

GEOLOGICAL SURVEY OF ALABAMA

Berry H. (Nick) Tew, Jr.
State Geologist

WATER INVESTIGATIONS PROGRAM

Patrick E. O'Neil
Director

**RESULTS OF QUALITATIVE SAMPLING FOR PROTECTED
MUSSEL SPECIES AT SELECTED STATIONS IN THE
CAHABA RIVER SYSTEM, ALABAMA, 2005**

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By

Stuart W. McGregor¹ and Jeffrey T. Garner²

¹Geological Survey of Alabama, Water Investigations Program

²Alabama Department of Conservation and Natural Resources,
Division of Wildlife and Freshwater Fisheries

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CONTENTS

	Page
Abstract.....	1
Introduction.....	1
Acknowledgments.....	2
Study area.....	3
Methods.....	3
Results.....	3
Discussion and Recommendations	10
References cited	12

ILLUSTRATIONS

Figure 1. Sampling stations in the Cahaba River system, 2005.....	4
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TABLES

Table 1. Summary information for mussel sampling stations in the Cahaba River system, Alabama, 2005	5
Table 2. Summary information for mussel species collected in the Cahaba River system, Alabama, 2005	7

RESULTS OF QUALITATIVE SAMPLING FOR PROTECTED MUSSEL SPECIES AT SELECTED STATIONS IN THE CAHABA RIVER SYSTEM, ALABAMA, 2005

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ABSTRACT

Freshwater mussel (Bivalvia: Unionidae) populations were evaluated at 40 stations in the Cahaba River system from May through September, 2005. About 84.5 man hours were expended using visual searches, usually with mask and snorkel, and tactile searches. A total of 29 species and 1,031 mussels were collected, including 25 species found live or fresh dead and 4 species represented by weathered dead or relic shells only. No mussels were found at 26 stations. Three federally listed endangered or threatened species were encountered live, including the finelined pocketbook, *Hamiota altilis*, ovate clubshell, *Pleurobema perovatum*, and triangular kidneyshell, *Ptychobranchus greenii*. Another endangered species, the southern clubshell, *Pleurobema decisum*, was represented by relic material at a single main channel station. The elephantear, *Elliptio crassidens*, accounted for 42.2 percent of the total collected live or fresh dead, followed by the southern pigtoe, *Fusconaia cerina*, with 13.7 percent, the Alabama orb, *Quadrula asperata*, with 11.9 percent, and the bleufer, *Potamilus purpuratus*, with 10.6 percent. Twenty one species accounted for less than 1 percent each. The ovate clubshell was not reported from the Cahaba River system from the early 1930s until one specimen was collected from Oakmulgee Creek in 2004. Another live individual was collected from the same vicinity during the present effort and one also from the main channel Cahaba River near Centreville. The triangular kidneyshell was reported from near Booth's Ford downstream to the vicinity of the old Marvel Slab during 2004. During this study its range was extended downstream to the vicinity of Piper Bridge. The finelined pocketbook has recently been reported from the headwaters of the Little Cahaba River and the main channel Cahaba near Marvel Slab. During this study its range in the Little Cahaba was extended downstream to the vicinity of Cahaba Valley Church, and in the main channel Cahaba it was found downstream of Centreville, a new downstream record for the system.

INTRODUCTION

Seventeen species of freshwater mussels historically known from the Mobile River basin are currently listed as endangered or threatened by the U.S. Fish and Wildlife Service. The decline of the mussel fauna is due to the collective effects of impoundment, sedimentation, eutrophication, pollution, channel modification, and urbanization (Bogan, 1993; Hartfield, 1994; Gangloff and Feminella, in press). Other factors affecting the distribution and abundance of freshwater mussels in North America include possible competition by exotic species such as the Asian clam, *Corbicula fluminea*, and the zebra mussel, *Dreissena polymorpha*. The Asian clam is known to compete with native mussels for space and food resources and has occupied streams in the Mobile River basin since the mid-20th century. The zebra mussel had a well-documented and profound affect in a very short time on native mussel populations in northern lakes and rivers in the United States and Canada, but has not been reported from the Mobile River basin.

Numerous studies of the Cahaba River mollusk fauna and the river's water quality have been published through the years. Lewis (1876) cataloged many freshwater and land shells of

Alabama, including numerous species of freshwater mussels from the Cahaba River reported by various collectors. His locality information was vague, but it included species listed from the Cahaba River drainage specifically and the Alabama River system generally. Other authors, including Johnson (1967), Frey and others (1976), and Stansbery (1983a, b, c) have reported other mussel records from the Cahaba River. However, only three comprehensive mussel surveys of the drainage have been completed to date, the most recent documenting survey efforts approximately a decade ago (van der Schalie, 1938; Baldwin, 1973; McGregor and others, 2000).

In a report on freshwater mussels collected in the Cahaba River system in 1933 and 1935, van der Schalie (1938) stated that the Cahaba River was "unusually productive conchologically," yielding 42 species in 23 genera from 34 stations in the system. He reported that the most prominent dangers to the Cahaba River mussel fauna were the possibility of pollution by acid-containing mine wastes, heavy concentrations of industrial wastes and sewage from Birmingham, and the disturbance of the natural conditions in the river by dam construction.

In a study of the changes in the Cahaba River mussel fauna over a 40-year period, Baldwin (1973) reported 31 species in 21 genera from 19 stations. He reported that 12 species had increased in abundance and 34 species had decreased in abundance during that time period. Baldwin (1973) supported van der Schalie's (1938) predictions regarding potential impacts to the mussel fauna of the Cahaba River. He also commented that pollution from coal fields and strip mining had caused considerable acid run-off, and housing developments near the river in Birmingham had doubled the amount of waste entering the river since the time of van der Schalie's (1938) study.

Collections from the early 1990s (McGregor and others, 2000) documented 23 species of native freshwater mussels in 17 genera and *Corbicula* in the Cahaba River downstream of Centreville in 45 collections. The first record from the Cahaba River system for one species, *Plectomerus dombeyanus*, was reported. Fresh dead specimens of threatened *Hamiota altilis* and endangered *Ptychobranchus greenii* and relic specimens of endangered *Pleurobema decisum* were reported during that study. The status of all freshwater mussel species known from the Cahaba River system at that time was discussed. A cumulative total of 43 species in 25 genera (adjusted to Turgeon and others, 1998) have been reported from the drainage from 1933 to 1994 (McGregor and others, 2000).

The primary objective of this study was to sample selected stations in the Cahaba River and tributaries for federally listed mussel species to refine ranges of listed species within the drainage. Secondary objectives included finding potential sources of broodstock for culture of listed species and documenting the current composition of the mussel fauna within the system.

ACKNOWLEDGMENTS

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STUDY AREA

The Cahaba River is the longest relatively free-flowing river in Alabama stretching 305 kilometers (190 miles) from its source in St. Clair County to its confluence with the Alabama River in Dallas County (fig. 1). It is a major tributary of the Alabama River, draining approximately 4,725 km² (1,825 mi²). The main channel flows through St. Clair, Jefferson, Shelby, Bibb, Perry, and Dallas Counties and also drains portions of Tuscaloosa and Chilton Counties.

METHODS

Mussels were collected by hand with the aid of mask and snorkel. Sampling stations were selected based on the presumed presence of habitat suitable for listed mussel species. Sampling duration at each station was dictated by the fauna encountered and sampling conditions at time of collection. Sampling was on a time-limited basis opposed to an area-limited basis, as suggested by Vaughn and others (1997), Metcalfe-Smith and others (2000), and Strayer and Smith (2003) for the most effective assessment of rare species present at a site. Effort ranged from 0.33 to 12 hours, depending on areal extent of a station sampled, number of collectors, and expected yield based on observation of habitat present. All mussels encountered were collected, identified to species and condition (live, fresh dead, weathered dead, or relic), and the number of each was recorded. Most live material was identified in the field and returned to the substrate. Only live and fresh dead material was used for species totals and abundance calculations. Weathered dead and relic material were excluded from those calculations, since it is impossible to determine how long those animals have been dead and whether they still persist at a site. Voucher material is housed in the ADCNR or North Carolina Museum of Natural Science collections. Habitat data for each station were also recorded. Sampling stations were referenced to nearby landmarks, and position was determined with a hand-held Global Positioning System (GPS) unit or with the aid of the on-line internet topographic mapping program TopoZone. Nomenclature generally follows Turgeon and others (1998) with some exceptions. *Lampsilis altilis* has been moved to the new genus *Hamiota* based on reproductive characteristics (Roe and Hartfield, 2005). Conservation status in Alabama follows Mirarchi (2004): P1=Highest Priority to P5=Lowest Priority.

RESULTS

Qualitative mussel sampling was performed at 40 stations in the Cahaba River and tributaries (fig. 1, table 1). Data collected during an unrelated quantitative sampling effort within the study area were also included. Most sampling stations were selected based on prior knowledge of recent records of federally listed species (McGregor and others, 2000), recent collections of federally listed species (Paul Johnson, ADCNR, pers. comm., 2004), and potential presence of listed species based on available habitat and presumed range of listed species. Some stations in smaller tributaries were selected to evaluate their faunas and to augment other data from those streams collected during unrelated studies. No mussels were found at 26 stations, most of which were located on small tributaries of the Cahaba downstream of the Fall Line and in the headwaters (fig. 1, table 2).

A total of 1,031 individuals among 25 species were collected live in about 84.5 hours of sampling for a cumulative catch per unit effort (CPUE) of 12.2 mussels/hour (table 2). Another four species were collected as weathered dead or relict shells and were not incorporated into CPUE calculations. Live individuals of three federally listed endangered species, the finelined pocketbook, *Hamiota altilis*, ovate clubshell, *Pleurobema perovatum*, and triangular kidneyshell,

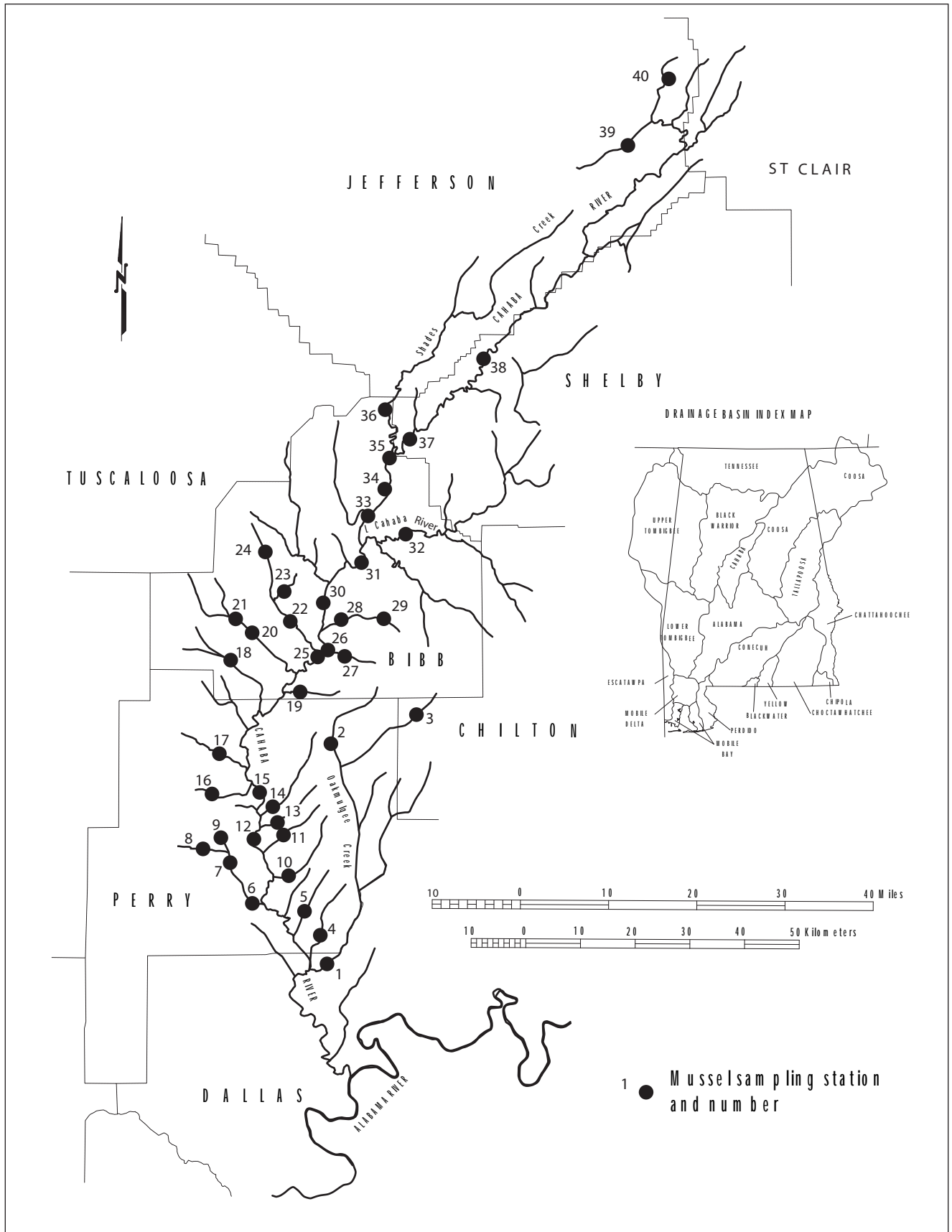


Figure 1. Sampling stations in the Cahaba River system, Alabama, 2005.

Table 1— Summary information for mussel sampling stations in the Cahaba River system, Alabama, 2005.

Station	Location	Map coordinates	County	Date
1	Oakmulgee Creek downstream of Alabama Hwy. 14 bridge	N 32° 28.560' W 87° 8.070'	Dallas	9/13/05
2	Beaverdam Creek at unnumbered county road near Alabama Hwy. 219	N 32° 46.837' W 87° 7.492'	Perry	4/18/05
3	Oakmulgee Creek at Alabama Hwy. 183 near U.S. Hwy. 82 at Lawley	N 32° 48.620' W 86° 59.494'	Chilton	4/18/05
4	Possum Creek at Alabama Hwy. 14 about 3.0 mi. S of Suttle	N 32° 29.686' W 87° 8.915'	Perry	5/4/05
5	Holley Creek at Alabama Hwy. 14 at Suttle	N 32° 31.897' W 87° 10.708'	Perry	5/4/05
6	Rice Creek at County Road 4 about 1.5 mi. NE of Villula	N 32° 33.434' W 87° 15.238'	Perry	5/4/05
7	Unnamed tributary of Rice Cr. at Co. Road. 60 about 1 mi. SE of Marion	N 32° 36.170' W 87° 18.151'	Perry	5/4/05
8	Rice Creek at County Road 30 about 1 mi. of SE Marion	N 32° 36.129' W 87° 17.151'	Perry	5/4/05
9	Rice Creek at unnumbered road, Arnold Hughey property, in NE Marion	N 32° 38.542' W 87° 18.122'	Perry	5/5/05
10	Waters Creek at Alabama Hwy. 14 about 0.75 mi. N of Radford	N 32° 35.866' W 87° 12.097'	Perry	5/4/05
11	Wells Creek at Alabama Hwy. 14 about 6 mi. E of Marion	N 32° 38.317' W 87° 12.995'	Perry	5/4/05
12	Cahaba River at shoal downstream of Alabama Hwy. 14 bridge near Sprott	N 32° 39.92' W 87° 14.50'	Perry	9/9/05
13	Goose Creek at Alabama Hwy. 14 about 0.5 mi. S of Sprott	N 32° 39.892' W 87° 13.251'	Perry	5/4/05
14	Mill Creek at Alabama Hwy. 183 about 0.5 mi. N of Sprott	N 32° 41.309' W 87° 13.077'	Perry	4/18/05
15	Cahaba River at Barton's Beach Nature Preserve upstream of Sprott	N 32° 41.69' W 87° 14.09'	Perry	9/9/05
16	Old Town Creek at County Road 16 about 4.5 mi. SW of Heiberger	N 32° 43.302' W 87° 20.415'	Perry	5/5/05
17	Wallace Creek between County Roads 47/17 about 2.5 mi. NW of Heiberger	N 32° 45.680' W 87° 17.970'	Perry	5/6/05
18	Blue Girt Creek at unnumbered road about 1.5 mi. N of County Road 80	N 32° 53.353' W 87° 17.522'	Bibb	4/18/05
19	Walton Creek at County Road 51 near Perry County line	N 32° 50.346' W 87° 11.142'	Bibb	5/6/05
20	Affonee Creek at County Road 16 about 3.0 mi. N of Pondville	N 32° 57.049' W 87° 17.90'	Bibb	5/6/05
21	Affonee Creek at Forest Service Road 731 about 6.0 mi. SW of Eoline	N 32° 57.977' W 87° 18.959'	Bibb	4/20/05
22	Haysop Creek at Alabama Hwy. 5 bridge at Brent	N 32° 54.314' W 87° 12.119'	Bibb	4/18/05
23	Unnamed tributary of Haysop Creek at County Road 4 3.0 mi. NW of Brent	N 32° 57.762' W 87° 12.049'	Bibb	5/6/05
24	Haysop Creek at unnumbered county road 2.75 mi. N of Eoline	N 32° 1.844' W 87° 14.086'	Bibb	5/6/05
25	Cahaba River at upstream end of Cooper's Island upstream of Haysop Creek	N 32° 52.796' W 87° 10.255'	Bibb	9/15/05
26	Cahaba River 1 mi. upstream of Cooper's Island on right descending bank	N 32° 52.906' W 87° 9.727'	Bibb	9/15/05

Table 1— Summary information for mussel sampling stations in the Cahaba River system, Alabama, 2005—Continued

27	Gulley Creek at Alabama Hwy. 219 about 3.0 mi. S of Centreville	N 32° 54.012' W 87° 7.444'	Bibb	4/20/05
28	Sandy Creek at Alabama Hwy. 219 about 1.5 mi. S of Centreville	N 32° 55.488' W 87° 7.760'	Bibb	4/20/05
29	Sandy Creek at County Road 29 nr. U.S. Hwy. 82 at Trio	N 32° 54.672' W 87° 1.664'	Bibb	4/20/05
30	Cahaba River at new U.S. Hwy. 82 bridge upstream of Centreville	N 33° 57.40' W 87° 8.45'	Bibb	9/8/05
31	Cahaba River at County Hwy. 26 (Pratt's Ferry)	N 33° 1.15' W 87° 4.78'	Bibb	9/8/05
32	Little Cahaba River at Cahaba Valley Church	N 33° 03.257' W 86° 58.200'	Bibb	9/14/05
33	Cahaba River at shoal downstream of Piper bridge	N 33° 5.22' W 87° 3.83'	Bibb	9/8/05
34	Cahaba River at first shoal upstream of Piper Bridge	N 33° 07.100' W 87° 2.050'	Bibb	5/25/05
35	Cahaba River upstream of Marvel Slab remains about 2.25 mi. NE of Marvel	N 33° 10.800' W 86° 1.150'	Bibb	5/24/05
36	Shades Cr. at Easter Valley Rd. (County Road 12) at Shady Grove #2 Church	N 33° 13.212' W 87° 1.903'	Bibb	9/16/05
37	Cahaba River at Booths Ford about 1.5 mi. W of County Road 10	N 33° 11.088' W 87° 1.62'	Shelby	5/24/05
38	Cahaba River at County Road 52 near Helena	N 33° 17.078' W 86° 52.957'	Shelby	8/02/05
39	Pinchgut Creek at Watterson Rd. and U. S. Hwy. 11 near Trussville	N 33° 36.920' W 86° 36.715'	Jefferson	9/16/05
40	Cahaba River tributary downstream of Lake in the Woods at Gardner Hill Rd.	N 33° 42.211' W 86° 34.721'	Jefferson	9/16/05

Table 2— Summary information for mussel species collected in the Cahaba River system, Alabama, 2005.

Species	Status ¹	Stations														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Amblema elliotti</i> Coosa fiveridge	P3															
<i>Amblema plicata</i> threeridge	P4															
<i>Ellipsaria lineolata</i> butterfly	P4												1			
<i>E. arctata</i> delicate spike	P1															
<i>Elliptio crassidens</i> elephantear	P5												1			
<i>Fusconaia cerina</i> southern pigtoe	P5															
<i>Fusconaia ebena</i> ebonyshell	P5															
<i>Hamiota altilis</i> finelined pocketbook	P2, T															
<i>Lampsilis ornata</i> southern pocketbook	P4												6			9
<i>L. straminea</i> southern fatmucket	P4	2		R ²												
<i>Lampsilis teres</i> yellow sandshell	P5															R
<i>Lasmigona c. alabamensis</i> Alabama heelsplitter	P3															
<i>Leptodea fragilis</i> fragile papershell	P5															
<i>Ligumia recta</i> black sandshell	P2															
<i>Megaloniais nervosa</i> washboard	P5															
<i>Obliquaria reflexa</i> three-horn wartyback	P5												5			4
<i>Pleurobema decisum</i> southern clubshell	P2															
<i>Pleurobema perovatum</i> ovate clubshell	P1, E	1														
<i>Potamilus purpuratus</i> bleufer	P5												1			1
<i>Ptychobranthus greenii</i> triangular kidneyshell	P1, E															
<i>Quadrula apiculata</i> southern mapleleaf	P5												1			4
<i>Quadrula asperata</i> Alabama orb	P5												15			16
<i>Quadrula metanevra</i> monkeyface	P3												1			2
<i>Strophitus subvexus</i> southern creekmussel	P3			R												
<i>Tritogonia verrucosa</i> pistolgrip	P4															
<i>Truncilla donaciformis</i> fawnsfoot	P3												2			1
<i>Villosa lienosa</i> little spectaclecase	P5	1		R												
<i>Villosa nebulosa</i> Alabama rainbow	P3															
<i>Villosa vibex</i> southern rainbow	P5															
Species totals ³		3	0	0	0	0	0	0	0	0	0	0	9	0	0	7
Total number of specimens		4	0	0	0	0	0	0	0	0	0	0	33	0	0	37
Sample effort (hours)		1.0	0.66	1.0	0.66	0.66	0.33	0.5	0.5	0.33	0.66	0.33	8.0	0.66	1.0	2.0
Catch per unit effort (number/hour)		4.0	0	0	0	0	0	0	0	0	0	0	4.1	0	0	19.4

Table 2— Summary information for mussel species collected in the Cahaba River system, Alabama, 2005—Continued

Species	Status ¹	Stations															
		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
<i>Amblema elliotti</i> Coosa fiveridge	P3															1	
<i>Amblema plicata</i> threeridge	P4																
<i>Ellipsaria lineolata</i> butterfly	P4										W	5				2	
<i>E. arctata</i> delicate spike	P1																
<i>Elliptio crassidens</i> elephantear	P5										3	1				127	
<i>Fusconaia cerina</i> southern pigtoe	P5										W						
<i>Fusconaia ebena</i> ebonyshell	P5										1						
<i>Hamiota altilis</i> finelined pocketbook	P2, E											1					
<i>Lampsilis ornata</i> southern pocketbook	P4										4	37				1	
<i>L. straminea</i> southern fatmucket	P4																
<i>Lampsilis teres</i> yellow sandshell	P5										W	1				R	
<i>Lasmigona c. alabamensis</i> Alabama heelsplitter	P3										1	1				1	
<i>Leptodea fragilis</i> fragile papershell	P5																
<i>Ligumia recta</i> black sandshell	P2											R					
<i>Megaloniais nervosa</i> washboard	P5										W						
<i>Obliquaria reflexa</i> three-horn wartyback	P5										1	19				2	
<i>Pleurobema decisum</i> southern clubshell	P2																
<i>Pleurobema perovatum</i> ovate clubshell	P1, E															1	
<i>Potamilus purpuratus</i> bleufer	P5										1					2	
<i>Ptychobranthus greenii</i> triangular kidneyshell	P1, E																
<i>Quadrula apiculata</i> southern mapleleaf	P5										1	1					
<i>Quadrula asperata</i> Alabama orb	P5										1	52				2	
<i>Quadrula metanevra</i> monkeyface	P3											2					
<i>Strophitus subvexus</i> southern creekmussle	P3																
<i>Tritogonia verrucosa</i> pistolgrip	P4																
<i>Truncilla donaciformis</i> fawnsfoot	P3																
<i>Villosa lienosa</i> little spectaclecase	P5										2						
<i>Villosa nebulosa</i> Alabama rainbow	P3																
<i>Villosa vibex</i> southern rainbow	P5																
Species totals ³		0	0	0	0	0	0	0	0	0	0	9	10	0	0	0	9
Total number of specimens		0	0	0	0	0	0	0	0	0	0	15	120	0	0	0	139
Sample effort (hours)		0.5	0.5	1.0	0.5	0.33	0.33	0.5	0.15	0.5	3.0	3.0	0.33	0.66	0.66	3.0	
Catch per unit effort (number/hour)		0	0	0	0	0	0	0	0	0	5.0	40.0	0	0	0	46.0	

Table 2— Summary information for mussel species collected in the Cahaba River system, Alabama, 2005—Continued

Species	Status ¹	Stations										Totals ³	
		31	32	33	34	35	36	37	38	39	40	n	%
<i>Amblema elliotti</i> Coosa fiveridge	P3							W	R			1	<1.0
<i>Amblema plicata</i> threeridge	P4				10	1						11	1.1
<i>Ellipsaria lineolata</i> butterfly	P4	2										10	1.0
<i>E. arctata</i> delicate spike	P1			2	W	7	R					9	<1.0
<i>Elliptio crassidens</i> elephantear	P5	22	1	9	100	100	1	50	20			435	42.2
<i>Fusconaia cerina</i> Gulf pigtoe	P5	2	1		10	100		27	1			141	13.7
<i>Fusconaia ebena</i> ebonyshell	P5											1	<1.0
<i>Hamiota altilis</i> finelined pocketbook	P2, E		1					1	R			3	<1.0
<i>Lampsilis ornata</i> southern pocketbook	P4	3			2			5				67	6.5
<i>L. straminea</i> southern fatmucket	P4				1	1		3				7	<1.0
<i>Lampsilis teres</i> yellow sandshell	P5				1							2	<1.0
<i>Lasmigona c. alabamensis</i> Alabama heelsplitter	P3											3	<1.0
<i>Leptodea fragilis</i> fragile papershell	P5				1							1	<1.0
<i>Ligumia recta</i> black sandshell	P2								R			R	<1.0
<i>Megaloniais nervosa</i> washboard	P5											W	<1.0
<i>Oblivaria reflexa</i> three-horn wartyback	P5	3			40							74	7.2
<i>Pleurobema decisum</i> southern clubshell	P2, E	R										R	<1.0
<i>Pleurobema perovatum</i> ovate clubshell	P1, E											2	<1.0
<i>Potamilus purpuratus</i> bleufer	P5	1	R		100				R			106	10.3
<i>Ptychobranhus greenii</i> triangular kidneyshell	P1, E	1				5		W				6	<1.0
<i>Quadrula apiculata</i> southern mapleleaf	P5											7	<1.0
<i>Quadrula asperata</i> Alabama orb	P5	7	1		20	5		4				123	11.9
<i>Quadrula metanevra</i> monkeyface	P3											5	<1.0
<i>Strophitus subvexus</i> southern creekmussel	P3											R	<1.0
<i>Tritogonia verrucosa</i> pistolgrip	P4		R		1							1	<1.0
<i>Truncilla donaciformis</i> fawnsfoot	P3											3	<1.0
<i>Villosa lienosa</i> little spectaclecase	P5					3	R	1				7	<1.0
<i>Villosa nebulosa</i> Alabama rainbow	P3			1								1	<1.0
<i>Villosa vibex</i> southern rainbow	P5				W	3		2				5	<1.0
Species totals ³		8	4	3	11	9	1	8	2	0	0	25	--
Total number of specimens		41	4	12	286	225	1	93	21	0	0	1,031	--
Sample effort (hours)		4.0	6.0	8.0	12.0	6.0	3.25	2.0	8.0	1.0	1.0	84.5	--
Catch per unit effort (number/hour)		10.3	0.67	1.5	23.8	37.5	0.3	46.5	02.6	0	0	12.2	--

¹Conservation priority—P1 Highest, P2 High, P3 Moderate, P4 Low, P5 Lowest (from Mirarchi and others, 2004); E=federally listed endangered, T=federally listed threatened.

²W—Weathered dead, R—Relic.

³Only live mussels and fresh dead shells are included in species and specimen totals.

Ptychobranchnus greenii, were secured. Another federally listed endangered species, the southern clubshell, *Pleurobema decisum*, was collected as weathered dead shell at a single station.

The finelined pocketbook, a federally listed endangered species, was reported by van der Schalie (1938) to be an inhabitant of the small- to medium-sized river zone from 10 miles upstream of Centreville to the headwaters and in a few headwater creeks. During the previous sampling effort, McGregor and Garner (2004) reported finding the species in the Little Cahaba River in Bibb County near the confluence of Shoal and Mahan Creeks, a new tributary record, and at two stations in the main channel Cahaba River upstream of the Shades Creek confluence. During this study it was collected at a downstream location in the Little Cahaba River at Cahaba Valley Church (station 32), a point bar in the Cahaba River located about 1 river mile upstream of Cooper's Island (station 26), and at Booth's Ford (station 37). The location upstream of Cooper's Island represents a downstream range extension within the system.

The ovate clubshell, a federally listed endangered species, was reported by van der Schalie (1938), under several names that have since been synonymized, to be a species associated with small- to medium-sized rivers within the Cahaba River system. During the previous collecting effort (McGregor and Garner, 2004) it was collected live in lower Oakmulgee Creek in Dallas County, representing a new tributary record and the first collection of that species in the Cahaba River system since the 1930s (McGregor and others, 2000; McGregor and Garner, 2004). That station (station 1) was revisited this year, and sampling continued further downstream where a second live specimen was collected. A live specimen was also collected in the Cahaba River proper just upstream of the U.S. Hwy. 82 bridge at Centreville (station 30), representing the second station in the Cahaba River with live ovate clubshells, but within the historic range described by van der Schalie (1938).

The known range of the triangular kidneyshell, a federally listed endangered species, within the Cahaba River system was reported by van der Schalie (1938) to include the small-river zone upstream of Centreville, and McGregor and others (2000) reported a fresh dead specimen at Caldwell Mill in Shelby County in the early 1990s, within that range. McGregor and Garner (2004) reported it in a series of main channel shoals upstream of the confluence of Shades Creek. During this study its current range in the system was extended downstream to the Bibb County Road 26 bridge at Pratt's Ferry (station 31). Recent records of the species within the Cahaba River system were limited to shoal areas upstream of the confluence of Shades Creek in Bibb and Shelby Counties upstream to Caldwell Mill in Shelby County (McGregor and others, 2000; McGregor and Garner, 2004). The Pratt's Ferry station is about 12 linear miles downstream of the confluence of Shades Creek, but is within the range for the species reported by van der Schalie (1938).

DISCUSSION AND RECOMMENDATIONS

The diversity of mussels, including federally listed species, in the Cahaba River upstream of the mouth of Shades Creek and upstream of Cooper's Island, in the Little Cahaba River, and in lower Oakmulgee Creek, suggests that those reaches contain habitat and ambient water quality sufficient to support diverse and abundant faunas or sensitive species and could be considered possible source locations for broodstock or as reintroduction locations. However, the Cahaba River stations immediately downstream of the mouth of Shades Creek showed a marked decline in abundance and diversity values from stations immediately upstream of that point during this and the previous study (McGregor and Garner, 2004), presumably caused by poor water quality and/or sediment introduced from Shades Creek. The extent of that presumed effect downstream is currently unknown, but some degree of downstream recovery is documented at Piper Bridge

(station 34), where 11 species were collected and a CPUE of 23.8 mussels per hour was documented. The impacts of urban and agricultural runoff in the Shades Creek system were reported in O'Neil (1984) and Shepard and others (1994); these impacts included poor to fair IBI scores and low habitat scores, reflecting the effects of erosion problems from agricultural practices and urban runoff. There were also detectable levels of such contaminants as lead, atrazine, and PCP found at some stations and low dissolved oxygen events.

One promising development for mussels in the Cahaba River downstream of Shades Creek was the removal of the Marvel Slab in 2004. What was once likely an extensive shoal area was inundated by the construction of the slab several decades ago and it essentially created a small run-of-the-river impoundment. Recent research has documented the effects of small dams and various road-stream crossings, such as culverts (as found at Marvel Slab), fords, open box, and slabs, as barriers to macroinvertebrate and fish passage (Watters, 1995; Warren and Pardew, 1998; Vaughan, 2002). If the host fishes of mussels are prevented from transiting stream reaches, mussel populations may become functionally extirpated through attrition. Warren and Pardew (1998) compared several road-stream crossing configurations to natural reaches and found that fish passage through culverts was an order of magnitude lower than other configurations except slabs, which had no passage. This result was likely due to increased velocity of water through the culverts and consequential downstream scouring of the streambed. With removal of the slab the river could be restored to its former condition and, hopefully, native mussels typical of shoals in the Cahaba River will recolonize the area.

During the previous sampling effort (McGregor and Garner, 2004), some upstream stations in the Cahaba River yielded relatively diverse and abundant faunas, though abundance was heavily weighted to one or a few species at each station. Abundance and diversity values steadily dwindled with upstream progression based on results of that study and the current study. Habitat available at each station was generally substandard, but with evaluation and mitigation of the limiting factors in those reaches, we feel that mussels, including federally listed species and species of high conservation priority, could recolonize those areas. As noted before, the triangular kidneyshell was found fresh dead at Altadena approximately 10 years previously, but in those intervening years the extensive *Justicia* beds once found there have been reduced to a few small stands, possibly reflecting a change in water quality or quantity or in flow regime. The Altadena and U.S. Highway 280 stations were both located immediately downstream of small dams, which certainly affect the quality of habitat and water quality at those stations. As documented by Watters (1995), small dams act as barriers to fish passage and therefore disrupt the most critical dispersal method for mussels.

A further concern is the presence of a gravel mining facility adjacent to Oakmulgee Creek upstream of the newly discovered population of the ovate clubshell and the resultant increase in turbidity observed (Elliott Barker, landowner, pers. comm., 2005). A major concern for that species is the necessary use of a visual cue to attract potential host fishes during its reproductive cycle. If the stream suffers from persistent turbidity, the species' ability to reproduce may become impaired or prevented and the population may become extirpated from that stream through attrition.

Based on the results of this study and insight offered by other researchers, we offer the following recommendations:

- More intensive sampling should be conducted to further evaluate the actual extent and viability of target populations before removal of broodstock is considered from any location.
- Water-quality and physical habitat problems in the Shades Creek system should be evaluated and any possible negative effects on mussel populations ameliorated; until that time it is possible that mussel populations in the Cahaba River for some distance downstream of Shades Creek may continue to be suppressed.
- Effort should be made to determine other factors that contribute to suppression of the mussel fauna in some areas of the Cahaba River system and steps taken to correct those factors; such areas include the streamside habitat near the confluence of Shoal and Mahan Creeks in the Little Cahaba River system that threatens a population of *Hamiota altilis*, and numerous tributaries that contribute heavy sediment loads directly into the main channel Cahaba River downstream of Centreville.
- Consideration should be given to removing other barriers to potential fish host migration in the Cahaba River. Removal of the Marvel Slab has been completed and pre-removal data are available. Progress of recovery of the fauna in that area should be evaluated over time, and information gathered should be applied to other activities that would benefit the fauna throughout the watershed. Effects of the presence of other small dams in the system such as those at U.S. Highway 280, at Lake Purdy, and Altadena should be evaluated and considered for removal or modification to allow fish passage.
- Gravel mining in the Oakmulgee Creek watershed should be monitored to protect the population of *Pleurobema perovatum* found there.

REFERENCES CITED

- Baldwin, C. S., 1973, Changes in the freshwater mussel fauna in the Cahaba River over the past 40 years: Tuskegee Institute, Alabama, Unpublished Masters Thesis, 45 p.
- Bogan, A. E., 1993, Freshwater bivalve extinctions (Mollusca: Unionoida): a search for causes: *American Zoologist*, v. 33, p. 599-609.
- Frey, P. J., Howard, H. S., Murphy, P. J., Rashcke, R. L., Shultz, D. A., Smith, D. R., and True, Howard, 1976, Upper Cahaba River report, Environmental Impact Statement under Sect. 201, PL 92-500: Athens, Georgia, Environmental Protection Agency, 59 p.
- Gangloff, M. M., and Feminella, J. W., in press, Distribution and status of freshwater mussels (Bivalvia: Unionidae) in the Upper Alabama (Coosa and Lower Tallapoosa) drainage, Alabama: Auburn University, Alabama, Department of Biological Sciences, 121 p.
- Hartfield, Paul, 1994, Status review of select mussel species in the Mobile River basin: Jackson, Mississippi, U.S. Fish and Wildlife Service, 3 p.
- Johnson, R. I., 1967, Additions to the unionid fauna of the gulf drainages of Alabama, Georgia and Florida (Mollusca: Bivalvia): *Breviora*, v. 270, 21 p.
- Lewis, J., 1876, Fauna of Alabama: Freshwater and land shells of Alabama: Alabama Geological Survey Report of Progress for 1876, p. 61-100.

- McGregor, S. W., and Garner, J. T., 2004, Results of qualitative sampling for protected mussel species at selected stations in the Cahaba and Coosa Rivers, Alabama 2004: Geological Survey of Alabama Open-File Report 0505, 18 p.
- McGregor, S. W., O'Neil, P. E., and Pierson, J. M., 2000, Status of the freshwater mussel (*Bivalvia*: *Unionidae*) fauna in the Cahaba River system, Alabama: *Walkerana*, v. 11, no. 26, p. 215-237.
- Metcalfe-Smith, F. L., Di Maio, Joanne, Staton, S. K., and Mackie, G. L., 2000, Effect of sampling effort on the efficiency of the timed search method for sampling freshwater mussel communities: *North American Benthological Society Journal*, v. 19, no. 4, p. 725-732.
- Mirarchi, R. E., 2004, Alabama wildlife, Volume 1, A checklist of vertebrates and selected invertebrates: Aquatic mollusks, fishes, amphibians, reptiles, birds, and mammals: Tuscaloosa, The University of Alabama Press, 209 p.
- O'Neil, P. E., 1984, Historical surface water-quality analysis of the Cahaba River basin north of Centreville, Alabama: Alabama Geological Survey Open-file report, 86 p.
- Roe, K. J., and Hartfield, P. D., 2005, *Hamiota*, a new genus of freshwater mussel (*Bivalvia*: *Unionidae*) from the Gulf of Mexico drainages of the southeastern United States: *The Nautilus*, v. 119, no. 1, p. 1-10.
- Shepard, T. E., O'Neil, P. E., McGregor, S. W., and Harris, S. C., 1994, Water-quality and biomonitoring studies in the Upper Cahaba River drainage of Alabama: Geological Survey of Alabama Bulletin 160, 118 p.
- Stansbery, D. H., 1983a, The status of *Pleurobema decisum*: Columbus, The Ohio State University Museum of Zoology, 10 p.
- Stansbery, D. H., 1983b, The status of *Pleurobema taitianum*: Columbus, The Ohio State University Museum of Zoology, 10 p.
- Stansbery, D. H., 1983c, The status of *Epioblasma penita*: Columbus, The Ohio State University Museum of Zoology, 15 p.
- Strayer, D. L., and Smith, D. R., 2003, A guide to sampling freshwater mussel populations: American Fisheries Society, Monograph 8, Bethesda, Maryland, 103 p.
- Turgeon, D. D., Quinn, Jr., J. F., Bogan, A. E., Coan, E. V., Hochberg, F. G., Lyons, W. G., Mikkelsen, P. M., Neves, R. J., Roper, C. F. E., Rosenberg, G., Roth, B., Scheltema, A., Thompson, F. G., Vecchione, M., and Williams, J. D., 1998, Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks, second edition: Bethesda, Maryland, American Fisheries Society, Special Publication 26, 526 p.
- van der Schalie, Henry, 1938, The naiades (fresh-water mussels) of the Cahaba River in northern Alabama: Occasional Papers of the Museum of Zoology, University of Michigan, 392, 29 p.
- Vaughan, D. M., 2002, Potential impact of road-stream crossings (culverts) on the upstream passage of aquatic macroinvertebrates: The Xerces Society, Portland Oregon, unpublished report to U.S. Forest Service, San Dimas, California, 15 p.

- Vaughn, C. C., Taylor, C. M., and Eberhard, K. J., 1997, A comparison of the effectiveness of timed searches vs. quadrat sampling in mussel surveys: Conservation and Management of Freshwater Mussels II: Initiatives for the Future, Proceedings of a symposium organized by the Upper Mississippi Conservation Committee, Cummings, K. S., Buchanan, A. C., Mayer, C. A., and Naimo, T. J., eds., October 16-18, 1995, St. Louis, Missouri, 293 p.
- Warren, M. L., Jr., and Pardew, M. G., 1998, Road crossings as barriers to small-stream fish movement: Transactions of the American Fisheries Society, v. 127, p. 637-644.
- Watters, G. T., 1995, Small dams as barriers to freshwater mussels (Bivalvia: Unionoida) and their hosts: Biological Conservation, v. 75, p. 79-85.

GEOLOGICAL SURVEY OF ALABAMA

P.O. Box 869999
420 Hackberry Lane
Tuscaloosa, Alabama 35486-6999
205/349-2852

Berry H. (Nick) Tew, Jr., State Geologist

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