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Freshwater Mussels in the Gulf Region: Alabama

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focus on gaining a better understanding of overall mussel genetics as well as examine the problems or benefits of mixing gene pools that have been isolated for less than a century. Another potential problem that should be investigated is flooding populations with specimens propagated from too few individuals.

Recovery plans for most federally protected mussels call for establishment of new populations throughout their historical ranges. This plan entail transplantation of specimens within river systems and possibly between river systems. Because these populations will be isolated, genetic considerations may not be as important as in augmentation of existing populations. However, a better understanding of mussel genetics would be valuable prior to moving mussels from place to place.

Culture technology.—Production of juvenile mussels with host fish has been performed for many years. However, recent advances in rearing technology have allowed maintenance of juveniles for much longer periods than were previously possible. Rearing juveniles to larger sizes enhances survival after release into the wild. Further research in the area of culture technology is needed to continue perfection of optimal diets and decrease juvenile mortality.

Artificial culture, circumventing the host fish by using an artificial medium, may simplify mussel propagation in the future. Benefits of using this method include eliminating the added effort and expense required to collect or rear fish and keep them alive for extended periods. Currently, mussels can be cultured with artificial media, but the mortality rate is higher among artificially cultured juveniles than among those transformed by traditional fish host methods. Several aspects of artificial culture are in need of research. One important aspect is evaluation of culture media for possible missing elements that may be necessary for survival past the early juvenile stage. Specificity of culture media among mussel taxa should also be investigated.

Pollution tolerance.—Much is known about toxicity of various compounds to mussels. However, gaps in our knowledge exist. Included in future studies should be a determination of suitability of current toxicity testing protocols to protect the various life history stages of freshwater mussels.

Nuisance species.—Several species of mollusks, including the Asiatic clam (*Corbicula fluminea*), zebra mussel (*Dreissena polymorpha*), and New Zealand mud snail (*Potamopyrgus antipodarum*), have been introduced into the waters of North America. All of these species compete with native mussels for food and space. The Asiatic clam is well established in the southeastern United States. Though the Asiatic clam can reach densities of several hundred per square meter, native mussel populations appear to have adjusted to its presence. The effects of zebra mussels on native species are well documented in more northerly areas. However, populations of zebra mussels in the southeast have not yet reached densities high enough to cause problems. Efforts to develop strategies for control of zebra mussels, which have been underway for several years, should continue. Though the New Zealand mud snail is not currently found in the southeastern United States, future consideration should be afforded this snail, which could appear in the region in the near future.

In addition to developing strategies to deal with exotic nuisance species, one line of research has been aimed at developing a protocol and holding facilities for native freshwater mussels in jeopardy of extinction because of competition with exotic species. These efforts should continue as a last ditch effort against extinction of critically imperiled taxa.

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FRESHWATER MUSSELS IN THE GULF REGION: ALABAMA.—The southeastern United States has the greatest diversity of freshwater bi-

TABLE 1. Margaritiferid and unionid species in Alabama, common name, and conservation status.

Species[a]	Common name[a]	Conservation status[b]			
		National status	Current status in Alabama[c]		
Margaritiferidae					
Cumberlandia monodonta (Say)	Spectaclecase	T	I	State listed	
Margaritifera marrianae R. I. Johnson	Alabama pearlshell	E	I	State listed	
Unionidae					
Actinonaias ligamentina (Lamark)	Mucket	CS	I		
A. pectorosa (Conrad)	Pheasantshell	SC	Possibly A*		
Alasmidonta marginata Say	Elktoe	SC	SC		
Alasmidonta mccordi Athearn	Coosa elktoe	E*	I*		
A. triangulata (Say)	Triangle floater	—	I		
A. virdis (Rafinesque)	Slippershell mussel	SC	SC	State listed	
Amblema plicata (Conrad)	Threeridge	CS	CS		
A. elliottii (Lea)	Coosa fiveridge	—	U		
Anodonta suborbiculata Say	Flat floater	CS	CS		
Anodontoides radiatus (Conrad)	Rayed creekshell	SC	SC		
Arcidens confragosus (Say)	Rock pocketbook	CS	CS		
Cyclonaias tuberculata (Rafinesque)	Purple wartyback	SC	CS		
Cyprogenia stegaria (Rafinesque)	Fanshell	E	E, 1991	State listed	A*
Dromus dromas (Lea)	Dromedary pearlymussel	E	E, 1976	State listed	A*
Ellipsaria lineolata (Rafinesque)	Butterfly	SC	CS		
Elliptio arca (Conrad)	Alabama spike	T	I		
E. arctata (Conrad)	Delicate spike	SC	SC		
E. chipolaensis Walker	Chipola slabshell	T	T, 1998	State listed	A*
E. complanata (Lightfoot)	Eastern elliptio	CS	CS		
E. crassidens (Lamark)	Elephantear	CS	CS		
E. dilatata (Rafinesque)	Spike	CS	CS		
E. fraterna (Lea)	Brother spkie	E	I*		
E. icterina (Conrad)	Variable spike	CS	CS		
E. mcmichaeli Clench and Turner	Fluted elephantear	SC	SC		
E. nigella (Lea)	Winged spike	E	I*		
Elliptoideus sloatianus (Lea)	Purple bankclimber	T	A*		
Epioblasma arcaeformis (Lea)	Sugarspoon	E*	I*		
E. biemarginata (Lea)	Angled riffleshell	E*	I*		
E. brevidens (Lea)	Cumberlandian combshell	E	E, 1997	State listed	

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TABLE 1. Continued.

Species[a]	Common name[a]	Conservation status[b]			
		National status	Current status in Alabama[c]		
E. capsaeformis (Lea)	Oyster mussel	E	E, 1997	State listed	
E. flexuosa (Rafinesque)	Leafshell	E*	I*		
E. florentina florentina (Lea)	Yellow blossom	E*	E*, 1976	State listed	
E. haysiana (Lea)	Acornshell	E*	I*		
E. lenior (Lea)	Narrow catspaw	E*	I*		
E. lewisii (Walker)	Forkshell	E*	I*		
E. metastriata (Conrad)	Upland combshell	E	E, 1993	State listed	A*
E. obliquata obliquata (Rafinesque)	Catspaw	E	E, 1990	State listed	A*
E. othcaloogensis (Lea)	Southern acornshell	E	E, 1993	State listed	A*
E. penita (Conrad)	Southern combshell	E	E, 1987	State listed	A*
E. personata (Say)	Round combshell	E*	I*		
E. propinqua (Lea)	Tennessee riffleshell	E*	I*		
E. stewardsonii (Lea)	Cumberland leafshell	E*	I*		
E. torulosa torulosa (Rafinesque)	Tubercled blossom	E*	I*	State listed	
E. triquetra (Rafinesque)	Snuffbox	T	I		
E. turgidula (Lea)	Turgid blossom	E*	E*, 1976	State listed	
Fusconaia barnesiana (Lea)	Tennessee pigtoe	SC	SC		
F. cerina (Conrad)	Gulf pigtoe	CS	CS		
F. cor (Conrad)	Shiny pigtoe	E	E, 1976	State listed	
F. cuneolus (Lea)	Fine-rayed pigtoe	E	E, 1976	State listed	
F. ebena (Lea)	Ebonyshell	CS	CS		
F. escambia Clench and Turner	Narrow pigtoe	T	I	State listed	
F. subrontunda (Lea)	Longsolid	SC	SC		
F. succissa (Lea)	Purple pigtoe	SC	SC		
Glebula rotundata (Lamark)	Round pearlshell	CS	CS		
Hemistena lata (Rafinesque)	Cracking pearlymussel	E	E, 1989	State listed	A*
Lampsilis abrupta (Say)	Pink mucket	E	E, 1976	State listed	
L. altilis (Conrad)	Finelined pocketbook	T	T, 1993	State listed	
L. australis Simpson	Southern sandshell	T	I	State listed	
L. binominata Simpson	Lined pocketbook	E*	I*		
L. cardium Rafinesque	Plain pocketbook	SC	SC		
L. fasciola Rafinesque	Wavyrayed lampmussel	CS	SC		
L. haddletoni Athearn	Haddleton lampmussel	E	I		
L. ornata (Conrad)	Southern pocketbook	SC	SC		

TABLE 1. Continued.

Species[a]	Common name[a]	Conservation status[b]			
		National status	Current status in Alabama[c]		
L. ovata (Say)	Pocketbook	SC	SC		
L. perovalis (Conrad)	Orangenacre mucket	T	T, 1993	State listed	
L. straminea claibornensis (Lea)	Southern fatmucket	CS	CS		
L. s. straminea (Conrad)	Rough fatmucket	SC	CS		
L. subangulata (Lea)	Shinyrayed pocketbook	T	T, 1998	State listed	
L. teres (Rafinesque)	Yellow sandshell	CS	CS		
L. virescens (Lea)	Alabama lampmussel	E	E, 1976	State listed	
Lasmigona complanata alabamensis Clarke	Alabama heelsplitter	SC	SC		
L. c. complanata (Barnes)	White heelsplitter	CS	SC		
L. costata (Rafinesque)	Flutedshell	CS	CS		
L. holstonia (Lea)	Tennessee heelsplitter	SC	SC		
L. subviridis (Conrad)	Green floater	T	A*		
Lemiox rimosus (Rafinesque)	Birdwing pearlymussel	E	I		A*
Leptodea fragilis (Rafinesque)	Fragile papershell	CS	CS		
L. leptodon (Rafinesque)	Scaleshell	E	A*		
Lexingtonia dolabelloides (Lea)	Slabside pearlymussel	T	I	State listed	
Ligumia recta (Lamark)	Black sandshell	SC	SC		
L. subrostrata (Say)	Pondmussel	CS	CS		
Medionidus acutissimus (Lea)	Alabama moccasinshell	T	T, 1993	State listed	
M. conradicus (Lea)	Cumberland moccasinshell	SC	SC	State listed	
M. mcglameriae van der Schalie	Tombigbee moccasinshell	E*	I*		
M. parvulus (Lea)	Coosa moccasinshell	E	E, 1993	State listed	
M. penicillatus (Lea)	Gulf moccasinshell	E	E, 1998		
Megalonaias nervosa (Rafinesque)	Washboard	CS	CS		
Obliquaria reflexa Rafinesque	Threehorn waryback	CS	CS		
Obovaria jacksoniana (Frierson)	Southern hickorynut	SC	SC		
O. olivaria (Rafinesque)	Hickorynut	CS	CS		
O. retusa (Lamark)	Ring pink	E	E, 1989	State listed	
"O." rotulata (Wright)	Round ebonyshell	E	I		
O. subrotunda (Rafinesque)	Round hickorynut	SC	SC		
O. unicolor (Lea)	Alabama hickorynut	SC	SC		
Pegias fabula (Lea)	Littlewing pearlymussel	E	E, 1998	State listed	A*
Plectomerus dombeyanus (Valenciennes)	Bankclimber	CS	CS		
Plethobasus cicatricosus (Say)	White wartyback	E	E, 1976	State listed	

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TABLE 1. Continued.

Species[a]	Common name[a]	Conservation status[b]			
		National status	Current status in Alabama[c]		
P. cooperianus (Lea)	Orangefoot pimpleback	E	E, 1976	State listed	
P. cyphyus (Rafinesque)	Sheepnose	T	I	State listed	
Pleurobema altum (Conrad)	Highnut	E	I*		
P. avellanum Simpson	Hazel pigtoe	E	I*		
P. chattanoogaense (Lea)	Painted clubshell	E	I*		
P. clava (Lamark)	Clubshell	E	E, 1993	State listed	A*
P. cordatum (Rafinesque)	Ohio pigtoe	SC	SC		
P. curtum (Lea)	Black clubshell	E	E, 1987	State listed	A*
P. decisum (Lea)	Southern clubshell	E	E, 1993	State listed	
P. flavidulum (Lea)	Yellow pigtoe	U	I*		
P. furvum (Conrad)	Dark pigtoe	E	E, 1993		
P. georgianum (Lea)	Southern pigtoe	E	E, 1993	State listed	
P. hagleri (Frierson)	Brown pigtoe	—	I*		
P. hanleyanum (Lea)	Georgia pigtoe	E	I*		A*
P. johannis (Lea)	Alabama pigtoe	U	I*		
P. marshalli Frierson	Flat pigtoe	E	E, 1987	State listed	A*
P. murrayense (Lea)	Coosa pigtoe	E	I*		
P. nucleopsis (Conrad)	Longnut	E	I*		
P. oviforme (Conrad)	Tennessee clubshell	SC	SC		
P. perovatum (Conrad)	Ovate clubshell	E	E, 1993	State listed	
P. plenum (Lea)	Rough pigtoe	E	E, 1976	State listed	
P. rubrum (Rafinesque)	Pyramid pigtoe	—	I	State listed	
P. pyriforme (Lea)	Oval pigtoe	E	E, 1998	State listed	
P. rubellum (Conrad)	Warrior pigtoe	E	I*		
P. sintoxia (Rafinesque)	Round pigtoe	—	I	State listed	
P. strodeanum (Wright)	Fuzzy pigtoe	SC	I		
P. taitianum (Lea)	Heavy pigtoe	E	E, 1987	State listed	
P. troschelianum (Lea)	Alabama clubshell	E	I*		
P. verum (Lea)	True pigtoe	E	I*		
Potamilus alatus (Say)	Pink heelsplitter	CS	CS		
P. inflatus (Lea)	Inflated heelsplitter	T	T, 1990	State listed	
P. ohiensis (Rafinesque)	Pink papershell	CS	CS		
P. purpuratus (Lamark)	Bleufer	CS	CS		
Ptychobranchus fasciolaris (Rafinesque)	Kidneyshell	CS	SC		

TABLE 1. Continued.

Species[a]	Common name[a]	Conservation status[b]			
		National status	Current status in Alabama[c]		
P. greenii (Conrad)	Triangular kidneyshell	E	E, 1993	State listed	
P. jonesi (van der Schalie)	Southern kidneyshell	T	I	State listed	
P. subtentum (Say)	Fluted kidneyshell	SC	I	State listed	A*
Pyganodon cataracta (Say)	Eastern floater	CS	CS		
P. grandis (Say)	Giang floater	CS	CS		
Quadrula apiculata (Say)	Southern mapleleaf	CS	CS		
Q. asperata (Lea)	Alabama orb	SC	CS		
Q. cylindrica cylindrica (Say)	Rabbitsfoot	T	I	State listed	
Q. fragosa (Conrad)	Winged mapleleaf	E	E, 1991		A*
Q. intermedia (Conrad)	Cumberland monkeyface	E	E, 1976	State listed	A*
Q. metanevra (Rafinesque)	Monkeyface	CS	CS		
Q. nodulata (Rafinesque)	Wartyback	CS	CS		
Q. pustulosa pustulosa (Lea)	Pimpleback	CS	CS		
Q. quadrula (Rafinesque)	Mapleleaf	CS	CS		
Q. rumphiana (Lea)	Ridged mapleleaf	SC	SC		
Q. stapes (Lea)	Stirrupshell	E	E, 1987		
Quincuncina burkei Walker	Tapered pigtoe	T	I		
Q. infucata (Conrad)	Sculptured pigtoe	SC	SC		
Strophitus connasaugaensis (Lea)	Alabama creekmussel	SC	SC		
S. subvexus (Conrad)	Southern creekmussel	SC	SC		
S. undulata (Say)	Creeper	CS	Possibly A*		
Toxolasma corvunculus (Lea)	Southern purple lilliput	U	I		
T. cylindrellus (Lea)	Pale lilliput	E	E, 1976	State listed	
T. lividus (Rafinesque)	Purple lilliput	SC	SC		
T. parvus (Barnes)	Lilliput	CS	CS		
T. paulus (Lea)	Irridescent lilliput	CS	CS		
Tritogonia verrucosa (Rafinesque)	Pistolgrip	CS	CS		
Truncilla donaciformis (Lea)	Fawnsfoot	CS	I		
T. truncata Rafinesque	Deertoe	CS	SC		
Uniomerus caroliniana (Bosc)	Florida pondhorn	CS	CS		
U. declivus (Say)	Tapered pondhorn	CS	CS		
U. tetralasmus (Say)	Pondhorn	CS	CS		
Utterbackia imbecillis Say	Paper pondshell	CS	CS		
U. peggyae (Johnson)	Florida floater	CS	CS		

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TABLE 1. Continued.

Species[a]	Common name[a]	Conservation status[b]		
		National status	Current status in Alabama[c]	
Villosa choctawensis Athearn	Choctaw bean	T	I	State listed
Villosa fabalis (Lea)	Rayed bean	SC	SC	A*
V. iris (Lea)	Rainbow	CS	CS	
V. lienosa (Conrad)	Little spectaclecase	CS	CS	
V. nebulosa (Conrad)	Alabama rainbow	T	CS	
V. taeniata (Conrad)	Painted creekshell	CS	CS	
V. trabalis (Conrad)	Cumberland creekshell	E	E, 1976	
V. vanuxemensis umbrans (Lea)	Coosa creekshell	SC	SC	
V. v. vanuxemensis (Lea)	Mountain creekshell	SC	SC	
V. vibex (Conrad)	Southern rainbow	CS	CS	

[a] Scientific and common names follow Turgeon et al. (1998) with the exception of *Potamilus inflatus*, which is the inflated heelsplitter not the Alabama heelsplitter.

[b] Conservation status follows Williams et al. (1993) for entire distribution and Garner, Hartfield, and Williams (unpubl. data) for Alabama. The conservation status for the entire range of the species and at the state level is identical if only one is given. Federally listed species are denoted as E = endangered, T = threatened, followed by the date of listing. Species not protected under the Federal Endangered Species Act are considered imperiled (I = species considered endangered or threatened by professional biologists, but not formally protected by the Endangered Species Act), special concern (SC), currently stable (CS), undetermined (U), presumed extinct (E* if federally listed, I* if not federally listed), extirpated in Alabama (A*).

[c] State-listed = species that are afforded protection at the state level.

valves or mussels of the families Margaritiferidae and Unionidae in the world (Williams et al., 1993; Lydeard and Mayden, 1995; Williams and Neves, 1995; Neves et al., 1997). Ninety-one percent (269 species) of the 297 species of the United States and Canada are found in the Southeast. Alabama is the most diverse state in the United States, with 177 species (Table 1) representing nearly 60% of all species found in the United States and Canada (Lydeard and Mayden, 1995; Williams and Neves, 1995; Neves et al., 1997). Tennessee has the second highest number of species (132 species), followed by Kentucky (103 species) and Georgia (98 species) (Neves et al., 1997).

The tremendous diversity of freshwater unionacean bivalves in Alabama can be attributed to the history of the drainages in which the organisms are found (Ward et al., 1992). Three major and several minor coastal river watersheds drain Alabama and adjacent states and flow into the northeastern Gulf of Mexico. The major drainages include the Mobile, Tennessee, and Apalachicola rivers; the minor rivers include the Escatawpa, Perdido, Escambia, Blackwater, Yellow and Choctawhatchee in the southeastern part of the state. Another factor contributing to the wealth of diversity of freshwater bivalves is the presence of a distinct array of physiographic regions including the Cumberland Plateau, Valley and Ridge, Piedmont, and Coastal Plain. The different physiographic regions possess a variety of unique geological and hydrological features that influence the physicochemical features of the drainages found within them. Many of the larger rivers within Alabama have flowed since Mesozoic times, allowing ample time for isolation and subsequent speciation. The aforementioned factors are largely responsible for the species richness of freshwater bivalves found in the state and a rich diversity of other aquatic organisms as well, including fishes, turtles, and gastropods (Lydeard and Mayden, 1995).

Freshwater mussels play a prominent role in many river and stream ecosystems and have a fossil record dating back to the Triassic Period over 200 million years ago. They are a large component of the total biomass of many aquatic ecosystems, serve as a food source for many organisms, and filter wastes from the water (McMahon, 1991). Freshwater mussels have a fascinating life history. Males release sperm into the water column, the sperm are taken up by females via their inhalent siphons, and eggs are fertilized internally. Females brood larvae (=glochidia) in specially modified compartments of their gills, called marsupia. Variation exists among species with regard to types of brood chambers as well as to the number of gill chambers modified as marsupia (McMahon, 1991). Brooding periods may be relatively short, with glochidia released during the same summer that fertilization took place, or relatively long, with glochidia held in the marsupia over winter. Females release the glochidia in a variety of manners, and many species have evolved elaborate mechanisms to attract appropriate fish hosts (e.g., Haag et al., 1995; Hartfield and Butler, 1997). Glochidia attach to the gills or fins of fish, depending on the bivalve species, and eventually metamorphose and drop off to begin life on the river bottom. Freshwater mussels are either host generalists (glochidia metamorphose on a variety of fish species) or host specialists (one or very few fish species are used); however, hosts of many unionacean species remain unknown. Numerous specific species accounts can be found in Cummings et al. (1997) and Parmalee and Bogan (1998). Freshwater mussels are long lived, with some species having life spans estimated at more than 50 yr. Reviews of the general ecology and physiology of unionid bivalves can be found in McMahon (1991) and Parmalee and Bogan (1998).

Conservation status.—Unionids are one of the most endangered groups of animals in the world, with 70% of the species considered imperiled (i.e., formally listed species via the Endangered Species Act or informally considered threatened or endangered; Williams et al., 1993; Neves et al., 1997; Master et al., 1998).

The conservation status of unionid and margaritiferid species in Alabama is as follows: 29 species (16.4%) are presumed extinct; 23 (12.9%) species are extirpated from Alabama but still exist outside the state; 43 (24.3%) species or subspecies are listed as endangered or threatened via the Endangered Species Act of 1973, as amended; 53 (29.9%) species are afforded some protection by the state; 31 (17.5%) species are of special concern; and 46 (25.9%) are currently stable.

The primary threat to freshwater bivalves is habitat destruction and/or modification. The most dramatic form of habitat destruction is impoundment of flowing waters. Most major rivers and streams of North America have been impounded (Benke, 1990), which completely alters the physical, chemical, and biological aspects of the ecosystem. Many mollusk species above and below impoundments have been lost largely because of the building of dams (Williams et al., 1992; Neves et al., 1997). In-

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deed, Alabama's Coosa River has lost more than a dozen bivalve and 36 gastropod species after the impoundment of nearly the entire mainstem (Neves et al., 1997). Some land-use practices also have a negative impact on Alabama bivalves. These practices include poor forestry and agricultural practices and poorly planned urban and suburban development. Inadequate precautions during these activities result in pesticides, herbicides, fertilizers, and other contaminants being washed into nearby rivers and streams. Construction and development along streams, without maintaining adequate riparian buffer zones, result in sediment washing into the streams. Additionally, replacement of natural ground cover with buildings, driveways, and parking lots elevates runoff levels, which can cause increased stream-bank erosion.

The introduction of nonnative species such as the zebra mussel (*Dreissena polymorpha*) has negatively impacted freshwater unionids. The zebra mussel currently occurs in low densities throughout the Tennessee River within the boundaries of the state of Alabama but has not been documented in Mobile Basin or Gulf Coast streams. Further details on causes of freshwater mussel decline can be found in Neves et al. (1997).

Efforts are ongoing to protect species in a variety of ways, including artificial propagation, genetic studies, and development of watershed management strategies (Burkhead et al., 1997; Neves, 1997; Shute et al., 1997).

Regulation and commercial harvest.—Unionids have been exploited by humans since prehistoric times. Initially, they served as a valuable resource for Native Americans, providing tools, food, and jewelry. Evidence for the use of mussels by Native Americans can be found along many rivers and streams of the southeastern United States in the form of shell middens (Parmalee and Bogan, 1998). During the late 1800s and early 1900s, freshwater mussels were harvested for button production, but this industry collapsed after WWII and the arrival of plastic buttons. Since the mid-1900s, freshwater mussels have been exported to Japan for the cultured pearl industry. Freshwater mussels are sliced, and beads produced from the shells are inserted into pearl oysters to serve as "seeds" or nuclei for pearl production. Jenkinson and Todd (1997) provided an excellent review of the history of freshwater mussel resource management. Specific state accounts can be found in Cummings et al. (1993). Between 1993 and 1998, 70–99% of the annual commercial harvest in Alabama came from the Tennessee River (mostly Pickwick and Wheeler reservoirs); most of the remainder came from the Alabama and Coosa rivers, with small amounts of shell harvested from the Black Warrior and Tombigbee rivers (Garner, unpubl.). Because of the effects of impoundment, the composition of unionid populations has changed, resulting in shifts among species valued for export (Ahlstedt and McDonough, 1993). For example, an 8 mile reach of Wheeler Reservoir in 1957 contained approximately 39 million individual mussels, of which 21 million were the commercially important *Pleurobema cordatum.* In 1991, estimates decreased to only 14 million mussels, of which the most abundant was the commercially undesirable *Elliptio crassidens.* Today, the most important commercial species are *Megalonaias nervosa* and *Fusconaia ebena,* but other commercial species include *Amblema plicata, Quadrula quadrula, Quadrula metanevra, Quadrula apiculata, Tritogonia verrucosa, Fusconaia ebena,* and *Obliquaria reflexa.*

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