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John L. Harris

Arkansas Highway & Transportation Department, omibob1@gmail.com

Mark E. Gordon

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DISTRIBUTION AND STATUS OF RARE AND ENDANGERED MUSSELS (MOLLUSCA: MARGARITIFERIDAE, UNIONIDAE) IN ARKANSAS

JOHN L. HARRIS

Environmental Division
Arkansas Highway & Transportation Department
P.O. Box 2261
Little Rock, AR 72203

MARK E. GORDON

304 North Willow, Apt. A
Fayetteville, AR 72701

ABSTRACT

Knowledge of the distribution and population status of freshwater bivalves occurring in Arkansas has increased markedly during the past decade. Sufficient data has become available to delineate species which are rare and/or endangered within the state. Historical and recent records from Arkansas exist for four mussels currently listed as federally endangered species: the fat pocketbook (*Potamilus capax*), the pink mucket (*Lampsilis orbiculata*), Curtis' pearly mussel (*Epioblasma florentina curtisi*), and the turgid-blossom pearly mussel (*Epioblasma turgidula*). Ten additional mussels which occur or were thought to occur in Arkansas are being considered for federal protection by the United States Fish and Wildlife Service. Several other taxa may warrant protective status.

INTRODUCTION

The state of our knowledge concerning the systematics and distribution of Arkansas freshwater bivalve mollusks has increased and, hopefully, improved considerably since R. E. Call (1895) published his monograph on the Unionidae of Arkansas. Numerous distributional studies have been conducted during the past decade culminating in valuable regional assessments of naiades by Gordon, *et al.* (1980), Gordon (1981), and Johnson (1980). As a result of these investigations, our knowledge of Arkansas mussels is now sufficient to identify those species which are rare or possibly endangered within the state.

Four species known historically from Arkansas are currently recognized as nationally endangered by the United States Fish and Wildlife Service (USFWS, 1982). These species are *Potamilus* (= *Proptera*) *capax*, *Lampsilis orbiculata*, *Epioblasma* (= *Dysnomia*) *florentina curtisi*, and *Epioblasma turgidula*. Ten additional taxa which occur or were thought to occur in Arkansas are currently under review by the USFWS. Available information indicates threatened or endangered listing is possibly appropriate for these species; however, conclusive data on biological vulnerability and threats have not been available (USFWS, 1984). Several additional taxa not included by the USFWS for possible protective listing appear to be rare and perhaps endangered, at least within the boundaries of Arkansas.

MATERIALS AND METHODS

During late 1983, we visited 11 major river systems in Arkansas which were poorly known in terms of the resident mussel fauna or which were considered likely refugia for known endangered species. These systems included the Spring, Strawberry, Eleven Point, Current, Little (Red River Drainage), Cossatot, Saline (Red River Drainage), Little Red, Caddo, Saline (Ouachita River Drainage), and Ouachita rivers. Surveys were made by collecting dead shells from depositional areas (islands or gravel bars) and handpicking live specimens from the substrate. Muskrat mid-dens provided a valuable source of recently dead shells, especially on the Spring and Eleven Point Rivers. Mask and snorkel were utilized where water clarity permitted, otherwise, specimens were obtained by "grubbing" the substrate for live mussels. Survey methods used by the

researchers cited in the Results and Discussion section included handpicking depositional areas, brailling with commercial shellfishing gear, SCUBA diving, and diving with surface based air compressors.

The distribution and status of species discussed in this paper were obtained by compiling data from literature, museum records, government reports, and personal collections. One of us (MEG) has examined over 2000 lots of Arkansas mussels from the University of Michigan Museum of Zoology, American Museum of Natural History, Philadelphia Academy of Natural Sciences, University of Oklahoma Stovall Museum, Harvard University Museum of Comparative Zoology, U.S. National Museum of Natural History, University of Colorado Museum, and University of Arkansas Museum. Distributions were plotted for both relic and live specimens when specific localities were determinable.

Taxa discussed in this paper are divided into three groups: 1) *Federal Endangered Species*, 2) *Species Under Federal Review*, and 3) *Other Species of Concern*. Except for federally protected, endangered species, we followed the terminology and criteria of Miller (1972) and Robison (1974) in defining the status of subject species:

Endangered - actively threatened with extinction. Continued survival unlikely without the implementation of special protective measures;

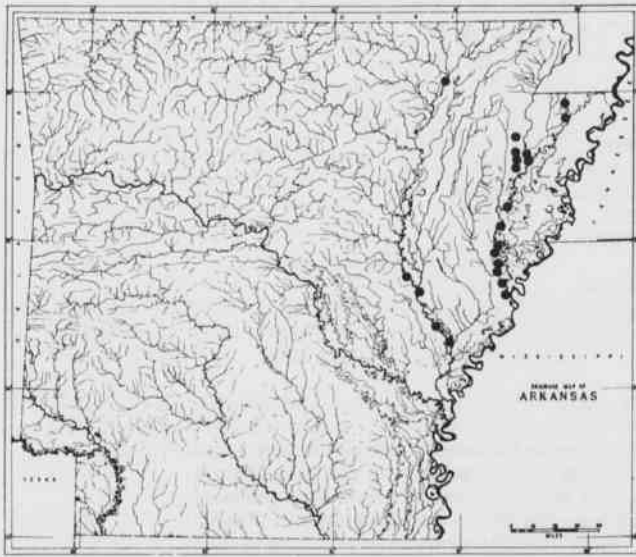
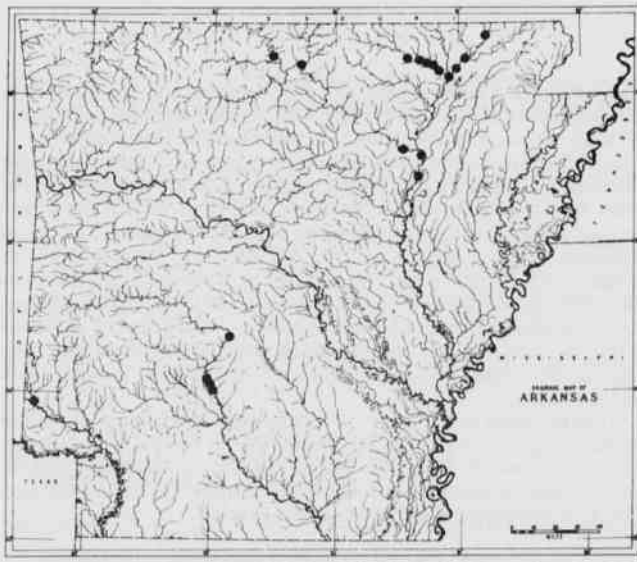
Threatened - not under immediate threat of extinction, but occurring in such small numbers and/or in such restricted or specialized habitat that it could quickly disappear. Requires careful monitoring;

Extirpated - eliminated from the subject area;

Special Concern - population levels appear secure and localities are widespread enough to ensure that a single catastrophic event would not extirpate the species from the subject area;

Uncertain - the taxonomic or distributional data are uncertain or so sparse that no recommendations can be made.

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Figure 1. Distribution of *Potamilus capax*.Figure 3. Distributions of *Epioblasma florentina curtisi* (●), *E. turgidula* (▲), and *E. triquetra* (■).Figure 2. Distribution of *Lampsilis orbiculata*.Figure 4. Distribution of *Arkansia wheeleri*.

RESULTS

Federal Endangered Species

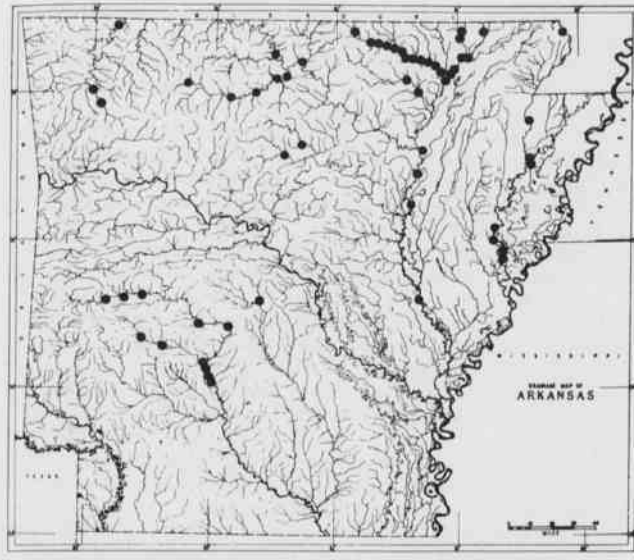
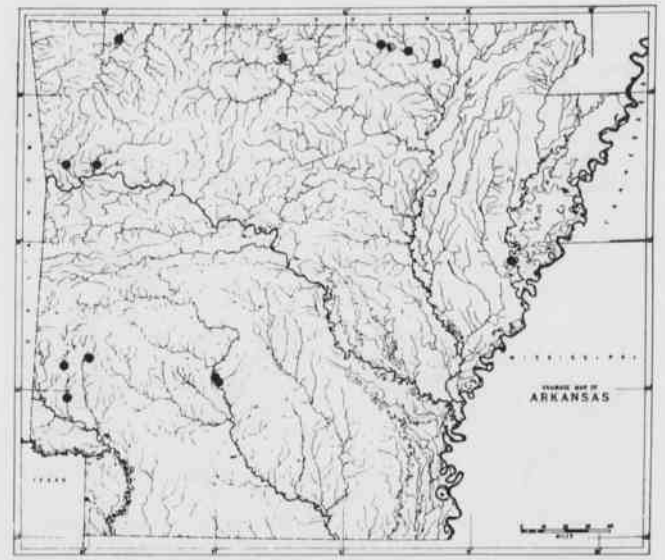
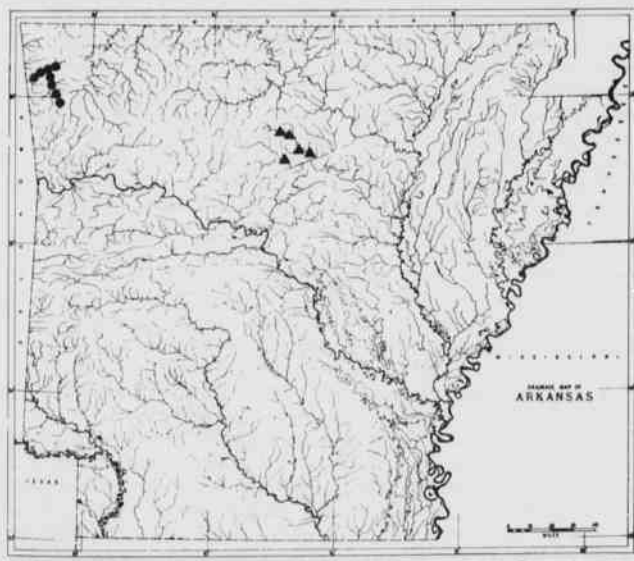
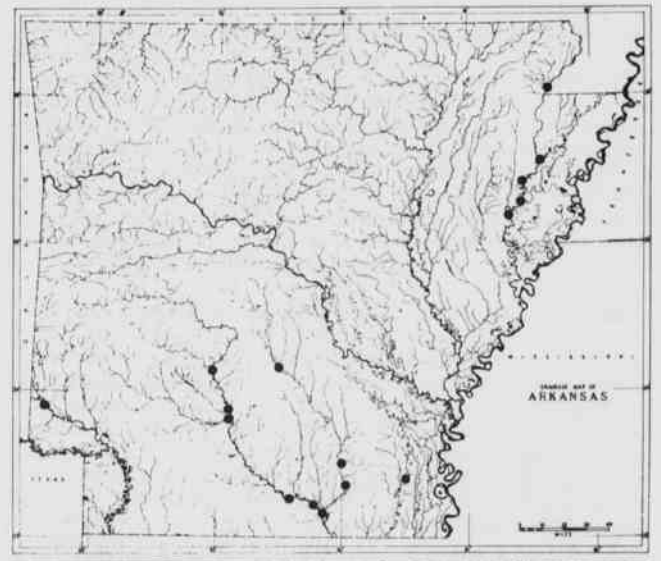
Potamilus (= *Proptera*) *capax* (Green, 1832) — Fat pocketbook pearly mussel. Distribution: Figure 1. *STATUS*: National and State-Endangered

Historically, the fat pocketbook occurred in larger streams throughout the Mississippi and Ohio River systems with verified records from the upper Mississippi River (above St. Louis, Missouri), the Wabash River, Indiana, and the St. Francis River, Arkansas (Dennis, 1985; Ahlstedt and Jenkinson, 1987). Apparently, the St. Francis River supports the last viable population of *Potamilus capax* as no recent records substantiate live specimens from the other systems (Dennis, 1985).

Within the past five years, four separate research projects have been

conducted involving the fat pocketbook pearly mussel. Bates and Dennis (1983) sampled 171 sites in the St. Francis River system of Arkansas and Missouri. This included sections of the St. Francis, Castor, Little, Tyronza, and L'Anguille rivers, their tributary ditches and bayous. Based on results of their survey, Bates and Dennis concluded that the only remaining viable population of *Potamilus capax* was located in an eight mile segment of the St. Francis River from Madison, St. Francis County, Arkansas, upstream to Clark's Corner Cutoff. During subsequent surveys conducted in 1984, the fat pocketbook was found at 68 sites from river miles (RMs) 25.8 to 69.0 and in the lower ten miles of Straight Slough (Ecosearch, Inc., 1985). *Potamilus capax* was found to be "the most abundant mussel species in the St. Francis Waterway" and the post-juvenile population size for the St. Francis populations was estimated at 11,000 - 24,000. Habitat for *P. capax* was almost exclusively

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Figure 5. Distribution of *Cyprogenia aberti*.Figure 7. Distribution of *Leptodea leptodon*.Figure 6. Distributions of *Lampsilis rafinesqueana* (●) and *Lampsilis streckeri* (▲).Figure 8. Distribution of *Pleurobema rubrum*.

sand substrate in water depths of 0.1 to 2.0 m.

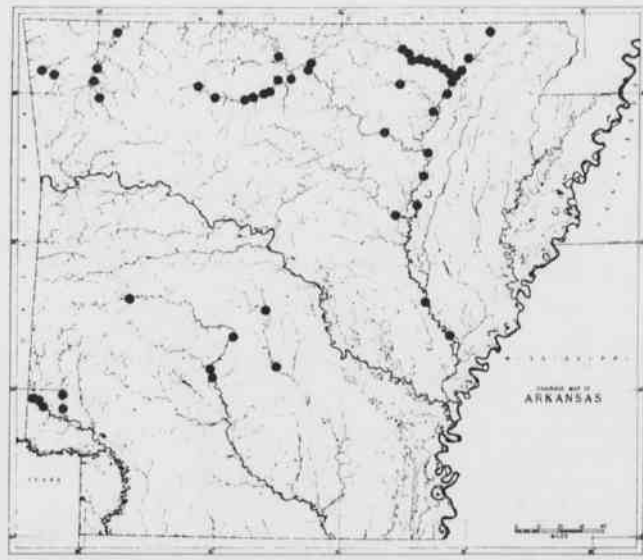
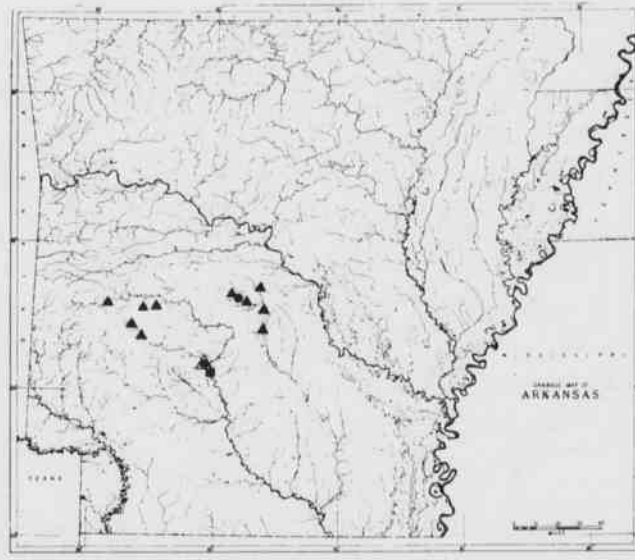
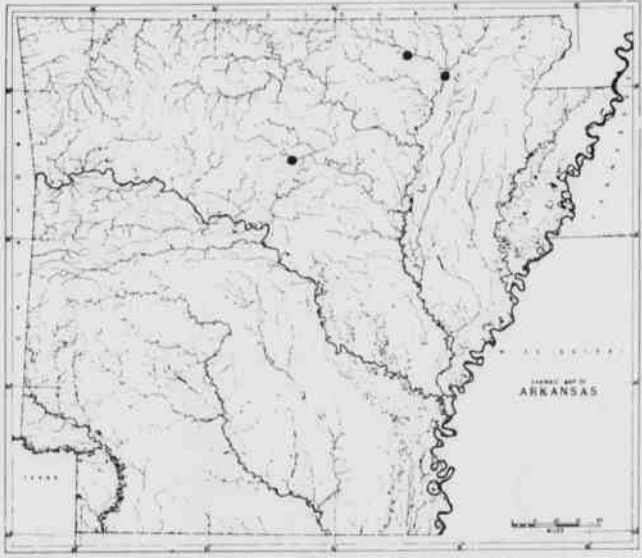
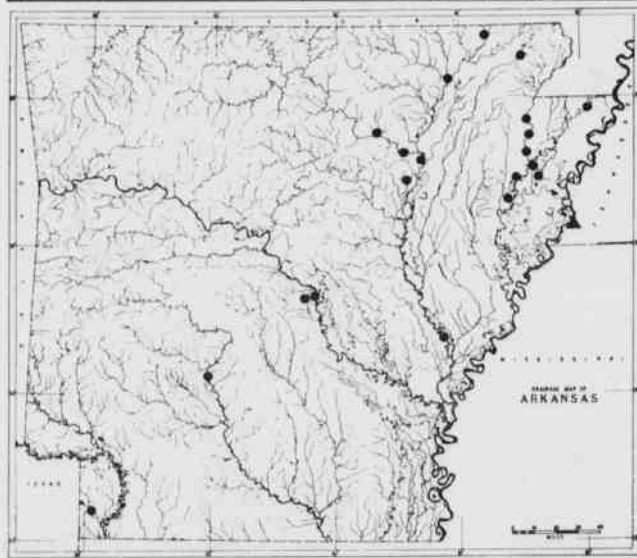
Construction of an Arkansas Game and Fish Commission boat ramp on the St. Francis River at Madison necessitated relocation of the fat pocketbook population from the construction zone. A total of 512 square meters of river bottom was searched during the relocation project and 7,825 mussels were removed. Eighty-two specimens of *Potamilus capax* were collected representing approximately 1.0% of the mussel population. Most *P. capax* were taken from firmly compacted gravel-sand-shell substrate at depths of 0.5 to 3.5 m (Harris, 1986).

In 1986, a COE sponsored survey documented the distribution and abundance of *Potamilus capax* within the St. Francis River and Floodway system below Wappapello Reservoir (Ahlstedt and Jenkinson, 1987). Approximately 250 river miles were examined and included 144

mainstem and tributary (ditch) sites. *Potamilus capax* was found at 24 sites, seven in the lower St. Francis River and Floodway, three in the St. Francis between Marked Tree and the Siphons Access, and at 14 sites in tributary ditches. Ahlstedt and Jenkinson (1987) concluded that the fat pocketbook inhabits manmade parts of the watershed and is absent in natural areas. *Potamilus capax* was found most often in substrate which contained a mixture of sand, mud, and clay although habitat was highly variable. Summation of all qualitative data for this survey showed the fat pocketbook to comprise 1.0% of the population (142 of 14,606 specimens).

Dennis (1984) and Clarke (Ecosearch, Inc., 1985) outlined programs to aid the recovery of the *Potamilus capax* population in the St. Francis River to a level that is not in imminent danger of extirpation. Specifics included 1) additional surveys to delineate the geographic range of the

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Figure 9. Distribution of *Quadrula cylindrica cylindrica*.Figure 11. Distribution of *Lampsilis excavata* (●), *Lampsilis powelli* (▲), and *Cumberlandia monodonta* (■).Figure 10. Distribution of *Simpsonia ambigua*.Figure 12. Distributions of *Anodonta suborbiculata* (●) and *Potamilus alatus* (▲).

species, 2) determination of microhabitat parameters of existing populations (i.e. preferred substrate, current velocity, water depth), 3) biological studies to determine reproductive season, reproductive potential, and fish host, and 4) relocation of individuals to suitable habitat at localities with no or few individuals of *P. capax* present. Data obtained by Ahlstedt and Jenkinson (1987) and Harris (1986) indicate that the distribution and population size of the fat pocketbook are larger than previously suspected. Additional surveys are in progress to further define the distribution of *P. capax* with emphasis placed on ditches and tributaries within the St. Francis drainage (Morris Mauney, COE, pers. comm.).

It would seem prudent to initiate biological studies of fish hosts and reproductive parameters while population levels are stable and to determine if feasible transplant sites exist within the historic range of the

species. Ecoserch, Inc., (1985), Ahlstedt and Jenkinson (1987), and Harris (1986) have all noted that many *P. capax* appear to strand and die during summer low water levels. Individuals in danger of stranding would be an ideal source of transplant material as they would likely die if not rescued anyway. Dredging activities and water discharge within the St. Francis system should be regulated to avoid adverse impacts to populations defined by the recent surveys.

Lampsilis orbiculata (Hildreth, 1828) — Pink mucket. Distribution: Figure 2. STATUS: National and State - Endangered.

Confusion and controversy surround the taxonomy of this species or species complex throughout its range. *Lampsilis orbiculata* and the closely related Higgins' eye pearly mussel (*Lampsilis higginsii* [Lea, 1857]) are very similar in appearance and have variously been considered

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separate species, subspecies, and the same species (see Gordon, 1981 for literature summary). Johnson (1980) and Gordon, *et al.* (1984) referred Arkansas populations to *Lampsilis higginsii* while Stansbery (in Bogan and Parmalee, 1983), Oesch (1984), and Ahlstedt (1985a) refer to White River drainage, AR and MO, specimens as *Lampsilis orbiculata*. To add to the confusion, Stansbery (Stansbery and Kokai, 1979; Bogan and Parmalee, 1983) considers the *Lampsilis orbiculata*-like form in the Ouachita River drainage to be at least a distinct subspecies and possibly an undescribed species. The senior author of this paper has chosen, perhaps somewhat arbitrarily, to refer to all Arkansas specimens of this complex as *Lampsilis orbiculata*. A thorough, critical systematic analysis of the complex throughout its range is desperately needed.

Lampsilis orbiculata has occurred historically in 25 river systems of the Interior Basin, mainly in the Tennessee, Cumberland, and Ohio River drainages with occasional records from the Mississippi River drainage. Although widespread, the pink mucket has never been found in large numbers from any one site and has usually been considered rare (Ahlstedt, 1985a).

Johnson (1980) listed four localities for this species in Arkansas. Two live specimens of *Lampsilis orbiculata* were recovered using hard hat divers by Stein and Stansbery (1980) from the White River at the site of the new U.S. Highway 67 bridge near Grand Glaize, Jackson County, Arkansas. Additional White River specimens have been noted from the vicinity of Batesville by R. S. Caldwell (pers. comm.) and Dames and Moore (1977) obtained a single specimen (misidentified as *Obovaria olivaria*, redetermined by MEG) from the vicinity of Oil Trough (RMs 261 - 276). Gordon and Harris (1983) found ten additional sites for the pink mucket with live individuals encountered in the Current, Spring and Ouachita rivers. Nowhere were recently dead or live specimens abundant and most sites were represented by single specimens or single valves.

A total of 3,372 mussels were recovered from 1483 m² of river bottom during a mussel relocation project in the Spring River, south of Ravenden, Lawrence County, Arkansas (AHTD, 1983). Six specimens, four females and two males, were *Lampsilis orbiculata*. Five of the six were taken in clean rock and gravel substrate while the other individual was found in bedrock and boulders. Water depth was 1.7 - 4.1 m and current velocities ranged 0.3 - 0.6 meters per second.

Gordon, *et al.* (1984) located three individuals of the pink mucket from two localities in the lower Spring River below Imboden, Lawrence County. Two specimens were recovered in approximately 0.7 m of water in gravelly substrate while the third was taken in a 1.0 m deep pool with muddy substrate. Miller and Nelson (1984) collected dead shells of *Lampsilis orbiculata* in the Spring River below Imboden (RM 11.0) and in the Black River at Old Davidsonville State Park (RM 75.2). Miller and Hartfield (1986) found a live pink mucket at each of two locations in the Black River (RMs 75.05 and 80.7). Habitat at RM 75.05 was sand/silt substrate mixed with organic matter with water depth 2.5 - 3.3 m and slow current velocity. The substrate at RM 80.7 was sand and mud with water depth less than 2.0 m and moderate current.

Most recently, Miller and Harris (1987) surveyed dredge spoil piles and the adjacent channel of the White River between Newport and Grand Glaize (RM 254.6 - 230.7) during October 1986 in an attempt to document effects of navigation maintenance dredging on the mussel resources of the river. Shells of *Lampsilis orbiculata* were found at eight of the 12 sites surveyed. There was certainly some indication that pink muckets were killed during dredging activities based on the presence of recently dead shells on fresh (< one year old) spoil piles. During the course of this survey a local commercial shell fisherman allowed us to examine 14 unpaired fresh valves of the pink mucket which were taken from the study area by local shellers. Both SCUBA and brailing techniques were utilized in a mussel bed known to support *Lampsilis orbiculata* (Robert Leisure, pers. comm.) but no live individuals were found.

Lampsilis orbiculata is a source of concern because of the seemingly low numbers within existing populations and continued habitat degradation in rivers sustaining the pink mucket. Gravel removal operations, reservoir discharges, and maintenance of navigation channels in the White and Ouachita rivers appear to be the most serious threats to *Lamp-*

silis orbiculata. An Environmental Impact Statement has been prepared by the COE for the Ouachita and Black Rivers 9-Foot Navigation project which will allow substantial dredging and bend shortening in the Ouachita River as far upstream as Camden, Ouachita County, Arkansas. Recent newspaper accounts (Arkansas Gazette, 9 April 1987) have reported plans for a similar project to make the White River navigable upstream to Batesville, Independence County, Arkansas. These projects will certainly not improve the status of existing *Lampsilis orbiculata* populations.

Epioblasma florentina curtisi (Utterback, 1916) — Curtis' pearly mussel. Distribution: Figure 3. STATUS: National and State - Endangered.

The only recent record for the state is three specimens (recently dead) collected near the mouth of the Spring River (Bates and Dennis, 1983; Ecological Consultants, Inc., 1984). Additional specimens are known from the South Fork Spring River near Salem collected in 1916 by A. J. Brown, an amateur shell collector.

Epioblasma turgidula (Lea, 1858) — Turgid blossom pearly mussel. Distribution: Figure 3. STATUS: National and State - Endangered.

The only record for the state was collected from the Spring River at Hardy, Sharp County prior to 1914 (Simpson, 1914; Johnson, 1978; Ahlstedt, 1985b).

Species Under Federal Review

Epioblasma triquetra (Rafinesque, 1820) — Snuffbox. Distribution: Figure 3. STATUS: State - Endangered.

Hinkley (1916) and Fuller (1974) provided the two known localities, both from the White River, for *Epioblasma triquetra* before the discovery in 1983 of additional sites by A. C. Buchanan (pers. comm.) in the Spring River and by Gordon and Harris (1983) in the Strawberry and Spring rivers. A single live specimen was discovered in the Spring River at Ravenden by AHTD (1984) and Environmental Consultants, Inc. (1984) found a dead specimen in the Black River at the mouth of the Spring River. This species, as are most *Epioblasma*, was found associated with riffle-shoal type habitat.

Arkansia wheeleri Ortmann and Walker, 1912 — Wheeler's pearly mussel. Distribution: Figure 4. STATUS: State - Extirpated?

Historically, this species is known from only three rivers: the Kiamichi in Oklahoma, Little River in southwestern Arkansas, and the Ouachita River in central Arkansas. Johnson (1980) and Clarke (1981) listed two localities for *Arkansia* within Arkansas (one in Little River, one in the Ouachita River). Gordon and Harris (1983) discovered relict shells at two additional sites in Little River and one additional site in the Ouachita River. One of us (JLH) recently collected a relict shell from the Ouachita River at Malvern. The status of this species is currently being surveyed by the USFWS. No viable populations are currently known within Arkansas.

Cyprogenia aberti (Conrad, 1850) — Western fan shell. Distribution: Figure 5. STATUS: State - Special Concern.

The western fan shell was considered rare within Arkansas by the COE and was one of the species concentrated on by Bates and Dennis (1983), Ecological Consultants, Inc. (1984), Gordon, *et al.*, (1984) and Ecosearch, Inc. (1985). The species is found in the White, St. Francis, and Ouachita river drainages and is locally abundant in the Spring and Caddo rivers. *Cyprogenia* composed 16.5% (558 of 3372 individuals) of the mussel population in the Spring River at Ravenden (AHTD, 1984). This species seems best suited to medium size rivers or streams that maintain pristine water quality and unaltered substrates. The western fan shell should be considered a key indicator of ecological conditions of streams in Arkansas.

Lampsilis rafinesqueana Frierson, 1927 — Neosho mucket. Distribution: Figure 6. STATUS: State - Threatened.

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Within Arkansas, this species is restricted to the Illinois River system in the northwest corner of the state. *L. rafinesqueana* is considered locally abundant from second order streams of the system downstream to the Arkansas - Oklahoma line. These populations are possibly threatened by a proposed municipal sewage discharge from the city of Fayetteville.

Lampsilis streckeri Frierson, 1927 - No common name. Distribution: Figure 6. STATUS: State - Uncertain.

The type locality of this taxon is the Little Red River at Clinton, Arkansas (Frierson, 1927). Paratypes listed from Onion Creek (Colorado River system), Travis County, Texas appear to be a closely related species, *Lampsilis bracteata* (Gould, 1855). The *streckeri* form has recently been collected from several localities in the Little Red River by Arthur Clarke (pers. comm.) and MEG during an assessment of the distribution, taxonomic status, and population status of this species. Specimens taken from the Little Red River are very similar to and perhaps conspecific with *Lampsilis reeveiana* (Lea), a common species of the White River system (Gordon and Kraemer, 1984).

Leptodea leptodon (Rafinesque, 1820) — Scale shell. Distribution: Figure 7. STATUS: State - Threatened.

Most of our records for this species have all been recorded during the present decade. The scale shell occurs in widely disjunct populations and appears to be rare at known localities. The species has been declared endangered in Missouri (Nordstrom, et al., 1977) and Oesch (1984) describes it as a typical riffle shell found in clear unpolluted water with good current.

Pleurobema rubrum (Rafinesque, 1820) — No common name. Distribution: Figure 8. Status: State - Special Concern.

This species has been identified as *Pleurobema cordatum pyramidatum* in previous surveys and publications. It appears to be a species which inhabits the larger sections of rivers such as the White, Ouachita, and St. Francis. Ahlstedt and Jenkinson (1987) found it to be relatively common in the St. Francis River between RM 71.5 - 84.3. Harris and Gordon (1985) encountered six live specimens using brailing methods in the Ouachita River at Arkadelphia.

Quadrula cylindrica strigillata (Wright, 1898) — Rough Rabbit's foot pearly mussel. Distribution: Figure 9. STATUS: State - Special Concern.

Although listed as occurring in Arkansas by the USFWS (1984), *Q. cylindrica strigillata* is found only in the upper tributaries of the Tennessee River (Bogan and Parmalee, 1983). The subspecies found in Arkansas is the nominate form *Q. c. cylindrica* (Say, 1917). Considerable emphasis has been placed on locating populations of this species by the COE (Ecosearch, Inc., 1985). The species is relatively common in middle to lower portions of the Spring River (Gordon and Harris, 1983) and comprised 2.1% of the mussel fauna in the Spring River at Ravenen (AHTD, 1984). Miller and Hartfield (1986) found the species at four sites in the Black River between RMS 73.2 - 75.1 where it was relatively common. Records for the Ouachita and Little rivers were relict shells and no live specimens have been taken from these sites recently.

Simpsonia ambigua (Say, 1825) — Salamander mussel. Distribution: Figure 10. STATUS: State - Threatened.

Buchanan (pers. comm.) collected several recently dead specimens from a muskrat midden in the Spring River at Imboden and Gordon, et al. (1984) found shells deposited on an island in the Black River just upstream of U.S. Highway 63 at Black Rock. An additional locality in the Little Red River at Clinton was noted by Johnson (1980), Gordon et al. (1980), and Clarke (1985).

Epioblasma lefevrei Utterback, 1915 — Lefevre's pearly mussel.

The distribution of this species is listed as Arkansas and Missouri by the USFWS (1984). This species is a synonym of *E. turgidula* (Johnson, 1980; Gordon, 1981).

Other Species of State Concern

Lampsilis excavata (Lea, 1857) — No common name. Distribution: Figure 11. STATUS: State - Uncertain.

Johnson (1980) listed the species as occurring in the Saline River at Benton, Saline County. Gordon and Harris (1983) found additional localities in the South and Middle Forks of the Saline River and the Caddo River for specimens referable to the figure in Johnson, 1980. However, these specimens may represent aberrant individuals of *Lampsilis satura* (Lea, 1852).

Lampsilis powelli (Lea, 1852) — No common name. Distribution: Figure 11. STATUS: State - Threatened.

This species is an Arkansas endemic with the type locality restricted to the Saline River at Benton, Saline County (Gordon and Harris, 1985). The species occurs in the upper portions of the Saline and Ouachita rivers and the Caddo River. Stable populations appear present in the South Fork Ouachita River and the South Fork Saline River.

Cumberlandia monodonta Say, 1829 — Spectacle case. Distribution: Figure 11. STATUS: State - Extirpated?

This species is known from a single locality in the Ouachita River near Arkadelphia, Clark County (Wheeler, 1918; Johnson, 1980). No live or relict specimens have been collected since.

Anodonta suborbiculata Say, 1831 — Flat floater. Distribution: Figure 12. STATUS: State - Special Concern.

Johnson (1980) mapped five localities for this species within Arkansas. Gordon (1982), Gordon and Harris (1983), Ecological Consultants, Inc. (1984), Ecosearch, Inc. (1985), and Ahlstedt and Jenkinson (1987) added 12 additional sites for the flat floater. All records for this species are from near or below the fall line in the Mississippi Alluvial Valley region. The species inhabits slow moving sloughs and backwaters and is typically a lowland species that does not lend itself to frequent collection. It is most often taken during drought from dried ponds or oxbows. We expect this species to be found at additional localities as greater collecting effort is expended during drier months of the year.

Potamilus alatus (Say, 1817) — Pink heel-splitter. Distribution: Figure 12. STATUS: State - Endangered (Peripheral)

Previous Arkansas records for the pink heel-splitter have been based on misidentifications of other species, primarily *P. purpuratus* (Lamarck, 1819) (Gordon et al., 1980). Thus, this species has not been previously recorded from Arkansas (Gordon, et al., 1979) although Oesch (1984:179) illustrates its occurrence across the northern half of the state. This species ranges primarily to the north and east of Arkansas. A single specimen was collected by JLH from the banks of the Mississippi River underneath the I-40 bridge at West Memphis, Crittenden County during low flow conditions in January 1981.

CONCLUSION

It is obvious that considerable work remains to better delineate the distributions, biology, and taxonomy of Arkansas mussels. With reference to species discussed in this paper, several trends are apparent. Some species broadly distributed over eastern North America such as *Lampsilis orbiculata* and *Leptodea leptodon* appear to have always been rare and, thus, vulnerable to almost any level of environmental disturbance. Although distributed nationally over a wide geographic area, *Epioblasma triquetra* appears to be following the trend of other *Epioblasma*, in that its numbers appear to be on the decline and populations appear to be small at most localities. Other species such as *Lampsilis powelli* and *Epioblasma florentina curtisi* appear restricted to very small geographic areas with low population numbers. Due to their endemism and presumed restricted environmental tolerances, these

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species are even more at risk to habitat destruction. *Epioblasma turgidula* may already be extinct (Bogan and Parmalee, 1983). Additional surveys should be undertaken in the Spring River drainage to determine the status of *Epioblasma florentina curtisi* and *E. turgidula* within Arkansas. Sections of the South Fork Spring River, Spring River below Ravenden, Eleven Point River, and also, the Strawberry River would seem to offer suitable habitat to sustain these endangered species.

Two species being reviewed by the USFWS for possible protective listing appear to be worthy of endangered status. If a viable population of *Arkansia wheeleri* is found and *Lampsilis streckeri* is determined to represent a distinct taxon, these species should be listed as endangered as quickly as possible. Two species not under review by the USFWS appear to merit national concern. Due to its restricted range in the upper Ouachita River drainage, *Lampsilis powelli* deserves some consideration for protected status. Further work needs to be done to determine the size of existing populations and to further define the distribution of the species. *Simpsonaias ambigua* remains a rather enigmatic species due to its small size and preferred habitat under large rocks. Additional work is needed on the distribution and biology of this species.

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