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RESULTS OF A SURVEY OF THE MUSSEL FAUNA AT SELECTED STATIONS IN THE BLACK WARRIOR RIVER SYSTEM, ALABAMA, 2009-11

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ABSTRACT

During the summers of 2009-11 sampling for mussels in the Black Warrior River system yielded 26 species from 16 main channel and 73 tributary stations. A cumulative total of 8.0 hours bottom time was spent sampling main channel stations (average 0.5 hour per station) and 82 hours in tributaries (average 0.9 hour per station). Main channel collections yielded 675 live or fresh dead individuals. The most numerically dominant and frequently encountered species there were *Plectomerus dombeyanus*, the Bankclimber (9 stations, 28.4 collected per hour), *Quadrula apiculata*, the Southern Mapleleaf (11 stations, 23.8 collected per hour), and *Obliquaria reflexa*, the Threehorn Wartyback (11 stations, 22.0 collected per hour). The federally listed threatened species *Potamilus inflatus*, Inflated Heelsplitter, was collected live at two main channel stations. Many tributary stations upstream of the Fall Line near Tuscaloosa yielded no evidence of mussels or only fresh or weathered dead shells. Some notable exceptions were a few Locust Fork and Blackburn Fork stations, where six species were collected live. Weathered dead valves of *Elliptio arctata*, Delicate Spike, a Highest Conservation Priority species in Alabama, were found in Locust Fork, and a badly eroded valve of what may be *Pleurobema rubellum*, the Warrior Pigtoe, was collected from Davis Creek. Mussels were encountered more frequently and often in greater abundance in Coastal Plain tributaries downstream of Tuscaloosa. *Hamiota perovalis*, Orangenacre Mucket, a federally listed threatened species, was found live at two stations in Fivemile Creek in Hale County and was the only federally listed species found in a tributary.

INTRODUCTION

The mussel and fish faunas of the Mobile River Basin are noteworthy for their high degrees of endemism and diversity. Those phenomena can be attributed to the large size of the basin, numerous habitat types available due to the diverse physiography of the basin, geographic barriers such as the Fall Line, and the proximity of the basin to adjacent drainages with diverse faunas (Williams, 1982). Hinkley (1906) reported 40 mussel species from the Tombigbee River system alone, while Williams and others (1992) reported that 50 species were known to have

occurred in the upper Tombigbee River system (upstream of the confluence of the Tombigbee and Black Warrior Rivers) and 48 in the Black Warrior system, adjusted to taxonomic revisions in recent decades. Williams and others (2008), in a comprehensive review of the mussels of Alabama, tallied 51 species known from the Black Warrior system. Hartfield (1990) reported on species collected from 16 main channel Locust Fork stations and 14 additional stations among Gurley, Mud, Turkey, and Valley Creeks, Blackburn Fork, and Little Warrior River.

While the mussel population in Alabama remains among the most diverse on Earth, significant declines in many areas of the state have been documented (see Williams and others, 2008, for a review). Some of the cause of declines in abundance and diversity can be attributed to the effects of anthropogenic factors such as impoundment, eutrophication, sedimentation, pollution, and channel modifications and resultant population fragmentation of mussels and their obligate fish hosts suppressing gene flow and causing a steep and possibly fatal decline in the fauna (Hartfield, 1994; Mott and Hartfield, 1994). With the rapid increase in urbanization and associated pollution and uncontrolled runoff from mining, farming, and silvicultural activities leading to sharply elevated sediment loads and nutrification, many areas of the state face further declines if measures to protect the habitat of mussels and their host fishes are not established and enforced.

In 1990 the U.S. Fish and Wildlife Service assessed the mussel fauna at 73 stations in the Black Warrior River system, mostly at locations where historic records were available for comparison, but also at some stations where historic data were not available (Hartfield, 1990). Collections were made by hand while digging in the substrate for live mussels, walking stream banks and gravel bars collecting material cast up by the river, and with SCUBA gear in impounded reaches. No information on effort expended in collecting was reported for comparison. Sixteen collections were made in the Locust Fork proper and 14 among Blackburn Fork, Little Warrior River, and Gurley, Mud, Turkey and Valley Creeks. The best habitat reported for the main channel was between Alabama Highway 77 near Warrior downstream to the mouth of Shoal Creek. No mussels were found upstream of the confluence of Blackburn Fork. Only 2 species were collected live from the main channel Locust Fork, 3 fresh dead, and 12 weathered dead or relict material only. The Locust Fork was silted in the upper reaches, likely due to truck farms, irrigation, chicken farming, and coal strip mining. Among the tributary

collections only a single weathered dead shell was found in Gurley Creek and a relict shell in Blackburn Fork.

The purpose of the present study is twofold: first, to document current populations of federally listed and State of Alabama Conservation Priority mussel species (Mirarchi, 2004) at selected stations in the Black Warrior River system; and second, to document other species in the system. It is hoped that information gathered during this study will serve as a guide for regulatory agencies to target streams worthy of some level of protection or enhancement, to provide stakeholders with information to guide them in appropriate activities to protect the existing fauna and foster recovery of the fauna as a whole, and to help find sources of animals for propagation and streams appropriate for reintroductions.

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STUDY AREA

The Mobile River Basin is the largest Gulf of Mexico river basin east of the Mississippi River, draining about 43,683 square miles (mi^2) in Alabama, Mississippi, Georgia, and Tennessee, including 32,207 mi^2, or 62 percent, of the land area of Alabama (Mettee and others, 1996). The Tombigbee River system is the westernmost tributary of the Mobile Basin and drains an area of 19,984 mi^2 in Alabama and Mississippi, and the Black Warrior River drains 6,228 mi^2 in north-central Alabama (fig. 1). Sampling in the main channel Black Warrior River extended from the tailwater of Oliver Lock and Dam at Black Warrior River mile (BWM) 113.6 upstream in the Oliver and Holt Pools to the Bankhead Lock and Dam tailwater at BWM 146.6. Tributary stations were selected based on accessibility and presence of suitable habitat for target species. Sampling locations were determined with the aid of Black Warrior River charts, DeLorme's Atlas and Gazetteer, and hand-held Global Positioning System (GPS) units.

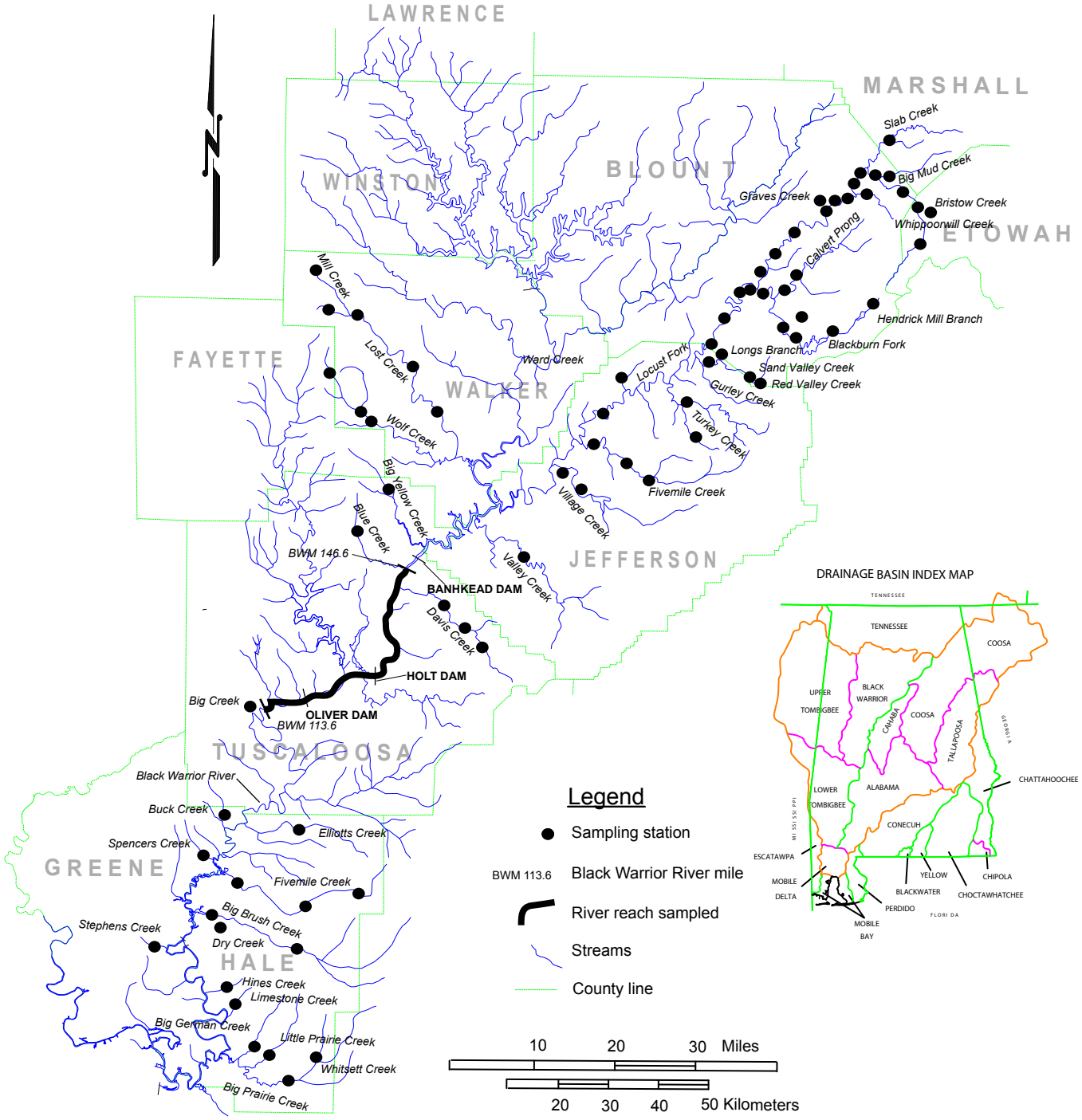

Figure 1. Map of the study area showing mussel sampling locations.

METHODS

Mussel sampling was performed at stations within the Black Warrior River system where mussels were known historically and in streams with no historic data available. Stations were accessed at bridge crossings, foot trails, or by boat. Mussel collections were made by hand, often with the aid of mask and snorkel in tributary stations and with a surface air source at main channel stations. Main channel stations were randomly selected on presumed presence of suitable habitat for mussels from the tailwater of Oliver Lock and Dam near Tuscaloosa upstream to the tailwater of Bankhead Lock and Dam in the Holt Pool.

Due to the nature of the project and limited sampling time and resources, a generally qualitative sampling protocol (timed search) was employed, with emphasis on sampling habitats favored by target species (Strayer and Smith, 2003). Sampling time was dictated by the habitat or fauna encountered at each station. If a meager fauna or poor quality habitat was encountered, we terminated our efforts at that station and moved to another sampling station. Stations where the potential for finding target species was highest (generally stable substrate with mixed sand, gravel, cobble, or boulders) received more attention; therefore, species that prefer other habitats may be underrepresented. Some collections were made incidental to sampling for unrelated projects and did not involve a concerted effort to find live animals.

Live animals were identified and returned to the stream where they were found. A few problematic specimens were retained for verification and possible genetic work and were deposited in the University of Alabama Malacological Collection. Representative specimens of shell material collected were retained and will be deposited in the North Carolina State Museum of Natural Sciences or the University of Alabama Malacological Collection. Nomenclature follows Williams and others (2008) and notes on species distributions were gleaned from Williams and others (2008) and Mirarchi (2004).

RESULTS AND DISCUSSION

During this project 16 stations were sampled in the main channel Black Warrior River and 73 in tributaries (table 1, fig. 1). Approximately 8.0 man hours of bottom time were spent sampling in the main channel (average 0.5 hour per station) and 82 man hours in tributaries (average about 0.9 man hour per station). An aggregate total of 31 species were collected, with

Table 1-Summary information for stations sampled in the Black Warrior River system, Alabama, 2009-11.

Locality[1]	County	Map coordinates
Main channel stations[1]		
BWM 113.6 opposite Snow's Drift in Clement Bend, Oliver tailwater	Tuscaloosa	N 33.1954° W 87.6794°
BWM 116.5, Oliver tailwater near mouth of Big Creek	Tuscaloosa	N 33.2028° W 87.6605°
BWM 118.5 downstream of Black Warrior Parkway, Oliver tailwater	Tuscaloosa	N 33.1972° W 87.6286°
BWM 121.3 near old Oliver Lock and Dam, Oliver Pool	Tuscaloosa	N 33.2113° W 87.5821°
BWM 122.0 at Bama Belle mooring facility, Oliver Pool	Tuscaloosa	N 33.2141° W 87.5723°
BWM 123.4 downstream of old lock wall near Tuscaloosa, Oliver Pool	Tuscaloosa	N 33.2304° W 87.5500°
BWM 123.6 upstream of old lock wall near Tuscaloosa, Oliver Pool	Tuscaloosa	N 33.2221° W 87.5459°
BWM 124.8, Oliver Pool upstream of U.S. Highway 82 bridge	Tuscaloosa	N 33.2241° W 87.5246°
BWM 126.3 downstream of Black Warrior Parkway bridge, Oliver Pool	Tuscaloosa	N 33.2395° W 87.5083°
BWM 128.0, Oliver Pool near Waterfalls Branch	Tuscaloosa	N 33.2524° W 87.4808°
BWM 129.1 upstream of Hurricane Creek mouth, Oliver Pool	Tuscaloosa	N 33.2529° W 87.4648°
BWM 133.3 upstream of Rocky Branch boat ramp, Holt Pool	Tuscaloosa	N 33.2811° W 87.4214°
BWM 137.5 upstream of Bluff Creek at Laurel Branch, Holt Pool	Tuscaloosa	N 33.3184° W 87.4140°
BWM 141.4 downstream of Harold's Lake, Holt Pool	Tuscaloosa	N 33.3715° W 87.4095°
BWM 144.4 opposite mouth of Davis Creek, Holt Pool	Tuscaloosa	N 33.4090° W 87.3945°
BWM 146.6 at mouth of Blue Creek, Holt Pool/Bankhead tailwater	Tuscaloosa	N 33.4365° W 87.3796°
Black Warrior River tributary stations		
Big Prairie Creek at Alabama Highway 25 near Prairie Eden	Hale	N 32.5360° W 87.5994°
Whitsett Creek near confluence with Big Prairie Creek at CR 10	Hale	N 32.5644° W 87.5602°
Little Prairie Creek at County Road 9 near Prairie Eden	Hale	N 32.5929° W 87.6464°
Big German Creek at County Road 16 near Cedarville	Hale	N 32.6124° W 87.6835°
Limestone Creek at County Road 24 and County Road 17 intersection	Hale	N 32.6787° W 87.7224°
Hines Creek at County Road 17 S of Sawyerville	Hale	N 32.7082° W 87.7364°
Stehpens Creek at U.S. Highway 43 S of Eutaw	Greene	N 32.7993° W 87.8972°
Big Brush Creek at Alabama Highway 60 near Wedgeworth	Hale	N 32.8198° W 87.7537°
Dry Creek at County Road 30 near Wedgeworth	Hale	N 32.8034° W 87.7604°
Big Brush Creek at County Road 19 NW of Greensboro	Hale	N 32.7688° W 87.6158°
Fivemile Creek at County Road 42 near Akron	Hale	N 32.8901° W 87.7302°
Fivemile Creek at Alabama Highway 69 near Harper Hill	Hale	N 32.8296° W 87.6041°
Fivemile Creek at Alabama Highway 25 near Water Oak	Hale	N 32.8601° W 87.4607°
Spencers Creek downstream of U.S. Highway 43 near Knoxville and Eutaw	Greene	N 32.9310° W 87.7883°
Buck Creek at County Road 86 SE of I-59/20 near Ralph and Knoxville	Greene	N 33.0036° W 87.7535°
Elliotts Creek at County Road 50 E of Moundville	Hale	N 32.9833° W 87.5725°
Big Creek at Commerce Road W of Malisham Parkway	Tuscaloosa	N 33.2066° W 87.6668°
Davis Creek at County Road 59 near Kellerman	Tuscaloosa	N 33.3882° W 87.2969°

Davis Creek at Hannah Road	Tuscaloosa	N 33.3319° W 87.2375°
Davis Creek downstream of County Road 99 near Pattersontown	Tuscaloosa	N 33.3104° W 87.2221°
Blue Creek at Alabama Highway 69	Tuscaloosa	N 33.5218° W 87.4849°
Big Yellow Creek at Alabama Highway 69	Tuscaloosa	N 33.5684° W 87.4080°
Wolf Creek at Alabama Highway 18 W of Oakman	Walker	N 33.7088° W 87.4777°
Wolf Creek alongside County Road 173	Walker	N 33.7300° W 87.4724°
Wolf Creek at Wolf Creek Road upstream of Alabama Highway 102	Fayette	N 33.7994° W 87.5334°
Lost Creek at County Road 20 W of Parrish and E of Oakman	Walker	N 33.7250° W 87.3111°
Lost Creek at Pleasant Grove Road SW of New Jagger	Walker	N 33.8025° W 87.3679°
Lost Creek at Alabama Highway 118 near Carbon Hill	Walker	N 33.8816° W 87.5098°
Mill Creek at Radiant City Road near Spring Hill, 2 mi SW of Nauvoo	Walker	N 33.9705° W 87.5378°
Lost Creek at Haley Bottoms Road near Kansas community	Walker	N 33.9019° W 87.5710°
Locust Fork and tributary stations		
Valley Creek near Oak Grove at Lock 17 Road (Co. Road 54)	Jefferson	N 33.4469° W 87.1225°
Village Creek at Elbow Porter Road near West Jefferson Power Plant	Jefferson	N 33.6274° W 87.0531°
Village Creek at Mulga Mine near Maytown	Jefferson	N 33.5666° W 87.0025°
Locust Fork at shoal 1 mile downstream of railroad bridge	Jefferson	N 33.6792° W 87.0026°
Fivemile Creek at U.S. Highway 78 near Graysville	Jefferson	N 33.6636° W 86.9709°
Fivemile Creek at Brookside Road near Brookside	Jefferson	N 33.6398° W 86.9161°
Fivemile Creek at Upper Coalburg on Coalburg Road	Jefferson	N 33.6060° W 86.8541°
Ward Creek at County Road 140 (Warrior-Jasper Road)	Jefferson	N 33.7641° W 86.9249°
Turkey Creek at Morris-Majestic Road 0.5 mile W of Crosston	Jefferson	N 33.7292° W 86.7391°
Turkey Creek at Turkey Creek Road in Turkey Creek Nature Preserve	Jefferson	N 33.7046° W 86.6948°
Gurley Creek at County Road 133 near Trafford	Jefferson	N 33.8023° W 86.7532°
Sand Valley Creek at Narrows Road (unnumbered county road)	Blount	N 33.7853° W 86.6483°
Red Valley Branch at Red Valley Road and Sand Valley Road	Blount	N 33.7776° W 86.6375°
Longs Branch at County Road 22 near County Line community	Blount	N 33.8388° W 86.7272°
Locust Fork at Dean's Ferry Bridge on County Road 22	Blount	N 33.8463° W 86.7274°
Locust Fork at County Road 43, Vaughn's Bridge, on Wallston Road	Blount	N 33.8893° W 86.6955°
Locust Fork at County Road 13	Blount	N 33.9459° W 86.6691°
Locust Fork at shoal 0.5 mi downstream of Blackburn Fork confluence	Blount	N 33.9354° W 86.6442°
Blackburn Fork at low water bridge on Jerry Marsh Road	Blount	N 33.9351° W 86.6159°
Calvert Prong at Moss Bridge on Deavers Town Road	Blount	N 33.3508° W 86.5825°
Calvert Prong at County Road 33	Blount	N 33.9773° W 86.5272°
Blackburn Fork at Hendrick Mill on House Road off County Road 15	Blount	N 33.8798° W 86.5805°
Hendrick Mill Branch at County Road 15 near Limestone Springs	Blount	N 33.8771° W 86.5677°
Blackburn Fork at Alabama Highway 75 near Remlap	Blount	N 33.8566° W 86.5632°
Blackburn Fork at Blount County Road 27	Blount	N 33.8654° W 86.4435°
Blackburn Fork at Blount County Road 20	Blount	N 33.9059° W 86.3934°
Locust Fork at Alabama Highway 160 near Nectar	Blount	N 33.9803° W 86.6159°

Locust Fork at Swann Bridge W of Cleveland	Blount	N 33.9978° W 86.6015°
Locust Fork at U.S. Highway 231 N of Cleveland	Blount	N 34.0236° W 86.5733°
Graves Creek at Hamilton Mountain Road off Alabama Highway 79	Blount	N 34.0567° W 86.5644°
Locust Fork at Royal (Riverside) on County Road 26	Blount	N 34.0674° W 86.4934°
Locust Fork at Ward's Mill Bridge near Susan Moore	Blount	N 34.0979° W 86.4571°
Locust Fork at County Road 30 near Susan Moore	Blount	N 34.0996° W 86.4353°
Whippoorwill Creek unnumbered county road S of County Road 14	Blount	N 34.1057° W 86.4123°
Locust Fork at County Road 14 (Stracener Bridge)	Blount	N 34.1143° W 86.4387°
Locust Fork at U.S. Highway 278 near Snead	Blount	N 34.1313° W 86.4140°
Slab Creek at County Road 39	Marshall	N 34.1948° W 86.3619°
Locust Fork at Alabama Highway 75 near Snead and Highmound	Blount	N 34.1347° W 86.3850°
Big Mud Creek at County Road 21	Blount	N 34.1354° W 86.3720°
Locust Fork at County Road 36 just N of U.S. Highway 278	Blount	N 34.1111° W 86.3622°
Locust Fork at unnumbered county road 1 mile NE of Walnut Grove	Etowah	N 34.0844° W 86.2892°
Bristow Creek at Bud Umphrey Road near Pine Grove	Etowah	N 34.0881° W 86.2573°
Locust Fork at Dee Nix Road near Altoona	Etowah	N 33.9956° W 86.3103°

[1] BWM = Black Warrior River mile

16 found in the main channel and 26 in tributaries, with 11 species common to both habitats (tables 2, 3).

A cumulative total of 675 mussels either live or represented by fresh dead shells were collected in main channel Black Warrior River stations, for a catch per unit effort (CPUE) of 84.4 mussels/hour. The most numerically dominant and frequently encountered species there were the Bankclimber, *Plectomerus dombeyanus* (9 stations, CPUE 28.4), the Southern Mapleleaf, *Quadrula apiculata* (11 stations, CPUE 23.8), and the Threehorn Wartyback, *Obliquaria reflexa* (11 stations, CPUE 22.0). Four individuals of the federally threatened Inflated Heelsplitter, *Potamilus inflatus*, were collected, with three live individuals collected in the Oliver Lock and Dam tailwater at BWM 118.5 near the Black Warrior Parkway Bridge, and one live individual near the city of Tuscaloosa at BWM 122.0. A breakdown of species encountered among the main channel stations is presented in table 2.

Mussels in the main channel Black Warrior were usually found in areas of stable gravel and sand sometimes mixed with cobble and boulders and generally having varying levels of silt deposition. The two most downstream main channel collections (BWM 113.6 and 116.5, table 1, fig. 1), located in the Oliver Lock and Dam tailwater just downstream of the Fall Line on the Coastal Plain, had relatively poor habitat and little effort was spent sampling there. Habitat generally improved with upstream progression in the main channel. Habitat in the Oliver and Holt pools was comprised primarily of fairly stable gravel and sand substrates with occasional cobble, boulders, woody debris, and bedrock with some areas of mud, often with a layer of fine silt in eddies and areas protected from the current. Visibility was often 3 to 4 feet with a light source.

During this study 43 stations were sampled in the Locust Fork system, with 17 in the main channel and 26 in selected tributaries (table 1, fig. 1). A cumulative total of 16 species was collected with 9 represented by live animals or fresh dead shells, compared to 17 reported by Hartfield (1990) (total 24 between the two studies) (table 4). Nine species were common to both studies.

The lower reaches of the main channel of Locust Fork and the lower reach of its major tributary, Blackburn Fork, yielded the most diverse and abundant populations. Most tributaries yielded few or no mussels. Hartfield (1990) reported 2 species live, 3 fresh dead, and 12 as weathered dead or relict shells from main channel Locust Fork stations, a single weathered dead

Table 2.—Overview of freshwater mussels collected in the Black Warrior River, Alabama, 2009.

Species	Status[1]	Results of sampling, summer 2009
Anodonta suborbiculata, Flat Floater	P4	Two live individuals were found in the upper reach of Holt Pool; these are the first main channel Black Warrior records of this adventitious species.
Arcidens confragosus, Rock Pocketbook	P3	Two live individuals were found in the Oliver Pool near Tuscaloosa.
Lampsilis teres, Yellow Sandshell	P5	Live individuals were frequently encountered throughout the study area.
Lasmigona alabamensis, Alabama Heelsplitter	P3	Live individuals were frequently encountered throughout the study area.
Leptodea fragilis, Fragile Papershell	P5	Live individuals were frequently encountered throughout the study area.
Megalonaias nervosa, Washboard	P5	A few live individuals were found at two stations in the upper reach of Holt Pool.
Obliquaria reflexa, Threehorn Wartyback	P5	The third most frequently encountered and numerically abundant species encountered, it was common throughout the study area.
Plectomerus dombeyanus, Bankclimber	P5	The most frequently encountered and numerically abundant species encountered, it was common throughout the study area.
Potamilus inflatus, Inflated Heelsplitter	T, P2	Four live individuals were encountered at two stations, one downstream of Oliver Dam and one in the Oliver Pool near Tuscaloosa.
Potamilus purpuratus, Bleufer	P5	Live individuals were frequently encountered throughout the study area.
Pyganodon grandis, Giant Floater	P5	A few live individuals were found at several scattered stations in the study area.
Quadrula apiculata, Southern Mapleleaf	P5	The second most frequently encountered and numerically abundant species encountered, it was common throughout the study area.
Quadrula asperata, Alabama Orb	P5	Only one live individual of this otherwise common and widespread Mobile Basin endemic was encountered in the Oliver Pool near Tuscaloosa.
Quadrula rumphiana, Ridged Mapleleaf	P4	A fairly commonly encountered species, especially in the Holt Pool; it can be difficult to distinguish from *Quadrula apiculata*, with some evidence of intergradation.
Toxolasma parvum, Lilliput	P3	A single live individual of this diminutive species was found in the Holt Pool.
Utterbackia imbecillis, Paper Pondshell	P5	A few live individuals and fresh dead shells of this common and widespread species were found.

[1] T=federally listed threatened; Alabama priority conservation ranks follow Mirarchi (2004): P2=High Conservation Concern, P3=Moderate Conservation Concern, P4=Low Conservation Concern, P5=Lowest Conservation Concern.

Table 3. — Overview of freshwater mussels collected in tributaries of the Black Warrior River, Alabama, 2009-11.

Species	Status[1]	Results of sampling
Amblema plicata, Threeridge	P5	Weathered dead valves were found in Locust Fork at Dean's Ferry Bridge and Blount County Road 13.
Anodontoides radiatus, Rayed Creekshell	P2	Live animals were found in Fivemile Creek and Bucks Creek downstream of Tuscaloosa.
Ellipsaria lineolata, Butterfly	P4	Fresh dead shells were found in Locust Fork.
Elliptio arctata, Delicate Spike	P1	Weathered dead valves were found in Locust Fork at Vaughn's Bridge.
Fusconaia cerina, Gulf Pigtoe	P5	Live animals and fresh dead shells were found in Big Brush and Fivemile Creeks and weathered dead valves in Limestone Creek downstream of Tuscaloosa.
Hamiota perovalis, Orangenacre Mucket	P2, T	Live animals were found in Fivemile Creek downstream of Tuscaloosa.
Lampsilis ornata, Southern Pocketbook	P4	Live animals were found in Blackburn Fork and in Locust Fork at Dean's Ferry Bridge and Vaughn's Bridge, and dead shells were found at several nearby stations; live animals were found in Big Brush Creek downstream of Tuscaloosa.
Lampsilis straminea, Southern Fatmucket	P4	A relict shell was found in Turkey Creek in the Locust Fork system; it was frequently found in tributaries downstream of Tuscaloosa.
Lampsilis teres, Yellow Sandshell	P5	Live animals were found in Locust Fork at Dean's Ferry Bridge and Vaughn's Bridge and a weathered dead shell was found in Village Creek; live animals were found in Big Brush Creek downstream of Tuscaloosa.
Lasmigona alabamensis, Alabama Heelsplitter	P3	Fresh dead shells were found in Locust Fork at Vaughn's Bridge and at Blount County Road 13 and in Village Creek.
Leptodea fragilis, Fragile Papershell	P5	Weathered dead shells were found in Village Creek and fresh and weathered dead shells at several stations in Locust Fork.
Megalonaias nervosa, Washboard	P5	Weathered dead shells were found in Little Prairie Creek downstream of Tuscaloosa.
Obliquaria reflexa, Threehorn Wartyback	P5	Live animals were found in Locust Fork at Dean's Ferry Bridge and Vaughn's Bridge and weathered dead shells at Blount County Road 13.
Pleurobema rubellum, Warrior Pigtoe	X	One valve of a relic shell tentatively identified as this species was collected from Davis Creek.
Potamilus purpuratus, Bleufer	P5	A live animal and fresh and weathered dead material was found in Locust Fork; 25 live animals were found in Blackburn Fork; fresh and weathered dead shells were found in Village Creek; a weathered dead shell was found in Big Prairie Creek downstream of Tuscaloosa.
Pyganodon grandis, Giant Floater	P5	Weathered dead shells were found in Village Creek.

Species	Status[1]	Results of sampling
Quadrula apiculata, Southern Mapleleaf	P5	One weathered dead shell was found in Little Prairie Creek downstream of Tuscaloosa.
Quadrula asperata, Alabama Orb	P5	Weathered dead shells were found in Davis Creek; live animals were found in Locust Fork at Dean's Ferry Bridge and Vaughn's Bridge and in Big Brush and Fivemile Creeks downstream of Tuscaloosa.
Quadrula verrucosa, Pistolgrip	P4	Live animals were found in Blackburn Fork; in Locust Fork a few live animals were found downstream of the mouth of Blackburn Fork and at Blount County Road 13, and fresh dead shells were found at Vaughn's Bridge.
Strophitus subvexus, Southern Creekmussel	P3	A relic shell was found in Blue Creek; live animals were found in Big Brush Creek downstream of Tuscaloosa.
Toxolasma parvum, Lilliput	P3	A live animal was found in Big Brush Creek and weathered dead shells in Big German and Whitsett Creeks downstream of Tuscaloosa.
Unionidae	X	A weathered dead shell of a Unionid, probably *Lampsilis* sp., was found in Fivemile Creek at Brookside in the Locust Fork system.
Uniomerus tetralasmus, Pondhorn	P4	Live animals were found Fivemile Creek and fresh and weathered dead shells were found in Little Prairie, Big German, Limestone, and Stephens Creeks downstream of Tuscaloosa.
Utterbackia imbecillis, Paper Pondshell	P5	Weathered dead shells were found in Big German and Whitsett Creeks downstream of Tuscaloosa.
Villosa lienosa, Little Spectaclecase	P5	Fresh and weathered dead shells were found in Blue Creek; a weathered dead shell was found in Sand Valley Creek; numerous live animals and fresh and weathered dead shells were found in tributaries downstream of Tuscaloosa.
Villosa nebulosa, Alabama Rainbow	P3	Fresh dead shells were found in Blue Creek and weathered dead shells in Blackburn Fork.
Villosa vibex, Southern Rainbow	P5	Weathered dead shells were found in Blackburn Fork; fresh dead shells were found in Fivemile Creek downstream of Tuscaloosa.

[1] Alabama priority conservation ranks follow Mirarchi (2004): P1=Highest Conservation Concern, P2=High Conservation Concern, P3=Moderate Conservation Concern, P4=Low Conservation Concern, P5=Lowest Conservation Concern, X=not assigned; T=federally listed Threatened.

Table 4. — Comparison of freshwater mussel species in Locust Fork and tributaries reported by Hartfield (1990) and the current study.

Species	Status[1]	Conditions of species reported[2]	
		Hartfield (1990)	Current study
Amblema plicata, Threeridge	P5	--	W
Ellipsaria lineolata, Butterfly	P4	W	F
Elliptio arca, Alabama Spike	P5	W	--
Elliptio arctata, Delicate Spike	P1	W	W
Elliptio crassidens, Elephantear	P1	W	--
Fusconaia cerina, Gulf Pigtoe	P5	W	--
Lampsilis ornata, Southern Pocketbook	P4	L	L
Lampsilis straminea, Southern Fatmucket	P4	--	W
Lampsilis teres, Yellow Sandshell	P5	W	L
Lasmigona alabamensis, Alabama Heelsplitter	P3	W	F
Leptodea fragilis, Fragile Papershell	P5	L	F
Ligumia recta, Black Sandshell	P4	W	--
Megalonaias nervosa, Washboard	P5	W	--
Obliquaria reflexa, Threehorn Wartyback	P5	--	L
Obovaria sp.	--	W	--
Pleurobema furvum, Dark Pigtoe	P5	W	--
Potamilus purpuratus, Bleufer	P5	F	L
Pyganodon grandis, Giant Floater	P5	--	W
Quadrula asperata, Alabama Orb	P5	W	L
Quadrula rumphiana, Ridged Mapleleaf	P4	F	--
Quadrula verrucosa, Pistolgrip	P4	F	L
Villosa lienosa, Little Spectaclecase	P5	--	W
Villosa nebulosa, Alabama Rainbow	P3	--	W
Villosa vibex, Southern Rainbow	P5	--	W

[1] Alabama priority conservation ranks follow Mirarchi (2004):P1=Highest Conservation Concern, P3=Moderate Conservation Concern, P4=Low Conservation Concern, P5=Lowest Conservation Concern.

[2]F=fresh dead shells, L=live animals, W=weathered dead or relict shells, --=not collected.

shell of *Quadrula verrucosa* in Gurley Creek, and a relict shell of *Lampsilis teres* in Blackburn Fork. No mussels were found in the Locust Fork main channel upstream of the confluence of Blackburn Fork in either study. Extensive areas of bedrock and loose, unconsolidated substrate along with the effects of past mining and ongoing silvicultural, farming, and poultry production activities likely restrict mussel abundance in the upper reach of Locust Fork and tributaries. Species reported by Hartfield (1990) not found during the current study include *Elliptio arca*, *Elliptio crassidens*, *Fusconaia cerina*, *Ligumia recta*, *Megalonaias nervosa*, *Obovaria* sp., *Pleurobema furvum*, and *Quadrula rumphiana*. Further sampling at additional stations could possibly reveal some of these species, some of which are often found in larger streams than those sampled during this study. Additionally, a single fresh dead specimen of *Ptychobranchus greenii*, the Triangular Kidneyshell, a federally listed endangered species and Conservation Priority 1 species in Alabama, was collected in the main channel Locust Fork by Geological Survey of Alabama personnel in the mid-90s during an unrelated project.

Among the Coastal Plain tributaries 16 species were recorded, with 12 represented by live animals or fresh dead shells (table 3). While some smaller streams yielded no mussels, some yielded species typical of small Mobile River Basin streams or the headwaters of larger streams, such as the Gulf Pigtoe, *Fusconaia cerina*, the Southern Fatmucket, *Lampsilis straminea*, and the Little Spectaclecase, *Villosa lienosa.* However, a few streams such as Big German, Brush, Fivemile, and Prairie Creeks in Hale County yielded more diverse and abundant faunas and warrant some discussion.

A cumulative total of eight species was recorded from two stations in Fivemile Creek while one station yielded no mussels, likely due to locally heavy sedimentation (tables 1, 3, fig. 1). All eight species collected were represented by live animals, including the only federally listed species encountered in Coastal Plain tributaries downstream of Tuscaloosa, the Orangenacre Mucket, *Hamiota perovalis*, a Conservation Priority 2 species. The most downstream station sampled, at Hale County Road 42 near Akron, yielded six species and was characterized by moderate flow over stable gravel substrate (stained black) in runs and riffles, relatively stable sand with scattered woody debris in some reaches, and areas of coarse particulate organic matter and detritus in pools. Rip rap along a railroad bed provided further stability for a long stretch of the reach sampled. The riparian border aside from the railroad grade is protected by extensive forest cover providing stable banks and canopy. The most upstream

station sampled in Fivemile Creek, at Alabama Highway 25, yielded a single live *H. perovalis* among six species, including two, the Rayed Creekshell, *Anodontoides radiatus*, a Conservation Priority 2 species, and the Pondhorn, *Uniomerus tetralasmus*, often found in headwaters and softer substrates such as encountered at this station. The site was characterized by extensive sand, mud, and silt introduced from upstream logging activities and the effects of recent tornados that had blown down streamside timber just upstream of the highway. All of the mussels found at this station were found among rip rap underneath the bridge, the only evident source of stability. A station sampled between these two, at Alabama Highway 69, yielded no mussels and was characterized by an extremely heavy sediment burden, likely due at least in part to poor land use practices in the vicinity and some recent tornado damage. Interestingly neither upstream station sampled yielded *Corbicula*.

Three stations sampled in the Big Brush Creek system yielded nine species, all represented by live animals or fresh dead shells (tables 1, 3, fig. 1). While no federally listed species were encountered, the abundance and diversity of mussels found at two stations suggests that with more time and a greater number of stations sampled, even more species could be encountered. Both stations sampled in Big Brush Creek proper had heavy sediment loads, with extensive areas of sand and scattered patches of gravel, and with woody debris providing refugia. The upper station had the addition of an old collapsed bridge frame in the creek bed providing a very stable area where most of the mussels were found. All three stations had extensive wooded riparian borders. The Lilliput, *Toxolasma parvum*, and the Southern Creekmussel, *Strophitus subvexus*, both Conservation Priority 3 species, were found live at the upper station.

Six fairly common species were found in Big German Creek, but only one, *Villosa lienosa*, was found live (table 3, fig. 1). The Lilliput was found weathered dead here. The stream was characterized by a very heavy sand load from an unknown source with scattered patches of gravel and extensive woody debris. Flow was moderate to slow and somewhat turbid from recent rain. The sand load was not present two years prior when crayfish were sampled at the same location. The riparian border was a narrow strip of trees with pasture beyond.

Three stations sampled in the Big Prairie Creek system yielded nine species, but none live and only three fresh dead. Again, additional sampling could reveal additional species and/or increased abundances. Interesting finds there were the Southern Mapleleaf, *Quadrula apiculata*, and Washboard, *Megalonaias nervosa*, found weathered dead in Little Prairie Creek. These

species are generally inhabitants of larger streams and rivers but were previously known from this system (Williams and others, 2008). Streams in this system were typically Black Belt in nature with extensive, soft 'bedrock' reaches interspersed with gravel and sand patches with lots of silt, mud, and detritus and scattered vegetation.

SPECIES ACCOUNTS

Amblema plicata, Threeridge, P4, is a widespread and common species in the Tennessee River system, the western and lower Mobile River Basin, and some coastal river systems, and can be found in riverine or impounded areas. It is declining in the Mobile River Basin. It was found as weathered dead material at two main channel Locust Fork stations.

Anodonta suborbiculata, Flat Floater, P4, is widespread in the Tennessee River system with localized populations in Mobile River Basin impoundments and is usually found in soft sediments in sluggish water. It may be a relatively recent invader of the Mobile River Basin. Two live animals were found in the upper reach of Holt Reservoir, representing the first main channel Black Warrior River record for this species.

Anodontoides radiatus, Rayed Creekshell, P2, occurs mostly on the Coastal Plain from Louisiana and Mississippi to Florida and Georgia and is usually found in small to medium-sized streams in sand or silt substrate and moderate flow. Live animals were found in typical habitat in Fivemile and Bucks Creeks on the Coastal Plain downstream of Tuscaloosa.

Arcidens confragosus, Rock Pocketbook, P3, is fairly common in some areas of the Tennessee River system but is declining in the Mobile River Basin and can be found in either riverine or impounded areas. Two live individuals were found in the Oliver Pool.

Ellipsaria lineolata, Butterfly, P4, is common and widespread in the Tennessee River system and Mobile River Basin, usually in riverine habitats. Fresh dead shells were found in Locust Fork.

Elliptio arctata, Delicate Spike, P1, is widespread but never common in the Mobile River Basin and is declining and is almost always found in riverine habitats, often under large rocks. Two weathered dead valves were found in the Locust Fork main channel. Hartfield (1990) reported weathered dead or relict shells from Locust Fork.

Fusconaia cerina, Gulf Pigtoe, P5, is endemic to the Mobile River Basin and is common throughout, usually found in streams with at least moderate current. It was found live and fresh

dead in Big Brush and Fivemile Creeks and weathered dead in Limestone Creek, all on the Coastal Plain downstream of Tuscaloosa.

Hamiotoa perovalis, Orangenacre Mucket, P2, is a federally listed Threatened species endemic to the western Mobile River Basin, usually in stable gravel/sand substrates in streams with at least moderate current. It was found live at two stations in Fivemile Creek on the Coastal Plain downstream of Tuscaloosa.

Lampsilis ornata, Southern Pocketbook, P4, is widespread and common in the Mobile River Basin and sporadically in the Conecuh River drainage and can occupy a variety of habitats. Live animals (including one female displaying) were found in Locust Fork and its tributary Blackburn Fork and in Big Brush Creek on the Coastal Plain downstream of Tuscaloosa. Hartfield (1990) reported four live individuals from Locust Fork.

Lampsilis straminea, Southern Fatmucket, P4, is fairly common and widespread in Alabama south of the Tennessee River system and is often found in slow to moderate current but generally not in impoundments. A relict shell was found in Turkey Creek in the Locust Fork system and was commonly found in tributaries on the Coastal Plain downstream of Tuscaloosa.

Lampsilis teres, Yellow Sandshell, P5, is common throughout Alabama and may be found in gravel, sand, or mud substrates in riverine or impounded habitats. It was frequently encountered in the Black Warrior main channel and Locust Fork and its tributary Village Creek, and a live animal was found in Big Brush Creek on the Coastal Plain downstream of Tuscaloosa. Hartfield (1990) reported weathered dead or relict shells from Locust Fork.

Lasmigona alabamensis, Alabama Heelsplitter, P3, is restricted to the Mobile River Basin and is uncommon and may be found in riverine or pooled habitats. It was found live at numerous stations in the main channel Black Warrior River and fresh dead at several stations in Locust Fork and one station in Village Creek. Hartfield (1990) reported weathered dead or relict shells from Locust Fork.

Leptodea fragilis, Fragile Papershell, P5, is a common and widespread species in the Tennessee River system and Mobile River Basin and can be found in riverine habitats and impoundments. It was frequently encountered live in the main channel Black Warrior and as weathered dead valves in Locust Fork and Village Creek. Hartfield (1990) reported a live individual from Locust Fork.

Megalonaias nervosa, Washboard, P5, is common and widespread throughout Alabama except the Choctawhatchee and Yellow River systems, and can be found in riverine habitats and impoundments. It was found live at a few stations in the upper reach of Holt Pool and weathered dead in Little Prairie Creek on the Coastal Plain downstream of Tuscaloosa. Hartfield (1990) reported weathered dead or relict shells from Locust Fork.

Obliquaria reflexa, Threehorn Wartyback, P5, is common throughout the Tennessee River system and Mobile River Basin, and can be found in riverine habitats and impoundments. It was frequently encountered at main channel Black Warrior River stations and was the third most frequently collected species there. A few live animals were found in Locust Fork.

Plectomerus dombeyanus, Bankclimber, P5, is common in the Alabama and lower Tombigbee River drainages and lower reaches of Coosa and Cahaba Rivers, and occurs in both sluggish and flowing water, often on channel slopes. It was the most commonly encountered and numerically abundant species found in the main channel Black Warrior River.

Pleurobema rubellum, Warrior Pigtoe, considered extinct, was endemic to the Black Warrior and Cahaba River systems, probably in stable gravel substrates like its congeners, but has not been collected in nearly 100 years. One very old shell resembling this species was found in Davis Creek.

Potamilus inflatus, Inflated Heelsplitter, P2, a federally listed threatened species, is uncommon, restricted to the Mobile River Basin, and is usually found in soft substrates in slow to moderate current. Four live individuals were collected in the Black Warrior River: three in the tailwater of Oliver Dam and one in the Oliver Pool near Tuscaloosa.

Potamilus purpuratus, Bleufer, P5, is widespread and common in the Mobile River Basin and is found in both pools and shoals, often under large rocks in shoals. It was frequently found live in main channel Black Warrior River stations and occasionally among several Locust Fork stations (including 25 live animals at the most downstream station in Blackburn Fork) as well as weathered dead in Big Prairie Creek on the Coastal Plain downstream of Tuscaloosa. Hartfield (1990) reported fresh dead shells from Locust Fork.

Pyganodon grandis, Giant Floater, P5, is common throughout Alabama and occurs in practically any habitat including farm ponds. Live animals were found at several stations in the main channel Black Warrior River and weathered dead shells were found in Village Creek.

Quadrula apiculata, Southern Mapleleaf, P5, is common and was formerly restricted to the Mobile River Basin but has been introduced into the Tennessee River, likely by mussel divers, and can be found in riverine and impounded reaches. It was the second most commonly encountered and numerically abundant species found among Black Warrior River stations, and a weathered dead shell was found in Little Prairie Creek on the Coastal Plain downstream of Tuscaloosa.

Quadrula asperata, Alabama Orb, P5, is common and endemic to the Mobile River Basin, usually in habitats with at least some current. Oddly, only one live individual of this common and widespread Mobile River Basin endemic was found in the Oliver Pool of Black Warrior River. Live animals were found at two stations in Locust Fork, weathered dead valves were found in Davis Creek, and live animals were found in Big Brush and Fivemile Creeks on the Coastal Plain downstream of Tuscaloosa. Hartfield (1990) reported weathered dead or relict shells from Locust Fork.

Quadrula rumphiana, Ridged Mapleleaf, P4, is endemic to the Mobile River Basin and fairly common, usually in habitats with at least some current. It was commonly encountered in main channel Black Warrior River stations, especially in the Holt Pool, but not in tributaries. Hartfield (1990) reported fresh dead shells from Locust Fork.

Quadrula verrucosa, Pistolgrip, P4, is fairly common and widespread in the Tennessee River system and Mobile River Basin, usually in streams with at least some current but occasionally in impoundments. Live animals were found in lower Blackburn Fork and at several stations in Locust Fork downstream of the mouth of Blackburn Fork. Hartfield (1990) reported fresh dead shells from Locust Fork.

Strophitus subvexus, Southern Creekmussel, P3, is found throughout Alabama south of the Tennessee River system but is uncommon and is often found in sluggish streams. Live animals were found in Big Brush Creek on the Coastal Plain downstream of Tuscaloosa and one relict valve was found in Blue Creek.

Toxolasma parvum, Lilliput, P3, is known from the Tennessee River system, Mobile River Basin, and Gulf Coast drainages, and often occupies soft sediments in sluggish water. It is poorly known and further taxonomic work may lead to generic revision and further restrict its distribution. A single live individual was found in the Holt Pool of the Black Warrior River upstream of Tuscaloosa; a live animal was also found in Big Brush Creek and weathered dead

shells were found in Whitsett and Big German Creeks, all on the Coastal Plain downstream of Tuscaloosa.

Uniomerus tetralasmus, Pondhorn, P4, is common across the Gulf Coast and Mobile River Basin, often in areas with little or no current, including intermittent ponds and streams. It was found live in Fivemile Creek and as fresh or weathered dead shells in Little Prairie, Big German, Limestone, and Stephens Creeks on the Coastal Plain downstream of Tuscaloosa.

Utterbackia imbecillis, Paper Pondshell, P5, is common throughout Alabama and occurs in practically any habitat including farm ponds. A few live and fresh dead individuals were found in the main channel Black Warrior River and weathered dead shells were found in Big German and Whitsett Creeks on the Coastal Plain downstream of Tuscaloosa.

Villosa lienosa, Little Spectaclecase, P5, is common throughout Alabama south of the Tennessee River system and can occur in a variety of habitats. One fresh dead and a few weathered dead shells were found in Blue Creek, a weathered dead shell was found in Sand Valley Creek in the Locust Fork system, and numerous live animals and fresh and weathered dead shells were found in tributaries on the Coastal Plain downstream of Tuscaloosa.

Villosa nebulosa, Alabama Rainbow, P3, is occasionally found in the Mobile River Basin upstream of the Fall Line, usually in small stream environments. Two fresh dead shells were found in Blue Creek and two weathered dead shells in Blackburn Fork.

Villosa vibex, Southern Rainbow, P5, is common throughout Alabama south of the Tennessee River system in a variety of habitats. Two weathered dead shells were found in Blackburn Fork and fresh dead shells were found in Fivemile Creek on the Coastal Plain downstream of Tuscaloosa.

RECOMMENDATIONS

Based on the results of this study we make the following recommendations:

- Further sampling of the mussel fauna should be executed to further refine the current distribution and status of mussels in the system.
- Factors that influence mussel distribution and abundance should be evaluated by such means as land cover/land use determinations, water and sediment quality measurements, and evaluation of rates of sediment loading.
- Upon determination of the factors limiting the fauna, steps should be taken to ameliorate those factors.

- Periodic monitoring of selected stations should be executed to document trends.

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