

A SEARCH FOR ADDITIONAL POPULATIONS OF *POTAMILUS CAPAX* IN THE ST. FRANCIS AND CACHE RIVER WATERSHEDS, ARKANSAS AND MISSOURI, U.S.A.

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ABSTRACT – The Tennessee Valley Authority conducted a second mussel survey in 1987 in the St. Francis River watershed, Arkansas and Missouri, and sampled a few sites in the Cache River watershed, Arkansas. The purposes of this survey were to identify additional populations of *Potamilus capax*, a federally-listed endangered species, and to collect abundance information on this species. The survey included qualitative sampling at 256 sites in selected reaches totaling approximately 380 miles of stream and ditch habitat. Quantitative samples were taken at 42 sites.

Thirty-five mussel species were found alive in the St. Francis River watershed and 19 species were found alive at the Cache River sites. *Potamilus capax* was found alive in nine reaches of the St. Francis watershed, most of which have continuous contact with the St. Francis Floodway. The atypical distribution of this species in the watershed would seem to match that of a migratory fish host (as yet unidentified). Distribution patterns of other mussels in the St. Francis watershed reflect general habitat similarity throughout the system. Evidence of past mussel assemblages indicates how much the stream habitat has been degraded during this century.

Abundance information collected for *Potamilus capax* indicated the species averaged 0.03/m² where it occurred. This value is similar to results from the complementary survey conducted in 1986. Length data on *P. capax* in four well-represented areas suggested that two of them were established populations, one (in a relatively new ditch) was growing rapidly, and the other may not be well established.

Key words: *Potamilus capax*, St. Francis River, Cache River, Arkansas, Missouri.

INTRODUCTION

In the fall of 1986, Tennessee Valley Authority (TVA) biologists conducted a freshwater mussel survey in the St. Francis River system, Arkansas and Missouri, for the Memphis District, U.S. Army Corps of Engineers (USACE) (Ahlstedt & Jenkinson, 1991). That survey, which included approximately 250 miles (mostly river mainstem), was intended to identify upstream and downstream limits on the range of the endangered fat pocketbook pearly mussel, *Potamilus capax*, within the watershed. The report on that survey (Ahlstedt & Jenkinson, 1991) reviewed recent mussel distribution literature on the St. Francis watershed and presented results that indicated *P. capax* was more

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widespread and more abundant than previously thought. They speculated that surveys of additional reaches of the St. Francis watershed would reveal other areas populated by the fat pocketbook.

Using this information, the USACE prepared a Scope of Work for a survey of approximately 350 miles, primarily of tributaries in the St. Francis watershed. This survey was designed to extend the 1986 survey and required the use of similar sampling techniques and levels of effort. The focus of this survey, like the one in 1986, was the distribution and abundance of *Potamilus capax*. Subsequently, the USACE requested that 30 additional miles of State Line Outlet Ditch habitat be sampled because *P. capax* had been found in that part of the watershed.

The primary purpose of this report is to present results of the survey called for in the USACE Scope of Work. It also uses information accumulated during this and several previous surveys to identify mussel distribution patterns in the St. Francis River system.

PROJECT AREA

Most of the St. Francis River watershed is located on the Mississippi River floodplain in northeast Arkansas and southeast Missouri (Fig. 1). This watershed, bounded on the west by Crowleys Ridge and on the east by the Mississippi River, has been substantially altered by local interests and the USACE to protect adjacent agricultural land. Most natural stream channels have been straightened or dredged and many ditches and levees have been built over the years to control flooding. These water control structures have substantially altered the drainage pattern to the point that there have been many channel diversions, one stream now crosses over another, and the watershed has been divided into two parallel basins between Marked Tree (River Mile 155) and Huxtable Dam (River Mile 12).

The USACE Scope of Work for the 1987 survey called for mussel sampling to be conducted in 66 identified reaches, most of which are located in smaller tributaries of the St. Francis system. The Scope of Work also called for sampling in Reeses Fork, a minor connection between the Cache and White rivers further west in Arkansas. These reaches included approximately 350 miles of stream and ditch habitat, ranging from the lower L'Anquille River near the mouth of the St. Francis to several ditches on the Arkansas-Missouri State line. The subsequent USACE request added three reaches (30 miles) in the State Line Outlet Ditch basin.

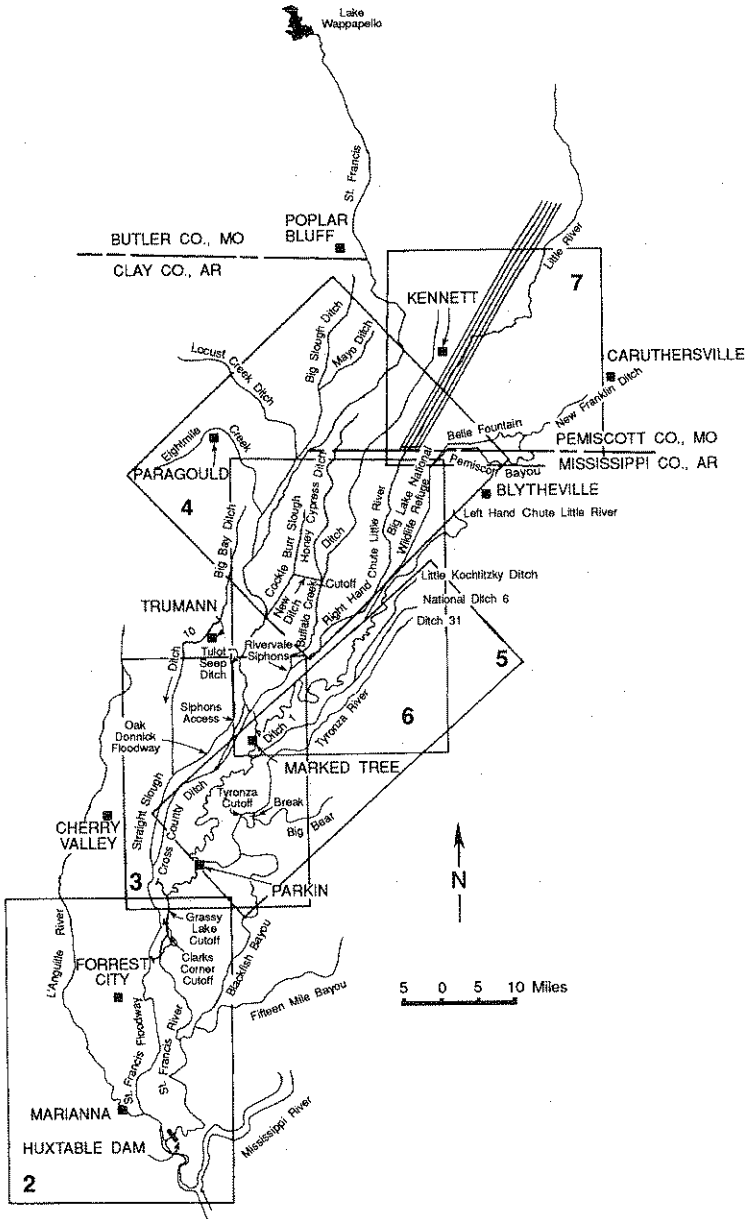


FIG. 1. The St. Francis River watershed, Arkansas and Missouri. Outlined areas are presented in more detail on Figs. 2-7, as indicated.

STUDY METHODS

Methods used during this survey were the same as those employed during the 1986 TVA study of the St. Francis River (Ahlstedt & Jenkinson, 1991). Access points were examined to locate boat launch and takeout points prior to the field effort. Information gathered during the access survey also helped determine which reaches would have to be floated to visit three or four sites within each five-mile reach.

Specific sampling sites were chosen in the field based upon the apparent quality of mussel habitat, uniform spacing of sites within the river reach, and accessibility by land or water. Large scale (7.5 minute series) topographic maps were used for navigation and site description.

When a sampling site was selected, the three- to five-man crew conducted a qualitative search for live and fresh-dead mussels. Methods typically employed included feeling along the substrate with hands or feet, raking, and collecting dead shells along the banks. Where necessary, snorkel or SCUBA equipment was used to perform an adequate search.

Collecting continued in all habitats at the site until the crew leader was satisfied that no additional species were being found. All mussels found were sorted by species, identified, and counted. Records kept on the qualitative search included the site location; number of man-minutes of search time; and numbers of live, fresh-dead (shells with shiny nacre), and relicts (dull nacre) of each mussel species encountered. Live individuals were returned to suitable habitat at the site. Fresh-dead and unusual relict shells were labeled and returned to the TVA Fisheries Laboratory in Norris, Tennessee, for storage.

Identification of virtually all mussels encountered during the survey was made by the leader of each field crew. These identifications were based upon considerable experience with all genera represented, augmented by specific study of species likely to occur in the St. Francis watershed. Species identification and synonymies had been clarified during an examination of St. Francis material housed at the Museum of Zoology, Ohio State University.

Quantitative sampling was conducted only at sites where live *Potamilus capax* were found during the qualitative search. Quantitative sampling consisted of carefully searching for mussels in 1 x 10 m intervals along a cable laid across the width of the river or ditch. Typically, two biologists would wade, snorkel, or use SCUBA equipment to find mussels within one-half meter (m) on each side of the cable. A complete quantitative search included two transects, spaced at least 20 m apart. Mussels found in each 10 m interval were identified to species, counted, and recorded along with substrate composition and water depth.

All live and unbroken fresh-dead *Potamilus capax* encountered during the survey were measured using dial or vernier calipers. Measurements taken included maximum anterior-posterior length, maximum height from anterior of umbos to ventral margin, and maximum thickness across the two shells. These data were recorded to the nearest 0.1 mm.

RESULTS

This survey was conducted in two segments. Most of the work was accomplished by two crews of TVA biologists between August 3 and September 2, 1987. The additional area examined in the State Line Outlet Ditch basin was surveyed by a single TVA crew during the week of October 26 -30, 1987.

Qualitative collections were made at 256 sites (Table 1, Figs. 2-8), where a total of 15,708 live and fresh-dead mussels were found (Table 2). Quantitative samples taken at 42 of these sites yielded a total of 3,961 live mussels (Table 3). Measurements were taken on 586 live and fresh-dead *Potamilus capax* found at these sites (Table 4).

Separate habitat descriptions, collection notes, and results tables are provided for each of nine major geographic areas or subwatersheds examined. Also provided are detailed qualitative and quantitative results from each group of collections. Measurements of the *Potamilus capax* specimens and general discussion of the data collected from all the sites are presented in the Discussion section.

L'Anguille River

Six sites were examined in the downstream part of this extensive watershed: three in the L'Anguille River between its mouth to the St. Francis Floodway and Marianna, two in the river mainstem upstream from Marianna, and one in a tributary (Larkin Creek) near its mouth (Fig. 2). All collections were made under what appeared to be low flow conditions, but visibility was never more than 10 cm.

Habitat at all mainstem sites was fairly consistent. The banks were high, rather steep, and stepped off quickly into water a meter or more in depth. Along the banks the substrate typically was thick silt, often overlain by partially or completely submerged trees. In the center of the river where the water was 1.5 to 2 m deep, the substrate was either thick silt or, occasionally, firm sand and gravel. Larkin Creek was quite small (less than 3 m wide), but still had high, steep banks. The substrate in this creek was silt and hard-packed clay.

Fifteen mussel species were found at the four downstream river sites (Table 5). No mussels were found in Larkin Creek and none were found in shallow water at Route 70 bridge (site 5). At the downstream sites, *Anodonta grandis* was by far the most abundant species, followed in order by *Arcidens confragosus*, *Lampsilis teres* form *anodontoides*, *Lasmigona complanata* and *Amblema plicata*. Single specimens of *Anodonta imbecillis*, *Potamilus capax*, *P. purpuratus*, *Quadrula apiculata* and *Truncilla truncata* were found. Quantitative samples taken at the most downstream site yielded 0.17 mussels/m² (Table 6).

St. Francis Floodway - Main Channels

Twenty-one sites were visited this year in two mainstem sections of the lower St. Francis Floodway: 7 sites in a 10-mile reach upstream

TABLE 1. Locations of collection sites visited during the St. Francis and Cache River watershed survey, August-October 1987.

Site Number	Location	County	State
L'Anguille River			
1	0.5 miles above its mouth to St. Francis Floodway	Lee	AR
2	0.9 miles east-northeast of Marianna	Lee	AR
3	At Rt. 79 bridge 1.4 miles northeast of Marianna	Lee	AR
4	0.7 miles north-northwest of Wrightland Bridge		
5	At Rt. 70 bridge	St. Francis	AR
6	Larkin Creek at bridge 2.0 miles northwest of Wright and bridge over L'Anguille	St. Francis	AR
St. Francis Floodway - Main Channels			
Madison Area			
7	0.4 miles northeast of Rt. 50 bridge in Madison	Cross	AR
8	1.4 miles northeast of Rt. 50 bridge in Madison	Cross	AR
9	2.0 miles north of Rt. 50 bridge in Madison	Cross	AR
10	0.5 miles above I-40 Bridge above Madison	Cross	AR
11	2.0 miles below Clarks Corner Cutoff	Cross	AR
12	1.0 miles below Clarks Corner Cutoff	Cross	AR
13	0.1 miles below Clarks Corner Cutoff	Cross	AR
Straight Slough			
14	Above confluence with Cross County Ditch	Cross	AR
15	0.5 miles above Cross County Ditch	Cross	AR
16	1.0 miles above Cross County Ditch	Cross	AR
17	2.5 miles above Cross County Ditch	Cross	AR
18	3.5 miles above Cross County Ditch	Cross	AR
19	3.0 miles south-southeast of Rt. 42 bridge	Cross	AR
20	2.5 miles south-southwest of Rt. 42 bridge	Cross	AR
21	1.6 miles downstream from Rt. 42 bridge	Cross	AR
22	1.1 miles downstream from Rt. 42 bridge	Cross	AR
23	Downstream from Rt. 42 bridge	Cross	AR
24	1 mile above Rt. 42 bridge	Cross	AR
25	2.8 miles north-northeast from Rt. 42 bridge	Cross	AR
26	1 mile above Sugar Creek	Cross	AR
27	2.5 miles east-southeast of Bay Village	Cross	AR
Western Ditches			
Ditch 10			
28	Above confluence of Ditch 9 above Rt. 69 bridge west of Stacey	Poinsett	AR
29	Below bridge east of Little Bay Ditch 9	Poinsett	AR

TABLE 1 (cont.)

Site Number	Location	County	State
Little Bay Ditch 9			
30	At bridge east of Shady Grove	Poinsett	AR
31	At bridge north of Shady Grove	Poinsett	AR
Tulot Seep Ditch (Ditches 123 and 103)			
32	Ditch 123 above bridge south of Anderson Tully (Stewart)	Poinsett	AR
33	Ditch 103 at bridge south of Payneway below Rt. 63 bridge	Poinsett	AR
34	Below Rt. 63 bridge at Payneway	Poinsett	AR
35	North of Payneway off levee road across from Floodway Dam Ditch 60	Poinsett	AR
36	At railroad crossing bridge south of Tulot	Poinsett	AR
Ditch 60 Connector to Ditch 61			
37	Connecting ditch between Ditch 60 and 61 on east bank below Rt. 63 bridge	Poinsett	AR
38	Connecting ditch between Ditch 60 and 61 on east bank below Rt. 63 bridge	Poinsett	AR
39	Ditch 61 just upstream from connector to Ditch 60	Poinsett	AR
40	At road culvert 1.3 miles west of Lester	Greene	AR
41	At road bridge 1.7 miles southwest of Dixie	Greene	AR
42	At road 2.1 miles southeast of Schug	Greene	AR
Thompson Creek Ditch			
43	At bridge 1.8 miles west of Lester	Greene	AR
44	Below mouth of Main Ditch	Greene	AR
45	3.7 miles east of Brookland	Greene	AR
Eightmile Creek Ditch			
46	At bridge east of Schug	Greene	AR
47	At bridge east of Mulbery Church	Greene	AR
48	At Rt. 135 road crossing	Greene	AR
49	At Rt. 412 bridge in Paragould	Greene	AR
50	At Rt. 49 bridge above Paragould	Greene	AR
Locust Creek Ditch			
51	1 mile above Lake Ditch south of Coffman	Greene	AR
52	Above Rt. 412 bridge crossing	Greene	AR

TABLE 1 (cont.)

Site Number	Location	County	State
Locust Creek Ditch (cont.)			
53	West of Bard	Greene	AR
54	East of Morning Star	Greene	AR
55	Henderson Creek, tributary to Locust Creek Ditch west of Bard	Greene	AR
Big Slough Ditch			
56	At Rt. 139 bridge crossing north of Fritz	Clay	AR
57	At bridge crossing east of White Walnut Creek	Clay	AR
58	At Rt. 90 bridge crossing near Hargrove Corner	Clay	AR
59	At bridge crossing 2.0 miles north-northeast of Hargrove Corner	Clay	AR
60	At county road bridge, 2.0 miles southeast of Greenway	Clay	AR
61	At county road bridge east of Greenway	Clay	AR
Mayo Ditch			
62	At county road bridge north of Middle Bark Camp Island	Greene	AR
63	At county road bridge north of Bark Camp Island	Greene	AR
64	At Rt. 139 bridge, 0.6 miles south of Mounds	Greene	AR
St. Francis River Channel			
65	2 miles below Rt. 79 bridge south of Raggio	Lee	AR
66	0.5 miles below Rt. 79 bridge	Lee	AR
67	Above Rt. 79 bridge at Cow Bayou Bar	Lee	AR
68	North of Tongin	Lee	AR
69	Cutoff above Old River Channel	St. Francis	AR
70	At Council Bar	St. Francis	AR
71	1.4 miles southwest of Joyland	Poinsett	AR
72	0.9 miles south-southwest of Joyland	Poinsett	AR
73	0.7 miles south-southwest of Joyland	Poinsett	AR
74	0.5 miles east-northeast of Joyland	Poinsett	AR
75	At Yellow Banks west of Mt. Olive	Poinsett	AR
76	Downstream from mouth of Ditch 1	Poinsett	AR
77	Above mouth of Ditch 1	Poinsett	AR
78	Below Neiswander Church	Poinsett	AR
79	North of Neiswander Church	Poinsett	AR
80	Below Rt. 63 bridge	Poinsett	AR
81	Above Rt. 63 bridge	Poinsett	AR
82	Below Rt. 63B bridge at Marked Tree	Poinsett	AR

TABLE 1 (cont.)

Site Number	Location	County	State
St. Francis River Channel (cont.)			
83	At sand bar upstream from Rt. 63B bridge at Marked Tree	Poinsett	AR
84	1 mile below railroad bridge	Poinsett	AR
85	Just above railroad bridge	Poinsett	AR
86	At mouth of Left Hand Chute Little River	Poinsett	AR
87	Below Siphons Access above Marked Tree	Poinsett	AR
88	Below Siphons Access above Marked Tree	Poinsett	AR
89	At Siphons Access above marked Tree	Poinsett	AR
Lower Eastern Tributaries			
Blackfish Bayou			
90	At Rawlinson	St. Francis	AR
91	Above Rt. 38 bridge	St. Francis	AR
92	Below bridge crossing southwest of Rt. 50	St. Francis	AR
93	At bridge crossing south of Rt. 50	St. Francis	AR
94	At Rt. 50 bridge crossing	St. Francis	AR
Fifteen Mile Bayou			
95	Above Rt. 38 bridge crossing	St. Francis	AR
96	North of Rt. 38	St. Francis	AR
Tyronza River			
97	1 mile above confluence with St. Francis River near Parkin	Cross	AR
98	North of Smithdale	Cross	AR
99	2.0 miles below Rt. 184 bridge crossing	Crittenden	AR
100	1.0 miles below Rt. 184 bridge crossing	Crittenden	AR
101	At Rt. 184 bridge crossing north of Norvell	Crittenden	AR
102	In field access west of Three Forks	Crittenden	AR
103	At Rt. 42 bridge crossing	Crittenden	AR
104	Tyronza cutoff at bridge west of King Solomon Cemetery and Rt. 149	Crittenden	AR
105	Tyronza cutoff at Rt. 149 bridge	Crittenden	AR
106	At Rt. 14 bridge, 1.6 miles north-northeast of Dyess	Mississippi	AR
107	At county bridge 2.0 miles northeast of Dyess	Mississippi	AR
108	Ditch 31 at bridge 1.2 miles east of Halftown	Mississippi	AR
109	Ditch 40 at Rt. 181 bridge crossing	Mississippi	AR
110	Ditch 40 at Rt. 158 bridge crossing	Mississippi	AR

TABLE 1 (cont.)

Site Number	Location	County	State
Big Creek			
111	At Rt. 149 bridge crossing northeast of Three Forks	Crittenden	AR
112	At confluence of upper Tyronsa River south of Rt. 42	Crittenden	AR
113	At Rt. 118 bridge crossing	Crittenden	AR
114	Below Deer Bayou south of Heafer	Crittenden	AR
115	At Rt. 42 bridge crossing east of Heafer	Crittenden	AR
116	At Rt. 42 bridge west of Turrell	Crittenden	AR
Ditch No. 1			
117	At confluence with St. Francis River	Poinsett	AR
118	At Rt. 149 bridge crossing south of Marked Tree	Poinsett	AR
119	At Rt. 308 bridge crossing	Poinsett	AR
120	At Rt. 135 bridge crossing north of Spear Lake	Poinsett	AR
121	At bridge south of Rt. 14	Mississippi	AR
122	2.8 miles southwest of Hall Town	Mississippi	AR
123	Tributary to National Ditch 6 at bridge crossing near Hall Town	Mississippi	AR
124	Tributary to National Ditch 6 at Rt. 140 bridge crossing	Mississippi	AR
Left Hand Chute Little River and Buffalo Creek Ditch			
Left Hand Chute Little River			
125	Just above confluence with St. Francis River	Poinsett	AR
126	At Rt. 140 bridge crossing, 1.5 miles north-northeast of Marked Tree	Poinsett	AR
127	At bridge 0.7 miles east-northeast of Marked Tree	Poinsett	AR
128	Where Rt. 308 turns east, 1.5 miles northeast of Marked Tree	Poinsett	AR
129	At bridge crossing, 2.3 miles northeast of Marked Tree	Poinsett	AR
130	At bridge crossing, 3.7 miles northeast of Marked Tree	Poinsett	AR
131	1.7 miles southwest of Lepanto	Poinsett	AR
132	At Rt. 140 bridge (North) in Lepanto	Poinsett	AR
133	Along dirt road, 2.4 miles south of Rivervale	Poinsett	AR
134	At Rt. 135 bridge crossing, 2.0 miles north of Lepanto	Poinsett	AR
135	Along Rt. 135, 0.5 miles from center of Lepanto	Poinsett	AR
136	At upstream southeast edge of Lepanto	Poinsett	AR
137	At Rt. 14 bridge crossing, 3.0 miles east of Lepanto	Mississippi	AR

TABLE 1 (cont.)

Site Number	Location	County	State
Left Hand Chute Little River (cont.)			
138	2.0 miles northeast of Lepanto	Mississippi	AR
139	At bridge 2.5 miles southwest of West Ridge	Mississippi	AR
140	At Rt. 77 bridge crossing in Bondsville	Mississippi	AR
141	At bridge 1.2 miles northeast of Bondsville	Mississippi	AR
142	At bridge 3.0 miles northeast of Bondsville	Mississippi	AR
143	At Rt. 140 bridge crossing, 2.2 miles southeast of Etowah	Mississippi	AR
144	1.7 miles southwest of Carrol Corner	Mississippi	AR
145	At Rt. 77 bridge crossing	Mississippi	AR
146	Unnamed ditch to LHCLR, 1.8 miles south-southeast of Rivervale	Poinsett	AR
Lower Buffalo Creek Ditch Complex			
147	New ditch at bridge 3.2 miles south-southeast of Rivervale	Poinsett	AR
148	New ditch 0.6 miles south-southeast of Rivervale	Poinsett	AR
149	Ditch north of Left Hand Chute just below Rivervale	Poinsett	AR
150	Unnamed ditch flowing under Right Hand Chute at Rivervale	Poinsett	AR
151	Unnamed ditch at powerline crossing, 1.0 mile north of Rivervale	Poinsett	AR
152	Unnamed ditch at Stier, Rt. 135 at Craighead County line	Poinsett	AR
153	Buffalo Creek Ditch off Rt. 158 bridge crossing	Mississippi	AR
154	Buffalo Creek Ditch at bridge west of Milligan	Mississippi	AR
155	Buffalo Creek Ditch east of Hancock	Mississippi	AR
156	Buffalo Creek Ditch at bridge east of Vail	Mississippi	AR
157	Unnamed ditch at Rt. 135 access, 0.8 miles southeast of Rivervale	Poinsett	AR
236	At Rt. 18 bridge crossing	Mississippi	AR
Right Hand Chute Little River Complex			
158	Iron Mines Creek off levee road west of Red Oak Church	Poinsett	AR
159	Right Hand Chute Little River off levee road west of Red Oak Church	Poinsett	AR
160	Iron Mines Creek north of Siphons Access	Poinsett	AR
161	Right Hand Chute Little River north of Siphons Access	Poinsett	AR
162	Iron Mines Creek off levee road north of Rt. 140	Poinsett	AR

TABLE 1 (cont.)

Site Number	Location	County	State
Right Hand Chute Little River Complex (cont.)			
163	Right Hand Chute Little River off levee road north of Rt. 140	Poinsett	AR
164	Right Hand Chute Little River below bridge south of Rivervale	Poinsett	AR
165	Dry Ditch (no name) 2 miles south of Rivervale	Poinsett	AR
166	Right Hand Chute Little River right channel below Rt. 135 bridge at Rivervale	Poinsett	AR
167	Right Hand Chute Little River above bridge at Rivervale	Poinsett	AR
168	Right Hand Chute Little River 2 miles above bridge at Rivervale	Poinsett	AR
169	Right Hand Chute Little River west of diversion ditch above Rivervale	Mississippi	AR
170	Right Hand Chute Little River east of Buffalo Creek Church above Rivervale	Mississippi	AR
171	Right Hand Chute Little River just downstream from mouth of Ditch 1, 1.2 miles south of Mandalay	Mississippi	AR
172	Ditch 1 above mouth to RHCLR, 1.3 miles south-southeast of Mandalay	Mississippi	AR
173	RHCLR at mouth of Ditch 2, 1.1 miles south-southeast of Mandalay	Mississippi	AR
174	Ditch 1, 2.3 miles southeast of Mandalay	Mississippi	AR
175	RHCLR 2.2 miles east-southeast of Mandalay	Mississippi	AR
176	RHCLR, 0.8 miles southwest of Mandalay	Mississippi	AR
177	Ditch 1, 0.7 miles south-southwest of Floodway	Mississippi	AR
178	RHCLR, 0.2 miles downstream from Rt. 77 Floodway bridge	Mississippi	AR
179	RHCLR, 0.1 miles upstream from Floodway (Rt. 77) bridge	Mississippi	AR
180	Ditch 1 at mouth to RHCLR, 0.4 miles southeast of Floodway	Mississippi	AR
181	Ditch 1, 1.6 miles east-northeast of Floodway	Mississippi	AR
182	RHCLR 1.9 miles northeast of Floodway	Mississippi	AR
183	Ditch 3, 2.5 miles south-southwest of Big Lake Dam	Mississippi	AR
184	RHCLR, 2.0 miles south-southwest of Big Lake Dam	Mississippi	AR
185	RHCLR above mouth of Ditch 81	Mississippi	AR
186	RHCLR, 0.5 miles south of Big Lake Dam	Mississippi	AR
187	RHCLR, downstream from Big Lake Dam under powerline	Mississippi	AR
188	RHCLR just below Big Lake Dam	Mississippi	AR
189	Lateral off of Ditch 1, east of Peach Orchard	Pemiscott	MO
190	Ditch 1 above Rt. EE bridge east of Peach Orchard	Pemiscott	MO

TABLE 1 (cont.)

Site Number	Location	County	State
Right Hand Chute Little River Complex (cont.)			
191	Ditch 83 at Rt. EE bridge east of Peach Orchard	Pemiscott	MO
State Line Outlet Ditch Basin			
Belle Fountain Main Ditch			
192	Above and below confluence of Pemiscot Bayou	Dunklin	MO
193	Below powerline crossing west of Rt. TT bridge	Dunklin	MO
194	Above powerline crossing west of Rt. TT bridge	Dunklin	MO
195	Above and below Main Ditch 1 west of Rt. TT bridge	Dunklin	MO
196	At Rt. TT bridge crossing	Dunklin	MO
197	At Rt. TT bridge crossing	Dunklin	MO
198	At bridge south of Shady Grove Church	Dunklin	MO
199	Below Rt. NN bridge crossing	Dunklin	MO
200	At bridge south of Rt. M and west of Hermondale	Pemiscott	MO
201	At bridge north of Hermondale	Pemiscott	MO
202	At Rt. 61 bridge crossing	Pemiscott	MO
203	At Rt. 559 bridge crossing	Pemiscott	MO
204	At bridge crossing southwest of Cooter	Pemiscott	MO
Pemiscot Bayou Ditch 29			
205	Above mouth of Pemiscot Bayou (Ditch 29)	Mississippi	AR
206	At Rt. 151N bridge above Calumet	Mississippi	AR
207	At Rt. 181N bridge	Mississippi	AR
208	At Rt. 150E bridge above Blytheville Air Force Base	Mississippi	AR
209	At Rt. 150 bridge spur north of Yarbro	Mississippi	AR
210	At Rt. 61 bridge northeast of Yarbro	Mississippi	AR
211	At I-55 bridge	Mississippi	AR
New Franklin Ditch 5			
212	At Rt. 554 bridge	Pemiscott	MO
213	At Rt. E bridge east of Cooter	Pemiscott	MO
214	Ditch 3 at bridge north of Cooter	Pemiscott	MO
215	At Rt. H bridge south of Acorn Corner	Pemiscott	MO
216	At bridge east of Rt. H below Acorn Corner	Pemiscott	MO
217	At Rt. 164 bridge	Pemiscott	MO
218	At Rt. D bridge	Pemiscott	MO

TABLE 1 (cont.)

Site Number	Location	County	State
Main Ditch 6			
219	At Missouri Rt. E bridge west of I-55	Pemiscott	MO
220	At bridge 1.0 miles southwest of Steele	Pemiscott	MO
221	At Rt. 61 bridge, north edge of Steele	Pemiscott	MO
222	At bridge east of Kings Chapel	Pemiscott	MO
223	At bridge east of Rt. 2	Pemiscott	MO
224	At Rt. J bridge southeast of Braggadiocio	Pemiscott	MO
225	At bridge north of Shade	Pemiscott	MO
Ditch 9			
226	At Rt. M west of West Hermondale	Pemiscott	MO
227	Below Channel at Rt. 164W bridge	Pemiscott	MO
228	At bridge east of the town of Channel	Pemiscott	MO
229	At bridge south of Rt. 164	Pemiscott	MO
230	At Rt. 164 bridge west of Denton	Pemiscott	MO
231	At bridge east of Rt. NN	Dunklin	MO
232	At Rt. 164 bridge	Dunklin	MO
Upper Eastern Tributaries			
Cockle Burr Slough Ditch			
233	At bridge west of Rt. 139	Craighead	AR
234	Above bridge at Rt. 139 and 18	Craighead	AR
235	At bridge west of Delfore	Craighead	AR
236	[locality follows site no. 157]		
Upper Buffalo Creek Ditch			
237	1 mile below Rt. 119 bridge crossing	Mississippi	AR
238	At lateral Ditch 12	Mississippi	AR
239	Off Rt. 119	Mississippi	AR
Honey Cypress Creek Ditch 12			
240	At new bridge east of Rt. 110 below Leachville	Mississippi	AR
241	At bridge east of Rt. 77	Mississippi	AR
242	At bridge east of Rt. 77	Mississippi	AR
243	At new bridge west of Buckeye	Mississippi	AR
244	At bridge west of Pawheen	Mississippi	AR
245	At bridge east of Rt. 77	Mississippi	AR
246	Dredge Boat Creek Ditch 12 at bridge east of Rt. 119	Mississippi	AR

TABLE 1 (cont.)

Site Number	Location	County	State
Cane Island Slough Ditch			
247	At mouth of Little Slough Ditch	Craighead	AR
248	At bridge, 1.6 miles east of Lake City	Craighead	AR
249	At Rt. 18 bridge crossing	Craighead	AR
Varney River Ditch			
250	At Osbunds Harvesting Rt. A bridge	Dunklin	MO
251	At dirt road bridge	Dunklin	MO
252	At Rt. A bridge	Dunklin	MO
Cache River			
253	At former channel outlet 2.0 miles north of Rt. 79 bridge in Clarendon	Monroe	AR
254	Reeses Fork 2.3 miles north-northwest of Rt. 79 bridge in Clarendon	Monroe	AR
255	Reeses Fork 3.0 miles northwest of Rt. 79 bridge in Clarendon	Monroe	AR
256	Reeses Fork 2.9 miles northwest of Rt. 79 bridge in Clarendon	Monroe	AR

from Madison (sites 7-13, Fig. 2), and 14 sites spaced along a 10-mile reach of Straight Slough upstream from its confluence with Cross County Ditch (sites 14-27, Fig. 3). Water levels were down and collecting conditions were excellent in both areas. Visibility was 20-30 cm at best.

Aquatic habitat in these two areas was not the same. The reach from Madison upstream to Clarks Corner Cutoff appeared to be a relatively unmodified old river channel. High banks either dropped off into the water or to bankside sand or gravel bars. The river typically was rather wide (70 m), less than 1 m deep, and had a substrate composed of stable or shifting sand. On the outside of bends there usually was a band of firm clay or gravel that could contain many mussels.

Straight Slough was a large, straight manmade ditch. The banks were high and steep, with little or no marginal strip along the water's edge. The channel was 30 to 50 m wide and nearly uniform in depth (30-70 cm). At its downstream end, the substrate was relatively firm mud. Further upstream the substrate gradually changed into shifting or firm sand with patches of mud along the banks. Gravel substrates

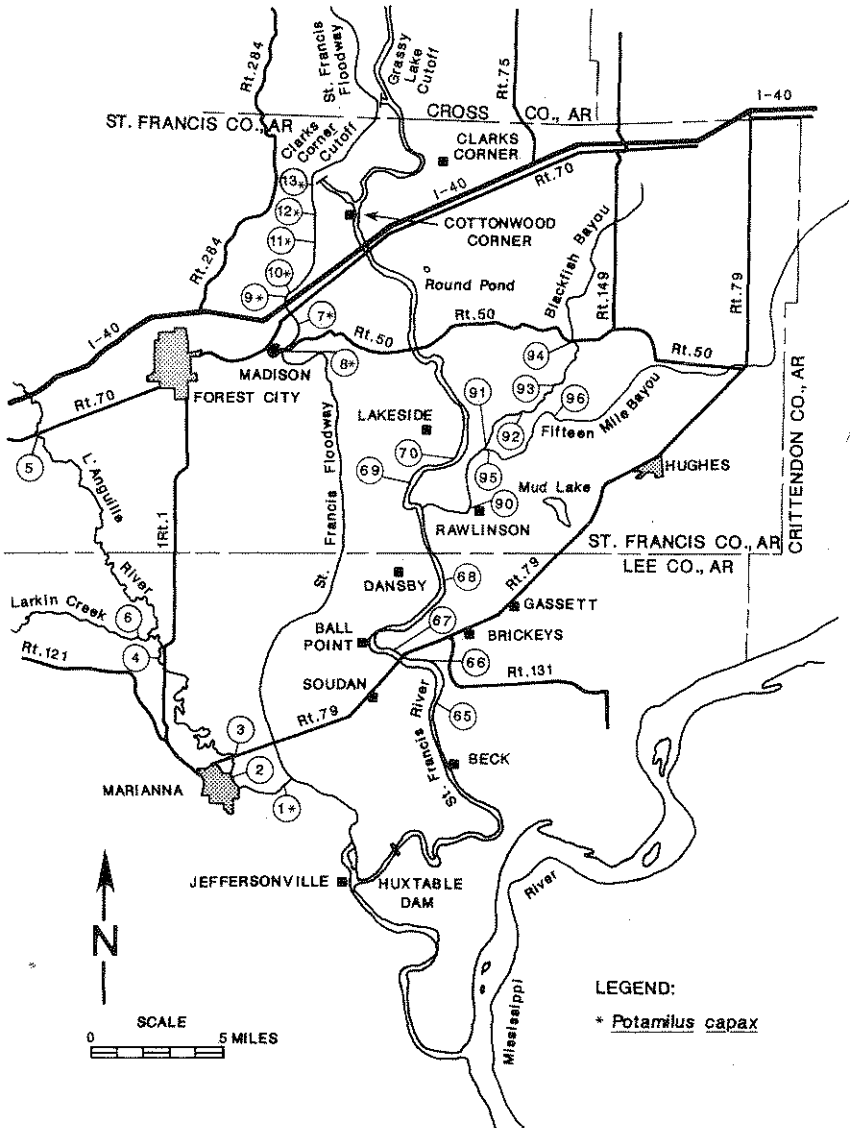


FIG. 2. Collection sites visited during 1987 in the L'Anguille River, Madison reach of the St. Francis Floodway, Lower St. Francis River, and Blackfish Bayou drainage. Stars identify sites where *Potamilus capax* was found.

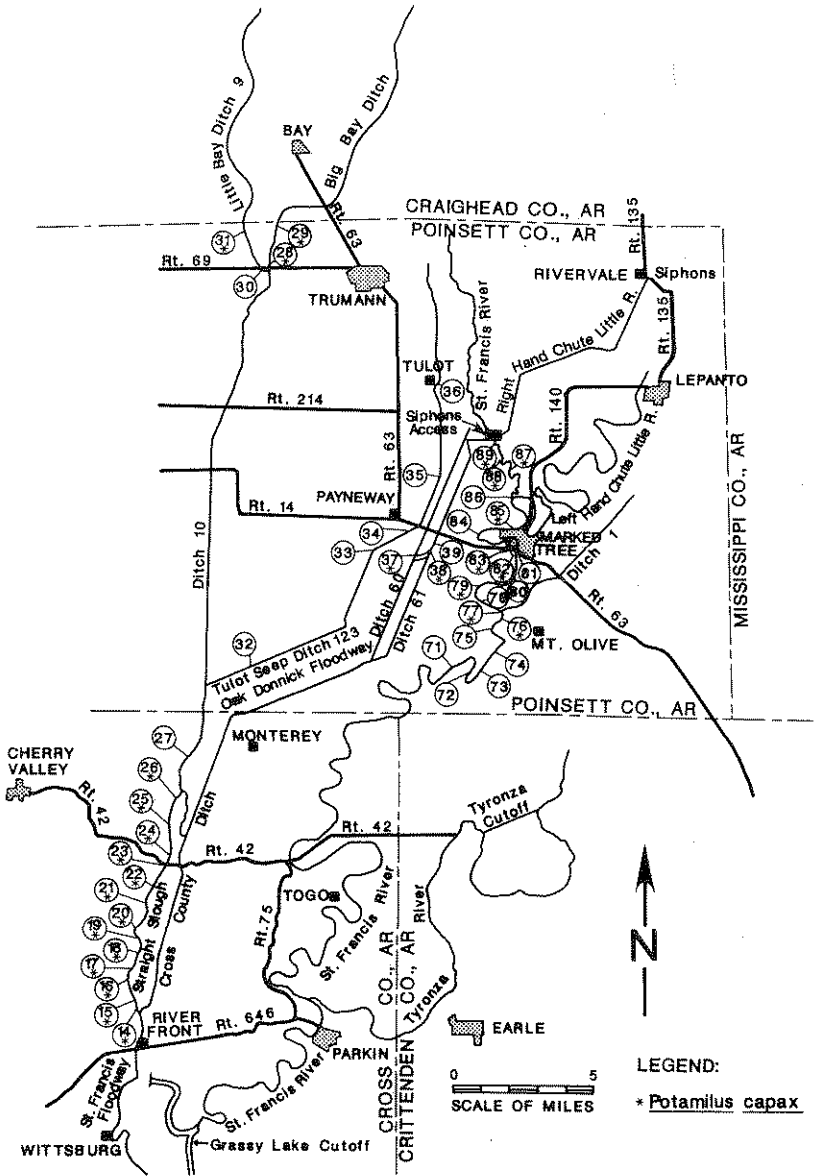


FIG. 3. Collection sites visited during 1987 in Straight Slough, some western tributaries, and the St. Francis River near Marked Tree, Arkansas. Stars identify sites where *Potamilus capax* was found.

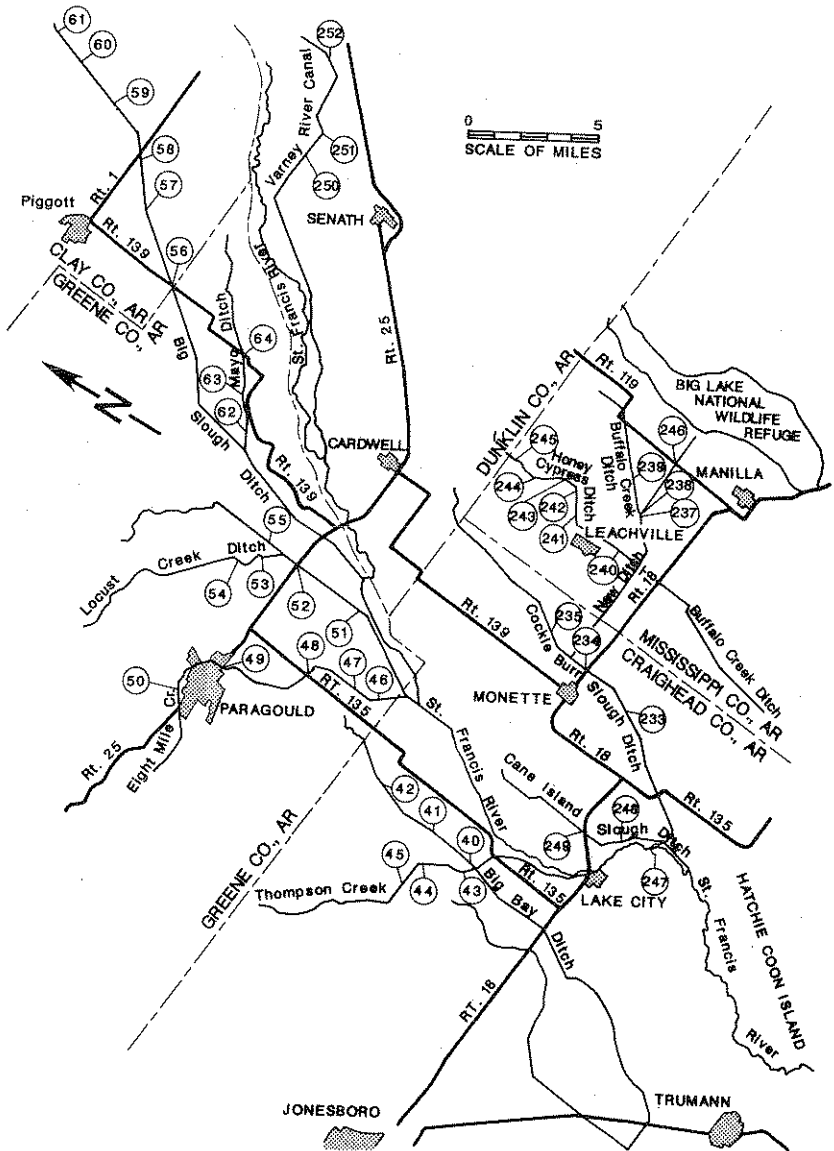


FIG. 4. Collection sites visited during 1987 in northwestern and upper eastern tributaries of the St. Francis River and Floodway system.

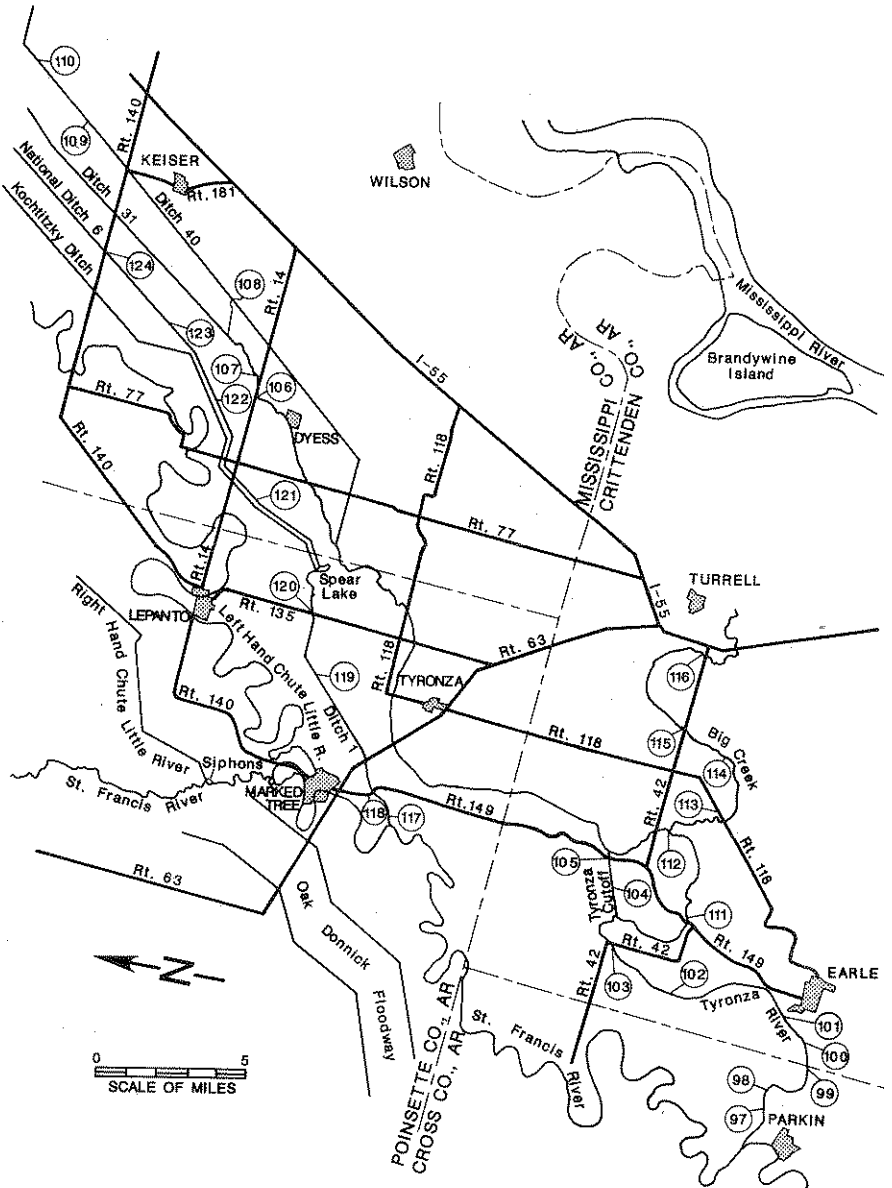


FIG. 5. Collection sites visited during 1987 in the Tyronza River and Ditch 1 drainage basins.

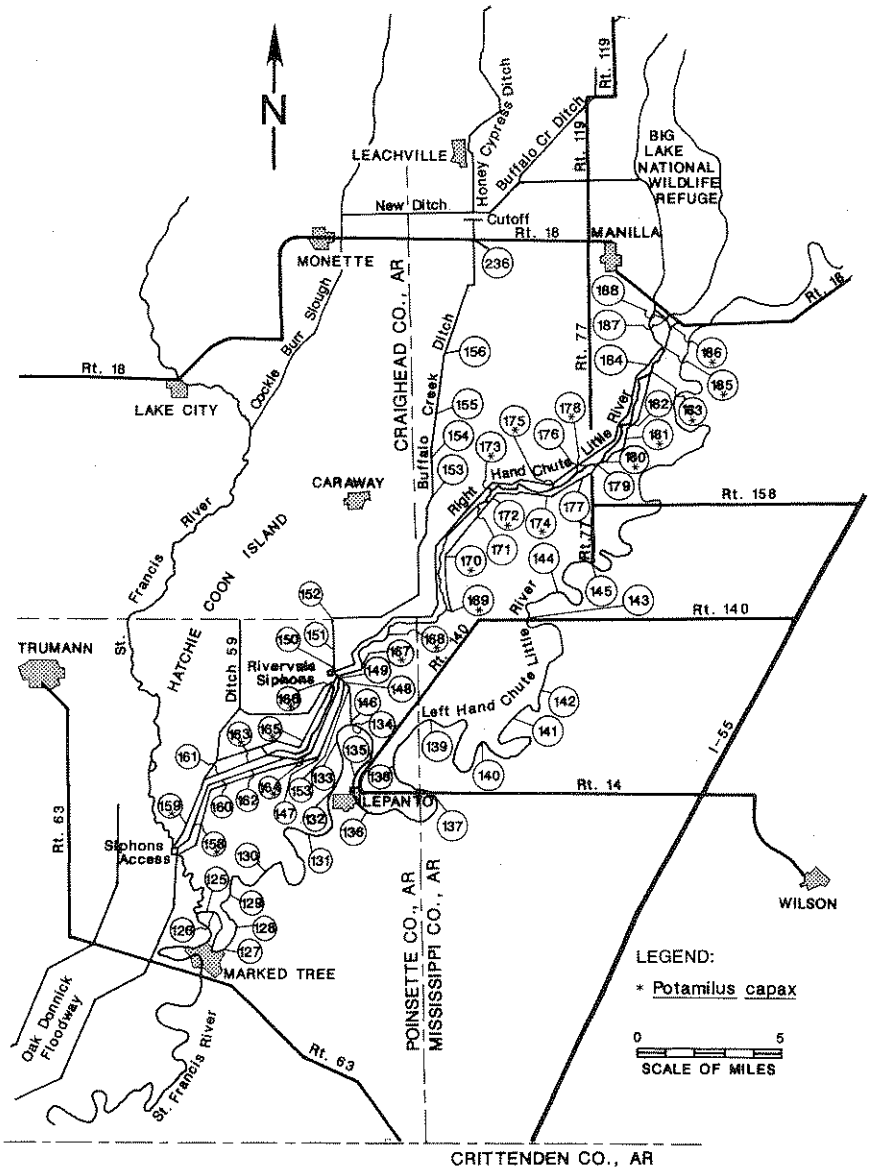


FIG. 6. Collection sites visited during 1987 in Left Hand Chute, Lower Buffalo Creek Ditch, and lower Right Hand Chute Little River. Stars identify sites where *Potamilus capax* was found.

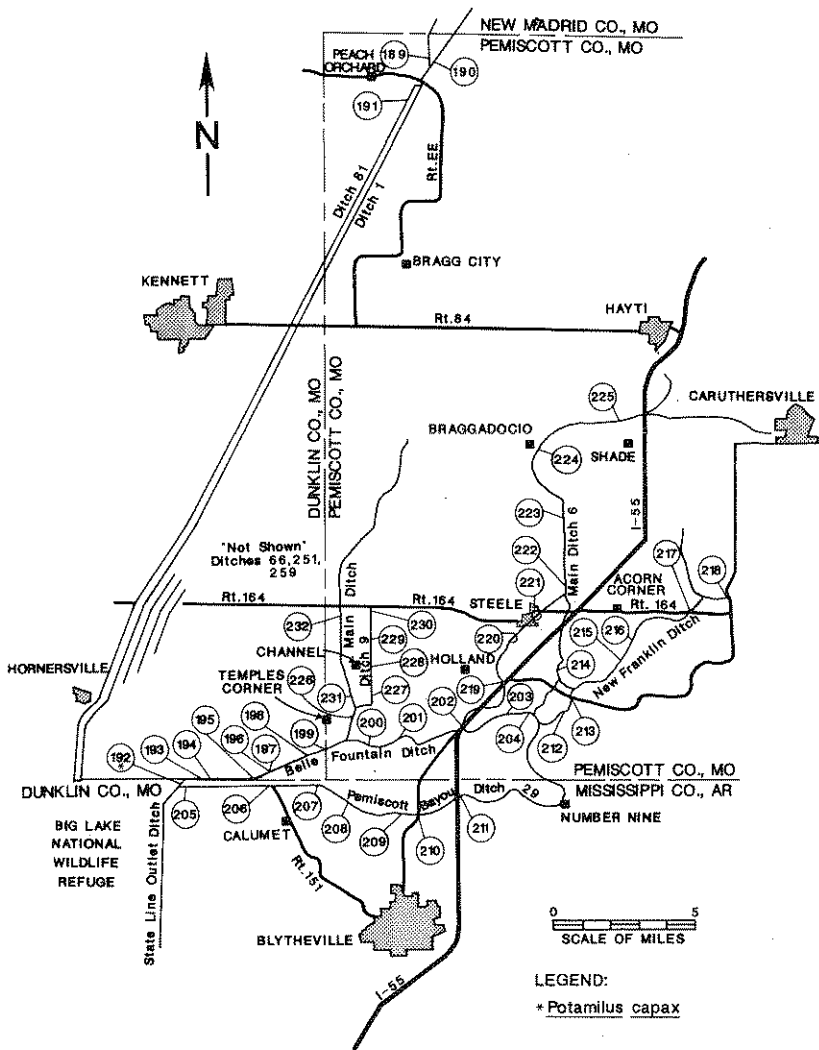


FIG. 7. Collection sites visited during 1987 in the State Line Outlet Ditch basin. A star indicates the site where *Potamilus capax* was found.

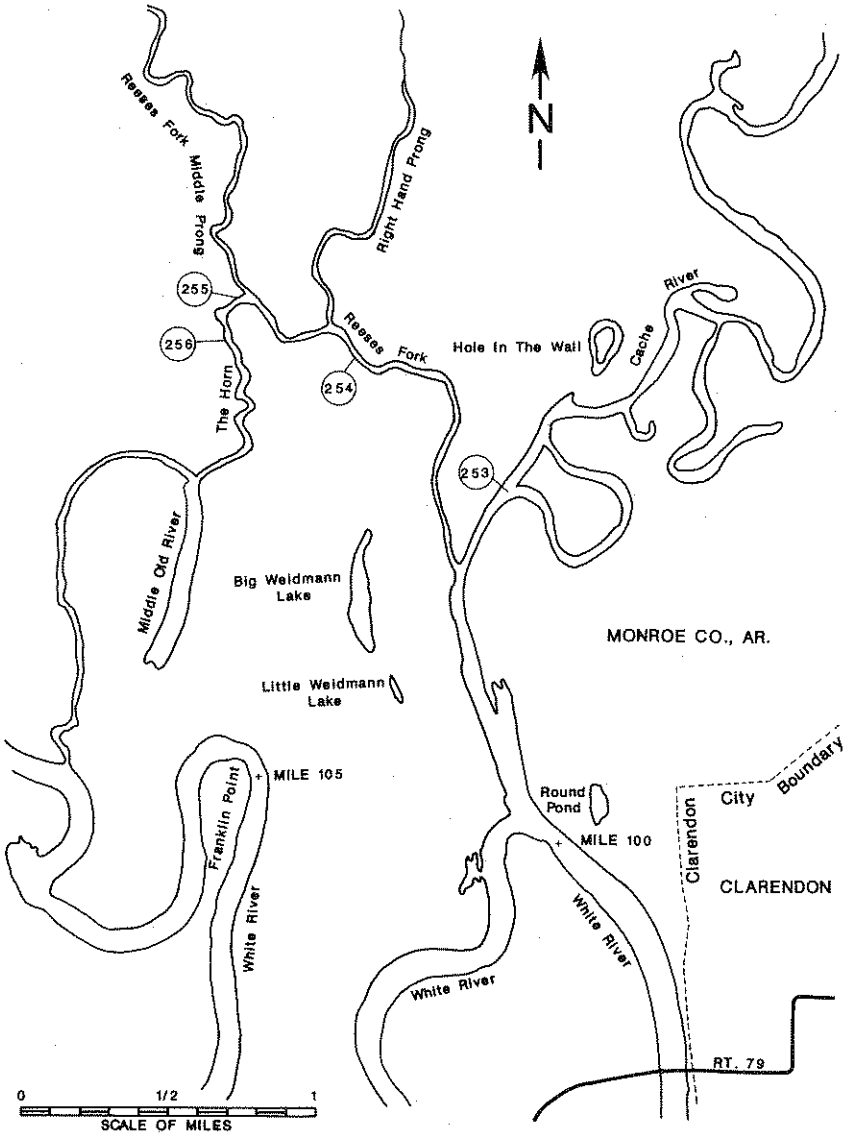


FIG. 8. Collection sites visited during 1987 in the Cache River basin.

TABLE 2. Summary of live and fresh-dead mussel records from the St. Francis and Cache River watershed survey, August-October, 1987.

Species	Site Number						
	1-6	7-27	28-64	65-89	90-124	125-157, 236	158-191
<i>Amblema plicata</i>	14	1412	166	1380	1545	431	213
<i>Anodonta grandis</i>	131	48	38	102	58	253	91
<i>Anodonta imbecillis</i>	1	3	17	5	7	4	7
<i>Anodonta suborbiculata</i>	10	4	1	2	10		2
<i>Arcidens confragosus</i>	22	7	10	10	24	14	3
<i>Cyprogenia aberti</i>		2					
<i>Fusconaia ebena</i>		37		3			
<i>Fusconaia flava</i>		108	33	123	35	18	21
<i>Lampsilis radiata hydiana</i>				1	1		
<i>Lampsilis teres f. anodontoides</i>	19	76	43	91	55	23	32
<i>Lampsilis teres f. teres</i>			3	4	7		
<i>Lampsilis ovata</i>		4	34	4	3	11	31
<i>Lasmigona complanata</i>	15	12	10	16	25	52	56
<i>Leptodea fragilis</i>		69	116	225	136	42	127
<i>Megaloniais nervosa</i>		135		83	125	41	5
<i>Obliquaria reflexa</i>		48	9	40	26	5	44
<i>Obovaria olivaria</i>							
<i>Ellipsaria lineolata</i>		26					
<i>Plectomerus dombeyanus</i>		3		3	2		
<i>Pleurobema rubrum</i>				20			
<i>Potamilus capax</i>	1	254	176	45			129
<i>Potamilus ohioensis</i>	3	66	21	87	36	56	124
<i>Potamilus purpuratus</i>	1	95	67	254	173	74	139
<i>Quadrula apiculata</i>	1				1		
<i>Quadrula metanevora</i>		4		2			
<i>Quadrula nodulata</i>		47	6	41	82	19	100
<i>Quadrula pustulosa</i>	2	682	4	573	206	29	80
<i>Quadrula quadrula</i>	13	632	53	82	116	27	65
<i>Strophitus undulatus</i>			3	1	5	1	
<i>Toxolasma texasensis</i>			7	9	31	3	11
<i>Tritogonia verrucosa</i>		50	1	78	86	20	7
<i>Truncilla donaciformis</i>		1		3	4		6
<i>Truncilla truncata</i>	1	5		6	19	1	
<i>Unio merus declivatus</i>			2		7		
<i>Unio merus tetralasmus</i>			13				
<i>Villosa hienosa</i>	5				1		
Totals							
Specimens	239	4184	833	3293	2826	1125	1293
No. Species	15	27	23	29	28	21	21
Sites Visited	6	21	37	25	35	34	34
Specimens/Site	39.83	199.24	22.51	131.72	80.74	33.09	38.03

TABLE 2. (Cont.)

Species	St. Line	Up East	St. Francis System		Cache R. System	
	Outlet Sites 192-232	Tribs. Sites 233-252 (-236)	Grand totals	Percent	Sites 253-256	Percent of total
<i>Amblyma plicata</i>	125	63	5349	35.69	78	10.90
<i>Anodonta grandis</i>	201	87	1009	6.73	6	0.84
<i>Anodonta imbecillis</i>	4	3	51	0.34		
<i>Anodonta suborbiculata</i>	5	4	38	0.25		
<i>Arcidens confragosus</i>	107	4	201	1.34		
<i>Cyprogenia aberti</i>			2	0.01		
<i>Fusconaia ebena</i>			40	0.27	21	2.94
<i>Fusconaia flava</i>		11	349	2.33	1	0.14
<i>Lampsilis hydiana</i>			2	0.01		
<i>Lampsilis teres f. anodontoides</i>	23	2	364	2.43	17	2.38
<i>Lampsilis teres f. teres</i>	3		17	0.11		
<i>Lampsilis ovata</i>	4	5	96	0.64	7	0.98
<i>Lasnigona complanata</i>	72	10	268	1.79		
<i>Leptodea fragilis</i>	122	12	849	5.66	121	16.91
<i>Megaloniais nervosa</i>			389	2.59	23	3.22
<i>Obliquaria reflexa</i>	10		182	1.21	28	3.92
<i>Obovaria obovaria</i>					3	0.42
<i>Ellipsaria lineolata</i>			26	0.17		
<i>Plectomerus dombeyanus</i>	1		9	0.06	142	19.86
<i>Pleurobema rubrum</i>			374	2.49		
<i>Potamilus capax</i>	2		607	4.05		
<i>Potamilus ohioensis</i>	31	5	429	2.86	18	2.52
<i>Potamilus purpuratus</i>	76	9	888	5.92	16	2.24
<i>Quadrula apiculata</i>	3	3	9	0.06		
<i>Quadrula metanevra</i>			6	0.04		
<i>Quadrula nodulata</i>	20		315	2.10	4	0.56
<i>Quadrula pustulosa</i>	1	29	1606	10.72	138	19.30
<i>Quadrula quadrula</i>	70	9	1067	7.12	74	10.35
<i>Strophitus undulatus</i>		6	16	0.11		
<i>Toxolasma texasensis</i>	6	12	79	0.53	4	0.56
<i>Tritogonia verrucosa</i>	23		265	1.77	8	1.12
<i>Truncilla donaciformis</i>	5		19	0.13		
<i>Truncilla truncata</i>			32	0.21	6	0.84
<i>Unio merus declivus</i>	4	7	20	0.13		
<i>Unio merus tetralasmus</i>	1		14	0.09		
<i>Villosa lienosa</i>			6	0.04		
Totals						
Specimens	919	281	14993	100.00	715	100.00
No. Species	24	18	35		19	
Sites Visited	41	19	252		4	
Specimens/Site	22.41	14.79	59.50		178.75	

TABLE 3. Summary of quantitative samples (mussels/m²) taken in each watershed area, St. Francis River System, August-October 1987.

Species	L'Anguille River	Floodway channels	Western ditches	St. Francis River	Right Hand Chute	Average per m ²	No. of spec.
<i>Ambiema plicata</i>		0.67*	0.10	0.18	0.00	0.38	1371
<i>Anodonta grandis</i>	0.12	0.00	0.01	0.01	0.01	0.01	25
<i>Anodonta imbecillis</i>			0.01			0.00	1
<i>Anodonta suborbiculata</i>		0.00			0.00	0.00	3
<i>Arcidens confragosus</i>		0.00		0.02		0.00	9
<i>Cyprogenia aberri</i>		0.00				0.00	2
<i>Fusconia ebena</i>		0.02		0.02		0.01	37
<i>Fusconia flava</i>		0.06		0.02		0.03	113
<i>Lampsilis teres f. anodontioides</i>		0.03	0.01	0.01	0.00	0.02	55
<i>Lampsilis ovata</i>		0.00	0.02			0.00	5
<i>Lesmignea complanata</i>	0.02	0.00		0.01	0.01	0.00	18
<i>Leptodea fragilis</i>		0.02	0.01	0.11	0.01	0.03	94
<i>Megalomaias nervosa</i>		0.07		0.05		0.04	149
<i>Obliquaria reflexa</i>		0.02		0.00	0.01	0.02	53
<i>Elipsaria lineolata</i>		0.01				0.01	26
<i>Plectomerus domibeyanus</i>				0.00		0.00	1
<i>Pleurobema rubrum</i>		0.18		0.00		0.10	355
<i>Potamilius capax</i>		0.03	0.04	0.01	0.02	0.03	92
<i>Potamilius ohioensis</i>	0.02	0.01	0.01		0.01	0.01	33
<i>Potamilius purpuratus</i>		0.03	0.01	0.06	0.02	0.03	95
<i>Quadrula apiculata</i>	0.02					0.00	1
<i>Quadrula metanetra</i>		0.00				0.00	4
<i>Quadrula nodulata</i>		0.01	0.01	0.01	0.02	0.01	51
<i>Quadrula pustulosa</i>		0.31		0.07	0.00	0.19	669
<i>Quadrula quadrula</i>		0.31	0.01	0.03	0.01	0.18	627
<i>Trigonia verrucosa</i>		0.02		0.05	0.00	0.02	64
<i>Truncilla donaciformis</i>		0.00			0.00	0.00	3
<i>Truncilla truncata</i>		0.00			0.00	0.00	5
Totals	0.17	1.85	0.23	0.63	0.12	1.11	
Number per Square Meter	6194	14	30	113	357		
Number of Samples (10 m ²)	10	3590	32	190	139		3961
Specimens found	4	25	11	17	15		28
Species included							

*All calculated values in the table have been rounded to two decimal places. These rounding errors make some summations appear to be incorrect.

TABLE 4. Lengths of *Potamilius capax* specimens encountered alive or as fresh-dead shells in each watershed area, St. Francis River system, August-October 1987.

Drainage Basins	Mean	Length Increments in Millimeters													Specimens	
		30	40	50	60	70	80	90	100	110	120	130				
L'Anguille River	111.70									1						1
Floodway Main Channels	101.90			1	3	13	46	62	36	39	33	10				243
Western Ditches	79.77		5	8	14	74	41	23	4	5	2					176
St. Francis River	90.12	1	3			4	12	15	6	1	2	1				45
Right Hand Chute	97.55	1		3	3	9	23	31	26	3	14	6				119
State Line Outlet Ditch	99.00						1			1						2
Totals	93.47	2	8	12	20	100	123	131	72	50	51	17				586

TABLE 5. Site by site counts of all mussels found in the L'Anguille River watershed, August 1987.

Species	Site						Totals	No. sites
	1	2	3	4	5	6		
<i>Anblema plicata</i>	1	11	2	-	-	-	14	3
<i>Anodontia grandis</i>	61	54	16	-	-	-	131	3
<i>Anodontia imbecillis</i>	1	-	-	-	-	-	1	1
<i>Anodontia suborbiculata</i>	5	2	3	-	-	-	10	3
<i>Arcidens confragosus</i>	1	20	1	-	-	-	22	3
<i>Lampsilis teres</i> f. <i>anodontoides</i>	2	11	5	1	-	-	19	4
<i>Lasnigona complanata</i>	2	10	3	-	-	-	15	3
<i>Potamilus capax</i>	1	-	-	-	-	-	1	1
<i>Potamilus ohioensis</i>	1	2	-	-	-	-	3	2
<i>Potamilus purpuratus</i>	1	-	-	-	-	-	1	1
<i>Quadrula epiculata</i>	1	-	-	-	-	-	1	1
<i>Quadrula pustulosa</i>	-	1	1	-	-	-	2	2
<i>Quadrula quadrula</i>	1	11	1	-	-	-	13	3
<i>Truncilla truncata</i>	-	-	1	-	-	-	1	1
<i>Villosa lierosa</i>	-	4	1	-	-	-	5	2
Total Specimens	78	126	34	1	0	0	239	
Species Included	12	10	10	1	0	0	15	

TABLE 6. Quantitative sampling results (mussels/m²) from the L'Anguille River watershed, August 1987.

Species	Site 1	Average per m ²	No. specimens
<i>Anodonta grandis</i>	0.12*	0.12	7
<i>Lasmigona complanata</i>	0.02	0.02	1
<i>Potamilus ohioensis</i>	0.02	0.02	1
<i>Quadrula apiculata</i>	0.02	0.02	1
Totals			
Number Per Square Meter	0.17	0.17	
Number of Samples (10 m ²)	6	6	
Specimens Found	10		10
Species Included	4		4

*All calculated values in the table have been rounded to two decimal places. These rounding errors make some summations appear to be incorrect.

were rare.

Twenty-five mussel species were found in the Madison reach and 16 species were found in Straight Slough (Table 7). Mussels were far more abundant in the Madison reach (Table 8). The most abundant species in the Madison reach was *Amblema plicata*, followed in order by *Quadrula pustulosa*, *Q. quadrula*, *Pleurobema rubrum* and *Potamilus capax*. The most abundant species in Straight Slough was *P. capax*, followed by *Anodonta grandis*, *Potamilus purpuratus*, *P. ohioensis* and *Q. quadrula*. As indicated in Table 7, several species were represented by only a few individuals in one or both of these reaches. *Potamilus capax* occurred at all but one of these sites.

Mussels were particularly abundant at the three downstream sites near Madison (sites 7, 8, 9). At all three sites, firm clay or gravel substrate adjacent to one bank was packed with mussels. At sites 7 and 8, the band of firm clay adjacent to the left (descending) bank changed fairly quickly to shifting sand substrates that did not contain many mussels. At site 9, the firm gravel along the right bank passed through a slow transition to packed sand and mussel shells (both live and dead) before becoming shifting sand near the left shoreline. Live mussels were packed into this site across more than half the width of the river.

Western Ditches

Thirty-seven sites were examined in 10 western ditches or small streams that drain into the St. Francis Floodway or the St. Francis

TABLE 7. (cont.)

Species	Madison Area													Straight Slough					
	Site	7	8	9	10	11	12	13	13	Subtotal	Percent	14	15	16	17	18	19	20	21
<i>Truncilla donaciformis</i>	-	-	1	-	-	-	-	-	-	1	0.03	-	-	-	-	-	-	-	-
<i>Truncilla truncata</i>	4	-	1	-	-	-	-	-	-	1	0.03	-	-	-	-	-	-	-	-
Total specimens	546	409	2670	136	40	30	63	3890	28	48	100.00	28	48	10	19	35	14	20	13
Species included	18	16	21	9	6	7	13	25	7	10	4	7	10	4	7	8	7	8	5

TABLE 7. (cont.)

Species	Straight Slough										Total	Percent	No. sites
	Site	22	23	24	25	26	27	Subtotal	Percent				
<i>Amblema plicata</i>	-	-	1	1	1	2	-	6	2.07	1412	11		
<i>Anodonta grandis</i>	-	-	-	3	-	-	-	48	16.55	48	8		
<i>Anodonta imbecillis</i>	-	-	-	1	-	-	-	2	0.69	3	3		
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	4	1.38	4	2		
<i>Arcidens confragosus</i>	-	-	-	-	-	-	-	3	1.03	7	5		
<i>Cyprogenia aberti</i>	-	-	-	-	-	-	-	-	0.00	2	1		
<i>Fusconia ebena</i>	-	-	-	-	-	-	-	-	0.00	37	3		
<i>Fusconia flava</i>	-	-	-	-	1	-	-	1	0.34	108	4		
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	1	-	-	-	-	2	0.69	76	9		
<i>Lampsilis ovata</i>	-	-	-	-	-	-	-	-	0.00	4	3		
<i>Lasmsgona complanata</i>	1	-	-	1	1	-	-	11	3.79	12	9		
<i>Leptodes fragilis</i>	1	3	2	1	2	-	-	21	7.24	69	18		
<i>Megaloniarias nervosa</i>	-	-	-	-	-	-	-	-	0.00	135	3		
<i>Obliquaria reflexa</i>	-	-	-	-	-	1	-	1	0.34	48	7		
<i>Ellipsaria lineolata</i>	-	-	-	-	-	-	-	-	0.00	26	1		
<i>Plectomerus dombeyanus</i>	-	-	-	-	-	-	-	-	0.00	3	1		
<i>Pleurobema rubrum</i>	-	-	-	-	-	-	-	-	0.00	354	2		
<i>Potamilus capax</i>	7	11	10	5	10	-	-	89	30.69	254	20		
<i>Potamilus ohioensis</i>	-	2	2	-	3	-	-	32	11.03	66	17		
<i>Potamilus purpuratus</i>	1	2	-	3	-	-	-	35	12.07	95	14		
<i>Quadrula metanevra</i>	-	-	-	-	-	-	-	-	0.00	4	1		
<i>Quadrula nodulata</i>	-	-	3	1	2	-	-	9	3.10	47	12		
<i>Quadrula pustulosa</i>	-	-	-	-	-	-	-	1	0.34	682	7		
<i>Quadrula quadrula</i>	1	4	5	1	5	1	25	8.62	632	15			
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	0.00	50	4		

TABLE 7. (cont.)

Species	Straight Slough										Total	No. sites
	Site	22	23	24	25	26	27	Subtotal	Percent			
<i>Truncilla donaciformis</i>	-	-	-	-	-	-	-	-	0.00	1	1	
<i>Truncilla truncata</i>	-	-	-	-	-	-	-	-	0.00	5	2	
Total specimens	11	24	24	16	27	1	290	4184	100.00			
Species included	5	7	7	8	9	1	16	27				

TABLE 8. Quantitative sampling results (mussels/m²) from the St. Francis Floodway—Main Channels, August 1987.

Species	Madison Reach							Straight Slough						
	Site	7	8	9	10	11	12	13	Average per m ² specimens	No.	14	15	17	18
<i>Ambleria plicata</i>		2.02*	1.05	11.93	0.10	0.02	-	0.02	1.20	1295	-	0.01	0.03	0.02
<i>Anodonta grandis</i>		-	-	-	-	-	-	-	-	-	-	0.01	-	-
<i>Anodonta suborbiculata</i>		-	-	-	-	-	-	-	-	-	-	0.01	-	-
<i>Arcidens confragosus</i>		0.01	0.01	0.01	-	-	-	-	0.00	4	-	-	-	-
<i>Cyprogenia aberti</i>		-	0.03	0.03	-	-	-	0.01	0.00	2	-	-	-	-
<i>Fusconia ebena</i>		0.04	-	0.44	-	-	-	-	0.03	37	-	-	-	-
<i>Fusconia flava</i>		0.03	0.03	1.41	-	-	-	-	0.10	107	-	-	-	-
<i>Lampsilis teres</i> f. <i>anodontoides</i>		-	0.05	0.53	0.00	0.01	-	0.01	0.04	49	-	-	-	-
<i>Lampsilis ovata</i>		-	0.01	-	-	0.00	-	-	0.00	2	-	-	-	-
<i>Lasnigona complanata</i>		0.01	-	-	-	-	-	-	0.00	1	-	-	-	0.01
<i>Lepidoxa fragilis</i>		0.09	0.09	0.23	0.00	-	0.01	0.01	0.04	43	-	-	-	-
<i>Megalomatus nerreosa</i>		0.03	0.05	1.77	-	-	-	-	0.12	135	-	-	-	-
<i>Obliaquaria reflexa</i>		0.01	0.08	0.37	0.00	-	-	0.03	0.04	44	-	-	-	-
<i>Elitpsaria lineolata</i>		-	-	0.37	-	-	-	-	0.02	26	-	-	-	-
<i>Pleurobema rubrum</i>		-	0.01	5.03	-	-	-	-	0.33	354	-	-	-	-
<i>Potamilus capax</i>		0.02	0.03	0.26	0.02	0.01	0.02	0.06	0.42	45	0.02	0.01	0.01	-
<i>Potamilus obtensis</i>		0.03	0.03	0.01	-	0.00	-	0.04	0.02	15	-	-	0.01	-
<i>Potamilus purpuratus</i>		0.06	0.08	0.44	-	-	-	0.02	0.50	54	-	-	-	0.01
<i>Quadrula metaevara</i>		-	-	0.06	-	-	-	-	0.00	4	-	-	-	-
<i>Quadrula nodulata</i>		-	0.11	0.06	0.01	0.00	-	0.01	0.02	24	-	-	-	0.01
<i>Quadrula pustulosa</i>		0.23	0.76	7.09	0.02	-	0.01	0.01	0.60	643	-	-	-	-
<i>Quadrula quadrula</i>		0.21	0.34	7.43	-	-	-	0.01	0.56	599	-	-	-	0.01
<i>Tritogonia verrucosa</i>		0.04	0.01	0.56	-	-	-	0.01	0.04	48	-	-	-	-
<i>Truncilla donaciformis</i>		-	-	0.01	-	-	-	-	0.00	1	-	-	-	-
<i>Truncilla truncata</i>		0.03	-	0.01	-	-	-	-	0.00	5	-	-	-	-

TABLE 8. (cont.)

Species	Site	Madison Reach							Straight Slough					
		7	8	9	10	11	12	13	Average No. per m ² Specimens	14	15	17	18	
Totals														
Number Per Square Meter		2.84	2.74	38.06	0.18	0.06	0.03	0.24	3.28		0.03	0.05	0.05	0.05
Number of Samples (10 m ²)		14	14	7	21	20	16	16	180		10	10	8	8
Specimens Found		397	384	2664	37	13	5	38		3558	3	5	4	4
Species Included		15	16	21	7	6	3	12	23		2	3	3	4

*All calculated values in the table have been rounded to two decimal places. These rounding errors make some summations appear to be incorrect.

TABLE 8. (cont.)

Species	Site	Straight Slough										Area Totals	
		19	20	21	22	23	24	25	26	Average per m ² Specimens	No. Specimens	Average per m ² Specimens	No. Specimens
<i>Amblyma plicata</i>	-	-	-	-	-	-	-	-	0.01	0.00	1	0.67	1296
<i>Anodonta grandis</i>	-	0.02	-	-	-	-	-	-	-	0.01	7	0.00	7
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	0.00	1	0.00	1
<i>Arcidens confragosus</i>	-	-	-	-	-	-	-	-	-	-	-	0.00	4
<i>Cyprogenia aberti</i>	-	-	-	-	-	-	-	-	-	-	-	0.00	2
<i>Fusconia ebena</i>	-	-	-	-	-	-	-	-	-	-	-	0.02	37
<i>Fusconia flava</i>	-	-	-	-	-	-	-	-	-	-	-	0.06	107
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	-	-	-	-	-	-	-	-	-	0.03	49
<i>Lampsilis ovata</i>	-	-	-	-	-	-	-	-	-	-	-	0.00	2
<i>Lasimigona complanata</i>	-	-	-	-	-	-	-	-	-	0.00	1	0.00	2
<i>Leptodea fragilis</i>	0.02	0.02	-	-	-	-	-	-	-	0.00	2	0.02	45
<i>Megalomias nervosa</i>	-	-	-	-	-	-	-	-	-	-	-	0.07	135
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	-	0.01	-	0.00	1	0.02	45
<i>Ellipsaria lineolata</i>	-	-	-	-	-	-	-	-	-	-	-	0.01	26
<i>Pleurobema rubrum</i>	-	-	-	-	-	-	-	-	-	-	-	0.18	354
<i>Potamilus capax</i>	0.02	0.02	-	0.03	0.07	0.02	0.02	0.02	0.02	0.02	16	0.03	61
<i>Potamilus ohioensis</i>	0.05	0.03	-	-	-	-	-	-	-	0.01	6	0.01	22
<i>Potamilus purpuratus</i>	0.02	0.02	-	0.02	-	-	0.02	-	-	0.01	5	0.03	59
<i>Quadrula metanema</i>	-	-	-	-	-	-	-	-	-	-	-	0.00	4
<i>Quadrula nodulata</i>	-	-	-	-	-	-	0.02	0.02	0.02	0.00	4	0.01	28
<i>Quadrula pustulosa</i>	-	-	-	-	-	-	-	-	-	-	-	0.33	643
<i>Quadrula quadrula</i>	-	-	0.03	0.02	-	-	0.02	0.04	0.01	0.01	8	0.31	607
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	-	-	0.02	48
<i>Truncilla donaciformis</i>	-	-	-	-	-	-	-	-	-	-	-	0.00	1
<i>Truncilla truncata</i>	-	-	-	-	-	-	-	-	-	-	-	0.00	5

TABLE 8 (cont.)

Species	Site	Straight Slough										Area Totals		
		19	20	21	22	23	24	25	26	Average No. Specimens per m ²	No. Specimens	Average per m ²	No. Specimens	
Totals														
Number Per Square Meter		0.10	0.08	0.03	0.07	0.07	0.02	0.10	0.11	0.06			1.85	
Number of Samples (10 m ²)		6	6	6	6	6	8	4	8	86			194	
Specimens Found		6	5	2	4	4	2	4	9		52		3590	
Species Included		4	4	1	3	1	1	4	5	11			25	

River (sites 28-64, Figs. 3 and 4). Most of these waterways had been dredged, cleared of snags, and had the trees cut back from along the banks.

Habitat in these ditches ranged from sloping muddy banks with soft mud and sand substrates across the width of the channels (Tulot Seep Ditch, Little Bay Ditch 9 and Ditch 10) to steep-sided banks with hard-packed clay, gravel, and coarse sand substrate (Big Bay Ditch, Eightmile Creek and Locust Creek).

Twenty-three mussel species were found in these tributaries (Table 9). In soft mud and sand habitats, mussels were randomly scattered. Mussels were rare or absent in some areas, especially the steep-sided, gully-like streams such as Eightmile Creek (sites 46-50), Locust Creek Ditch (sites 51-55), and Thompson Creek (sites 43-45). Tulot Seep Ditch (sites 32-36) contained the most species (18), followed by the channel connecting Ditches 60 and 61 (sites 37-39, 15 species), and Mayo Ditch (sites 62-64, 13 species).

The most abundant species in these streams were *Potamilus capax* and *Amblema plicata*, followed by *Leptodea fragilis*, *Potamilus purpuratus* and *Quadrula quadrula*. Uncommon species in these streams were *Anodonta suborbiculata*, *Tritogonia verrucosa* and *Unio merus declivus*.

Quantitative samples were taken at four ditch sites in this area (Table 10). Mussel density ranged from 0 (sites 29 and 31) to 0.52/m² (site 38). *Amblema plicata* was the most abundant species in the quantitative samples.

Potamilus capax was found in four of these ditches: Ditch 10 (sites 28 and 29), Little Bay Ditch 9 (site 31), Tulot Seep Ditch (site 32), and especially the channel connecting Ditches 60 and 61 (sites 37 and 38, Table 9).

St. Francis River Channel

Twenty-five sites were examined in two sections of the St. Francis River: six sites from below Route 79 bridge upstream to Council Bar (sites 65-70, Fig. 2) and 19 sites from Joyland upstream to the siphons near Marked Tree (sites 71-89, Fig. 3). The downstream section was surveyed at access points while the upstream reach was surveyed by boat.

Habitat at the downstream St. Francis River sites consisted of wide sloping banks and waist-deep mud overlain with tree limbs, leaves, and flocculent silt. The lower reach also was impounded by Huxtable Dam. At the upstream sites, the St. Francis was largely riverine, with sloping muddy banks and shifting sand across the width of the

TABLE 9. Site by site counts of all mussels found in the Western Ditches, St. Francis Watershed, August 1987.

Species	Ditch 10		Little Bay				Tulot Seep Ditch				60-61 Connector				Big Bay Ditch	
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	
<i>Ambiema plicata</i>	3	1	-	-	7	5	8	1	2	111	22	-	-	-	1	1
<i>Anodonta grandis</i>	12	-	-	1	1	2	1	3	1	-	-	-	-	-	6	6
<i>Anodonta imbecillis</i>	5	-	1	-	-	-	1	1	-	1	1	-	4	2	-	-
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Arcidens confragosus</i>	1	-	-	-	-	2	1	-	2	-	1	-	-	-	-	-
<i>Fusconia flavo</i>	-	-	-	-	-	1	1	1	-	-	1	-	-	-	-	-
<i>Lampsilis teres</i> f. <i>anodontoides</i>	1	1	2	-	9	5	8	1	1	6	2	-	-	-	-	-
<i>Lampsilis teres</i> f. <i>teres</i>	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-
<i>Lampsilis ovata</i>	2	-	-	-	6	11	-	-	-	1	4	-	-	-	1	-
<i>Lasnigona complanata</i>	-	-	-	-	1	1	2	-	-	-	-	-	-	-	1	-
<i>Lepidodea fragilis</i>	3	6	-	1	9	1	-	-	1	69	19	-	-	-	2	-
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-
<i>Potamitilus capax</i>	1	3	-	6	1	-	-	-	-	113	52	-	-	-	-	-
<i>Potamitilus ohioensis</i>	-	-	3	1	-	-	-	-	-	14	-	-	-	-	-	-
<i>Potamitilus purpuratus</i>	1	1	-	-	9	3	4	-	2	37	7	-	-	-	-	-
<i>Quadrula nodulata</i>	-	-	-	-	-	1	-	-	-	1	4	-	-	-	-	-
<i>Quadrula pustulosa</i>	-	-	-	-	1	1	-	-	-	1	-	-	-	-	-	-
<i>Quadrula quadrula</i>	2	1	2	1	2	5	1	-	3	2	6	-	-	-	2	-
<i>Strophitus undulatus</i>	-	-	-	-	1	1	-	-	1	-	-	-	-	-	-	-
<i>Toxolasma texasensis</i>	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
<i>Unionemus deditus</i>	-	-	-	-	-	-	1	-	-	-	-	-	-	12	-	-
<i>Unionemus tetralasmus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Specimens	31	13	8	12	50	40	28	7	13	344	135	0	16	16	7	7
Species Included	10	6	4	7	13	14	10	5	8	11	14	0	2	8	2	2

TABLE 9. (cont.)

Species	Thompson Creek			Eightmile Creek Ditch					Locust Creek Ditch			Big Slough			
	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
<i>Amblyma plicata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Anodonta grandis</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
<i>Anodonta imbecillis</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Arcidens confragosus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fusconia flava</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lampsilis teres f. anodontoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lampsilis teres f. teres</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lampsilis orata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lasmigona complanata</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
<i>Leptodea fragilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Potamilus capax</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Potamilus ohioensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Potamilus purpuratus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Quadrula nodulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Quadrula pustulosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
<i>Quadrula quadrula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Strophitus undulatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Toxolasma texasensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Unionmeris declivis</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
<i>Unionmeris tetralasmus</i>	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
Total Specimens	0	0	1	0	0	0	0	1	0	0	0	0	4	0	0
Species Included	0	0	1	0	0	0	0	1	0	0	0	0	4	0	0

TABLE 9. (cont.)

Species	Big Slough Ditch					Mayo Ditch				Total	No. sites
	Site	58	59	60	61	62	63	64			
<i>Amblema plicata</i>	-	-	-	-	-	-	4	-	-	166	12
<i>Anodonta grandis</i>	-	-	-	-	-	4	-	-	-	38	11
<i>Anodonta imbecillis</i>	-	-	-	-	-	-	-	-	-	17	9
<i>Anodonta suborbiculata</i>	-	-	-	-	-	1	-	-	-	1	1
<i>Arcidens confragosus</i>	-	-	-	-	-	1	2	-	-	10	7
<i>Fusconata flava</i>	-	-	-	-	-	-	29	-	-	33	5
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	-	7	-	-	-	-	-	43	11
<i>Lampsilis teres</i> f. <i>teres</i>	-	-	-	-	-	-	-	-	-	3	2
<i>Lampsilis orata</i>	2	2	4	-	-	-	-	1	-	34	10
<i>Lasnigona complanata</i>	1	-	-	-	-	1	3	-	-	10	7
<i>Leptodea fragilis</i>	3	-	-	-	-	1	-	-	-	116	12
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	6	-	-	9	3
<i>Potamilus capax</i>	-	-	-	-	-	-	-	-	-	176	6
<i>Potamilus ohioensis</i>	-	-	-	-	-	3	-	-	-	21	4
<i>Potamilus purpuratus</i>	1	-	-	-	-	2	-	-	-	67	10
<i>Quadrula nodulata</i>	-	-	-	-	-	-	-	-	-	6	3
<i>Quadrula pustulosa</i>	-	-	-	-	-	-	1	-	-	4	4
<i>Quadrula quadrula</i>	-	-	-	-	-	-	25	-	-	53	13
<i>Strophitus undulatus</i>	-	-	-	-	-	-	-	-	-	3	3
<i>Toxolasma texasensis</i>	-	-	-	3	-	-	-	-	-	7	5
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	1	1
<i>Unionemus decitus</i>	-	-	-	-	-	-	-	-	-	2	2
<i>Unionemus tetralasmus</i>	-	-	-	-	-	-	-	-	-	13	2
Total Specimens	7	2	14	0	0	13	70	1	1	833	
Species Included	4	1	3	0	0	7	7	1	1	23	

TABLE 10. Quantitative sampling results (mussels/m²) from the Western Ditches, St. Francis watershed, August 1987

Species	Site	28	29	31	38	Average per m ²	No. specimens
<i>Amblema plicata</i>		-	-	-	0.23*	0.10	14
<i>Anodonta grandis</i>		0.02	-	-	-	0.01	1
<i>Anodonta imbecillis</i>		-	-	-	0.02	0.01	1
<i>Lampsilis teres</i> f. <i>anodontoides</i>		-	-	-	0.02	0.01	1
<i>Lampsilis ovata</i>		-	-	-	0.05	0.02	3
<i>Leptodea fragilis</i>		-	-	-	0.02	0.01	1
<i>Potamilus capax</i>		-	-	-	0.08	0.04	5
<i>Potamilus ohioensis</i>		-	-	-	0.03	0.01	2
<i>Potamilus purpuratus</i>		-	-	-	0.02	0.01	1
<i>Quadrula nodulata</i>		-	-	-	0.02	0.01	1
<i>Quadrula quadrula</i>		-	-	-	0.03	0.01	2
Totals							
Number per square meter		0.02	0.00	0.00	0.52	0.23	
Number of samples (10 m ²)		4	2	2	6	14	
Specimens found		1	0	0	31		32
Species included		1	0	0	10		11

*All calculated values in the table have been rounded to two decimal places. These rounding errors make some summations appear to be incorrect.

channel.

Ten mussel species were found at the six downstream sites, while 27 species were found at the upstream sites (Table 11). Downstream, the most abundant species were *Potamilus purpuratus* and *Anodonta grandis*. Few specimens of *Anodonta imbecillis* and *Quadrula quadrula* were found. The most abundant species at the upstream sites was *Amblema plicata*. Other common species were *Quadrula pustulosa*, *Potamilus purpuratus*, *Leptodea fragilis*, *Fusconaia flava* and *Anodonta grandis*. Few specimens of *Plectomerus dombeyanus*, *Lampsilis hydiana*, *Strophitus undulatus*, *Anodonta suborbiculata* and *Quadrula metanevora* were present in this area. Only three live *Plectomerus dombeyanus* were found throughout this river reach, but relict (old-dead) shells were observed at many sites.

Quantitative samples were taken at four of the upstream sites (Table 12). Because *Potamilus capax* was not present at the downstream sites, no quantitative samples were taken. Mussel density ranged from 0 (site 89) to 1.22/m² (site 82). *Amblema plicata* was the most abundant species in the quantitative samples.

Potamilus capax was found only from below Ditch 1 (site 16) upstream to the siphons (site 89). A total of 45 specimens were found at

TABLE 11. Site by site counts of all mussels found in the St. Francis River Channel, August 1987.

Species	Site	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
<i>Amblema plicata</i>	-	-	-	-	-	-	-	48	351	113	120	87	18	63	51	63
<i>Anodonta grandis</i>	4	7	16	10	2	4	4	1	2	5	3	3	2	4	1	1
<i>Anodonta imbecilis</i>	-	-	-	1	-	-	-	-	-	-	-	2	-	1	-	-
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Arcidens confragosus</i>	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-
<i>Fusconia ebena</i>	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
<i>Fusconia flava</i>	-	-	-	-	-	-	-	1	86	-	1	15	2	-	-	5
<i>Lampsilis hydiana</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
<i>Lampsilis teres f. anodontoides</i>	-	1	6	11	-	4	4	3	-	2	-	5	1	17	1	1
<i>Lampsilis teres f. teres</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	2	-	-
<i>Lampsilis ovata</i>	-	-	-	-	-	-	-	-	-	2	1	-	-	-	1	-
<i>Lasignona complanata</i>	-	-	-	-	-	-	-	-	-	2	1	3	1	-	-	-
<i>Leptodea fragilis</i>	-	5	6	6	-	-	-	4	6	8	12	13	15	26	5	-
<i>Megalomias nervosa</i>	-	-	-	-	-	-	-	4	13	9	3	8	-	4	-	2
<i>Obliquaria reflexa</i>	-	-	1	-	-	-	4	1	-	-	4	1	5	1	-	1
<i>Plectomerus dombejanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pleurobema rubrum</i>	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
<i>Potamilius capax</i>	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-
<i>Potamilius obtensis</i>	1	8	-	-	-	-	-	-	-	-	-	-	1	2	-	2
<i>Potamilius purpuratus</i>	3	4	8	22	12	43	12	12	9	18	14	1	2	5	3	1
<i>Quadrula metacera</i>	-	-	-	-	-	-	-	-	-	-	-	2	-	3	-	6
<i>Quadrula nodulata</i>	-	-	-	-	-	-	-	-	-	3	-	-	5	3	-	1
<i>Quadrula pustulosa</i>	-	-	-	-	-	-	15	90	10	16	16	98	36	31	16	27
<i>Quadrula quadrula</i>	-	-	1	-	-	-	-	3	20	3	1	5	8	4	-	1
<i>Strophitus undulatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Trochasma texasensis</i>	1	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	2	7	10	-	10	1	1	-	10
<i>Truncilla donaciformis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
<i>Truncilla truncata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total specimens	9	30	41	52	16	58	99	599	191	178	264	98	168	78	121	13
Species included	4	6	7	6	3	5	14	11	13	13	18	14	16	7	7	13

TABLE 11. (cont.)

Species	Site	80	81	82	83	84	85	86	87	88	89	Total	No. Sites
<i>Amblema plicata</i>		23	203	64	23	88	11	41	13	-	-	1380	17
<i>Anodontia grandis</i>		4	8	2	2	4	2	13	-	2	-	102	23
<i>Anodontia imbecillis</i>		-	-	-	-	-	-	-	-	1	-	5	4
<i>Anodontia suborbiculata</i>		-	-	-	-	-	-	-	-	-	-	2	1
<i>Arcidens confregosus</i>		-	2	2	1	-	3	-	-	-	-	10	6
<i>Fusconia ebena</i>		-	-	-	-	-	-	-	-	-	-	3	2
<i>Fusconia flava</i>		-	3	3	1	3	3	-	-	-	-	123	11
<i>Lampsilis hydiana</i>		-	-	-	-	-	-	-	-	-	-	1	1
<i>Lampsilis teres f. anodontoides</i>		1	2	8	6	1	16	-	3	2	-	91	19
<i>Lampsilis teres f. teres</i>		-	-	1	-	-	-	-	-	-	-	4	3
<i>Lampsilis ovata</i>		-	-	-	-	-	-	-	-	-	-	4	3
<i>Lasimigona complanata</i>		1	-	5	-	-	1	-	2	-	-	16	8
<i>Leptodea fragilis</i>		2	10	13	13	19	39	-	10	8	5	225	20
<i>Megalomus nervosa</i>		-	-	3	2	7	12	13	-	-	-	83	13
<i>Obliguaria reflexa</i>		2	4	4	4	5	2	-	5	-	-	40	14
<i>Plectomerus donbeyanus</i>		-	1	1	-	-	-	-	-	-	-	3	3
<i>Pterobema rubrum</i>		-	-	1	-	-	-	-	-	-	-	20	3
<i>Potamilius capax</i>		-	-	2	3	-	12	-	-	5	9	45	9
<i>Potamilius okiensis</i>		1	4	4	4	14	1	3	10	2	9	87	21
<i>Potamilius purpuratus</i>		2	2	16	14	12	17	8	23	2	1	254	24
<i>Quadrula metacurea</i>		-	-	-	-	-	-	-	-	-	-	2	1
<i>Quadrula nodulata</i>		3	8	-	9	4	2	-	1	-	-	41	11
<i>Quadrula pustulosa</i>		7	61	8	57	80	20	-	-	-	-	573	16
<i>Quadrula quadrula</i>		2	2	7	13	4	3	-	3	2	-	82	17
<i>Strophitus undulatus</i>		-	1	-	-	-	-	-	-	-	-	1	1
<i>Toxolasma texanensis</i>		-	-	-	-	-	-	-	-	-	-	9	3
<i>Trigonia verrucosa</i>		1	4	14	4	5	7	1	1	-	-	78	15
<i>Truncilla donaciformis</i>		1	-	-	-	-	1	-	-	-	-	3	3
<i>Truncilla truncata</i>		2	4	-	-	-	-	-	-	-	-	6	2
Total specimens		52	319	158	157	242	152	79	84	24	24	3293	
Species included		14	16	18	15	13	17	6	13	8	4	29	

TABLE 12. Quantitative sampling results (mussels/m²) from the St. Francis River channel, August 1987.

Species	Site	82	85	87	89	Average per m ²	No. specimens
<i>Amblema plicata</i>		0.56*	0.09	-	-	0.18	54
<i>Anodonta grandis</i>		0.01	0.01	-	-	0.01	2
<i>Arcidens confragosus</i>		0.02	0.03	-	-	0.02	5
<i>Fusconaia flava</i>		0.04	0.03	-	-	0.02	6
<i>Lampsilis teres f. anodontoides</i>		0.01	0.02	-	-	0.01	3
<i>Lasmigona complanata</i>		0.05	-	-	-	0.01	4
<i>Leptodea fragilis</i>		0.09	0.25	-	-	0.11	32
<i>Megaloniaias nervosa</i>		0.04	0.11	-	-	0.05	14
<i>Obliquaria reflexa</i>		-	0.01	-	-	0.00	1
<i>Plectomerus dombeyanus</i>		0.01	-	-	-	0.00	1
<i>Pleurobema rubrum</i>		0.01	-	-	-	0.00	1
<i>Potamilus capax</i>		-	0.02	-	-	0.01	2
<i>Potamilus purpuratus</i>		0.14	0.06	0.02	-	0.06	18
<i>Quadrula nodulata</i>		-	0.02	-	-	0.01	2
<i>Quadrula pustulosa</i>		0.06	0.16	-	-	0.07	21
<i>Quadrula quadrula</i>		0.06	0.03	0.02	-	0.03	9
<i>Tritogonia verrucosa</i>		0.11	0.06	-	-	0.05	15
Totals							
Number per square meter		1.22	0.90	0.03	0.00	0.63	
Number of samples (10 m ²)		8	10	6	6	30	
Specimens found		98	90	2	0		190
Species included		14	14	2	0		17

*All calculated values in the table have been rounded to two decimal places. These rounding errors make some summations appear to be incorrect.

nine sites in this reach. This species was relatively common in the river channel between the siphons and Marked Tree, but became increasingly rare downstream.

Lower Eastern Tributaries

Thirty-five sites were examined in eight lower eastern tributaries of the St. Francis River (sites 90-124, Figs. 2, 5). Although included in the Scope of Work, Kochtitsky Ditch was not sampled because it was dry and overgrown with vegetation. Most of the length of these watercourses had either been dredged, straightened, or cleared of snags.

Habitat in these areas varied primarily with stream size. Larger watercourses (Tyronza River, Blackfish Bayou, Fifteen Mile Bayou, and Ditch 1) had steep sloping muddy banks that interfaced with soft mud and shifting sand in the channel. Habitat in smaller ditches (Ditch 31, National Ditch 6) consisted of low, grass-covered banks with hard-packed clay and gravel substrates, typically colonized by

emergent vegetation.

Twenty-eight mussel species were found in this area (Table 13). The vast majority of individuals and species occurred in narrow bands where the shifting sand in the channel met the mud or clay of the banks. This was especially true in the Tyronza River where *Amblyma plicata* was abundant in these bankside bands.

The Tyronza River (sites 97-107) had the most diverse species assemblage (23), followed by 17 species in National Ditch 6 (sites 123-124), and 16 species each in Big Creek (sites 111-116) and Ditch 1 (sites 117-122).

The most abundant species in these watercourses was *Amblyma plicata*. Other common species included *Quadrula pustulosa*, *Potamilus purpuratus*, *Leptodea fragilis* and *Megaloniaias nervosa*. One or two individuals of four species were found (*Villosa lienosa*, *Lampsilis hydianna*, *Quadrula apiculata* and *Plectomerus dombeyanus*). Many relict specimens of *Plectomerus dombeyanus* were observed in the Tyronza River and Ditch 1. *Potamilus capax* was not found at any of the sampling sites in this area.

Several piles of mussel shells were seen along the lower Tyronza River. Most of these shells were *Amblyma plicata* or *Megaloniaias nervosa*. Apparently, the Tyronza River still supports a limited commercial mussel fishery.

Left Hand Chute Little River and Lower Buffalo Creek Ditch

Twenty-two collections were made in the lower 30 miles of Left Hand Chute Little River (sites 125-146) and twelve collections were made in Lower Buffalo Creek Ditch (sites 147-157 and 236, Fig. 6). This reach of Left Hand Chute appeared to be a naturally meandering stream that had not been channelized, but had received considerable sedimentation in recent years.

The sequence of connected channels here called Lower Buffalo Creek Ditch (referred to as "unnumbered ditch" in Ahlstedt & Jenkinson, 1991) seem to be parts of several drainage ditches constructed over a long period of time. The mouth of this system now flows into the St. Francis River just downstream from the siphons at Marked Tree by way of a ditch constructed since 1978. Upstream, this ditch flows under (no water-to-water contact) Right Hand Chute Little River at Rivervale through a culvert dated 1924 (Fig. 6). The upstream end of the system now drains part of western Mississippi County, Arkansas. The former upstream portion of Buffalo Creek

TABLE 13. Site by site counts of all mussels found in the Lower Eastern Tributaries, St. Francis River System, August 1987.

Species	Site	Blackfish Bayou										Tyronza River									
		15 Mile																			
		90	91	92	93	94	95	96	97	98	99	100	101	102	103	104					
<i>Anblema plicata</i>	7	-	12	11	23	-	10	51	46	149	128	220	236	78	16						
<i>Anodonta grandis</i>	2	9	1	1	-	2	2	-	-	-	-	-	-	2	2						
<i>Anodonta imbecillis</i>	-	-	1	-	-	1	-	-	-	1	-	-	-	-	-						
<i>Anodonta suborbiculata</i>	5	2	-	-	-	-	-	-	-	-	-	-	-	-	-						
<i>Arcidens confragosus</i>	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-						
<i>Fusconaea flava</i>	-	-	-	-	-	-	-	-	-	2	-	1	25	1	-						
<i>Lampsilis hydiana</i>	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-						
<i>Lampsilis teres f. anodontoides</i>	-	-	2	-	-	12	-	-	4	8	4	1	-	1	2						
<i>Lampsilis teres f. teres</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-						
<i>Lampsilis ovata</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-						
<i>Lasmigona complanata</i>	-	-	3	1	-	-	-	2	1	-	-	-	1	3	1						
<i>Leptodea fragilis</i>	2	3	2	4	4	5	1	4	5	22	8	10	4	4	1						
<i>Megalomus nervosa</i>	-	-	2	5	14	-	1	10	9	8	6	20	29	3	-						
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	-	-	2	16	-	-	-	-	-						
<i>Plectomerus dombeyanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
<i>Potamilius ohioensis</i>	6	-	3	5	2	-	-	3	1	5	-	4	2	-	-						
<i>Potamilius purpuratus</i>	2	4	10	8	5	1	2	16	11	19	12	27	7	14	3						
<i>Quadrula apiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
<i>Quadrula nodulata</i>	-	-	1	1	1	-	2	-	8	35	-	1	1	-	9						
<i>Quadrula pustulosa</i>	-	-	1	2	2	-	-	1	4	26	-	7	71	16	1						
<i>Quadrula quadrula</i>	3	-	12	-	-	1	3	1	2	4	-	1	9	4	3						
<i>Strophitus undulatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
<i>Toxolasma texanensis</i>	5	4	-	-	-	14	-	1	-	-	-	-	-	-	-						
<i>Tritogonia verrucosa</i>	-	-	-	1	-	-	-	2	4	7	30	4	13	5	-						
<i>Truncilla donaciformis</i>	-	-	-	-	-	-	-	-	1	3	-	-	-	-	-						
<i>Truncilla truncata</i>	-	-	-	-	-	-	-	-	1	7	-	-	-	2	-						
<i>Unionemus declivus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
<i>Villosa hienosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Total specimens	32	22	50	38	51	37	21	91	100	312	190	296	399	134	38						
Species included	8	5	12	9	7	8	7	10	15	15	8	11	12	13	9						

TABLE 13. (cont.)

Species	Site	Tyronza River								Big Creek						Ditch 1		
		105	106	107	108	109	110	111	112	113	114	115	116	117	118	119		
<i>Amblyma plicata</i>		3	-	-	1	-	-	19	7	-	2	16	-	2	3	246		
<i>Anodonta grandis</i>		1	-	-	3	-	-	19	6	-	1	-	1	2	-	-		
<i>Anodonta imbecillis</i>		-	-	-	-	1	3	-	-	-	-	-	-	-	-	-		
<i>Anodonta suborbiculata</i>		-	-	-	-	-	-	3	-	-	-	-	-	-	-	-		
<i>Arcidens confragosus</i>		-	-	-	6	-	-	-	1	-	1	-	-	-	-	-		
<i>Fusconia flava</i>		-	-	-	1	-	-	-	-	-	-	1	-	-	-	-		
<i>Lampsilis hydiana</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Lampsilis teres f. anodontoides</i>		1	-	-	-	-	-	-	-	-	-	-	-	-	-	4		
<i>Lampsilis teres f. teres</i>		-	-	-	-	-	-	-	-	-	-	2	2	-	-	2		
<i>Lampsilis ovata</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Lasmgona complanata</i>		2	-	-	2	-	-	-	-	-	1	-	-	-	-	-		
<i>Leptodea fragilis</i>		2	-	-	1	-	-	2	-	-	1	10	-	-	-	-		
<i>Megalomias nervosa</i>		1	-	-	-	-	-	5	5	-	1	-	-	1	-	5		
<i>Obliquaria reflexa</i>		3	-	-	2	-	-	-	-	-	-	-	-	-	-	-		
<i>Plectomerus dombyanus</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Potamilus ohioensis</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Potamilus purpuratus</i>		2	-	-	1	-	-	1	-	-	-	2	2	-	-	-		
<i>Quadrula apiculata</i>		-	-	-	-	-	-	1	1	-	2	1	1	-	-	-		
<i>Quadrula nodulata</i>		6	-	-	-	-	-	-	-	-	1	4	-	-	-	2		
<i>Quadrula pustulosa</i>		-	-	1	-	-	-	-	-	-	-	52	-	-	-	4		
<i>Quadrula quadrula</i>		2	-	-	1	-	2	-	-	1	1	31	1	-	-	2		
<i>Strophitus undulatus</i>		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Toxolasma texanensis</i>		-	-	-	-	-	-	-	-	-	1	-	6	-	-	-		
<i>Trilogonia verrucosa</i>		-	-	-	-	-	-	-	-	-	-	7	-	-	-	1		
<i>Truncilla domaciformis</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Truncilla truncata</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Unionemias declivus</i>		-	-	-	-	3	4	-	-	-	-	-	-	-	-	-		
<i>Villosa liencosa</i>		-	-	-	-	-	1	-	-	-	-	-	-	-	-	-		
Total specimens		23	0	2	18	4	10	50	20	0	11	135	13	5	3	266		
Species included		10	0	2	9	2	4	7	5	0	9	11	6	3	1	8		

TABLE 13. (cont.)

Species	Ditch 1							Total	No.
	120	121	122	123	124				
<i>Amblenia plicata</i>	23	172	17	17	30			1545	27
<i>Anodonta grandis</i>	3	1	-	-	-			58	17
<i>Anodonta imbecillis</i>	-	-	-	-	-			7	5
<i>Anodonta suborbiculata</i>	-	-	-	-	-			10	3
<i>Arcidens confragosus</i>	-	4	1	5	4			24	9
<i>Fusconia flava</i>	-	1	-	3	-			35	8
<i>Lampsilis hydiana</i>	-	-	-	-	-			1	1
<i>Lampsilis teres f. anodontoides</i>	-	12	-	4	-			55	12
<i>Lampsilis teres f. teres</i>	-	-	-	-	-			7	4
<i>Lampsilis ovata</i>	-	-	-	1	-			3	3
<i>Lasnigona complanata</i>	-	1	1	3	3			25	14
<i>Leptodea fragilis</i>	-	32	1	6	2			136	24
<i>Megalomias nervosa</i>	-	-	-	-	1			125	17
<i>Obliquaria reflexa</i>	-	3	-	-	-			26	5
<i>Plectomerus dombejanus</i>	-	-	-	2	-			2	1
<i>Potamilius ohioensis</i>	-	-	-	-	-			36	12
<i>Potamilius purpuratus</i>	-	16	1	4	2			173	26
<i>Quadrula apiculata</i>	-	-	-	1	-			1	1
<i>Quadrula nodulata</i>	-	9	-	1	1			82	15
<i>Quadrula pustulosa</i>	-	7	1	6	4			206	17
<i>Quadrula quadrula</i>	-	8	-	20	5			116	21
<i>Strophitus undulatus</i>	-	1	-	3	-			5	3
<i>Toxolasma texanensis</i>	-	-	-	-	-			31	6
<i>Trigonia oerrucosa</i>	2	5	1	4	-			86	14
<i>Truncilla donaciformis</i>	-	-	-	-	-			4	2
<i>Truncilla truncata</i>	-	-	-	-	-			19	4
<i>Unionerus declivus</i>	-	-	-	-	-			7	2
<i>Villosa tenosa</i>	-	-	-	-	-			1	1
Total specimens	28	272	23	80	52			2826	
Species included	3	14	7	15	9			28	

Ditch has been diverted into Cockle Burr Slough Ditch through a new channel that runs north of Route 18. Collection sites for that portion of the drainage are covered as part of the Upper Eastern Tributaries area.

Aquatic habitat throughout Left Hand Chute was virtually uniform: well-defined banks bordering water less than 2 m deep over a heavy silt substrate. Mussels found in this reach typically were scattered at random, "floating" on the surface of the silt. Habitat in Buffalo Creek Ditch also was uniform, but here steep banks dropped off into water typically 1 m deep over sand substrates. Any mussels present appeared to be randomly scattered in stable or shifting sand.

Twenty-one mussel species were found in these watersheds: 19 in Left Hand Chute and 17 in Lower Buffalo Creek Ditch (Table 14). Four species were found in Left Hand Chute but not in Buffalo Creek Ditch (*Anodonta imbecillis*, *Quadrula apiculata*, *Toxolasma texasensis* and *Truncilla truncata*) while two species (*Obliquaria reflexa* and *Strophitus undulatus*) were found in Buffalo Creek but not in Left Hand Chute. In all, 913 live and fresh-dead mussels were found at the 22 Left Hand Chute sites (an average of 41.5 specimens per site). The 12 Buffalo Creek Ditch sites yielded 212 live or fresh-dead specimens (17.7 per site).

In both drainages, *Amblema plicata* was the most abundant species and *Anodonta grandis* was second. Other abundant species in Left Hand Chute were *Potamilus purpuratus*, *P. ohiensis* and *Megaloniais nervosa*. In Buffalo Creek Ditch, other abundant species were *Lasmigona complanata*, *Quadrula pustulosa* and *Leptodea fragilis*. At the other end of the spectrum, single individuals of *Lampsilis ovata*, *Quadrula apiculata* and *Truncilla truncata* were found in Left Hand Chute. *Strophitus undulatus* was the only species represented by a single individual in Buffalo Creek Ditch. *Potamilus capax* was not found in either drainage this year and no quantitative samples were taken.

At several sites on Left Hand Chute, relict shells were found either far underneath the surface of the substrate or in eroding bankside deposits. Samples of these relict shells were collected at two locations (sites 129 and 131). Tentative identifications and counts of these relicts are presented in Table 15. Differences in species composition and relative abundance between these relict samples and the extant fauna of Left Hand Chute are covered as part of the Discussion.

TABLE 14. Site by site counts of all mussels found in Left Hand Chute and Lower Buffalo Creek Ditch, August 1987.

Species	Left Hand Chute Little River																
	Site	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	
<i>Anblema plicata</i>	17	56	46	55	18	17	16	12	53	6	2	2	2	8	13	4	
<i>Anodonta grandis</i>	16	11	21	10	21	8	1	6	7	-	18	3	5	7	2	-	
<i>Anodonta imbecillis</i>	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Arcidens confusus</i>	-	-	-	1	2	-	-	1	1	-	-	1	-	-	1	1	
<i>Fusconia flava</i>	-	-	-	-	2	-	3	-	-	-	-	-	1	-	-	-	
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	-	7	7	-	2	-	-	-	1	1	1	1	-	-	
<i>Lampsilis ovata</i>	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	
<i>Lasmitigona complanata</i>	-	1	1	-	3	3	2	4	2	1	2	-	-	-	1	3	
<i>Leptodea fragilis</i>	-	-	2	1	8	1	-	-	1	-	2	2	-	-	1	-	
<i>Megaloniais nereosa</i>	6	29	1	-	1	-	-	-	-	-	-	-	-	-	-	-	
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Potamilius obtensis</i>	-	1	7	6	2	2	2	-	2	-	5	2	6	6	2	-	
<i>Potamilius purpuratus</i>	3	9	3	11	13	4	2	1	1	-	-	-	1	4	1	-	
<i>Quadrula apiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Quadrula nodulata</i>	-	-	1	-	1	-	-	6	2	-	1	-	-	2	-	-	
<i>Quadrula pustulosa</i>	-	-	-	1	3	2	1	3	-	1	-	-	-	-	1	-	
<i>Quadrula quadrula</i>	-	-	-	-	1	-	-	3	-	1	-	-	-	-	2	5	
<i>Strophitus undulatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Toxolasma texanensis</i>	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	
<i>Trigonia verrucosa</i>	-	1	-	3	2	2	-	1	-	-	-	-	-	-	-	-	
<i>Truncilla truncata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total specimens	42	108	91	98	78	39	29	37	69	9	32	12	23	36	18	7	
Species included	4	7	11	11	14	8	8	9	8	4	8	7	6	9	7	7	

TABLE 14. (cont.)

Species	Left Hand Chute Little River													Lower Buffalo Creek Ditch					
	140	141	142	143	144	145	146	Subtotal	Percent	147	148	149	150	151	152	153	154		
<i>Amblyma plicata</i>	-	2	9	14	8	-	-	358	39.21	-	-	8	-	3	-	24	25		
<i>Anodonta grandis</i>	4	17	11	18	23	11	-	220	24.10	1	-	1	-	-	-	-	2		
<i>Anodonta imbecillis</i>	-	-	-	1	-	-	-	4	0.44	-	-	-	-	-	-	-	-		
<i>Arcidonta confragosus</i>	-	1	1	-	-	-	-	10	1.10	-	1	-	-	-	-	-	1		
<i>Fusconaiia flavo</i>	-	-	-	1	-	-	-	6	0.66	2	-	-	-	-	-	3	2		
<i>Lampsilis teres</i> f. <i>anodonitooides</i>	-	1	-	-	-	-	-	20	2.19	2	-	1	-	-	-	-	-		
<i>Lampsilis ovata</i>	-	-	-	-	-	-	-	1	0.11	-	-	4	-	-	-	3	3		
<i>Lasimigona complanata</i>	-	-	3	4	2	1	2	35	3.83	-	-	3	-	-	-	1	5		
<i>Leptodea fragilis</i>	-	3	1	1	4	1	3	31	3.40	4	-	1	-	1	-	-	-		
<i>Megalomias nervosa</i>	1	-	-	-	-	-	-	38	4.16	-	-	2	-	-	-	-	-		
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	-	-	0.00	4	-	1	-	-	-	-	-		
<i>Potamilius ohioensis</i>	1	4	3	1	2	-	-	54	5.91	-	-	-	-	-	-	-	-		
<i>Potamilius purpuratus</i>	2	2	4	3	1	1	2	68	7.45	-	-	1	-	-	-	2	2		
<i>Quadrula apiculata</i>	-	-	-	-	-	-	-	1	0.11	-	-	-	-	-	-	-	-		
<i>Quadrula nodulata</i>	-	-	1	-	2	-	-	16	1.75	2	-	-	-	1	-	-	-		
<i>Quadrula pustulosa</i>	-	-	1	1	-	-	-	14	1.53	-	-	1	-	1	-	3	5		
<i>Quadrula quadrula</i>	-	1	4	3	2	2	-	24	2.63	1	-	1	-	-	1	-	1		
<i>Strophitus unilobatus</i>	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	1		
<i>Toxolasma texasensis</i>	-	-	-	-	-	-	-	3	0.33	-	-	-	-	-	-	-	-		
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	9	0.99	-	-	2	-	-	-	3	3		
<i>Truncilla truncata</i>	-	-	1	-	-	-	-	1	0.11	-	-	-	-	-	-	-	-		
Total specimens	8	31	39	47	44	16	7	913	100.00	16	1	26	0	6	0	40	49		
Species included	4	8	11	10	8	5	3	19		7	1	12	0	4	0	8	10		

TABLE 14. (cont.)

Species	Lower Buffalo Creek Ditch							Total	No. sites
	Site	155	156	157	236	Subtotal	Percent		
<i>Amblena plicata</i>	1	6	-	6	-	73	34.43	431	26
<i>Anodonta grandis</i>	2	16	-	11	-	33	15.57	253	26
<i>Anodonta imbecillis</i>	-	-	-	-	-	-	0.00	4	3
<i>Arcidens confragosus</i>	-	1	-	1	-	4	1.89	14	13
<i>Fusconata flava</i>	1	1	-	3	-	12	5.66	18	9
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	-	-	-	3	1.42	23	9
<i>Lampsilis ovata</i>	-	-	-	-	-	10	4.72	11	4
<i>Lasmigona complanata</i>	3	3	-	2	-	17	8.02	52	22
<i>Leptodea fragilis</i>	2	-	-	3	-	11	5.19	42	19
<i>Megaloniatis nervosa</i>	-	-	-	1	-	3	1.42	41	7
<i>Obitquaria reflexa</i>	-	-	-	-	-	5	2.36	5	2
<i>Potamitus ohioensis</i>	1	1	-	-	-	2	0.94	56	19
<i>Potamitus purpuratus</i>	-	-	-	1	-	6	2.83	74	23
<i>Quadrula apiculata</i>	-	-	-	-	-	-	0.00	1	1
<i>Quadrula nodulata</i>	-	-	-	-	-	3	1.42	19	10
<i>Quadrula pustulosa</i>	1	3	-	1	-	15	7.08	29	16
<i>Quadrula quadrula</i>	-	-	-	-	-	3	1.42	27	13
<i>Sirophitus undulatus</i>	-	-	-	-	-	1	0.47	1	1
<i>Toxolasma texensis</i>	-	-	-	-	-	-	0.00	3	3
<i>Tritogonia verrucosa</i>	-	-	-	3	-	11	5.19	20	9
<i>Truncilla truncata</i>	-	-	-	-	-	-	0.00	1	1
Total specimens	11	31	0	32	0	212	100.00	1125	
Species included	7	7	0	10	0	17		21	

TABLE 15. Counts of old-dead (relict) shells collected from two sites on Left Hand Chute Little River. Site numbers are the same as those previously listed.

Species	Site 129		Site 131	
	Valves	Percent	Valves	Percent
<i>Fusconaia flava</i>	120	50.43	2	3.85
<i>Quadrula pustulosa</i>	37	15.55	4	7.69
<i>Amblema plicata</i>	29	12.18	5	9.62
<i>Fusconaia ebena</i>	13	5.46	6	11.54
<i>Plectomerus dombeyanus</i>	9	3.78		0.00
<i>Obliquaria reflexa</i>	5	2.10		0.00
<i>Obovaria</i> sp. (<i>jacksoniana</i> ?)	5	2.10		0.00
<i>Quadrula nodulata</i>	4	1.68	1	1.92
<i>Cyprogenia aberti</i>	4	1.68		0.00
<i>Quadrula quadrula</i>	3	1.26		0.00
<i>Pleurobema rubrum</i>	2	0.84	30	57.69
<i>Truncilla truncata</i>	2	0.84	3	5.77
<i>Tritogonia verrucosa</i>	2	0.84		0.00
<i>Obovaria olivaria</i>	1	0.42		0.00
<i>Truncilla donaciformis</i>	1	0.42		0.00
<i>Megaloniaias nervosa</i>	1	0.42		0.00
<i>Potamilus purpuratus</i>		0.00	1	1.92
Total number of valves	238	100.00	52	100.00
Species included	16		8	
<i>Pleurocera</i> sp. (heavy, low spire)	1			
<i>Pleurocera</i> sp. (high spire, striate)			7	
<i>Campeloma</i> sp.			26	

Right Hand Chute Drainage

The Iron Mines Creek-Right Hand Chute Little River system consisted of a braided series of natural and manmade channels between the siphons at Marked Tree and Big Lake National Wildlife Refuge (Fig. 6). North of the Big Lake Refuge, much of the waterflow was contained in five large, parallel ditches (Fig. 7). In 1987, 34 sites were visited in this system: 31 in the Iron Mines Creek-Right Hand Chute complex (sites 158-188, Fig. 6) and three at adjacent sites on two of the upstream ditches (sites 189-191, Fig. 7).

Habitat throughout this system varied primarily with channel size and constancy of flow. Large channels (usually manmade) were relatively wide (60-70 m) and 2 m or more deep, with substantial flow and firm sand substrates. Smaller channels were as little as 4 m wide and less than 30 cm deep, with little or no obvious flow and flocculent silt substrates. Because of the braided nature of the channels between the Marked Tree siphons and Big Lake Refuge, both large and small

channel habitats could occur side by side. The upstream ditches sampled all were of modest size (10-15 m wide) with obvious flow and firm sand substrates.

These collections produced live or fresh-dead specimens of 21 species: 20 in the downstream reach and 16 at the three upstream sites (Table 16). Five species were present downstream, but absent at the upstream sites (*Anodonta suborbiculata*, *Arcidens confragosus*, *Megaloniaias nervosa*, *Potamilus capax* and *Toxolasma texasensis*). *Fusconaia flava* was the single species present at the upstream sites but absent throughout the downstream reach.

The five most abundant species in the downstream channels were *Amblema plicata*, *Potamilus capax*, *Potamilus ohioensis*, *Potamilus purpuratus* and *Leptodea fragilis*. At the upstream sites, *Quadrula pustulosa* was most abundant, followed by *Amblema plicata*, *Potamilus purpuratus*, *Leptodea fragilis* and *Lampsilis ovata*. In the downstream channels, four species were represented by five or fewer live or fresh-dead individuals (*Anodonta imbecillis*, *Anodonta suborbiculata*, *Arcidens confragosus* and *Truncilla donaciformis*). At the upstream sites, two of the same species (*Anodonta imbecillis* and *Truncilla donaciformis*) and *Tritogonia verrucosa* were represented by such low numbers.

Quantitative samples were taken at 14 sites in the Iron Mines Creek-Right Hand Chute complex (Table 17). At the upstream sites, no quantitative samples were taken because *Potamilus capax* was not present.

Mussel density varied considerably among sites, ranging from 0 (sites 164 and 175) to 0.45/m² (site 166). *Potamilus capax* was the most abundant species in these quantitative samples.

State Line Outlet Ditch Basin

Forty-one sites were examined in six ditch systems which drain into the Right Hand Chute Little River at Big Lake (sites 192-232, Fig. 7). These small ditches resemble free-flowing streams given their canopy cover and stabilized streambanks; however, each is relatively straight and flat-bottomed. The upper portion of Main Ditch 6 was not sampled because it was dry and covered with emergent vegetation.

Substrates varied from soft mud throughout (New Franklin Ditch 5, Main Ditch 6, and Ditch 9) to mud banks with shifting sand or hard-packed clay out in midchannel (Belle Fountain Ditch and Pemiscot Bayou Ditch 29). Main Ditch 6 (sites 214-225) was practically dry, but had a mixture of gravel, sand and mud substrate. Most of the streams

TABLE 16. Site by site counts of all mussels found in the Right Hand Chute Drainage, August-September 1987.

Species	Iron Mines Creek — Right Hand Chute Little River																
	Site	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	
<i>Amblyema plicata</i>	57	-	1	3	-	5	-	6	-	12	-	-	-	-	-	1	
<i>Anodonta grandis</i>	14	-	-	-	-	-	-	2	4	-	-	-	-	-	-	-	
<i>Anodonta imbecilis</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Arcidens confragosus</i>	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	
<i>Fusconia flava</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lampsilis teres</i> f. <i>anodontoides</i>	2	-	-	-	-	-	-	1	2	1	4	-	-	1	1		
<i>Lampsilis ovata</i>	1	-	-	-	-	-	-	-	-	-	1	1	1	-	-		
<i>Lasmigona complanata</i>	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-		
<i>Leptodea fragilis</i>	1	3	-	-	-	5	1	4	2	8	4	2	6	-	3		
<i>Megatonniaus neroosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	-	-	-	3	-	-	1	-	-		
<i>Potamilus capax</i>	7	1	-	-	-	-	22	5	11	15	4	15	7	9	-		
<i>Potamilus ohioensis</i>	14	2	-	-	-	-	-	-	3	12	3	4	7	13	-		
<i>Potamilus purpuratus</i>	1	2	-	1	-	4	-	12	16	1	8	5	4	-	4		
<i>Quadrula notulata</i>	44	1	-	-	-	2	1	17	1	5	9	1	-	-	-		
<i>Quadrula pustulosa</i>	3	-	-	2	-	1	-	1	1	1	1	1	-	-	-		
<i>Quadrula quadrula</i>	14	3	-	-	-	1	-	2	1	1	2	-	-	-	-		
<i>Toxolasma texasensis</i>	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-		
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Truncilla donaciformis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-		
Total specimens	172	12	1	6	0	40	7	61	56	39	48	24	36	1	10		
Species included	14	6	1	3	0	7	3	12	10	10	9	7	7	1	5		

TABLE 16. (cont.)

Species	Right Hand Chute Little River																
	Site	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	
<i>Amblema plicata</i>	1	-	1	1	1	1	-	-	1	-	12	31	11	3	3	5	
<i>Anodonta grandis</i>	-	-	-	1	-	-	-	-	-	-	2	2	3	8	15	8	
<i>Anodonta imbecillis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	
<i>Arcidens confragosus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Fusconia flavo</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	1	
<i>Lampsilis ovata</i>	-	-	-	-	-	-	2	-	-	3	-	-	-	-	-	-	
<i>Lasniogona complanata</i>	-	-	1	-	-	-	-	-	-	8	1	6	1	4	5	-	
<i>Leptodera fragilis</i>	10	-	8	2	3	6	1	2	10	4	-	4	-	3	3	1	
<i>Mezalonaias neruosa</i>	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	
<i>Obliquaria reflexa</i>	2	-	1	-	-	-	-	-	1	5	-	9	-	-	1	-	
<i>Potamitus capax</i>	3	1	4	-	-	-	5	-	9	4	-	1	-	3	2	-	
<i>Potamitus ohioensis</i>	2	1	8	-	-	-	4	1	1	13	-	6	-	-	10	-	
<i>Potamitus purpuratus</i>	1	2	4	2	1	1	-	2	3	1	-	8	-	4	4	6	
<i>Quadrula nodulata</i>	-	-	-	1	-	-	-	-	3	1	-	2	1	-	2	-	
<i>Quadrula pustulosa</i>	-	-	-	-	1	-	-	-	1	3	-	4	-	3	-	3	
<i>Quadrula quadrula</i>	-	-	1	-	-	-	1	-	-	2	2	4	-	1	6	1	
<i>Toxolasma texasensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	1	-	-	-	3	-	1	
<i>Truncilla donaciformis</i>	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total specimens	19	4	30	7	6	19	2	20	54	22	78	16	34	53	26	8	
Species included	6	3	9	5	4	6	2	8	12	5	12	4	11	12	8		

TABLE 16. (cont.)

	Upper Ditches						Total	No. sites
	Site 188	189	190	191				
<i>Ambiema plicata</i>	7	2	38	11	213		22	
<i>Anodontia grandis</i>	21	-	3	8	91		13	
<i>Anodontia imbecillis</i>	-	-	2	1	7		4	
<i>Anodontia suborbiculata</i>	-	-	-	-	2		2	
<i>Arcidens confragosus</i>	-	-	-	-	3		2	
<i>Fusconata flava</i>	-	-	18	3	21		2	
<i>Lampsilis teres</i> f. <i>anodontoides</i>	1	2	13	-	32		14	
<i>Lampsilis ovata</i>	-	1	13	8	31		9	
<i>Lasmigona complanata</i>	22	-	-	5	56		11	
<i>Leptodea fragilis</i>	2	2	19	12	127		27	
<i>Megaloniata nervosa</i>	-	-	-	-	5		1	
<i>Obliquaria reflexa</i>	5	-	14	2	44		11	
<i>Potamilius capax</i>	-	-	-	-	129		20	
<i>Potamilius ohioensis</i>	1	6	13	-	124		20	
<i>Potamilius purpuratus</i>	9	4	16	14	139		27	
<i>Quadrula nodulata</i>	1	-	5	3	100		18	
<i>Quadrula pustulosa</i>	1	1	41	13	80		16	
<i>Quadrula quadrula</i>	12	-	-	11	65		17	
<i>Toxolasma texasensis</i>	-	-	-	-	11		3	
<i>Tritogonia verrucosa</i>	1	-	-	1	7		5	
<i>Truncilla domactiformis</i>	-	-	2	-	6		3	
Total specimens	83	18	197	92	1293			
Species included	12	7	13	13	21			

TABLE 17. Quantitative sampling results (mussels/m²) from the Right Hand Chute drainage, August 1987.

Species	Site	163	164	166	167	168	169	170	173	175
<i>Amblema plicata</i>	-	-	-	-	0.02*	-	-	-	-	-
<i>Anodonta grandis</i>	-	-	0.33	-	-	-	-	-	-	-
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	-
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	0.02	-	-	-	-	-	-	-
<i>Lasmigona complanata</i>	-	-	-	-	-	-	-	-	-	-
<i>Leptodea fragilis</i>	0.01	-	0.02	0.01	-	-	-	0.01	0.01	-
<i>Obliquaria reflexa</i>	-	-	-	0.01	-	-	-	0.01	0.01	-
<i>Potamilius capax</i>	0.01	-	0.17	0.02	0.02	0.01	-	-	0.01	-
<i>Potamilius ohionensis</i>	-	-	0.03	-	-	-	-	0.03	-	-
<i>Potamilius purpuratus</i>	0.01	-	0.15	0.01	0.02	0.02	-	-	-	-
<i>Quadrula nodulata</i>	0.01	-	0.02	0.02	0.09	0.01	-	-	-	-
<i>Quadrula pustulosa</i>	-	-	-	-	0.01	-	-	-	-	-
<i>Quadrula quadrula</i>	0.01	-	0.02	-	-	0.01	-	-	-	-
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	-
<i>Truncilla donaciformis</i>	-	-	-	-	-	-	-	0.02	-	-
Totals		0.04	0.00	0.45	0.09	0.15	0.02	0.07	0.04	0.00
Number per square meter		14	6	6	12	10	10	10	8	4
Number of samples		5	0	27	11	15	2	7	3	0
Specimens found		5	0	8	6	5	2	4	3	0
Species included		5	0	8	6	5	2	4	3	0

* All calculated values in the table have been rounded to two decimal places. These rounding errors make some summations appear to be incorrect.

TABLE 17. (cont.)

Species	Site	178	180	181	185	186	Average per m ²	No. specimens
<i>Amblema plicata</i>			0.01			-	0.00	4
<i>Anodonta grandis</i>			-	-	0.02	0.05	0.01	8
<i>Anodonta suborbiculata</i>					0.02	0.01	0.00	2
<i>Lampsilis teres</i> f. <i>anodontoides</i>				0.01	-		0.00	2
<i>Lasrignona complanata</i>				0.10	0.05	0.01	0.01	11
<i>Leptodea fragilis</i>			0.01	0.09		0.03	0.01	16
<i>Obliquaria reflexa</i>			0.01	0.04			0.01	7
<i>Potamilius capax</i>			0.03	0.02		0.01	0.02	24
<i>Potamilius ohioensis</i>			0.01			0.02	0.01	8
<i>Potamilius purpuratus</i>			0.03	0.01	0.02		0.02	17
<i>Quadrula nodulata</i>			0.04	0.01		0.02	0.02	20
<i>Quadrula pustulosa</i>			0.01	0.04			0.00	5
<i>Quadrula quadrula</i>				0.01	0.02	0.03	0.01	9
<i>Tritogonia verrucosa</i>			-	0.01			0.00	1
<i>Truncilla donaciformis</i>							0.00	2
Totals								
Number per square meter	0.05	0.17	0.35	0.15	0.18		0.12	
Number of samples	4	7	8	4	10		113	
Specimens found	2	12	28	6	18			136
Species included	2	8	10	5	8			15

(ditches) sampled in this area were clogged with fallen trees, and beaver dams were common throughout the area.

Twenty-five mussel species were found in this area (Table 18), typically scattered at random across the substrate. At sites where shifting sand was present in the channel (Belle Fountain Ditch), most mussels were found in mud bars along the banks.

Belle Fountain Ditch (sites 192-204) included the most species (17), followed by Pemiscot Bayou Ditch 29 (sites 205-211, 14 species) and Main Ditch 6 (sites 219-225, 13 species).

The most abundant species were *Anodonta grandis*, *Amblema plicata*, *Leptodea fragilis* and *Arcidens confragosus*. Few *Plectomerus dombeyanus*, *Quadrula pustulosa* and *Uniomereus declivus* were found.

Potamilus capax was collected at only one location (site 192) in the extreme lower portion of Belle Fountain Ditch. The two fresh-dead specimens found did not meet the criterion to start taking quantitative samples.

Upper Eastern Tributaries

Twenty sites were examined in five upper eastern tributaries to the St. Francis River (sites 233-235 and 237-252, Fig. 4). All of these water-courses appeared to be dredged channels.

These tributaries had gently sloping, grass- and tree-covered banks with soft mud (ooze) to shifting sand substrates. In Cockle Burr Slough, the largest ditch sampled in this area, the substrate changed from waist-deep mud at downstream sites to mud banks with mid-channel patches of shifting sand at upstream sites. The remaining ditches (upper Buffalo Creek, Honey Cypress Creek, Cane Island Slough, and Varney River) all had thick mud substrates with occasional patches of sand, large amounts of submerged vegetation, and beaver dams. Upstream sites on upper Buffalo Creek Ditch (sites 238 and 239) and Dredge Boat Creek (site 246) had virtually no flow and were stagnant.

Eighteen mussel species were found in these tributaries (Table 19). Most were found scattered across the mud bottom. At sites with shifting sand in the channel and mud along the banks (Cockle Burr Slough and Honey Cypress Creek), mussels occurred in a band at the sand-mud transition.

Cockle Burr Slough (sites 233-235) and Varney River (sites 250-252) both contained 12 mussel species. Upper Buffalo Creek Ditch (sites 237-239) and Cane Island Slough (sites 246-249) each yielded seven

TABLE 18. Site by site counts of all mussels found in State Line Outlet Ditch basin, August and October 1987.

Species	Belle Fountain Main Ditch														Pemiscol	
	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	
<i>Amblema plicata</i>	1	9	-	9	18	-	25	25	8	6	3	1	3	-	5	
<i>Anodonta grandis</i>	1	-	-	-	-	2	-	-	-	3	1	-	2	2	6	
<i>Anodonta imbecillis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
<i>Arcidens confragosus</i>	-	-	-	-	-	1	-	-	1	-	1	-	4	-	12	
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lampsilis teres</i> f. <i>teres</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	
<i>Lampsilis ovata</i>	-	-	1	-	-	-	1	-	-	-	-	1	-	-	-	
<i>Lasniogona complanata</i>	6	1	-	11	2	2	-	-	-	-	-	2	1	5	11	
<i>Leptodea fragilis</i>	19	4	9	2	7	4	2	4	1	1	4	-	2	6	5	
<i>Obliquaria reflexa</i>	5	1	-	-	-	1	1	-	-	-	-	-	-	-	-	
<i>Plectomerus dombeyanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Potamilius capax</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Potamilius obtensis</i>	4	-	1	1	-	-	-	-	2	-	-	-	1	4	1	
<i>Potamilius purpuratus</i>	12	4	4	11	2	1	3	2	1	3	2	-	1	5	1	
<i>Quadrula apiculata</i>	13	1	-	-	-	-	-	-	-	1	-	-	1	1	-	
<i>Quadrula nodulata</i>	-	-	-	-	-	1	-	-	-	-	1	1	1	2	-	
<i>Quadrula pustulosa</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	
<i>Quadrula quadrata</i>	17	1	1	-	1	1	1	4	2	2	5	4	7	-	2	
<i>Toxolasma texasensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Tritogonia verrucosa</i>	1	-	4	5	5	4	2	1	-	1	-	-	-	-	-	
<i>Truncilla donaciformis</i>	1	-	1	1	-	1	-	1	-	-	-	-	-	-	-	
<i>Unionemus decitens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Unionemus tetralasmus</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total specimens	83	21	21	40	35	18	35	38	15	17	17	10	22	28	43	
Species included	13	7	7	7	6	10	7	7	6	7	7	6	9	9	8	

TABLE 18. (cont.)

Species	Pemiscot Bayou							New Franklin Ditch							Main Ditch 6		
	Site	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	
<i>Ambleria plicata</i>	1	-	-	-	1	-	1	3	-	-	-	-	-	-	-	-	
<i>Aneodonta grandis</i>	4	4	9	11	14	-	-	5	2	10	7	3	12	1	1	1	
<i>Aneodonta imbecillis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	
<i>Aneodonta suborbiculata</i>	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	
<i>Arcidens confragosus</i>	1	9	10	14	7	4	4	-	-	8	-	-	-	5	-	1	
<i>Lampsilis teres</i> f. <i>anodontoides</i>	2	-	2	-	2	-	-	6	-	1	-	-	-	1	2	-	
<i>Lampsilis teres</i> f. <i>teres</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
<i>Lampsilis ovata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
<i>Lasmitigona complanata</i>	9	5	4	8	1	1	1	1	1	1	-	-	-	-	-	-	
<i>Leptodea fragilis</i>	3	4	3	8	1	2	2	12	-	3	2	1	-	2	1	-	
<i>Obliquaria reflexa</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Plectomerus dombeyanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Potamilus capax</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Potamilus ohioensis</i>	1	-	1	-	2	-	-	3	-	2	-	1	-	-	-	-	
<i>Potamilus purpuratus</i>	2	-	3	5	-	1	4	-	-	1	-	-	-	-	2	-	
<i>Quadrula apiculata</i>	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	
<i>Quadrula nodulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Quadrula pustulosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Quadrula quadrula</i>	1	-	3	4	-	1	3	-	-	-	-	-	-	2	1	-	
<i>Toxolasma texasensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Truncilla donaciformis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Unionmerus declivis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
<i>Unionmerus tetralasmus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total specimens	25	22	35	51	26	11	37	8	2	27	9	5	12	12	10	2	
Species included	10	4	8	7	5	7	8	1	8	2	3	1	6	8	2	2	

TABLE 18. (cont.)

Species	Site	Main Ditch 6										Ditch 9					Total	No. sites			
		222	223	224	225	226	227	228	229	230	231	232	233	234							
<i>Amblyma plicata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	125	18
<i>Anodonta grandis</i>	26	3	12	4	1	6	-	-	-	-	-	-	-	-	-	-	-	45	3	201	29
<i>Anodonta imbecillis</i>	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3
<i>Anodonta suborbiculata</i>	1	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	5	4
<i>Arcidens confragosus</i>	6	4	4	8	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1	107	20
<i>Lampsilis teres f. anodontoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3	23	9
<i>Lampsilis teres f. teres</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2
<i>Lampsilis ovata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4
<i>Lasmigona complanata</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	17
<i>Leptodea fragilis</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	122	28
<i>Obliquaria reflexa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	10	6
<i>Plectomerus dombejanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
<i>Potamilus capax</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1
<i>Potamilus ohioensis</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3	31	16
<i>Potamilus purpuratus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	76	23
<i>Quadrula apiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3
<i>Quadrula nodulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	7
<i>Quadrula pustulosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
<i>Quadrula quadrata</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	70	23
<i>Toxolasma texasensis</i>	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1
<i>Tritogonia verrucosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	8
<i>Truncilla donaciformis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5
<i>Unionemus declivus</i>	1	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4
<i>Unionemus tetrasmus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Total specimens	41	7	17	14	1	17	0	0	0	0	0	0	0	0	0	0	0	73	20	919	
Species included	7	2	3	4	1	5	0	0	0	0	0	0	0	0	0	0	0	8	8	24	

TABLE 19. Site by site counts of all mussels found in the Upper Eastern Tributaries, August 1987.

Species	Cockle Burr					Buffalo Creek Ditch					Honey Cypress Creek					Cane Island	
	Site	233	234	235	237	238	239	240	241	242	243	244	245	246	247	248	
<i>Aniblema plicata</i>			2	10			1	1	5	24	2	15	1				
<i>Anodonta grandis</i>		7	4				1							29		6	
<i>Anodonta imbecillis</i>													1				
<i>Anodonta suborbiculata</i>		4															
<i>Arcidens confragosus</i>									2	6		1					
<i>Fusconia flava</i>																	
<i>Lampsilis teres f. anodontoides</i>						1											
<i>Lampsilis ovata</i>			3			1											
<i>Lasniogona complanata</i>		1	1	6		1										1	
<i>Leptodea fragilis</i>			7				3										
<i>Potamilius ohioensis</i>		3														2	
<i>Potamilius purpuratus</i>				1			1					1					
<i>Quadrula apiculata</i>				1													
<i>Quadrula pustulosa</i>							2	1		2							
<i>Strophitus undulatus</i>			5	1						2	1		1			1	
<i>Toxolasma texasensis</i>		7	3											1			
<i>Unionensis decitrans</i>														7			
Total specimens	22	25	7	21	0	2	9	2	7	34	3	17	3	37		10	
Species included	5	7		6	0	2	6	2	2	4	2	3	3	3		4	

TABLE 19. (cont.)

Species	Cane Island				Varney River				Total	No. sites
	Site	248	249	250	251	252	255	256		
<i>Amblyma plicata</i>	-	-	-	-	2	-	-	-	63	10
<i>Anodonta grandis</i>	10	7	-	7	4	12	-	-	87	10
<i>Anodonta imbecillis</i>	1	-	-	-	-	1	-	-	3	3
<i>Anodonta suborbiculata</i>	-	-	-	-	-	-	-	-	4	1
<i>Arcidens confragosus</i>	-	-	-	1	-	3	-	-	4	2
<i>Fusconia flava</i>	-	-	-	1	-	1	-	-	11	5
<i>Lampsilis teres</i> f. <i>anodontoides</i>	-	-	1	-	-	-	-	-	2	2
<i>Lampsilis ovata</i>	-	-	-	-	1	-	-	-	5	3
<i>Lasnigona complanata</i>	-	-	-	-	1	-	-	-	10	5
<i>Leptodea fragilis</i>	-	-	-	-	-	1	-	-	12	4
<i>Potamilus ohioensis</i>	-	-	-	-	-	-	-	5	5	2
<i>Potamilus purpuratus</i>	-	-	-	-	4	-	-	2	9	5
<i>Quadrula apiculata</i>	-	-	-	-	1	1	-	1	3	3
<i>Quadrula pustulosa</i>	-	-	-	24	-	-	-	-	29	4
<i>Quadrula quadrula</i>	-	-	-	1	1	-	-	1	9	5
<i>Strophitus undulatus</i>	-	-	-	-	-	-	-	-	6	4
<i>Toxolasma texasensis</i>	-	-	-	-	-	-	-	-	12	4
<i>Unionemius aëtius</i>	-	-	-	-	-	-	-	-	7	1
Total specimens	11	8	8	34	14	22	8	281	18	
Species included	2	2	2	5	7	8	7			

species, while six species were found in Honey Cypress Creek (sites 240-245). In all, 281 mussels were examined from these ditches.

The most abundant species in this area was *Anodonta grandis*, especially in Cane Island Slough and Varney River. *Amblema plicata* was common in Honey Cypress Creek. Uncommon species in this area were *Lampsilis teres*, *Anodonta imbecillis* and *Quadrula apiculata*. *Potamilus capax* was not encountered at any site in this area.

Cache River

In compliance with the Scope of Work for this project, four sites were examined in and around Reeses Fork, Monroe County, Arkansas. Reeses Fork is (or has been) a secondary connection between the White River and the Cache River upstream from their confluence near Clarendon (Fig. 8). Three collections were made in Reeses Fork (sites 254, 255, and 256) and one was made in the Cache River just upstream from the mouth of Reeses Fork (site 253).

In mid-August 1987, the Cache River mouth of Reeses Fork was a small, entrenched channel that meandered through a second-growth woodland. The banks were 2-4 m high and dropped fairly quickly into water that ranged between 0.2 and 3 m in depth. When sampled, the water level was quite low and there was no surface flow from either the Middle Prong or Right Hand Prong of Reeses Fork. The substrate typically was shifting sand (site 254 was an exposed sand bar); however, clay outcrops with sharp rocky (marl ?) inclusions were present at site 255. Fallen trees occurred all along the stream. Collections were made no further upstream than site 256 because the channel was blocked there by fallen trees and the remains of a collapsed logging road culvert.

The mainstem Cache River collection (site 253) was made at the downstream end of a standing-water meander and the channel apparently constructed to bypass it. Firm sand was the substrate on the main channel margin, but considerably more silt was present around the corner in the meander. Water depth was 2 m across the mouth of the meander.

Nineteen mussel species were found at these collection sites (Table 20). Most abundant was *Plectomerus dombeyanus*, followed in order by *Quadrula pustulosa*, *Leptodea fragilis*, *Amblema plicata* and *Quadrula quadrula*. Less than five specimens of *Fusconaia flava*, *Obovaria olivaria*, *Quadrula nodulata*, *Toxolasma texasensis* and *Truncilla truncata* were collected. No specimens of *Potamilus capax* were found.

TABLE 20. Site by site counts of all mussels found in the Cache River watershed, August 1987.

Species	Site	Cache R.		Reeses Fork		Total	No. sites
		253	254	255	256		
<i>Amblyma plicata</i>		48	21	6	3	78	4
<i>Anodonta grandis</i>		5	-	1	-	6	2
<i>Fusconaia ebena</i>		-	16	4	1	21	3
<i>Fusconaia flava</i>		-	1	-	-	1	1
<i>Lampsilis teres</i> f. <i>anodontoides</i>		2	7	5	3	17	4
<i>Lampsilis ovata</i>			3	4	-	7	2
<i>Leptodea fragilis</i>		3	101	16	1	121	4
<i>Megalonaias nervosa</i>		9	13	1	-	23	3
<i>Obliquaria reflexa</i>		1	23	4	-	28	3
<i>Obovaria olivaria</i>		-	2	1	-	3	2
<i>Plectomerus dombeyanus</i>		67	36	38	1	142	4
<i>Potamilus ohioensis</i>		1	7	3	7	18	4
<i>Potamilus purpuratus</i>		-	10	4	2	16	3
<i>Quadrula nodulata</i>		2	1	1	-	4	3
<i>Quadrula pustulosa</i>		5	102	23	8	138	4
<i>Quadrula quadrula</i>		46	23	4	1	74	4
<i>Toxolasma texasensis</i>		4	-	-	-	4	1
<i>Tritogonia verrucosa</i>		1	2	5	-	8	3
<i>Truncilla truncata</i>		-	4	2	-	6	2
Total specimens		194	372	122	27	715	
Species included		13	17	17	9	19	

DISCUSSION

Mussel Distribution

This survey has provided freshwater mussel distribution and abundance information for parts of the St. Francis River watershed that had not been examined in such detail previously. When combined with data from the 1986 TVA survey (Ahlstedt & Jenkinson, 1991) and from other recent surveys of the watershed (Stansbery & Stein, 1982; Bates & Dennis, 1983; Clarke, 1985; and Harris, 1986), these results can be used to describe mussel distribution patterns throughout the system.

As indicated in Results and Table 2, we have chosen to examine our 1987 collection data from the St. Francis River system as samples from nine geographic areas or actual subwatersheds. These watershed areas typically contain fairly uniform habitat conditions and mussel communities. This approach also can be expanded to form the basis for a discussion of mussel distribution patterns throughout the river

system.

Expanding these nine watershed areas to cover the remainder of the river system downstream from Wappapello Dam requires that the Floodway area be extended downstream to the mouth of the river and that two additional areas be added: the Sunken Lands \cong the St. Francis River between the Marked Tree siphons (River Mile 155) and U.S. Route 62 bridge (River Mile 229), and the river mainstem between U.S. Route 62 and Wappapello Dam (River Mile 305). The resulting 11 watershed areas in the St. Francis River system are illustrated on Fig. 9.

Table 21 summarizes presence/absence information in the 11 watershed areas from this and the five other recent St. Francis River surveys. For this compilation, location information from the various surveys has been used to place collection sites within our watershed areas. Also, species names presented in the various reports have been listed as the synonyms we prefer to use.

In Table 21, the final column under each watershed is a composite list of species that have been reported from that area. While 46 species have been reported from the entire river system, composite lists for the 11 watershed areas range from 16 to 38 species. The 14 species found in at least 10 of the 11 watershed areas are those that typically occur in muddy or sandy habitats. The 18 species found in less than five of the areas typically occur in gravel or other firm substrates. In general, there does not seem to be any substantial increase in species number with stream size. This observation also has been made by Stansbery & Stein (1982).

Principal Components Analysis

A search for trends in the distribution of mussel species throughout the St. Francis system was conducted using principal components analysis (PCA). As used here, PCA is a non-parametric, exploratory technique that sorts out a series of independent factors which represent relationships in the data (Echelle & Schnell, 1976). This analysis technique also calculates weightings that indicate how strongly each species conforms to each factor. A strong positive or negative weighting for some factor indicates that a species follows that trend in the data set. The ecological meaning of each factor must be inferred using other information.

Table 22 presents the results of a PCA of the mussel presence/absence data from St. Francis watershed sites visited during the 1986

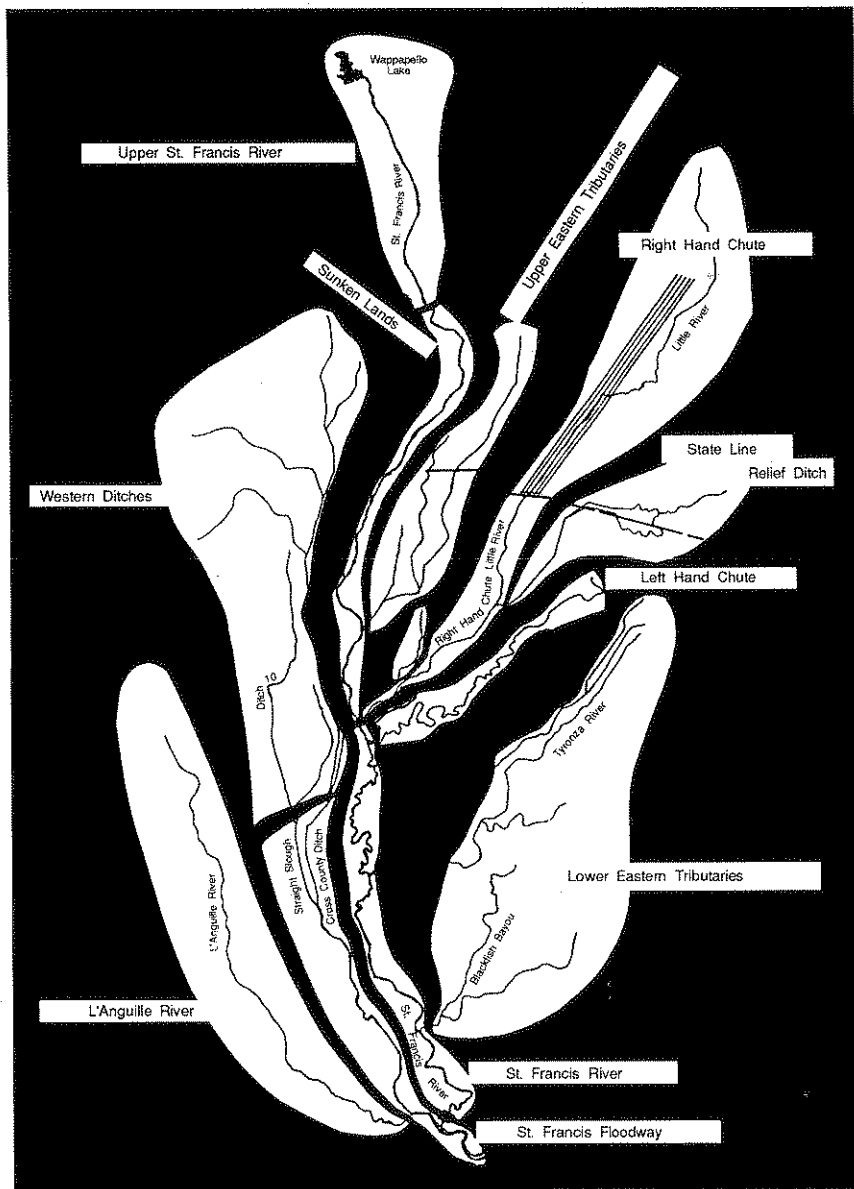


FIG. 9. Exploded view of the St. Francis River system to separate the eleven geographic or subwatershed areas discussed in the text.

TABLE 21. Summary of recent mussel survey results (presence/absence) for eleven geographic areas or subwatersheds of the St. Francis River System.

Species	L'Anguille River				Lower St. Francis River								Western Trib.			
	S*	B	T	Co	S	B	C	H	A	T	Co	B	A	T	Co	
<i>Actinonaias ligamentina</i>																
<i>Amblema plicata</i>		X	X	X	X	X	X	X	X	X	X		X	X	X	
<i>Anodonta grandis</i>	X	X	X		X	X	X	X	X	X	X		X	X	X	
<i>Anodonta imbecillis</i>		X	X		X					X	X		X	X	X	
<i>Anodonta suborbiculata</i>		X	X		X	X				X	X		X	X	X	
<i>Arcidens confragosus</i>		X	X		X	X	X			X	X		X	X	X	
<i>Cyprogenia aberti</i>										X	X					
<i>Elliptio dilatatus</i>										X	X					
<i>Fusconaia ebena</i>					X	X	X	X	X	X	X					
<i>Fusconaia flava</i>					X	X	X	X		X	X		X	X		
<i>Lampsilis hydiana</i>					X			X			X					
<i>Lampsilis siliquoidea</i>								X			X					
<i>Lampsilis teres f. anodontoides</i>		X	X		X	X	X	X	X	X	X		X	X	X	
<i>Lampsilis teres f. teres</i>					X					X				X	X	
<i>Lampsilis ovata</i>					X	X	X	X		X	X		X	X	X	
<i>Lasmigona complanata</i>		X	X		X		X	X	X	X	X		X	X	X	
<i>Leptodea fragilis</i>					X	X	X	X	X	X	X		X	X	X	
<i>Leptodea leptodon</i>							X				X					
<i>Ligumia recta</i>								X			X					
<i>Ligumia subrostrata?</i>							X				X					
<i>Megalonaias nervosa</i>					X	X	X	X	X	X	X					
<i>Obliquaria reflexa</i>					X	X	X	X	X	X	X		X	X	X	
<i>Obovaria jacksoniana</i>					X					X						
<i>Ellipsaria lineolata</i>					X	X		X		X	X					
<i>Plectomerus dombeyanus</i>					X	X	X	X		X	X					
<i>Pleurobema cordatum</i>						X	X				X					
<i>Pleurobema rubrum</i>								X		X	X					
<i>Pleurobema sintoxia</i>					X		X				X		X		X	
<i>Potamilus capax</i>		X	X		X	X	X	X	X	X	X		X	X	X	
<i>Potamilus ohioensis</i>		X	X		X	X	X	X	X	X	X		X	X	X	
<i>Potamilus purpuratus</i>		X	X	X	X	X	X	X	X	X	X		X	X	X	
<i>Quadrula apiculata</i>			X	X	X	X				X	X					
<i>Quadrula metanevra</i>					X	X	X			X	X					
<i>Quadrula nodulata</i>					X	X	X	X	X	X	X		X	X	X	
<i>Quadrula pustulosa</i>		X	X	X	X	X	X	X	X	X	X		X	X	X	
<i>Quadrula quadrula</i>			X	X	X	X	X	X	X	X	X		X	X	X	
<i>Strophitus undulatus</i>					X									X	X	
<i>Toxolasma parvum</i>											X					
<i>Toxolasma glans</i>																
<i>Toxolasma texasensis</i>													X	X	X	
<i>Tritogonia verrucosa</i>		X		X	X	X	X	X	X	X	X		X	X	X	
<i>Truncilla donaciformis</i>					X	X				X	X		X	X	X	
<i>Truncilla truncata</i>		X	X		X	X	X	X	X	X	X		X	X	X	
<i>Unionomerus declivus</i>					X									X	X	
<i>Unionomerus tetralasmus</i>													X	X	X	
<i>Villosa lienosa</i>			X	X									X		X	
Totals																
Species encountered	0	5	15	16	32	23	26	24	17	27	38	0	22	23	27	
Sites visited	2	8	6		24	19	93	1	19	21		9	26	37		

*Abbreviations - see bottom of next page.

TABLE 21. (cont.)

Species	St. Francis River				Lower E. Tribs				L.H. Ch./Buff. Cr.			
	S	B	A	T	Co	C	T	Co	B	A	T	Co
<i>Actinonaias ligamentina</i>												
<i>Amblema plicata</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Anodonta grandis</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Anodonta imbecillis</i>			X	X	X	X	X	X	X		X	X
<i>Anodonta suborbiculata</i>				X	X	X	X	X	X	X		X
<i>Arcidens confragosus</i>	X	X	X	X	X	X	X	X			X	X
<i>Cyprogenia aberti</i>			X		X							
<i>Elliptio dilatatus</i>												
<i>Fusconaia ebena</i>	X	X	X	X	X							
<i>Fusconaia flava</i>	X	X	X	X	X	X	X	X		X	X	X
<i>Lampsilis hydiana</i>	X	X	X	X	X		X	X				
<i>Lampsilis siliquoidea</i>												
<i>Lampsilis teres f. anodontoidea</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Lampsilis teres f. teres</i>	X		X	X	X		X	X				
<i>Lampsilis ovata</i>	X	X	X	X	X	X	X	X		X	X	X
<i>Lasmigona complanata</i>	X	X	X	X	X		X	X		X	X	X
<i>Leptodea fragilis</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Leptodea leptodon</i>												
<i>Ligumia recta</i>			X		X							
<i>Ligumia subrostrata?</i>												
<i>Megalonaias nervosa</i>	X	X	X	X	X	X	X	X			X	X
<i>Obliquaria reflexa</i>	X	X	X	X	X		X	X		X	X	X
<i>Obovaria jacksoniana</i>												
<i>Ellipsaria lineolata</i>			X		X							
<i>Plectomerus dombeyanus</i>	X	X	X	X	X	X	X	X				
<i>Pleurobema cordatum</i>		X			X	X		X	X			X
<i>Pleurobema rubrum</i>			X	X	X							
<i>Pleurobema sintoxia</i>	X		X	X	X							
<i>Potamilus capax</i>	X		X	X	X					X		X
<i>Potamilus ohioensis</i>	X	X	X	X	X		X	X		X	X	X
<i>Potamilus purpuratus</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Quadrula apiculata</i>							X	X			X	X
<i>Quadrula metanevra</i>	X	X	X	X	X			X	X		X	X
<i>Quadrula nodulata</i>	X	X	X	X	X		X	X	X	X	X	X
<i>Quadrula pustulosa</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Quadrula quadrula</i>	X	X	X	X	X	X	X	X			X	X
<i>Strophitus undulatus</i>				X	X		X	X			X	X
<i>Toxolasma parvus</i>	X				X							
<i>Toxolasma glans</i>												
<i>Toxolasma texasensis</i>	X			X	X		X	X			X	X
<i>Tritogonia verrucosa</i>	X	X	X	X	X		X	X			X	X
<i>Truncilla donaciformis</i>			X	X	X		X	X		X		X
<i>Truncilla truncata</i>	X	X	X	X	X		X	X	X		X	X
<i>Unio merus declivus</i>							X	X				
<i>Unio merus tetralasmus</i>												
<i>Villosa lienosa</i>							X	X				
Totals												
Species encountered	26	21	30	29	35	14	28	29	7	14	21	26
Sites visited	10	15	35	25		69	35		10	3	34	

Abbreviations: A - Ahlstedt & Jenkinson, 1987; B - Bates & Dennis, 1983; C - Clarke, 1985; Co - Composite list for this area; H - Harris, 1986; S - Stansbery & Stein, 1982; T - This study.

TABLE 21. (cont.)

Species	Right Chute				Sunk. Lnds.			St. Line Out.			Up. E. Tribs		
	B	A	T	Co	B	A	Co	B	T	Co	B	T	Co
<i>Actinonaias ligamentaria</i>													
<i>Amblema plicata</i>		X	X	X	X	X	X	X	X	X		X	X
<i>Anodonta grandis</i>		X	X	X	X	X	X		X	X		X	X
<i>Anodonta imbecillis</i>			X	X					X	X		X	X
<i>Anodonta suborbiculata</i>		X	X	X	X	X	X		X	X		X	X
<i>Arcidens confragosus</i>		X	X	X		X	X		X	X		X	X
<i>Cyprogenia aberti</i>													
<i>Elliptio dilatatus</i>													
<i>Fusconaia ebena</i>						X	X						
<i>Fusconaia flava</i>			X	X	X	X	X					X	X
<i>Lampsilis hydiana</i>													
<i>Lampsilis siliquoides</i>													
<i>Lampsilis teres f. anodontoides</i>			X	X	X	X	X		X	X		X	X
<i>Lampsilis teres f. teres</i>						X	X		X	X			
<i>Lampsilis ovata</i>			X	X	X	X	X		X	X		X	X
<i>Lasmigona complanata</i>		X	X	X	X	X	X		X	X		X	X
<i>Leptodea fragilis</i>		X	X	X	X	X	X		X	X		X	X
<i>Leptodea leptodon</i>													
<i>Ligumia recta</i>													
<i>Ligumia subrostrata ?</i>													
<i>Megalonaias nervosa</i>			X	X	X	X	X						
<i>Obitquaria reflexa</i>			X	X	X	X	X		X	X			
<i>Obovaria jacksoniana</i>													
<i>Ellipsaria lineolata</i>													
<i>Plectomerus dombeyanus</i>					X	X	X		X	X			
<i>Pleurobema cordatum</i>					X		X						
<i>Pleurobema rubrum</i>						X	X						
<i>Pleurobema sintoxia</i>													
<i>Potamilus capax</i>		X	X	X					X	X			
<i>Potamilus ohioensis</i>		X	X	X	X	X	X		X	X		X	X
<i>Potamilus purpuratus</i>		X	X	X	X	X	X		X	X		X	X
<i>Quadrula apiculata</i>									X	X		X	X
<i>Quadrula metanevra</i>						X	X						
<i>Quadrula nodulata</i>		X	X	X	X	X	X		X	X			
<i>Quadrula pustulosa</i>			X	X	X	X	X		X	X		X	X
<i>Quadrula quadrula</i>		X	X	X	X	X	X		X	X		X	X
<i>Strophitus undulatus</i>												X	X
<i>Toxolasma parvus</i>													
<i>Toxolasma gians</i>					X		X						
<i>Toxolasma texasensis</i>			X	X	X	X	X		X	X		X	X
<i>Tritogonia verrucosa</i>			X	X	X	X	X		X	X			
<i>Truncilla donaciformis</i>			X	X	X	X	X		X	X			
<i>Truncilla truncata</i>					X	X	X						
<i>Uniomerus declivus</i>						X	X		X	X			
<i>Uniomerus tetralasmus</i>									X	X			
<i>Villosa lienosa</i>													
Totals													
Species encountered	0	11	21	21	21	25	28	0	24	24	4	17	17
Sites visited	4	2	34		6	35		4	41		28	19	

Abbreviations: A - Ahlstedt & Jenkinson, 1987; B - Bates & Dennis, 1983; C - Clarke, 1985; Co - Composite list for this area; H - Harris, 1986; S - Stansbery & Stein, 1982; T - This study.

TABLE 21. (cont.)

Species	Upper St. Francis			No. Areas/Species
	B	A	Co	
<i>Actinonaias ligamentina</i>	X	X	X	1
<i>Amblema plicata</i>	X	X	X	11
<i>Anodonta grandis</i>	X	X	X	11
<i>Anodonta imbecillis</i>		X	X	10
<i>Anodonta suborbiculata</i>				10
<i>Arcidens confragosus</i>	X	X	X	11
<i>Cyprogenia aberti</i>	X	X	X	3
<i>Elliptio dilatatus</i>	X		X	1
<i>Fusconaia ebena</i>				3
<i>Fusconaia flava</i>	X	X	X	9
<i>Lampsilis hydiana</i>				3
<i>Lampsilis siliquoidea</i>	X		X	1
<i>Lampsilis teres</i> f. <i>anodontoides</i>	X	X	X	11
<i>Lampsilis teres</i> f. <i>teres</i>		X	X	7
<i>Lampsilis ovata</i>	X	X	X	10
<i>Lasmigona complanata</i>	X	X	X	11
<i>Leptodea fragilis</i>	X	X		10
<i>Leptodea leptodon</i>				1
<i>Ligumia recta</i>				2
<i>Ligumia subrostrata</i> ?				1
<i>Megalonaias nervosa</i>	X	X	X	7
<i>Obliquaria reflexa</i>	X	X	X	9
<i>Obovaria jacksoniana</i>				1
<i>Ellipsaria lineolata</i>				2
<i>Plectomerus dombeyanus</i>	X	X	X	6
<i>Pleurobema cordatum</i>	X		X	6
<i>Pleurobema rubrum</i>		X	X	4
<i>Pleurobema sintoxia</i>		X	X	4
<i>Potamilus capax</i>				7
<i>Potamilus ohioensis</i>		X	X	11
<i>Potamilus purpuratus</i>	X	X	X	11
<i>Quadrula apiculata</i>				6
<i>Quadrula metanevra</i>	X	X	X	4
<i>Quadrula nodulata</i>				8
<i>Quadrula pustulosa</i>	X	X	X	11
<i>Quadrula quadrula</i>	X	X	X	11
<i>Strophitus undulatus</i>	X	X	X	6
<i>Toxolasma parvus</i>				2
<i>Toxolasma glans</i>				1
<i>Toxolasma texasensis</i>				8
<i>Tritogonia verrucosa</i>	X	X	X	10
<i>Truncilla donaciformis</i>	X	X	X	9
<i>Truncilla truncata</i>	X	X	X	8
<i>Unio merus declivus</i>				5
<i>Unio merus tetralasmus</i>				2
<i>Villosa lienosa</i>	X		X	4
Totals				
Species encountered	25	26	30	46
Sites visited	12	27		

Abbreviations: A - Ahlstedt & Jenkinson, 1987; B - Bates & Dennis, 1983; C - Clarke, 1985; Co - Composite list for this area; H - Harris, 1986; S - Stansbery & Stein, 1982; T - This study.

TABLE 22. Groupings of St. Francis watershed mussel species based upon principal components analysis results. Factor weightings less than ± 0.2 are not presented in the table.

Info. incl. (%)	Factor 1 21.2	Factor 2 8.2	Factor 3 8.0	Factor 4 5.5	Factor 5 4.6
Groups and species					
Group 1					
<i>Potamilus purpuratus</i>	0.596	0.282	0.209	-	-
<i>Quadrula nodulata</i>	0.526	0.276	-	-	0.218
<i>Leptodea fragilis</i>	0.484	0.382	-	-	-
<i>Lampsilis teres form anodontoides</i>	0.433	0.271	-	0.580	0.339
<i>Potamilus ohioensis</i>	0.343	0.644	-	-	-0.461
<i>Anodonta grandis</i>	0.242	-0.220	0.720	0.314	-
<i>Arcidens confragosus</i>	0.411	-0.218	0.427	0.223	-
<i>Fusconaia flava</i>	0.527	-0.345	-0.238	-	-
<i>Amblema plicata</i>	0.655	-0.276	-	-	-
<i>Quadrula pustulosa</i>	0.658	-0.293	-0.333	-	-
Group 2					
<i>Lasnigona complanata</i>	0.398	-	0.518	-0.492	-
<i>Cyprogenia aberti</i>	0.201	-	-0.280	-	-
<i>Ellipsaria lineolata</i>	0.239	-	-0.215	-	-
<i>Truncilla donaciformis</i>	0.295	-	-0.213	-	-
<i>Quadrula metanevora</i>	0.340	-	-0.279	-	-
<i>Fusconaia ebena</i>	0.412	-	-0.216	0.217	-
<i>Obliquaria reflexa</i>	0.573	-	-0.322	-	-
<i>Tritogonia verrucosa</i>	0.636	-	-0.230	-	-
Group 3					
<i>Truncilla truncata</i>	0.405	-	-	-	-
<i>Pleurobema rubrum</i>	0.382	-	-	-	-
<i>Lampsilis ovata</i>	0.357	-	-	-	-
<i>Pleurobema sintoxia</i>	0.214	-	-	-	-
<i>Plectomerus dombeyanus</i>	0.208	-	-	-	-
Ungrouped					
<i>Megaloniaias nervosa</i>	0.552	-	-	0.238	-0.242
<i>Quadrula quadrula</i>	0.634	-	-	-0.237	0.464
<i>Potamilus capax</i>	-	0.640	-	-0.258	0.275
<i>Strophitus undulatus</i>	-	-0.203	-	-	-
<i>Anodonta suborbiculata</i>	-	-	0.370	-	-
<i>Actinoniaias carinata</i>	-	-	-0.208	-	-
<i>Anodonta imbecillis</i>	-	-	-	0.244	0.291
<i>Lampsilis hydiana</i>	-	-	-	-	-
<i>Lampsilis teres form teres</i>	-	-	-	-	-
<i>Ligumia recta</i>	-	-	-	-	-
<i>Quadrula apiculata</i>	-	-	-	-	-
<i>Toxolasma texasensis</i>	-	-	-	-	-
<i>Unio merus declivus</i>	-	-	-	-	-
<i>Unio merus tetralasmus</i>	-	-	-	-	-
<i>Villosa lienosa</i>	-	-	-	-	-

and 1987 TVA surveys. Data from other recent surveys of the watershed were not included because site-by-site results from those surveys were not available. As indicated in the table, the first five factors calculated by the analysis incorporated 47.6% of the information included in the data set. The remaining information is included in a long series of less important factors, not included in Table 22.

In an attempt to identify the ecological trend being represented by each PCA factor, species that received the highest weightings were contrasted with those that received the lowest weightings. Distribution patterns, specific habitat associations, fish host relationships (when known), and other characteristics were considered in this trend identification process.

Factor 1 yielded strong (greater in magnitude than ± 0.2) positive weightings for 25 of the 38 species involved. This trend appeared to sort the species according to the uniformity of their distribution and frequency of occurrence throughout the watershed. Widely distributed, frequently-found species had the highest weightings. Rarely-found species or those with disjunct distribution patterns had much lower weightings.

Factor 2 gave both positive and negative weightings. This trend seemed to sort the species based on stability of the aquatic habitat. Species with strong positive weightings all occurred at sites with unstable substrates, often in areas that had been disturbed in recent years. Species with strong negative weightings all occurred at sites that had stabilized substrates and well-established bankside vegetation.

Factor 3 gave strong positive and strong negative weightings, apparently related to the composition of site substrates. Species with strong positive weightings typically occurred in soft, silty substrates while species with strong negative weightings typically occurred in gravel or rocky substrates.

Factors 4 and 5 each gave a few strong positive and negative weightings, but we were unable to identify the basis for either trend. Stream size, flow characteristics, fish host habitat preferences, and other likely determinants of mussel distribution patterns should contribute to some factor in this type of analysis. Unfortunately, we were unable to recognize any such relationship in these weightings of the species.

In Table 22, the species are arranged in groups determined by similar weightings for one or more of the factors. The 10 species that make up Group 1 all had strong positive weightings for Factor 1 and

strong weightings for Factor 2. All of these species seemed to be widely and uniformly distributed, some occurring in unstable habitats while the others occurred primarily where the habitat was stable. *Potamilus ohioensis* and *Leptodea fragilis* had the highest positive weightings for both of these factors and, during the surveys, these species were the ones expected to be found in the unstable substrates of a new ditch. Two of the five members of this group with negative weightings for Factor 2 (*Anodonta grandis* and *Arcidens confragosus*) typically were found in stable silty substrates (positive weightings for Factor 3). The other three (*Fusconaia flava*, *Amblema plicata* and *Quadrula pustulosa*) typically were found in firm substrates (negative weightings for Factor 3).

Group 2 consists of eight species, all of which had strong positive weightings for Factor 1 and strong weightings for Factor 3, but weak weightings for Factor 2. These mussels also were widespread and uniformly distributed; however, they occurred in either soft or firm substrates, apparently without regard to how long since these habitats had been disturbed. *Lasmigona complanata* is the single member of this group with a strong positive weighting for Factor 3, interpreted to indicate an association with soft substrates. It seemed to be present wherever soft mud substrate occurred. The seven other members of this group (with negative weightings for Factor 3) occurred in firm substrates. These species were found in clay or gravel substrates both in undisturbed reaches (the Floodway near Madison and in the St. Francis River near Parkin) and in the atypical river reach downstream from Wappapello Dam.

The six Group 3 species had strong weightings only for Factor 1. All six of these species were found in several areas of the watershed; however, none of them was represented by many individuals (between 48 and 452 mussels, or 0.16 to 1.53 percent of the combined total). The small representation within each species may have prevented stronger weightings for factors 2 or 3.

Fifteen species are listed in Table 22 as "ungrouped." These species either did not have strong weightings for any factor (eight species) or they did not share relationships with any other species. Both *Megaloniais nervosa* and *Quadrula quadrula* had strong weightings for Factors 1, 4 and 5. Both had positive weightings for Factor 1, probably indicating widespread distributions; however, they had opposite relationships for Factor 4 and for Factor 5. There does not appear to be any close relationship between the distribution patterns of these two species (at least within the St. Francis River system).

Both *Potamilus capax* and *Strophitus undulatus* had strong weightings for Factor 2 and weak weightings for Factors 1 and 3.

Potamilus capax also had strong weightings for Factors 4 and 5. According to the PCA results, neither of these species is widely or uniformly distributed in the St. Francis system, nor do they routinely occur in soft or firm substrates. The analysis suggests that *Potamilus capax* occurs in unstable habitats and *Strophitus undulatus* occurs in stable habitats.

Most of the remaining species were represented by very few individuals and, for that reason, might not have generated stronger weightings for some factors. The analysis suggests *Anodonta suborbiculata* occurs in soft substrates and *Actinonaias ligamentinata* occurs in firm substrates (both because of strong weightings for Factor 3). No information is provided concerning the eight species which had no strong weighting for any factor.

Nothing in the preceding discussion associates present mussel distribution patterns in the St. Francis River system with stream size or drainage area. The typical pattern of species number increasing with stream size recognized and confirmed by malacologists for many years (*i.e.*, Ortmann, 1925; van der Schalie & van der Schalie, 1950; Jenkinson & Heuer, 1986) apparently does not apply to this watershed. Stream size was not an apparent component in any of the factors produced by the PCA and there is no size-related trend in the numbers of species encountered in each of the subwatersheds (Table 21).

This difference between the St. Francis River and other streams probably can be attributed to two related developments: the high percentage of land involved in row crops and the extensive channelization of the streams necessary to minimize flooding in this extremely flat watershed. Every watercourse in the St. Francis system appears to have been impacted by siltation; many of them have been dredged or channelized. Aquatic habitat throughout the system is fairly uniform, with silt and sand substrates predominating. Gravel or firm mud substrates are rare; however, they are present at less-modified sites throughout the watershed. Mussel species that persist in this system do not occur in longitudinal zones; rather they are found wherever suitable habitat exists.

Historic Perspective

A seldom referenced paper (Meek, 1896) does a surprisingly good job of describing habitat conditions in the St. Francis River basin

before the area was developed. In 1895, Meek collected fish at Marked Tree, Big Bay (today "Bay" is located between Trumann and Jonesboro), and fish and a few mussels at Old River near Greenway (probably southeast of Piggott). The latter two of these sites are located in the watershed area we refer to as the Sunken Lands (Fig. 9).

At that time much of the St. Francis basin consisted of large lakes "five to six miles wide and three to four times as long" connected by clear, slow-moving channels. Meek mentions sandy substrates most frequently and includes several comments about abundant aquatic vegetation and water clarity. Old River, the mussel collection site, is described as half a mile to only a few rods wide, as much as 20 feet deep in places, with little current, a sandy bottom, and only a small amount of aquatic vegetation.

Meek collected 15 species of mussels at Old River (Table 23). Abundance information presented in the table was extracted from notes in the paper; however, it is not clear whether this information is intended to apply to the collection or to the general distribution of each species. Five of these species (*Anodonta grandis*, *A. imbecillis*, *Lampsilis teres* form *anodontoides*, *Quadrula pustulosa* and *Tritogonia verrucosa*) still are found throughout the St. Francis watershed. Five other species (*Elliptio dilatatus*, *Lampsilis hydiana*, *Obovaria jacksoniana*, *Pleurobema rubrum* and *Villosa lierosa*) are rare now or no longer exist in the system.

TABLE 23. Freshwater mussels collected in 1894 by Meek from Old River, near Greenway, Arkansas. Original identifications made by C. T. Simpson, U. S. National Museum. (Adapted from Meek, 1896.)

Species reported	Current names	Abundance
<i>Unio pyramidatus</i> Lea	<i>Pleurobema rubrum</i>	Scarce
<i>Unio gibbosus</i> Barnes	<i>Elliptio dilatata</i>	Quite common
<i>Unio parvus</i> Barnes	<i>Toxolasma parva</i>	Scarce
<i>Unio texasensis</i> Lea	<i>Toxolasma texasensis</i>	Scarce
<i>Unio tuberculatus</i> Barnes	<i>Tritogonia verrucosa</i>	Scarce
<i>Unio turgidus</i> Lea	<i>Quadrula pustulosa</i>	
<i>Unio anodontoides</i> Lea	<i>Lampsilis teres</i> form <i>anodontoides</i>	Abundant
<i>Unio lierosus</i> Conrad	<i>Villosa lierosa</i>	Not common
<i>Unio castaneus</i> Lea	<i>Obovaria jacksoniana</i>	Common
<i>Unio hydianus</i> Lea	<i>Lampsilis hydiana</i>	Very abundant
<i>Unio cerinus</i> Conrad	<i>Fusconaia flava</i>	Abundant
<i>Unio undulatus</i> Barnes	<i>Megaloniaia nervosa</i>	Scarce
<i>Anodonta imbecillis</i> Say	<i>Anodonta imbecillis</i>	Scarce
<i>Anodonta edentula</i> Say	<i>Strophitus undulatus</i>	Not common
<i>Anodonta opaca</i> Sea	<i>Anodonta grandis</i>	Scarce

Another indication of previous mussel assemblages in the watershed was encountered in the form of relict shells at several sites on Left Hand Chute Little River. As indicated in Results, two collections of relicts were made at sites between Marked Tree and Lepanto (Fig. 6). The species present in these collections (Table 15) include some that typically occur on gravel substrates (*Cyprogenia aberti*, *Fusconaia flava* and *Pleurobema rubrum*), a habitat type that no longer exists in Left Hand Chute. Differences in relative abundance among the species in these collections and the extant fauna of Left Hand Chute (Table 14) could indicate habitat changes over time. However, these differences also could be artifacts of the small sample sizes, missing species records (because fragile shells are rarely preserved), or selection for certain species by some previous collector (mussel fisherman?).

The habitat observations and premodification mussel species list presented by Meek (1896) and the relict collections from Left Hand Chute Little River probably represent stages in the degradation of this lowland drainage basin. If so, they document that some species have been lost from the community, some added, and some have been able to persist – but not necessarily in their original relative abundance.

Potamilus capax

When this survey was designed, its primary purpose was to locate and quantify additional *Potamilus capax* populations in the St. Francis River watershed. A secondary purpose was to collect information on the abundance of the species in areas not sampled quantitatively during 1986. The large number of *Potamilus capax* found this year (607) and the site-specific information collected with them, has added greatly to our understanding of the species and its distribution in this watershed.

Distribution

Ahlstedt & Jenkinson (1991) found *Potamilus capax* in the Lower St. Francis River, the St. Francis Floodway near Marianna, and in a variety of ditch and stream habitats near Marked Tree. One of the *P. capax* habitats near Marked Tree was the downstream two and one-half mile reach of lower Buffalo Creek Ditch (called "unnumbered ditch" in Ahlstedt & Jenkinson, 1991). As indicated in Results, in our current survey, *P. capax* was found in 10 areas:

- the downstream reach of the L'Anguille River,

- the St. Francis Floodway at Madison (previously reported by several authors),
- Straight Slough (previously reported by Clarke, 1985),
- Ditch 10 (previously reported by Ahlstedt & Jenkinson, 1991),
- Little Bay Ditch 9,
- Tulot Seep Ditch (previously reported by Ahlstedt & Jenkinson, 1991),
- the connector between Ditch 60 and 61 (previously reported by Ahlstedt & Jenkinson, 1991),
- St. Francis River from Ditch 1 upstream to the siphons [previously sampled near the siphons by Stansbery & Stein (1982) and Ahlstedt & Jenkinson (1991)],
- Iron Mines Creek-Right Hand Chute from the siphons upstream to Big Lake (Iron Mines Creek sites previously reported by Ahlstedt & Jenkinson, 1991), and
- Belle Fountain Main Ditch (not previously reported, but found by USACE and Fish and Wildlife Service personnel earlier in 1987).

Each of these areas inhabited by *Potamilus capax* has a continuous connection with the St. Francis Floodway, except the St. Francis River downstream from the siphons at Marked Tree and lower Buffalo Creek Ditch. When in operation, the siphons divert water from the Floodway system into the river channel at the mouth of Buffalo Creek Ditch. The river and Floodway systems are distinct from each other between the siphons (River Mile 155) and Huxtable Dam (River Mile 12). Water in the river is released into the Floodway at Huxtable Dam; however, there is no possibility for upstream mussel or fish passage through that structure.

The distribution pattern this substantially enlarged data set suggests (Fig. 10) is quite similar to the one presented in Ahlstedt & Jenkinson (1991). *Potamilus capax* typically occurs in the Floodway system and ditches or streams with unimpeded access to it. The fact that *P. capax* becomes increasingly rare with distance from the siphons in the St. Francis River and lower Buffalo Creek Ditch suggests the species has gained access to these reaches through the large, gravity-fed siphons. Colonization of these areas might be considered a recent event, except that Stansbery & Stein (1982) reported collecting *P. capax* downstream from the siphons in 1973.

If *Potamilus capax* has been in the St. Francis River downstream from the siphons since 1973 (at least), the species does not seem to have been able to extend its range in the river beyond the mouth of Ditch 1,

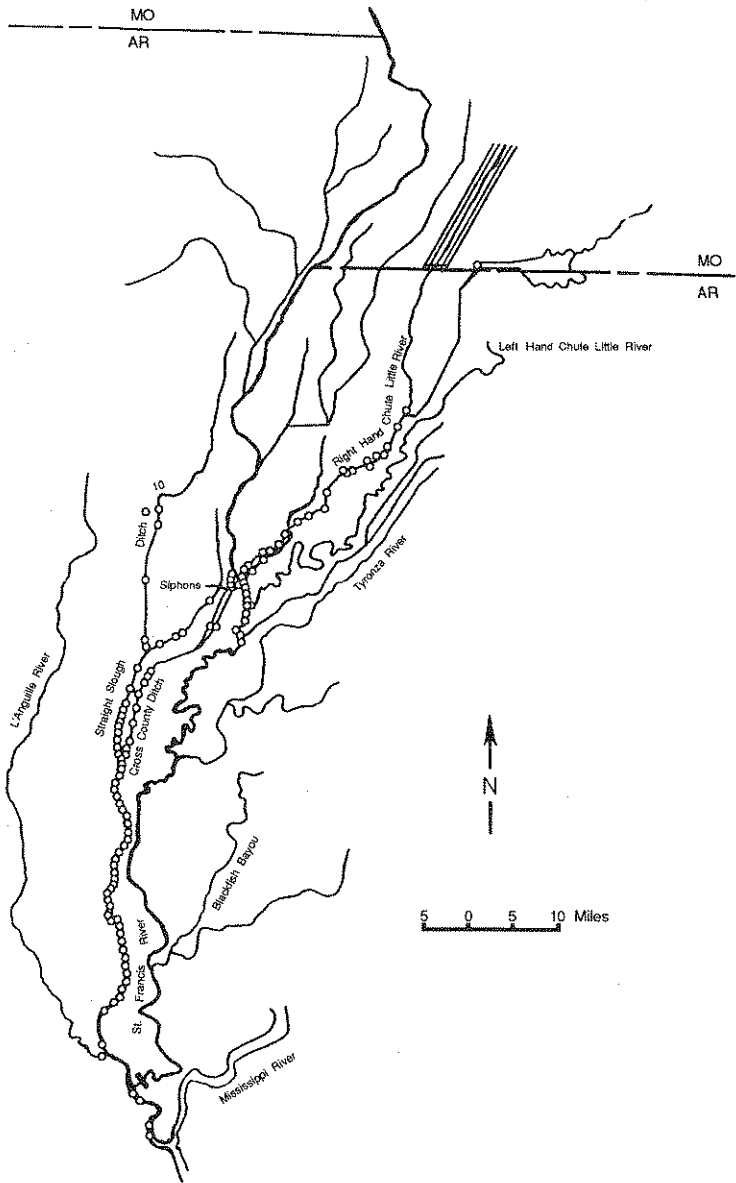


FIG. 10. Sites in the St. Francis River watershed where the fat pocketbook, *Potamilus capax*, has been found during the period 1973-1987. This figure incorporates information from several sources (see text).

upstream more than two miles in Buffalo Creek Ditch, or into adjacent tributaries like Left Hand Chute. Since these reaches appear to contain the types of substrate in which *P. capax* is normally found, this observation suggests some life cycle requirement is not being met in this part of the watershed. One obvious life cycle requirement not associated with substrate that could be affected by the water control system is fish host movement. If the host for *P. capax* was a migratory species, some infected fish could be introduced through the siphons, but would leave this part of the watershed and could not return to the river area through Huxtable Dam. While this idea seems to fit the available data, identification of the fish host would be required to confirm it.

Habitat

During this survey, the fat pocketbook was found in a broad range of substrate types. In the Madison reach of the St. Francis Floodway, *Potamilus capax* occurred in shifting sand, firm clay, and gravel. At the most downstream site on the L'Anguille River and at several sites in the St. Francis River downstream from Marked Tree, *P. capax* occurred in firm mud. In the connector between ditches 60 and 61, in Right Hand Chute Little River, and in most other areas where it was found, *P. capax* occurred in a mixture of sand, mud, and clay (called "sticky mud" in Ahlstedt & Jenkinson, 1991). Field experience gained during this and the 1986 survey suggests this sticky mud is the most likely substrate in which to expect the fat pocketbook. However, searches for the species should not be restricted to this stabilized sand substrate, because *P. capax* has been found alive in all but the most flocculent silt substrates present in the St. Francis River system.

Other characteristics of the habitats in which the fat pocketbook was found also exhibited considerable variation. Channel width ranged from less than 10 m (Ditch 10 system) to over 100 m (Madison reach). Bankside vegetation ranged from virtually none (Ditch 60-61 connector) to large trees and a nearly closed canopy (Straight Slough, St. Francis River near Marked Tree). Human influence on channel morphometry appeared to range from little or none (Madison reach, St. Francis River near Marked Tree) to recent construction (lower Buffalo Creek Ditch, Ditch 60-61 connector).

Abundance

One of the purposes of this survey was to gather quantitative infor-

mation on *Potamilus capax* populations not sampled in 1986, especially those in the Madison area and Straight Slough. These data, when accompanied by quantitative information from the sites evaluated in 1986 and the areas discovered this year, will permit a complete review of *P. capax* abundance throughout the watershed.

Table 3 presents a summary of the quantitative data collected during this survey. In all of these collections, the 92 *Potamilus capax* found in the 357 10-m² quadrat intervals (3,570 square meters) yielded an average of 0.03 *P. capax*/m². Density seemed to be quite consistent in each of the watershed areas where *P. capax* was found this year. The highest density was 0.26/m² (18 individuals in seven transect intervals) found in the St. Francis Floodway upstream from Madison (site 9, Table 8). The lowest average density in a watershed area (0.01/m² in the St. Francis River) included one site with a density of 0.02/m², and three sites where live *P. capax* were found but not in any transect intervals.

These results are quite similar to the averages found during the 1986 TVA survey. In that study, Ahlstedt & Jenkinson (1991) reported 0.02 *P. capax*/m² for river sites (three individuals in 190 m²) and 0.01/m² for ditch sites (six individuals in 580 m²). The density estimates from these TVA surveys are one order of magnitude lower than the 0.16/m² (82 individuals in 512 m²) reported from Madison by Harris (1986) and one order of magnitude higher than the 0.004/m² (226 individuals in 58,152 m of productive habitat) reported from the Madison and Straight Slough reaches by Clarke (1985).

Differences between these abundance estimates probably are most related to the intensity of each survey. Harris counted his specimens while attempting to remove all mussels from a single, small site where a boat ramp was to be built. Clarke's counts were made while sampling many large, randomly-selected sites scattered throughout a long floodway reach. The quantitative sampling included in both TVA surveys was conducted only where live *Potamilus capax* had been found during a qualitative search. When taken, the TVA quantitative samples also were restricted to one or two narrow bands across the width of each site. While the differences in field techniques used during these surveys have yielded three different estimates of fat pocketbook abundance, the results vary along expected lines given their relative intensity.

Population Structure

Length class data for the 586 live or fresh-dead *Potamilus capax*

measured during this survey are presented in Table 4. As indicated in the table, at least 45 individuals were measured from each of four watershed areas. Inspection of numbers in length class intervals suggests that each of these well represented areas contains a normal distribution of shell lengths. Two of the areas have mean lengths of approximately 100 mm (101.9 mm for the Floodway Main Channels and 97.55 mm for Right Hand Chute), while one has a mean of 90.12 mm (St. Francis River), and the other has a mean of 79.77 mm (Western Ditches).

The Floodway Main Channels and Right Hand Chute areas both consist of sites that appear to have been relatively undisturbed in recent years. This observation, accompanied by the similarity of their mean length values and size class relationships suggests they both represent well-established *Potamilus capax* populations. Measurement data from the Floodway Channels collected by Clarke (1985) and Harris (1986) support this concept. Mean lengths Clarke measured were 91.94 mm in 1984 (124 individuals) and 101.70 mm in 1985 (94 individuals). The mean of 81 individuals Harris measured in 1985 was 97.21 mm.

The relatively small number of measured *Potamilus capax* from the St. Francis River between the mouth of Ditch 1 and the siphons (45 animals) had a mean length of 90.12 mm, 10 mm shorter than those from the Floodway or Right Hand Chute. The mean length of 35 individuals from this area measured in 1986 was similar, 88.11 mm (Ahlstedt & Jenkinson, 1991). The difference between these mean values and those from other areas could suggest the river habitat did not promote shell growth as much as other habitats or, perhaps, the population was not as well established as those in the Floodway system.

Ninety-four percent of the measured specimens from the Western Ditches (165 of 176 mussels, Table 9) came from the connector or between Ditches 60 and 61 (constructed in 1978). The mean length of these mussels by themselves was 79.07 mm. Mean length of 49 individuals from this same ditch measured in 1986 was 50.19 mm (Ahlstedt & Jenkinson, 1991). The differences in these mean values, accompanied by the age of this ditch, suggests this is a relatively new population, in which the individuals are growing rapidly.

SUMMARY

As anticipated, this survey of the St. Francis River system has documented the existence of several previously unknown *Potamilus capax*

populations. This endangered species is now known to occur virtually throughout the length of the St. Francis Floodway and in many of its tributaries. Upstream from the Floodway, *P. capax* occurs in the Iron Mines Creek-Right Hand Chute Little River system at least as far as Big Lake Dam and the lower portion of Belle Fountain Main Ditch. The species also occurs in the St. Francis River from the siphons near Marked Tree downstream to the Mouth of Ditch 1 and in Buffalo Creek Ditch near the siphons. This distribution pattern is unlike that of any other freshwater mussel present in the St. Francis River system and seems likely to be tied to the movement pattern of a migratory fish host.

Survey results this year indicated the habitat of *Potamilus capax* was broader than indicated by Ahlstedt & Jenkinson (1991). Populations or individuals of the species were found in the full range of habitat types, from shifting sand and flocculent mud to hard clay and gravel. Results of a principal components analysis indicated *P. capax* had an affinity for unstable habitats (disturbed areas). We are still of the opinion that the most likely habitat in which to find this species is "sticky-mud" - a mixture of sand, silt, and clay.

In terms of abundance, the 92 *Potamilus capax* found in a total of 357 10-m² transect intervals yielded an average of 0.03/m². This average was consistent wherever *P. capax* occurred and is quite similar to the averages found during the 1986 TVA survey. These values are one order of magnitude lower than the 0.16/m² density estimate obtained during intensive work at Madison (Harris, 1986) and one order of magnitude higher than the 0.004/m² estimate from wide-ranging work conducted in the Madison-Straight Slough area by Clarke (1985).

Length data on 586 *Potamilus capax* suggested that two of the populations appeared to be well established, with a normal distribution of lengths around a mean of approximately 100 mm. One of these populations was in the Madison-Straight Slough reach of the Floodway and the other was in the Right Hand Chute complex. Individuals in the St. Francis River reach near Marked Tree had a mean length of approximately 90 mm, suggesting slower growth rates in that area or a relatively young population.

Measured *Potamilus capax* from the connector between Ditches 60 and 61 had a mean length of approximately 80 mm. Individuals from this ditch also had been measured in 1986 (mean 50 mm). This change in mean length, accompanied by the recent completion date of the ditch (1978), suggested this was a rapidly growing, young popula-

tion.

Additional finds of *Potamilus capax* in the St. Francis River system could occur; however, they are not likely to make substantial changes in the distribution pattern. The one possible exception to this generalization is the recent discovery of *P. capax* in Belle Fountain Main Ditch, upstream from Big Lake Dam. This find suggests the species could occur in other parts of the Right Hand Chute drainage basin, possibly including the five major ditches that drain much of the Missouri bootheel.

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