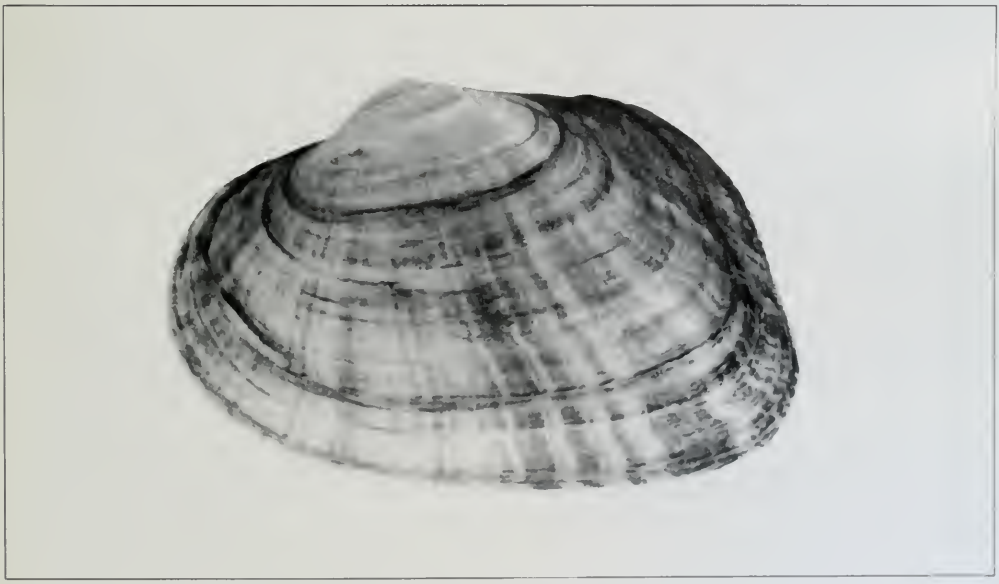
A Survey of the Freshwater Mussels (Bivalvia: Unionidae) of the Sangamon River Basin, Illinois

Robert W. Schanzle
Kevin S. Cummings



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Cover photograph: The slippershell mussel, *Alasmidonta viridis* (Rafinesque 1820), is the only extant Sangamon River mussel currently considered endangered in Illinois. The photographed specimen, which was taken from the Little Vermilion River in Illinois, is actually only 28 mm long (a little more than 1 inch). The photo is by Molly Scott.

Editor: John Ballenot

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Illinois Natural History Survey
Distribution Center
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A Survey of the Freshwater Mussels (Bivalvia: Unionidae) of the Sangamon River Basin, Illinois

Robert W. Schanzle and Kevin S. Cummings

Abstract

The freshwater mussels of the Sangamon River and its tributaries in Illinois were studied between 1910 and 1967 by a number of investigators. The current study was undertaken to compare the existing mussel resources of the Sangamon River basin with those documented by the earlier researchers. During the present study, sampling of 30 mainstem and 27 tributary stations resulted in the collection of 33 species of live mussels and of the introduced Asian clam, *Corbicula fluminea*. Four additional species were represented by dead material only. Four species that are included on the state threatened, endangered, or "watch" lists were collected live, in many cases from stations where they were previously unrecorded.

Introduction

The Sangamon River originates as field tile drainage at a county highway bridge approximately one-half mile north of Ellsworth in McLean County. From this modest beginning it flows more than 240 miles in a broad curve, first toward the east, then south, and finally west, before emptying into the Illinois River near Beardstown (Figure 1). A river of the prairie, the Sangamon, as well as each of its major tributaries, arises within the Grand Prairie Natural Division of Illinois (Schwegman 1973). The Sangamon drains an area of 5,419 square miles (Healy 1979).

Since the settlement of Illinois in the early 1800s, the Sangamon has been subjected to numerous artificial changes. Major reaches between Decatur and Springfield and between Petersburg and Beardstown have been channelized to speed drainage and reduce the frequent flooding that characterized the river after the surrounding forests, prairies, and wetlands were drained and cleared for agriculture. The mainstem of the river and several of its major tributaries have been dammed to create impoundments for community water supplies, power plant cooling, and recreational use. The river has historically served as a receiving water for effluents generated by industries and municipalities located along its banks, and it has suffered further pollution from agricultural runoff, oil field drainage, and other sources. All of these factors have affected the quality of its fisheries and other biota (Bertrand 1983).

This study was undertaken to determine which species of freshwater mussels currently inhabit the Sangamon River and its tributaries and to compare the river's existing mussel populations with those reported by earlier researchers. It was hoped that this work would accurately gauge the health and distribution of existing mussel populations, as well as any recent increases or decreases in species richness.

One of the earliest listings of Sangamon River mussels was that of F.E. Wood (1910), who reported eight species found in a muskrat midden near White Heath during his study of the mammals of Champaign County. James Zetek, who identified Wood's specimens, listed 17 mussel species collected from the Sangamon River in his 1918 study of the mollusks of Champaign, Piatt, and Vermilion counties. Frank Collins Baker (1922) included 23 Sangamon River mussels in a report on the mollusks of the Big Vermilion River. (Baker also recorded a number of mussel species attributed to "Athens, Menard Co." and "Springfield, Sangamon Co." in his 1906 *Catalogue of the Mollusca of Illinois*. Unfortunately, it is not clear whether those records were from the Sangamon River or any of its tributaries.) These early listings of the Sangamon River's mussel resources are summarized in Table 1.

More recent investigations of the mussels of the Sangamon River basin (Table 1) include those by University of Illinois professor M.R. Matteson in 1956–1960 (unpublished observations) and by his students Q.V. Shier (1962) and G.V.C. Hall (1967). Matteson's work had been by far the most comprehensive to date, covering 10 stations on the Sangamon and its major tributaries and documenting the presence within the basin of at least 32 mussel species. Shier concentrated on Kickapoo and Salt creeks, sampling 25 stations and collecting 17 species of mussels. Hall sampled 12 stations on the upper Sangamon between Savbrook and Monticello and collected a total of 23 mussel

Robert W. Schanzle is waterways permit program manager for the Illinois Department of Conservation, Division of Planning, in Springfield. Kevin S. Cummings is an assistant research biologist with the Illinois Natural History Survey, Center for Biodiversity, in Champaign.

species. Prior to the present study, no mussel records had been published for the lower Sangamon River between Springfield and the mouth.

Materials and Methods

Fifty-seven mainstem and tributary stations were sampled during the summers of 1987–1989 (Figure 2; see also Appendix 1). Mussels were collected by hand for four man-hours at each station, and an effort was made to sample all available habitats, such as riffles, pools, and areas of differing substrate types. Supplemental sampling was conducted for four additional hours at two stations (nos. 6 and 8). Typically, mussels were identified to the species level in the field, their numbers recorded, and one or two voucher specimens retained for deposition in the collection of the Illinois Natural History Survey. If specimens could not readily be identified in the field, they were retained for positive identification in the laboratory. Any remaining mussels were returned to the stream.

A photographic record was made of each station and the mussels collected there. Stream width, depth, and velocity were estimated, and a station map was sketched for future reference. Finally, the mussels that were retained as vouchers were bagged, labeled by station number and/or location, and kept on ice until they could be cleaned for later transfer to the Illinois Natural History Survey collection.

To allow comparisons with historical data, each of the 40 stations sampled by Matteson was resampled during the present study. Two exceptions were stations on the South Fork Sangamon River (Matteson station 164) and Salt Creek (Matteson station 90), which were inundated by Lake Taylorville and Lake Clinton, respectively. Because Hall had sampled an area of the upper river thoroughly worked by Matteson ten years earlier, no attempt was made to resample her stations unless they had also been sampled by Matteson (or, as in the case of station 4, Hall's records indicated the presence of uncommon species). Similarly, not all of Shier's stations on Kickapoo and Salt creeks were resampled during the present study. Instead, Matteson's stations were resampled where possible (his single Salt Creek station had been inundated by Lake Clinton) and were supplemented with selected stations worked by Shier.

At two mainstem stations, one near Fisher in Champaign County and the other near Decatur in

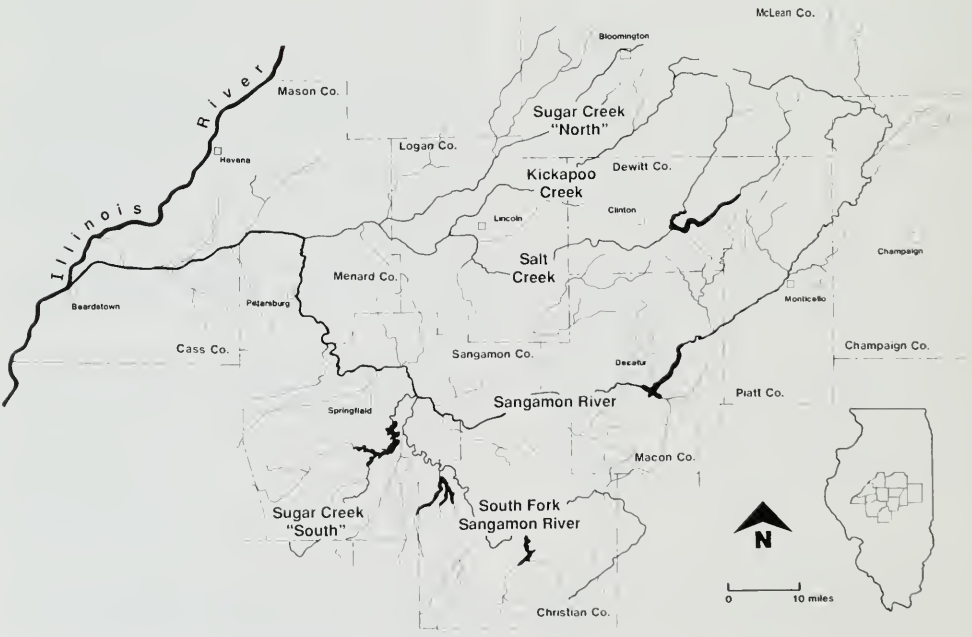

Figure 1. The Sangamon River and its major tributaries.

Macon County, Matteson had assigned station numbers but had not provided legal descriptions or any record of his sampling results. These stations (Matteson nos. 8 and 15) could not be located and were dropped from the current survey. Several new stations were selected on the lower Sangamon River and on various tributaries that had not been covered in Matteson's earlier work. Where possible, the stations chosen were sites that had also been sampled during the Illinois Department of Conservation's Sangamon River Basin Fisheries Assessment (Bertrand 1983). With the exception of Lonetree Creek (station 6) and Flat Branch Creek (stations 45–47), which were included in Matteson's 1956–1960 work, only streams at least 50 miles long (Healy 1979) were sampled during the present study. These include the Sangamon River mainstem, Sugar Creek "north" (McLean and Logan counties), Kickapoo Creek, Salt Creek, the South Fork Sangamon River, and Sugar Creek "south" (Sangamon County).

The nomenclature employed in this report follows that of the Committee on Scientific and Vernacular Names of Mollusks of the Council of Systematic Malacologists, American Malacological Union (Turgeon et al. 1988), except that subspecies are not recognized and *Pleurobema sintoxia* (Rafinesque 1820)

Table 1. Comparison of mussel species reported from the Sangamon River drainage by various researchers.

	Wood 1910	Zetek 1918	Baker 1922	Matteson 1956–1960	Shier 1962	Hall 1967	S & C 1991
Actinonaias ligamentina			x				
Alasmidonta marginata		x	x	x	x	x	x
Alasmidonta viridis		x	x	x			x
Amblema plicata		x	x	x	x	x	x
Anodonta grandis	x	x	x	x		x	x
Anodonta imbecillis				x		x	x
Anodonta suborbiculata							x
Anodontoides ferussacianus		x	x	x	x	x	x
Arcidens confragosus		x	x	x		x	x
Elliptio dilatata		x	x	x		x	x
Elliptio complanata						x	
Fusconaia ebena			x				
Fusconaia flava	x	x	x	x	x	x	x
Lampsilis cardium	x	x	x	x	x	x	x
Lampsilis siliquoidea	x	x	x	x	x	x	x
Lampsilis teres		x		x	x		x
Lasmigona complanata	x	x	x	x	x	x	x
Lasmigona compressa				x			x
Lasmigona costata		x	x	x		x	x
Leptodea fragilis				x	x	x	x
Ligumia subrostrata				x			x
Megalonaias nervosa				x			x
Obliquaria reflexa				x			x
Pleurobema sintoxia	x	x	x	x	x	x	x
Potamilus alatus				x	x	x	x
Potamilus capax			x				
Potamilus ohiensis				x		x	x
Quadrula metanevra			x	x			x
Quadrula pustulosa	x	x	x	x	x	x	x
Quadrula quadrula			x	x	x		x
Strophitus undulatus		x	x	x	x	x	x
Toxolasma parvus			x	x		x	x
Tritogonia verrucosa	x	x	x	x	x	x	x
Truncilla donaciformis				x	x		x
Truncilla truncata				x		x	x
Uniomerus tetralasmus				x			x
Venustaconcha ellipsiformis			x	x	x	x	x
Number of species	8	17	23	32	17	23	33

is accepted for the round pigtoe rather than *P. coccineum* (Conrad 1834).

Results and Discussion

Fifty-seven stations were sampled in the Sangamon River basin during the summers of 1987–1989, resulting in the collection of 37 species of freshwater mussels. The 2,083 living specimens represented 33 species. Two hundred twenty-eight man-hours were spent in the initial sampling, and nine mussels on average were collected per man-hour. Additional sampling at two locations (Lonetree Creek just downstream from station 6 and the Sangamon River mainstem at station 8) resulted in the collection of individuals representing 10 species that were not collected during the original sampling at those locations (Tables 2 and 3).

The most common species collected were *Lampsilis cardium* and *Lasmigona complanata*, which constituted 11.95% and 10.30%, respectively, of the total sample (Table 2). Seven additional species represented 5% or more of the sample, including *Leptodea fragilis* (9.10%), *Anodonta grandis* (8.47%), *Amblema plicata* (8.03%), *Lampsilis teres* (7.74%), *Quadrula pustulosa* (7.64%), *Potamilus ohiensis* (6.34%), and *Fusconaia flava* (5.27%). The number of live specimens collected at each station ranged from 0 to 178, with an average of 37, and the number of species represented by live individuals at each station ranged from 0 to 17, with an average of 7. Each of the 32 species collected by M.R. Matteson during 1956–1960 was also collected during the current survey.

The stations having the greatest species richness, with 17 live species each, were no. 41 on Salt Creek in DeWitt County and no. 8 on the Sangamon River mainstem in Champaign County. Station 41 also supported the highest population density, yielding 178 live individuals. Station 41 was the only collection site in the basin from which *Quadrula metanevra* was collected live, and station 8 was the only site where live specimens of either *Elliptio dilatata* or *Lasmigona costata* were collected. Two additional species were found alive at only one station in the basin: *Ligumia subrostrata* at station 55 and *Toxolasma parvus* at station 6.

The Sangamon River mainstem contained the greatest number of species, with 27 represented by live individuals (Table 3). Salt Creek was second with 23 species, followed by the South Fork Sangamon River

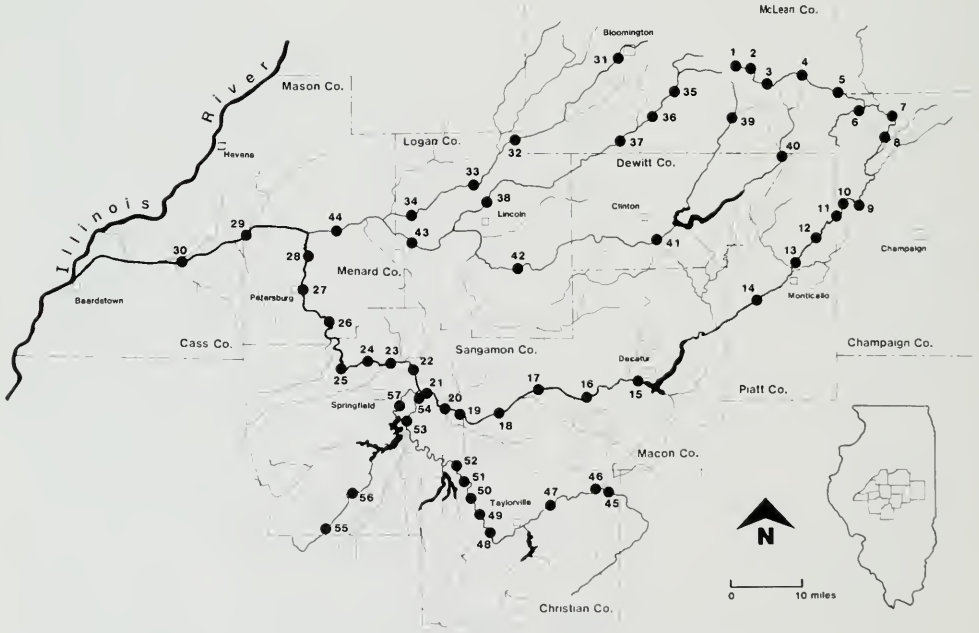

Figure 2. Collection sites in the Sangamon River basin, 1987–1989.

with 17, Sugar Creek "north" and Kickapoo Creek with 14 each, and Sugar Creek "south" with 9 (Table 4). These totals, however, may reflect the amount of sampling in a stream more closely than they reflect its actual species richness.

In 1956–1960, M.R. Matteson sampled 24 Sangamon River mainstem stations and 16 tributary stations, collecting a total of 2,989 live mussels representing 32 species (Tables 5–7). The status (live or dead) of 39 additional specimens at station 7 was not recorded; neither was his sampling success at station 9. If these data are omitted, Matteson's collections ranged from 0 to 357 live individuals per station, with an average of 77, and from 0 to 17 species, with an average of 6. The most common species collected by Matteson was *Quadrula pustulosa*, which made up 15.26% of the total collection, followed by *Amblema plicata* (11.91%), *Anodontoides ferussacianus* (11.37%), and *Lampsilis cardium* (10.71%). These four species ranked 7th, 5th, 14th, and 1st, respectively, in the current survey.

Anodonta suborbiculata was the only unionid species collected during the current survey that was not encountered by Matteson. This species was collected at station 8 on the Sangamon River mainstem and at station 50 on the South Fork Sangamon River and was represented by only four individuals. *Corbicula fluminea*, the introduced Asian clam, was also not encountered by Matteson but was represented in the current survey by live or recently dead specimens in the Sangamon River, the South Fork Sangamon River, Salt Creek, and Sugar Creek "south." Interestingly, it was not collected from the Sangamon River above Decatur, nor from Kickapoo Creek or Sugar Creek "north." However, its absence from those collections may be a result of sampling inefficiency rather than an indication that it has not yet invaded the entire basin.

Four Illinois endangered, threatened, or "watch list" species (Illinois Endangered Species Protection Board 1989) were collected live during the present study, all of which were also found by Matteson, in small numbers for the most part, in 1956–1960. These included the endangered *Alasmidonta viridis*, the threatened *Lasmigona compressa* and *Uniomerus tetralasmus*, and the uncommon *Venustaconcha ellipsiformis*. The abundance and distribution of live individuals of these species in Matteson's and the current survey are summarized in Table 8.

A notable feature of the Sangamon River mainstem is the sudden change in mussel species richness (Figure 3) and total numbers (Figure 4) that occurs at Decatur in Macon County. Stations 1–14 above Decatur yielded an average of 9.8 species each and an average collection total of 52 mussels per station. By comparison, stations 15–30 below Decatur yielded an average of only 4.1 species each and an average collection total of 19 mussels (Table 3). Several mussel species (e.g., *Potamilus alatus* and *Pleurobema sintoxia*) were collected live from the mainstem only upstream from Decatur, and several other species (e.g., *Amblema plicata* and *Lampsilis cardium*) disappeared from

Table 2. Total numbers, abundance ranking, and percent composition of the mussel species collected live in the Sangamon River basin, 1987–1989.

	Total*	Rank	%	Cum. %
Lampsilis cardium	247	1	11.95	11.95
Lasmigona complanata	213	2	10.30	22.25
Leptodea fragilis	188	3	9.10	31.35
Anodonta grandis	175(3)	4	8.47	39.82
Amblema plicata	166	5	8.03	47.85
Lampsilis teres	160	6	7.74	55.59
Quadrula pustulosa	158	7	7.64	63.23
Potamilus ohiensis	131(1)	8	6.34	69.57
Fusconaia flava	109(1)	9	5.27	74.84
Pleurobema sintoxia	67	10	3.24	78.08
Quadrula quadrula	60	11	2.90	80.98
Truncilla truncata	59(1)	12	2.85	83.83
Strophitus undulatus	56(1)	13	2.71	86.54
Anodontoides ferussacianus	50	14	2.42	88.96
Potamilus alatus	48	15	2.32	91.28
Lampsilis siliquoidea	35(4)	16	1.69	92.97
Tritogonia verrucosa	34	17	1.64	94.61
Truncilla donaciformis	33	18	1.60	96.21
Obliquaria reflexa	14	19	0.68	96.89
Megalonaias nervosa	11	20	0.53	97.42
Uniomerus tetralasmus	10	21	0.48	97.90
Alasmidonta marginata	9	22	0.44	98.34
Arcidens confragosus	7	23	0.34	98.68
Anodonta imbecillis	6(2)	24	0.29	98.97
Alasmidonta viridis	5	25	0.24	99.21
Lasmigona compressa	4(1)	26	0.19	99.40
Anodonta suborbiculata	3(1)	27	0.15	99.55
Venustaconcha ellipsiformis	3	27	0.15	99.70
Lasmigona costata	2	28	0.10	99.80
Leptodea subrostrata	2	28	0.10	99.90
Quadrula metanevra	1	29	0.05	99.95
Toxolasma parvus	1	29	0.05	100.00
Elliptio dilatata	0(1)			
Actinonaias ligamentina	0			
Leptodea recta	0			
Plethobasus cyphyus	0			
Quadrula nodulata	0			
Total live individuals	2,083			
Total species, live	33			
Total species, dead	4			

*Numbers in parentheses indicate live individuals taken during supplemental work at stations 6 and 8. Each of these was of a species not taken during the initial sampling at those stations.

Table 3. Station-by-station listing of all mussels collected in the Sangamon River mainstem, 1987–1989.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Actinonaias ligamentina															sf						sf						wd			
Alasmidonta marginata				2	2		1	1																						
Alasmidonta viridis			4	1																										
Amblema plicata				1	1	8	1	5	wd	wd	5	1	wd	1		wd		wd		wd	wd				sf	1	8			
Anodonta grandis						1*		2*		6		1			5	5						wd	3			wd		d		d
Anodonta imbecillis						2*																				wd				
Anodonta suborbiculata								1*																						
Anodontoides ferussacianus	29		2	1		2			1																					
Arcidens confragosus												1												2						
Elliptio dilatata								1*						wd				wd		wd	wd				wd					
Fusconaia flava					12	42	5	1*	1			4									sf						wd	sf		
Lampsilis cardium				13	22	11	2	3	1	6	10	23	7	8						wd	wd		wd		wd		wd	1	1	4
Lampsilis siliquoidea			1	3	1	3*		1*	wd	1	1	1	1	wd							wd									
Lampsilis teres																		wd								d	1	3	21	66
Lasmigona complanata			1	6	3	3	30	35	20	10	7	19		4		1				wd	1	wd	d				wd	d	2	d
Lasmigona compressa				1		1*																								
Lasmigona costata								2																						
Leptodea fragilis				1	1	1	4	3	7	10	11	8	6	6	2	1	1			d	5	3	10	3	d	4	2	2	5	11
Ligumia recta																				wd							sf			
Ligumia subrostrata																														
Megalonaias nervosa																														
Obliquaria reflexa																					wd	1				1	5	d		
Plethobasus cyphyus																				sf							sf			
Pleurobema sintoxia					2	2	9	9	3	2	10	6	1	wd						wd	wd						wd			
Potamilus alatus				2		2	16	3	5	6	4	6	1	2																
Potamilus ohiensis							d	1*	1	3	1		1	1	1	3	5	1	2	d	5	wd	17	3		3	3	2	10	39
Quadrula metanevra																					sf									
Quadrula nodulata																										d	d			
Quadrula pustulosa							16	17	wd	2	24	12	6	4		wd				wd	1	1		1		2	3	d		
Quadrula quadrula														1		wd				wd	1	2		1		1	1	2		
Strophitus undulatus			wd	3	8	1*		wd			1	2	1																	
Toxolasma parvus						1																								
Tritogonia verrucosa					1		2	2	wd		2	6	5	2						wd							wd	d		
Truncilla donaciformis						1								3	d		1				1	7				d		1		1
Truncilla truncata						1*	6	2	4	1	15	3	1	5						d	1	2	d	d	d	1	1	d	1	1
Uniomerus tetralasmus																														
Venustaconcha ellipsiformis				1																										
Total live individuals	0	29	8	35	53	82	92	89	43	47	91	93	30	37	8	10	7	1	2	0	15	16	30	10	0	13	24	11	40	122
Total species (live)	0	1	4	12	10	16	11	17	9	10	12	14	10	11	3	4	3	1	1	0	7	6	3	5	0	7	8	6	6	6

d = dead (recent), wd = weathered dead, sf = subfossil; *collected during supplemental sampling. Station 6 was on Lonetree Creek rather than the Sangamon mainstem.

Table 4. Station-by-station listing of all mussels collected in tributaries of the Sangamon River, 1987–1989.

	Sugar Creek "north"				Kickapoo Creek				Salt Creek						South Fork Sangamon River										Sugar Creek "south"		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Actinonaias ligamentina																											
Alasmidonta marginata			2									1	d														
Alasmidonta viridis									wd																		
Amblema plicata		d	wd	wd	1	6		wd		wd			sf	wd		9		25	20	8	1	1	61	2			
Anodonta grandis									5		14			wd	3	8	2	21	12	49	20	10	8	2		wd	1
Anodonta imbecillis											1	1				1	1		d	1	d			1			
Anodonta suborbiculata																				3							
Anodontoides ferussacianus		2			5	4	d	wd	3	1	wd																
Arcidens confragosus																		1	1			1		1			
Elliptio dilatata																											
Fusconaia flava		1	wd	sf		3	1	5	1	4	17	1		sf				1	2				7	2			
Lampsilis cardium		1	2	2	2	12	5	4	2	8	50	36	7	4													
Lampsilis siliquoidea		2		sf	9	3	5		4		2	1		sf													
Lampsilis teres		8	2	11		2	5	1			4	1	10	25													
Lasmigona complanata		7	1		2	6	11			5	8	wd	4	1		wd		5	5	1	6	5	3				1
Lasmigona compressa					1	1	d		1																		
Lasmigona costata			wd																								
Leptodea fragilis		6	9	7		wd	2	wd			7	7	8	14	1	1		d	2	3	2	1	6	d			5
Ligumia recta																											
Ligumia subrostrata																									2		
Megalonaias nervosa																							10	1			
Obliquaria reflexa												3												1			3
Plethobasus cyphyus																											
Pleurobema sintoxia										2	19	2		sf													
Potamilus alatus								wd			1																
Potamilus ohiensis		1		1			d	1				3	1	11				d	1	2	5	3	d	wd			1
Quadrula metanevra											1																
Quadrula nodulata																											
Quadrula pustulosa		3	1	wd				1			40	10		wd					1	wd			6	7			
Quadrula quadrula		d	1					4				3						8	5	7	4	1	7	8			3
Strophitus undulatus		3	3	2	10	8	5	2	1	3	1	1	2														
Toxolasma parvus																											
Tritogonia verrucosa			1					wd			2	2	1							1			4	2			1
Truncilla donaciformis			2	1							4	5	4											2			
Truncilla truncata											6	2					d	d	1	3			1	2			
Uniomerus tetralasmus					3										1					wd					4	2	
Venustaconcha ellipsiformis										1	1																
Total live individuals	0	34	24	24	33	45	34	18	17	24	178	79	37	55	5	19	3	61	50	78	38	22	113	31	6	2	15
Total species (live)	0	10	10	6	8	9	7	7	7	7	17	16	8	5	3	4	2	6	10	10	6	7	10	12	2	1	7

d = dead (recent), wd = weathered dead, sf = subfossil

collections at and immediately below Decatur only to appear again in collections made at Springfield and points farther downstream. Table 6, which summarizes Matteson's 1956–1960 collections on the mainstem, shows that he encountered similar reductions in species richness and abundance in this reach.

As noted in the introduction, much of the Sangamon River mainstem between Decatur and Springfield was channelized some years ago. Many collection sites in this reach (stations 15–21) exhibit rapidly shifting sand substrates that are not conducive to mussel survival. Two species that effectively bridge the gap between Decatur and Springfield, *Leptodea fragilis* and *Potamilus ohiensis*, are tolerant of a variety of bottom types (Parmalee 1967) and are able to use such substrates. However, even in unchannelized sections of the river below Decatur, mussel abundance and species richness are generally much lower than that encountered upstream.

Bertrand (1983) noted a similar contrast in the fisheries of the Sangamon River, stating that "the Sangamon River and its tributaries above Lake Decatur had a relatively high quality fishery characterized by the sport species smallmouth bass and longear sunfish," whereas the mainstem and tributaries below Decatur "were generally not of comparable quality to the upper basin." It is likely that the same factors that affect the quality of the Sangamon's finfish populations (i.e., channel modification, pollution, etc.) are similarly limiting to its shellfish.

Table 5. Total numbers, abundance ranking, and percent composition of the mussel species collected live by M.R. Matteson in the Sangamon River basin, 1956–1960.

	Total*	Rank	%	Cum. %
Quadrula pustulosa	456	1	15.26	15.26
Amblema plicata	356	2	11.91	27.17
Anodontoides ferussacianus	340	3	11.37	38.54
Lampsilis cardium	320	4	10.71	49.25
Pleurobema sintoxia	200	5	6.69	55.94
Leptodea fragilis	166	6	5.55	61.49
Lasmigona complanata	142	7	4.75	66.24
Fusconaia flava	139(39)	8	4.65	70.89
Anodonta grandis	117	9	3.91	74.80
Quadrula quadrula	103	10	3.45	78.25
Truncilla truncata	102	11	3.41	81.66
Lampsilis siliquoidea	74	12	2.48	84.14
Strophitus undulatus	72	13	2.41	86.55
Lampsilis teres	69	14	2.31	88.86
Megalonaias nervosa	67	15	2.24	91.10
Potamilus alatus	60	16	2.01	93.11
Potamilus ohiensis	45	17	1.50	94.61
Uniomerus tetralasmus	44	18	1.47	96.08
Tritogonia verrucosa	39	19	1.30	97.38
Arcidens confragosus	12	20	0.40	97.78
Elliptio dilatata	12	20	0.40	98.18
Anodonta imbecillis	8	21	0.27	98.45
Truncilla donaciformis	8	21	0.27	98.72
Toxolasma parvus	8	21	0.27	98.99
Lasmigona costata	7	22	0.23	99.22
Alasmidonta viridis	5	23	0.17	99.39
Obliquaria reflexa	5	23	0.17	99.56
Lasmigona compressa	3	24	0.10	99.66
Liguma subrostrata	3	24	0.10	99.76
Quadrula metanevra	3	24	0.10	99.86
Alasmidonta marginata	2	25	0.07	99.93
Venustaconcha ellipsiformis	2	25	0.07	100.00
Total live individuals	2,989(39)			
Total species, live	32			
Total species, dead	0			

*Number in parentheses represents 39 *F. flava* collected at station 7 whose condition (live or dead) could not be determined from Matteson's notes.

Species Accounts

The following is an annotated listing of mussel species encountered in the Sangamon River basin during the present study. Each is listed alphabetically with a brief discussion of its current and historical status and distribution in the drainage. In some cases, comparisons are made with other recently sampled streams in the state.

The abbreviations used to identify museums holding Sangamon River drainage specimens are as follows:

ANSP	Academy of Natural Sciences, Philadelphia
FMNH	Field Museum of Natural History
INHS	Illinois Natural History Survey
ISM	Illinois State Museum
OSUM	Ohio State University Museum of Zoology
UIMNH	University of Illinois Museum of Natural History
UMMZ	University of Michigan Museum of Zoology

Native Species

Actinonaias ligamentina (Lamarck 1819) — mucket

The mucket was not collected live in the Sangamon River basin during the current study but was represented by weathered or subfossil material at three mainstem stations (Table 3). The most recent live individual collected in the basin appears to be a specimen taken on the east side of Springfield near

Clear Lake, Sangamon County, in September 1932 (UIMNH Z-33369). It is likely that the species has been extirpated. Recent sampling in the Little Wabash River drainage (Cummings et al. 1989) suggests that the species may have declined there as well. The mucket is quite abundant in the Kankakee River (Suloway 1981) and is also common in the Embarras and Wabash rivers (Cummings et al. 1988a, 1988c).

Alasmidonta marginata Say 1818 — elktoe

This species is scarce in the Sangamon River drainage. It was represented by only two live individuals in Matteson's 1956–1960 work and by nine live individuals and one recent dead specimen during the current study. Shier (1962) and Hall (1967) collected only one elktoe each during their respective surveys.

Alasmidonta viridis (Rafinesque 1820) — slippershell mussel

The only extant Sangamon River mussel presently considered endangered in Illinois (Illinois Endangered Species Protection Board 1989), the slippershell was found at two consecutively numbered stations in the upper reaches of the Sangamon mainstem. Until recently, the Sangamon River population of *A. viridis* was thought to be the only one remaining in the state

Table 6. Station-by-station listing of all mussels collected in the Sangamon River mainstem by M.R. Matteson, 1956–1960.

	3	6	7	8	10	11	12	13	14	16	17	18	21	22	25
Actinonaias ligamentina															
Alasmidonta marginata				2											
Alasmidonta viridis	d	5													
Amblema plicata		1	15	29	6		15	6	24		d		1	1	1
Anodonta grandis		4	4	1	1		3	2	d						
Anodonta imbecillis			1											1	
Anodonta suborbiculata															
Anodontoides ferussacianus	3	313	2		1			1			d				
Arcidens confragosus							2		1						
Elliptio dilatata				11	1										
Fusconaia flava		4	39*	26	5		6	25	10				2	2	
Lampsilis cardium			1	55	14	wd	64	74	22						
Lampsilis siliquoidea			2	7	4		29	2	10						
Lampsilis teres															
Lasmigona complanata			19	9	9		13	11	21				2	3	
Lasmigona compressa	d														
Lasmigona costata				6			1								
Leptodea fragilis		wd	8	11	8	4	52	8	23	2			6	1	
Ligumia recta															
Ligumia subrostrata															
Megalonaias nervosa															
Obliquaria reflexa													2	1	
Plethobasus cyphyus															
Pleurobema sintoxia			12	68	17	4	41	55	3						
Potamilus alatus			8	2	4	1	18	22	5						
Potamilus ohiensis			4		2		5	1	6				13	1	
Quadrula metanevra				2				1							
Quadrula nodulata															
Quadrula pustulosa			48	53	23	9	42	70	59		d		23	7	
Quadrula quadrula										20	1	2	24	16	
Strophitus undulatus		28	4	10	9		6	3	1						
Toxolasma parvus		2	1							1			1		
Tritogonia verrucosa							16	2	7					1	
Truncilla donaciformis													2		
Truncilla truncata			36	7	1		13	29	5		d		2	1	
Uniomerus tetralasmus															
Venustaconcha ellipsiformis			2												
Total live individuals	3	357	167	299	105	18	326	312	197	23	1	2	78	35	1
Total species (live)	1	7	17	16	15	4	16	16	14	3	1	1	11	11	1

No specimens were collected at stations 1, 2, 5, 15, 19, 20, 23, and 24. Collection results were not recorded for station 9. Stations 4 and 26–30 were not sampled by Matteson. d = dead (recent), wd = weathered dead, sf = subfossil; *live + dead totals combined.

(Cummings et al. 1988b). However, the recent collection of live individuals from Baker Creek in Kankakee County and Bean Creek in Vermilion County (INHS 7866 and 8416) and of several live and recent dead individuals from the Little Vermilion River in Vermilion County (Sauer 1989) suggests that this species is less likely to become extirpated from the state in the near future than was previously believed. Although Lonetree Creek (station 6) was the only location at which Matteson collected live *A. viridis*, this species was not found there during the current survey.

Amblema plicata (Say 1817) — threeridge

Parmalee (1967) considered the threeridge "one of the most common and wide-spread mussels found in Illinois waters." This species made up 11.91% of Matteson's sample, ranking second overall with 356 individuals. It constituted 8.03% of the current sample, ranking fifth with 166 individuals. Recent surveys of the Embarras, Mackinaw, and Little Wabash rivers (Cummings et al. 1988a, 1988b, 1989) show that healthy populations are present in each of those streams as well. A species widely harvested from the

Table 7. Station-by-station listing of all mussels collected in tributaries of the Sangamon River by M.R. Matteson, 1956–1960.

	Sugar Creek "north"	Kickapoo Creek			Salt Creek	South Fork Sangamon River							
	32	35	36	37	*	45	46	47	**	51	52	53	54
Actinonaias ligamentina													
Alasmidonta marginata					d								
Alasmidonta viridis					wd								
Amblema plicata	26				10	1	54	24	1		16	120	5
Anodonta grandis	2				3	11	2	60	12	1	9	2	
Anodonta imbecillis							1	1		3	1		
Anodonta suborbiculata													
Anodontoides ferussacianus		14		6									
Arcidens confragosus												8	1
Elliptio dilatata													
Fusconaia flava	8						7	3			7	26	8
Lampsilis cardium	54	4	23	9									
Lampsilis siliquoidea	2	6	4	4	3						1		
Lampsilis teres	69												
Lasmigona complanata	24	12		3	d			2			1	6	7
Lasmigona compressa		1	2										
Lasmigona costata													
Leptodea fragilis	1			1		3	9	14			1	4	10
Ligumia recta													
Ligumia subrostrata						2	1						
Megalonaias nervosa							1				6	55	5
Obliquaria reflexa													2
Plethobasus cyphyus													
Pleurobema sintoxia													
Potamilus alatus													
Potamilus ohiensis										5	7		1
Quadrula metanevra													
Quadrula nodulata													
Quadrula pustulosa	19						4	7			14	21	57
Quadrula quadrula	1						4	2	wd		3	5	25
Strophitus undulatus	1	1	5	1								2	1
Toxolasma parvus	d		1	1						1			
Tritogonia verrucosa	3									1	1	7	1
Truncilla donaciformis											1	1	4
Truncilla truncata												3	5
Uniomerus tetralasmus						23	3	3	15				
Venustaconcha ellipsiformis													
Total live individuals	210	38	35	25	16	40	86	116	28	11	68	260	132
Total species (live)	12	6	5	7	3	5	10	9	3	5	13	13	14

Tributary stations 31, 33, 34, 38–44, and 55–57 were not sampled by Matteson. No specimens were collected at stations 48–50. d = dead (recent), wd = weathered dead, sf = subfossil; *inundated by Lake Clinton (Matteson station 90); **inundated by Lake Taylorville (Matteson station 164).

Mississippi and Illinois rivers for use in the cultured pearl industry, the threeridge accounted for 20.5% (224 tons) of the shells purchased by Illinois shell buyers in 1988 (Arnold W. Fritz, Illinois Department of Conservation, personal communication).

Anodonta grandis Say 1829 — giant floater

Another common and widespread species in Illinois, the giant floater ranked fourth overall in the current survey and made up more than 8% of the total sample. It was most common in the relatively sluggish waters of the South Fork Sangamon River, occurring at each of the ten stations located on that tributary. Of 178 *A. grandis* collected during the present study, 135 were taken from the South Fork.

Anodonta imbecillis Say 1829 — paper pondshell

Though apparently common but sporadic in other streams and lakes throughout Illinois, the paper pondshell was not found in large numbers in the Sangamon River drainage during either Matteson's survey (eight individuals at six stations) or the current one (eight individuals at seven stations). Shier (1962) did not encounter the paper pondshell during her work on Salt and Kickapoo creeks, and Hall (1967) collected only one live specimen during her survey of the upper Sangamon River.

Anodonta suborbiculata Say 1831 — flat floater

The flat floater was not encountered by Matteson, but its presence in the Sangamon River drainage had been documented by a single specimen collected by P.W. Parmalee at Carpenter Park near Springfield, Sangamon County, in November 1953 (ISM 673906). Four *A. suborbiculata* were collected at two stations (nos. 8 and 50) during the current survey.

Anodontoides ferussacianus (I. Lea 1834) — cylindrical papershell

Matteson collected 313 *A. ferussacianus* at station 6 on Lonetree Creek, the most abundant single-station population encountered during his 1956–1960 work. Largely because of this single collection, the cylindrical papershell (340 specimens in all) made up more than 11% of Matteson's total sample and ranked third after *Quadrula pustulosa* and *Amblema plicata*. Although it was not found in comparable numbers during the present survey, 50 individuals of this headwater species were collected at ten stations and constituted more than 2% of the total sample.

Arcidens confragosus (Say 1829) — rock pocketbook

Parmalee (1967) noted that the rock pocketbook seldom occurs in large numbers although it is widely distributed in Illinois. Matteson collected only 12 individuals of this species, and only 7 were collected during the present survey. In both Matteson's and the current survey, this species was collected only in the Sangamon River mainstem and the South Fork Sangamon River.

Elliptio dilatata (Rafinesque 1820) — spike

Considered widespread and common in Illinois by Parmalee (1967), the spike appears to be declining statewide. Although the species persists in the Kankakee River (Suloway 1981), it has been extirpated from the Illinois River (Starrett 1971) and was represented only by weathered and subfossil shells in a recent survey of the Wabash River (Cummings et al. 1988c). Similarly, only one live specimen was collected in a 1988 survey of the Little Wabash River (Cummings et al. 1989), and only dead material was collected in 1987 surveys of the Embarras and Mackinaw rivers (Cummings et al. 1988a, 1988b). Matteson collected 12 *E. dilatata* at stations 8 and 10 (Table 6), but only one live individual was taken (at station 8) during the current survey.

Fusconaia flava (Rafinesque 1820) — Wabash pigtoe

Though declining in some Illinois streams because of siltation (Parmalee 1967), the Wabash pigtoe appears to be holding its own in the Sangamon River basin. In Matteson's study, *F. flava* made up 4.65% of the total collection, ranking eighth in abundance with 139 specimens (the condition, live or dead, of 39 additional specimens was not recorded). By comparison, *F. flava* constituted 5.27% of the 1987–1989 sample, ranking ninth in overall abundance with 109 individuals. The Wabash pigtoe was collected at 15 of Matteson's 40 stations and at 18 of 57 stations during the present study.

Lampsilis cardium Rafinesque 1820 — plain pocketbook

Currently the most common species in the Sangamon River drainage, the plain pocketbook constituted

Table 8. Distribution and abundance of endangered, threatened, and "watch list" species for 1956–1960 and 1987–1989.

	1956–1960		1987–1989	
	Number of stations	Total live	Number of stations	Total live
Alasmidonta viridis	1	5	2	5
Lasmigona compressa	2	3	5	5
Uniomerus tetralasmus	4	44	4	10
Venustaconcha ellipsiformis	1	2	3	3

11.95% of the total sample with 247 live individuals. It was collected at 27 of 57 stations and in every stream sampled except the South Fork Sangamon River. Cummings et al. (1988a, 1988b) found this to be the most common species in the drainage of both the Embarras and Mackinaw rivers. Similarly, Suloway et al. (1981) reported good populations in the Vermilion River system. In Matteson's survey of the Sangamon basin, *L. cardium* (10.71% of the sample) ranked fourth in abundance after *Quadrula pustulosa* (15.26%), *Amblema plicata* (11.91%), and *Anodontoides ferussacianus* (11.37%).

Lampsilis siliquoidea (Barnes 1823) — fatmucket

Parmalee (1967) found the fatmucket to be "wide-ranging and often locally abundant in Illinois," a statement borne out by several recent surveys. However, the species appears to have declined in the Sangamon River drainage. It was represented by 74 live individuals in Matteson's work (2.48% of the total collection) and by only 35 (1.69%) in the 1987–1989 sample. The fatmucket constituted more than 10% of the live mussels collected in a recent survey of the adjacent Mackinaw River basin (Cummings et al. 1988b).

Lampsilis teres (Rafinesque 1820) — yellow sandshell

Many authors (Parmalee 1967, Starrett 1971, Oesch 1984) recognize two subspecies or forms of the yellow sandshell: *L. teres teres* and *L. teres fallaciosa*. Although individuals representing both types were collected in the Sangamon River drainage, they are combined here under *L. teres* in keeping with Turgeon et al. (1988). Matteson collected 69 yellow sandshells, all of them at a single station on Sugar Creek "north." One hundred sixty *L. teres* were collected during the current survey, and the species was present in good numbers in all but Sugar Creek "south" and the South Fork Sangamon River. The yellow sandshell was most common in the lower reaches of Salt Creek (25 individuals at station 44) and in the lower Sangamon River (66 individuals at station 30), which were not sampled by Matteson.

Lasmigona complanata (Barnes 1823) — white heelsplitter

Possibly the most common and widespread species in Illinois, the white heelsplitter was collected in large numbers in recent surveys of the Embarras, Mackinaw, and Little Wabash rivers (Cummings et al. 1988a, 1988b, 1989). Similarly, Suloway et al. (1981) found it to be the most common species collected in the Vermilion River system. *Lasmigona complanata* ranked seventh in Matteson's survey, with 142 individuals taken (4.75% of his total sample). In the current survey it ranked second, behind *Lampsilis cardium*, with 213 individuals collected (10.30% of the sample).

Lasmigona compressa (I. Lea 1829) — creek heelsplitter

Listed as a threatened species in Illinois (Illinois Endangered Species Protection Board 1989), the creek heelsplitter was represented by only one individual at each of the five stations where it was collected live during the current survey. Typically found in "creeks, small streams and headwaters of the larger rivers" (Parmalee 1967), the only specimen collected from the Sangamon River mainstem was at station 4; the others were taken from Lonetree Creek (station 6), Kickapoo Creek (stations 35 and 36), and the North Fork of Salt Creek (station 39). Matteson collected only three *L. compressa* at two stations on Kickapoo Creek.

Lasmigona costata (Rafinesque 1820) — fluted shell

Apparently a declining species within its range in Illinois, the fluted shell was not collected live during

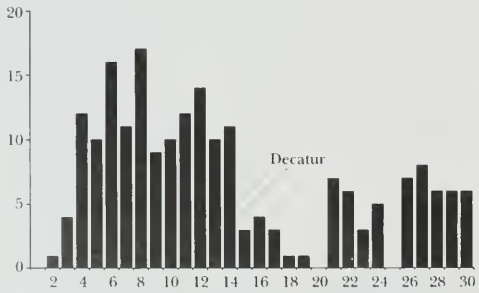

Figure 3. Number of species collected live per station in the Sangamon River mainstem, 1987–1989.

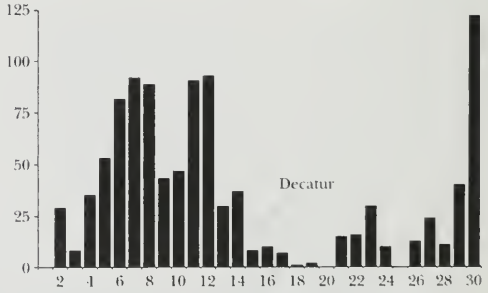

Figure 4. Number of individuals collected live per station in the Sangamon River mainstem, 1987–1989.

recent surveys of the Mackinaw and Little Wabash rivers (Cummings et al. 1988b, 1989), and it showed a 66% decrease in abundance since 1956 in the Embarras River (Cummings et al. 1988a). Only two specimens were collected from the Sangamon River in 1987–1989, whereas seven were taken by Matteson in 1956–1960. Although the species may be on the verge of extirpation from these streams, fair numbers have been collected in the Vermilion River system (Suloway et al. 1981), and the species is relatively abundant in the Kankakee River (Suloway 1981).

Leptodea fragilis (Rafinesque 1820) — fragile papershell

Widespread and common in both small streams and rivers (Parmalee 1967), the fragile papershell was the third most commonly collected species in the current survey. The 188 individuals collected represented 9.10% of the total sample. The fragile papershell was found at more stations than any other species (39 of 57) and was collected from each of the tributaries sampled as well as from the Sangamon River mainstem.

Ligumia recta (Lamarck 1819) — black sandshell

The black sandshell was not collected live in the Sangamon River basin during either Matteson's or the current survey, but it was represented by weathered dead and subfossil material at two mainstem stations in the current study. A species of "medium-sized to large rivers" (Parmalee 1967), *L. recta* has probably been extirpated from the Sangamon River drainage. Three collections purportedly from the Sangamon River (ANSP 366176, ISM 679369, and INHS 152) provide no data concerning location or date of collection.

Ligumia subrostrata (Say 1831) — pondmussel

Notable for its scarcity in both Matteson's work (three individuals collected) and in the present survey (two individuals collected), the pondmussel, as its name implies, is a species of quiet waters. Reported by Parmalee (1967) to be "exceedingly abundant in some areas (for example . . . Lake Springfield, Sangamon Co.)," the only specimens collected during the present survey were from Sugar Creek "south," a short distance upstream from Lake Springfield. Though Spring Creek was not among the Sangamon River tributaries sampled during this study, specimens of *L. subrostrata* were collected there just west of Springfield by Department of Conservation staff in 1987 (INHS 4955).

Megalonaias nervosa (Rafinesque 1820) — washboard

Parmalee (1967) noted that this species, though more typical of large rivers, "may become well established in small streams (for example, South Fork, Sangamon River)." Since 1932, when a specimen was taken from the Sangamon River proper on the east side of Springfield (UIMNH Z-33363), the washboard has apparently been collected in the basin only from the South Fork drainage. Matteson collected 67 individuals of *M. nervosa* in the South Fork and its headwater stream, Flat Branch, whereas only 11 specimens were collected there during the present survey. This 84% decrease in numbers suggests that the washboard might be in danger of extirpation from the Sangamon River drainage in the near future.

Obliquaria reflexa Rafinesque 1820 — threehorn wartyback

Primarily a large-river species, the threehorn wartyback sometimes occurs in the lower reaches of smaller streams. Most likely a minor component of the Sangamon River drainage's mussel fauna, *O. reflexa* was represented by only five individuals in Matteson's survey and by 14 in the present study. It was found in small numbers in the Sangamon River mainstem and in Salt Creek, Sugar Creek "south," and the South Fork Sangamon River.

Plethobasus cyphyus (Rafinesque 1820) — sheepnose

Listed as a threatened species in Illinois (Illinois Endangered Species Protection Board 1989), the sheepnose was not encountered by Matteson and was represented in the current survey by only two subfossil specimens. Parmalee (1967) considered the sheepnose to be "restricted primarily to the Mississippi River above St. Louis and in the Lower Wabash and Ohio Rivers." It is almost certainly extirpated from the Sangamon River drainage, and it was not collected live during recent surveys of the Vermilion, Embarras, Mackinaw, Wabash, Little Wabash, and Saline rivers in Illinois (Suloway et al. 1981; Cummings et al. 1988a, 1988b, 1988c, 1989; Hunter ESE 1989). However, it is still found in some larger Illinois rivers, including the Mississippi (Fuller 1985), Kankakee (Illinois Department of Conservation, unpublished observations), Wabash (INHS 6271), and Ohio (Williams and Schuster 1989).

Pleurobema sintoxia (Rafinesque 1820) — round pigtoe

Common in the upper Sangamon River (stations 1–14) and upper Salt Creek (stations 39–42), where it was found at 12 of 18 stations during the current survey, the round pigtoe was not collected live in the lower Sangamon River, lower Salt Creek, or any of the other tributaries sampled. The 67 individuals collected represented 3.24% of the total collection and ranked tenth in abundance. Matteson, by comparison,

collected *P. sintoxia* only in the upper Sangamon River, where 200 live individuals made up 6.69% of his total collection and ranked fifth in abundance. The evident reductions in total numbers, frequency of collection, and overall rank between Matteson's and the present survey indicate that this species is in decline in the Sangamon River drainage.

Potamilus alatus (Say 1817) — pink heelsplitter

Strikingly similar in distribution to the round pigtoe, the pink heelsplitter was collected live during the current survey only in the upper Sangamon River and upper Salt Creek. The 48 live individuals collected made up 2.32% of the total collection and ranked 15th in abundance. As with *P. sintoxia*, Matteson found *P. alatus* only in the upper Sangamon River; with 60 individuals (2.01% of Matteson's collection), the species ranked 16th in abundance.

Potamilus ohiensis (Rafinesque 1820)— pink papershell

A species that is apparently increasing in numbers in the Sangamon River drainage, the pink papershell was collected at 30 of 57 stations and occurred both in the Sangamon River proper and in each of the tributaries sampled. *Potamilus ohiensis* made up 6.34% of the 1987–1989 sample, ranking eighth in abundance with 131 live individuals. In Matteson's survey it made up only 1.50% of the sample, ranking 17th in abundance. The 45 live individuals collected in 1956–1960 were gathered from only 10 of 40 stations.

Quadrula metanevra (Rafinesque 1820) — monkeyface

A rare species in the Sangamon River drainage in 1956–1960, when Matteson collected only three specimens at two stations on the upper Sangamon River, the monkeyface was represented in the current survey by a single live specimen taken from upper Salt Creek. Parmalee (1967) noted that this is a species of medium-sized to large rivers, though it may become locally numerous in smaller streams such as the Spoon River. In recent surveys of the Vermilion, Embarras, Mackinaw, Little Wabash, and Saline rivers in Illinois (Suloway et al. 1981; Cummings et al. 1988a, 1988b, 1989; Hunter/ESE 1989), it was collected live at only one station on the Embarras. However, the species appears to be fairly abundant in the Kankakee River (Suloway 1981).

Quadrula nodulata (Rafinesque 1820) — wartyback

Though not collected by Matteson and represented only by dead material during the present survey, the wartyback is still extant in the Sangamon River drainage. Live specimens of this mussel were collected by Department of Conservation staff in September 1990 from the lower Sangamon River in Menard County (INHS 10685). It is likely that this species is restricted to the lower reaches of the Sangamon River proper because all known specimens from the drainage have been collected in the mainstem below Springfield.

Quadrula pustulosa (I. Lea 1831) — pimpleback

The most common species in the Sangamon River drainage in Matteson's survey, with 456 individuals representing 15.26% of the total collection, the pimpleback has noticeably declined in numbers. Though the species is still quite common in the drainage, only 158 individuals representing 7.64% of the total sample were taken in 1987–1989; it ranked seventh overall. At six stations where Matteson collected more than 40 *Q. pustulosa*, no more than 17 were taken from a single station during the current survey.

Quadrula quadrula (Rafinesque 1820) — mapleleaf

Like the pimpleback, *Q. quadrula* was collected throughout the Sangamon River drainage, both in the Sangamon River mainstem and in each of the tributaries. However, this species was notably scarce in the upper portions of the Sangamon mainstem. Matteson collected no mapleleafs upstream of station 16 at Decatur in 1956–1960, and only one was taken above Decatur (at station 14) during the present survey. By comparison, Matteson collected 304 pimplebacks in the reach above Decatur, and 81 were collected there during the current study. *Quadrula quadrula* was the most abundant species collected during Klippel and Parmalee's (1979) study of Lake Springfield in Sangamon County.

Strophitus undulatus (Say 1817) — squawfoot

A relatively common and widespread species in Illinois, the squawfoot was found primarily in the headwaters of the Sangamon River drainage in the current study. It occurred in the Sangamon River upstream from station 13 at Monticello and in Kickapoo Creek, Sugar Creek "north," and Salt Creek. Although Matteson also found *S. undulatus* in the lower portions of the South Fork Sangamon River, none were collected there during the present study. The squawfoot made up 2.41% of Matteson's collection, ranking 13th with 72 individuals. In the current study, it made up 2.71% of the total sample, ranking 13th again with 56 individuals.

Toxolasma parvus (Barnes 1823) — lilliput

Only one specimen of *T. parvus* was collected during the current survey, at station 6 on Lonetree Creek.

However, it is likely that this species is more common in the Sangamon River drainage than the sampling results suggest. Because it is small, the lilliput may easily be overlooked. Matteson collected eight *T. parvus*, finding it in the Sangamon River, the South Fork Sangamon River, and Kickapoo Creek.

Tritogonia verrucosa (Rafinesque 1820) — pistolgrip

Parmalee (1967) stated that the pistolgrip was "common, although of local occurrence, in most rivers throughout the state." It was collected in the Sangamon River and in each of the tributaries sampled in 1987–1989, with the exception of Kickapoo Creek, where it was represented by weathered material. Matteson collected 39 pistolgrips in 1956–1960, when the species made up 1.30% of his total collection and ranked 19th in abundance. In the current study, 34 *T. verrucosa* were taken, and this species constituted 1.64% of the total sample and ranked 17th in abundance.

Truncilla donaciformis (I. Lea 1828) — fawnsfoot

The fawnsfoot was represented by only eight individuals in Matteson's survey, all of them collected from the Sangamon River mainstem and the South Fork Sangamon River. By comparison, 33 fawnsfoots were collected during the current survey, and they were found in both of those streams as well as Salt Creek and Sugar Creek "north." Another diminutive species, the fawnsfoot is probably more common than the sampling results indicate.

Truncilla truncata Rafinesque 1820 — deertoe

Parmalee (1967) noted that the deertoe was most common in medium-sized to large rivers and "may become well established in lakes (for example Lake Decatur, Macon Co.)." Fair numbers of *T. truncata* were collected in both Matteson's and the present survey (102 and 59 individuals, respectively), and the species was most common in both surveys at stations upstream from Lake Decatur on the Sangamon River mainstem. As with *T. donaciformis*, Matteson collected *T. truncata* only in the Sangamon River proper and the South Fork Sangamon River. During the current study, it was also collected in Salt Creek and Lonetree Creek.

Uniomerus tetralasmus (Say 1831) — pondhorn

Considered a threatened species in Illinois (Illinois Endangered Species Protection Board 1989), the pondhorn appears to have declined in the Sangamon River drainage in the past 30 years. Matteson collected 44 pondhorns, all of them in the South Fork Sangamon River and its tributary, Flat Branch. By contrast, only 10 *U. tetralasmus* were taken during the current survey, and only one of those came from the South Fork drainage (Kickapoo Creek yielded three additional specimens, and Sugar Creek "south," six). It is noteworthy that the pondhorn was found only at heavily silted, sometimes stagnant locations and that with the exception of one station on Kickapoo Creek, it tended to occur alone or in association with a few tolerant species (e.g., *Anodonta grandis* and *Leptodea fragilis*).

Venustaconcha ellipsiformis (Conrad 1836) — ellipse

A rarity in the Sangamon River drainage, where Matteson collected only two specimens and only three were found during the current survey, the ellipse is a "watch list" species in Illinois (Illinois Endangered Species Protection Board 1989). This designation indicates that the species appears to be declining in Illinois and may someday merit state-threatened or endangered status. A species more abundant in northern Illinois, the ellipse is present in fair numbers in the Kankakee River (Suloway 1981), though it is uncommon in the Mackinaw River (Cummings 1988b).

Introduced Species

Corbicula fluminea (Müller 1774) — Asian clam

Though not a unionid, the Asian clam was collected during this study to assess its current distribution and abundance in the Sangamon River basin. Parmalee (1967) noted that this species, though already well established in the Ohio and Tennessee rivers, had not yet ascended the Mississippi River above Cairo. Thus, Matteson, Shier (1962), and Hall (1967) did not encounter it during their respective surveys. Fifty-seven live *C. fluminea* were taken during the present study, and this species was collected from all of the streams sampled except Kickapoo Creek, Sugar Creek "north," and the Sangamon River mainstem above Decatur. Its apparent absence from those streams may well be a result of sampling inefficiency rather than an indication that it has not yet invaded the entire basin. Live *C. fluminea* were taken at stations 15–17, 22, 26, 41, 42, 48–52, and 54. Dead specimens were collected at stations 24, 25, 28, 43, 53, and 57 (Appendix 2).

Other Species Reported from the Sangamon River Basin

Early published reports on the mussels of the Sangamon River basin (Table 1) as well as museum records from Illinois and other states indicate that several

species may once have been present in the drainage that were not represented by either live or dead material in the current study. In some cases, because of the absence of a voucher specimen or uncertainties about the accuracy of the collection data, it is not possible to verify that these species were actually taken from the Sangamon River basin. In other cases, voucher specimens with complete collection data are available.

It must be noted that many of the following reports are based wholly or in part on specimens originally in the collection of Elihu Hall, a turn-of-the-century shell collector and resident of Athens in Menard County, Illinois. Hall's specimens, which typically bear no collection data except the notation "Sangamon River" or "Athens, Illinois," are of uncertain origin and cannot definitely be attributed to the Sangamon River or its tributaries. It appears that Hall shared or traded specimens with his contemporaries, and many shells from other collections bearing data such as "Sangamon River" must also be considered of questionable origin. The reader is referred to McKnight (1985) for a discussion of similar uncertainties involving Hall's bryophyte collections.

Cyclonaias tuberculata (Rafinesque 1820) — purple wartyback

The purple wartyback is represented by two collections of E. Hall's, one (ANSP 43150) marked "Athens, Illinois" and the other (FMNH 14305) marked "Sangamon River, Illinois," and by one collection of W.A. Nason's (INHS 1581) marked "Athens, Illinois." No other specimens that may be attributable to the Sangamon River basin are known to the authors. However, the purple wartyback has historically occurred in the Illinois River (Starrett 1971) and could conceivably have been present in the Sangamon River as well.

Ellipsaria lineolata (Rafinesque 1820) — butterfly

The butterfly occurs in the Mississippi River and was also present in the Illinois River prior to the mid-1920s (Starrett 1971). Thus, it is possible that the species once occurred in the Sangamon River as well. Unfortunately, the only known museum records that may be attributable to the Sangamon River (FMNH 14237) are E. Hall specimens marked "Sangamon River" and bear no other data that would help to establish their origin.

Elliptio complanata (Lightfoot 1786) — eastern elliptio

Although this species is generally distributed north and east of Illinois and the Sangamon basin, a specimen of the eastern elliptio was reportedly collected by Hall (1967) at station 9 near Mahomet in Champaign County. Hall's manuscript indicates that this was an individual released at the site by M. R. Matteson in conjunction with an experiment some years earlier, and not a part of the native mussel fauna.

Epioblasma triquetra (Rafinesque 1820) — snuffbox

The snuffbox has not been reported from the Sangamon River basin but is represented by three E. Hall specimens (ANSP 56557) and four W.A. Nason specimens (INHS 1667), all bearing the notation "Athens, Illinois." Whether these were actually collected from the Sangamon River or its tributaries cannot be established from the available data. However, the species has historically occurred in the Illinois River (Starrett 1971) and could have been present in the Sangamon River as well.

Fusconaia ebena (I. Lea 1831) — ebonyshell

In his study of the mussels of the Big Vermilion River in Illinois, Baker (1922) listed the ebonyshell (as *Quadrula ebena*) among 23 species present in the Sangamon River. No museum specimens of *F. ebena* from the Sangamon River basin are known to the authors, though this mussel was once "fairly abundant" in the Illinois River (Starrett 1971) and could conceivably have occurred in a large tributary such as the Sangamon River.

Leptodea leptodon (Rafinesque 1820) — scaleshell

The scaleshell is represented by three museum collections that may be attributable to the Sangamon River. The first (ANSP 42183) includes six E. Hall specimens bearing no data except "Athens, Illinois." The second (FMNH 14218) consists of eight of Hall's specimens carrying only the notation "Sangamon River." The third (FMNH 9420) includes four specimens from the collection of S.W. Stanage, which similarly bear no data except "Sangamon River." Although these records may suggest that the scaleshell was at one time present in the Sangamon River basin, no known collections have been made since at least the early 1900s, and the species, if it ever occurred there, has probably been extirpated.

Potamilus capax (Green 1832) — fat pocketbook

Although *P. capax* was reported to be present in the Sangamon River by Baker (1922; as *Lampsilis capax*), no museum records of this species attributed to the basin are known to the authors. Starrett (1971) indicates that the fat pocketbook was present in the Illinois River until about 1920, and it is possible the species also occurred in large tributaries such as the Sangamon River.

Quadrula fragosa (Conrad 1835) — winged mapleleaf

The winged mapleleaf is represented by six museum records that may be attributable to the Sangamon River: ANSP 127486 (C.M. Wheatley collection), UMMZ 75817 (Frierson collection), and OSUM 24947 (W.F. Webb collection), all of which bear no data except "Sangamon River"; and ANSP 41717 (E. Hall collection), INHS 1722 (W.A. Nason collection), and INHS 4969, all marked "Athens, Illinois." If the winged mapleleaf was once present in the Sangamon River basin, no collections have been made in many years, and the species has likely been extirpated.

Simpsonaias ambigua (Say 1825) — salamander mussel

Three museum records of the salamander mussel may be attributable to the Sangamon River: ANSP 366208 (ex. Alfred University) and FMNH 14269 (E. Hall collection), both of which bear no collection data except "Sangamon River," and ANSP 41067 (E. Hall collection), marked "Athens, Illinois." The Sangamon River basin is well within the historical range of the salamander mussel, and it is possible the species once occurred there.

Villosa iris (I. Lea 1829) — rainbow

The only Sangamon River drainage records of *V. iris* known to the authors are a single live individual collected by P.W. Parmalee 1 mile northeast of Mahomet, Champaign County, on August 7, 1955 (ISM 676693), and a weathered dead specimen collected from Sugar Creek "north" near Hartsburg, Logan County, on May 10, 1985 (INHS 4688). A species that is apparently declining statewide, the rainbow was recently listed as endangered in Illinois (Illinois Endangered Species Protection Board 1989). Its continued survival in the Sangamon River basin must be considered unlikely.

Villosa lienosa (Conrad 1834) — little spectaclecase

A species now apparently restricted to the Wabash River drainage in Illinois, the little spectaclecase is represented from the Sangamon River basin by a single specimen (INHS 1373) bearing the notation "Sangamon R. above Mahomet, summer 1929." An endangered species in Illinois (Illinois Endangered Species Protection Board 1989), *V. lienosa* probably no longer occurs in the Sangamon River drainage.

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Appendix 1
Locations and dates of sample collections in the Sangamon River basin, Illinois, 1987–1989

1. Sangamon River, 0.5 mi N Ellsworth, McLean Co. T23N, R4E, sec. 14. June 6, 1987

2. Sangamon River, 1.5 mi E Ellsworth, McLean Co. T23N, R5E, sec. 18. June 6, 1987

3. Sangamon River, 2 mi S Arrowsmith, McLean Co. T23N, R5E, sec. 28. June 6, 1987

4. Sangamon River, 1.5 mi NW Saybrook, McLean Co. T23N, R6E, sec. 19. May 14, 1988

5. Sangamon River, 6 mi SW Gibson City, Ford/Champaign Co. T23N, R7E, sec. 31 & T22N, R7E, sec. 6. June 6, 1987

6. Lonetree Creek, 5 mi S Gibson City, Champaign Co. T22N, R7E, sec. 14. June 27, 1987, and May 14, 1988

7. Sangamon River, 3 mi NE Fisher, Champaign Co. T22N, R8E, sec.20. June 27, 1987

8. Sangamon River, 1 mi E Fisher, Champaign Co. T21N, R8E, sec.5. June 27, 1987, and August 20, 1988

9. Sangamon River, 1 mi S Mahomet, Champaign Co. T20N, R7E, sec.21 & 22. July 11, 1987

10. Sangamon River, 2 mi SW Mahomet, Champaign Co. T20N, R7E, sec.19 & 20. July 11, 1987

11. Sangamon River at Piatt/Champaign Co. line. T20N, R7E, sec. 31 & T20N, R6E, sec. 36. September 12, 1987

12. Sangamon River, 1.5 mi NNW of White Heath, Piatt Co. T19N, R6E, sec. 15 & 16. July 11, 1987

13. Sangamon River at Lodge Park, Monticello, Piatt Co. T19N, R6E, sec. 31. September 12, 1987

14. Sangamon River, 3 mi SE Cisco, Piatt Co. T18N, R5E, sec. 31. September 19, 1987

15. Sangamon River, below Route 48 bridge in Decatur, Macon Co. T16N, R2E, sec. 21. September 12, 1987

16. Sangamon River, at Lincoln Memorial Highway Bridge, Macon Co. T16N, R1E, sec. 32. September 23, 1987

17. Sangamon River, 2.5 mi NNE Mt. Auburn, Christian Co. T16N, R1W, sec. 30. September 19, 1987

18. Sangamon River, 4 mi W Mt. Auburn, Christian/Sangamon Co. T15N, R2W, sec. 7 & 8. June 20, 1987

19. Sangamon River, 1 mi N Buckhart, Sangamon Co. T15N, R3W, sec. 9. June 20, 1987

20. Sangamon River, 2.5 mi NW Buckhart, Sangamon Co. T15N, R3W, sec. 6. July 23, 1988

21. Sangamon River, 0.25 mi above confluence with South Fork, Sangamon Co. T16N, R4W, sec. 27. August 22, 1987

22. Sangamon River, 0.5 mi NW Riverton, Sangamon Co. T16N, R4W, sec. 4, 5 & 9. June 20, 1987

23. Sangamon River, above old Route 66 bridge at Springfield, Sangamon Co. T16N, R5W, sec. 1. May 30, 1987

24. Sangamon River, above Route 29 bridge at Springfield, Sangamon Co. T16N, R5W, sec. 4. May 30, 1987

25. Sangamon River, 2 mi N Bradfordton, Sangamon Co. T16N, R6W, sec. 11. May 30, 1987

26. Sangamon River, 2 mi WSW Athens, Menard Co. T17N, R6W, sec. 3. July 15, 1989

27. Sangamon River, below Route 123 bridge, Petersburg, Menard Co. T18N, R7W, sec. 13. July 8, 1989

28. Sangamon River, 4 mi W Greenview, Menard Co. T19N, R6W, sec. 19. July 15, 1989

29. Sangamon River, above Route 97 bridge NW Oakford, Menard/Mason Co. T19N, R8W, sec. 3. July 8, 1989

30. Sangamon River, above Route 78 bridge, Chandlerville, Cass/Mason Co. T19N, R9W, sec. 30. July 8, 1989

31. Sugar Creek, 3 mi SW Bloomington, McLean Co. T23N, R1E, sec. 13. September 30, 1989

32. Sugar Creek, 5 mi NW Atlanta, Logan Co. T21N, R2W, sec. 2 & 3. August 20, 1988

33. Sugar Creek, 2.5 mi SE Hartsburg, Logan Co. T21N, R3W, sec. 35. June 25, 1989

34. Sugar Creek, 2 mi SE New Holland, Logan Co. T20N, R4W, sec. 28. June 25, 1989

35. Kickapoo Creek, below Route 150 bridge at Downs, McLean Co. T23N, R3E, sec. 33. June 18, 1988

36. Kickapoo Creek, 3 mi NE Heyworth, McLean Co. T22N, R2E, sec. 23 & 24. June 18, 1988

37. Kickapoo Creek, below Route 136 bridge 2 mi W Heyworth, Mclean Co. T21N, R2E, sec. 5. June 18, 1988

38. Kickapoo Creek, 3 mi N Lincoln, Logan Co. T20N, R2W, sec. 18. June 25, 1989

39. North Fork Salt Creek, 1 mi NE LeRoy, McLean Co. T22N, R4E, sec. 22. August 20, 1989

40. Salt Creek at Weedman, DeWitt Co. T21N, R5E, sec. 14. August 20, 1989

41. Salt Creek, 0.5 mi S Weldon Springs State Park, DeWitt Co. T19N, R2E, sec. 13. August 27, 1988

42. Salt Creek, above Route 121 bridge 3 mi N Mt. Pulaski, Logan Co. T19N, R2W, sec. 35. August 26, 1989

43. Salt Creek, 2 mi E Middletown, Logan Co. T19N, R4W, sec. 16. August 26, 1989

44. Salt Creek, below Route 29 bridge 3 mi N Greenview, Menard/Mason Co. T19N, R6W, sec. 2. September 26, 1989

45. Flat Branch, 2 mi SW Moweaqua, Christian Co. T14N, R1E, sec. 35. June 4, 1988

46. Flat Branch, 3.25 mi W Moweaqua, Christian Co. T14N, R1E, sec. 33. June 4, 1988

47. Flat Branch, 3.5 mi S Stonington, Christian Co. T13N, R1W, sec. 9. June 4, 1988

48. South Fork Sangamon River, 3.5 mi WSW Taylorville, Christian Co. T13N, R2W, sec. 31. June 25, 1988

49. South Fork Sangamon River, 2.5 mi SE Kinkaid, Christian Co. T13N, R3W, sec. 13 & 24. June 25,1988

50. South Fork Sangamon River, 0.5 mi NE Kinkaid, Christian Co. T13N, R3W, sec. 10. July 23, 1988

51. South Fork Sangamon River, 2.5 mi SW Edinburg, Christian Co. T14N, R3W, sec. 27. July 23, 1988

52. South Fork Sangamon River, 2 mi W Edinburg, Christian Co. T14N, R3W, sec. 21. July 9, 1988

53. South Fork Sangamon River, 1.5 mi W Rochester, Sangamon Co. T15N, R4W, sec. 17. July 9, 1988

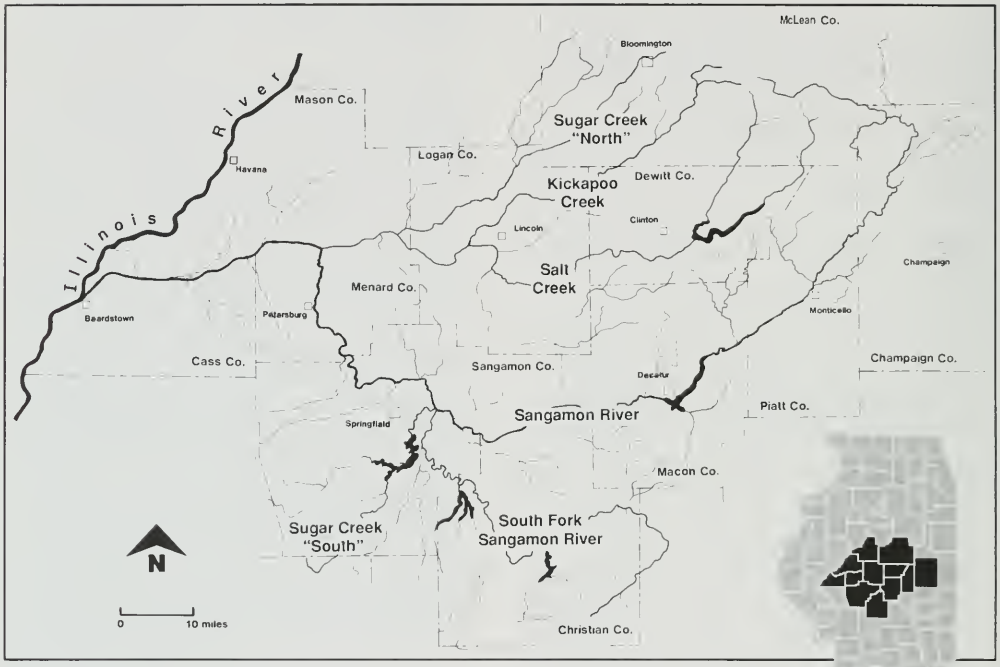
54. South Fork Sangamon River, 1.5 mi E Village of Clear Lake, Sangamon Co. T16N, R4W, sec. 28. July 9, 1988

55. Sugar Creek, 1 mi SW Thayer, Sangamon Co. T13N, R6W, sec. 32. September 21, 1989

56. Sugar Creek, 2 mi NE Auburn, Sangamon Co. T13N, R6W, sec. 1. September 16, 1989

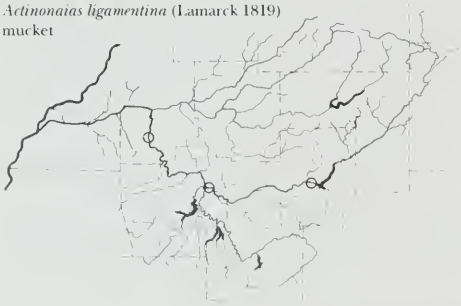
57. Sugar Creek, below Route 29 bridge SE Springfield, Sangamon Co. T15N, R4W, sec. 6. September 16, 1989

Appendix 2
Distribution maps of freshwater mussels and of the Asian clam *(Corbicula fluminea)* in the Sangamon River basin, Illinois, 1987–1989

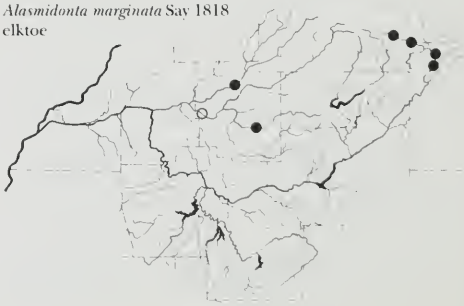


The following distribution maps employ these symbols: ● live specimen ○ dead shell

Actinonaias ligamentina (Lamarck 1819)
mucket



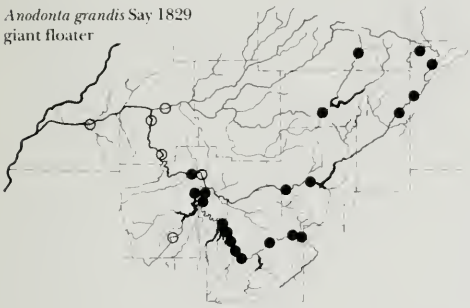
Alasmidonta marginata Say 1818
elktoe



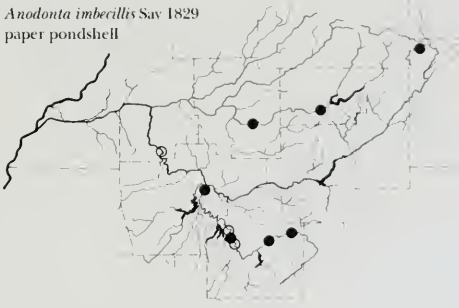
Alasmidonta viridis (Rafinesque 1820)
slippershell mussel

Amblema plicata (Say 1817)
threeridge

Anodonta grandis Say 1829
giant floater



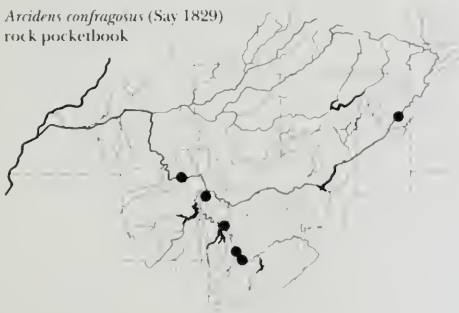
Anodonta imbecillis Say 1829
paper pondshell



Anodonta suborbiculata Say 1831
flat floater

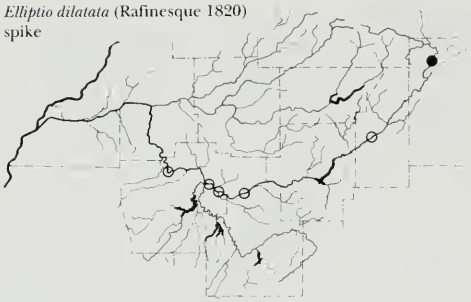
Anodontoides ferussacianus (Lea 1834)
cylindrical papershell

Arcidens confragosus (Say 1829)
rock pocketbook

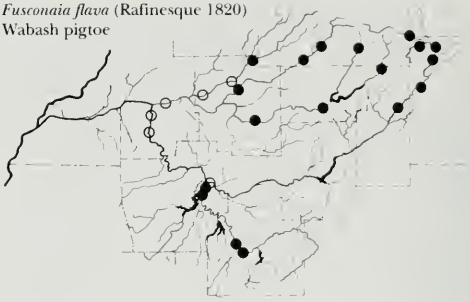


Corbicula fluminea (Müller 1774)
Asian clam

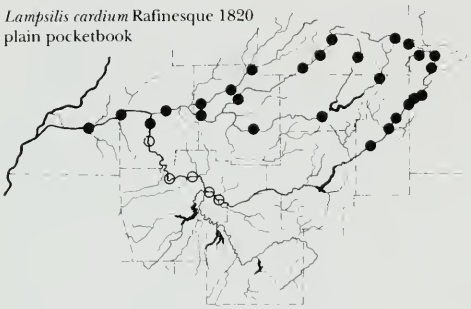
Elliptio dilatata (Rafinesque 1820)
spike



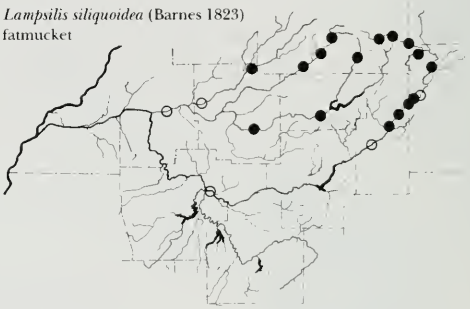
Fusconaia flava (Rafinesque 1820)
Wabash pigtoe



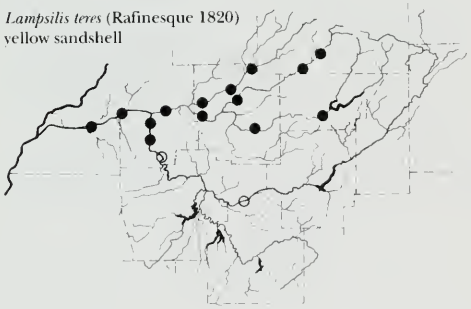
Lampsilis cardium Rafinesque 1820
plain pocketbook



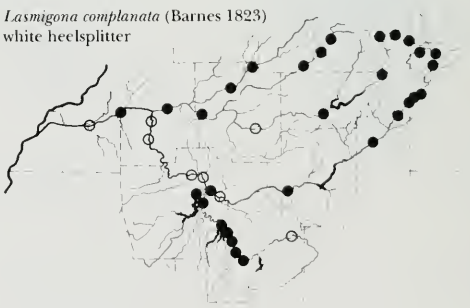
Lampsilis siliquoidea (Barnes 1823)
fatmucket



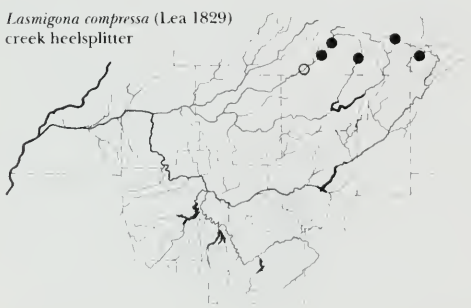
Lampsilis teres (Rafinesque 1820)
yellow sandshell



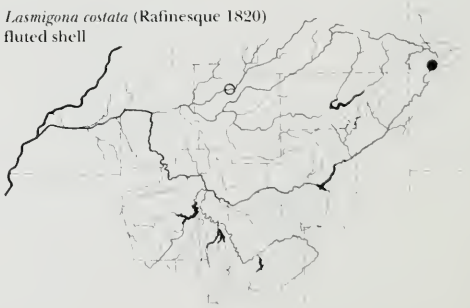
Lasmigona complanata (Barnes 1823)
white heelsplitter



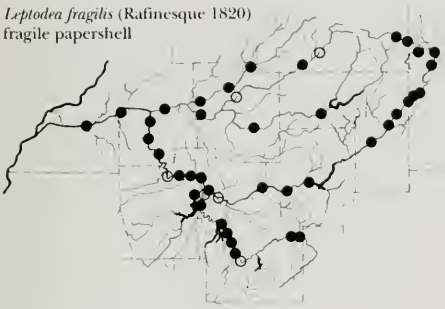
Lasmigona compressa (Lea 1829)
creek heelsplitter



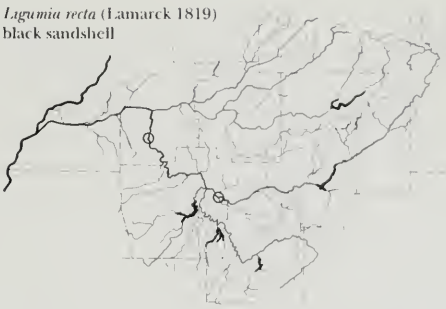
Lasmigona costata (Rafinesque 1820)
fluted shell



Leptodea fragilis (Rafinesque 1820)
fragile papershell

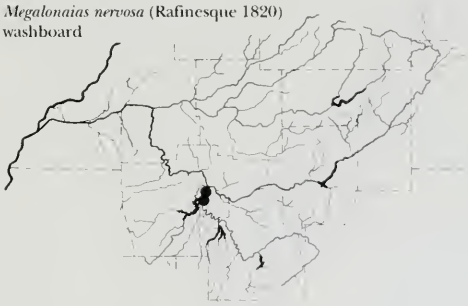


Lagumia recta (Lamarck 1819)
black sandshell



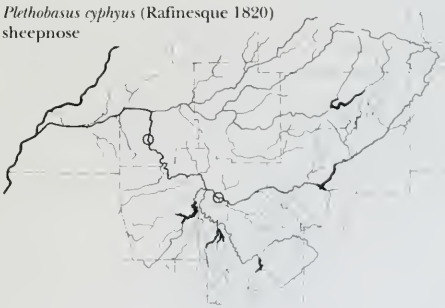
Ligumia subrostrata (Say 1831)
pondmussel

Megalonaias nervosa (Rafinesque 1820)
washboard

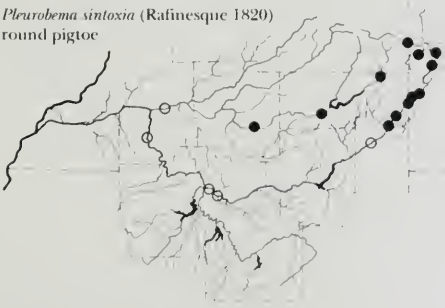


Obliquaria reflexa (Rafinesque 1820)
threeborn wartyback

Plethobasus cyphyus (Rafinesque 1820)
sheepnose

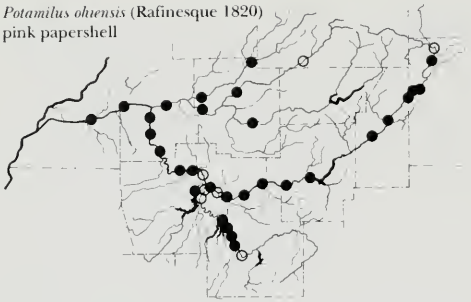


Pleurobema sintoxia (Rafinesque 1820)
round pigtoe

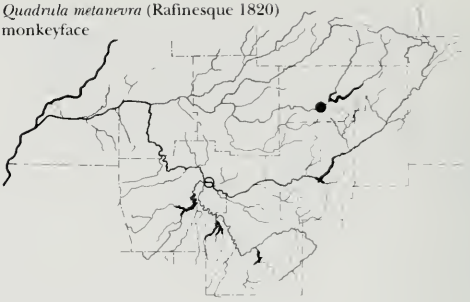


Potamilus alatus (Say 1817)
pink heelsplitter

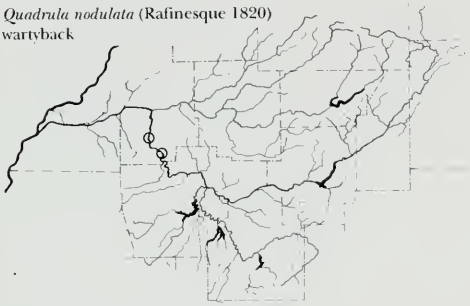
Potamilus ohiensis (Rafinesque 1820)
pink papershell



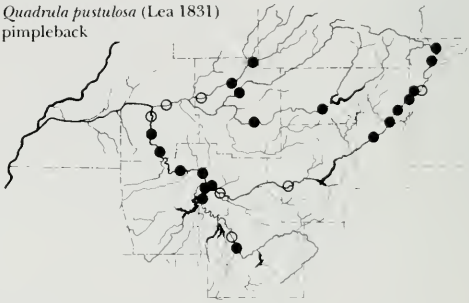
Quadrula metanevra (Rafinesque 1820)
monkeyface



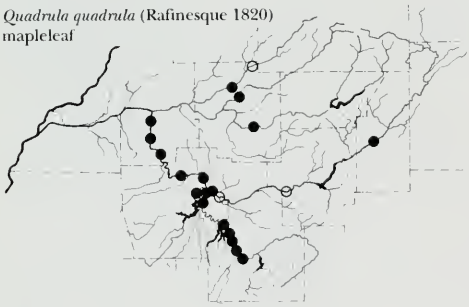
Quadrula nodulata (Rafinesque 1820)
wartyback



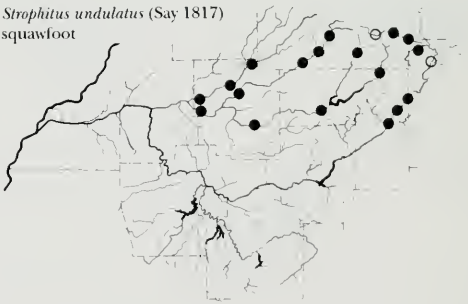
Quadrula pustulosa (Lea 1831)
pimpleback



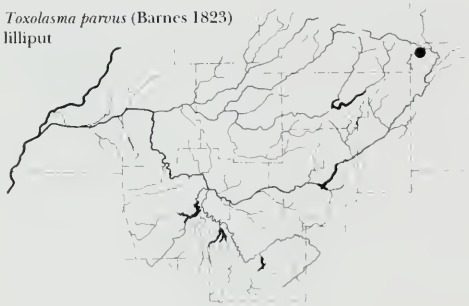
Quadrula quadrula (Rafinesque 1820)
mapleleaf



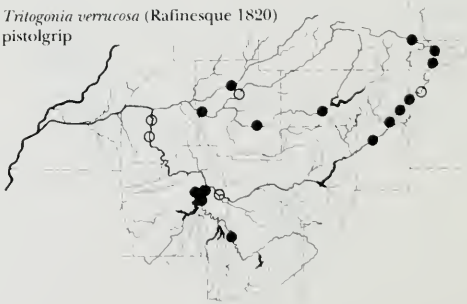
Strophitus undulatus (Say 1817)
squawfoot



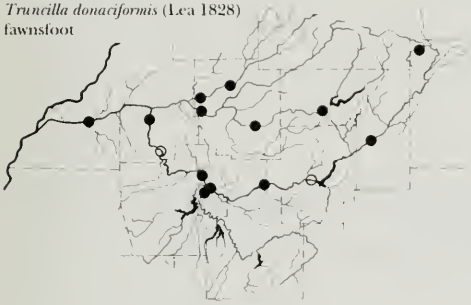
Toxolasma parvus (Barnes 1823)
lilliput



Tritogonia verrucosa (Rafinesque 1820)
pistolgrip

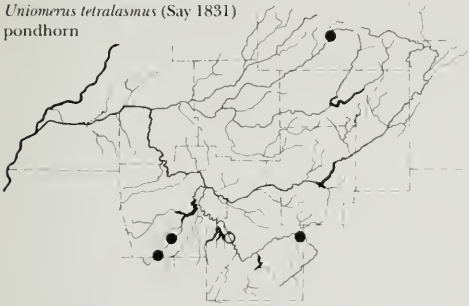


Truncilla donaciformis (Lea 1828)
fawnsfoot



Truncilla truncata Rafinesque 1820
deertoe

Uniomerus tetralasmus (Say 1831)
pondhorn



Venustaconcha ellipsiformis (Conrad 1836)
ellipse

Illinois Natural History Survey
Natural Resources Building
607 East Peabody Drive
Champaign, Illinois 61820

A Division of the Department of Energy and Natural Resources