcus between the two rows of large pustules; sulcus without small pustules in the umbo region .....mapleleaf (*Quadrula quadrula*)
   b. Pustules in definite rows, no sulcus between the rows; pustules sparse, one to three per row, sometimes pustules may be present only on one row .... wartyback (*Quadrula nodulata*)

6. a. Many pustules on shell; margin of shell nearly round; nacre purple..... ..... purple wartyback (*Cyclonaias tuberculata*)
   b. Rounded to slightly triangular shell with sulcus betweeen posterior ridge and anterior half of shell; sulcus with wrinkeled or striated appearance; shell colored with tiny flecks that become dense enough to form fines rays; posterior slope fluted.....western fanshell (*Cyprogenia aberti*)
   c. Shell with parallel ridges or with pustules more or less randomly scattered..... 7

7. a. Shell elongate, posterior ridge prominent and extends margin of the shell; pustules usually present, sometimes extremely prominent .... pistolgrip (*Tritogonia verrucosa*)
   b. Pustules randomly distributed on shell, abundant to almost absent; usually green pigmented area on umbo, especially in younger individuals; shell nearly round . ..... pimpleback (*Quadrula pustulosa*)
   c. Not as above 8

8. a. Shell with 3 or more parallel ridges beginning on the umbo and directed towards the posterior ventral margin, pustules and/or crenulations absent from anterior; nacre usually white, sometimes with a purplish iridescence on the posterior margin ..... threeridge (*Amblema plicata*)
   b. Shell quadrate; usually with pustules and/or ridges 9

9. a. Shell quadrate and with fluting, pustules, ridges or corrugation on posterior slope and other portions of the shell..... 10
   b. Shell quadrate to rounded with fluting and ridges more or less restricted to posterior slope and posterior ridge..... 11

10. a. Umbo covered with small zigzag ridges; posterior slope fluted; exterior coloration black, not shiny; nacre usually white, often with copper or gold colored spots ... . washboard (*Megalonaiais nervosa*)
    b. Posterior ridge prominent, posterior ventral margin appears pointed (especially in smaller individuals); pustules and ridges usually present but not prominent; nacre purple to copper colored..... bankclimber (*Plectomerus dombeyanus*)

11. a. Posterior slope fluted; shell compressed and valves relatively thin; beaks low, narrow, not raised above hingeline; external coloration chestnut brown to dark brown, rays often present in smaller specimens; pseudocardinal teeth present, lateral teeth reduced or absent..... flutedshell (*Lasmigona costata*)
    b. Shell oval with large, prominent posterior dorsal wing, often with small flutations or corrugations; pseudocardinal teeth moderately to well developed, lateral teeth absent; nacre white ..... white heelsplitter (*Lasmigona complanata*)

12. a. Shell decidedly more elongate than rounded; posterior ridge not sharply angled; shape rhomboidal to elliptical 13
    b. Shell triangular, round or oval in shape..... 29

13. a. Shell without distinct color rays, base color banana yellow; posterior ridge rounded and posterior slope smooth .....yellow sandshell (*Lampsilis teres*)
    b. Shell background coloration yellow, yellow-green, green to brown; color rays present 14
    c. Shell not as above 19

14. a. Shell background coloration yellow, faint to prominent green rays usually present; posterior wing prominently to poorly developed; shell relatively thin; lateral and pseudocardinal teeth thin ..... fragile papershell (*Leptodea fragilis*)
    b. Shell with distinct green or black color rays 15

15 a. Rays prominent, thin to broad in width but broken – not continuous; females with indentation to shell anterior to posterior ridge .... Ozark brokenray (*Lampsilis reeveiana brevicula*)
    b. Rays prominent to obscure, thin to broad in width but continuous – not broken or interrupted; rays not noticeably concentrated in posterior one third of shell ... 16
    c. Rays prominent, thin to broad in width but continuous – not broken or interrupted; rays more concentrated in posterior one third of shell, also often with green or black background coloration in this area 18

16. a. Rays prominent, very thin (like a fine-point pen line), continuous and closely spaced; valves moderately thick; shell laterally compressed .... Ouachita kidneyshell (*Ptychobranchus occidentalis*)
    b. Rays prominent to usually obscure; background coloration tan to brown; shell stout, compressed at dorsal margin; nacre purple to white; beak cavity absent .. ..spike (*Elliptio dilatata*)
    c. Rays prominent; shell moderately inflated in umbo region..... 17

17. a. Rays prominent, thin to broad in width and continuous – not broken, more or less widely spaced; valves moderately thick to thin; shell laterally inflated; umbo located anteriorly; pseudocardinal and lateral teeth well developed..... ..... Louisiana fatmucket (*Lampsilis hydiana*)
    b. Rays prominent, usually broad in width and continuous – not broken, valves moderately thick to thin; shell laterally inflated; umbo located greater than one third of way toward center of shell; pseudocardinal and lateral teeth poorly developed .....creeper (*Strophitus undulatus*)
    c. Rays prominent to somewhat obscure; shell quite elongate and valves moderately thick; umbo located anteriorly, very broad but not raised much above the hinge line, moderately inflated; nacre white except in beak cavity where it is purple or salmon ..... black sandshell (*Ligumia recta*)

18. a. Shell distinctly pointed on posterior end, males acutely pointed, females bluntly pointed; posterior ridge with an upturned appearance at posterior end; shell thin but solid; nacre iridescent; pseudocardinal teeth thin ....pondmussel (*Ligumia subrostrata*)
    b. Shell bluntly rounded on posterior end; nacre iridescent; pseudocardinal teeth relatively stout.....rainbow (*Villosa iris*)

19. a. Shell decidedly elongate, usually more than twice as long as deep 20
    b. Shell elongate, rhomboidal or elliptical in shape 23

20. a. Shell coloration dark green, brown or black; pseudocardinal and lateral teeth well developed 21
    b. Shell coloration tan, yellow-green, green or light brown; pseudocardinal and lateral teeth poorly developed or absent..... 22

21. a. Shell with broad, green rays in small specimens, larger specimens uniformly black; dorsal margin rounded, somewhat inflated in large specimens; posterior end rounded in females, bluntly pointed in males; nacre usually white except in beak cavity where it is purple or salmon..... black sandshell (*Ligumia recta*)
    b. Shell stout, external coloration uniformly dark; compressed at the dorsal margin; nacre dark purple to white; beak cavity absent .....spike (*Elliptio dilatata*)

22. a. Shell fragile; ventral margin broadly rounded; shell coloration yellow, olive, or brown; nacre rose colored in the beak cavity, iridescent bluish color over the remainder; pseudocardinal teeth reduced to thickened ridge, lateral teeth low and indistinct; when viewed from above (dorsal aspect), the shell has a somewhat twisted appearance, almost never is the shell straight .... scaleshell (*Leptodea leptodon*)
    b. Shell fragile; hingeline straight; umbos not extending above hingeline; coloration yellow, yellow-green to green; pseudocardinal and lateral teeth absent..... ..... paper pondshell (*Utterbackia imbecillis*)

23. a. Pseudocardinal and lateral teeth absent; shell greatly inflated in the umbo region and central part of shell; external coloration tan, olive, black; shell thin ....giant floater (*Pyganodon grandis*)
    b. Pseudocardinal and lateral teeth present and well developed..... 24

24. a. Nacre purple 25
    b. Nacre white, salmon or iridescent 26

25 a. Shell inflated at the posterior end, broadly truncate in females; external coloration dark, black or green, sometimes with broad color rays in small specimens; pseudocardinal and lateral teeth well developed; nacre purple .... bleufer (*Potamilus purpuratus*)

b. Shell small, relatively solid and inflated; pseudocardinal and lateral teeth well developed; nacre purple and usually lighter toward the ventral margin .... purple lilliput (*Toxolasma lividus*)

26. a. Color rays absent, shell texture shiny, satiny or cloth-like 27

b. Broad green color rays present, often obscure ..little spectaclecase (*Villosa lienosa*)

27. a. Shell small, relatively solid and inflated; pseudocardinal teeth well developed, lateral teeth long, thin, and straight; beak cavity moderately deep; nacre white and iridescent ..... lilliput (*Toxolasma parvus*)

b. Shell small to medium size, relatively solid and moderately inflated; beak cavity shallow; nacre white to salmon .....Texas lilliput (*Toxolasma texasensis)*

c. Shell compressed; base color tan, brown to occasionally black; posterior ridge gently rounded but posterior slope with two parallel grooves with slightly raised ridge in between 28

28. a. Posterior end terminates in a rather distinct, sharp point . ... tapered pondhorn (*Uniomerus declivis*)

b. Posterior end is bluntly pointed .....pondhorn (*Uniomerus tetralasmus*)

29. a. Small shell with pronounced, regularly spaced, concentric ridges over the entire surface; external coloration greenish yellow to black and shiny; solid and strong at all sizes ..... Asian clam (*Corbicula fluminea*)

b. Shell with posterior ridge sharply angled (approaching 90 degrees); posterior slope prominent..... 30

c. Shell with posterior ridge gently angled; posterior slope not prominent..... 32

30. a. Shell triangular to somewhat oval; external coloration green, yellow-brown, to brown, usually with distinct fine color rays often grouped together to form broad bands of color..... deertoe (*Truncilla truncata*)

b. Shell broadly triangular and elongated from anterior to posterior; posterior ridge sharply angled; posterior slope relatively wide..... 31

31. a. Posterior ridge sharply angled; posterior slope wide, expanded and ribbed; umbos swollen and slightly elevated above hingeline, located slightly toward anterior of shell; external coloration yellow or yellow-green with dark green rays, blotches or chevron-shaped markings; two pseudocardinal teeth in each valve; lateral teeth short but elevated; beak cavity deep..... ..... snuffbox (*Epioblasma triquetra*)

b. Posterior ridge sharply angled; posterior slope wide; expanded and ribbed; umbos swollen and slightly elevated above hingeline, located near the center of the shell; external coloration yellow to yellow green with dark green spots, posterior slope often lighter than rest of shell; one pseudecardinal tooth in right valve, ocassionally two in left valve; lateral teeth absent or greatly reduced..... ..... elktoe (*Alasmidonta marginata*)

c. Shell elongate, described as boat shaped; dorsal end pointed; external coloration yellow, green, tan to black, usually with dark wavy rays; no lateral or pseudocardinal teeth present; byssal threads present for attachment .... zebra mussel (*Dreissena polymorpha*)

32. a. Shell laterally compressed (thin) with posterior dorsal wing present, small to very prominent 33

b. Not as above 36

33. a. Shell nearly circular; shell thin even in large specimens; small posterior wing present; external coloration yellowish tan to olive, shiny; lateral and pseudocardinal teeth absent ..... flat floater (*Anodonta suborbiculata*)

b. Shell oval to oblong; prominent posterior dorsal wing present..... 34

34. a. Shell oval with large, prominent posterior dorsal wing, often with small flutations or corrugations; pseudocardinal teeth moderately to well developed, lateral teeth absent; nacre white ..... white heelsplitter (*Lasmigona complanata*)

b. Shell oblong to ovate with prominent posterior dorsal wing; nacre pink to purple.35

35. a. Shell oblong to slightly ovate; small anterior dorsal wing present; external coloration greenish, reddish brown or light brown, and shiny; nacre color light purple to pink; pseudocardinal teeth thin, one in left valve and two in right valve; lateral teeth short and curved .....pink papershell (*Potamilus ohiensis*)

b. Shell oblong to somewhat rectangular; anterior dorsal wing absent; external, coloration dark green to black; nacre color light to dark purple; two thin pseudocardinal teeth in each valve.....pink heelsplitter (*Potamilus alatus*)

36. a. Shell oval to elliptical, often greatly inflated; external coloration yellow in small individuals to brownish yellow in larger specimens, almost always with prominent color rays; nacre white; beaks broad and raised above the hinge line; pseudocardinal and lateral teeth well developed .... plain pocketbook (*Lampsilis cardium*)

b. Shell oval and greatly inflated; dorsal margin s-shaped; beaks broad, high and turned decidedly inward; external coloration tan, gray or olive, and color rays absent, shell shiny; nacre bluish white tinged with salmon .... fat pocketbook (*Potamilus capax*)

c. Not as above 37

37. a. Shell acutely to broadly triangular, thick; umbos inflated; coloration reddish brown to black 38

b. Not as above 39

38. a. Shell acutely triangular (distinctly taller than wide); coloration dark brown to black; beaks elevated and hooked; sulcus absent in front of posterior ridge..... ..... pyramid pigtoe (*Pleurobema rubrum*)

b. Shell broadly triangular; coloration reddish brown to brown; beaks broad but not extremely elevated; posterior ridge prominent and often sharply angled; broad flat sulcus in front of posterior ridge ..... Wabash pigtoe (*Fusconaia flava*)

39. a. Shell broadly triangular, laterally compressed; shell thick and stout; posterior ridge prominent and acutely angled; beaks broad and flattened on the side but pointed at the apex; external coloration yellow, yellow brown or greenish brown; color rays narrow to broad and covering entire shell, rays discontinuous with spots, bars, and chevron shapes. ..... butterfly (*Ellipsaria lineolata*)

b. Shell broadly triangular, moderately inflated; shell thin to moderately thick; posterior ridge not prominent, posterior slope gentle; external coloration yellow to yellowish green, color rays form vertical bands, w-shaped markings aligned horizontally on shell ..... fawnsfoot (*Truncilla donaciformis*)

c. Not as above 40

40. a. Shell circular to oval or quadrate, often somewhat elongated posteriorly; beaks thick and inflated; external coloration tan, brown to black, color rays sometimes present 41

b. Not as above 42

41. a. Shell thick and stout, anterior end considerably thicker than posterior half; beaks elevated and hooked, strongly directed forward; beak cavity well developed; nacre white; pseudocardinal teeth parallel to long axis of lateral teeth ....ebonyshell (*Fusconaia ebena*)
    b. Shell thick and stout, posterior end nearly as thick as anterior half; beaks stout, but not extensively elevated above hingeline; external coloration yellowish brown to brown, often with broad color rays; pseudocardinal and lateral teeth stout, not parallel; nacre white with pink in beak cavity or entirely pink..... ..... pink mucket (*Lampsilis abrupta*)

42. a. Shell outline quadrate to elliptical; shell stout and thick to very thick, compressed to inflated; beaks broad and only slightly elevated; external coloration tan, brown to black, often with broad color rays; pseudocardinal and lateral teeth thick; nacre white to pink .....mucket (*Actinonaias ligamentina*)
    b. Shell outline rhomboid to quadrate; shell thin to moderately thick; umbos full and elevated above hingeline; coloration yellow-green with numerous wavy green rays; pseudocardinal teeth triangular and lateral teeth poorly developed to absent; nacre iridescent .....slippershell (*Alasmidonta viridis*)
    c. Not as above 43

43. a. Shell outline broadly triangular; shell moderately inflated, valves thick and stout; beaks are compressed and only slightly elevated; sulcus anterior to posterior ridge broad and flat; pseudocardinal teeth stout, lateral teeth moderately high; beak cavity is very shallow .....round pigtoe (*Pleurobema sintoxia*)
    b. Shell outline elliptical to somewhat cylindrical; color rays generally absent and background coloration brown to black..... 44

44. a. Shell small, relatively solid and inflated; pseudocardinal and lateral teeth well developed; nacre purple and usually lighter toward the ventral margin .... purple lilliput (*Toxolasma lividus*)
    b. Shell small, relatively solid and inflated; nacre white and iridescent..... 45

45. a. Color rays absent, shell texture satiny or cloth-like..... 46
    b. Broad green color rays present, often obscure ..little spectaclecase (*Villosa lienosa*)

46. a. Shell small, relatively solid and inflated; pseudocardinal teeth well developed, lateral teeth long, thin, and straight; beak cavity moderately deep; nacre white and iridescent ..... lilliput (*Toxolasma parvus*)
    b. Shell small to medium size, relatively solid and moderately inflated; beak cavity shallow; nacre white to salmon.....Texas lilliput (*Toxolasma texasensis*)

Group 1

Shells with Knobs, Pustules, Folds and Ridges

Bankclimber
(*Plectomerus dombeyanus*)

Description: **Shell quadrate**, compressed to moderately inflated with moderately thick valves. **Prominent, downturned posterior ridge with numerous small undulations anterior and posterior to the ridge**. External coloration is brown or black and rays are not evident; **nacre color is purple to copper**, often lighter outside the pallial line.

Similar species: Washboard has a less prominent posterior ridge, rounded posterior end (versus truncate), and white nacre. Threeridge is less quadrate, has 3-6 anterior to posterior ridges, generally lacks pustules and pimples anywhere on the shell, and has white nacre. Pistolgrip is more elongate with prominent knobs on the posterior ridge and a white or light purple nacre.

Relative abundance: Collected at 11 of 113 river sites and 0 of 31 ditch sites reported by Ahlstedt and Jenkinson (1991). Represented by 39 specimens, the bankclimber comprised 0.3% of mussels collected from river sites. Posey (1997) collected four individuals from three of 10 mussel beds sampled. The bankclimber is a relatively rare component of the mainstem river mussel community.

Local names: bankclimber, washboard

Flutedshell
(*Lasmigona costata*)

Description: **Shell elongate rhomboidal in shape**, compressed to moderately inflated; valves thin to moderately thick. **Posterior slope covered with prominent to sometimes indistinct flutings or small ridges**. External color tan to black with indistinct broad green rays often present. **Pseudocardinal teeth reduced, lateral teeth absent**. Nacre white to iridescent; soft tissues usually bright orange. Maximum length to seven inches.

Similar species: Mucket is similarly shaped but a much heavier shell lacking flutes on the posterior slope. Louisiana fatmucket is smooth shelled with prominent bold green rays. Fragile papershell is smooth shelled with a more or less well developed posterior wing. Spike is elongate but much heavier shelled, lacks flutings and usually has a purple nacre.

Relative abundance: The flutedshell is known only from the St. Francis River upstream of Wappapello Reservoir in Missouri (Oesch 1984).

Local names: flutedshell

Mapleleaf
(*Quadrula quadrula*)

Description: The **shell is roundly quadrate to broadly 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 the ridge and the mid-portion of the shell**. **Pustules or pimples usually occur on each ridge creating two rows of pustules** but these are occasionally absent. External color ranges from tan to brown, and green 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. There is wide variation in shell morphology for this species. *Four types are illustrated in the accompanying illustrations*.

Similar Species: The mapleleaf is similar to the wartyback, rock pocketbook, pimpleback, purple wartyback, and western fanshell. The rock pocketbook may have two rows of small knobs in the umbo region but it is thin shelled and inflated. The wartyback has two rows of pustules or knobs but no sulcus and is usually round, the mapleleaf quadrate. The pimpleback and purple wartyback lack the two distinct rows of pustules and do not have a sulcus. The western fanshell has a sulcus but completely lacks pustules.

Relative abundance: The mapleleaf was collected at 53 of 113 river sites (= 47%) and 14 of 31 ditch sites (= 45%) reported by Ahlstedt and Jenkinson (1991). The mapleleaf comprised 3.6% of total mussels collected at river sites and almost 10% of total mussels collected from ditch sites. Posey (1997) collected the mapleleaf from 10 of 10 mussel beds sampled where it represented from 2%-85% of mussels within a particular bed. The mapleleaf is common within the St. Francis River system.

Local names: mapleleaf

Shell variance of mapleleaf.

Monkeyface
(*Quadrula metanevra*)

Description: **Quadrate**, moderately inflated shell with moderately thick to thick valves. **Prominent posterior ridge with a series of large knobs or pustules**. Smaller pustules usually prominent on other portions of the shell. External coloration is yellowish, tan, or brown with numerous small to large, dark green, down pointing triangles scattered randomly over the shell. Nacre is white. Maximum length about five inches.

Similar species: Rabbitsfoot has large knobs on the posterior ridge and similar coloration, but it is much more elongate than monkeyface. Mapleleaf, wartyback and pimpleback do not possess the prominent posterior ridge with large knobs.

Relative abundance: The monkeyface was collected a 14 of 113 river sites (= 12%) and was not collected from any of 31 dtich sites sampled by Ahlstedt and Jenkinson (1991). It represented approximately 1.0% of total mussels collected. Posey (1997) collected a total of five individuals from three of 10 sites sampled. The monkeyface is relatively uncommon in the mainstem of the St. Francis River.

Local names: monkeyface

Pimpleback
(*Quadrula pustulosa*)

Description: **Round shell**, moderately inflated, moderately thick to thick valves. External color tan to dark brown, **often with a green shower of color extending from the umbo** a short distance to the shell's center. **Shell exterior has few to many pustules and/or pimples (sometimes completely absent). Nacre is white**, teeth are well developed, and a well developed beak cavity is present. Maximum length about three inches.

Similar species: Purple wartyback has purple nacre and taller, more prominent pimples over the posterior two thirds of the shell. Wartyback has a more wing-like posterior slope and never has green coloration on the umbo. Mapleleaf always has a sulcus and a more prominent posterior ridge. Pimpleback without pustules are difficult to separate from Wabash pigtoe. Wabash pigtoe has a more prominent posterior ridge, more acutely angled posterior slope, a broader, flatter umbo region, and triangular shape.

Relative abundance: Ahlstedt and Jenkinson (1991) collected the pimpleback at 62 of 113 river sites (= 58%) and at two of 31 ditch sites (= 6%). It represented 7.7% of total mussels collected from river sites and 0.2% of total mussels at ditch sites. The pimpleback was the second most abundant mussel in the river site collections. Posey (1997) found the pimpleback in nine of 10 mussel bed sites where it represented from 2% - 56% of total mussels within individual beds.

Local names: pimpleback

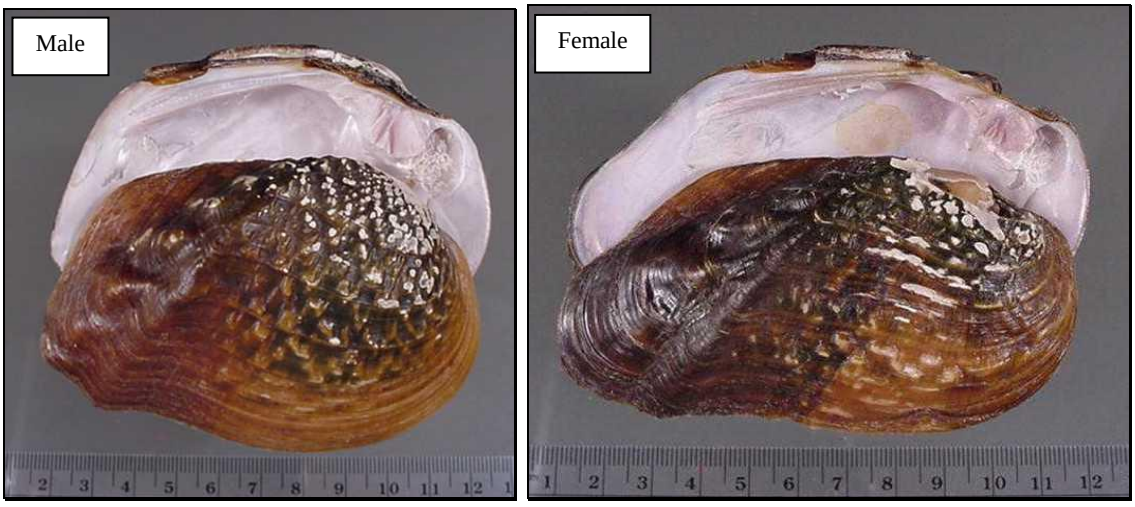
Pistolgrip
(*Tritogonia verrucosa*)

Description: **Elongate to slightly quadrate shell with prominent posterior ridge that terminates in a bulge at the ventral margin**. Shell compressed to slightly inflated, and valves are thick to moderately thick. **Shell exterior covered with bumps, pustules and flutings**, especially anterior to the posterior ridge. **Posterior slope with flutings or wavy pustules**. Exterior coloration brown, greenish brown to black, occasionally with small greenish downpointing triangles in small specimens. Nacre is white, pink or light purple. Pseudocardinal and lateral teeth are well developed. Maximum length is 10-12 inches.

Similar species: Most similar to the bankclimber in shape, but bankclimber lacks pustules and is more quadrate with a distinctive coppery to purple nacre. Threeridge and washboard are more quadrate and lack the prominent posterior ridge of pistolgrip. Spike and black sandshell are elongate and dark colored, but both of these are smooth shelled throughout.

Relative abundance: Ahlstedt and Jenkinson (1991) found the pistolgrip at 26% of river sites sampled but it was not collected at any of 31 ditch sites sampled. It represented 0.7% of the total specimens collected. Posey (1997) found the pistolgrip at eight of 10 mussel beds sampled where it composed 1% - 7% of the total mussels within a bed.

Local names: buckhorn



Purple Wartyback
(*Cyclonaias tuberculata*)

Description: **Round shell with pustules and flutings densely distributed on the posterior two thirds of the shell exterior**. Moderately thick valves and slightly inflated shell are characteristic of the White River form in this region. External color is dark brown to black in the big river form, **nacre is deep purple**. Pseudocardinal and lateral teeth are well developed. Maximum size is three inches.

Similar species: Most similar to the pimpleback which has a white nacre, and the pimples are seldom as "tall" or well developed as those of the purple wartyback. Also similar to the wartyback and mapleleaf but these species have two rows of pustules and white nacre.

Relative abundance: The purple wartyback was not collected by Ahlstedt and Jenkinson (1991) or Posey (1997). It occurs in the upper mainstem of the St. Francis River (Oesch 1984).

Local names: walnut, purple pimpleback

Rabbitsfoot
(*Quadrula cylindrica*)

Description: An **elongated, quadrate shaped shell**, moderately inflated, with thick to moderately thick valves. The **posterior ridge has large, distinctive knobs**. The **shell generally maintains the same depth from the anterior to posterior ends**. 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 six inches.

Similar species: The rabbitsfoot is probably most similar to the monkeyface, pistolgrip and small individuals of the bankclimber. The rabbitsfoot is much more elongate than the monkeyface, and the bankclimber lacks the characteristic knobs on the posterior ridge that define the rabbitsfoot. The pistolgrip tapers significantly from the anterior to posterior in females, is much deeper relative to its length than the rabbitsfoot, and also has few to many pustules on the shell. The rabbitsfoot is also superficially similar to other elongate species like the spike, black sandshell, and yellow sandshell, however they are smooth shells.

Relative abundance: Neither Ahlstedt and Jenkinson (1991) nor Posey (1997) collected the rabbitsfoot in the St. Francis River system. It occurs primarily in the mainstem St. Francis River upstream of Wappapello Reservoir (Oesch 1984).

Local names: cucumber, corncob, cob shell

Rock Pocketbook
(*Arcidens confragosus*)

Description: Shell thin to moderately thick, **quadrate to elliptical, and inflated**. The umbos are elevated above the hingeline and located near the middle of the shell. The **umbos also have two rows of pustules or knobs that are more prominent in smaller shells** and generally become smaller to absent on the ventral half of the shell. The **pseudocardinal teeth are moderately developed but the lateral teeth are poorly developed to almost absent**. The nacre is white to iridescent. Maximum shell length is approximately eight inches.

Similar species: Young rock pocketbook resemble the mapleleaf, however the mapleleaf is a much heavier, less inflated shell. Also the pustules on the mapleleaf are usually well developed to the ventral margin of the shell. The threeridge has a similar shell outline, however the threeridge usually has the characteristic parallel ridges running anterior to posterior and the rock pocketbook lacks these ridges.

Relative abundance: Ahlstedt and Jenkinson (1991) found the rock pocketbook at approximately 25% of river sample sites and 22.5% of ditch sample sites. It comprised 0.5% of mussels at river sites and 1.3% of mussels at ditch sites. Posey (1997) found the rock pocketbook at three of 10 sample sites where it comprised 1%-3% of the mussel community.

Local names: rockshell, grandmaw

Threehorn Wartyback
(*Obliquaria reflexa*)

Description: The **shell is round to broadly triangular** in outline with **one to four (usually three) prominent knobs in a row down the middle of the shell from dorsal to ventral**, and a series of ridges on the posterior slope. Nacre color is white to iridescent, and the 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 three and a half inches.

Similar species: The threehorn wartyback is superficially similar to the mapleleaf and wartyback. The mapleleaf has two rows of pustules running dorsal to ventral with a sulcus in between, and the wartyback has somewhat larger pustules, also in two rows, but without a sulcus. Neither species has the large knobs or raying characteristic of the threehorn wartyback.

Relative abundance: Threehorn wartyback was found at 48 of 113 river sample sites and four of 31 ditch sample sites of Ahlstedt and Jenkinson (1991). It represented 1.7% of mussels at river sites and 2.0% at ditch sites. Posey (1997) collected it at five of 10 mussel bed sites where it represented 1%-2% of the mussel community.

Local names: three dot, hornyback, three knot

Threeridge
(*Amblema plicata*)

Description: Shell **rectangular to quadrate**, moderately compressed to moderately inflated, with thick to very thick valves. **Pseudocardinal and lateral teeth well developed** and large. **Three to six (occasionally more) undulating ridges running from the anterior to posterior**. External coloration ranges from tan to black. Nacre white, some specimens with blue, purple or pink tinge at posterior apex.

Similar species: Some specimens of washboard are very difficult to distinguish from threeridge. Washboard has pimples anterior to the umbo and much smaller pseudocardinal teeth when compared with comparable sized threeridge. Bankclimber has a more quadrate shape, lacks ridges, and possesses a prominent posterior ridge.

Relative abundance: Ahlstedt and Jenkinson (1991) found threeridge at 66 of 113 river sites and at 18 of 31 ditch sites. It was the most common species at river sites representing 57% of the total mussels collected. It represented 10.5% of specimens at ditch sites. Posey (1997) found the threeridge at all 10 mussel bed sample sites where it represented from 7%-65% of the mussels collected.

Local names: bluepoint, threeridge

Wartyback
(*Quadrula nodulata*)

Description: **Round**, moderately inflated shell with moderately thick valves. **Two rows of large pustules from umbo to ventral margin**. There is **no sulcus** between the two rows of pustules or knobs. External shell color is yellow to tannish brown, and color rays are absent. Nacre is white. Maximum length is three inches.

Similar species: Most similar to the pimpleback, but pimpleback does not have distinct rows of knobs or pustules, and pimpleback will often possess green coloration in the umbo region. The mapleleaf has a sulcus between two rows of pustules and is quadrate in outline. The western fanshell lacks pustules and has a sulcus with small furrows. The threehorn wartyback is sometimes shaped and colored like the wartyback, however the threehorn wartyback has the single row of knobs down the center of the shell.

Relative abundance: Ahlstedt and Jenkinson (1991) collected the wartyback at 27 of 113 river sites and eight of 31 ditch sites. It represented 1% of the mussels collected from river sites and 8% of mussels collected at ditch sites. Posey (1997) found the wartyback at eight of 10 mussel beds sampled where it represented from 1%-3% of mussels within the beds.

Local names: pimpleback, mapleleaf, purple wartyback

Washboard
(*Megalonaias nervosa*)

Description: **Shell quadrate to slightly elongate**, compressed to moderately inflated, valves thick. **External surface corrugated with a variety of small ridges, flutes, and pustules**. External color tan to black, nacre white. Lateral teeth well developed and large; **pseudocardinal teeth well developed but medium sized compared with total shell size**. Maximum length 10-12 inches.

Similar species: Threeridge usually has 3-6 distinct anterior to posterior ridges, generally lacks pustules or pimples anywhere on the shell, and the pseudocardinal teeth are much larger in relative size. Bankclimber is more quadrate in shape with more prominent, downturned posterior ridge, and coppery to purple nacre. Rock pocketbook has distinctive double row of small knobs on umbo, is more inflated with thinner valves, and has poorly developed teeth.

Relative abundance: The washboard was collected at 48 of 113 river sites by Ahlstedt and Jenkinson (1991) where it represented 1.7% of total mussels collected. It was not collected at any of 31 ditch sites. Posey (1997) found the washboard in 9 of 10 mussel beds where it represented from 1%-11% of mussels in individual beds.

Local names: washboard

Western Fanshell
(*Cyprogenia aberti*)

Description: **Shell round to broadly triangular**, usually flattened laterally (compressed) but somewhat inflated in the big river form. **Posterior ridge raised, sulcus present that has furrows or a wrinkled appearance**. External shell coloration yellow, greenish yellow to tan. **Fine color rays present on most of shell, concentrated areas of rays alternate with less concentrated areas forming light and dark bands**. Nacre is white to iridescent. Maximum shell size three and a half inches.

Similar species: Superficially similar to pimpleback, wartyback, and mapleleaf but none of these has the sulcus with furrows or wrinkles. The butterfly, deertoe, and fawnsfoot have similar coloration but also lack the sulcus with furrows.

Relative abundance: Ahlstedt and Jenkinson (1991) found the western fanshell at nine of 131 river sample sites, but it was not collected from any of the 31 ditch sites. Six sites were in the upper river downstream of Wappapello Dam between River Miles (RM) 286 - 305. Two sites were in the lower river at RM 74.3 and RM 110.2 in Arkansas. It represented 0.2% of the total mussels collected. Posey (1997) did not collect the western fanshell from any of 10 sample sites.

Local names: mapleleaf

Group 2

Smooth Shells with Elongate Shape

Black Sandshell
(*Ligumia recta*)

Description: **Shell elongate**, solid, moderately compressed. **External color shiny black to dark brown**, green rays visible on some small individuals. **Umbos low, only slightly elevated above the hingeline**. Pseudocardinal teeth well developed; lateral teeth long, moderately thin and straight. Posterior end of shell sharply rounded. Nacre variable from white, pink and salmon to purple. Maximum length 8-10 inches.

Similar species: Yellow sandshell has similar shape but yellow external coloration and white nacre. Spike is more compressed and usually has a purple nacre.

Relative abundance: Ahlstedt and Jenkinson (1991) collected only three specimens from two of 131 river sites sampled. It was not found in any of 31 ditch sites sampled. Posey (1997) did not encounter this species at any of 10 sample sites.

Local names: butcher knife, lady's slipper

Bleufer
(*Potamilus purpuratus*)

Description: **Shell rhomboidal, moderately to greatly inflated**, valves of medium thickness. **Low posterior wing sometimes present**; umbos slightly elevated. **Posterior end bluntly squared or truncated**. External color dark green, brown or black, rays sometimes visible in smaller specimens. Pseudocardinal teeth relatively small; lateral teeth long, thin and curved. **Nacre normally purple to rose**. Maximum length approximately eight inches.

Similar species: Plain pocketbook normally yellow with green rays; deep beak cavity; umbos raised above the hingeline; nacre white. Giant floater lacks teeth and the valves are much thinner and more fragile.

Relative abundance: Ahlstedt and Jenkinson (1991) found the bleufer at 76 of 131 river sample sites (= 67%) and 20 of 31 ditch sites (= 64.5%). It comprised 4% of the total mussels collected at river sites and 10.5% of total mussels from ditch sites. Posey (1997) found the bleufer at seven of 10 sample sites where it represented from 1%-4% of total mussels per bed.

Local names: blooper, blue mucket, blue hen

Creeper
(*Strophitus undulatus*)

Description: Shell thin to relatively thick, rhomboidal in shape. Young relatively compressed laterally, older specimens more inflated. **Coloration green, brown to black**; broad color rays present in younger individuals, usually absent in larger specimens. **Umbo located at least one third of the way from anterior end (towards center of shell)**. **Pseudocardinal and lateral teeth poorly developed, outline of hinge teeth s-shaped**. Maximum length to approximately five inches.

Similar species: The giant floater is usually more inflated, thinner shelled, and the umbo is located more toward the anterior end. The paper pondshell has a more anteriorly located umbo and the umbo does not extend above the hingeline. The mucket and Louisiana fatmucket have well developed pseudocardinal and lateral teeth.

Relative abundance: Ahlstedt and Jenkinson (1991) collected two specimens from two of 131 sites in the St. Francis River. Posey (1997) did not encounter the creeper at 10 mussel bed sites that were sampled. The creeper is relatively rare in the St. Francis River system.

Local names: squawfoot, strange floater

Fragile Papershell
(*Leptodea fragilis*)

Description: **Shell thin, compressed, rhomboidal in shape**. **Posterior wing present posterior to the umbo, prominent to poorly developed**. **Pseudocardinal and lateral teeth present but reduced**. External color yellow to tan with indistinct rays present over much of the shell (sometimes absent in larger specimens). Nacre iridescent. Maximum length is approximately eight inches.

Similar species: Scaleshell is darker externally, umbo is located more anterior than in fragile papershell, and shell twisted in dorsal aspect. White heelsplitter is more rounded in shape and laterally compressed, has thicker valves, a more prominent posterior wing, and lacks lateral teeth. Pink papershell and pink heelsplitter have more prominent posterior and anterior wings, and the nacre is pink or rose colored. Mucket is a heavier, more inflated shell that lacks a posterior wing, and has well developed, heavy pseudocardinal and lateral teeth.

Relative abundance: Ahlstedt and Jenkinson (1991) found the fragile papershell at 97 of 113 river sites and 19 of 31 ditch sites where it represented 5.8% and 9.2% ot the total mussels collected, respectively. Posey (1997) found it at seven of 10 sites sampled where it represented 2%-28% of mussels within each community.

Local names: papershell

Giant Floater
(*Pyganodon grandis*)

Description: **Shell rhomboid, inflated, valves thin**. **Beaks elevated above the hingeline**; posterior end bluntly rounded. External color dark green to tan to brown, rays usually absent. **Pseudocardinal and lateral teeth absent**, nacre white to iridescent. Beak cavity broad and rounded. Length to 10 inches.

Similar species: Flat floater is round and more compressed. Pink heelsplitter and pink papershell have well developed posterior wings and pink or purple nacre. Rock pocketbook has a similar shape but possesses two rows of knobs or pustules on the umbos and additional flutes and crenulations on the shell. Fat pocketbook is much more inflated; beaks greatly elevated above the hingeline; pseudocardinal teeth and lateral teeth present.

Relative abundance: Ahlstedt and Jenkinson (1991) found the giant floater at 48 of 131 river sample sites and 17 of 31 ditch sites. It represented 1.5% of total mussels sampled from river sites and 8% from ditch sites. Posey (1997) collected the giant floater from two of 10 bed sites where it comprised 2% of the mussels collected.

Local names: hogshell, slopbucket, grandmaw

Louisiana Fatmucket
(*Lampsilis hydiana*)

Description: **Shell elongate and rhomboidal, moderately inflated**, valves moderately thick uniformly throughout the shell's length. Pseudocardinal teeth elongate and compressed; lateral teeth well developed and curved. External color yellow to tan or brown with well defined, **thick, greenish rays on posterior two thirds of shell**. Nacre color white to iridescent. Maximum length five inches.

Similar species: Yellow sandshell is more elongate and inflated at the hingeline and does not have the broad color rays. Ozark brokenray has interrupted, discontinuous rays. Pond mussel and rainbow have rays concentrated on posterior one third of shell. Mucket is more compressed, has thicker valves, and is more quadrate with much thicker valves than Louisiana fatmucket.

Relative abundance: Ahlstedt and Jenkinson (1991) encountered four specimens at three of 131 river sample sites, but it was not encountered at any of 31 ditch sites. Posey (1997) did not encounter the Louisiana fatmucket at 10 mussel bed sites. It is apparently rare within the St. Francis River system.

Local names: grass mucket

Ouachita Kidneyshell
(*Ptychobranchus occidentalis*)

Description: **Shell elongate, elliptical to rhomboidal in shape; compressed**. Valves stout. **Beaks compressed and not elevated above hingeline**. **Coloration light yellow to light brown, usually with fine, dark color rays**. Posterior ridge gently curved and posterior slope smooth. Pseudocardinal and lateral teeth well developed; **lateral teeth short, stout and curved**. Beak cavity shallow. Nacre white and iridescent posteriorly. Maximum length to approximately six inches.

Similar Species: Spike has brown coloration, lacks fine color rays, usually has a purple nacre, and the lateral teeth are not as curved. Mucket is more laterally inflated with broader umbos and a more prominent posterior ridge. Rainbow and Louisiana fatmucket are relatively more inflated but individual valves are not as solid as Ouachita kidneyshell.

Relative abundance: Oesch (1984) shows the distribution of the Ouachita kidneyshell as upstream of Wappapello Reservoir and downstream of the reservoir for a short distance. It was not collected by Ahlstedt and Jenkinson (1991) and Posey (1997).

Local names: ladyfinger, spike

Ozark Brokenray
(*Lampsilis reeveiana brevicula*)

Description: **Shell elliptical**, valves moderately thick and stout. Males moderately inflated, females inflated. Beaks low, rounded, only slightly raised above hinge line. **Coloration yellow to yellowish brown; thin to broad broken (discontinuous) black to green color rays prominent**. Pseudocardinal teeth well developed; lateral teeth short, straight, and widely separated from pseudocardinals. Beak cavity shallow. Nacre salmon to white tinged, iridescent posteriorly. Maximum length approximately 3 – 3.5 inches.

Similar species: Shell shape somewhat similar to Louisiana fatmucket and Ouachita kidneyshell, but color rays are discontinuous in Ozark brokenray. Species with rays that appear broken or discontinuous like deertoe, fawnsfoot, slippershell and snuffbox are either triangular or quadrate in shape.

Relative abundance: Not collected by Ahlstedt and Jenkinson (1991) or Posey (1997). Oesch (1984) indicates the species' distribution is limited to upstream of Wappapello Reservoir.

Local names: none

Paper Pondshell
(*Utterbackia imbecillis*)

Description: **Shell elongate and elliptical in shape**; compressed in young individuals and more inflated (cylindrical) in older individuals. **Valves very thin and fragile**. **Coloration yellow, green to tan, rays generally absent**. **Umbos flattened, not elevated above the hingeline**. Beak cavities shallow to absent. **Both pseudocardinal and lateral teeth absent**.

Similar species: Young giant floater lack teeth but the beaks are elevated above the hingeline and the shell is generally more inflated. Young creeper have rudimentary pseudocardinal teeth (a swelling or bulge) and usually have broad distinct color rays.

Relative abundance: Ahlstedt and Jenkinson (1991) found 21 individuals of paper pondshell at 15 of 113 river sample sites. Sixty-seven individuals were collected from 17 of 31 ditch sample sites. Posey (1997) did not collect the paper pondshell from 10 mussel bed sites in the St. Francis River. Paper pondshell is more common in slow moving ditches and silty pool habitats than river habitats.

Local names: papershell

Pondhorn
(*Uniomerus tetralasmus*)

Description: Shell elliptical, elongate, and compressed to moderately inflated. **Anterior end rounded and posterior end bluntly rounded**. Dorsal and ventral margins both straight. Umbos low, approximately even with hingeline. **Two shallow grooves present on posterior slope giving rise to a short ridge. Coloration yellowish brown, green, brown to black; rays generally absent**. Pseudocardinal teeth small and thin; lateral teeth relatively thin, short and straight to slightly curved. Beak cavity shallow. Nacre white to occasionally salmon tinged. Maximum length to approximately six inches.

Similar species: The tapered pondhorn is very similar except it has a much more acutely pointed posterior end, and the posterior ridge is more pronounced. The Ouachita kidneyshell has fine rays on the shell and is more laterally compressed. The spike lacks the grooves on the posterior slope, and it most often has a purple nacre.

Relative abundance: Ahlstedt and Jenkinson (1991) collected 10 pondhorn individuals from two of 31 ditch sites that were sampled, and it was not collected at any of the 113 river sites sampled. Posey (1997) did not collect the pondhorn at 10 mussel bed sites in the St. Francis River. This species prefers backwaters, ponds, and lake habitats to that of main channels of streams or rivers.

Local names: none

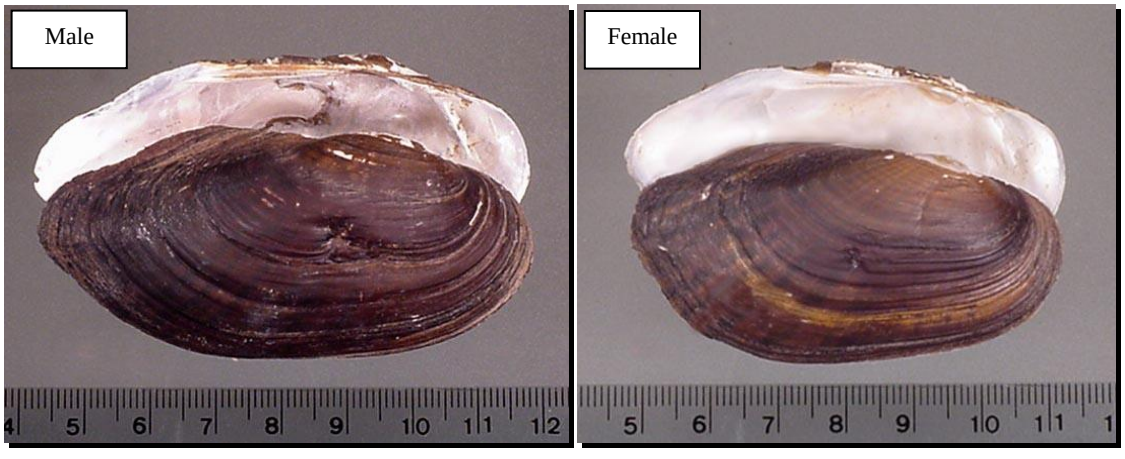
Pondmussel
(*Ligumia subrostrata*)

Description: Shell elongate, elliptical to rhomboidal, laterally compressed; valves thin. Umbos slightly elevated above hinge line. **Posterior end acutely (male) to broadly (female) pointed. Posterior ridge often prominent and appearing upturned (dorsad) at the posterior one third of the shell. Coloration yellowish brown to brown with numerous wavy green rays often distinctly concentrated on the posterior one third of the shell.** Pseudocardinal teeth thin, compressed; lateral teeth long thin and straight. Nacre white and highly iridescent posteriorly. Maximum length to approximately four inches.

Similar species: The Ozark brokenray has discontinuous external color rays and is generally a more inflated and stouter shell. The rainbow has a more rounded posterior end and less prominent posterior ridge. The Texas lilliput and little spectaclecase have darker background coloration and lack prominent rays.

Relative abundance: Neither Ahlstedt and Jenkinson (1991) nor Posey (1997) found the pondmussel in their surveys. Oesch (1984) indicates the species occurs upstream of Wappapello Reservoir in the St. Francis. This species prefers slow moving waters or backwaters in smaller streams, ponds, and lakes.

Local names: none



Rainbow
(*Villosa iris*)

Description: Shell elongate, elliptical, relatively thin (males) to moderately inflated (females). Beaks low, not raised above the hinge line. **Coloration yellow brown to green; fine radiating rays becoming wider and more dense on the posterior one third of the shell.** Two pseudocardinal teeth, small and sharp pointed, in left valve, one more post-like pseudocardinal tooth in right valve; lateral teeth short, thin, straight. Beak cavity shallow. **Nacre bluish white and iridescent, especially posterior.**

Similar species: The pondmussel has a more prominent, upturned posterior ridge. The Louisiana fatmucket is more inflated, has stouter pseudocardinal and lateral teeth, and less concentrated rays on posterior portion of shell. The Ozark brokenray has discontinuous rays. The little spectaclecase and Texas lilliput generally lack raying and have a darker coloration.

Relative abundance: Oesch (1984) shows that the rainbow occurs in the headwaters of the St. Francis River upstream of Wappapello Reservoir.

Local names: none

Scaleshell
(*Leptodea leptodon*)

Description: **Shell elongate, compressed, and valves thin**. **Umbos small and low, about even with hingeline; located far anterior**. **Ventral margin of shell broadly rounded, like a butcher knife blade**. External color yellowish green to brown with faint green rays. Pseudocardinal teeth reduced; lateral teeth moderately long and low. Beak cavity very shallow to absent. **Nacre pinkish white or light purple and highly iridescent**. Maximum length five inches.

Similar species: Fragile papershell has a slightly higher posterior wing, the umbo is broader and located slightly more posterior, and the nacre is white to iridescent. Spike and black sandshell have thicker valves and well developed pseudocardinal and lateral teeth.

Relative abundance: The scaleshell was not encountered by Ahlstedt and Jenkinson (1991) or Posey (1997). Its inclusion in the drainage is based on Ecological Consultants, Inc. (1984) statement that the species "has been reported from this area but its occurrence has not been verified" and the collections of Ecosearch, Inc. (1985) which recorded two specimens from two sites in St. Francis County, AR.

Local names: None

Spike
(*Elliptio dilatata*)

Description: **Shell elongate, laterally compressed with moderately thick valves. Umbos low, usually not elevated above hinge line**. **External color brown to black**. Pseudocardinal teeth well developed; lateral teeth short, roughened and straight. Beak cavity shallow; **nacre purple** (occasionally white). Maximum length about six inches.

Similar species: Black sandshell is usually more inflated, more pointed on the posterior end, and umbos are slightly elevated above the hingeline. Black sandshell nacre is usually white.

Relative abundance: Ahlstedt and Jenkinson (1991) and Posey (1997) did not find the spike during their surveys. Oesch (1984) indicates the spike occurs both usptream and downstream of Wappapello Reservoir in the St. Francis River.

Local names: lady finger

Tapered pondhorn
(*Uniomerus declivis*)

Description: Shell elliptical, elongate, and compressed to moderately inflated. **Anterior end rounded and posterior end acutely pointed**. Dorsal and ventral margins both straight. Umbos low, approximately even with hingeline. **Two shallow grooves present on posterior slope, giving rise to a short ridge. Posterior ridge prominent**. **Coloration yellowish brown, green, brown to black; rays generally absent.** Pseudocardinal teeth small and thin; lateral teeth relatively thin, short and straight to slightly curved. Beak cavity shallow. Nacre white to occasionally salmon tinged. Maximum length to approximately six inches.

Similar species: The pondhorn is very similar except it has a more rounded posterior end, and the posterior ridge is less pronounced. The Ouachita kidneyshell has fine rays on the shell and is more laterally compressed. The spike lacks the grooves on the posterior slope, and it most often has a purple nacre.

Relative abundance: Ahlstedt and Jenkinson (1991) collected 11 specimens at six sites among 113 sites sampled in the St. Francis River. Posey (1997) did not find the tapered pondhorn at 10 mussel bed sites in the river. The tapered pondhorn is relatively rare within the St. Francis River mainstem.

Local names: None

Yellow Sandshell
(*Lampsilis teres*)

Description: **Shell elongate, moderately inflated, with smooth, shiny outer surface ranging from yellow to yellow-tan in color**; occasionally with faint green rays. Valves are moderately thick, but uniformly so throughout the length of the shell. Nacre is white. Pseudocardinal teeth elongate and compressed; lateral teeth long and straight to slightly curved. Maximum length to eight inches.

Similar species: Black sandshell external coloration is uniformly brown to black. Louisiana fatmucket usually has bold green rays over most of the shell and is not as elongate as yellow sandshell. Fragile papershell and scaleshell are more compressed, the umbo does not extend above the hinge line, and the valves are much thinner.

Relative abundance: Ahlstedt and Jenkinson (1991) encountered the yellow sandshell at 50 of 131 river sample sites and 12 of 31 ditch sites. It represented 1.7% of total mussels collected from river sites and 4.4% of total mussels from ditch sites. Posey (1997) encountered the yellow sandshell at one of 10 beds sites where it comprised 3.7% of the mussel community.

Local names: creeper, sandshell

Group 3

Smooth Shells with Round, Oval or Triangular Shape

Asian Clam
(*Corbicula fluminea*)

Description: **Shell triangular**, moderately inflated, valves moderately thick. **External surface covered with coarse, concentric, elevated ridges running around the shell**. Umbos high, centrally located, elevated above the hingeline. External color yellow, brown to black. **Serrated lateral teeth along each side of the pseudocardinals on each valve**. Beak cavity deep. Nacre white to deep purple. Length to two inches.

Similar species: Superficially similar to small specimens of triangular shaped species, but concentric, elevated ridges are diagnostic for this species.

Relative abundance: Common and often abundant throughout the St. Francis River system.

Local names: Asian clam, *Corbicula*

Butterfly
(*Ellipsaria lineolata*)

Description: **Shell broadly triangular**, laterally compressed, **posterior ridge sharply angled**, valves thick. **Umbos broad and flat, scarcely elevated but with swept back appearance. External color yellow or yellowish green, scattered rays broken into v-shaped or irregular rectangular blotches**. Pseudocardinal teeth large, lateral teeth short, heavy, and straight. Beak cavity shallow to moderately deep, nacre white and iridescent posteriorly. Maximum size to five inches.

Similar species: Deertoe is triangular but inflated with a sharply angled posterior ridge, and umbos do not appear swept back. Western fanshell is more inflated and has a furrowed sulcus down the center of the valves. Mucket is oval to quadrate, moderately inflated with a rounded posterior slope, and lacks the broken rays characteristic of the butterfly.

Relative abundance: The butterfly was not encountered by Ahlstedt and Jenkinson (1991) in their survey, but Posey (1997) collected it from two of 10 mussel bed sites where it comprised <1.0% of the mussel total community.

Local names: butterfly

Deertoe
(*Truncilla truncata*)

Description: **Shell triangular; prominent posterior ridge drops acutely to the hingeline**; moderately inflated, valves thin but solid. Umbos full and elevated well above the hingeline. External color tan to dark green with **numerous thin pigment rays extending from umbo to ventral margin; rays often bunched to form broad color bands**. Colored triangles and splotches often occur on the umbonal region. Teeth well developed but blade-like. Length to two inches.

Similar species: Wabash pigtoe shaped similarly but does not possess the acutely angled posterior ridge and slope nor the characteristic raying. Western fanshell has similar shape and raying but possesses a sulcus with furrows that is absent in the deertoe. Butterfly is somewhat similar in shape and raying, but is more compressed laterally, the posterior ridge is more rounded in profile, and the raying is broken and not continuous. Fawnsfoot is similar in size and shape, however the posterior ridge angle is less acute (more rounded) and with zigzag raying running anterior to posterior in addition to the dorsal to ventral ray bands.

Relative abundance: Ahlstedt and Jenkinson collected the deertoe from 24 of 113 river sample sites and two of 31 ditch sites. It comprised 0.6% of mussels sampled from both river and ditch sites. Posey (1997) encountered the deertoe at four of 10 mussel beds sampled where it comprised 0.5%-2.0% of the mussel community.

Local names: deerhorn

Ebonyshell
(*Fusconaia ebena*)

Description: **Shell round, inflated at the umbos** and thinner posteriorly; **umbos low** and about even with hingeline, **projecting anteriorly**. **External color tan, brown to black**; rays not prominent. **Pseudocardinal and lateral teeth well developed, aligned parallel to each other**. Beak cavity very deep, nacre white. Maximum length about five inches.

Similar species: Wabash pigtoe is triangular with flattened sulcus, umbos not projecting anteriorly. Pink mucket with much broader umbo that does not project anteriorly, nacre pink tinged in beak cavity. Teeth not aligned parallel in either.

Relative abundance: Ahlstedt and Jenkinson (1991) collected the ebonyshell from 15 of 113 river sites but it was not found at 31 ditch sites. It comprised 0.3% of total mussels collected from river sites. Posey (1997) encountered the ebonyshell at five of 10 mussel beds sampled and it comprised 0.4% - 6.0% of the total mussel community.

Local names: niggerhead, sheep's toe

Elktoe
(*Alasmidonta marginata*)

Description: **Shell elongate, triangular, inflated and relatively thin**. **Posterior ridge sharply angled and prominent; posterior slope broad, flat and covered with fine ridges**. **Umbos broad, located near center of shell**, and elevated above the hingeline. **Coloration yellow green to green with numerous rays and dark green spots present**. **Posterior slope often lighter colored than rest of shell.** Pseudocardinal teeth thin and elongate; one in right valve and occasionally two in left valve. Lateral teeth reduced to a thickened swelling along hinge line. Beak cavity moderately deep. Nacre bluish white. Maximum length approximately four inches.

Similar species: Deertoe is more triangular and less elongate, posterior slope not as inflated, and lateral teeth are well developed. Snuffbox is more triangular, lateral teeth are well developed, and external coloration has green rays, blotches, and or chevrons. Slippershell has less prominent posterior ridge, the posterior slope is flattened, and the umbo is located toward the anterior one third of the shell.

Relative abundance: Oesch (1984) shows the elktoe distributed upstream of Wappapello Reservoir in the St. Francis River and also just downstream from Wappapello Dam.

Fat Pocketbook
(*Potamilus capax*)

Description: **Shell round**, sometimes truncate on the posterior end, **greatly inflated**, valves thin (in young) to moderately thick (in adults). **Umbos greatly inflated, elevated above hingeline, and turned inwards. Hingeline s-shaped in outline. External surface smooth and very shiny; color yellow, yellowish tan, olive or dark brown, rays absent**. Pseudocardinal teeth thin, compressed, and elevated; lateral teeth thin and greatly curved. Beak cavity very deep, nacre white, sometimes tinged with pink or salmon. Maximum length approximately six inches.

Similar species: Plain pocketbook is less inflated, has a flattened hingeline (not s-shaped), usually has external color rays. Both mucket and pink mucket are moderately inflated; have thick valves with thick, well developed teeth, moderately elevated beaks and external color rays (especially pink mucket). Giant floater has a more centrally located umbo, a rhomboid shape, no teeth, and a thin shell.

Relative abundance: Ahlstedt and Jenkinson (1991) found the fat pocketbook at 10 of 113 river sites where is comprised 0.2% of total mussels collected. It was found at 14 of 31 ditch sites and it comprised 12.8% of mussels collected. Posey (1997) did not encounter the fat pocketbook at 10 mussel beds sampled.

A distribution map for the fat pocketbook in the St. Francis Drainage is in Appendix II.

Local names: pocketbook, grandmaw

Fawnsfoot
(*Truncilla donaciformis*)

Description: **Shell broadly triangular to oblong**, moderately inflated, valves thin to moderately thick. Umbos full, centrally located, and beak slightly elevated above hinge line. **The posterior ridge not prominent; posterior slope not acutely angled** from posterior ridge to hinge line. External coloration yellow to greenish brown with **numerous green rays that form alternating bands of light and dark on the shell. Also, horizontal rows of w-shaped pigment are sometimesprominent.** Pseudocardinal teeth small; lateral teeth thin. Beak cavity moderately shallow. Nacre white, iridescent posteriorly.

Similar species: Deertoe with similar size and coloration, however, posterior ridge more acutely angled and external coloration without w-shaped pigments aligned anterior to posterior.

Relative abundance: Fawnsfoot was collected at 11 of 113 river sample sites and one of 31 ditch sites by Ahlstedt and Jenkinson (1991). It represented <0.3% of total mussels collected in both habitat types. Posey (1997) encountered the fawnsfoot at two of 10 mussel beds and it comprised <0.5% of total mussels in those two beds.

Local names: None

Flat Floater
(*Anodonta suborbiculata*)

Description: **Shell rounded, laterally compressed, saucer-like in outline**, low posterior wing present; valves thin and fragile. **Umbos low, flattened, not raised above hingeline**. **External color yellow to tan to almost brown**, young specimens have faint green rays. **Teeth are absent**; beak cavity is large but shallow. Nacre is white. Maximum length approximately eight inches.

Similar species: Pink papershell is flattened but possesses posterior and anterior wings, thin laterial teeth and pink nacre. White heelsplitter is laterally compressed but possesses a significant posterior wing and pseudocardinal teeth. Giant floater is much more inflated and umbos extend above the hingeline.

Relative abundance: Ahlstedt and Jenkinson (1991) collected five specimens at three of 113 river sample sites and 18 specimens at six of 31 ditch sample sites. The flat floater comprised 2% of the total mussels collected from ditch sites. Posey (1997) did not encounter the flat floater at any of 10 mussel bed sample sites.

Common names: pearl leader, heelsplitter

Lilliput
(*Toxolasma parvus*)

Description: **Small shell, elliptical to cylindrical, relatively solid and inflated. Anterior and posterior ends rounded**. Umbos inflated and slightly elevated above the hinge line. **Coloration dark green, dark brown or black and without rays. External texture coarse, often described as cloth-like**. Pseudocardinal teeth thin and elevated; two in left valve, one or two in right valve. Nacre silvery to bluish white and highly iridescent. **Maximum length to 1.5 inches.**

Similar species: The purple lilliput is similar but with a purple nacre, at least in the beak cavity. The Texas lilliput has a more pointed posterior end in males and truncated posterior end in females. The little spectaclecase has dark green rays, often obscured by organic accumulation on the shell.

Relative abundance: Oesch (1984) shows the lilliput occurring upstream of Wappapello Reservoir in the St. Francis River.

Local names: None

Little Spectaclecase
(*Villosa lienosa*)

Description: Shell small, slightly elongate, thin to moderately thick, compressed in males and inflated in females. **Anterior end rounded, posterior end bluntly pointed in males and truncated in females**. Umbos elevated above hinge line. **Coloration green to dark brown with green rays that are often obscure**. Pseudocardinal teeth small, two in left valve, one in right valve. Lateral teeth elongate, thin and straight. Nacre white or bluish white, iridescent posteriorly. **Maximum length approximately 2.5 inches.**

Similar species: The purple lilliput is smaller and has a purple nacre, at least in the beak cavity. The lilliput is also smaller and lacks sexual dimorphism in females. The Texas lilliput has satiny clothlike external texture and lacks color rays.

Relative abundance: Ahlstedt and Jenkinson (1991) collected three individuals from two of 31 ditch sites sampled. Oesch (1984) mapped numerous localities for the little spectaclecase within the St. Francis River, both upstream and downstream of Wappapello Reservoir.

Local names: None

Mucket
(*Actinonaias ligamentina*)

Description: **Shell rhomboid, moderately inflated**, valves thick, umbos slightly elevated above hingeline. External color yellow, olive or tan; rays prominent to absent. **Pseudocardinal teeth large; lateral teeth thin and long**. Beak cavity shallow to moderately deep. Nacre white to pink or salmon. Maximum length to seven inches.

Similar species: Plain pocketbook is more inflated, thinner shelled, and has more elevated umbos. Pink mucket is more inflated anteriorly, umbos are located more anterior.

Relative abundance: Ahlstedt and Jenkinson (1991) collected the mucket at eight of 113 river sample sites, and it comprised 1.1% of the total mussels collected. All muckets were encountered in upstream portions of the river between RM 284 and RM 305.5, and it was a common species at five of these sites. It was not found at 31 ditch sample sites. Posey (1997) did not find the mucket at any of 10 mussel bed sample sites.

Local names: brass mucket, niggerhead, steamboat mucket, grass mucket, Saline mucket

Pink Heelsplitter
(*Potamilus alatus*)

Description: **Shell triangular in outline**, compressed, thin in young individuals to moderately thick in older individuals. Umbos flattened and only slightly elevated above the hinge line. **Large posterior wing present**. Coloration dark green, brown to black. Young shells may have faint green rays that fade with age. Pseudocardinal teeth small and thin, two in left valve, two in right valve. Lateral teeth long, thin, and straight to slightly curved. **Nacre purple or pinkish purple,** rarely white; highly iridescent.

Similar species: Pink papershell has posterior wing and pinkish purple nacre, but also has a well developed anterior wing. Pink papershell is usually more elongate, less triangular in shape. White heelsplitter lacks lateral teeth, has a white nacre and flutings or ridges on the posterior slope. Fragile papershell has a white nacre and is more elongate (quadrate) rather than triangular in outline.

Relative abundance: Oesch (1984) shows a single locality record in the bootheel of Missouri in the St. Francis River. Ahlstedt and Jenkinson (1991) and Posey (1997) did not encounter this species during their surveys.

Local names: None

Pink Mucket
(*Lampsilis abrupta*)

Description: **Shell oval and inflated**, valves thick, umbos slightly elevated above hingeline. **External color tan to brown with wide rays**, sometimes absent. Teeth well developed and stout. Beak cavity deep. **Nacre white, tinged with pink or salmon in beak cavity**. Length to five inches.

Similar species: Mucket is moderately inflated and the umbo is more central than in pink mucket. Plain pocketbook is more inflated, valves are thinner, umbos are more elevated and located more toward center of shell, and external color is more yellowish and shiny. Ebonyshell is oval with swept back, more pointed umbos, lacks external rays, and teeth are arranged with parallel long axes.

Relative abundance: The pink mucket was not encountered during the surveys of Ahlstedt and Jenkinson (1991) or Posey (1997). Oesch (1984) shows the species to occur upstream of Wappapello Reservoir.

Local names: grandmaw, alkali mucket

Pink Papershell
(*Potamilus ohiensis*)

Description: **Shell elongate, compressed**; valves thin and fragile. **Posterior and anterior wings present**, umbos flattened and not elevated above the hingeline. **External color tan, olive to dark brown**, generally rayless. Pseudocardinal teeth thin and elongate, lateral teeth long and thin, straight to slightly curved. Beak cavity shallow, **nacre light purple to pink and iridescent**. Length to seven inches.

Similar species: Fragile papershell has smaller posterior wing, white iridescent nacre, and pseudocardinal teeth slightly stouter than in pink papershell. White heelsplitter has larger posterior wing with undulations, thicker valves, no lateral teeth, and white nacre. Flat floater lacks both the prominent posterior wing and teeth, and has a white nacre.

Relative abundance: Ahlstedt and Jenkinson (1991) encountered the pink papershell at 56 of 113 river sites where it comprised 1.9% of the total mussels collected. It was found at 14 of 31 ditch sample sites where it represented 7.7% of total mussels collected. Posey (1997) did not find the species at 10 mussel bed sample sites.

Common names: papershell, fragile heelsplitter

Plain Pocketbook
(*Lampsilis cardium*)

Description: **Shell round to quadrate, inflated**, valves moderately thick. Umbos elevated above the hingeline. **External color yellow, yellowish green to tan, shiny, usually with numerous dark green rays** of various width. Beak cavity deep, **nacre usually white**, occasionally pink and iridescent. Pseudocardinal teeth relatively large; lateral teeth well developed, straight to curved. Length to seven inches.

Similar species: Fat pocketbook is more inflated, umbos are raised higher above the hingeline creating an s-shaped dorsal outline, and color rays are never present. Mucket has thicker valves, is less inflated, and has umbos scarcely raised above the hingeline. Pink mucket has thicker valves, thicker teeth, is more inflated posteriorly, has umbos scarcely raised above the hingeline, usually has external color rays, and the nacre is usually pink in the beak cavity.

Relative Abundance: Ahlstedt and Jenkinson (1991) collected the plain pocketbook at 36 of 113 river sites and seven of 31 ditch sites. It comprised 0.8% of total mussels at river sites and 1.5% of total mussels at ditch sites. Posey (1997) did not find the plain pocketbook at 10 mussel bed sites.

Common names: grandmaw, pocketbook

Purple Lilliput
(*Toxolasma lividus*)

Description: **Shell small, rounded to somewhat oblong, relatively solid and inflated.** Anterior end rounded, posterior end broadly rounded. Umbos inflated and slightly elevated above hinge line. **Coloration dark green to dark brown or black.** Pseudocardinal teeth well developed, elevated, two in left valve, one in right valve. **Nacre purple, usually lighter near the ventral margin, iridescent.**

Similar species: The lilliput is similar but with a white iridescent nacre. The Texas lilliput has a more pointed posterior end in males and truncated posterior end in females. The little spectaclecase has dark green rays, often obscured by organic accumulation on the shell.

Relative abundance: Oesch (1984) indicates that the purple lilliput occurs in the St. Francis River upstream of Wappapello Reservoir.

Local names: None

Pyramid Pigtoe
(*Pleurobema rubrum*)

Description: **Shell triangular and elongate**, moderately inflated, valves relatively thick. **Umbos high, projected forward and anterior to rest of shell**. Shallow sulcus sometimes present. **External color brown or black**, rays not prominent. Pseudocardinal teeth well developed; lateral teeth straight to slightly curved. Beak cavity moderately deep. **Nacre pink, rose** or white. Length to four inches.

Similar species: Wabash pigtoe is broadly triangular and umbos are scarcely elevated. Ebonyshell is round, umbos are low and even with hingeline, beak cavity is very deep, pseudocardinal teeth aligned parallel to lateral teeth.

Relative abundance: Ahlstedt and Jenkinson (1991) collected the pyramid pigtoe at 12 of 113 river sites, however it was not collected in the 31 ditch sites sampled. It comprised 0.6% of the total mussels collected from river sites. The majority were encountered between RM 70 and RM 110 in Cross and Poinsett counties, AR. Posey (1997) found the pyramid pigtoe at five of 10 mussel beds sampled, and it comprised 3%-5% of the mussel community in these beds.

Local names: pink pigtoe

Round Pigtoe
(*Pleurobema sintoxia*)

Description: **Shell moderately thick, round, and compressed to inflated**. Anterior end rounded and posterior end rounded to bluntly pointed. **Umbos low and only slightly elevated above the hinge line. Coloration light brown to black.** Pseudocardinal teeth well developed; two in left valve, one in right valve. Lateral teeth well developed and straight. **Beak cavity shallow to moderately deep.** Nacre variable from white to pink or rose colored. Maximum length to four inches.

Similar species: Pyramid pigtoe is more triangular in outline with more angular umbones. Wabash pigtoe is also more triangular in shape and pseudocardinal teeth are less massive, more slender.

Relative abundance: Ahlstedt and Jenkinson (1991) collected the round pigtoe at 10 of 113 river sample sites. These sites yielded 202 individuals which represented 1.5% of total mussels collected from river sample sites. Round pigtoe was found at only one of 31 ditch sample sites. Posey (1997) collected round pigtoe at two of 10 mussel beds, and it comprised from 0.4% to 2.8% of the mussel community at these sites.

Local names: None

Slippershell
(*Alasmidonta viridis*)

Description: **Shell small, triangular to rectangular in shape, somewhat inflated.** Shell thin to moderately thick**. Posterior ridge high and rounded, posterior slope flattened**. Beak slightly raised above hinge line, umbo toward anterior one third of shell. **Coloration tan to yellow with wavy green rays.** Pseudocardinal teeth present; two in left valve, one in right valve. **Lateral teeth poorly developed to absent.** Nacre bluish white, iridescent. Maximum length to approximately 1.5 inches.

Similar species: The elktoe is more triangular in shape and has a more sharply angled posterior ridge. The posterior slope is broad and flat, covered with fine ridges.

Relative abundance: Oesch (1984) indicated one locality record for the slippershell in the St. Francis River upstream of Wappapello Reservoir.

Local names: None

Snuffbox
(*Epioblasma triquetra*)

Description: **Small triangular to slightly elongate shell, inflated and solid**. Anterior end rounded, posterior end broadly rounded to pointed. **Posterior ridge sharply angled, posterior slope wide, expanded and ribbed. Umbos broad** and slightly elevated above the hinge line. **Coloration yellow to tan with numerous dark green rays, blotches, and/or chevrons.** Pseudocardinal teeth well developed; two in left valve and two in right valve. Lateral teeth very short and slightly curved. Beak cavity fairly deep. Nacre pearly white and iridescent posteriorly. Maximum size to 2.5 inches.

Similar species: Deertoe has a more triangular shape, and the posterior slope is less pronounced than snuffbox. Wabash pigtoe shaped similarly but does not possess the acutely angled posterior ridge and slope nor the characteristic raying. Western fanshell has similar shape and raying but possesses a sulcus with furrows that is absent in the snuffbox. The fawnsfoot posterior ridge angle is less acute (more rounded) and with zigzag raying running anterior to posterior in addition to the dorsal to ventral ray bands.

Relative abundance: Oesch (1984) showed several site localities for the snuffbox in the St. Francis River upstream of Wappapello Reservoir and one locality downstream but within close proximity to Wappapello Dam.

Local names: None

Texas Lilliput
(*Toxolasma texasensis*)

Description: Shell elongate, elliptical, thin to moderately thick valves, and moderately inflated. **Anterior end rounded, posterior end pointed (males) or truncated (females). Coloration greenish brown to black with coarse "cloth-like" texture.** Pseudocardinal teeth relatively thin, elevated, two in left valve one in right valve; lateral teeth long straight or slighly curved. Beak cavity shallow. Nacre white to occasionally salmon. **Maximum length approximately 2.5 inches.**

Similar species: The purple lilliput is smaller and has a purple nacre, at least in the beak cavity. The lilliput is also smaller and lacks sexual dimorphism in females. The little spectaclecase has dark green rays, often obscured by organic accumulation on the shell.

Relative abundance: Ahlstedt and Jenkinson (1991) collected a total of three specimens from three of 113 river samples sites and one specimen from a single site among 31 ditch sample sites. The Texas lilliput is apparently uncommon within the St. Francis River system.

Local names: None

Wabash Pigtoe
(*Fusconaia flava*)

Description: **Shell broadly to sharply triangular**, moderately inflated, valves moderately thick. Umbos low to moderately elevated; **a wide shallow sulcus usually present on the ventral half of shell. External color brown to black**, faint rays visible in small specimens. Pseudocardinal teeth well developed; lateral teeth straight or slightly curved. **Beak cavity deep**. Nacre white, pink or salmon. Length to four inches.

Similar species: Ebonyshell is round, lacks a sulcus, and pseudocardinal teeth are aligned parallel to lateral teeth. Pyramid pigtoe is more angular, has heavier pseudocardinal teeth, and is often pink nacred.

Relative abundance: Ahlstedt and Jenkinson (1991) found the Wabash pigtoe at 29 of 113 rivers sites, and it represented 1.0% of the total mussels collected. It was found at only three of 31 ditch sites and comprised 0.5% of the total mussels collected. Posey (1997) found the Wabash pigtoe at six of 10 mussel bed sites, and it comprised 1%-5% of the mussel community at these sites.

Local names: sheep's nose, pigtoe

White Heelsplitter
(*Lasmigona complanata*)

Description: **Shell round, compressed**, valves thin to moderately thick. **Large posterior wing with several shallow folds or ridges that extend onto the posterior slope**. Umbos flattened and not projecting above hingeline. **External coloration brown or black**. Pseudocardinal teeth well developed, **lateral teeth poorly developed**. Beak cavity shallow to moderately deep. Nacre white. Length to eight inches.

Similar species: Flat floater is more round, has a small dorsal wing, valves are very thin, and lateral teeth are absent. Pink papershell has well developed posterior wing, moderate anterior wing, moderate to small pseudocardinal teeth, and pink nacre.

Relative abundance: Ahlstedt and Jenkinson (1991) collected the white heelsplitter at 36 of 113 river sites and 17 of 31 ditch sites. It comprised 0.6% of total mussels from river sites and 6.9% of total mussels from ditch sites. Posey (1997) collected the white heelsplitter at four of 10 mussel beds where it comprised from 0.4% - 4.0% of the mussel community.

Common names: pancake, razorback, hackle-back

Zebra Mussel
(*Dreissena polymorpha*)

Description: **Shell elongate, triangular, and inflated**; very distinctive. **External color variable, most are white or cream-colored with lateral brown to black stripes or bands**. No pseudocardinal or lateral teeth. Moderately deep beak cavity. Nacre white. **Attaches to solid structures like rocks, woody debris, and mussel shells**. Length to 1.5 inches.

Similar species: None

Relative abundance: An introduced species that has infiltrated the St. Francis River via boat traffic and passive transport from Mississippi River floodwater backing into the mouth of the St. Francis. Can become extremely abundant in suitable habitat. Appears to be abundant in the most downstream 10 river miles of the St. Francis River.

Local names: None

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Glossary

Anterior: front or forward.

Anterior slope: area across the dorsal portion of the valve from the beak to the anterior margin.

Anterior wing: a wing positioned along the dorsal margin anterior to the beak.

Beak: the raised portion of the dorsal margin of a shell; formed by embryonic shell around which the rest of the shell develops.

Beak cavity: the hollow on the inside of each valve leading into the beak, under the interdentum.

Cardinal teeth: teeth located between the two sets of lateral teeth as in *Corbicula*.

Chevron: shaped like a wide-angled V; appearing as lines or rays on the epidermis (periostracum) or external portion of the shell.

Compressed: flattened out or pressed together.

Concentric: having a common center, such as ridges or loops radiating from the beak of a mussel valve.

Corrugated: marked by wrinkles or ridges and grooves.

Denticle: a small swelling, tooth-like projection or minor tooth on the hinge line, usually anterior to the major pseudocardinal tooth or teeth.

Dorsal: the top or back; in mussels, the hinge area.

Elliptical: elongated, having the form of an ellipse.

Elongate: long or extended.

Fluted: valves in which the posterior margin or slope is corrugate, the corrugations (usually parallel) opening onto the margin of the shell.

Glochidium (pl. glochidia): the bivalved larvae of freshwater mussels in the superfamily Unionoidea which are generally parasitic on the gills of fish.

Hinge ligament: an elastic, elongate, corneous structure that unites the two valves dorsally along the hinge plate.

Hinge line: the dorsal portion of the shell forming the pviot upon which the two valves rotate to open.

Hinge plate: the dorsal area of the unionoid mussel shell, including the pseudocardinal and lateral teeth and the interdentum, if present.

Inflated: moderately to greatly swollen.

Interdentum: a flattened area of the hinge plate between the pseudocardinal and lateral teeth.

Iridescent: showing lustrous colors like those of a rainbow.

Knob: a protuberance exteriorly on the shell, usually large in size and few in number.

Lateral teeth: the elongate, raised, and interlocking structures along the hinge line of the valve.

Marsupial swelling: a section of the posterior ventral margin of certain female unionoid shells, which is enlarged or inflated to provide space for expansion of the marsupium with the development of the glochidia.

Marsupium: in unionoids, a brood pouch for eggs and developing glochidia, formed by a restricted portion of the outer gill, the complete outer gill or all four gills.

Nacre: the interior iridescent, thin layer of a mussel shell.

Nodule: a small rounded mass of irregular shape.

Oval: egg-shaped, broadly elliptical.

Pallial line: an indented groove or line approximately parallel with the ventral margin of a bivalve shell which marks the line of muscles attaching the mantle to the shell.

Periostracum: exterior or outside layer of the shell.

Periphery: the external boundary on a surface; edge.

Plications: parallel ridges on the surface of the shell.

Posterior: hind or rear.

Posterior ridge: a ridge on the exterior of a mussel shell, extending from the umbo to the posterior margin.

Posterior slope: the area across the dorsal portion of the valve extending from the umbo to the posterior margin, often above or behind the posterior ridge.

Pseudocardinal teeth: triangular-shaped hinge teeth near the anterior-dorsal margin of the shell.

Pustule: small, raised structure on the external or outside surface of the shell.

Quadrate: square or nearly square in outline.

Ray: a streak or linear mark, either broken or continuous; often in a radiating pattern in unionids.

Rhomboid: having generally four distinct sides, two sides being longer than the others.

Serrated: notched or grooved, like saw blade teeth.

Solid: shells which are thick and heavy.

Species: group of interbreeding natural populations that are reproductively isolated from all other such groups.

Sulcus: a longitudinal furrow or depression.

Triangular: a shape having three sides and three angles, like a triangle.

Truncate: having an end squared off.

Tubercle: small, raised, rounded knob on the outside of the shell.

Umbo: the dorsally raised, inflated area of the bivalve shell, centrally or anteriorly placed along the dorsal margin of the valve.

Undulation: pattern with waves; raised ridges or bars.

Unionoids: refers to any member of the freshwater bivalve mollusks that belong to the superfamily Unionoidea, and by definition, glochidial larvae.

Valve: the right or left half of a mussel (or unionoid) shell.

Ventral: the underside or bottom.

Wing: the usually thin, flat extension of the dorsal margin above the hinge line.

Appendix I

Discovery of Mussel Resources During Dredging Operations

PROCEDURES TO FOLLOW IF MUSSEL RESOURCES ARE DISCOVERED DURING CONSTRUCTION OR DREDGING ACTIVITIES

1. During work activities, the monitoring staff shall inspect the work site at all times to determine immediately if mussel resources are being impacted. In potential problem areas, the work activities will periodically cease so the inspector(s) may check the disposal area for mussels.

2. Any time endangered or threatened species of mussels occur in the work/disposal site, regardless of number of individuals (either living or dead), work must cease in the immediate area.

3. When concentrations of mussels occur in the disposal pile, the work activity shall cease immediately until a determination is made regarding significance.

    a. The government mussel monitor must first determine if live mussels occur in the work/disposal site, how many and what species are present. If only relic shells of non-endangered species are present, the work activity can proceed at the discretion of the monitor. If live mussels are discovered, then work shall cease in the immediate area. The monitor should contact the Administrative Contracting Officer (ACO) if an endangered/threatened species or a concentration of mussels is encountered. At the discretion of the monitor (including coordination with the ACO), work may proceed in other portions of the site that do not impact mussels. Photo-documentation should be gathered along with other data.

    b. If the government mussel monitor is not present and mussels are encountered, the Contractor must contact the ACO, Don Tutor, at the Wynne Area Office, (901)-544-3851/3856, or Steve Shankle, at the Caruthersville Area Office, (901) 544-3074/3075, as soon as possible. The ACO will issue corrective measures and may place the equipment or dredge in an idle standby status (by oral notification) until satisfactory corrective measures have been made, or the Contractor is directed to move to another location.

4. The mussel monitor should record the number and type of mussels that have been deposited in the dredge disposal sites. Live specimens should be placed in designated areas or in the event that no specific area has been designated, live specimens should be returned to the watercourse at approximately the same depth and distance from the shore but at least 100 feet downstream of the location of the work at the time of impact. If endangered species are deposited in the disposal site, they should be photographed with graphic scale comparison (using a macro lens for close up), and measured for length, width and depth prior to being returned to the stream. Shells that have been chipped or cracked but the soft parts are not exposed should be returned to the stream. If endangered species are

irreparably damaged, the specimens should be collected. There are two options for storage of specimens. Both require containers to be permanently labeled with precise location, date/time, and name of collector. In both options the specimens are packed on ice or otherwise refrigerated. The first option is to place shell and soft parts (if necessary to separate, label accordingly) in a tightly sealed glass container of absolute alcohol. A second option for collection is to utilize a high quality ziplock bag(s). All pertinent data (including information regarding relic shells encountered) will be provided to the CE Environmental Branch personnel. The Environmental staff will contact the FWS Law Enforcement Officer, Ron Parker (AR), (501) 513-4474 or Larry Keck (MO), (573) 636-7815, for final curation of the specimen(s).

5. The mussel monitor and regulatory agencies must be aware that individual mussels of certain species can occur at any point in the water course. Individuals of fragile papershell, threehorn wartyback, yellow sandshell, pink heelsplitter and Asiatic clam regularly occur in shallow depositional areas (sand or gravel bars) and live individuals are likely to occur in disposal sites. Occurrence of low numbers of these species in disposal sites are to be expected and should not be considered reason to cease work activities.

6. The ACO shall immediately notify CE Environmental and Economic Analysis Branch personnel when significant mussel resources or endangered and threatened species have been encountered during work activities. One of the following individuals should be notified:

Mark Smith, Aquatic Biologist	(901) 544-0670 (W)
	(901) 683-7683 (H)
Joe Hockmuth, Fisheries Biologist	(901) 544-0973 (W)
	(870) 933-7166 (H)
Leighann Gipson, Fisheries Biologist	(901) 544-4015 (W)
	(901) 327-8903 (H)
Environmental Branch	(901) 544-3857
FAX	(901) 544-3955

7. The Environmental Branch personnel shall immediately notify the following FWS and state game and fish personnel when significant mussel resources or endangered and threatened species have been encountered:

FWS: (Only one of the following individuals needs to be contacted.)

a) Chris Davidson, Endangered Species Coordinator in AR (501) 513-4481
b) Allan Mueller, Field Supervisor, Conway (AR) Field Office (501) 513-4475
FAX (501) 513-4480
c) Andy Roberts, Malacologist in MO (573) 234-2132 ext.110
d) Charlie Scott, Field Supervisor,
Columbia (MO) Field Office (573) 234-2132 ext. 104
FAX (573) 234-2181

AGFC (Arkansas only): (Only one of the following individuals needs to be contacted.)

a) Bill Posey, Malacologist (870) 777-5580
Mobile (870) 261-5002
FAX (870) 777-3032
b) Craig Uyeda, Chief, River Basins (501) 219-4311
FAX (501) 219-4315

Missouri Department of Conservation (MDC) (Missouri only):

a) Karen Bataille, Environmental Health Supervisor (573) 882-9909 ext. 3215
FAX (573) 882-4517

8. Within five working days of notification of the discovery, all parties shall attempt to resolve the issue of how to proceed when significant mussel resources or endangered species have been impacted. A field meeting shall be held at the earliest possible time following the discovery. It shall be the responsibility of the Memphis District CE to provide sufficient data regarding mussel resources and work activities to resolve the issue.

9. These procedures may be modified to reflect the FWS comments in any future Biological Opinion on endangered species regarding St. Francis River Basin construction/maintenance activities.

Appendix II

Distribution Map for Fat Pocketbook