ALABAMA MUSEUM of Natural History

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Bulletin 24 July 31, 2005

A Historical and Current Perspective of the Freshwater Mussel Fauna (Bivalvia: Unionidae) from the Choctawhatchee River Drainage in Alabama and Florida

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by Holly N. Blalock-Herod, Jeffrey J. Herod, James D. Williams, Britton N. Wilson, and Stuart W. McGregor

THE UNIVERSITY OF ALABAMA
TUSCALOOSA, ALABAMA
July 31, 2005

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Abstract: A comprehensive review of the historical and recent distribution of unionid species within the Choctawhatchee River drainage of Alabama and Florida is presented from museum records, field notes, published literature, and recent survey data. Historical distributions of unionids from 42 sites are compared with recent survey data from these same sites in order to describe changes in the unionid fauna over time. In addition, 136 new sites were examined to provide a drainage-wide picture of the present unionid distribution and to assess the current conservation status of each species. Twenty-three species are known from the Choctawhatchee River drainage. Species composition at the 42 historical sites has changed over time with the addition of generalist species and the loss of imperiled and rare species. Although recent intensive sampling revealed additional populations of unionids throughout the drainage, we consider the overall fauna highly imperiled. Conservation status categories for unionids within the Choctawhatchee River drainage are: 4% imperiled, possibly extinct; 9% imperiled, possibly extirpated; 26% imperiled; 13% rare; 13% special concern; and 35% currently stable.

Introduction

The Choctawhatchee River drainage of southern Alabama and western Florida is the third largest river drainage in the East Gulf Coastal Plain in terms of drainage area and discharge (Livingston et al., 1991). However, compared to other nearby river systems such as the Mobile Bay drainage to the west and the Apalachicola River drainage to the east, little is known about the freshwater mussel fauna (Bivalvia: Unionidae) of the

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Choctawhatchee River drainage. Investigation of the Unionidae in the Choctawhatchee River drainage began in the mid-1800s, when three new species were described: *Unio succissus* Lea, 1852, *Unio floridensis* Lea, 1852, and *Unio cacao* Lea, 1859. Simpson (1893, 1914) examined the Unionidae of Florida and other southeastern states and placed many of Lea's types, including *U. floridensis* and *U. cacao*, in synonymy with other described taxa. In the early 1900s, Ortmann and Walker (1922) described a new genus, *Quincuncina* Ortmann, 1922, and a new species, *Quincuncina burkei* Walker, 1922. Later, Ortmann (1924) described the conchology and anatomy of several species of unionids from the Choctawhatchee River and other Gulf Coast drainages. *Ptychobranchus jonesi* (van der Schalie, 1934) was also described from the Choctawhatchee River drainage during that period.

Clench and Turner (1956) published the first systematic review of the unionid fauna within the Choctawhatchee River drainage. Clench and Turner's landmark publication serves as a foundation for mollusk distribution data in the eastern Gulf Coast drainages of Alabama, Florida, and Georgia, from the Escambia River drainage east to the Suwannee River drainage. They considered the mussel fauna of these drainages to be fairly old, depauperate, and derived from the Coosa-Alabama and Tennessee river systems to the west and north. They identified 16 species and described a new species, *Elliptio mcmichaeli* Clench and Turner, 1956, from the Choctawhatchee River drainage.

Though the fauna of the East Gulf Coastal Plain had been documented in a comprehensive work, little collecting effort had been expended in the Choctawhatchee River drainage as compared to the Coosa-Alabama and Apalachicola river systems (Hurd, 1974; Brim Box and Williams, 2000). In the mid-1960s, two additional new species, *Lampsilis haddletoni* Athearn, 1964 and *Villosa choctawensis* Athearn, 1964, were described from, and considered endemic to, the Choctawhatchee River drainage. A new species, *Utterbackia peggyae* (Johnson, 1965), described from the nearby Ochlockonee River drainage, was reported from the Choctawhatchee River drainage as well. In addition to the new species descriptions from the Choctawhatchee and other eastern Gulf Coast drainages, Johnson (1967) discussed additions to the fauna and changes in taxonomy of other species. Burch (1975) and Heard (1979) published unionid keys, which included species from the Choctawhatchee River drainage. More recently, Butler (1989) provided a zoogeographical summary of the Gulf Coast drainages unionid fauna, corrected erroneous records from the literature, and reported range extensions for several species, including *V. choctawensis*. Other recent works (Williams et al., 1993; Williams and Butler, 1994; Lydeard et al., 1999) included species recognized from the Choctawhatchee River drainage and described conservation status, ecology, and declines in the unionid fauna of Alabama, Florida, and the United States.

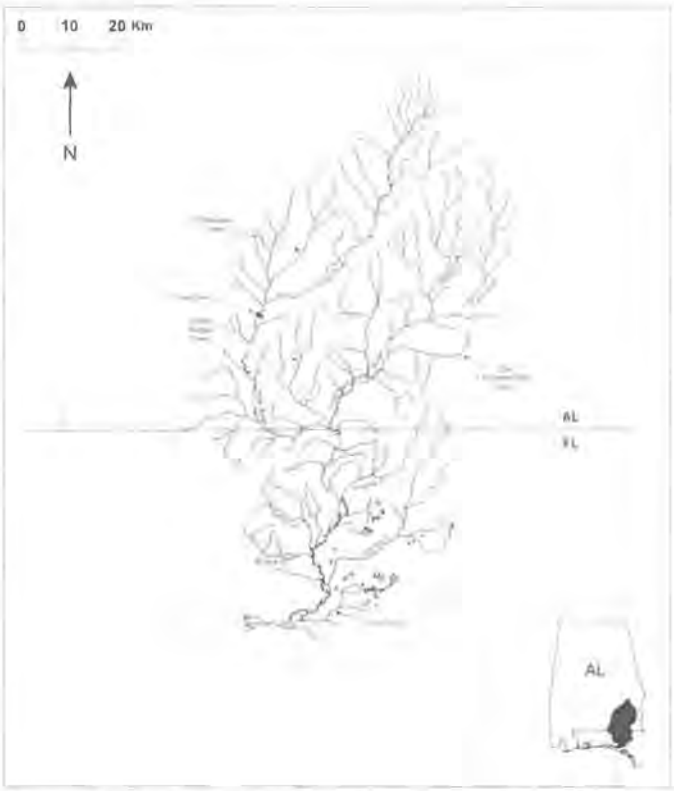

Figure 1. Choctawhatchee River drainage in Alabama and Florida.

While knowledge of the Choctawhatchee River fauna encompasses information collected over nearly 150 years, current information about the unionid fauna is minimal. In this study, historical distribution data from museum records, field notes and published literature were used with recent survey data to: 1) provide a comprehensive review of the unionid distributions (historical and recent) within the Choctawhatchee River drainage, 2) assess changes in the unionid fauna over time, and 3) present a current evaluation of the conservation status of unionids from the Choctawhatchee River drainage based on all available data.

Study Area

The Choctawhatchee River drainage lies entirely within the East Gulf Coastal Plain of southeastern Alabama and western Florida (Sapp and Emplaincourt, 1975) (Figure 1). The drainage flows in a southwesterly direction for approximately 142 km in Alabama and drains about 16,835 km^2 in ten counties: Barbour, Bullock, Coffee, Covington, Crenshaw, Dale, Geneva, Henry, Houston, and Pike. In Florida, the river flows for another 140 km, draining 10,101 km^2 in five counties: Bay, Holmes, Jackson, Walton, and Washington. The Choctawhatchee River proper is formed from headwater tributaries of the East Fork Choctawhatchee and West Fork Choctawhatchee rivers southwest of Eufaula,

Barbour County, Alabama. The two forks flow south and form the Choctawhatchee River northwest of Dothan, Dale County, Alabama.

The Pea River is the largest tributary to the Choctawhatchee River. It begins near Union Springs, Bullock County, Alabama, and flows in a south-southwesterly direction into Geneva County, Alabama, where it makes a sharp bend to the east to join the Choctawhatchee River in the city of Geneva, Geneva County, Alabama. Other major tributaries within the Choctawhatchee River drainage in Alabama include: Whitewater, Judy, Claybank, Flat, and Double Bridges creeks, and Little Choctawhatchee River. In Florida, the main channel of the Choctawhatchee River flows south and is joined by several tributaries including Holmes, Wrights, Sandy, Pine Log, Seven Runs, and Bruce creeks, before emptying into Choctawhatchee Bay.

Methods

Historical species distributions were determined from published literature, field notes, and museum collections. The following museums provided access to their collections and graciously allowed us to borrow specimens when necessary: Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania; Carnegie Museum of Natural History, Pittsburgh, Pennsylvania; Field Museum of Natural History (FMNH), Chicago, Illinois; Florida Museum of Natural History (UF), Gainesville, Florida; Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts; Museum of Fluviatile Mollusks, Herb Athearn personal collection, Cleveland, Tennessee; National Museum of Canada (NMC), Ottawa, Ontario; Ohio State University Museum of Biological Diversity, Columbus, Ohio; United States National Museum (USNM), Smithsonian Institution, Washington, DC; and University of Michigan Museum of Zoology, Ann Arbor, Michigan. Treatment of historical records (pre-1990) follows Strayer and Fetterman (1999) in that all historical records were considered presence/absence data since abundance data and sampling methods were generally unavailable for these collections. Historical species composition at a site was determined by combining all species records from different collectors on different dates at a single site.

Recent distributions were based on qualitative surveys conducted from 1998–2000, by the U.S. Geological Survey (USGS), Gainesville, Florida, in cooperation with the Geological Survey of Alabama (GSA), Tuscaloosa, Alabama. We also utilized field notes and samples made by other scientific collectors between 1990–1998. Every effort was made to re-examine historical sites; however, this was not possible in some cases due to the imprecise nature of the original locality data. New sites were chosen in an attempt to provide a systematic and uniform sampling coverage of all habitat types throughout the Choctawhatchee River drainage. Historical and recent records were catalogued in a Microsoft Access database and are maintained at USGS. For all sites, latitude and longitude coordinates were calculated from 7.5 minute topographical maps or were recorded from a handheld Garmin GPS III Plus at the collection site. All maps were constructed using ArcView software with a modified 1:1,000,000 coverage. Locality data from the Choctawhatchee River drainage may be requested from the authors. Scientific nomenclature follows Turgeon et al. (1998) unless otherwise noted. Common names were capitalized following Parmalee and Bogan (1998) to provide more clarity in the text.

During the recent USGS and GSA surveys, unionids were collected using qualitative tactile searches while wading or snorkeling in shallow areas or SCUBA diving in deeper waters. All sites were searched for a minimum of 1.5 person hours, until 15 minutes after the last new species had been found and all suitable habitats had been examined. Search times ranged from 1.5 to 10 person hours and typically covered 100–500 m of stream reach. Mussels were brought to the shoreline for identification and recorded before being returned to the stream. Voucher specimens of live material collected were returned to USGS, relaxed in sodium pentobarbital, preserved in 10% formalin, and transferred to 70% ethanol for museum storage. Some specimens were placed in 95% ethanol for future genetic analysis. Fresh dead and weathered shell materials were also collected for reference material.

Photographs of many unionids known from the Choctawhatchee River drainage have been published in widely available literature (Cummings and Mayer, 1992; Brim Box and Williams, 2000; Williams et al., in prep.). In this publication, Figures 2–4 depict variation found within the *Elliptio icterina* (Conrad, 1834a) complex. Figures 5 and 6 depict two endemic species, *Elliptio mcmichaeli* and *Lampsilis haddletoni,* respectively. Figure 7 is a photograph of a *Medionidus* specimen, presumably *M. acutissimus* (Lea, 1831), collected from the Choctawhatchee River drainage. A photograph of *M. acutissimus* from the Mobile Bay drainage is published in Parmalee and Bogan (1998) and the conchological variation within the species among drainages should be noted. Figure 8 is *Quincuncina burkei,* a Choctawhatchee River drainage endemic. Specimens used for photography were selected based on typical characteristics of the species from the Choctawhatchee River drainage.

Changes in overall unionid composition over time were statistically examined ($\alpha = 0.05$) using a paired t-test. Maps depicting diversity "hot spots" and imperiled species "hot spots" were generated using the graduated symbol feature in the Legend Editor in ArcView. Conservation status was determined by scoring each species based on the guidelines outlined below. A species was considered imperiled, possibly extinct (IX) if it was not found at any

Figure 2. *Elliptio icterina* **complex (58 mm) collected 22 March 2000, from a canal tributary to Smokehouse Lake, Choctawhatchee River drainage, Walton County, Florida. Copyright Richard T. Bryant.**

Figure 3. *Elliptio icterina* **complex (46 mm) collected 29 July 1998, from Wrights Creek at Co. Rd. 179, 3 air miles NE of Westville, Choctawhatchee River drainage, Holmes County, Florida. Copyright Richard T. Bryant.**

Figure 4. *Elliptio icterina* **complex (87 mm) collected 22 March 2000, from a canal tributary to Smokehouse Lake, Choctawhatchee River drainage, Walton County, Florida. Copyright Richard T. Bryant.**

Figure 5. *Elliptio mcmichaeli* **(72 mm) collected from Choctawhatchee River, 8 miles W of Miller Crossroads, on St. Rt. 2, Choctawhatchee River drainage, Holmes County, Florida. Paratype (USNM 710723). Copyright Richard T. Bryant.**

Figure 6. ***Lampsilis haddletoni*** **(30 mm) collected 23 September 1956, from Choctawhatchee River, West Fork, 7 miles SE of Ozark, Choctawhatchee River drainage, Dale County, Alabama. Holotype (NMC 20095). Copyright Richard T. Bryant.**

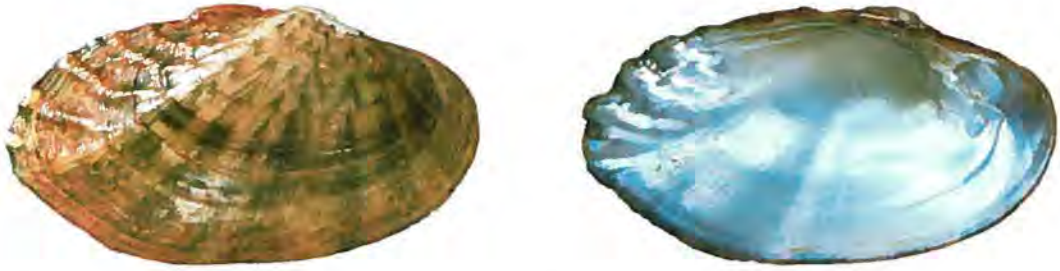

Figure 7. ***Medionidus acutissimus*** **(26 mm) collected October 1933, from Choctawhatchee River, Choctawhatchee River drainage, Walton County, Florida. (FMNH 89892). Copyright Richard T. Bryant.**

Figure 8. ***Quincuncina burkei*** **(55 mm) collected from Holmes Creek, Choctawhatchee River drainage, Jackson County, Florida. (UF 64972). Copyright Richard T. Bryant.**

sites in the current survey and was considered endemic to the Choctawhatchee River drainage. A species was considered imperiled, possibly extirpated (IT) if it was not collected at any sites in the current survey but occurs in at least one other river drainage. The remaining species were scored based on the recent occurrence at known historical sites (0% = 0 points, 1-25% = 1 point, 26-50% = 2 points, 51-75% = 3 points, 76-100% = 4 points), occurrence at new sites (0% = 0 points, 1-25% = 1 point, 26-50% = 2 points, 51-75% = 3 points, 76-100% = 4 points), and range (endemic to the Choctawhatchee = 0 points, narrow [two to four river drainages] range = 1 point, intermediate [Gulf Coast drainages, not within the Interior Basin] range = 2 points, wide [Gulf Coast drainages and the Interior Basin or Atlantic Slope] range = 3 points). For each species, points were totaled and a total score of 2-3 points = imperiled (I), 4 points = rare (R), 5 points = special concern (SC), and 6-9 points = currently stable (CS).

Results

Drainage Summary

A cumulative total of 23 species was identified from all available historical and recent data, including the USGS and GSA survey work within the Choctawhatchee River drainage (Table 1). It was possible to georeference 55 historical sites from museum records and field notes (Figure 9). We revisited 42 (76%) historical sites between 1998 and 2000. Historical unionid composition across the 42

Table 1. Freshwater mussels of the Choctawhatchee River basin, Alabama and Florida.

Taxa	% Occurrence at Known Historical Sites	% Occurrence at New Sites	Range	Status
Amblema plicata	0	0	Wide	IT
Anodontoides radiatus	0	9	Interm.	I
Elliptio icterina complex	60	65	Wide	CS
Elliptio mcmichaeli	75	38	Endemic	SC
Glebula rotundata	0	2	Wide	R
Hamiota australis	25	11	Narrow	I
Lampsilis haddletoni	0	0	Endemic	IX
Lampsilis straminea	57	18	Interm.	CS
Lampsilis teres	100	32	Wide	CS
Medionidus acutissimus	0	0	Narrow	IT
Pleurobema strodeanum	46	25	Narrow	R
Ptychobranchus jonesi	8	0	Narrow	I
Pyganodon grandis	25	15	Wide	SC
Quadrula succissa	71	34	Narrow	CS
Quincuncina burkei	32	19	Endemic	I
Toxolasma sp.	0	26	Wide	SC
Uniomerus tetralasmus	100	15	Wide	CS
Utterbackia imbecillis	33	15	Wide	CS
Utterbackia peggyae	0	3	Interm.	I
Villosa choctawensis	67	15	Narrow	SC
Villosa lienosa	55	58	Wide	CS
Villosa vibex	50	49	Wide	CS
Villosa villosa	0	4	Interm.	I

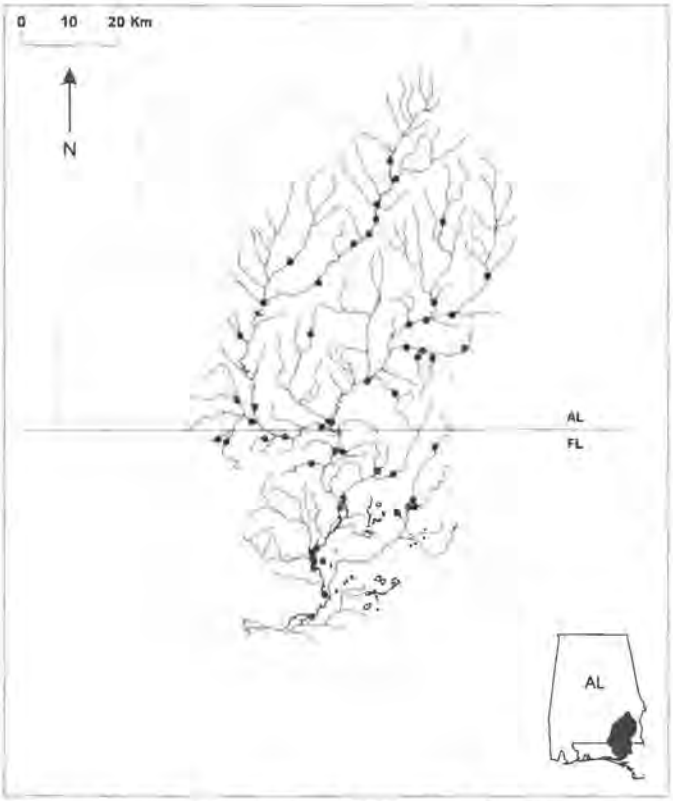

Figure 9. Historical sites within the Choctawhatchee River drainage of Alabama and Florida.

sites ranged from 0-10 species ($\bar{X}$ = 4.2 species, s = 6.3), while recent unionid composition at the 42 historical sites ranged from 0-12 species per site ($\bar{X}$ = 5.1 species, s = 11.7). Although mean unionid composition increased across the 42 sites over time, the difference was not significant (p = 0.0783). However, when the fauna is separated into two conservation categories, imperiled species (IX, IT, I, R, and SC) and common species (CS), the increase in mean unionid composition over time is due to a significant (p = 0.0007) increase in the presence of common species (historical $\bar{X}$ = 1.8, s = 2.0; recent $\bar{X}$ = 3.1, s = 3.3). Though not statistically significant (p = 0.3725), the mean number of imperiled species across the 42 sites declined over time (historical $\bar{X}$ = 2.3, s = 3.2; recent $\bar{X}$ = 2.0, s = 3.6).

A total of 136 new sites were surveyed from 1998-2000 or identified from recent field notes (1990–1998) (Figure 10). Recent unionid species composition at new sites ranged from 0-12 species per site ($\bar{X}$ = 3.5 species, s = 8.4). At new sites the number of imperiled species present ranged from 0-6 ($\bar{X}$ = 1.3, s = 1.9) and common species ranged from 0-8 ($\bar{X}$ = 2.2, s = 3.2). The number of common species at new sites comprised significantly more of the fauna than did imperiled species ($p = 2.6 \times 10^{-11}$). Recent unionid richness was concentrated in the upper Pea River, West and East forks of the Choctawhatchee River, Alabama, Flat Creek watershed, Alabama and

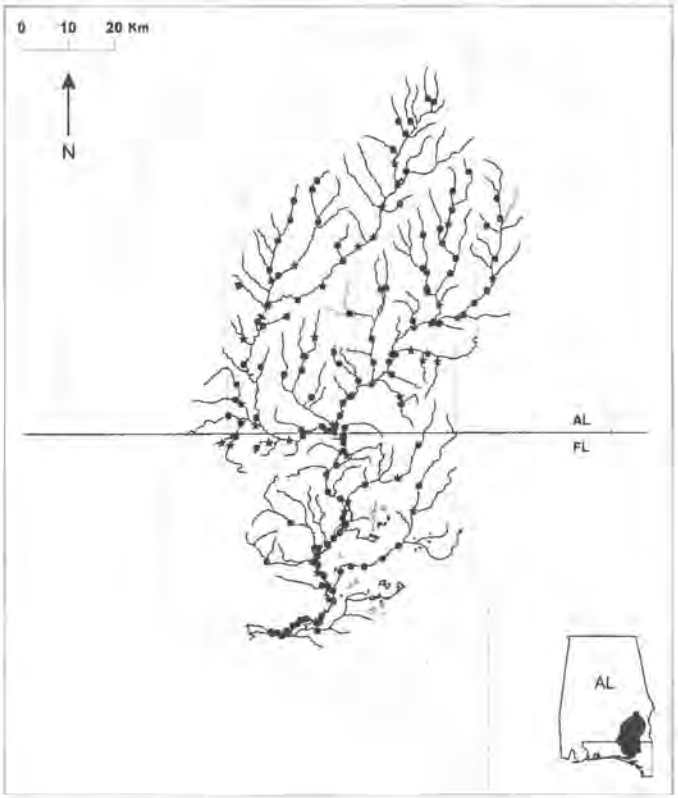

Figure 10. New sites sampled from 1990–2000 within the Choctawhatchee River drainage of Alabama and Florida. ★ = both historical and recent sites; ● = recent sites only.

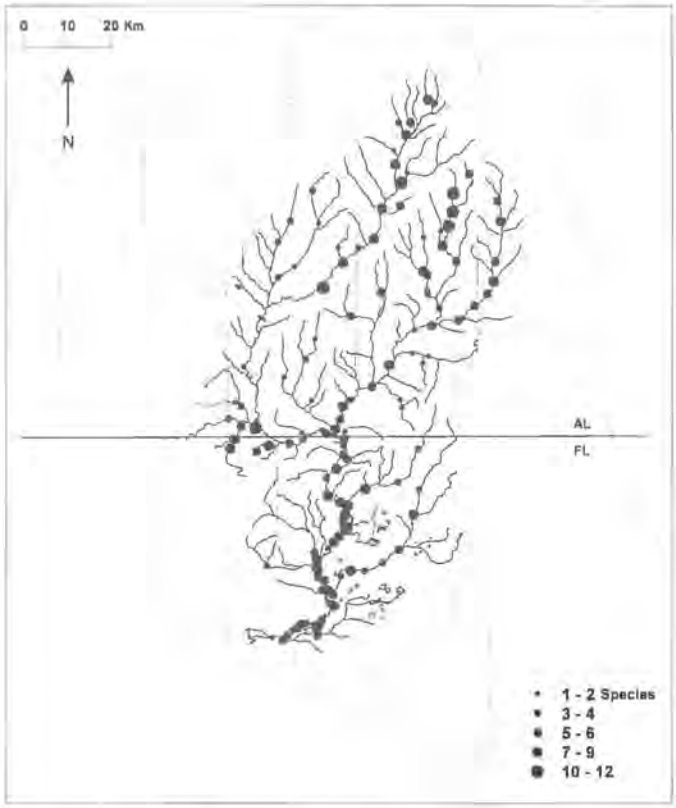

Figure 11. Recent (1990–2000) unionid species richness within the Choctawhatchee River drainage of Alabama and Florida.

Florida, and the main channel of the Choctawhatchee River in Florida (Figure 11). Distribution of imperiled species followed the same pattern (Figure 12). No unionids were located at 36 (26%) of the new sites sampled. These sites were roughly clustered in the middle of the Choctawhatchee River drainage separating the upper and lower portions of the drainage (Figure 13). The absence of unionids may be due to local geological formations in the Claiborne Group, which are characterized by loose sand deposits. While there are streams within this area that have unionid mollusks, some unrecognized characteristic(s) of local geology may contribute to the absence of mussels. Another area without unionid mollusks was located at the most downstream location sampled, at the junction of the Choctawhatchee River and the Sister River (a distributary of the Choctawhatchee), Walton County, Florida. In this area, the native estuarine mollusk, Atlantic Rangia, *Rangia cuneata* (Sowerby I, 1831) (Bivalvia: Mactridae), was the only bivalve mollusk found.

The nonindigenous Asian Clam, *Corbicula fluminea* (Müller, 1774), was not reported from Florida until 1960 (Schneider, 1967). However, in this survey we found the Asian Clam established throughout the Choctawhatchee River drainage. Fortunately, no specimens of the invasive nonindigenous Zebra Mussel, *Dreissena polymorpha* (Pallas, 1771), were found in the drainage.

Species Accounts

The following accounts discuss changes in the taxonomy of unionids from the Choctawhatchee River drainage. Current taxonomy in this publication follows Turgeon et al. (1998) unless otherwise stated. The native range of each species, the number of known historical occurrences within the Choctawhatchee River drainage, the number of historical sites for each species that were revisited, the number of recent occurrences at historical sites, and the number of new sites where a species was recently located are reported. From the data examined in this study, we assign a conservation status for each species within the Choctawhatchee River drainage and report species conservation status from nearby drainages and national reviews. Table 1 summarizes historical occurrence, recent occurrence, range, and current conservation status as determined from this study.

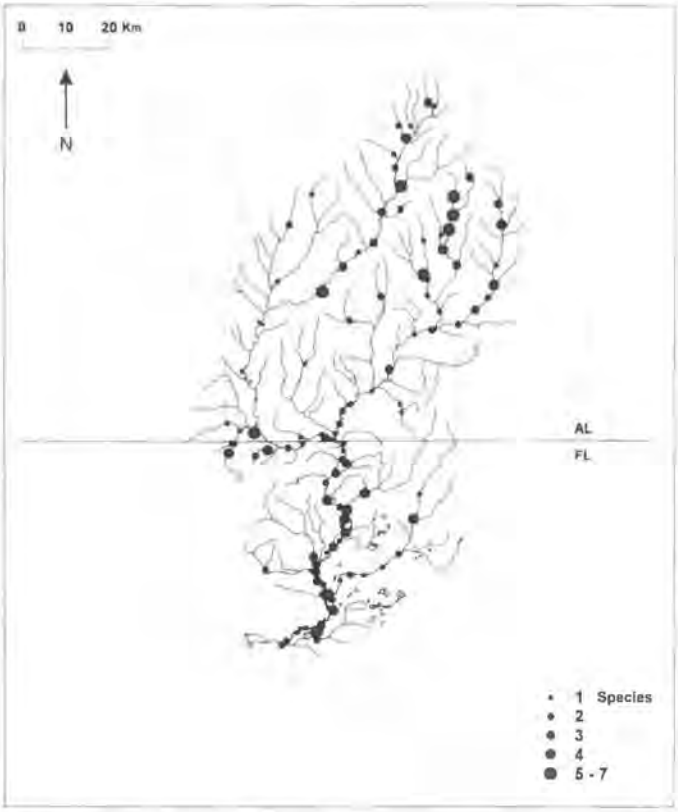

Figure 12. Recent (1990–2000) richness of imperiled unionid species within the Choctawhatchee River drainage of Alabama and Florida.

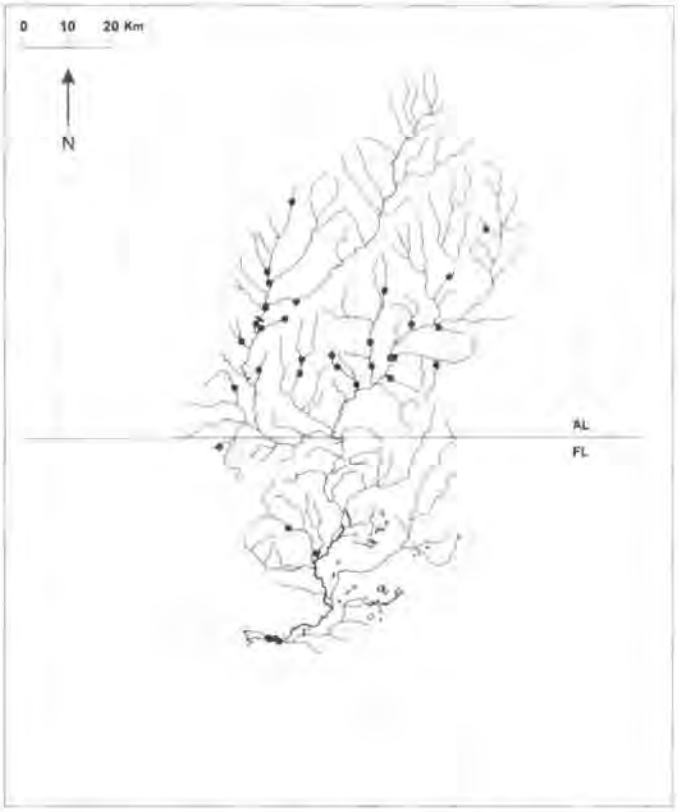

Figure 13. Sites where no unionid mollusks were collected between 1998–2000 within the Choctawhatchee River drainage of Alabama and Florida.

Amblema plicata
(Say, 1817)
Threeridge

Within the Alabama, Escambia, and Choctawhatchee river drainages, *Amblema plicata* has recently been referred to as *Amblema perplicata* (Conrad, 1841) (Butler, 1989; Williams and Butler, 1994). Mulvey et al. (1997) found that specimens of the genus *Amblema* from the Alabama River (within the East Gulf Coastal Plain Physiographic Province) and from the Escambia River were genetically indistinguishable from *A. plicata*. Though genetic analysis has not been conducted on specimens of *Amblema* from the Choctawhatchee River drainage, based on conchological characters we currently consider them to be *A. plicata*.

The native range of *Amblema plicata* extends throughout the Interior Basin and from the San Antonio River, Texas, east to the Choctawhatchee River, but not from the Yellow River (Butler, 1989; Howells et al., 1996). Within the Choctawhatchee drainage, it has been found historically at four sites, one of which could not be precisely located for georeferencing (Figure 14). We resurveyed 2 (67%) of the known historical sites and surveyed sites upstream and downstream of the third site. We did not find this species at its historical locations or at any new sites. Williams et al. (in prep.) considered the Threeridge currently stable in the Escambia River drainage. It is considered currently stable throughout the remainder of its range (Williams et al., 1993; Lydeard et al., 1999). We currently consider this species imperiled, possibly extirpated from the Choctawhatchee River drainage.

Anodontoides radiatus
(Conrad, 1834b)
Rayed Creekshell

The range of *Anodontoides radiatus* includes Gulf Coast drainages from the Amite River system, Louisiana (Vidrine, 1993), east to the Apalachicola River system, Florida and Georgia (Brim Box and Williams, 2000). In our search of the available historical data, we did not locate any records of *A. radiatus* from the Choctawhatchee River drainage, confirming the existence of a gap within the range of the Rayed Creekshell as noted by Johnson (1967). However, we extend the known range of *A. radiatus* to include the Choctawhatchee River

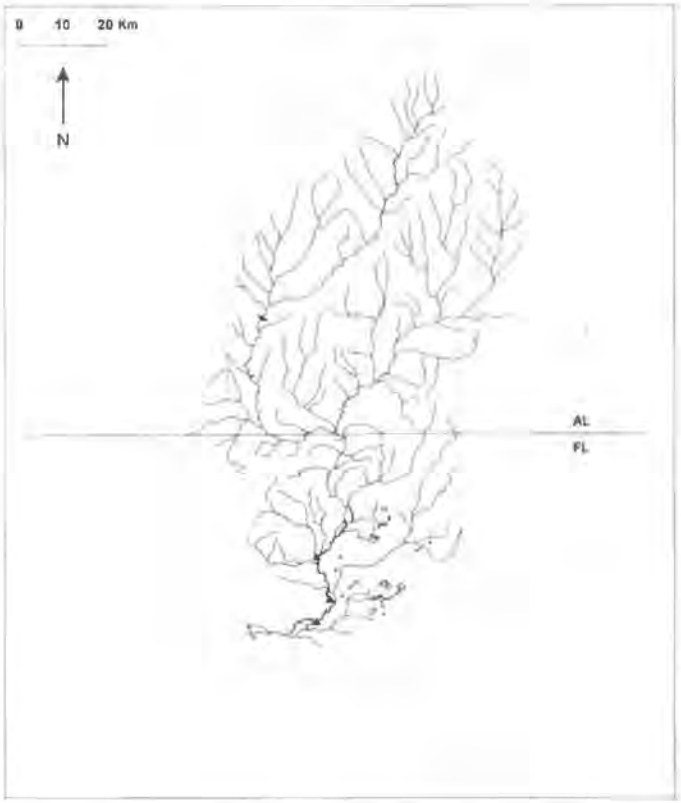

Figure 14. Historical distribution of *Amblema plicata* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only.

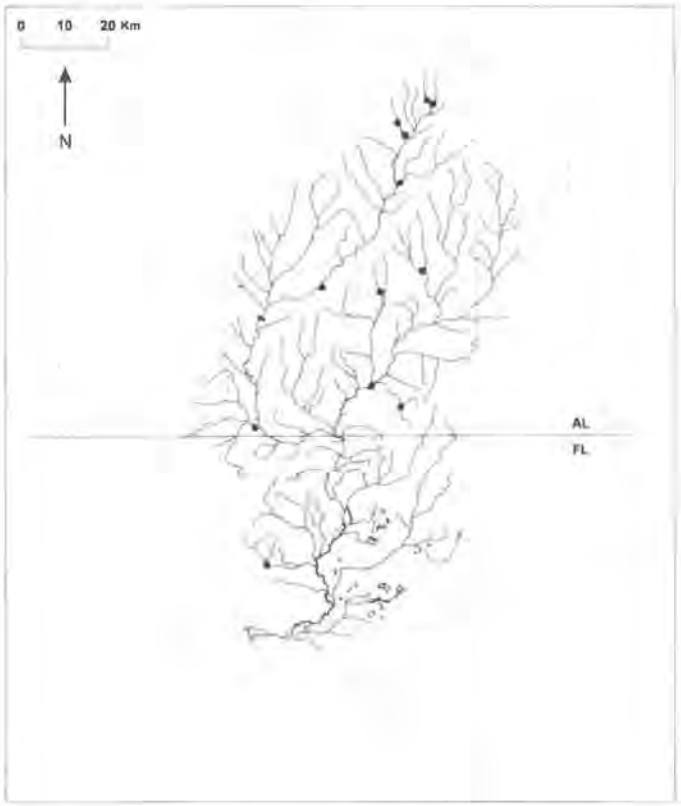

Figure 15. Current distribution of *Anodontoides radiatus* within the Choctawhatchee River drainage of Alabama and Florida. ● = recent occurrence only.

drainage based on the presence of this species at 12 (9%) new sites, most of which were small tributaries (Figure 15). The Rayed Creekshell is threatened in the Escambia River drainage and endangered in the Apalachicola River drainage (Brim Box and Williams, 2000; Williams et al., in prep.). It is considered a species of special concern throughout its range (Williams et al., 1993; Lydeard et al., 1999). We consider this species imperiled within the Choctawhatchee River drainage.

Elliptio icterina
(Conrad, 1834a) complex
Variable Spike

Within the Choctawhatchee River drainage, lanceolate shells of the genus *Elliptio* without sculpture on the posterior slope have been referred to as *Elliptio strigosa* (Lea, 1840) (Clench and Turner, 1956) and *Elliptio lanceolata* (Lea, 1828) (Burch, 1975). The shells of *Elliptio* are highly variable and may express ecophenotypic morphologies (Figures 2-4). Until genetic and morphological analyses can be conducted, we recognize all the unsculptured, lanceolate *Elliptio* as members of the *E. icterina* complex within the Choctawhatchee River drainage. There are no named lanceolate *Elliptio* from drainages between the Escambia and Choctawhatchee rivers.

The native range of *Elliptio icterina* extends from Atlantic Coast rivers in North Carolina, south to the St. Johns River drainage in Florida (Johnson, 1970). Within Gulf Coast rivers, *E. icterina* occurs from the Escambia River drainage in Florida and Alabama, east throughout peninsular Florida (Johnson, 1970). *Elliptio icterina* is known from 14 historical sites within the drainage, 2 of which could not be precisely located for georeferencing (Figure 16). We resurveyed 10 (83%) of the known historical sites and found it at 6 (60%) of these sites. We also located *E. icterina* at 89 (65%) new sites. The Variable Spike is distributed widely throughout the upper and lower portions of the drainage. Throughout its range, *E. icterina* is considered currently stable (Williams et al., 1993; Lydeard et al., 1999; Brim Box and Williams, 2000; Williams et al., in prep.). We consider the current conservation status of *E. icterina* complex to be currently stable within the Choctawhatchee River drainage.

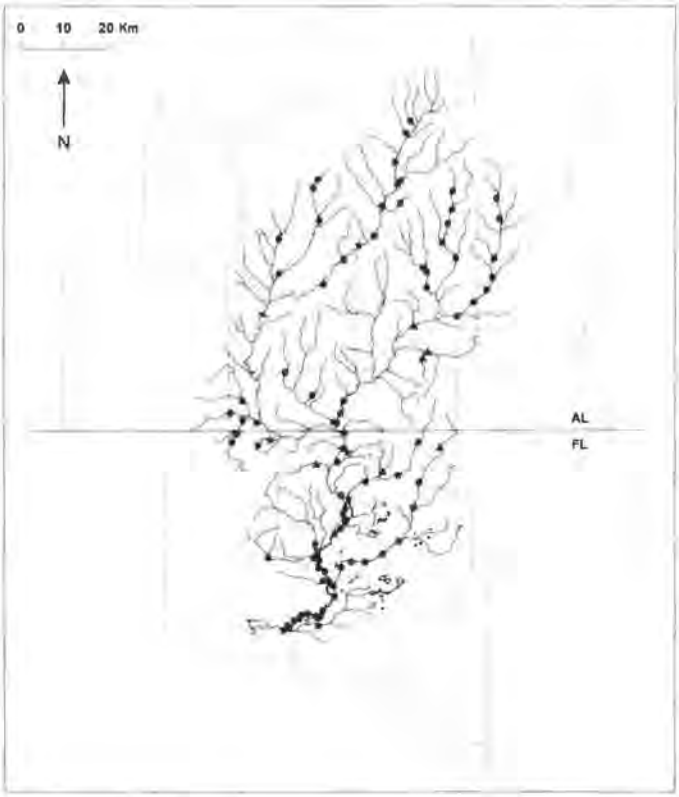

Figure 16. Historical and recent distribution of *Elliptio icterina* complex within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

Elliptio mcmichaeli
Clench and Turner, 1956
Fluted Elephantear

Clench and Turner (1956) described *Elliptio mcmichaeli* as a new species endemic to the Choctawhatchee River drainage (Figure 5). Johnson (1970) placed *E. mcmichaeli* in the synonymy of *Elliptio fraterna* (Lea, 1852), a species described from the Savannah River drainage. *Elliptio fraterna* also historically occurred in the Apalachicola River drainage (Brim Box and Williams, 2000). Fuller and Bereza (1973) resurrected *E. mcmichaeli* as a species distinct from *E. fraterna* based on anatomical characteristics. Burch (1975) reported that both species occur in the Choctawhatchee River drainage. Shells resembling *E. mcmichaeli* have also been collected from the Escambia and Yellow river drainages in Alabama and Florida; however, no specific name has been assigned to these specimens.

Elliptio crassidens (Lamarck, 1819) is known from the Interior Basin east to the Yellow River drainage and is also present in the Apalachicola River drainage to the east of the Choctawhatchee River drainage (Brim Box and Williams, 2000; Williams et al., in prep.). Within the Choctawhatchee River drainage, forms of *E. mcmichaeli* exist that conchologically resemble *E. crassidens* from the Escambia and Yellow river drainages to the west, in that the periostracum is less rough, shells are more inflated and higher, and the posterior ridge is more prominent. Herod et al. (1999; 2001) found significant differences in shell morphology and tissue condition between *E. mcmichaeli* from two different sites within the Choctawhatchee River drainage. Genetic analysis of these two forms is necessary to determine if *E. mcmichaeli* and *E. crassidens* are sympatric species within the Choctawhatchee River drainage. For the purposes of this publication, we consider all individuals of the genus *Elliptio* with sculpture on the posterior slope to be *E. mcmichaeli*.

The type locality of *Elliptio mcmichaeli* is the Choctawhatchee River, 8 miles west of Miller Cross Roads, Holmes County, Florida, on Florida State Route 2 (Clench and Turner, 1956). *Elliptio mcmichaeli* is known from 29 historical sites, 5 of which could not be georeferenced due to imprecise locality data (Figure 17). We resurveyed 20 (83%) of the known historical sites and found it at 15 (75%). Although we located *E. mcmichaeli* at 51 (38%)

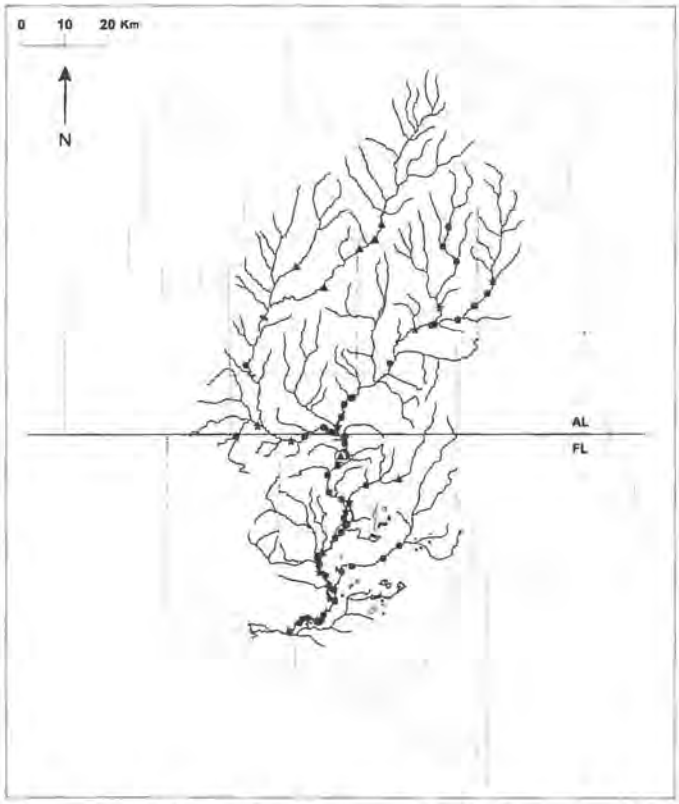

Figure 17. Historical and recent distribution of *Elliptio mcmichaeli* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ◬ = historical occurrence at type locality; ★ = both historical and recent occurrences; ● = recent occurrence only.

new sites, its range has been reduced in Alabama. The Fluted Elephantear is concentrated in the lower portion of the main channel of the Choctawhatchee River drainage and no specimens (live or shell material) of *E. mcmichaeli* were found in the Pea River, upstream of Elba Dam, Coffee County, Alabama. This dam was constructed in the early 1900s to generate electrical power (Hall and Hall, 1916). These data suggest that *E. mcmichaeli*, like its sister taxa *E. crassidens*, may use a migratory host fish. *Elliptio crassidens* uses fishes from the genus *Alosa* (Clupeidae) (Hoggarth, 1992; O'Brien et al., 2003). Williams et al. (1993) considered *E. mcmichaeli* a species of special concern throughout its range. We consider *E. mcmichaeli* special concern within the Choctawhatchee River drainage.

Glebula rotundata
(Lamarck, 1819)
Round Pearlshell

The range of *Glebula rotundata* includes Gulf Coast drainages from the San Jacinto River, Texas, east to the Apalachicola River, Florida (Williams and Butler, 1994; Howells et al., 1996). It is also known from the Interior Basin (Branson, 1969; Gordan, 1983; Cicerello et al., 1991). Within the Choctawhatchee River drainage, *G. rotundata* is known from three historical sites, one of which could not be precisely located to be georeferenced (Figure 18). We resurveyed both historical sites with georeferenced locality data and did not find *G. rotundata*. We did find this species at 3 (2%) new sites confined to the lower portion of the Choctawhatchee River drainage, Florida, in high relative abundance. Williams et al. (1993), Lydeard et al. (1999) and Brim Box and Williams (2000) considered the Round Pearlshell currently stable throughout its range. In the Escambia River drainage, *G. rotundata* is considered threatened (Williams et al., in prep.). We consider the Round Pearlshell rare in the Choctawhatchee River drainage.

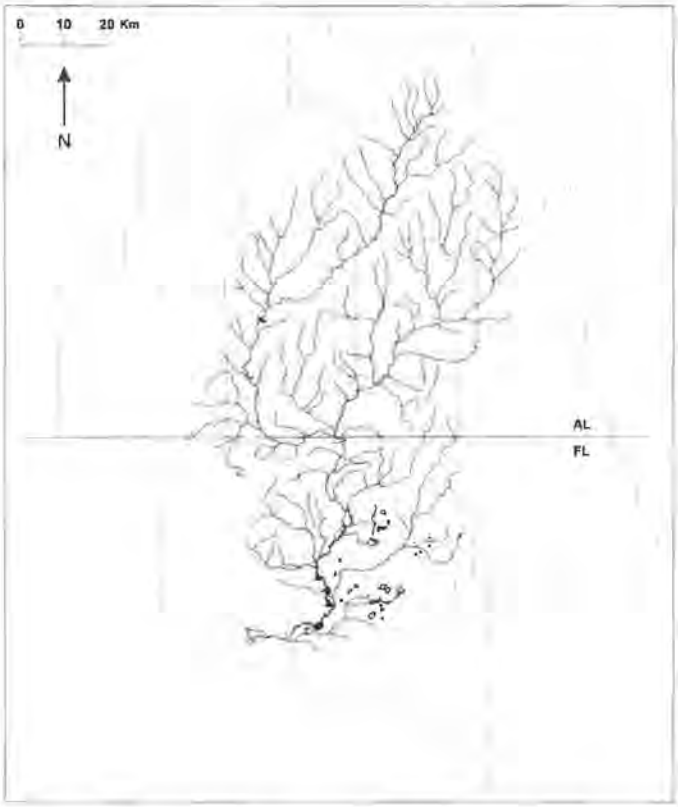

Figure 18. Historical and recent distribution of *Glebula rotundata* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ● = recent occurrence only.

Hamiota australis
(Simpson, 1900)
Southern Sandshell

Simpson (1900) first described and illustrated *Lampsilis australis* from Little Patsaliga Creek, in the Escambia River basin, southeastern Alabama. Clench and Turner (1956) placed *Lampsilis jonesi* (= *Ptychobranchus jonesi*) (van der Schalie, 1934) as a synonym of *L. australis*. Athearn (1964) discussed the differences between the two species and recognized *P. jonesi* as a species distinct from *L. australis*. Other taxonomic problems have been documented in the literature for the Southern Sandshell. Heard (1979) considered the Southern Sandshell to be a member of the genus *Villosa* based on anatomical characteristics. Fuller and Bereza (1973) suggested the Southern Sandshell might belong to an undescribed genus, but did not propose a generic name or suggest diagnostic characteristics for a new genus. Williams and Butler (1994) supported the placement of the Southern Sandshell in the genus *Villosa* as designated by Heard (1979) and speculated that increased knowledge about the reproductive biology of the species may provide evidence in support of a new generic description. Roe et al. (2001) examined the mitochondrial DNA of *L. australis* and the other superconglutinate producer and found that the four species, *L. altilis* (Conrad, 1834), *L. australis*, *L. perovalis* (Conrad, 1834), and *L. subangulata* (Lea, 1840), formed a monophyletic group in the subfamily Lampsilinae supporting the hypothesis of Fuller and Bereza (1973) and Williams and Butler (1994). Roe and Hartfield (2005) subsequently described a new genus, *Hamiota*, for the superconglutinate producers. Therefore we will follow Roe and Hartfield (2005) and recognize the Southern Sandshell as *Hamiota australis*.

A review and discussion of the known life history and complete distribution of *Hamiota australis* is provided in Blalock-Herod et al. (2002). *Hamiota australis* is endemic to

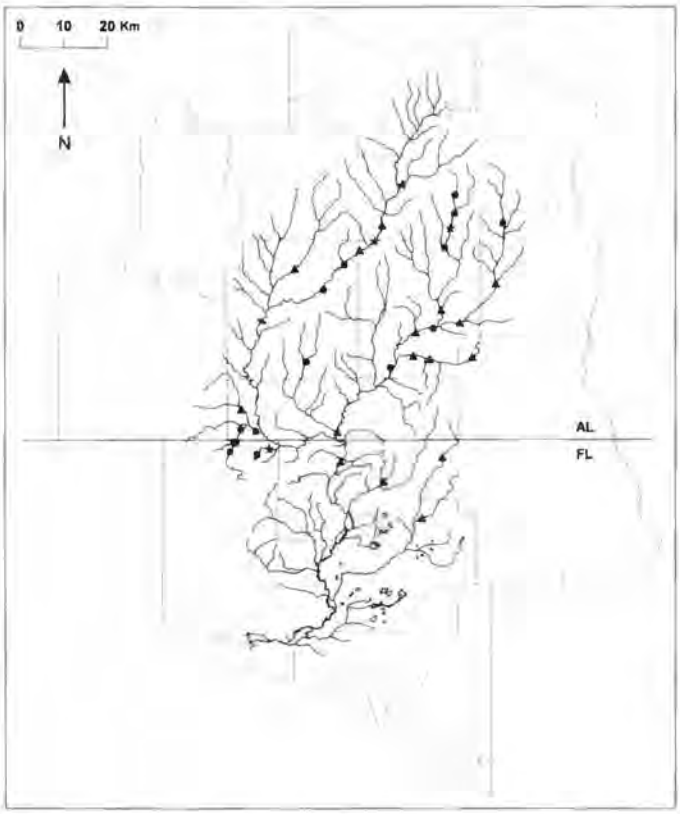

Figure 19. Historical and recent distribution of *Hamiota australis* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

the Escambia River drainage in Alabama, and the Yellow and Choctawhatchee river drainages in Alabama and Florida (Blalock-Herod et al., 2002). van der Schalie (1934), Clench and Turner (1956), and Burch (1975) reported *Hamiota subangulata*, a closely related species, from the Choctawhatchee River drainage. Johnson (1967) reviewed museum vouchers and determined that *H. subangulata* was endemic to the Apalachicola and Ochlockonee river drainages. Within the Choctawhatchee River drainage, *H. australis* is known from 26 historical sites, 6 of which could not be precisely located for georeferencing (Figure 19). We resurveyed 16 (80%) of the known historical sites and located *H. australis* at 4 (25%). We found *H. australis* at 15 (11%) new sites in the Choctawhatchee River drainage. Only one site had more than two specimens of *H. australis*. Williams et al. (1993) considered the Southern Sandshell threatened throughout its range and Lydeard et al. (1999) considered *H. australis* imperiled throughout its range. Williams et al. (in prep.) reported the Southern Sandshell as endangered in the Escambia and Yellow river drainages. *Hamiota australis* is recognized as a candidate species for protection under the Endangered Species Act of 1973, as amended. We consider this species to be imperiled within the Choctawhatchee River drainage.

Lampsilis haddletoni
Athearn, 1964
Haddleton Lampmussel

Lampsilis haddletoni is a Choctawhatchee River endemic known only from the two type specimens (Figure 6). The type locality published by Athearn (1964) was corrected by Butler (1989) from "Choctawhatchee River, West Fork, 7 miles southwest of Ozark, Dale County, Alabama" to read "Choctawhatchee River, West Fork, 7 miles southeast of Ozark, Dale County, Alabama".

We resurveyed the type locality and did not find any live or shell material of *Lampsilis haddletoni* at the historical site (Figure 20), or at any of the other sites examined during this survey. Williams et al. (1993) considered *L. haddletoni* to be endangered. Lydeard et al. (1999) considered the Haddleton Lampmussel to be imperiled. *Lampsilis haddletoni* was considered a category 2 candidate species by U.S. Fish and Wildlife Service (1994) and was not given endangered or threatened status due to a lack of current distributional data. We consider *L. haddletoni* to be imperiled, possibly extinct.

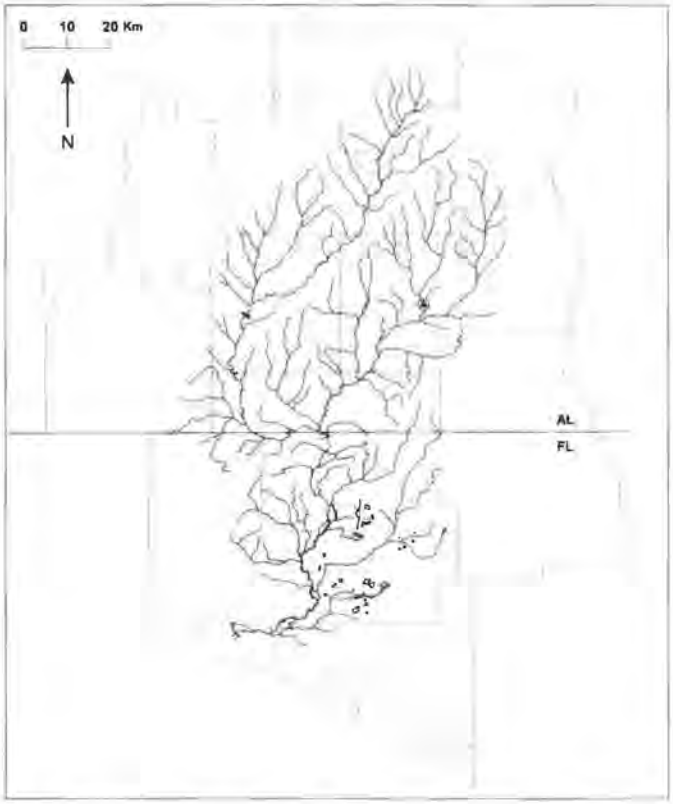

Figure 20. Historical distribution of *Lampsilis haddletoni* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence at type locality.

Lampsilis straminea
(Conrad, 1834a)
Southern Fatmucket

Clench and Turner (1956) and Burch (1975) referenced this species as *Lampsilis claibornensis*. Turgeon et al. (1998) listed this species with two subspecies: *L. straminea straminea* and *L. straminea claibornensis*. Subspecies designation was based on a conchological character (corrugations that parallel shell growth) of specimens from the type locality. However, these corrugations have also been detected in other unionid species from the same geographic region, the Black Belt Province. This region is characterized by chalky limestone and calcareous clay substrate (Adams et al., 1926). We consider the corrugations on shells of mussels from the Black Belt Province in central Alabama to represent eco-phenotypic variation. Until genetic or detailed morphological analyses are conducted to provide some basis for recognition of this subspecies, we will not utilize subspecies designation and will recognize the species as *L. straminea*.

The range of *Lampsilis straminea* includes Gulf Coast drainages from the Amite River, Louisiana, east to the Suwannee River drainage, Florida (Clench and Turner, 1956; Vidrine, 1993). Within the Choctawhatchee River drainage, the Southern Fatmucket is known from 26 historical sites, 11 of which could not be precisely located for georeferencing (Figure 21). We resurveyed 14 (93%) of the known historical sites and located this species at 8 (57%). We also found this species at 25 (18%) new sites. The Southern Fatmucket occurs in portions of the main channels and tributaries in Alabama and a small section of the main channel of the Choctawhatchee River in Florida. The Southern Fatmucket is considered currently stable throughout its range (Williams et al., 1993; Lydeard et al., 1999; Williams et al., in prep.), except in the Apalachicola River drainage, where it is considered a species of special concern (Brim Box and Williams, 2000). We consider *L. straminea* to be currently stable within the Choctawhatchee River drainage.

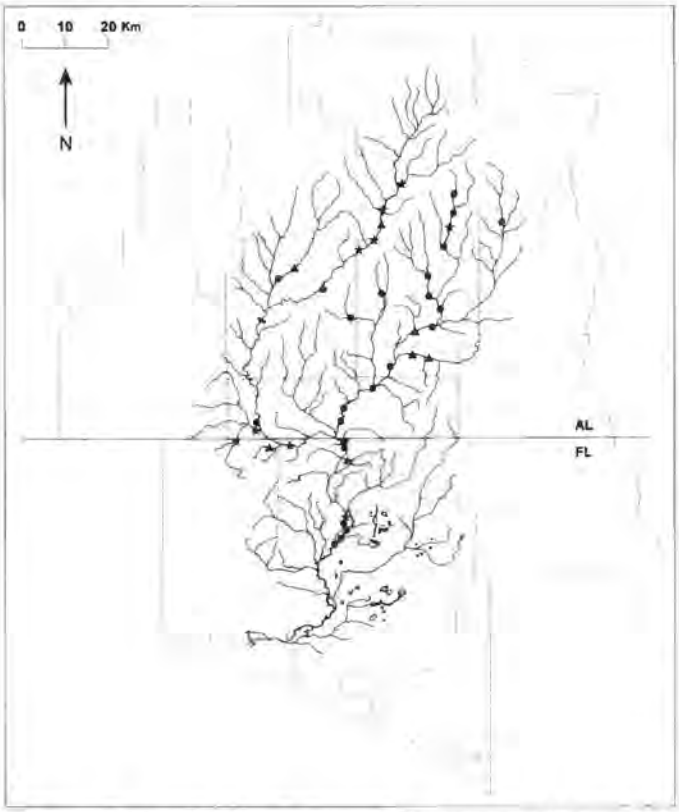

Figure 21. Historical and recent distribution of *Lampsilis straminea* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

Lampsilis teres
(Rafinesque, 1820)
Yellow Sandshell

Unio floridensis Lea, 1852 was described from the Choctawhatchee River drainage. This species was treated as a subspecies of *Lampsilis anodontoides*, var. *floridensis*, by Simpson (1914) and is referenced under this name by Clench and Turner (1956). Johnson (1972) placed this species under the synonymy of *L. teres*.

The native range of *Lampsilis teres* includes the Interior Basin and Gulf Coast streams from the Rio Grande River in Texas (Howells et al., 1996), east to the Hillsborough River drainage in Florida (Johnson, 1972). Within the Choctawhatchee River drainage, *L. teres* is known from three historical sites (Figure 22). We resurveyed the historical sites and located this species at all 3 (100%). We also found this species at 43 (32%) new sites. The distribution of the Yellow Sandshell is confined to the lower portions of the main channels of the Pea and Choctawhatchee rivers with the exception of one site near the headwaters of the Pea River. *Lampsilis teres* is considered currently stable throughout its range (Williams et al., 1993; Lydeard et al., 1999; Brim Box and Williams, 2000), except in the Escambia River drainage, where it is considered a species of special concern (Williams et al., in prep.). We consider *L. teres* to be currently stable within the Choctawhatchee River drainage.

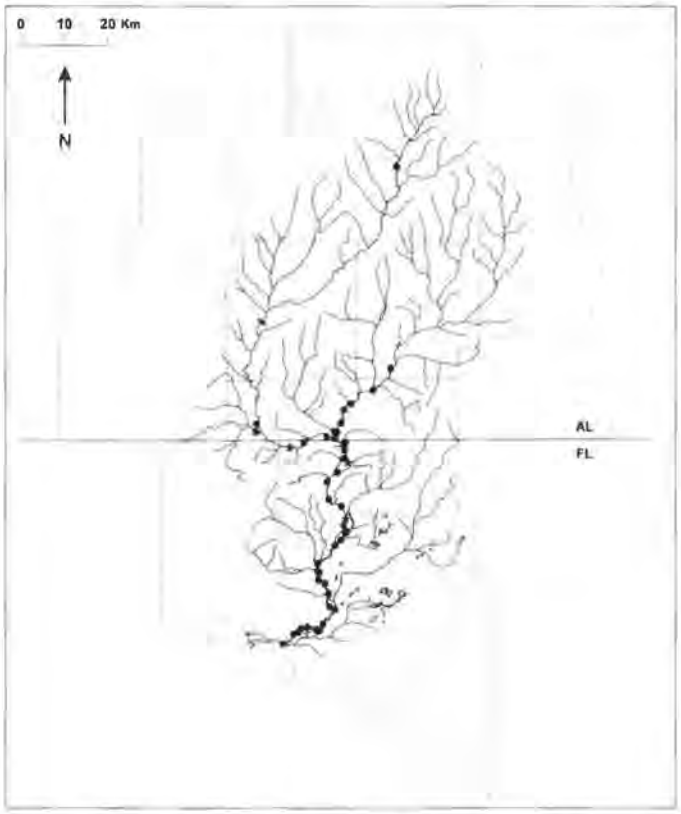

Figure 22. Historical and recent distribution of *Lampsilis teres* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

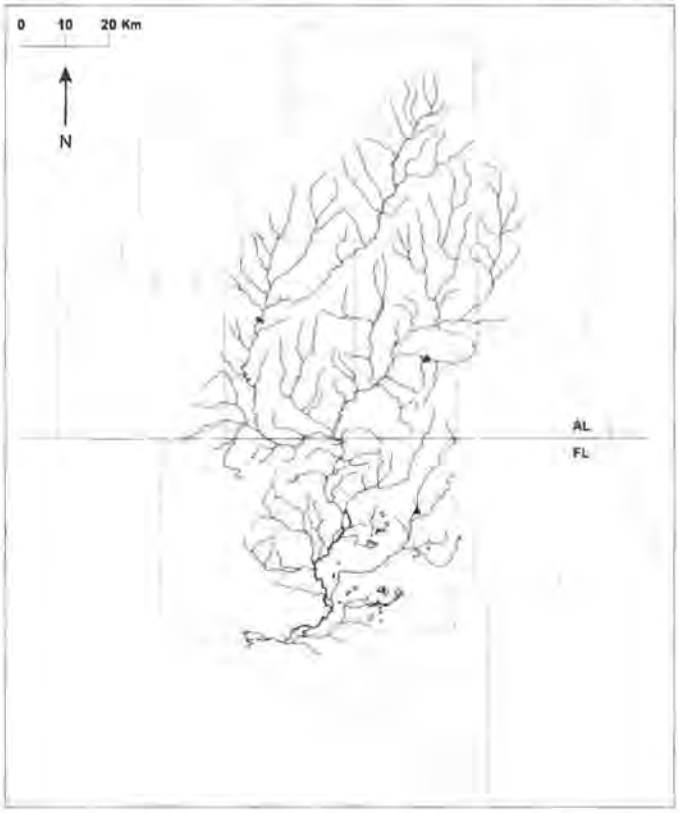

Figure 23. Historical distribution of *Medionidus acutissimus* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only.

Medionidus acutissimus
(Lea, 1831)
Alabama Moccasinshell

Medionidus acutissimus (Figure 7) has not been previously been considered part of the Choctawhatchee River drainage mussel fauna. Johnson (1977) examined specimens he considered *Medionidus penicillatus* (Lea, 1857) from the Yellow River drainage in Alabama, but mapped the distribution in the Choctawhatchee River drainage. Specimens of *Medionidus* were first reported from the Choctawhatchee River drainage by Butler (1989) as *M. penicillatus*. Brim Box and Williams (2000) reviewed all the museum records of *M. penicillatus* and determined that species to be endemic to the Apalachicola River drainage in Alabama, Florida, and Georgia. Museum lots of *Medionidus* from the Choctawhatchee River drainage were examined and found to closely resemble *M. acutissimus* from the Mobile Bay drainage, Alabama. We tentatively assign individuals of *Medionidus* from the Choctawhatchee River to *M. acutissimus*.

Medionidus acutissimus is known from six historical sites, four of which could not be precisely located for georeferencing (Figure 23). We revisited the historical sites and several additional sites in each of the streams within the historical distribution. We did not locate any live individuals or shell material of *M. acutissimus*. *Medionidus acutissimus* is a federally threatened species (U.S. Fish and Wildlife Service, 1993). Williams et al. (in prep.) reported the Alabama Moccasinshell endangered, possibly extirpated from the Escambia and Yellow river drainages. We consider this species to be imperiled, possibly extirpated from the Choctawhatchee River drainage.

Pleurobema strodeanum
(Wright, 1898)
Fuzzy Pigtoe

Pleurobema strodeanum is native to the Escambia, Yellow, and Choctawhatchee river drainages in Alabama and Florida. Within the Choctawhatchee River drainage, *P. strodeanum* is known from 21 historical sites, 4 of which could not be precisely located for georeferencing (Figure 24). We resurveyed 13 (76%) of the known historical sites and located this species at 6 (46%). We also found *P.*

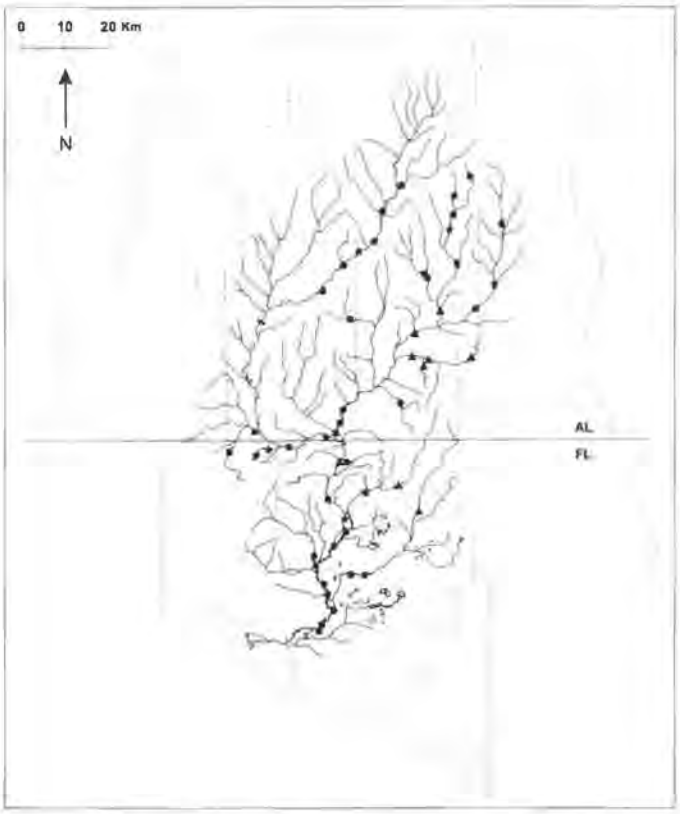

Figure 24. Historical and recent distribution of *Pleurobema strodeanum* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

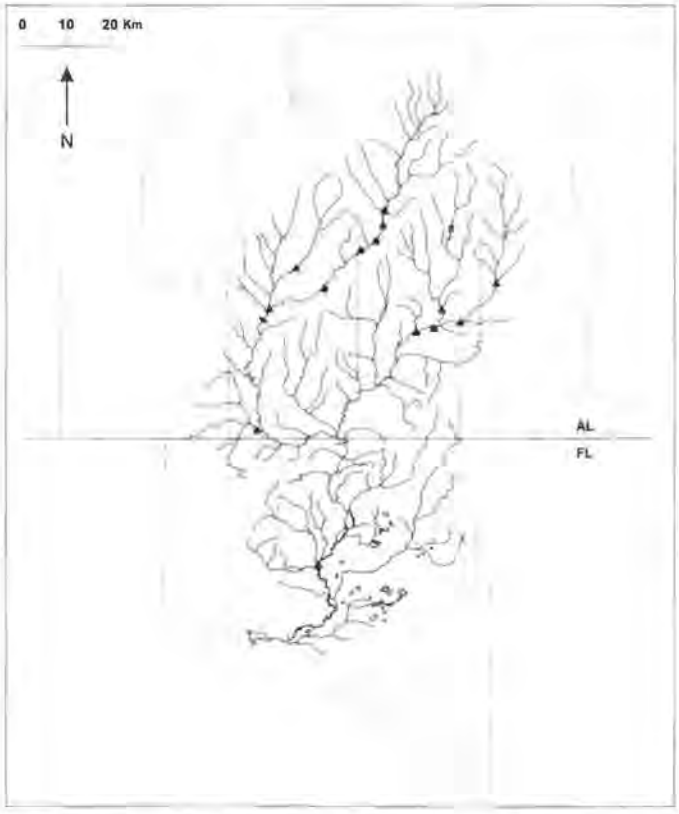

Figure 25. Historical and recent distribution of *Ptychobranchus jonesi* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

strodeanum at 34 (25%) new sites scattered in the upper and lower portions of the drainage. Williams et al. (1993) considered *P. strodeanum* a species of special concern throughout its range. Lydeard et al. (1999) considered the Fuzzy Pigtoe imperiled throughout its range. Williams et al. (in prep.) considered the Fuzzy Pigtoe threatened in the Escambia and Yellow river drainages in Alabama and Florida. *Pleurobema strodeanum* is recognized as a candidate species for protection under the Endangered Species Act of 1973, as amended. We consider *P. strodeanum* to be rare within the Choctawhatchee River drainage.

Ptychobranchus jonesi
(van der Schalie, 1934)
Southern Kidneyshell

In the original description of *Ptychobranchus jonesi* there is some confusion regarding the location where the type specimens were collected. The locality was given as "the Pea River, at Priston's Mill, Dale County, Alabama" (van der Schalie, 1934), however, we have been unable to locate a mill by this name on any recent or historical map. In the early 1900s there was a mill on the East Fork of the Choctawhatchee River, Prestons Mill, Dale County, which was located near the present day County Highway 67 crossing, north of Midland City. Historically, there were two mills, Dex Mill and Blacks Mills, located on the short reach of the Pea River in extreme northwest Dale County (Remington and Kallsen, 1999). Based on the locality information given, Pea River and Dale County, the type locality for *P. jonesi* is most likely the Pea River in northwest Dale County, but the name of the mill was incorrect or possibly renamed.

Clench and Turner (1956) placed *Lampsilis jonesi* in synonymy of *H. australis*. Athearn (1964) reviewed the systematics, elevated *L. jonesi*, and determined that it was a distinct species. Fuller and Bereza (1973) detected folded gills in the Southern Kidneyshell and determined the animal to be *Ptychobranchus jonesi*. Genetic analysis of specimens presumed to be *P. jonesi* were compared with that of *H. australis* and other members of the genus *Ptychobranchus*. This analysis confirmed the identification of *P. jonesi* from the Choctawhatchee River drainage as a species of *Ptychobranchus* and determined that it was sister to *Ptychobranchus greenii* (Conrad, 1834a) from the Black Warrior River drainage (Roe and Cummings, 2001).

Johnson (1967) reported the distribution of *Ptychobranchus jonesi* as the Choctawhatchee River drainage of Alabama and Florida. Burch (1975) extended the range of *P. jonesi* to include the Escambia River drainage in Alabama. Williams et al. (in prep.) found historical records of *P. jonesi* in the Yellow River drainage of Alabama. A summary of the literature indicates that the historical range of *P. jonesi* is the Escambia and Yellow river drainages in Alabama, and the Choctawhatchee River drainage in Alabama and Florida. This species is known from 19 sites within the drainage, 5 of which could not be precisely located for georeferencing (Figure 25). We examined 13 (93%) of the known historical sites and additional sites upstream and downstream of the fourteenth site. Live animals were found at only 1 (8%) historical site within the drainage. However, we also resurveyed a site where several live *P. jonesi* were located in 1993. We did not find this species at the 1993 site and we did not locate any new populations. Williams et al. (1993) considered *P. jonesi* to be threatened throughout its range. Lydeard et al. (1999) reported the Southern Kidneyshell as imperiled throughout its range. Williams et al. (in prep.) did not locate *P. jonesi* at any sites within the Escambia or Yellow river drainages of Alabama and Florida, and subsequently considered it extirpated within those drainages. *Ptychobranchus jonesi* is recognized as a candidate species for protection under the Endangered Species Act of 1973, as amended. We consider this mussel to be imperiled within the Choctawhatchee River drainage and one of the most imperiled species in the United States.

Ironically, bridge demolition for replacement activities began on the day of the USGS and GSA survey at the only site known to recently (1995–2000) support live *Ptychobranchus jonesi* within the entire historical range of the species. The bridge was directly overhead and upstream of the habitat where *P. jonesi* were collected. Fortunately, one year after the old bridge was dropped to the bank and the new bridge was almost complete, one of the authors (SWM) returned to the site and was able to locate a few live *P. jonesi*.

Pyganodon grandis
(Say, 1829)
Giant Floater

Clench and Turner (1956) reported *Anodonta gibbosa* (Say, 1824) and *Anodonta hallenbecki* (Lea, 1858) (= *Pyganodon hallenbecki*) from the Choctawhatchee River drainage. *Anodonta gibbosa* is endemic to the Altamaha River drainage in Georgia (Burch, 1975) and *P. hallenbecki* is a synonym of *P. grandis* (Brim Box and Williams, 2000). Records of *A. gibbosa* and *P. hallenbecki* within the Choctawhatchee River drainage are considered to represent *P. grandis*.

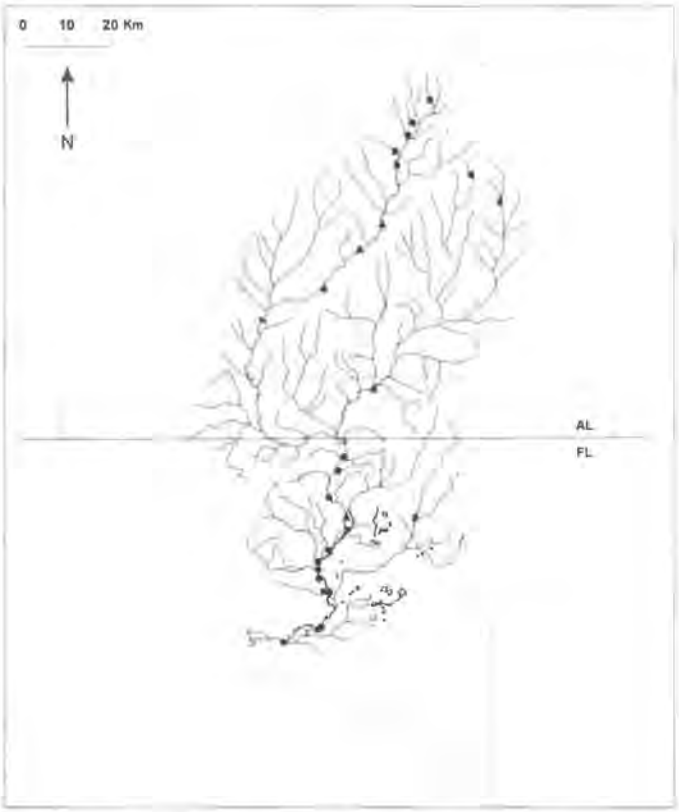

Figure 26. Historical and recent distribution of *Pyganodon grandis* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

The distribution of *Pyganodon grandis* extends throughout all of the Interior Basin and Gulf drainages from northeastern Mexico, east to the Apalachicola River drainage, Florida (Brim Box and Williams, 2000). *Pyganodon grandis* is known from six historical sites, one of which was too vague to be georeferenced (Figure 26). We revisited 4 (80%) of the historical sites and additional localities upstream and downstream from the fifth site. We found *P. grandis* at 1 (25%) of its historical sites and at 21 (15%) new sites. The Giant Floater was found in pools in headwater areas and in backwater and sluggish water habitats of the main channels. *Pyganodon grandis* is considered currently stable throughout its native range (Williams et al., 1993; Lydeard et al., 1999; Brim Box and Williams, 2000; Williams et al., in prep.). We consider *P. grandis* to be a species of special concern within the Choctawhatchee River drainage.

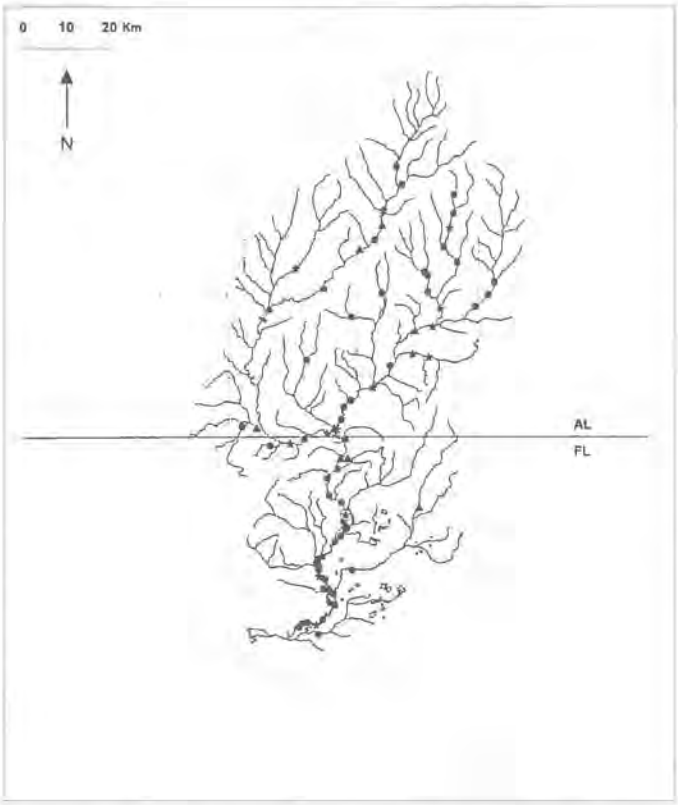

Figure 27. Historical and recent distribution of *Quadrula succissa* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ⊛ = both historical and recent occurrences at type locality; ● = recent occurrence only.

Quadrula succissa
(Lea, 1852)
Purple Pigtoe

Lea (1852) described *Unio succissus* from "west Florida". Clench and Turner (1956) restricted the type locality to the most probable location for Lea's collection in west Florida, the Choctawhatchee River, Caryville, Holmes County, Florida. Lea (1859) also described *Unio cacao* from the Chachtahachie [Choctawhatchee] River, west Florida. Clench and Turner (1956) corrected Lea's locality data for *U. cacao* to read "Choctawhatchee River, west Florida". Simpson (1914) placed *U. cacao* and *U. succissus* under synonymy of *Quadrula succissa* based on conchological characteristics. Ortmann (1923) placed *Q. succissa* in synonymy with *Fusconaia succissa*. Lydeard et al. (2000) gave a detailed discussion on the molecular phylogeny of *F. succissa*, which indicated that the Purple Pigtoe is not a member of the genus *Fusconaia*. Subsequent work by Serb et al. (2003) has shown the Purple Pigtoe to be a member of the "*pustulosa* group" within the genus *Quadrula*. Therefore, we recognize the Purple Pigtoe as *Quadrula succissa*.

Quadrula succissa is endemic to the Escambia, Yellow, and Choctawhatchee river drainages of Alabama and Florida (Clench and Turner, 1956). It is known from 44 historical sites within the drainage, 15 of which could not be precisely located for georeferencing (Figure 27). We resurveyed 24 (83%) of the known historical sites and found it at 17 (71%). We also located *Q. succissa* at 46 (34%) new sites. The Purple Pigtoe is distributed throughout the Choctawhatchee River drainage. Williams et al. (1993) and Lydeard et al. (1999) considered this species to be special concern throughout its range. In the Escambia and Yellow river drainages, *Q. succissa* is considered special concern (Williams et al., in prep.). We consider *Q. succissa* to be currently stable within the Choctawhatchee River drainage.

Quincuncina burkei
Walker, 1922
Tapered Pigtoe

In Ortmann and Walker (1922), Ortmann described the genus *Quincuncina* and Walker described the species *Q. burkei* (Figure 8). In their publication, Ortmann and Walker (1922) went on to describe the conchological and anatomical characteristics noting that a gravid female was collected on 12 May 1915. This species is endemic to the Choctawhatchee River drainage. The type locality is Sikes' Creek, a tributary of the [West Fork] Choctawhatchee River, Barbour County, Alabama (Ortmann and Walker, 1922). It is historically known from 40 localities, 12 of which were too vague to be georeferenced (Figure 28). We resurveyed 22 (79%) of the known historical localities and sampled upstream and downstream of the other 6 sites. We found *Q. burkei* at 7 (32%) historical locations and 26 (19%) new locations. The Tapered Pigtoe was absent throughout much of its historical range and is located at isolated spots in the headwaters, the Flat Creek watershed, and the main channel and some tributaries in Florida. Williams et al. (1993) considered *Q. burkei* to be threatened. Lydeard et al. (1999) considered this species imperiled. *Quincuncina burkei* is recognized as a candidate species for protection under the Endangered Species Act of 1973, as amended. We consider the Tapered Pigtoe to be imperiled.

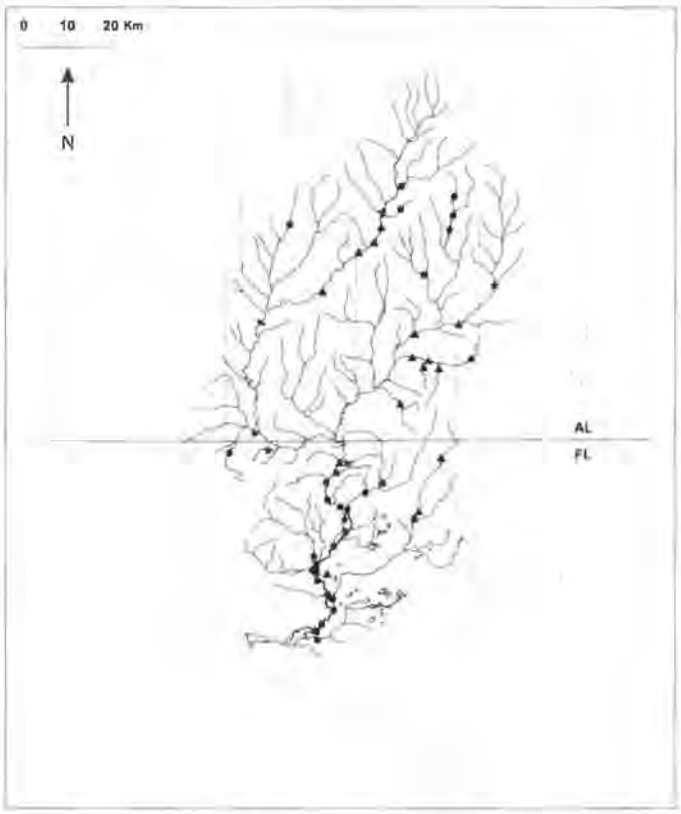

Figure 28. Historical and recent distribution of *Quincuncina burkei* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

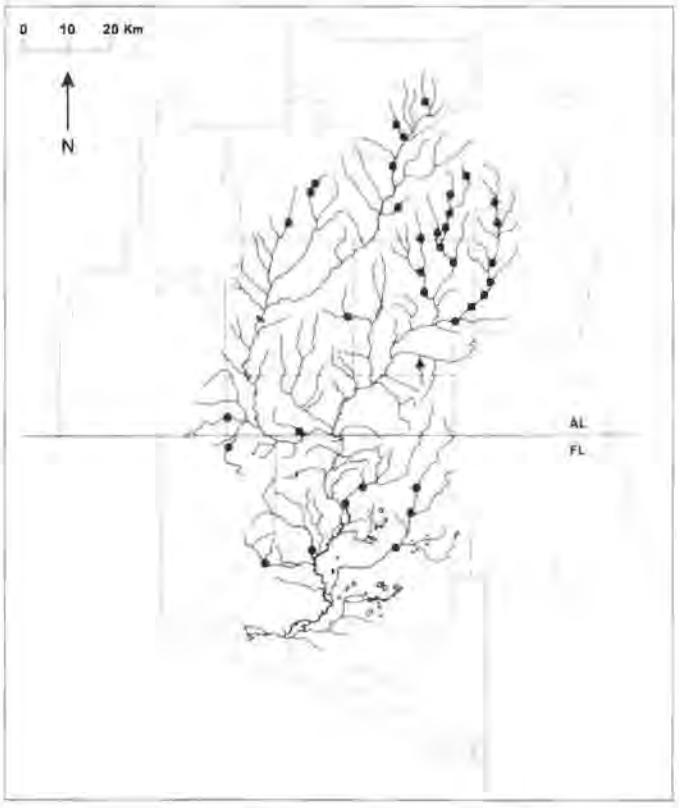

Figure 29. Historical and recent distribution of *Toxolasma* sp. within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ● = recent occurrence only.

Toxolasma sp.
Gulf Lilliput

Clench and Turner (1956) refer to *Toxolasma* from the Choctawhatchee and eastern Gulf of Mexico drainages as *Corunculina paula* (Lea, 1840). Ortmann (1924) discussed soft tissue anatomy of *Carunculina paula* (= *Toxolasma* sp.) and noted that the specimens examined from the Choctawhatchee River drainage were not different from *Carunculina parva* (= *T. parvus*). Burch (1975) provided an explanation for the inconsistent spelling of the genus *Carunculina*. Buchanan (1980) placed *Carunculina* in synonymy with *Toxolasma*. Brim Box and Williams (2000) restricted *T. paulus* to the Apalachicola River drainage and eastward. Based on shell morphology *Toxolasma* in the Choctawhatchee River drainage are easily distinguishable from *T. parvus* and *T. paulus*. We consider the Choctawhatchee River *Toxolasma* to be undescribed.

The total range of *Toxolasma* sp. has not been determined. In the Choctawhatchee River drainage, this species is known from two historical sites, one of which we could not precisely locate for georeferencing (Figure 29). We resurveyed the georeferenced historical site and did not locate any *Toxolasma* specimens. We found *Toxolasma* sp. at 36 (26%) new locations. Though the total range can not be defined for *Toxolasma* sp. at this time, we believe it will represent a species endemic to the Escambia, Yellow, and Choctawhatchee river drainages or be endemic to only the Choctawhatchee River drainage. Therefore, we currently consider this species to be rare within the Choctawhatchee River drainage.

Uniomerus tetralasmus
(Say, 1831)
Pondhorn

Clench and Turner (1956) referred to *Uniomerus obesus* (Lea, 1831) within the Choctawhatchee River drainage. In this publication we follow Johnson (1970, 1972) and recognize *U. tetralasmus* from the Choctawhatchee River drainage. The distribution of *U. tetralasmus* extends throughout the Mississippi Basin from the Ohio River

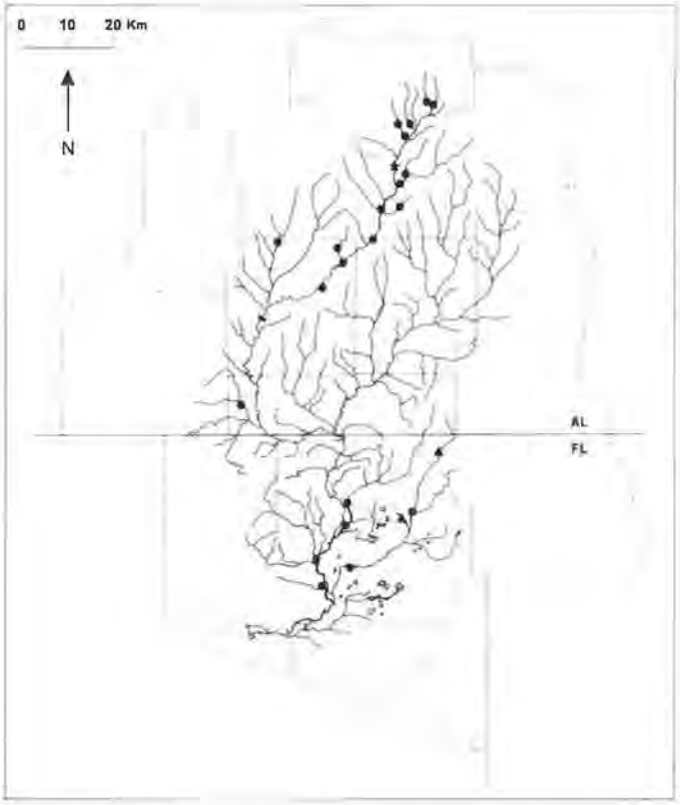

Figure 30. Historical and recent distribution of *Uniomerus tetralasmus* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

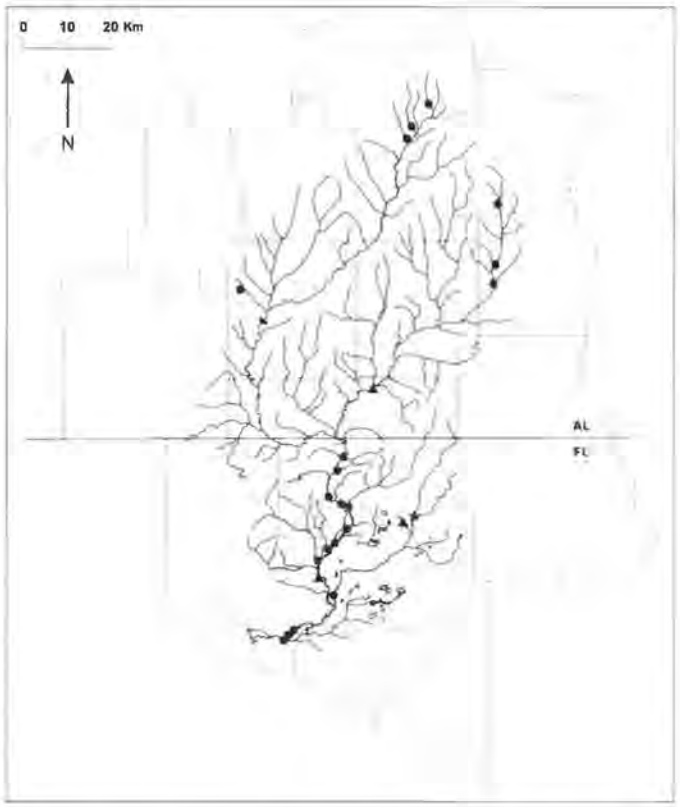

Figure 31. Historical and recent distribution of *Utterbackia imbecillis* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★= both historical and recent occurrences; ● = recent occurrence only.

drainage south to the Gulf Coast, and from the Nueces River drainage, Texas (Howells et al., 1996), east to the Choctawhatchee River drainage in Alabama and Florida (Williams et al., in prep.). This species is known from five historical sites, two of which were too vague to be georeferenced (Figure 30). We resurveyed 1 (33%) of the historical sites and *U. tetralasmus* was present. We also located *U. tetralasmus* at 21 (15%) new sites. The Pondhorn is considered currently stable throughout its range (Williams et al., 1993; Lydeard et al., 1999; Williams et al., in prep.). We consider *U. tetralasmus* currently stable within the Choctawhatchee River drainage.

Utterbackia imbecillis
(Say, 1829)
Paper Pondshell

Clench and Turner (1956) referenced this species as *Anodonta imbecillis*. Based on a phylogenetic analysis of *Anodonta*, Hoeh (1990) recognized three genera, *Anodonta*, *Pyganodon*, and *Utterbackia*. The Paper Pondshell was placed in the genus *Utterbackia*.

The distribution of *Utterbackia imbecillis* extends throughout the Interior Basin and from the Gulf drainages of Texas (Howells et al., 1996), east to the southern end of peninsular Florida (Williams, pers. obs.). On the Atlantic Coast, it occurs from the Gunpowder River drainage, Maryland (Johnson, 1970) to the Satilla River drainage, Georgia (Williams, pers. obs.). It also has been documented from the Ocklawaha River system and lakes within the St. Johns River drainage, Florida (Williams, pers. obs.). *Utterbackia imbecillis* is known from five historical sites, one of which could not be precisely located for georeferencing (Figure 31). We resurveyed 3 (75%) historical sites and found *U. imbecillis* at only 1 (33%). We also located *U. imbecillis* at 20 (15%) new sites. *Utterbackia imbecillis* is considered currently stable throughout its range (Williams et al., 1993; Lydeard et al., 1999; Brim Box and Williams, 2000; Williams et al., in prep.). We consider *U. imbecillis* to be currently stable throughout the Choctawhatchee River drainage.

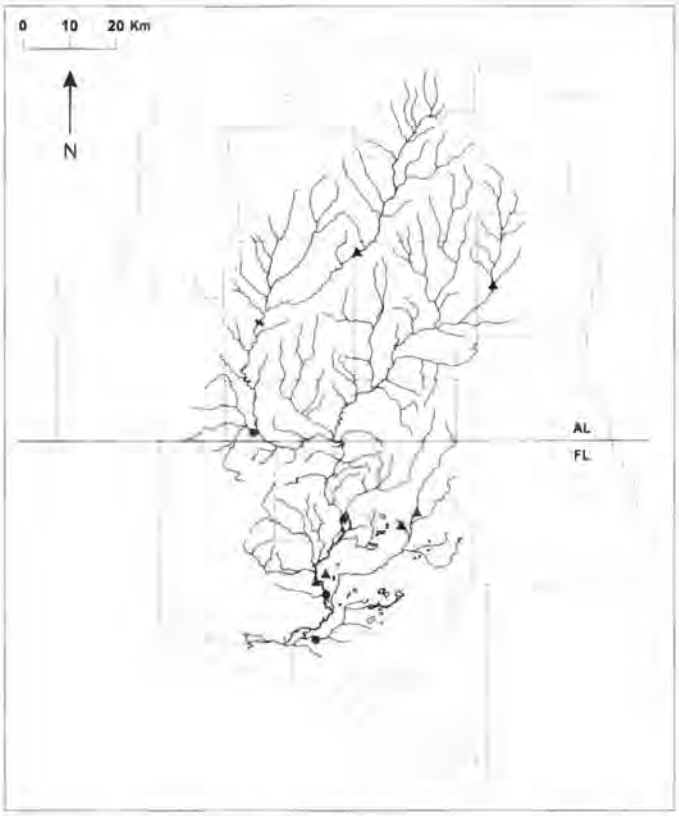

Figure 32. Historical and recent distribution of *Utterbackia peggyae* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ● = recent occurrence only.

Utterbackia peggyae
(Johnson, 1965)
Florida Floater

This species was first described as *Anodonta peggyae*. After a phylogenetic analysis, Hoeh (1990) placed *A. peggyae* in the genus *Utterbackia*. The distribution of *Utterbackia peggyae* includes Gulf Coast drainages from the Escambia River, Florida, east to the Ochlockonee River, Florida (Bogan and Hoeh, 1995). *Utterbackia peggyae* is known from eight historical sites within the Choctawhatchee River drainage, two of which had vague locality data and could not be georeferenced (Figure 32). We resurveyed 3 (50%) of the historical sites and did not locate *U. peggyae*. However, we did locate *U. peggyae* at 4 (3%) new sites. Williams et al. (1993), Lydeard et al. (1999), and Brim Box and Williams (2000) considered this species currently stable. Williams et al. (in prep.) considered the Florida Floater endangered in the Escambia and Yellow river drainages. We consider *U. peggyae* to be imperiled within the Choctawhatchee River drainage.

Villosa choctawensis
Athearn, 1964
Choctaw Bean

Originally considered endemic to the Choctawhatchee River drainage, *Villosa choctawensis* is also known from the Escambia and Yellow river drainages (Butler, 1989; Williams et al., in prep.). The type locality is the Choctawhatchee River, 2 miles SW of Caryville, about 1 mile downstream of US Hwy 90, Holmes County, Florida. Johnson (1967) provided additional records for this species within the Choctawhatchee River drainage to supplement Athearn's (1964) work. *Villosa choctawensis* is known from six historical sites within the Choctawhatchee River drainage (Figure 33). We resurveyed 3 (50%) of the known historical sites and located *V. choctawensis* at 2 (67%). We also located 20 (15%) new sites with populations of *V. choctawensis*. Williams et al. (1993) considered *V. choctawensis* threatened throughout its range. Lydeard et al. (1999) reported the Choctaw Bean as imperiled throughout its range. Williams et al. (in prep.) considered the Choctaw Bean endangered in the Escambia and

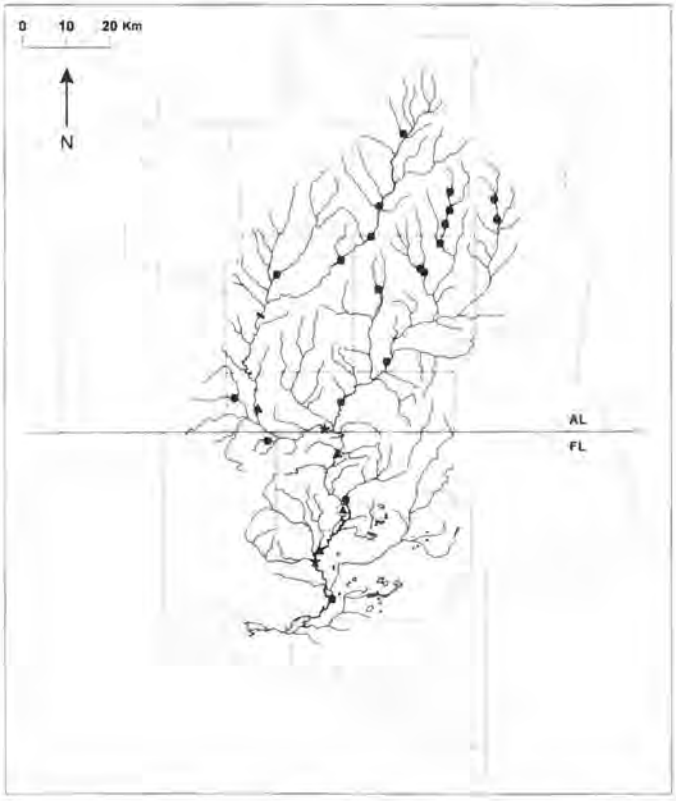

Figure 33. Historical and recent distribution of *Villosa choctawensis* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ⏏ = historical occurrence at type locality; ★ = both historical and recent occurrences; ● = recent occurrence only.

Yellow river drainages. *Villosa choctawensis* is recognized as a candidate species for protection under the Endangered Species Act of 1973, as amended. We consider the Choctaw Bean to be a species of special concern within the Choctawhatchee River drainage.

Villosa lienosa
(Conrad, 1834b)
Little Spectaclecase

Simpson (1900) referred to the Little Spectaclecase as *Lampsilis lienosus*. In a discussion of soft anatomy, Ortmann (1924) referenced specimens from the Choctawhatchee River drainage as *Micromya lienosa concestator*. *Villosa* was erected as a subgenus by Frierson (1927) and was subsequently elevated to generic level and applied to the Little Spectaclecase as *Villosa lienosa* by Clench and Turner (1956).

The distribution of *Villosa lienosa* includes the Interior Basin from the Missouri and the Lower Ohio river drainages south to the Gulf Coast, and Gulf drainages from the San Jacinto River, Texas (Howells et al., 1996), east to the Suwannee River drainage in Florida (Clench and Turner, 1956). *Villosa lienosa* is known from 18 historical sites throughout the Choctawhatchee River drainage, 6 of which could not be precisely located for georeferencing (Figure 34). We resurveyed 11 (92%) historical sites and located *V. lienosa* at 6 (55%). We also located *V. lienosa* at 79 (58%) new sites. The Little Spectaclecase is considered currently stable throughout its range (Williams et al., 1993; Lydeard et al., 1999; Brim Box and Williams, 2000; Williams et al., in prep.). We consider *V. lienosa* to be currently stable within the Choctawhatchee River drainage.

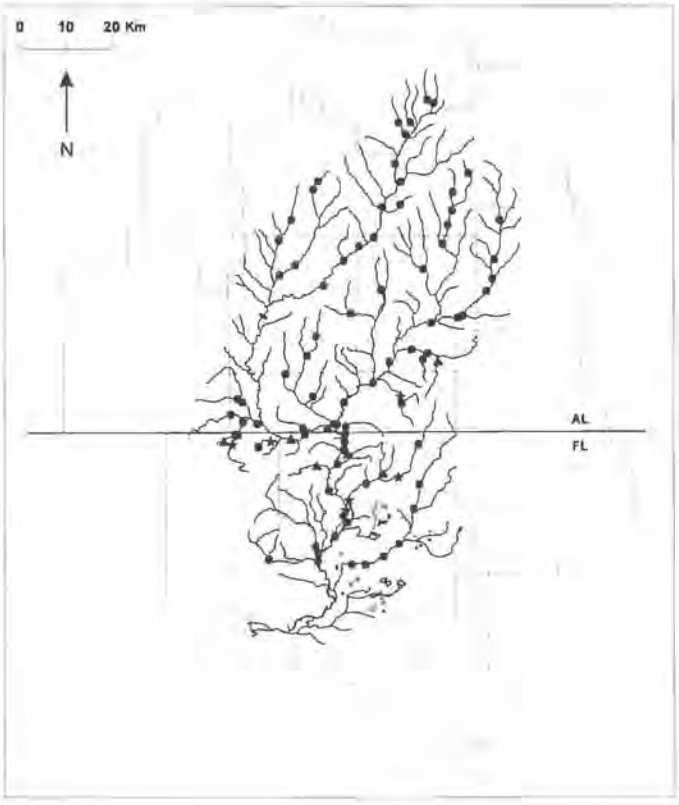

Figure 34. Historical and recent distribution of *Villosa lienosa* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

Villosa vibex
(Conrad, 1834a)
Southern Rainbow

Ortmann (1924) discussed shell nacre and soft anatomy of *Villosa vibex* from the Choctawhatchee River drainage under the name *Micromya vibex*. See the comments under *Villosa lienosa* concerning the change of the genus name from *Micromya* to *Villosa*.

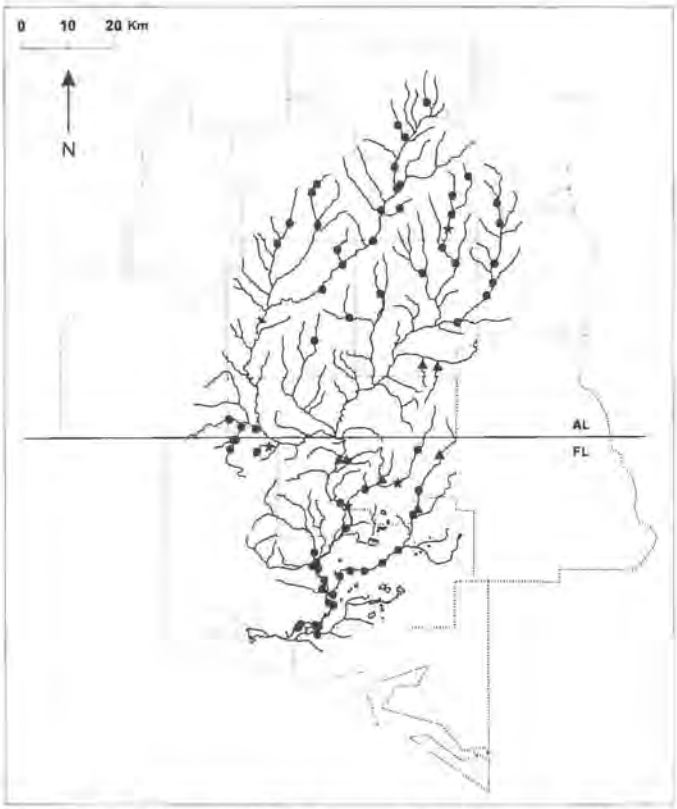

Figure 35. Historical and recent distribution of *Villosa vibex* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ★ = both historical and recent occurrences; ● = recent occurrence only.

The distribution of *Villosa vibex* includes Gulf Coast drainages from the Amite River, Louisiana, east to the Hillsborough River drainage, Florida (Butler, 1989; Vidrine, 1993). In Atlantic Coast drainages, *V. vibex* can be located from coastal ponds of the Cape Fear River drainage, North Carolina, south to the St. Marys River drainage, Florida (Johnson, 1970; Butler, 1989). Within the Choctawhatchee River drainage, *V. vibex* is known from 18 historical sites, 7 of which could not be precisely located for georeferencing (Figure 35). We resurveyed 8 (73%) of the historical sites and located *V. vibex* at 4 (50%). We also located *V. vibex* at 66 (49%) new sites. The Southern Rainbow is considered currently stable throughout its range (Williams et al., 1993; Lydeard et al., 1999; Brim Box and Williams, 2000; Williams et al., in prep.). Within the Choctawhatchee River drainage, we also consider *V. vibex* to be currently stable.

Villosa villosa
(Wright, 1898)
Downy Rainbow

The distribution of *Villosa villosa* includes Gulf Coast drainages from the Escambia River, Florida, east to the Myakka River, Florida (Butler, 1989; Athearn, pers. comm.). It also occurs within the St. Marys and St. Johns river drainages, Florida, on the Atlantic Slope (Johnson, 1972). The Downy Rainbow is not known from Alabama. *Villosa villosa* is known from three historical sites within the Choctawhatchee River drainage (Figure 36). We resurveyed 2 (67%) of the georeferenced historical sites and did not find any individuals of *V. villosa*. We did locate *V. villosa* at 5 (4%) new sites. Williams et al. (1993) considered *V. villosa* to have a conservation status of special concern throughout its range. Brim Box and Williams (2000) considered the Downy Rainbow to be of special concern in the Apalachicola River drainage. This species may be extirpated in the Escambia River drainage (Williams, pers. obs.). Within the Choctawhatchee River drainage, we consider *V. villosa* to be imperiled.

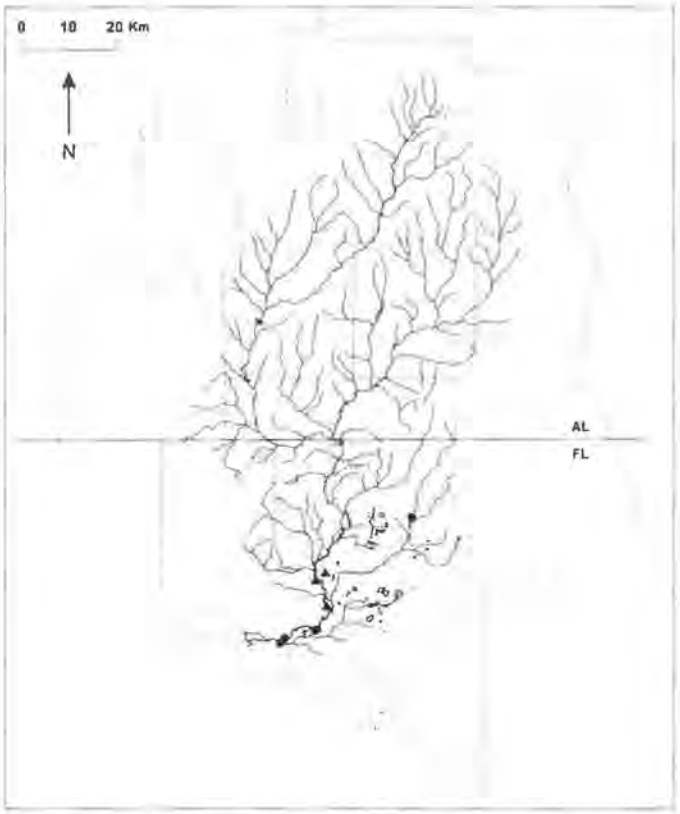

Figure 36. Historical and recent distribution of *Villosa villosa* within the Choctawhatchee River drainage of Alabama and Florida. ▲ = historical occurrence only; ● = recent occurrence only.

DISCUSSION

Changes in species composition over time within the Choctawhatchee River drainage were documented in this study. The drainage currently supports 20 of the 23 (87%) species known from the drainage. While two species (*Amblema plicata* and *Medionidus acutissimus*) appear to be extirpated from this portion of their historical ranges and one species, *Lampsilis haddletoni,* may be extinct, overall species composition has appeared to increase at historical sites. The apparent increase in species richness at historical sites is due to the documented presence of common or generalist species with currently stable conservation status.

Additionally, *Arcidens confragosus* (Say, 1829), the Rock Pocketbook, was reported from the Choctawhatchee River drainage by Clarke (1981) based on a collection made by Spillman. However, after reviewing this record (USNM 86169) and other records of material collected by Spillman in the early to mid-1800s, we determined that the record of *A. confragosus* within the Choctawhatchee River drainage is not valid and the locality data presented by Clarke (1981) are incorrect. We base this decision on the following information: 1) USNM 86169 labeled "Enterprise, Alabama" is the only historical or recent record that exists in all the collections and sites that were examined as a part of this study, 2) Clarke (1981) added without notation "Double Bridge[s] Creek" and "Coffee Co." in the material examined and these data are not on the original label, 3) Double Bridges Creek near Enterprise is not suitable habitat for *A. confragosus,* 4) *A. confragosus* is absent from river systems directly to the east (Apalachicola River) and west (Yellow and Escambia rivers) which generally share a similar fauna with the Choctawhatchee River, 5) there are three other settlements named Enterprise in Alabama and all are within

the range of *A. confragosus*, and 6) there is another collection made by Spillman for *Megalonaias nervosa* (USNM 83985) that is labeled "Tombigbee River, Enterprise."

Our documentation of species not previously reported from historical sites and species absent from historical sites may represent changes in metapopulation dynamics (Strayer and Fetterman, 1999). However, we attribute finding previously unreported species at historical sites to a more thorough effort to examine all habitat types using a variety of methods, with a sizable crew, for lengthy periods of time, and to report every species found. The nature of past sampling effort is largely unknown (i.e., potentially not recording/depositing vouchers of every species collected, lost collections, not searching all habitats, size of crew, duration of sampling effort, and efficiency of collectors). Several of the historical collectors were known to work independently, walking the stream with a rake, or looking for siphons and could easily miss species that burrow deeply, inhabit shallow bank areas instead of channels, or inhabit areas among tree and plant roots (Obermeyer, 1998). Some of the species that we found that were previously unreported from historical sites were likely present historically, but not vouchered or reported. Based on our level of sampling effort, we attribute the absence of species at historical sites to a localized extirpation or a decrease in population abundance to an undetectable level.

Some of the species recently located at historical sites where they were previously unreported are not common (I, R or SC). Though the mean number of imperiled species at historical sites has declined over time, the declines were not statistically significant. We attribute the lack of statistical significance of this decline to the lack of power to detect modest declines. Strayer (1999) suggests that presence/absence data from 30 sites has enough statistical power to only detect the most severe (≥ 70%) faunal declines, and failure to statistically detect small and modest declines in a species range does not rule out the fact that the species may be declining.

Though we sampled many new sites within the Choctawhatchee River drainage and located new sites with unionids present, several threats exist in the Choctawhatchee River drainage that may put the fauna at risk. Our observations of potential threats included destruction of riparian zones at several sites, oily films across the water surface of some sites, and absent or inadequate best management practices at bridge/road construction, agriculture, and silviculture sites. Also, one or more impoundments are planned within the drainage (USDA SCS and USDA Forest Service, 1993). The negative effects of riparian zone loss, hydrologically altered water regimes due to impoundments, and effects of agricultural and silvicultural practices have been discussed in detail by Neves et al. (1997). Few data are available to assess the impacts of petroleum product toxicity on all life stages of freshwater mussels (Keller et al., 1998). Additionally, preliminary analysis has indicated that glochidia are sensitive to the contaminant body burden of the host fish (Kernaghan et al., unpubl. data).

Several species known from the Choctawhatchee River drainage are offered protection under the Endangered Species Act of 1973, as amended. Based on the recent survey data, we consider the overall fauna of the Choctawhatchee River drainage highly imperiled with 4% imperiled, possibly extinct; 9% imperiled, possibly extirpated from the drainage; 26% imperiled; 13% rare; 13% special concern; and 35% currently stable. The unionid fauna of the Choctawhatchee River drainage is characterized by a high degree of endemism to the drainage or to a relatively small number of East Gulf Coastal Plain drainages. Within the Choctawhatchee River drainage, unionid species richness is isolated to a few key areas (Figures 11 and 12), especially the upper Pea River, Alabama; East and West forks of the Choctawhatchee River, Alabama; Flat Creek watershed in Alabama and Florida; and the main channel of the Choctawhatchee River in Florida. These areas supporting mussel richness are isolated from one another by extensive stream reaches where only a few, if any, unionids were collected (Figure 13). The area that is devoid of mussels correlates to a geological formation that is characterized by an entrenched channel between lime rock walls, and coarse, shifting sand substrates. After a recent flood (March 1998), the state of Alabama removed over 4.5 m (in depth) of sand from a boat ramp on the Pea River within this area. The nature of the geologic formation and frequent flooding/sediment movements in the Choctawhatchee River drainage may limit this intermediate area from supporting unionid communities continuous with the remainder of the drainage. The Choctawhatchee River drainage is the only area that supports *Hamiota australis*, *Pleurobema strodeanum*, and *Villosa choctawensis* at more than a few sites (Williams et al., in prep.) and the only river drainage that supports *Elliptio mcmichaeli*, *Ptychobranchus jonesi*, and *Quincuncina burkei*. Protective habitat measures in areas with unique biodiversity and imperiled species will increase the probability of preventing the extinction or extirpation of additional species.

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