

Habitat Characterization and Species Associates
of the Speckled Pocketbook (Lampsilis streckeri Frierson)
in the Middle Fork Little Red River, Arkansas

Final Report

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Introduction

Lampsilis streckeri is an endangered freshwater mussel which is known to occur in approximately 9.0 river miles of the Middle Fork Little Red River in Stone and Van Buren Counties, Arkansas (Stewart 1992). Specific data regarding the habitat and species associates (both fish and mussel) of the endangered speckled pocketbook are generally lacking. The available information on biology of the speckled pocketbook has been summarized by Clarke (1987), Harris (1992) and U.S. Fish and Wildlife Service (1991).

The Middle Fork is the largest tributary of the Little Red River system and has a watershed of approximately 66,561 hectares (McDaniel 1984). Gradient averages 2.8m/km along a 65 kilometer reach terminating at Shirley, Van Buren County, AR. Data accumulated prior to 1980 showed that 68% of the watershed was forested and 30% was agricultural (U.S. Dept. Agri. 1979).

The purpose of research summarized in this report is to: 1) characterize the habitat of Lampsilis streckeri including substrate composition, water depth, water velocity, discharge, and water chemistry, 2) determine the age class structure of the speckled pocketbook within a localized population, and 3) determine the fish and mussel species associated with the speckled pocketbook. Field survey and data acquisition were conducted in two stream reaches of the Middle Fork Little Red

River on 29-30 August 1992. The survey area is illustrated in Figure 1.

Methods

Field survey locations were accessed by canoe and speckled pocketbooks were located by both snorkeling and diving techniques. Diving was performed using a Brownie's Third Lung generator and compressor connected to a hookah regulator by reinforced hose.

Two sites were intensively surveyed for Lampsilis streckeri. The downstream end of Site 1 corresponds to Site 18 in Harris (1992a) and is located upstream of Shirley in the NE1/4 NW1/4 Sec 19; R12W; T12N, Van Buren County, AR (Figure 2). Drainage area upstream of Site 1 is approximately 673 km² (260 mi²) (Sullavan, 1974). Site 2 is located downstream of Arlberg in Sections 21, 28, 29; R13W; T13N (Figure 3). Drainage area upstream of Site 2 is approximately 492 km² (190 mi²) (Sullavan, 1974).

Each speckled pocketbook specimen encountered was measured for length, width and depth to the nearest 0.1 mm using Helios dial calipers. Specimens were sexed based on shell morphology and marsupial swelling of the gills, and aged when feasible by counting the shell external growth rings. The physical variables water depth and current velocity were recorded at each speckled pocketbook occurrence using a wading rod and Teledyne Gurley flowmeter.

Stream habitat of Lampsilis streckeri concentrations was characterized by identifying habitat types (McCain, et al 1990)

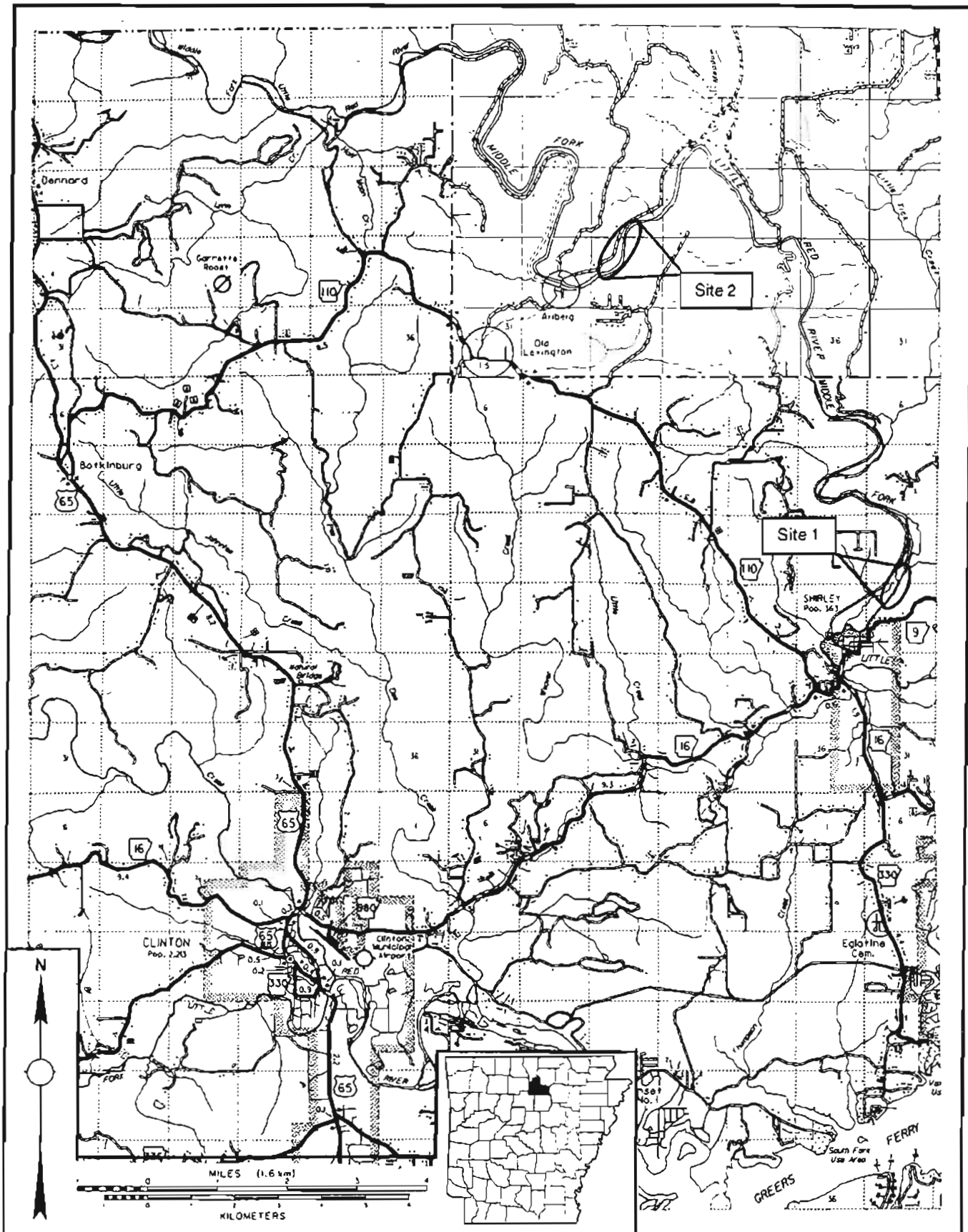


Figure 1 *Lampsillis streckeri* survey area.

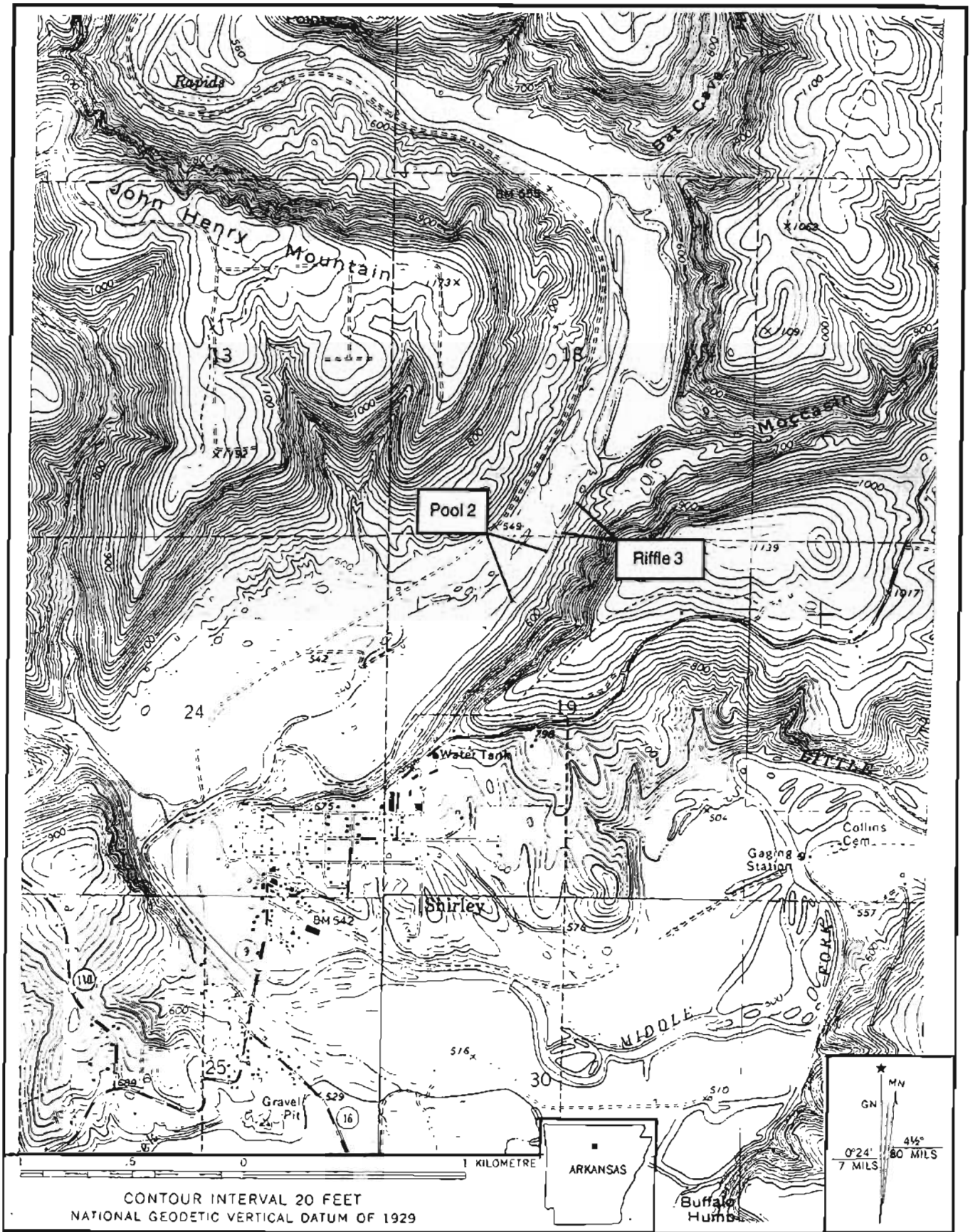


Figure 2. Survey Site 1 location.

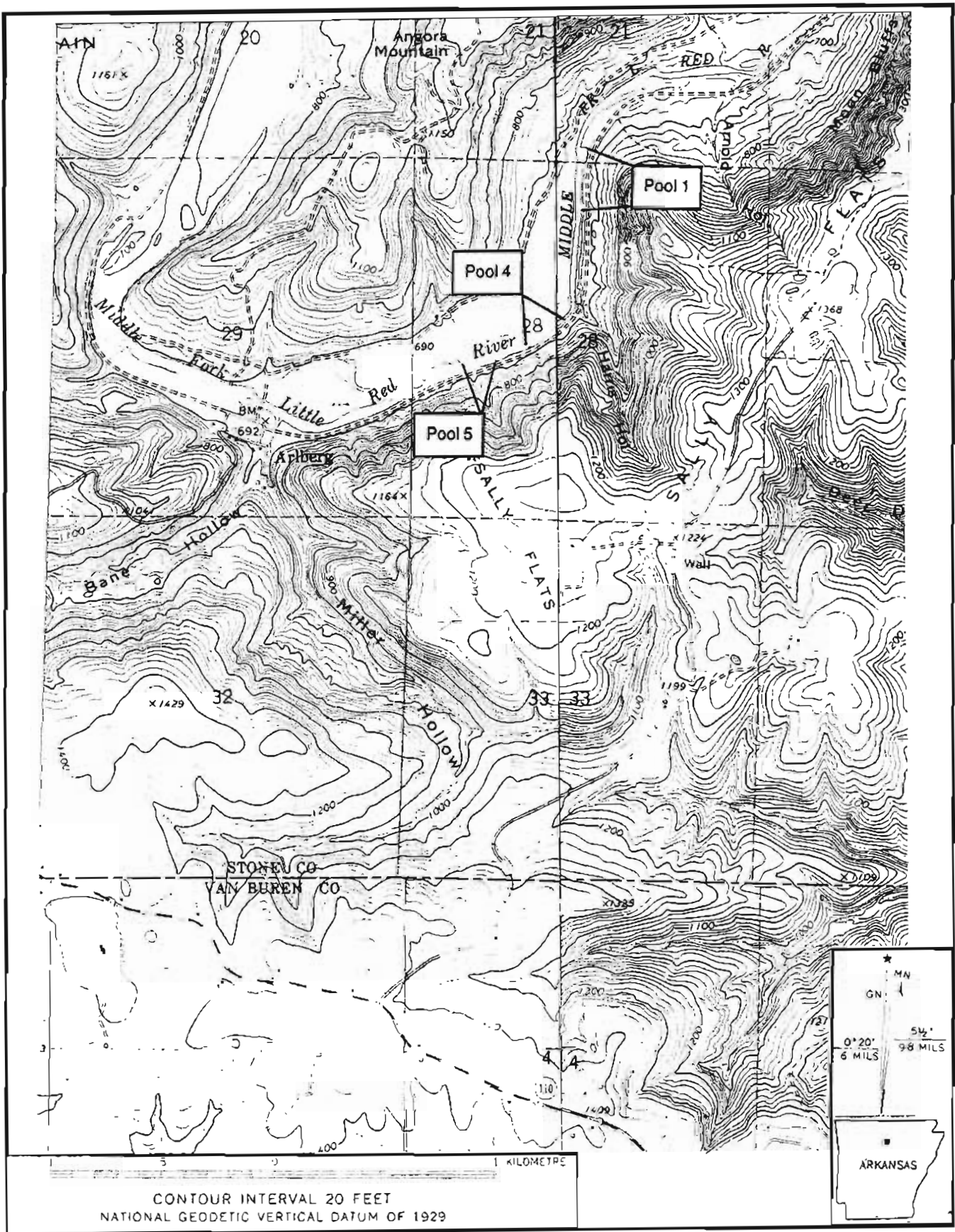


Figure 3. Survey Site 2 location.

and measuring length and width for each stream reach within each survey site. In addition, discharge was quantified at three or more locations for Site 1 and Site 2 using the flowmeter and standard techniques.

Substrate was quantified at Site 1 by using random numbers tables to select 10 m² quadrats and measuring substrate particle size within each quadrat. Particles were measured to the nearest 1.0 cm along the length and width axes and classified as follows:

- Boulder - > 30 cm along length axis
- Cobble - 8 - 30 cm along length axis
- Large gravel - 3 - 7 cm along length axis
- Gravel/sand - < 3 cm along length axis

The substrate area covered by each particle type was quantified and calculated as percent of m². The gravel/sand component was quantified as the residual after summing the boulder, cobble, and large gravel components. Substrate was quantified for three Lampsilis streckeri occurrences at Site 2. Qualitative substrate descriptions were recorded for the remaining occurrences.

All mussel species co-occurring with Lampsilis streckeri were recorded and enumerated for Site 1 and two subsites at Site 2. Nomenclature follows Turgeon, et al (1988). Fish species recorded from the Middle Fork Little Red River were extracted from Robison and Buchanan (1988). Additional information regarding benthic fish assemblages in the Middle Fork Little Red River was taken from McDaniel (1984). Fishes were collected from Riffle 3 of Site 1 by seining with a 2.4m X 3.0m net with 3.2mm mesh. All specimens were collected, fixed in 10% formalin, and preserved in 40% isopropanol.

Water chemistry variables are quantified monthly from samples taken at the Middle Fork Little Red River at Shirley, AR (Petersen 1992). Water chemistry trend analysis for selected parameters is summarized from Petersen (1992), and monthly means with standard deviation for dissolved oxygen, turbidity, total hardness and total suspended solids are summarized from USGS (1975 - 1989) water quality records. Means and standard deviations were calculated using SYSTAT (Wilkinson, 1990).

Results

Eight Lampsilis streckeri were encountered within Site 1, Riffle 1 (Table 1), and 26 specimens were examined from the entire length of Site 2 (Table 2).

Table 1. Biological and physical data of Lampsilis streckeri occurrences at Site 1.

Specimen Number	Sex	Length (mm)	Width (mm)	Depth (mm)	Water Depth (m)	Water Velocity (m/sec)
1	F	47.2	17.0	28.2	0.58	0.42
2	F	71.0	32.6	41.8	0.34	0.22
3	U	26.3	7.9	14.5	0.34	0.22
4	F	64.1	23.4	38.4	0.20	0.85
5	F	67.5	25.0	40.3	0.63	0.48
6	M	68.9	24.5	37.5	0.25	0.73
7	M	75.8	29.5	44.0	0.52	0.06
8	F	66.5	26.0	40.0	0.40	0.25

Table 2. Biological and physical data of Lampsilis streckeri occurrences at Site 2.

Specimen Number	Sex	Length	Width	Depth	Water Depth	Water Velocity
1	M	73.0	26.7	42.4	0.58	0.02
2	F	74.4	26.6	44.4	0.24	0.00
3	F	73.3	26.9	40.9	0.27	0.00
4	M	85.3	34.5	52.3	0.52	0.01
5	F	71.9	23.7	45.2	0.43	0.01
6	M	80.3	28.5	47.5	0.76	0.00
7	F	67.6	28.6	42.6	0.76	0.00
8	F	62.5	28.1	38.4	0.67	0.01
9	F	62.6	20.6	37.7	0.70	0.01
10	M	73.8	25.1	43.6	0.76	0.01
11*	F	57.6	22.2	36.3	0.40	0.06
12*	M	73.7	27.4	43.5	0.40	0.06
13*	M	70.9	25.3	40.7	0.40	0.06
14*	U	34.9	11.3	20.1	0.34	0.05
15*	M	66.6	22.1	39.1	0.34	0.05
16*	M	70.1	24.0	41.3	0.34	0.05
17*	F	54.4	18.7	32.0	0.34	0.05
18*	M	62.5	21.0	36.8	0.34	0.05
19*	M	59.8	19.9	34.7	0.40	0.06
20*	F	52.9	21.5	32.3	0.40	0.06
21*	U	26.9	9.5	15.4	0.40	0.06
22*	F	41.8	15.5	24.1	0.40	0.07

continued . . .

Table 2. Continued

Table 2. Biological and physical data of Lampsilis streckeri occurrences at Site 2.

Specimen Number	Sex	Length	Width	Depth	Water Depth	Water Velocity
23	F	49.2	17.9	30.4	0.37	0.22
24	M	75.3	33.5	45.5	0.27	0.42
25	M	76.8	29.5	47.1	0.27	0.42
26	M	43.9	15.6	25.6	0.82	0.05

* = found under slab rock boulders

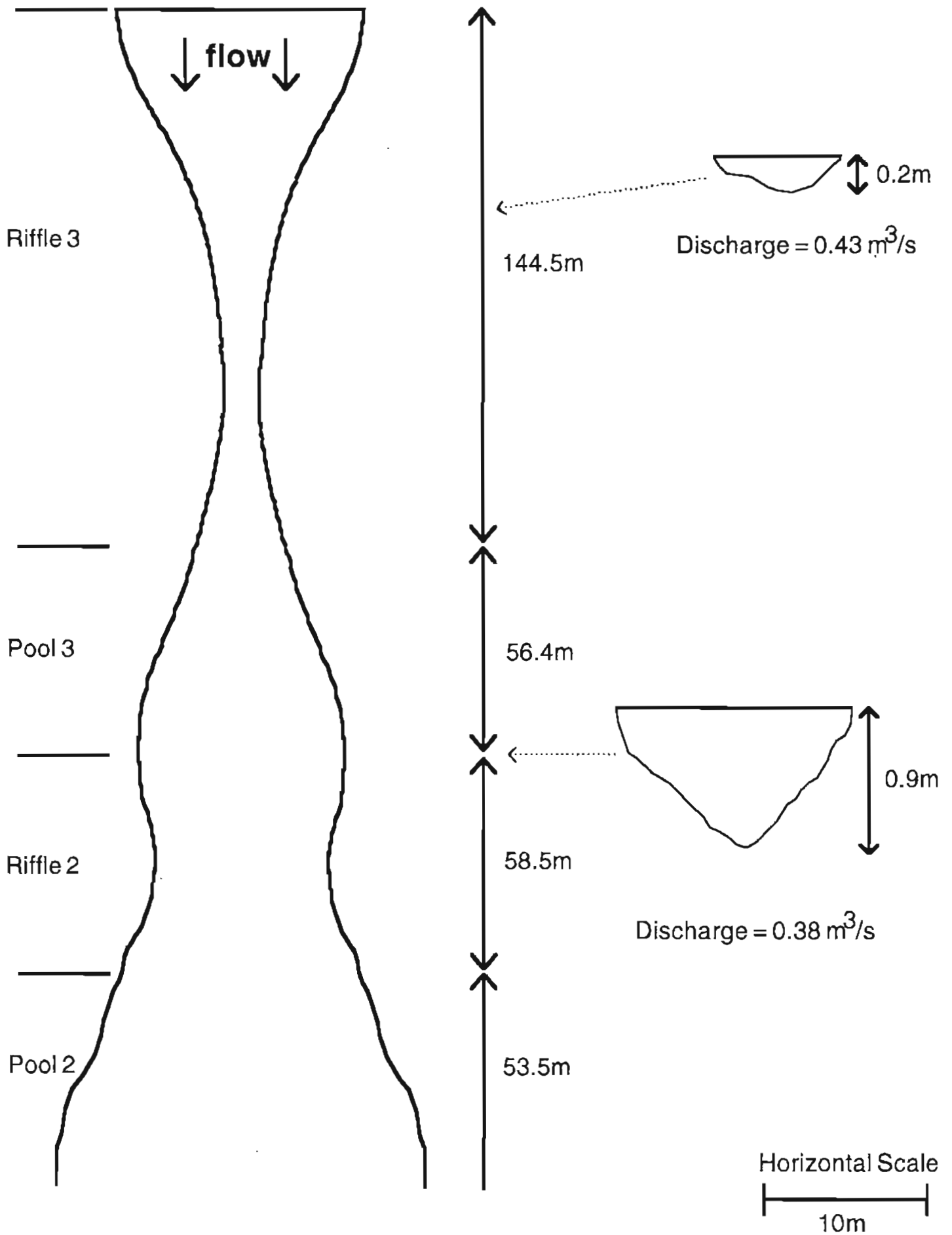
Stream habitat classifications, lengths, widths, selected cross sections and discharge are stylistically illustrated for Site 1 and Site 2 in Figures 4 and 5, respectively. Photographic illustration of Sites 1 and 2 are presented in Figures 6 and 7, respectively. Substrate quantifications for Site 1, Riffle 1 and Site 2, Pool 5 (3 Lampsilis streckeri occurrences only) are summarized in Tables 3 and 4, respectively. The pool to riffle ratio at Site 1 for three pools and three riffles is 2.3 : 1.0. The pool to riffle ratio at Site 2 for five pools and five riffles was 2.2 : 1.0.

Mussel species associates of Lampsilis streckeri at Site 1, Riffle 1 were presented by Harris (1992a). This data is found in Appendix I. Mussel associates recorded for Site 2, Pools 4 and 5 are also presented in Appendix I. Fishes known historically from

Figure 4. Schematic and stylized map of Study Site 1.

Middle Fork Little Red River

Survey Site 1



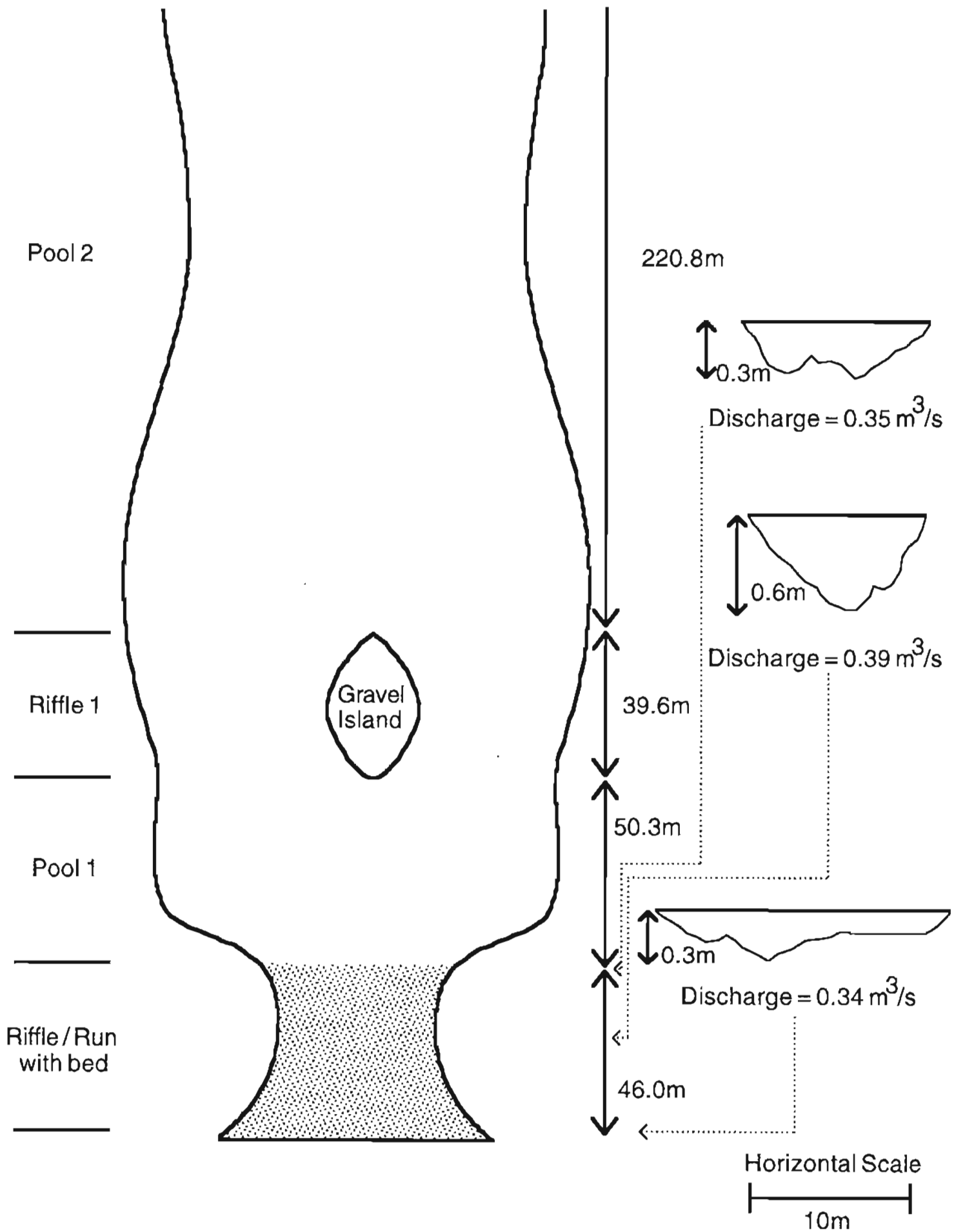
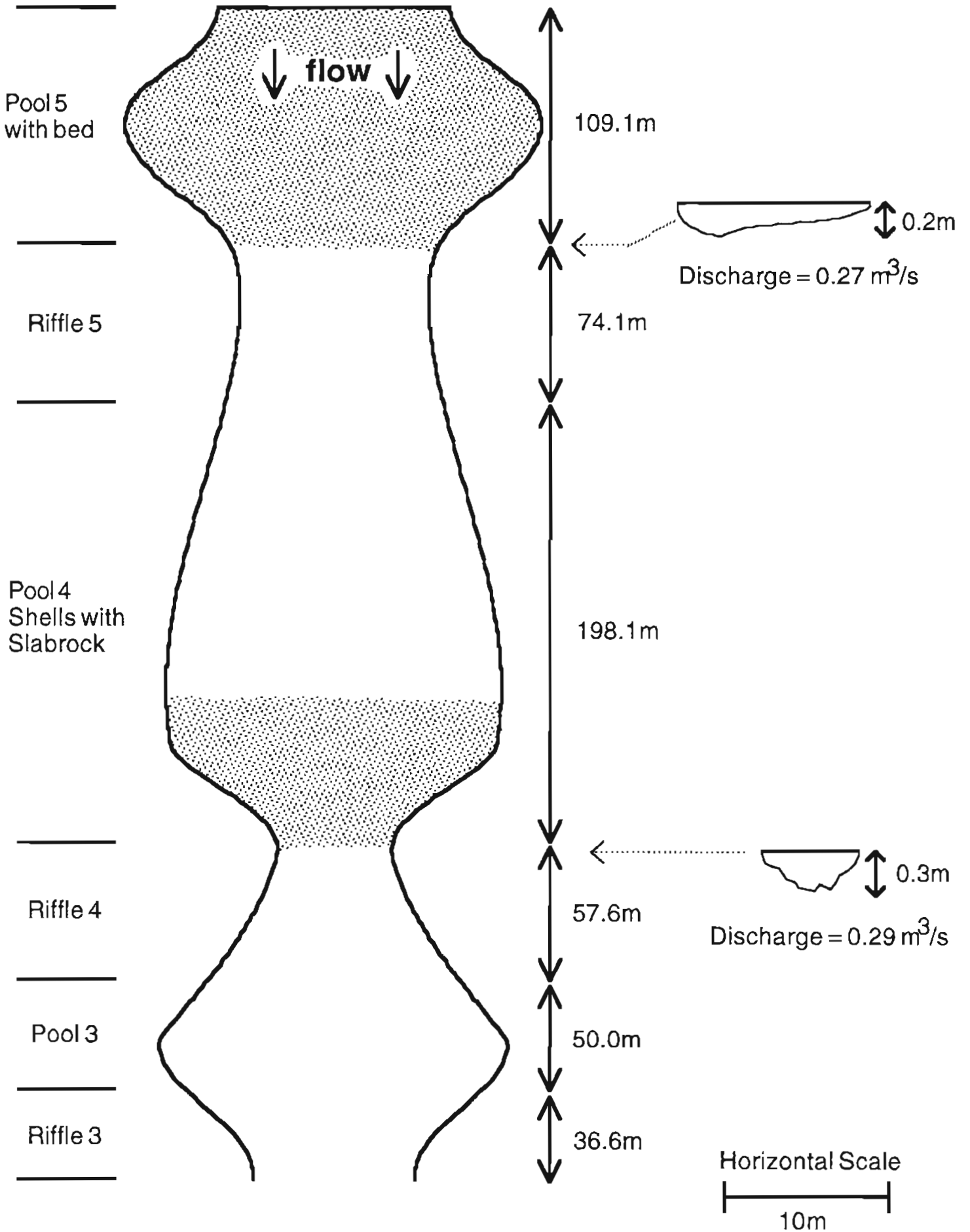
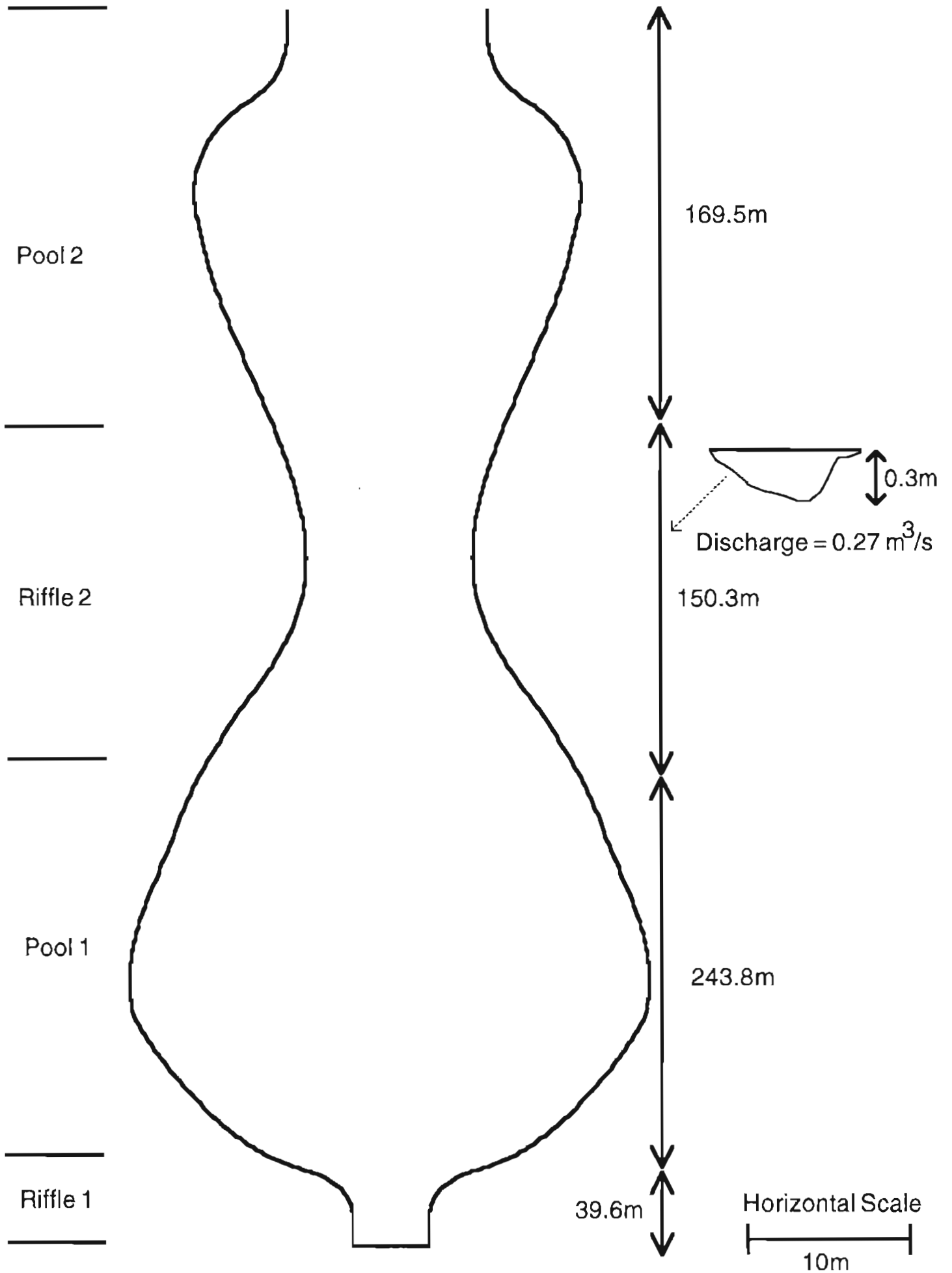


Figure 5. Schematic and stylized map of Study Site 2.

Middle Fork Little Red River

Survey Site 2





A.



B.

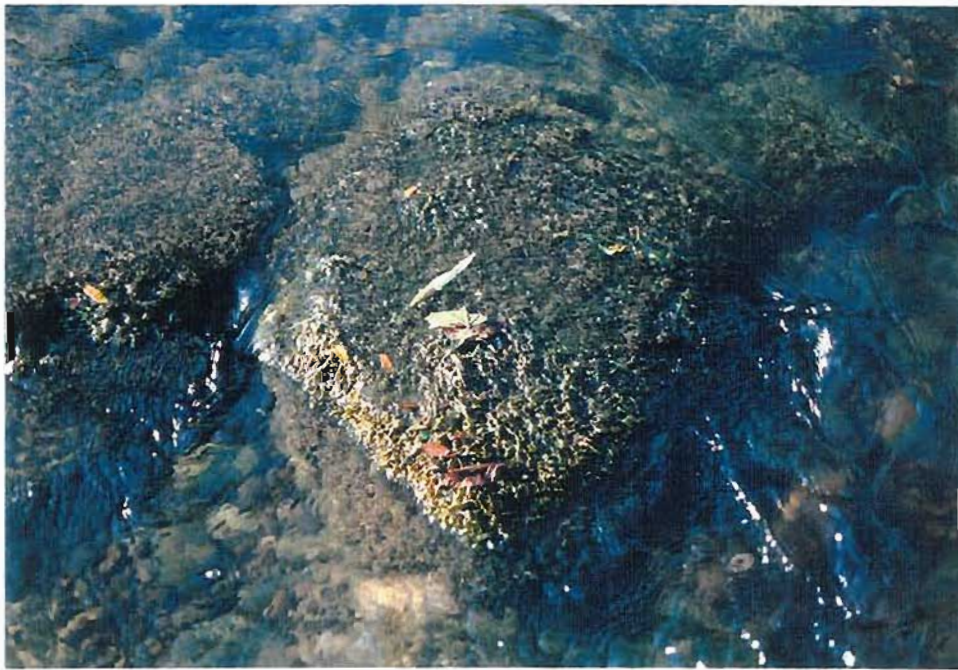


Figure 6. A. View downstream from Site 1, Pool 3.
B. Substrate at Site 1 riffle/run bed area.

A.



B.



Figure 7. A. Site 2, Pool 4. B. Slab rock boulder substrate at Site 2, Pool 4.

Table 3. Substrate quantification for Site 1, Riffle 1.

Sample #	% Boulder	% Cobble	% Large Gravel	% Gravel/Sand
1	27.8	30.2	15.7	26.4
2	20.4	42.7	18.6	18.3
3	43.6	23.1	10.5	22.8
4	52.3	30.5	17.1	--
5	--	75.2	18.0	6.8
6	21.0	53.4	13.4	12.2
7	39.4	56.6	4.0	--
8	46.9	41.6	11.4	--
9	33.4	16.3	9.3	41.0
10	36.0	25.5	20.3	18.2
Mean	32.1	39.5	13.8	14.6

Table 4. Substrate quantification for Site 2, Pool 5 (Lampsilis streckeri occurrences only).

Sample #	% Boulder	% Cobble	% Large Gravel	% Gravel/Sand
1	19.8	34.6	5.8	39.8
2	--	12.5	15.7	71.8
3	7.4	30.0	9.3	53.3

the Middle Fork Little Red River are listed in Appendix II. Fishes collected from Site 1, Riffle 3 are summarized in Table 5.

Water quality trends for selected parameters analyzed by Petersen (1992) are summarized in Table 6. Monthly means and standard deviations for dissolved oxygen, turbidity, total hardness, total suspended solids, and discharge during water years 1977 - 1989 are illustrated in Figures 8 - 10.

Discussion

Eight Lampsilis streckeri were found at Site 1 in water velocities ranging from 0.06 - 0.85 m/sec and at water depths ranging from 0.20 - 0.63 meters. Specimens 2 - 6 were located beneath boulders in sand/gravel substrates. These boulders were classified as "slab rocks", were poorly embedded in the substrate, and allowed for water and nutrient circulation underneath.

Twenty-six Lampsilis streckeri were examined from four distinct microhabitats throughout Site 2. Five individuals (specimens 1 - 5, Table 2) were found in a low velocity, relatively shallow glide (as defined by McCain et al, 1990). Substrate was composed of 45% - 88% large gravel to sand substrate at depths ranging from 0.24 - 0.58 m and current velocity of 0.00 - 0.02 m/sec. This is similar to the preferred habitat for another protected Arkansas endemic mussel, Lampsilis powelli, the Arkansas fatmucket which is found in the Ouachita River drainage (Harris and Gordon, 1988).

Table 5. Fishes collected from Site 1, Riffle 3, Middle Fork Little Red River.

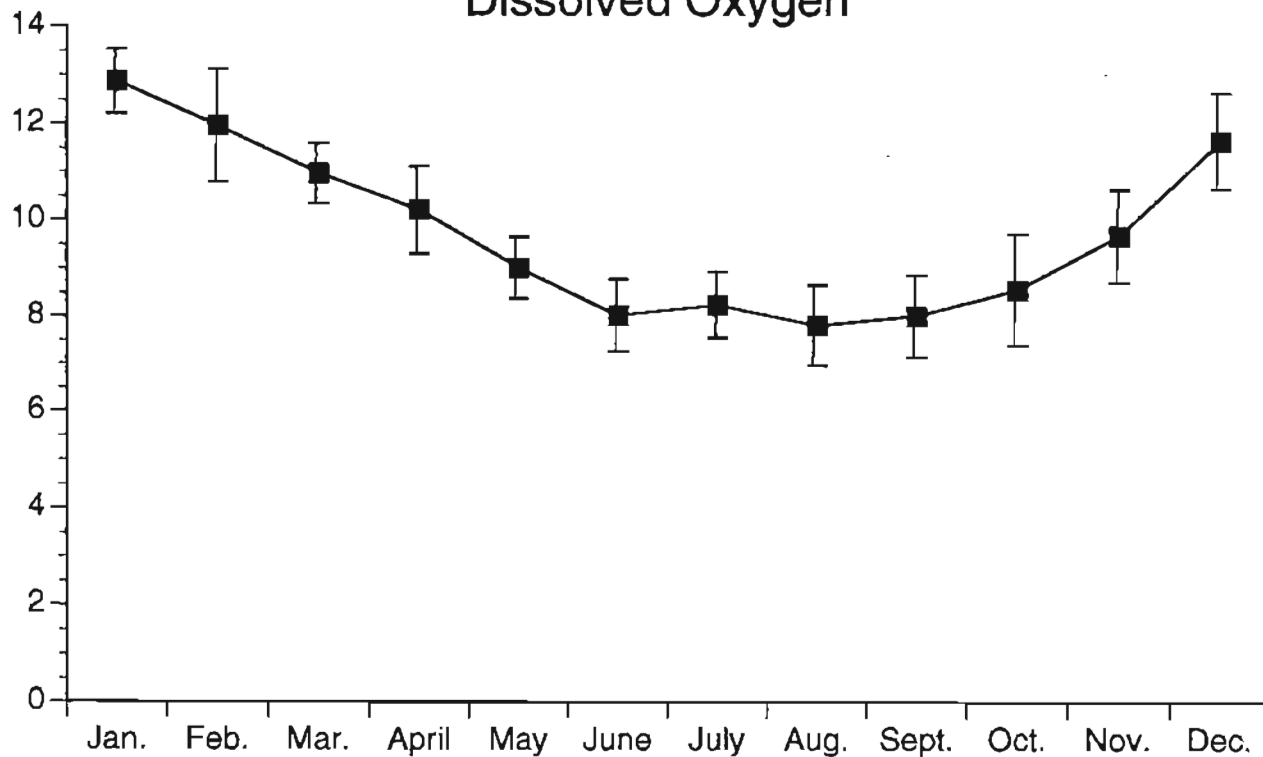
<u>Species</u>	<u>Common Name</u>	<u>Number</u>
<u>Ichthyomyzon castaneus</u>	chestnut lamprey	1
<u>Campostoma anomalum</u>	central stoneroller	5
<u>Cyprinella whipplei</u>	steelcolor shiner	3
<u>Luxilus pilsbryi</u>	duskystripe shiner	18
<u>Notropis boops</u>	bigeye shiner	12
<u>Notropis greenei</u>	wedgespot shiner	13
<u>Pimephales notatus</u>	bluntnose minnow	2
<u>Noturus albater</u>	Ozark madtom	1
<u>Ambloplites ariommus</u>	shadow bass	2
<u>Lepomis megalotis</u>	longear sunfish	4
<u>Etheostoma blennioides</u>	greenside darter	10
<u>Etheostoma caeruleum</u>	rainbow darter	2
<u>Etheostoma moorei</u>	yellowcheek darter	5
<u>Etheostoma zonale</u>	banded darter	15
<u>Percina caprodes</u>	logperch	1
15 species		90

Table 6. Summary of selected water quality parameters of the Middle Fork Little Red River for 1975 - 1989 (adapted from Petersen, 1992).

Water Chemistry Parameter	Sample Size	Mean	Trend Unit/Yr	Result %/Yr
pH, standard units*	168	7.42	0.02	0.28
Turbidity, NTU	99	9.07	0.01	0.11
Dissolved Oxygen, mg/l	169	9.60	0.00	-0.05
Fecal Coliform, c/100ml	139	83.54	0.30	0.35
Total Hardness, mg/l	93	40.12	-0.34	-0.85
Dissolved Sulfate, mg/l	74	6.41	-0.23	-3.51
Dissolved Chloride, mg/l*	164	3.47	-0.14	-3.95
Total Susp. Solids, mg/l	169	8.80	-0.12	-1.39
Total NO ₂ + NO ₃ , mg/l	106	0.06	0.00	0.00
Total NH ₃ , mg/l	128	0.05	0.00	0.00
Total Phosphorus, mg/l	84	0.05	0.00	0.00
Total OrthoP, mg/l	99	0.02	0.00	0.00

* = significant increase or decrease (p < 0.05)

Dissolved Oxygen



Turbidity

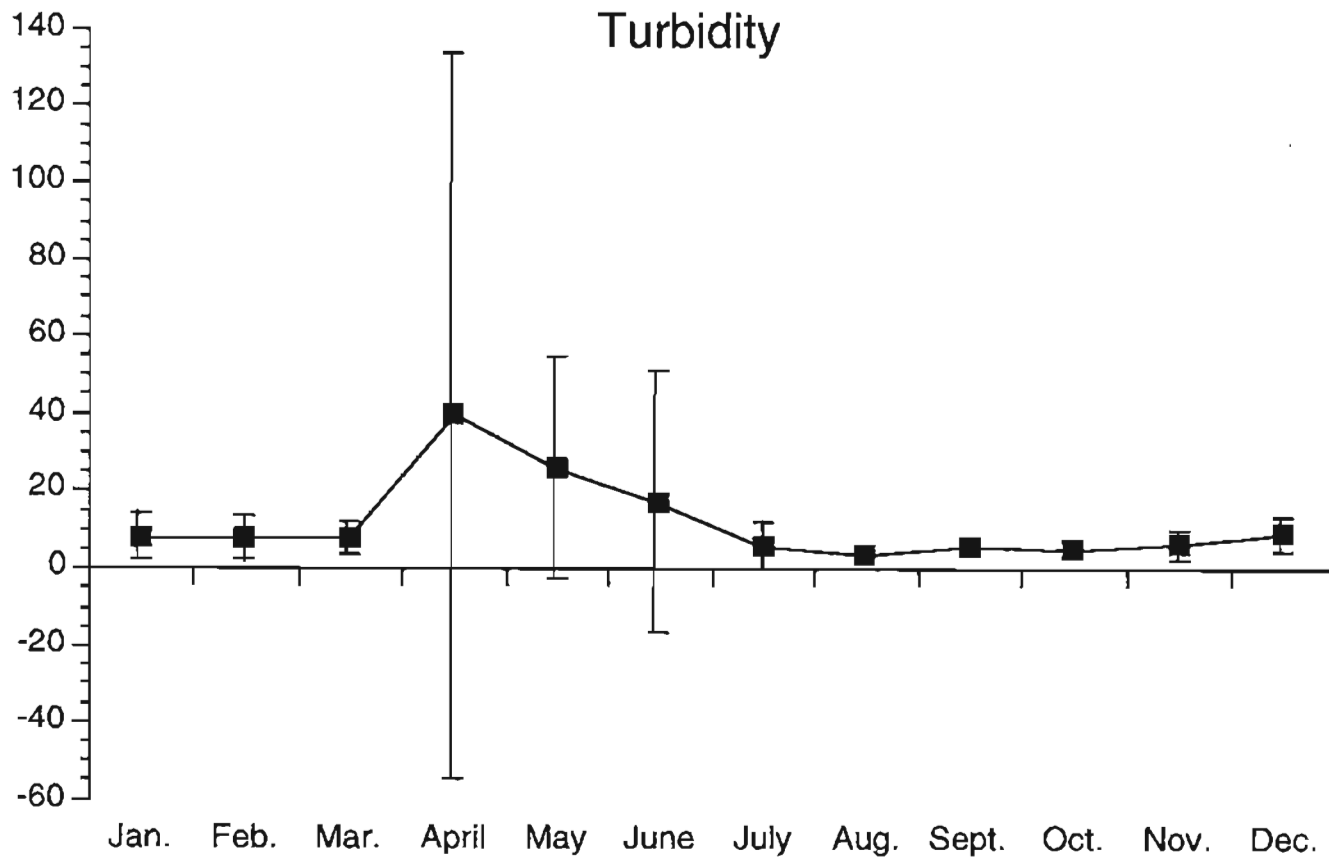
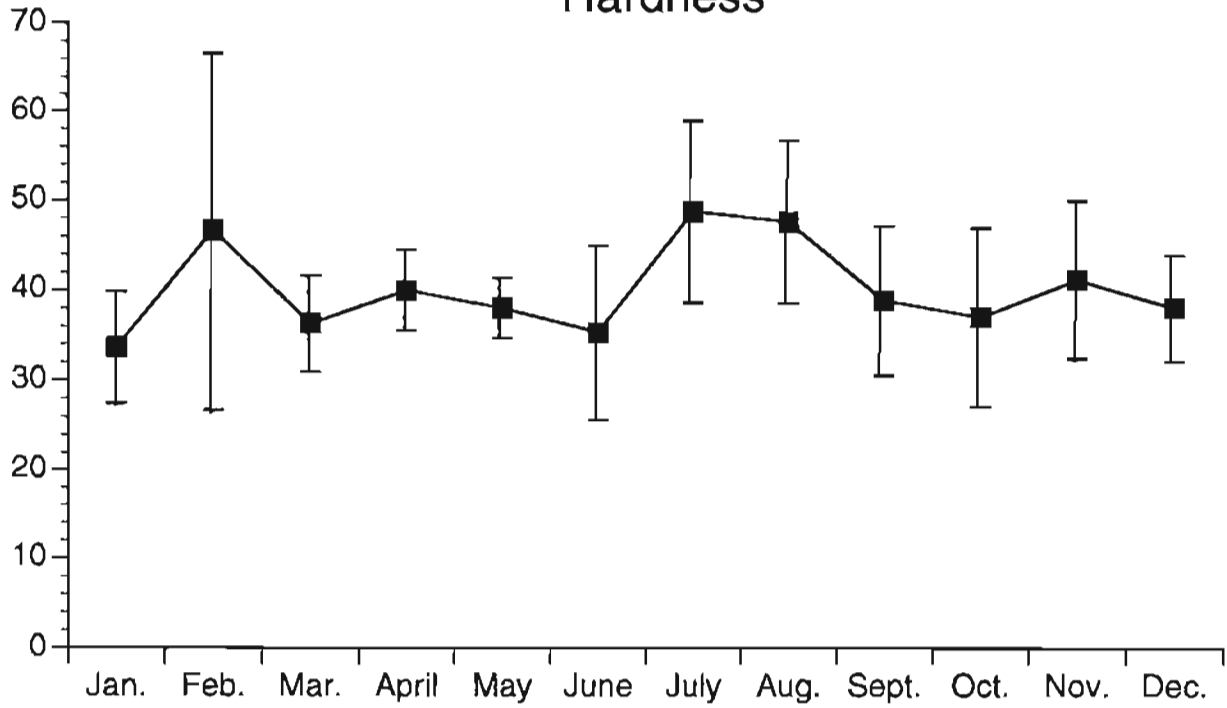


Figure 8. Mean dissolved oxygen ($\pm 1sd$) and turbidity ($\pm 1sd$) for water years 1975-1989 in Middle Fork Little Red River.

Hardness



Total Suspended Solids

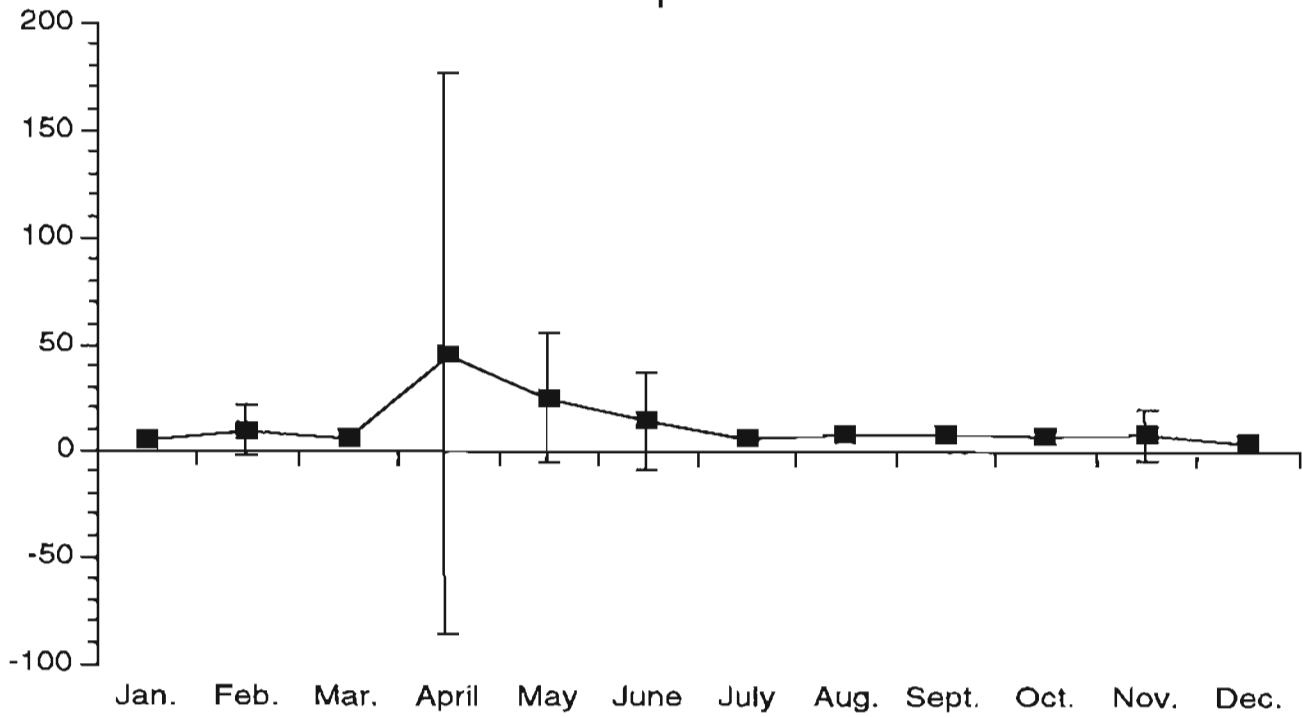


Figure 9. Mean hardness($\pm 1sd$) and total suspended solids ($\pm 1sd$) for water years 1975-1989 in Middle Fork Little Red River.

Middle Fork Little Red River Discharge

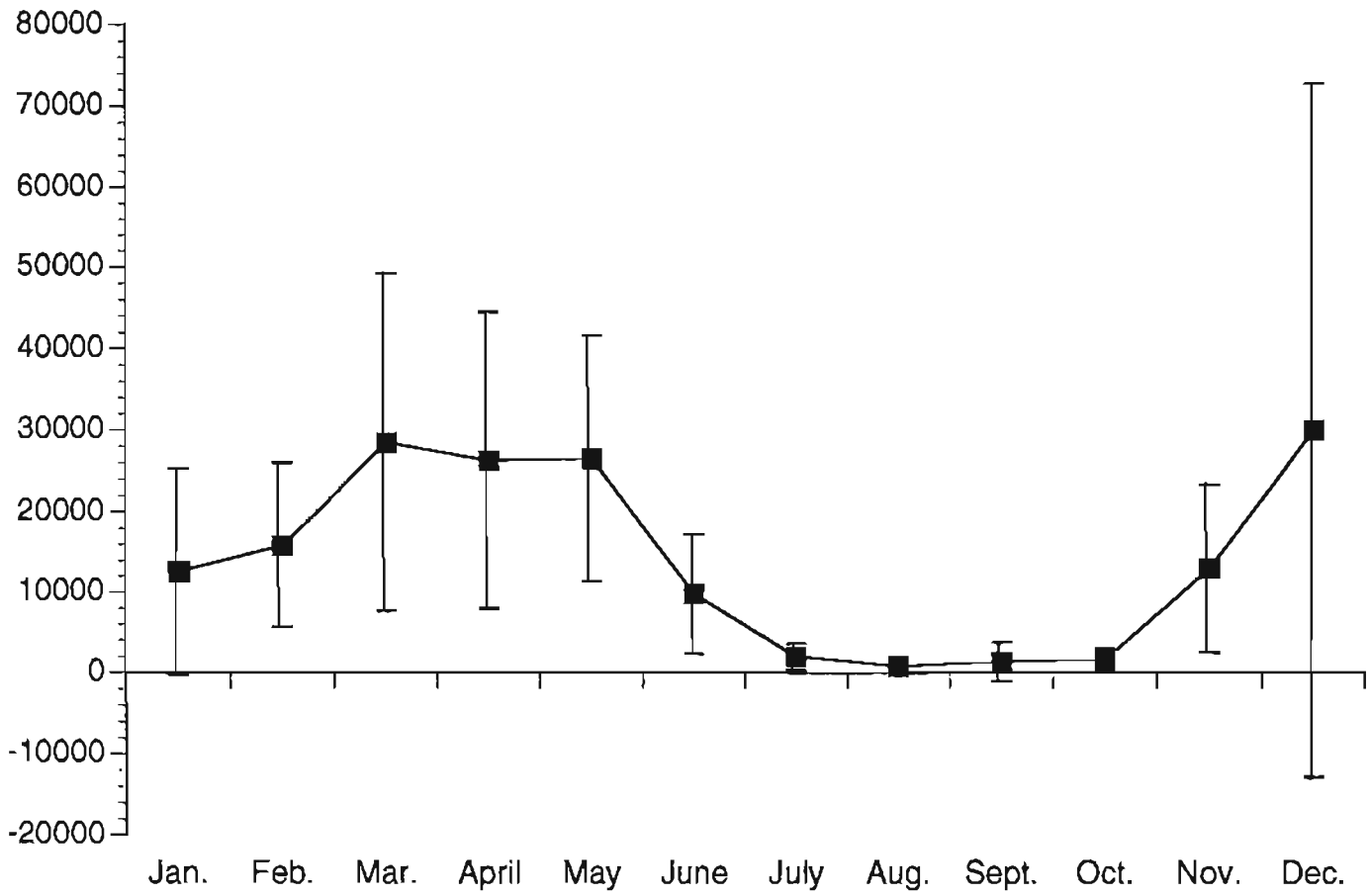


Figure 10. Mean discharge ($\pm 1sd$) for water years 1975-1989 in Middle Fork Little Red River.

Six individuals (specimens 6 - 10 and 26, Table 2) were found in low velocity, somewhat deeper glide habitat dominated by boulder and bedrock substrate (no quantification taken). Water depth where these individuals were located ranged from 0.43 - 0.82 m and current velocity ranged from 0.00 - 0.05 m/sec. These six Lampsilis streckeri were found in sand/gravel filled crevices between boulders or fissures in bedrock. This particular microhabitat association for the speckled pocketbook has also been found upstream of Site 1 and was discussed by Harris (1992a, 1992b).

Microhabitat type three was found in the same glide habitat, but individuals 11 - 22 (Table 2) were located under slab rock boulders (See Figure 7). Water depth in the slab rock area ranged from 0.34 - 0.40 m and current velocity following removal of the slab rock ranged from 0.05 - 0.07 m/sec. Substrate beneath the slab rock consisted of fine gravel and sand. A single slab rock measuring 0.85 m X 0.55 m provided cover for three Lampsilis streckeri (length 56.7 mm - 73.7 mm), six Elliptio dilatata, and one Ptychobranchus occidentalis. Another slab measuring 0.63 m X 0.58 m covered four L. streckeri (length 34.9 mm - 70.1 mm) and six Elliptio dilatata.

Microhabitat type four consisted of low gradient riffles dominated by cobble substrate with lower percentages of boulder and large gravel substrates. This microhabitat is equivalent to that quantified at Site 1. Individuals 23 - 25 (Table 2) were found in this microhabitat and were located at water depth

ranging from 0.27 - 0.37 m with water velocity ranging from 0.22 - 0.42 m/sec.

Attempts to spatially quantify and discern a pattern to the distribution of mussel concentrations or beds in the Middle Fork Little Red River were unsuccessful at the scale attempted. Harris (1992a) found six mussel concentrations along a 19.3 km section of the Middle Fork Little Red River from Meadow Creek downstream to Greer's Ferry Lake. The longitudinal distribution of the beds was neither predictable nor equally spaced from upstream to downstream. The physical, chemical or biological components which determine mussel bed longitudinal distribution within stream systems remain undetermined. Stream classification and inventory procedures (McCain et al 1990) performed in conjunction with mussel bed distributional surveys for entire rivers may reveal definitive patterns to mussel bed distribution.

The sex ratio for 34 speckled pocketbook individuals located during this study was 15 males : 16 females or approximately 1 : 1. Three of the 34 specimens were < 35 mm in length and sex could not be determined with confidence. Age structure of the Lampsilis streckeri population was not determined during this study. Neves and Moyer (1988) discussed the problems with ageing mussels based on external growth bands and larger specimens examined during this survey were generally highly eroded in the umbonal region making band counts impossible. Four specimens ranging from 26.3 mm to 41.8 mm in length were located with periostracum intact and growth bands that were very distinct.

Counts of bands for these specimens yielded the following results:

<u>Length</u>	<u>Estimated Age</u>
26.3 mm	4+
26.9 mm	4+
34.9 mm	9+
41.8 mm	10+

Allometric growth patterns reported for other mussels are plainly evident for the speckled pocketbook also.

If 40 mm is the length of 10+ year old individuals, then 91% (31 of 34) of the population examined is > 10 years old. It is also likely that individuals > 40 mm length are reproductively mature. The presence of the three < 40 mm length individuals indicates that recruitment is occurring for Lampsilis streckeri in the Middle Fork Little Red River.

Eight mussel species were associated with Lampsilis streckeri at Site 1 and 12 species were identified from Site 2 (See Appendix I). Species most closely associated with L. streckeri spatially within concentrated mussel areas included Elliptio dilatata and Ptychobranthus occidentalis. Actinonaias ligamentina is numerically dominant at Site 1 and Site 2, Pool 4 in open substrates. Mucklets were not associated with Lampsilis streckeri under slab rock boulders. It is also of some interest to note that Villosa iris is found associated with Lampsilis streckeri under slab rocks. Villosa iris is a relatively rare component of the Arkansas mussel fauna, and I have collected live

specimens only from the Little Red River drainage and only in association with Lampsilis streckeri.

Sixty six fish species including 17 cyprinids, 10 centrarchids, and 12 percids are known historically from the Middle Fork Little Red River. Fifteen species were collected from Site 1, Riffle 3 and species composition was dominated by cyprinids (six species) and percids (five species). It is of interest to note that Etheostoma moorei (yellowcheek darter) (Robison and Buchanan, 1988) and a distinct morph of Erimystax harrisi (spotted chub) (Harris, 1986) are endemic to the Little Red River system as is Lampsilis streckeri.

Water chemistry parameters showed a significant increase in pH and a significant decrease in dissolved chloride for the fifteen year period from 1975 - 1989. ADPCE (1992) reports that turbidity increased significantly during the three year period from 1989 - 1991 due to excessively high turbidity levels associated with high flow periods. McDaniel (1984) summarized the Middle Fork Little Red River as a typical Ozark stream characterized by low carbon dioxide, good oxygen content, and extreme variability in volume. Data indicate that water quality should not be a limiting factor to Lampsilis streckeri in this drainage.

Both Clarke (1987) and Harris (1992a, 1992b) have commented that the preferred habitat of the speckled pocketbook is riffle with sand/mud or sand/gravel substrate. During this survey, 12 Lampsilis streckeri were found at Site 2, Pool 4 under slab rock boulders with slow current velocity (<0.07 m/sec).

Undoubtedly, many more speckled pocketbook individuals were present beneath the slab rock substrate but were not disturbed. This finding requires that concepts of speckled pocketbook preferred habitat and perhaps abundance be revised.

The location of Lampsilis streckeri approximately 1.0 km downstream of Arlberg increases the known range by approximately 5.0 km. It also refutes Clarke's (1987) contention that cessation of flow during summer or fall low flow is limiting to Lampsilis streckeri distribution. In fact, pool or glide habitat may be the preferred habitat for the speckled pocketbook.

Summary

Lampsilis streckeri was found in four distinct microhabitats within the Middle Fork Little Red River. These include:

- 1) Riffles with boulder/cobble/gravel substrate and fast water, L. streckeri in crevices and under slab boulders;
- 2) Riffles with sand/gravel substrate and fast water;
- 3) Glides (= pools with moderate to slow flow) with sand/gravel substrate; and
- 4) Glides with boulder/cobble substrate and L. streckeri in interstices and under boulders

The report of Lampsilis streckeri occurring under slab rock boulders is new to the literature for this species. It apparently tolerates a relatively wide range of current velocities in both pool and riffle habitats.

The primary mussel species associates of Lampsilis streckeri under slab rock boulders are Elliptio dilatata and Ptychobranthus occidentalis. Villosa iris was also found closely associated

substrates, Actinonaias ligamentina and Elliptio dilatata are the primary species associates.

Reproduction and recruitment of Lampsilis streckeri is occurring within the Middle Fork Little Red River. More than 90% of the population is estimated to be 10+ years old.

Studies to determine the fish host for Lampsilis streckeri are needed. No predictions as to the potential fish host can be made based on the results of this study. The presence of relatively large numbers of Lampsilis streckeri under slab rocks raises the possibility of fish hosts including lithophilic species such as darters, stonerollers, and juvenile centrarchids.

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APPENDIX I

Mussel Collections

ARKANSAS MUSSEL SPECIES LIST

Shell Summary Data Sheet

Field ID# USFWS - LS - 1B Date 22 July 1991

Quantitative Sample X Qualitative Sample X

Shell Summary

Species	Live	Dead	Species	Live	Dead
<u>Plectomerus</u> <u>P. dombeyanus</u>			<u>Toxolasma</u> <u>T. lividus</u>		
<u>Pleurobema</u> <u>P. coccineum</u>			<u>T. parvus</u>		
<u>P. cordatum</u>			<u>T. texasensis</u>		
<u>P. pyramidatum</u>			<u>Tritogonia</u> <u>T. verrucosa</u>	1	
<u>Potamilus</u> <u>P. alatus</u>			<u>Truncilla</u> <u>T. donaciformis</u>		
<u>P. obiensis</u>			<u>T. truncata</u>		
<u>P. purpuratus</u>			<u>Uniomerus</u> <u>U. declivis</u>		
<u>Ptychobranhus</u> <u>P. occidentalis</u>	2		<u>U. tetralasmus</u>		
<u>Quadrula</u> <u>Q. cylindrica</u>			<u>Venustaconcha</u> <u>V. ellipsiformis</u>		
<u>Q. metanevra</u>			<u>V. pleasii</u>		
<u>Q. nodulata</u>			<u>Villosa</u> <u>V. arkansasensis</u>		
<u>Q. pustulosa</u>			<u>V. iris</u>	1	1
<u>Q. quadrula</u>			<u>V. lienosa</u>		
<u>Simpsonaias</u> <u>S. ambigua</u>					
<u>Strophitus</u> <u>S. undulatus</u>					

Notes: AR, VAN BUREN Co. Middle Fork Little Red River ca. 0.5 Km downstream of confluence with Moccasin Hollow. NE 1/4 NW 1/4 sec 19; R12W; T12N. Shirley 7.5' Quad. J.L. Harris, J.T. Fleming. Rocky riffle/run with water depth to about 0.5m. Good sand/gravel mix among rocks - some coarse sand along banks - Flow moderate - best concentration of shells from top of riffle downstream for ca. 15m. Average width ca. 4m. Moderate #'s of mussels dominated by spike and mucket. L. streckeri found in gravel/sand in main run.²

AR Shell Bed Survey

Shell Summary Data Sheet

Field ID# USFWS - LS - 28 Date 30 August 1992Quantitative Sample _____ Qualitative Sample X

Shell Summary

Species	Live	Dead	Species	Live	Dead
<u>Plectomerus</u> <u>P. dombeyanus</u>			<u>Toxolasma</u> <u>T. lividus</u>		
			<u>T. parvus</u>		
<u>Pleurobema</u> <u>P. coccineum</u>			<u>T. texasensis</u>		
<u>P. cordatum</u>			<u>Tritogonia</u> <u>T. verrucosa</u>		
<u>P. pyramidatum</u>					
<u>Potamilus</u> <u>P. alatus</u>			<u>Truncilla</u> <u>T. donaciformis</u>		
<u>P. ohiensis</u>			<u>T. truncata</u>		
<u>P. purpuratus</u>	2		<u>Uniomerus</u> <u>U. declivis</u>		
<u>Ptychobranhus</u> <u>P. occidentalis</u>	2		<u>U. tetralasmus</u>		
<u>Quadrula</u> <u>Q. cylindrica</u>			<u>Venustaconcha</u> <u>V. ellipsiformis</u>		
<u>Q. metanevra</u>			<u>V. pleasii</u>		
<u>Q. nodulata</u>					
<u>Q. pustulosa</u>			<u>Villosa</u> <u>V. arkansasensis</u>		
<u>Q. quadrula</u>			<u>V. iris</u>		
<u>Simpsonaias</u> <u>S. ambigua</u>			<u>V. lienosa</u>		
<u>Strophitus</u> <u>S. undulatus</u>					

Notes: Site 2, Pool 5 AR, STONE CO. NW 1/4 SW 1/4 SEC 28; T13N;
R13W. Middle Fork Little Red R. ca. 1.0 KM downstream
of Arkberg. Shells along left descending bank from
downstream riffle up to upstream run. Mussels more concentrated
at downstream end of site. Very similar to L. powelli habitat
in S. Fork Ouachita R.

AR Shell Bed Survey

Shell Summary Data Sheet

Field ID # USFWS - LS - 29Date 30 August 1992

Quantitative Sample _____

Qualitative Sample X

Species	Live	Dead	Species	Live	Dead
<u>Actinonaias</u> <u>A. ligamentina</u>	17		<u>Fusconaia</u> <u>F. ebena</u> <u>F. flava</u> <u>F. ozarkensis</u> <u>F. subrotunda</u>		
<u>Alasmidonta</u> <u>A. marginata</u> <u>A. viridis</u>			<u>Glebula</u> <u>G. rotundata</u>		
<u>Amblema</u> <u>A. plicata</u>			<u>Lampsilis</u> <u>L. abrupta</u> <u>L. cardium</u> <u>L. hydiana</u> <u>L. powelli</u> <u>L. rafinesqueana</u> <u>L. reeveiana</u> <u>L. satura</u> <u>L. silicoidea</u> <u>L. streckeri</u> <u>L. teres</u>	12	
<u>Anodonta</u> <u>A. grandis</u> <u>A. imbecillis</u> <u>A. suborbiculata</u>			<u>Lasmigona</u> <u>L. complanata</u> <u>L. costata</u>		
<u>Anadontoides</u> <u>A. ferussacianus</u>			<u>Leptodea</u> <u>L. fragilis</u> <u>L. laevissima</u> <u>L. leptodon</u>		
<u>Arcidens</u> <u>A. confragosus</u>			<u>Ligumia</u> <u>L. recta</u> <u>L. subrostrata</u>		
<u>Arkansia</u> <u>A. wheeleri</u>			<u>Megalonaias</u> <u>M. nervosa</u>		
<u>Cumberlandia</u> <u>C. monodonta</u>			<u>Obliquaria</u> <u>O. reflexa</u>		
<u>Cyclonaias</u> <u>C. tuberculata</u>			<u>Obovaria</u> <u>O. jacksoniana</u> <u>O. olivaria</u>		
<u>Cyprogenia</u> <u>C. aberti</u>					
<u>Ellipsaria</u> <u>E. lineolata</u>					
<u>Elliptio</u> <u>Elliptio dilatata</u>	9				
<u>Epioblasma</u> <u>E. florentina</u> <u>E. triquetra</u> <u>E. turgidula</u>					

APPENDIX II

Fishes of Middle Fork Little Red River

Fishes Known Historically
from the Middle Fork Little Red River

Petromyzontidae -- Lampreys	
<u>Ichthyomyzon castaneus</u>	chestnut lamprey
Lepisosteidae -- Gars	
<u>Lepisosteus oculatus</u>	spotted gar
<u>Lepisosteus osseus</u>	longnose gar
Anguillidae -- Freshwater eels	
<u>Anquilla rostrata</u>	American eel
Clupeidae -- Herrings	
<u>Dorosoma cepedianum</u>	gizzard shad
Cyprinidae -- Minnows and Carps	
<u>Campostoma anomalum</u>	central stoneroller
<u>Campostoma oligolepis</u>	largescale stoneroller
<u>Cyprinella galactura</u>	whitetail shiner
<u>Cyprinella whipplei</u>	steelcolor shiner
<u>Cyprinus carpio</u>	carp
<u>Erimystax harrvi</u>	spotted chub
<u>Hybopsis amblops</u>	bigeye chub
<u>Luxilus pilsbryi</u>	duskystripe shiner
<u>Nocomis biguttatus</u>	hornyhead chub
<u>Notemigonus crysoleucas</u>	golden shiner
<u>Notropis boops</u>	bigeye shiner
<u>Notropis greenei</u>	wedgespot shiner
<u>Notropis umbratilus</u>	redfin shiner
<u>Pimiphales notatus</u>	bluntnose minnow
<u>Pimephales tenellus</u>	slim minnow
<u>Pimephales vigilax</u>	bullhead minnow
<u>Semotilus atromaculatus</u>	creek chub
Catostomidae -- Suckers	
<u>Hypentelium nigricans</u>	northern hogsucker
<u>Ictiobus bubalus</u>	smallmouth buffalo
<u>Ictiobus cyprinellus</u>	bigmouth buffalo
<u>Ictiobus niger</u>	black buffalo
<u>Minytrema melanops</u>	spotted sucker
<u>Moxostoma carinatum</u>	river redhorse
<u>Moxostoma duquesnei</u>	black redhorse
<u>Moxostoma erythrurum</u>	golden redhorse

Fishes Known Historically
from the Middle Fork Little Red River

Ictaluridae -- Bullhead Catfishes

<u>Ictalurus furcatus</u>	blue catfish
<u>Ictalurus punctatus</u>	channel catfish
<u>Ameiurus natalis</u>	yellow bullhead
<u>Noturus albater</u>	Ozark madtom
<u>Noturus exilis</u>	slender madtom
<u>Noturus miurus</u>	brindled madtom
<u>Noturus nocturnus</u>	freckled madtom
<u>Pylodictus olivaris</u>	flathead catfish

Fundulidae -- Killifishes

<u>Fundulus catenatus</u>	northern studfish
<u>Fundulus olivaceus</u>	blackspotted topminnow

Atherinidae -- Silversides

<u>Labidesthes sicculus</u>	brook silverside
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Moronidae -- Temperate Basses

<u>Morone chrysops</u>	white bass
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Centrarchidae -- Sunfishes

<u>Ambloplites ariommus</u>	shadow bass
<u>Lepomis cyanellus</u>	green sunfish
<u>Lepomis gulosus</u>	warmouth
<u>Lepomis macrochirus</u>	bluegill
<u>Lepomis megalotis</u>	longear sunfish
<u>Lepomis microlophus</u>	redeer sunfish
<u>Lepomis punctatus</u>	spotted sunfish
<u>Micropterus dolomieu</u>	smallmouth bass
<u>Micropterus punctulatus</u>	spotted bass
<u>Micropterus salmoides</u>	largemouth bass

Percidae -- Perches

<u>Etheostoma blennioides</u>	greenside darter
<u>Etheostoma caeruleum</u>	rainbow darter
<u>Etheostoma euzonum</u>	Arkansas saddled darter
<u>Etheostoma moorei</u>	yellowcheek darter
<u>Etheostoma proeliare</u>	cypress darter
<u>Etheostoma punctulatum</u>	stippled darter
<u>Etheostoma stigmaeum</u>	speckled darter
<u>Etheostoma whipplei</u>	redfin darter
<u>Etheostoma zonale</u>	banded darter
<u>Percina caprodes</u>	logperch
<u>Percina maculata</u>	blackside darter
<u>Percina nasuta</u>	longnose darter

Sciaenidae -- Drums

<u>Aplodinotus grunniens</u>	freshwater drum
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