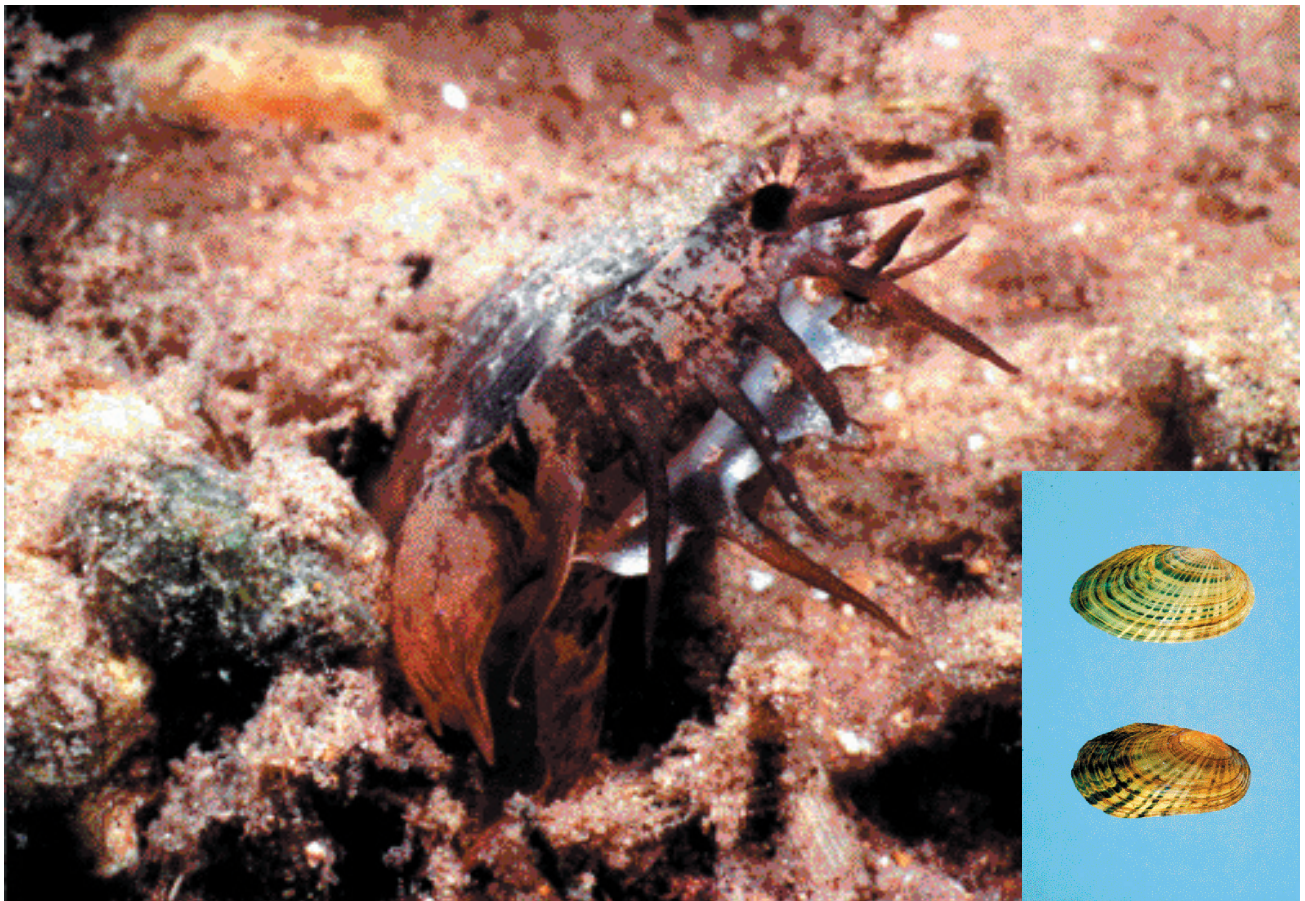


# The Freshwater Mussels

## (Bivalvia:Unionidae) of the Fox River Basin, Illinois and Wisconsin

Robert W. Schanzle, Glen W. Kruse, Joseph A. Kath,  
Roger A. Klocek, and Kevin S. Cummings



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**Cover Photo:** A live rainbow (*Villosa iris*) showing its “lure” to attract a host fish. Photo taken in Swan Creek, Taney County, Missouri. Copyright 1999 Wm. Roston. The Fox River basin is thought to support the only extant population of the rainbow in the Upper Mississippi River drainage.

**Inset (cover photo):** Rainbow (*Villosa iris*), male (top), female (bottom), Tipton River, White County, Indiana.

**Title page photo:** Male rainbow (*Villosa iris*).

For more information on Illinois freshwater mussels see: <http://www.inhs.uiuc.edu/cbd/collections/mollusk/molluskintro.html>

For more information on the rainbow (including video) see Chris Barnhart’s Unio Gallery at Southwest Missouri State University: <http://courses.smsu.edu/mcb095f/gallery/>

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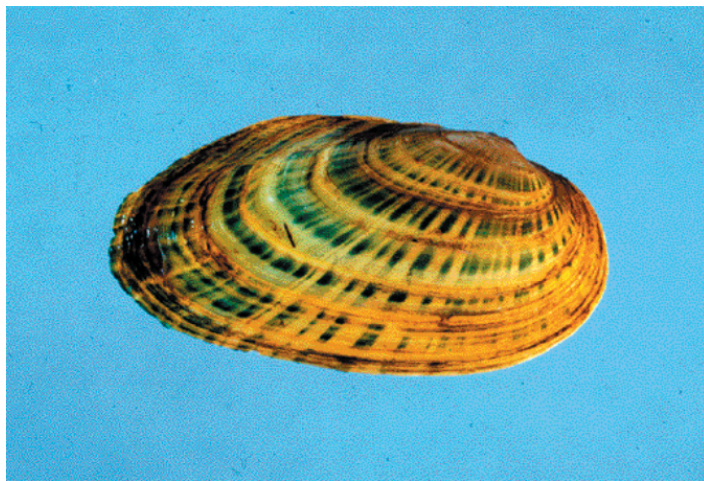
# The Freshwater Mussels (Bivalvia:Unionidae) of the Fox River Basin, Illinois and Wisconsin

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## ABSTRACT

The freshwater mussel fauna of the Fox River and its tributaries in Illinois and Wisconsin was surveyed during the summers of 1997–2001. Ninety-six mainstem and tributary stations were sampled, resulting in the collection of 27 species of native mussels, 23 of which were represented by live specimens. Five species considered threatened or endangered in one or both states were extant in the basin, and two additional listed species were collected as dead material. Two introduced bivalves were also collected live.

## INTRODUCTION

The Fox River originates near Menominee Falls in Waukesha County, Wisconsin, and flows southward approximately 80 miles before crossing the Illinois border about 5 miles west-northwest of Antioch, in Lake County. From there it flows generally south and west some 115.1 miles (Healy 1979) before emptying into the Illinois River near Ottawa in LaSalle County (Figs. 1a,b). The Fox drains a total area of 2,658 square miles (Healy 1979).

The river primarily drains row crop and pasture lands within the state of Wisconsin, but also receives urban runoff from

cities including Waukesha, Waterford, and Burlington. Passing southward into Illinois, the river empties into the Fox-Chain O' Lakes, and its waters flow through portions of Grass, Nippersink, Fox, and Pistakee lakes before once again entering a distinct river channel near the village of McHenry. Continuing downstream, the section of river passing through Kane County has historically sustained major industrial and urban growth, and is flanked by many communities including Elgin, St. Charles, Geneva, Batavia, and Aurora. Downstream from the heavily urbanized section, in Kendall and LaSalle counties, the Fox is again largely bordered by agricultural lands and small towns such as Yorkville, Millington, Sheridan, Wedron, and Dayton.

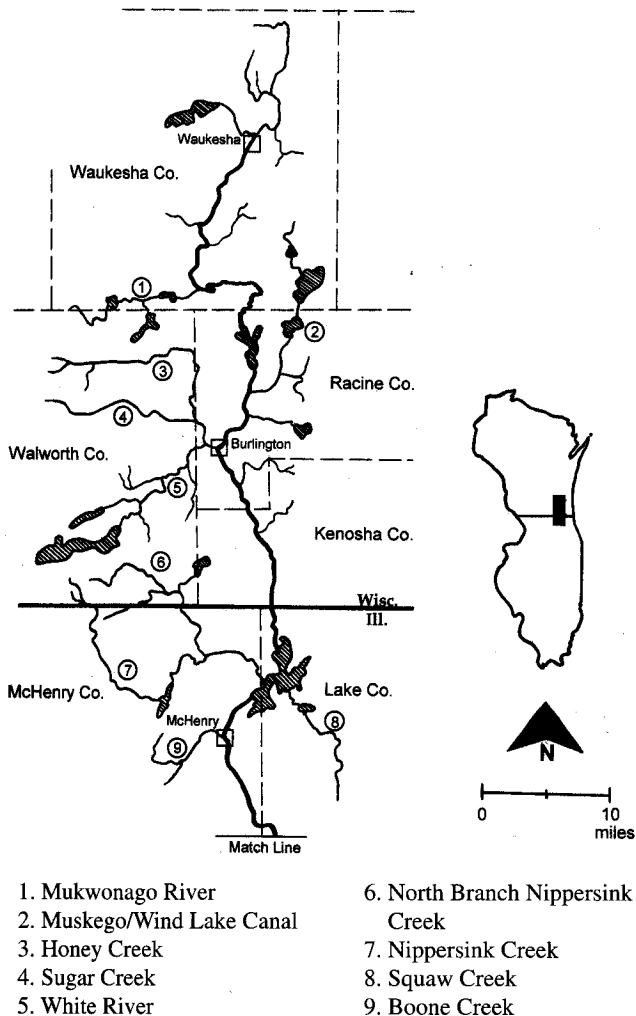


Figure 1a. The Fox River and Its Major Tributaries.

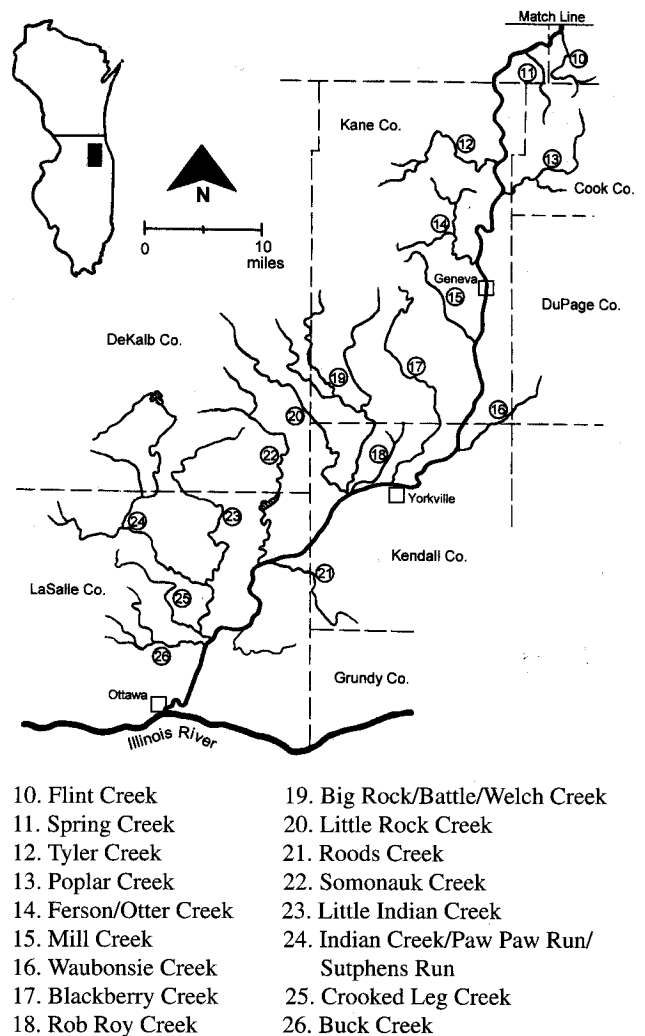


Figure 1b. The Fox River and Its Major Tributaries.

Knapp (1988) reported that low-head dams existed at 19 locations on the Fox River, 15 of them in the state of Illinois. Most of these “were built in the period 1830–50 to provide power for saw mills and flour mills, and typically are only seven or eight feet high.” These dams, along with other post-settlement developments including urbanization, discharges of industrial and municipal effluents, and agricultural runoff, have all contributed to changes in the makeup and distribution of the Fox River’s aquatic resources. Smith (1971) rated the Fox River system as “good to excellent” based on the fish species that were known to inhabit the basin, and stated that although the river “has some domestic and industrial pollution...most of its tributaries have a variety of habitats and rather high species diversity.” Day et al. (1992) reported the collection of 61 species of fish from the Fox River mainstem post-1978, and stated “this river supports a diverse fish fauna despite the many modifications to the watershed.”

The freshwater mussel resources of the Fox River basin have been studied over the years by a number of researchers (Table 1). The earliest, W. W. Calkins (1874), listed nine species of mussels occurring in the Fox River in LaSalle County, Illinois. G. H. Chadwick (1905) included seven mussel species in a listing of terrestrial and aquatic mollusks from Wisconsin. F. C. Baker, in his 1906 publication *A Catalogue of the Mollusca of Illinois*, ascribed 24 species to the river. Of these, 18 were attributed directly to the Fox River while the rest were reported from “Dundee, Kane Co.” or “Algonquin, McHenry Co.”, two towns located on the river’s mainstem.

Baker also included distributional information for Fox River mussels in his 1928 *Fresh Water Mollusca of Wisconsin*. However, the majority of Baker’s references to the Fox River in the 1928 publication pertain to the stream that flows northeast from south-central Wisconsin, passing through Lake Winnebago on its way to Lake Michigan via Green Bay, and not to the Fox River that flows south into Illinois. Distributional information for the mussels of the latter stream must be inferred from comments in Baker’s text (e.g., “Fox River of Illinois”) or from species records attributed to streams or lakes within its basin, such as the Mukwonago River and Lake Geneva.

J. A. Eldridge (1914) investigated the mussel resources of the Fox River on behalf of the U.S. Commissioner of Fisheries, primarily assessing the value of the river’s mussels in terms of freshwater pearl production. He described several mussel beds within the river’s mainstem that were actively worked by pearl hunters and collectors for button manufacturers. Some of the most productive beds were located in the lower portions of the river near the towns of Millington and Sheridan, Illinois.

More recent investigations into the mussel resources of the Fox River basin (Table 1) include those of M. R. Matteson

in the years 1957–1958 (unpublished data), H. A. Mathiak (1979), and Cummings and Mayer (1997). Matteson collected 1,700 live specimens representing 20 species at 10 stations in the Fox River mainstem between the Wisconsin state line and the river’s mouth at Ottawa. Mathiak included distributional information for Fox River mussels in his report *A River Survey of the Unionid Mussels of Wisconsin 1973–1977*, noting 18 species in the upper reaches of the river. Cummings and Mayer examined museum collections nationwide for their 1997 *Distributional Checklist and Status of Illinois Freshwater Mussels (Mollusca: Unionacea)*, and reported 32 species historically collected from the Fox River system in Illinois.

This study was undertaken to determine the species of freshwater mussels currently inhabiting the Fox River basin and, to the extent allowed by earlier records, compare the river’s existing mussel resources with those reported historically to identify changes in species richness that may have occurred over time.

## MATERIALS AND METHODS

Ninety-six mainstem and tributary stations in Illinois and Wisconsin were sampled during the summers of 1997–2001 (Fig. 2a,b; Tables 2–4). Mussels were collected by hand picking for four collector-hours at each station, and all available habitats (e.g., riffles, pools, areas of differing substrate, etc.) were searched. The mussels were identified to the species level in the field, their numbers were recorded, and one or two voucher specimens of each species were retained for deposition in the mollusk collection of the Illinois Natural History Survey, Champaign, Illinois. Any remaining mussels were returned to the stream. (Note: the collection of live specimens of state threatened or endangered species was not permitted in Wisconsin—if a dead specimen could not be found, no voucher was taken.) A photographic record was made of each station and the mussels collected there. Estimates were also made of stream width, average depth, and average rate of flow, and a site map was sketched for future reference.

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. 1998), except that subspecies are not recognized. The terms “dead,” “weathered,” and “subfossil,” when used in this report to indicate shell condition, mean the following: dead—nacre shiny, periostracum mostly intact; weathered—nacre dull, periostracum partly to mostly gone; subfossil—nacre chalky, periostracum mostly to completely gone.

## RESULTS

During the current study, 23 mainstem and 73 tributary stations were sampled in the Fox River basin in Illinois and



Table 1. Comparison of mussel species reported from the Fox River drainage by Calkins (1874) and subsequent researchers.

	Calkins (1874)	Baker (1906)	Eldridge (1913)	Baker (1928)	Matteson (1957–58)	Mathiak (1979)	Cummings & Mayer (1997)	Current Study (1997–2001)
<i>Actinonaias ligamentina</i>		•	•	•	•	•	•	•
<i>Alasmidonta marginata</i>	•	•	•		•	•	•	•
<i>Alasmidonta viridis</i>		•		•		•	•	•
<i>Amblema plicata</i>		•	•	•	•	•	•	•
<i>Anodontoides ferussacianus</i>		•		•		•	•	•
<i>Arcidens confragosus</i>		•						
<i>Cyclonaias tuberculata</i>			•		•		•	•
<i>Elliptio dilatata</i>	•	•	•	•	•	•	•	•
<i>Epioblasma triquetra</i>								•
<i>Fusconaia flava</i>	•	•	•		•	•	•	•
<i>Lampsilis cardium</i>		•	•		•	•	•	•
<i>Lampsilis fasciola</i>		•					•	
<i>Lampsilis siliquoidea</i>	•	•	•	•	•	•	•	•
<i>Lasmigona complanata</i>					•	•	•	•
<i>Lasmigona compressa</i>		•				•	•	•
<i>Lasmigona costata</i>	•	•	•	•	•	•	•	•
<i>Leptodea fragilis</i>		•			•		•	•
<i>Ligumia recta</i>		•	•	•	•		•	•
<i>Obovaria olivaria</i>	•						•	
<i>Plethobasus cyphus</i>		•					•	
<i>Pleurobema sintoxia</i>	•	•		•	•	•	•	•
<i>Potamilus alatus</i>	•	•					•	•
<i>Potamilus ohioensis</i>					•		•	•
<i>Pyganodon grandis</i>		•	•	•	•	•	•	•
<i>Quadrula metanevra</i>							•	
<i>Quadrula pustulosa</i>		•	•		•	•	•	•
<i>Quadrula quadrula</i>					•		•	•
<i>Strophitus undulatus</i>		•	•		•	•	•	•
<i>Toxolasma parvus</i>					•	•	•	•
<i>Tritogonia verrucosa</i>		•					•	
<i>Truncilla donaciformis</i>							•	
<i>Utterbackia imbecillis</i>					•		•	•
<i>Venustaconcha ellipsiformis</i>	•	•		•		•	•	•
<i>Villosa iris</i>		•		•			•	•
Number of species	9	24	13	12	20	18	32	27

• indicates species collected

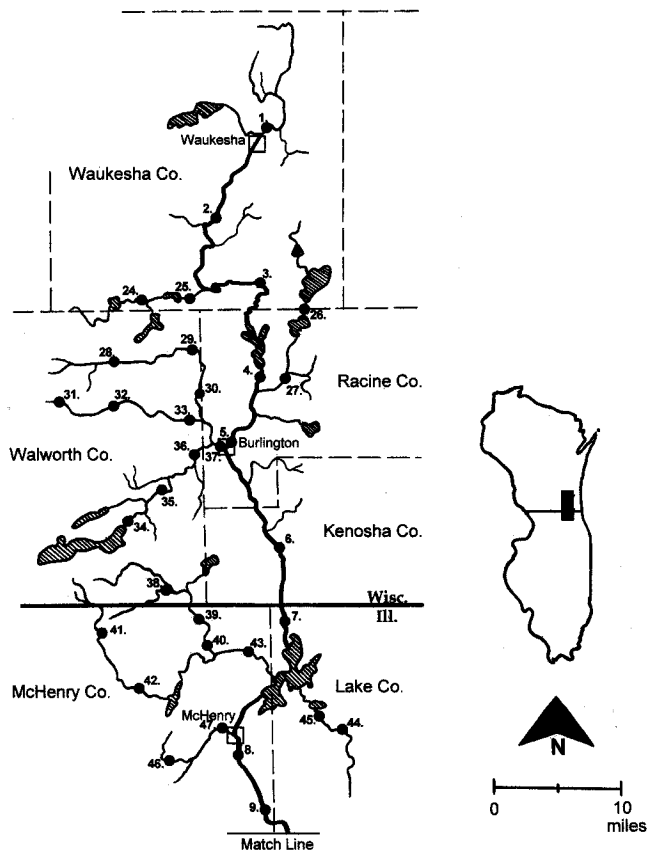


Figure 2a. Collection Stations in the Fox River Basin, 1997–2001.

Wisconsin. Twenty-seven species of native freshwater mussels were collected, of which 23 were represented by living specimens totaling 3,585 individuals (Table 2). Two introduced bivalve species, *Corbicula fluminea* and *Dreissena polymorpha*, were also collected live.

The most common species collected were *Quadrula pustulosa* (487 live), *Pyganodon grandis* (486 live), and *Lasmigona complanata* (483 live), each of which constituted approximately 13.5% of the total sample (Table 2). Two additional species were represented by more than 300 live individuals: *Lampsilis cardium* with 397 and *Anodontoides ferussacianus* with 305. The four species represented only by dead material were *Cyclonaias tuberculata*, *Epioblasma triquetra*, *Potamilus alatus*, and *Potamilus ohioensis*.

The number of live specimens collected at a given station ranged from 0 to 356, and the number of species represented by live and/or dead material ranged from 0 to 17 (Tables 3 and 4). The stations having the greatest live species richness, with 11 species each, were Station 25 on the Mukwonago River in Wisconsin and Station 11 on the Fox River mainstem at West Dundee, Illinois. Station 8 on the Fox River mainstem near McHenry, Illinois, supported the highest abundance, yielding 356 live individuals in four collector-hours of sampling.

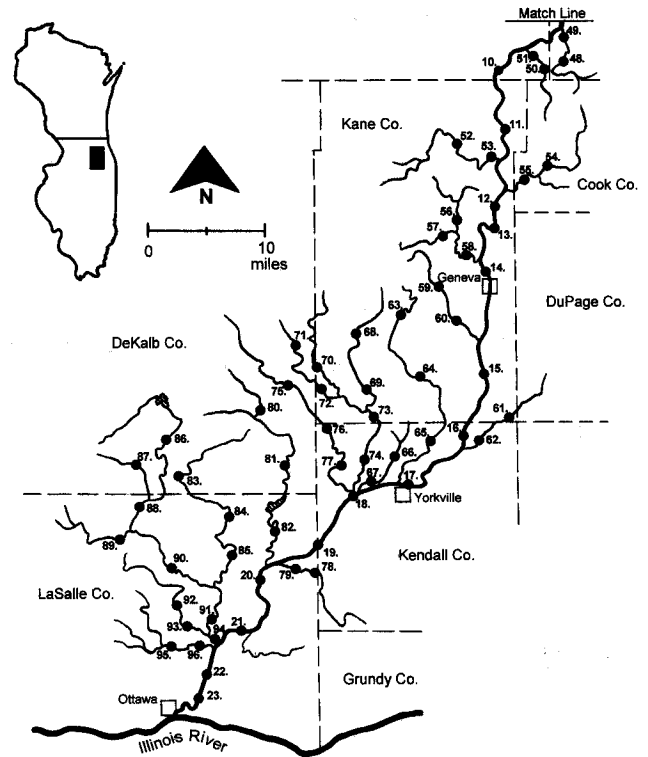


Figure 2b. Collection Stations in the Fox River Basin, 1997–2001.

The Fox River mainstem produced 18 of the 23 total living species collected. Species collected live only in the mainstem were *Leptodea fragilis*, *Ligumia recta*, and *Quadrula quadrula*. Species that were not found alive in the Fox River, but only in its tributaries, were *Alasmidonta viridis*, *Anodontoides ferussacianus*, *Lasmigona compressa*, *Venustaconcha ellipsiformis*, and *Villosa iris*. Live individuals of several species considered endangered or threatened in Illinois (I) and/or Wisconsin (W) were collected, including *A. viridis* (I/W), *Elliptio dilatata* (I), *L. recta* (I), *V. ellipsiformis* (W), and *V. iris* (I/W). Additional state-listed species represented only by dead material included *C. tuberculata* (I/W) and *E. triquetra* (I/W).

## DISCUSSION

Although Eldridge (1914) discussed the Fox River's mussel resources in terms of the tonnage of shells collected annually, little additional information was available in the literature concerning the relative abundance of mussels within the basin over time. Max R. Matteson of the University of Illinois sampled 10 stations located between Ottawa and the Wisconsin border during 1957–58, and a summary of his collections, which are housed in the Mollusk Collection at the Illinois Natural History Survey in Champaign, is provided in Table 5. Matteson reportedly employed a four-collector-hour sampling protocol, identical to that used in

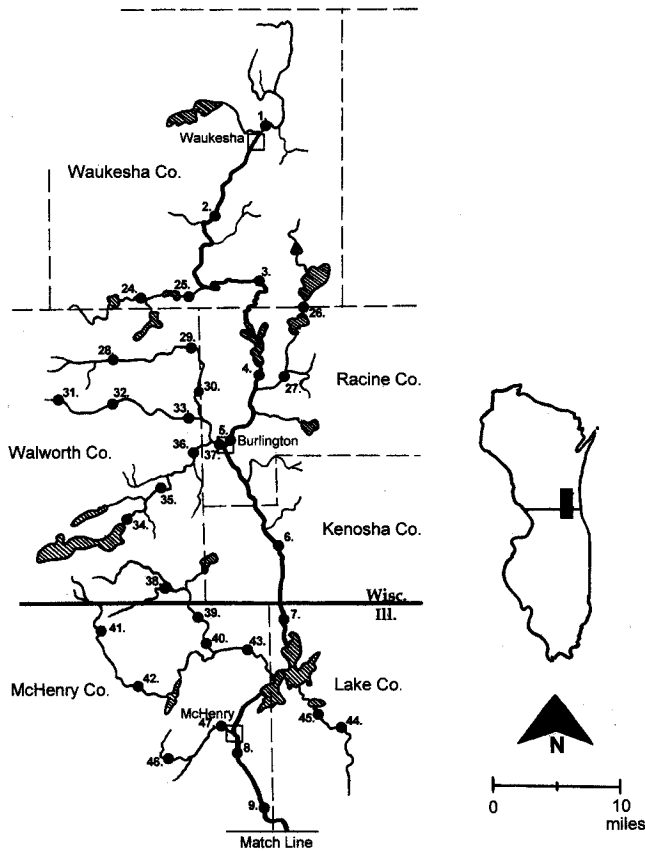


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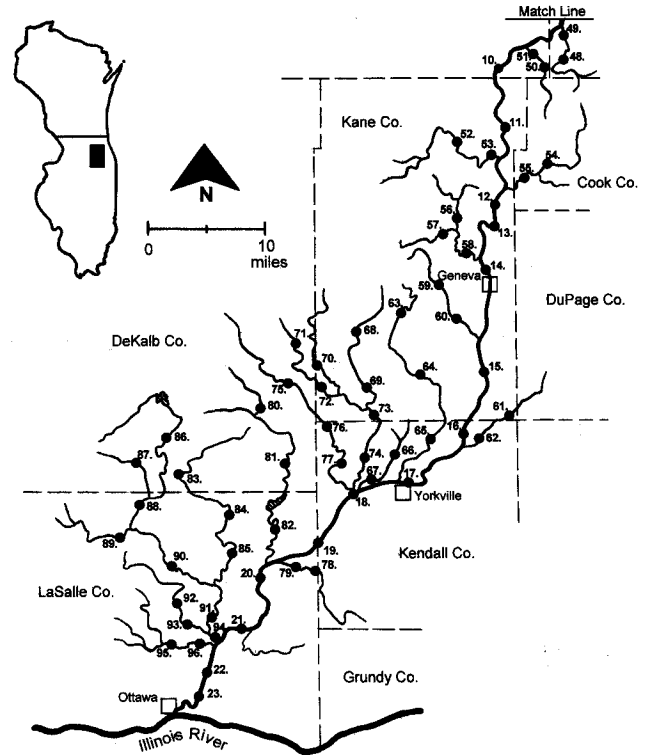


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the current survey, and it is therefore possible to directly compare his sampling results with those acquired roughly 40 years later.

At the 10 stations sampled in both Matteson's and the current survey, Matteson collected a total of 1,700 live mussels representing 20 species (Tables 5 and 6). During the current survey, those same 10 stations yielded only 626 live mussels (36.8% of Matteson's total) comprising 14 species. Several species that were collected in abundance by Matteson have declined significantly at the stations common to both studies. For example, while Matteson collected 477 live *Actinonaias ligamentina* during 1957–58 (the second most abundant species after *Q. pustulosa*), none were collected at stations common to both studies during 1997–2001. Similarly, *E. dilatata* and *C. tuberculata*, of which Matteson collected 49 and 11 live individuals, respectively, were not collected live at common stations during 1997–2001. In fact, *C. tuberculata* may no longer be living in the drainage. Three additional species collected in small num-

bers by Matteson—*Lasmigona costata*, *L. recta*, and *P. ohiensis*—were not collected at stations common to both studies during 1997–2001.

The decline in the number of mussel species and species abundance parallels the increased urbanization of the Fox River watershed, but it is difficult to determine what factor or group of factors (e.g., dams, siltation, point source pollution, nonpoint pollution, development of tributary corridors, loss of fish hosts, etc.) has caused the most impact on the mussel resources of the river. Dams and impoundments have been implicated in mussel declines elsewhere (Watters 1996, 2000; Metcalfe-Smith et al. 1998), and the numerous dams constructed historically across the Fox may have greatly affected its current mussel fauna. What cannot be argued is that the abundance and species richness of mussels in the Fox have both declined over the intervening years, despite the elimination of commercial mussel harvest and the passage of the Clean Water Act in the 1970s. This follows the disturbing national trend in mussel declines described by Neves (1993).

Table 2. Total numbers, abundance ranking, and percent composition of the mussel species collected live in the Fox River basin, 1997–2001.

Species	Total	Rank	% Comp.	Cum. %
<i>Quadrula pustulosa</i>	487	1	13.6	13.6
<i>Pyganodon grandis</i>	486	2	13.6	27.1
<i>Lasmigona complanata</i>	483	3	13.5	40.6
<i>Lampsilis cardium</i>	397	4	11.1	51.7
<i>Anodontooides ferussacianus</i>	305	5	8.5	60.3
<i>Fusconaia flava</i>	189	6	5.3	65.6
<i>Venustaconcha ellipsiformis</i>	174	7	4.9	70.3
<i>Pleurobema sintoxia</i>	167	8	4.7	75.0
<i>Actinonaias ligamentina</i>	156	9	4.4	79.3
<i>Alasmidonta marginata</i>	116	10	3.2	82.6
<i>Amblema plicata</i>	104	11	2.9	85.5
<i>Strophitus undulatus</i>	104	11	2.9	88.4
<i>Toxolasma parvus</i>	73	13	2.0	90.4
<i>Lasmigona costata</i>	71	14	2.0	92.4
<i>Lampsilis siliquoidea</i>	62	15	1.7	94.1
<i>Lasmigona compressa</i>	61	16	1.7	95.8
<i>Elliptio dilatata</i>	60	17	1.7	97.5
<i>Alasmidonta viridis</i>	31	18	0.9	98.4
<i>Quadrula quadrula</i>	31	18	0.9	99.2
<i>Utterbackia imbecillis</i>	14	20	0.4	99.6
<i>Villosa iris</i>	8	21	0.2	99.8
<i>Ligumia recta</i>	4	22	0.1	99.9
<i>Leptodea fragilis</i>	2	23	0.1	100.0
<i>Cyclonaias tuberculata</i>	0	0	0.0	
<i>Epioblasma triquetra</i>	0	0	0.0	
<i>Potamilus alatus</i>	0	0	0.0	
<i>Potamilus ohiensis</i>	0	0	0.0	
Total Live Individuals	3,585		100.0	
Total Species (live)	23			
Total Species (dead)	4			



Table 3 (part 1 of 2). Listing of all mussels collected in the Fox River mainstem, 1997–2001.

Station Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
<i>Actinonaias ligamentina</i>					8	6				w		10	w		w	w	w
<i>Alasmidonta marginata</i>		w			11	2						12	23	w	w		d
<i>Alasmidonta viridis</i>		w				sf											w
<i>Amblema plicata</i>		w	d			w				w	2	w	w	w			w
<i>Anodontoides ferrussacianus</i>										w							
<i>Cyclonaias tuberculata</i>											w						
<i>Eliptio dilatata</i>	w				w	w				w	w	w	w	w			w
<i>Epioblasma triquetra</i>																	
<i>Fusconaias flava</i>	w		7			w				2	w	w	w	w			w
<i>Lampsilis cardium</i>		22	1	8	21	68	1	15	10	7	21	w	9	w	11		23
<i>Lampsilis siliquoidea</i>			1			w		7	w	w	4	2	1	w	16	14	5
<i>Lasmigona complanata</i>	16	33	1	1	2	8											
<i>Lasmigona compressa</i>																	
<i>Lasmigona costata</i>	1		w		20	w					w						w
<i>Leptodea fragilis</i>																	
<i>Ligumia recta</i>					1	1		w				2	w	w		w	w
<i>Pleurobema sintoxia</i>												5	w	w			w
<i>Potamilius alatus</i>																	
<i>Potamilius ohioensis</i>																	
<i>Pyganodon grandis</i>	3	2	9	21	5	4	4	58	63	33	13	w	24	1	w		1
<i>Quadrula pustulosa</i>			7		11	54	1	270	1	w	38	w	1		3		4
<i>Quadrula quadrula</i>		7															
<i>Strophitus undulatus</i>			1				1	1	2		1		w				
<i>Toxolasma parvus</i>			1														
<i>Utterbackia imbecillis</i>					1							2	w				w
<i>Venusstacconcha ellipsiformis</i>						sf										d	
<i>Villosa iris</i>						w											w
Introduced bivalves:																	
<i>Corbicula fluminea</i>																	
<i>Dreissena polymorpha</i>								1									
Total Live Individuals*	20	64	28	30	86	150	14	356	78	45	107	0	58	1	30	16	32
Total Species (live)*	3	4	8	3	9	8	5	8	5	4	11	0	5	1	3	3	3

d = dead, w = weathered, sf = subfossil

\* Totals do not include introduced species

Table 3 (part 2 of 2). Listing of all mussels collected in the Fox River mainstem.

Station Number	18	19	20	21	22	23	Total live
<i>Actinonaias ligamentina</i>	w	w	w	w	w	w	24
<i>Alasmidonta marginata</i>	1	4	w	w	w	w	53
<i>Alasmidonta viridis</i>							0
<i>Amblyema plicata</i>	37	3	2	4	w	3	51
<i>Anodontoides ferrussacianus</i>		sf					0
<i>Cyclonaias tuberculata</i>				sf		w	0
<i>Elliptio dilatata</i>	w	w	w	w			1
<i>Epioblasma triquetra</i>							0
<i>Fusconaia flava</i>	w	w	w	w		w	9
<i>Lampsilis cardium</i>	6	15	7	9	1	1	256
<i>Lampsilis siliquoidea</i>		w		w	sf		8
<i>Lasnigona complanata</i>	28	27	8	20	1	6	193
<i>Lasnigona compressa</i>							0
<i>Lasnigona costata</i>	w						21
<i>Leptoda fragilis</i>						2	2
<i>Ligumia recta</i>						w	4
<i>Pleurobema sintoxia</i>	w	w	w	w		w	6
<i>Potamius alatus</i>						w	0
<i>Potamius ohioensis</i>					d		0
<i>Pyganodon grandis</i>	14	1	w	1	w	1	258
<i>Quadrula pustulosa</i>	45	12	d	3		2	445
<i>Quadrula quadrula</i>	13	7		3	w	w	31
<i>Strophitus undulatus</i>							22
<i>Toxolasma parvus</i>						w	6
<i>Urbachia imbecillis</i>	d		d				12
<i>Venustaconcha ellipsiformis</i>		sf		w			0
<i>Villosa iris</i>	sf	sf					0
Introduced bivalves: <i>Corbicula fluminea</i> <i>Dreissena polymorpha</i>		w					0 1
Total Live Individuals*	144	69	17	40	2	15	1402
Total Species (live)*	7	7	3	6	2	6	18

d = dead, w = weathered, sf = subfossil

\* Totals do not include introduced species

Basin-wide species totals.

	Mainstem	Tribs.	Total live
	24	132	156
	53	63	116
	0	31	31
	51	53	104
	0	305	305
	0	0	0
	1	59	60
	0	0	0
	9	180	189
	256	141	397
	8	54	62
	193	290	483
	0	61	61
	21	50	71
	2	0	2
	4	0	4
	6	161	167
	0	0	0
	0	0	0
	258	228	486
	445	42	487
	31	0	31
	22	82	104
	6	67	73
	12	2	14
	0	174	174
	0	8	8
	1402	2183	3585
	18	20	23

Table 4 (part 1 of 4). Listing of all mussels collected in tributaries of the Fox River, 1997–2001.

Stream Name	Big Rock Creek/Battle Creek/ Welch Creek, IL	Blackberry Creek, IL	Boone Creek, IL	Buck Creek, IL	Crooked Leg Creek, IL	Ferson/Otter Creek, IL
Station Number	68 69 70 71 72 73 74	63 64 65	46 47	95 96	92 93	56 57 58
<i>Actinonaias ligamentina</i>						
<i>Alasmidonta marginata</i>						
<i>Alasmidonta viridis</i>	1	1 w	d	w		
<i>Amblyema plicata</i>						
<i>Anodontooides ferussacianus</i>	d w 3 6 1	7 2 w	w	62 2	147 3	1 1
<i>Cyclonaias tuberculata</i>						
<i>Elliptio dilatata</i>						
<i>Epioblasma triquetra</i>						
<i>Fusconaias flava</i>		2 1				
<i>Lampsilis cardium</i>	w	2 8 w				d w 2
<i>Lampsilis siliquoidea</i>		2 1				w d 16 w
<i>Lasmigona complanata</i>			d w 49	1		
<i>Lasmigona compressa</i>	6 w w d 3 2	1 1 2 8		w	10 1	1 1 d
<i>Lasmigona costata</i>						
<i>Leptodea fragilis</i>						
<i>Ligumia recta</i>						
<i>Pleurobema simtoxia</i>		3				
<i>Potamilius alatus</i>						
<i>Potamilius ohioensis</i>						
<i>Pyganodon grandis</i>		12 8	1	1		
<i>Quadrula pustulosa</i>						
<i>Quadrula quadrula</i>						
<i>Strophitus undulatus</i>		w			5 1	
<i>Toxolasma parvius</i>		w	1	15 61	5 4	1 w
<i>Utherbackia imbecillis</i>						
<i>Venusstacochcha ellipsiformis</i>	d	1 w	3 w			1 w 1
<i>Villosa iris</i>						
Introduced bivalves:						
<i>Corbicula fluminea</i>		w				
<i>Dreissena polymorpha</i>						
Total Live Individuals*	6 0 4 6 17 23 0	11 21 34	1 1 3 53	140 3 2	166 4	5 3 3 17 9
Total Species (live)*	1 0 2 1 6 6 0	3 7 8	1 1 3	5 2	4	3 2 5

d = dead, w = weathered, sf = subfossil

\* Totals do not include introduced species

Table 4 (part 2 of 4). Listing of all mussels collected in tributaries of the Fox River, 1997–2001.

Stream Name	Flint Creek, IL	Honey Creek, WI	Indian Creek/Paw Paw Run/Surphens Run, IL	Little Indian Creek, IL	Little Rock Creek, IL	Mill Creek, IL
Station Number	48 49	28 29 30	86 87 88 89 90 91 94	83 84 85	75 76 77	59 60
<i>Actinonaias ligamentina</i>						
<i>Alasmidonta marginata</i>		3 6				
<i>Alasmidonta viridis</i>		1 47 6 2	1 w	1 12	4	
<i>Anodonta ferussaciana</i>		3 d	4 w 5	d 1	1 w w	2
<i>Cyclonaias tuberculata</i>						
<i>Elliptio dilatata</i>						
<i>Epioblasma triquetra</i>						
<i>Fusconaias flava</i>		9 57 7		1 9		
<i>Lampsilis cardium</i>		11 1	4 w w w w	w 11 6	8	
<i>Lampsilis siliquoidea</i>			2 2 2 w w w	1 32 3		
<i>Lasnigona complanata</i>	32 2		2 14 4 5 w	4 4 16	10 19 w	30
<i>Lasnigona compressa</i>		2 w	2 2	w 4 8	3 w w	
<i>Lasnigona costata</i>		5 4				
<i>Leptodea fragilis</i>						
<i>Ligumia recta</i>						
<i>Pleurobema sintoxia</i>		1 3		7		
<i>Potamilius alatus</i>						
<i>Potamilius ohioensis</i>						
<i>Pyganodon grandis</i>	21 2	4 d	23 w w w			7
<i>Quadrula pustulosa</i>						
<i>Quadrula quadrula</i>		11 3	1 d		1	
<i>Strophilius undulatus</i>						
<i>Toxolasma parvus</i>		d				
<i>Uterbackia imbecillis</i>		w	2 w	7 1	15 1	16 1
<i>Venustaconcha ellipsiformis</i>						
<i>Villosa iris</i>						
Introduced bivalves:						
<i>Corbicula fluminea</i>						
<i>Dreissena polymorpha</i>						
Total Live Individuals*	53 4	17 145 26	19 0 42 13 5 0 18	1 69 63	35 28 0 0	0 39
Total Species (live)*	2 2	5 9 7	5 0 6 4 1 0 2	1 8 9	6 3 0 0	0 3

d = dead, w = weathered, sf = subfossil

\* Totals do not include introduced species



Table 4 (part 3 of 4). Listing of all mussels collected in tributaries of the Fox River, 1997-2001.

Stream Name	Mukwonago River, WI	Muskego/Wind Lake Canal, WI	Nippersink Creek, IL	No. Br. Nippersink Creek, IL/WI	Poplar Creek, IL	Rob Roy Creek, IL	Roods Creek, IL	Somomauk Creek, IL
<i>Actinonaias ligamentina</i>								
<i>Alasnidonta marginata</i>								
<i>Alasnidonta viridis</i>	1		2		1	2		1
<i>Ambelma plicata</i>	1							
<i>Anodontoides ferussacianus</i>	4		d	1	4	2	2	1
<i>Cyclonaias tuberculata</i>								
<i>Elliptio dilatata</i>		51						
<i>Epioblasma triquetra</i>								
<i>Fusconaias flava</i>	w	9		6	w			
<i>Lampsilis cardium</i>		5		1				w
<i>Lampsilis siliquoidea</i>		4		17				w
<i>Lasmigona complanata</i>		7		w				w
<i>Lasmigona compressa</i>	3		1	21	w			w
<i>Lasmigona costata</i>			1	w				
<i>Leptodea fragilis</i>				2				
<i>Ligumia recta</i>				3				
<i>Pleurobema sintoxia</i>	w	17		2				w
<i>Potamilius alatus</i>				18				
<i>Potamilius ohioensis</i>				84				
<i>Pygamodon grandis</i>	d	11	21	w	16			
<i>Quadrula pustulosa</i>		1	7		1			
<i>Quadrula quadrula</i>					29			
<i>Strophitus undulatus</i>		22		5	w		1	
<i>Toxolasma parvus</i>		d	1					
<i>Uterbackia imbecillis</i>		2						
<i>Venustaconcha ellipsiformis</i>	31	19		w	9			
<i>Villosa iris</i>	8	d			5			
Introduced bivalves:								
<i>Corbicula fluminea</i>								
<i>Dreissena polymorpha</i>			d					
Total Live Individuals*	48	148	21	8	30	4	2	2
Total Species (live)*	6	11	1	2	4	2	2	2

d = dead, w = weathered, sf = subfossil  
 \* Totals do not include introduced species

Table 4 (part 4 of 4). Listing of all mussels collected in tributaries of the Fox River, 1997–2001.

Stream Name	Spring Creek, IL	Squaw Creek, IL	Sugar Creek, WI	Tyler Creek, IL	Waubonsie Creek, IL	White River, WI	Total live
Station Number	50 51	44 45	31 32 33	52 53	61 62	34 35 36 37	
<i>Actinonaias ligamentina</i>						w	132
<i>Alasmidonta marginata</i>						57	63
<i>Alasmidonta viridis</i>	1		w 3	1	1 d	4 11	31
<i>Ambleria plicata</i>	w					3 w	53
<i>Anodontoides ferussacianus</i>			5 5 1	14	d 4	w	305
<i>Cyclonaias tuberculata</i>						0	0
<i>Elliptio dilatata</i>	w						59
<i>Epioblasma triquetra</i>							0
<i>Fusconaia flava</i>			w 3 1			sf 18 49	180
<i>Lampsilis cardium</i>	w w						141
<i>Lampsilis siliquoidea</i>			w 1			sf	54
<i>Lasnigona complanata</i>	1	33		d			290
<i>Lasnigona compressa</i>	w				14 1		61
<i>Lasnigona costata</i>			1			3 12 1	50
<i>Leptodea fragilis</i>							0
<i>Ligumia recta</i>							0
<i>Pleurobema sintoxia</i>	1			w		2 20	161
<i>Potamilus alatus</i>						0	0
<i>Potamilus ohioensis</i>							0
<i>Pygamodon grandis</i>	5 4	d 46	w w w		27	1 2	228
<i>Quadrula pustulosa</i>							42
<i>Quadrula quadrata</i>							0
<i>Sirophitus undulatus</i>	1			1		2 3 1	82
<i>Toxolasma parvus</i>		1			w	w	67
<i>Uterbackia imbecillis</i>							2
<i>Venusiaconcha ellipsiformis</i>	w 1		16 2	1	3 2	2 w	174
<i>Villosa iris</i>							8
Introduced bivalves:							
<i>Corbicula fluminea</i>					1 30		31
<i>Dreissena polymorpha</i>						100+	100+
Total Live Individuals*	6 8	0 80	5 29 5	16 0 0	45 7 3	0 27 168 16	2183
Total Species (live)*	2 5	0 0 3	1 6 4	3 3 0	4 4 3	0 5 10 5	20

d = dead, w = weathered, sf = subfossil

\* Totals do not include introduced species

Table 5. Total Numbers, abundance ranking, and percent composition of the mussel species collected in the Fox River by Matteson, 1957–1958.

Species	Total	Rank	% Comp.	Cum. %
<i>Quadrula pustulosa</i>	620	1	36.5	36.5
<i>Actinonaias ligamentina</i>	478	2	28.1	64.6
<i>Lampsilis cardium</i>	134	3	7.9	72.5
<i>Lasmigona complanata</i>	100	4	5.9	78.4
<i>Amblema plicata</i>	72	5	4.2	82.6
<i>Quadrula quadrula</i>	51	6	3.0	85.6
<i>Elliptio dilatata</i>	49	7	2.9	88.5
<i>Lampsilis siliquoidea</i>	44	8	2.6	91.1
<i>Alasmidonta marginata</i>	39	9	2.3	93.4
<i>Fusconaia flava</i>	30	10	1.8	95.1
<i>Pleurobema sintoxia</i>	27	11	1.6	96.7
<i>Utterbackia imbecillis</i>	14	12	0.8	97.5
<i>Cyclonaias tuberculata</i>	11	13	0.6	98.2
<i>Pyganodon grandis</i>	11	13	0.6	98.8
<i>Lasmigona costata</i>	8	15	0.5	99.3
<i>Toxolasma parvus</i>	4	16	0.2	99.5
<i>Strophitus undulatus</i>	3	17	0.2	99.6
<i>Leptodea fragilis</i>	2	18	0.1	99.8
<i>Ligumia recta</i>	2	18	0.1	99.9
<i>Potamilus ohioensis</i>	1	20	0.1	100.0
Total Live Individuals	1,700		100.0	
Total Species (live)	20			

Although no historical information is available concerning mussel populations inhabiting tributaries of the Fox River, several of these streams are noteworthy because of their current species richness and abundance, and the presence of endangered or threatened species. Tributaries supporting 10 or more mussel species, including species listed as threatened or endangered in Illinois and/or Wisconsin, were Blackberry Creek (IL), Honey Creek (WI), Little Indian Creek (IL), Mukwonago River (WI), Nippersink Creek (IL), North Branch Nippersink Creek (IL/WI), and White River (WI), each of which is briefly addressed below:

**Blackberry Creek**—Sampling of this tributary resulted in the collection of 11 living mussel species and 2 additional species represented by weathered material. Although mussel abundance was only moderate, averaging 22 live individuals per sampling location, specimens of the Illinois and Wisconsin threatened slippershell (*A. viridis*) were collected at the upstream station. Other than Waubonsie Creek, where several live individuals were collected, Blackberry Creek was the only Fox River tributary in which the Asian clam (*Corbicula fluminea*) was encountered. A weathered valve was found at Station 65.

**Honey Creek**—This stream yielded 13 living mussel species, 1 additional species represented by dead material, and 1 by weathered material. Mussel abundance was high, averaging nearly 63 live mussels per station. Live specimens of the Wisconsin threatened ellipse (*V. ellipsiformis*) were collected at the upstream station. Of only 104 live threeridge (*Amblema plicata*) collected basin-wide, 47 were taken at one station on Honey Creek.

**Little Indian Creek**—Though mussel abundance and diversity were low in the headwaters of Little Indian Creek, the two downstream stations yielded an average of 66 live mussels and a combined total of 11 species. These included the Illinois threatened spike (*E. dilatata*) and the Wisconsin threatened ellipse (*V. ellipsiformis*). Weathered and subfossil shells of the Illinois and Wisconsin threatened slippershell (*A. viridis*) were also collected.

**Mukwonago River**—Although only two stations were sampled on this stream, it exhibited the highest species richness (16 live and 1 dead) of any tributary in the Fox River basin (Table 4c.; Stations 24 & 25). Mussel abundance was also quite high, averaging 98 live individuals per station.

Table 6. Side-by-side listing of mussels collected at stations common to Matteson's (1957-58) and current study.

Station No. (Matteson/current)	1 / 7		2 / 8		3 / 10		4 / 12		5 / 14		8 / 17		9 / 18		10 / 20		11 / 22		12 / 23		
Year Sampled	1957	1999	1957	1999	1957	1999	1957	1999	1957	1999	1957	1998	1958	1999	1958	1999	1958	1999	1958	1999	
<i>Actinonaias ligamentina</i>			5	w	19	w															
<i>Alasmidonta marginata</i>			2		4				42	w	54	w	144	w	50	w	77	87			
<i>Alasmidonta viridis</i>											2	2	6	1	11	w	13	1			
<i>Amblema plicata</i>		w	4	2	2	w					12		16	37	16	2	1	21			
<i>Anodonta fessendeniana</i>				w							2		4		4			1		1	
<i>Cyclonaias tuberculata</i>											3	3	1	w	1	w					
<i>Elliptio dilatata</i>			12	w	32	w		w			12	w	4	4	4						
<i>Epioblasma triquetra</i>																					
<i>Fusconaias flava</i>			4	2	6	w					12	w	4	w	4	w				w	
<i>Lampsilis caritum</i>		1	25	15	41	7	1	1	12	w	16	23	12	6	4	7	20	1	3	1	
<i>Lampsilis siliquoidea</i>			27	7	16	w				w	32	5	3	28	10	8	43	1	1	12	
<i>Lasmigona complanata</i>						4														6	
<i>Lasmigona compressa</i>																					
<i>Lasmigona costata</i>					8									w			2			2	
<i>Leptodea fragilis</i>																					
<i>Ligumia recta</i>																					
<i>Pleurobema sinuoxia</i>			5	w	11	1					8	w	2	w	2	w				w	
<i>Potamilius alatus</i>																				w	
<i>Potamilius ohioensis</i>																					
<i>Pyganodon grandis</i>		4	1	58	5	33		w	1	3	3	7	14	14	39	w	1	d	1	1	
<i>Quadrula pustulosa</i>	9	1	487	270	36	w		w		4	4	7	45	45	39	d	18	20	1	2	
<i>Quadrula quadrula</i>											23	4	10	13	7		3	8		w	
<i>Strophitus undulatus</i>		1	4	1													1	2		w	
<i>Toxolasma parvus</i>			7								2										
<i>Utterbackia imbecillis</i>	1	7	7	w	3	w			d			w		d	1	d				*	
<i>Venustaconcha ellipsiformis</i>																					
<i>Villosa iris</i>												w		sf							
Total Live Individuals	10	14	583	356	183	45	1	0	54	1	173	32	210	144	149	17	180	2	157	15	
Total Species (live)	2	5	12	8	13	4	1	0	2	1	13	3	12	7	12	3	11	2	11	6	

d = dead, w = weathered, sf = subfossil

These totals included 51 spikes (*E. dilatata*—Illinois threatened), 50 ellipses (*V. ellipsiformis*—Wisconsin threatened), 1 slippershell (*A. viridis*—Illinois and Wisconsin threatened) and 8 rainbows (*V. iris*—Illinois and Wisconsin endangered). The latter represent the only known extant population of *V. iris* in the entire Upper Mississippi River basin.

**Nippersink Creek and North Branch Nippersink Creek**—Arguably among the best mussel streams in the Fox River basin in terms of species richness and abundance, the Nippersink Creek/North Branch Nippersink Creek system yielded 15 live mussel species, 1 additional species represented by dead material, and 2 by weathered material. Nippersink Creek was the only stream in the drainage from which *E. triquetra* was collected (a single, weathered valve at Station 43), and also produced 9 live slippershells (*A. viridis*—Illinois and Wisconsin threatened) and 23 ellipses (*V. ellipsiformis*—Wisconsin threatened). The Nippersink is also one of only three creeks in the Illinois part of the Fox River drainage that historically contained the rainbow, *V. iris*. While the North Branch of Nippersink Creek yielded higher raw numbers of mussels, averaging 88 live individuals per station compared to 36 for Nippersink Creek, no live specimens of listed species were collected there during the current survey. However, if intensive sampling were performed in the North Branch, extant populations of listed species (e.g., *A. viridis*, *V. ellipsiformis*) would likely be found.

**White River**—No live mussels were collected at the upstream station on the White River nearest its source, Lake Geneva, Wisconsin. However, Station 36, approximately 10 miles downstream, produced the highest abundance (168 individuals) of any tributary station in the Fox River basin. The White River yielded 11 live species, 2 additional species represented by weathered material, and 1 by subfossil material. The Wisconsin threatened ellipse (*V. ellipsiformis*), represented by 2 live specimens, was the only listed species collected in this stream. The upper reaches of the White River near Lake Geneva are heavily infested by the zebra mussel (*D. polymorpha*), which may eventually impact native mussel populations downstream including those in the Fox River.

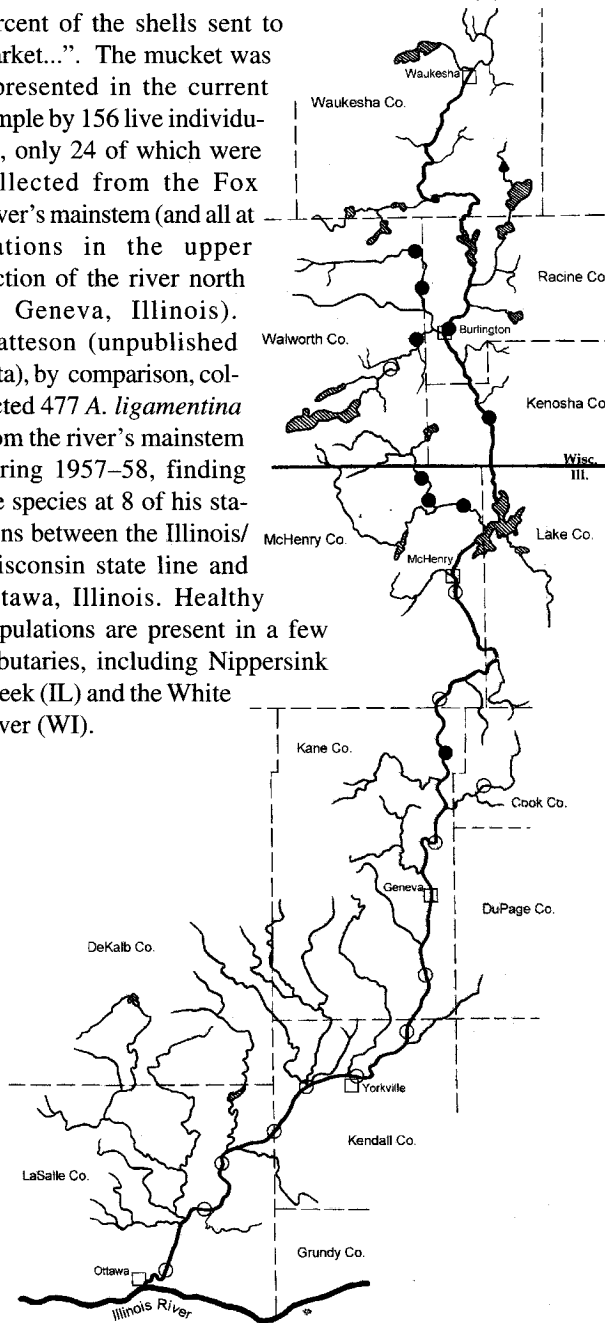
SPECIES ACCOUNTS

The following is an annotated listing of mussel species encountered in the Fox River basin during the present study or attributed to the basin by earlier researchers. 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 region. On the following maps, closed (black) circles indicate stations where live mussels were found; open (white) circles indicate where dead, weathered-dead, or subfossil shells were found.

NATIVE UNIONIDS

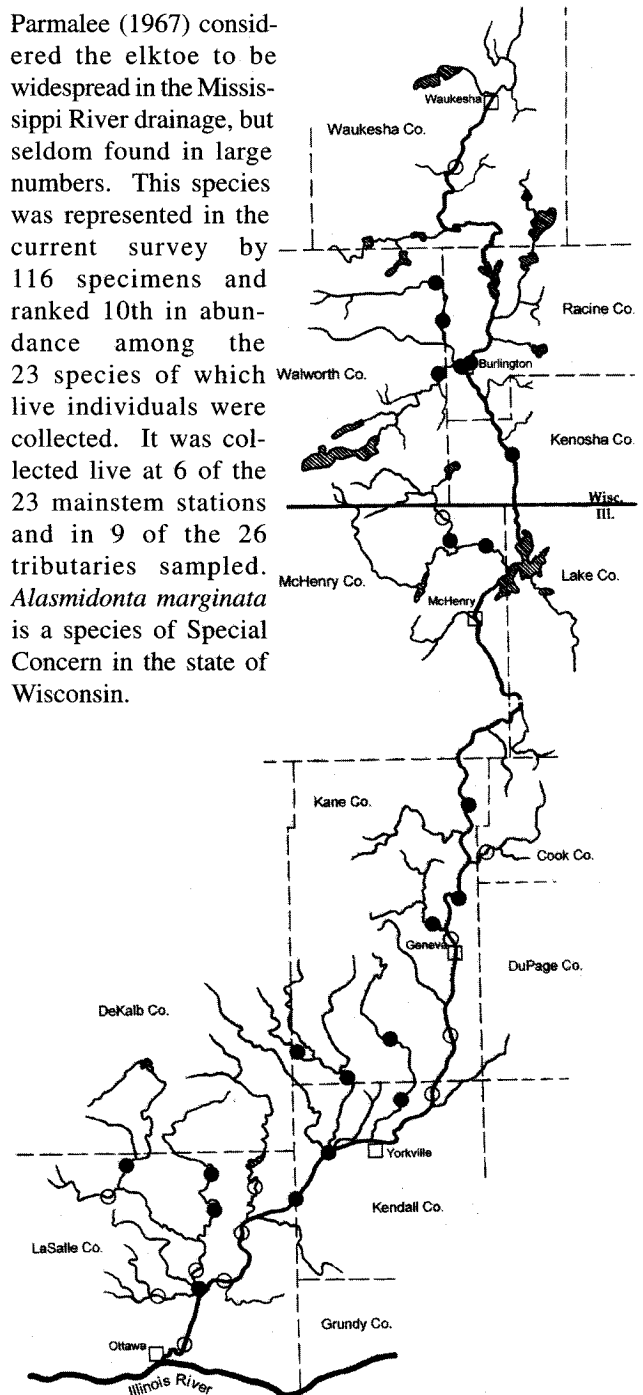
*Actinonaias ligamentina* (Lamarck, 1819) — mucket

Eldridge (1914) found the mucket to be the “most characteristic mussel of the Fox...which constitutes 90 percent of the shells sent to market...”. The mucket was represented in the current sample by 156 live individuals, only 24 of which were collected from the Fox River’s mainstem (and all at stations in the upper section of the river north of Geneva, Illinois). Matteson (unpublished data), by comparison, collected 477 *A. ligamentina* from the river’s mainstem during 1957–58, finding the species at 8 of his stations between the Illinois/Wisconsin state line and Ottawa, Illinois. Healthy populations are present in a few tributaries, including Nippersink Creek (IL) and the White River (WI).



*Alasmidonta marginata* Say, 1818 — elktoe

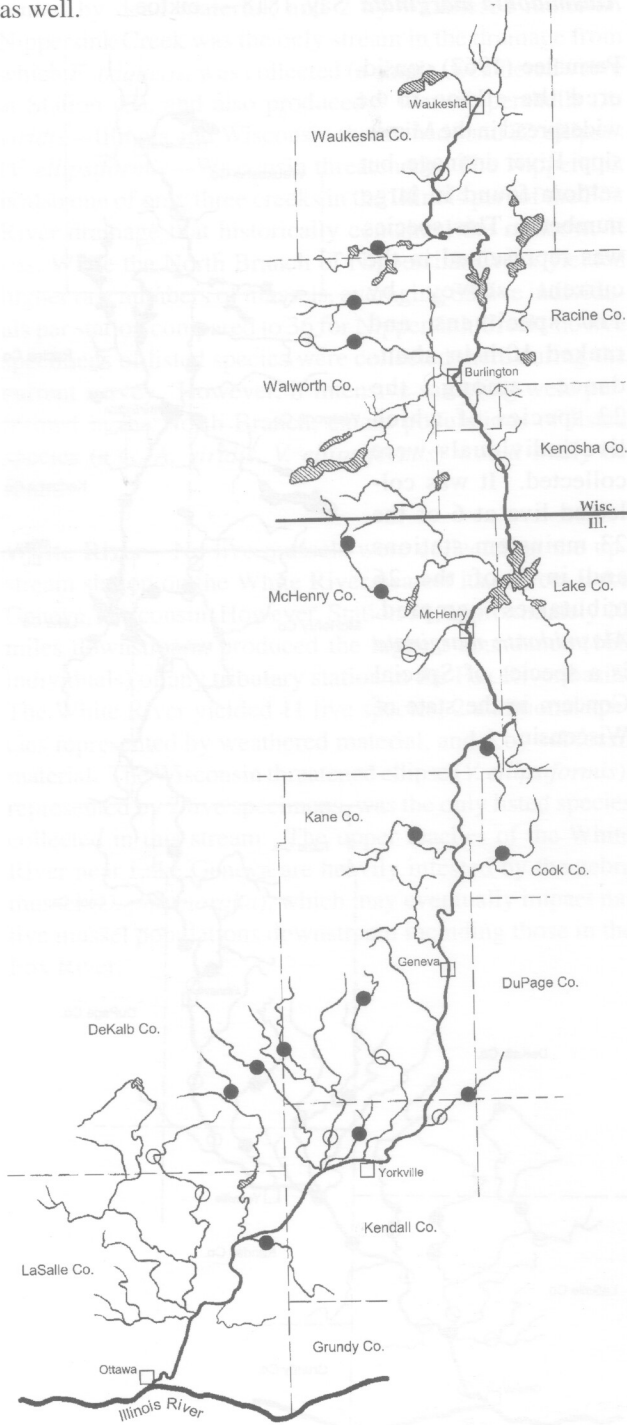
Parmalee (1967) considered the elktoe to be widespread in the Mississippi River drainage, but seldom found in large numbers. This species was represented in the current survey by 116 specimens and ranked 10th in abundance among the 23 species of which live individuals were collected. It was collected live at 6 of the 23 mainstem stations and in 9 of the 26 tributaries sampled. *Alasmidonta marginata* is a species of Special Concern in the state of Wisconsin.





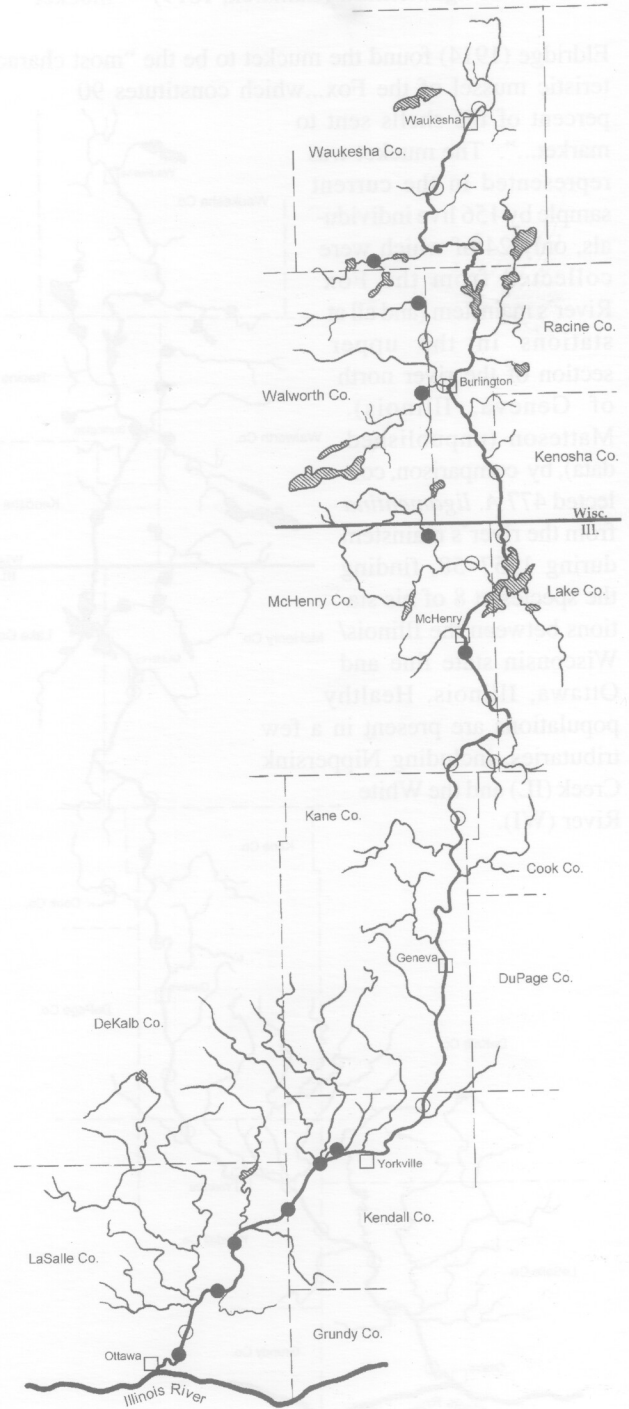
*Alasmidonta viridis* (Rafinesque, 1820) — slippershell mussel

A species which inhabits headwater streams in the upper Midwest, the slippershell is listed as a threatened species in both Illinois and Wisconsin. Live slippershells were collected from 14 tributaries of the Fox River, and the species was represented by dead, weathered, or subfossil material in 2 other tributaries. The slippershell has lately been reported from a number of streams in Illinois (Sauer 1989, Schanzle and Cummings 1991, Szafoni et al. 2000), and is apparently widespread, though typically present only in small numbers. This is the situation in the Fox River basin as well.



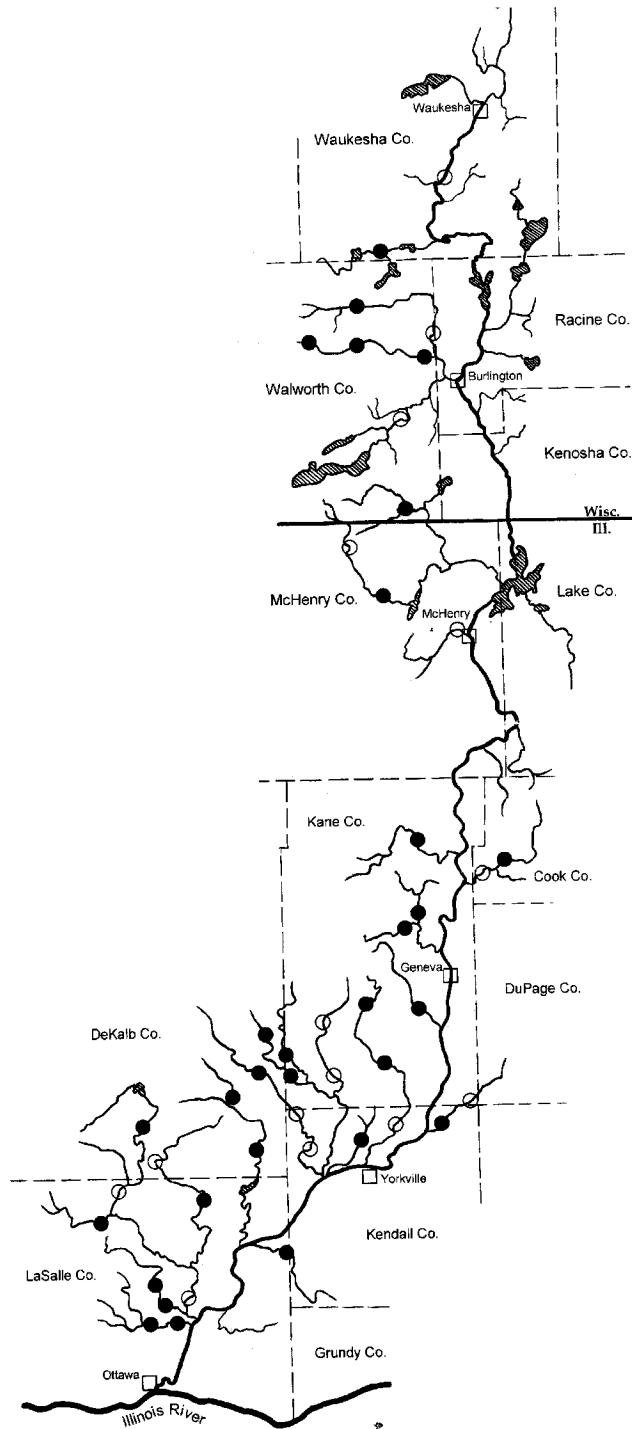
*Amblyma plicata* (Say, 1817) — threeridge

Cummings and Mayer (1992) considered the threeridge “Widespread and common throughout most of its range,” including all of Illinois and most of Wisconsin. Fifty-one live threeridges were collected from the Fox River mainstem in the current survey, all but 2 from the lower part of the river downstream from Yorkville, Illinois. Surprisingly, only 5 tributary streams yielded live threeridges, and of 53 individuals collected, 47 came from a single station in Honey Creek (WI).



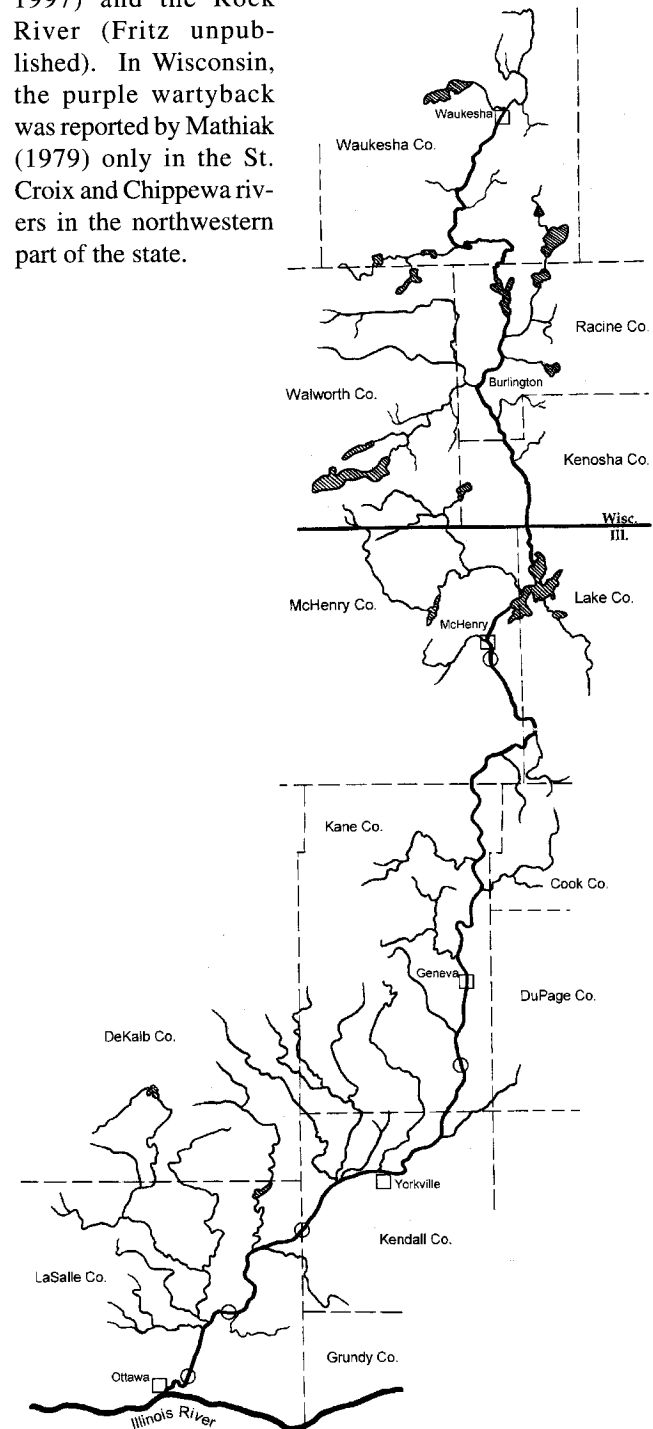
***Anodontoides ferussacianus*** (I. Lea, 1834) — cylindrical papershell

The cylindrical papershell is a species typical of headwater areas and may be quite numerous locally as demonstrated by the 147 live individuals found during the current study at station 92 on Crooked Leg Creek (IL). This species ranked fifth in abundance overall (305 individuals) and was represented by live or dead material in all but 4 of the tributary streams sampled. The exceptions included Flint Creek, Spring Creek, and Squaw Creek (IL) and the Muskego/Wind Lake Drainage Canal (WI).



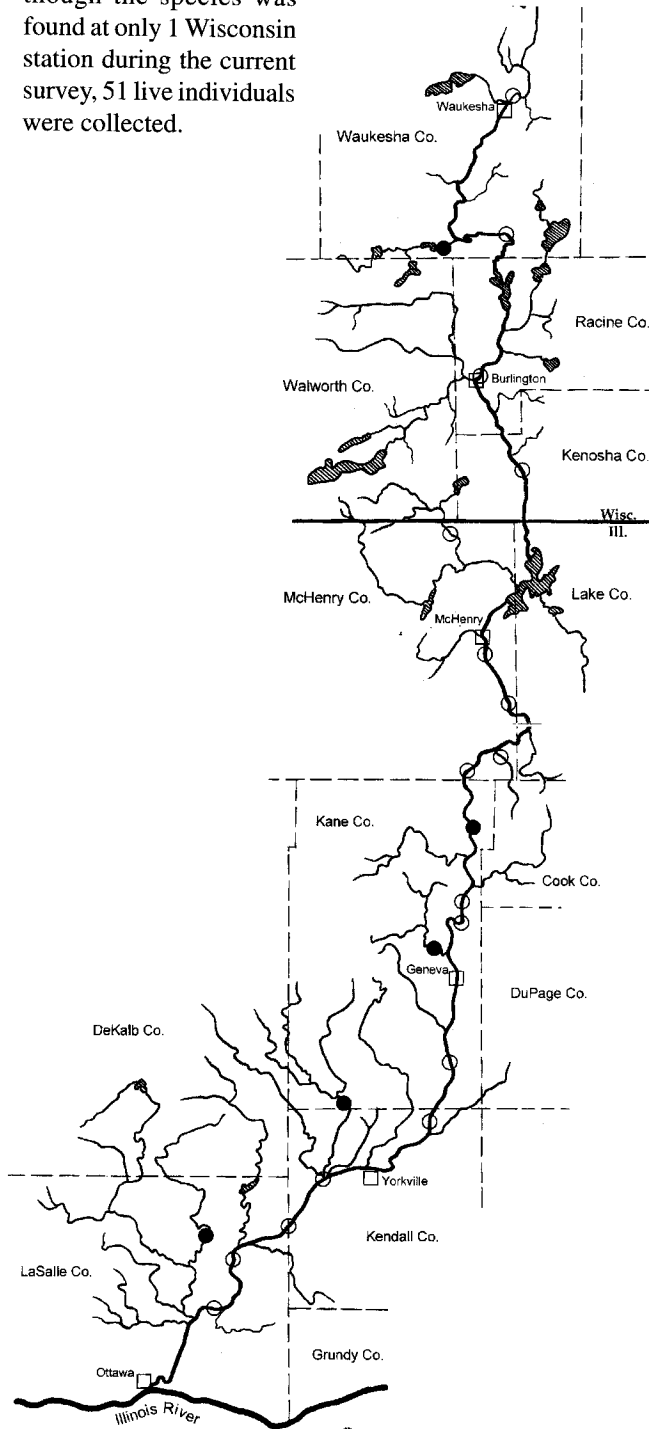
***Cyclonaias tuberculata*** (Rafinesque, 1820) — purple wartyback

Although Matteson (unpublished data) collected 11 live *C. tuberculata* at 4 mainstem stations in Illinois during 1957–58, the species was represented in the current study only by weathered and subfossil shells and may no longer inhabit the basin. The purple wartyback is listed as a threatened species in Illinois and an endangered species in Wisconsin. In Illinois, it has been collected live in recent years “only in the Kankakee, Vermilion (Wabash), and Ohio rivers” (Cummings and Mayer 1997) and the Rock River (Fritz unpublished). In Wisconsin, the purple wartyback was reported by Mathiak (1979) only in the St. Croix and Chippewa rivers in the northwestern part of the state.

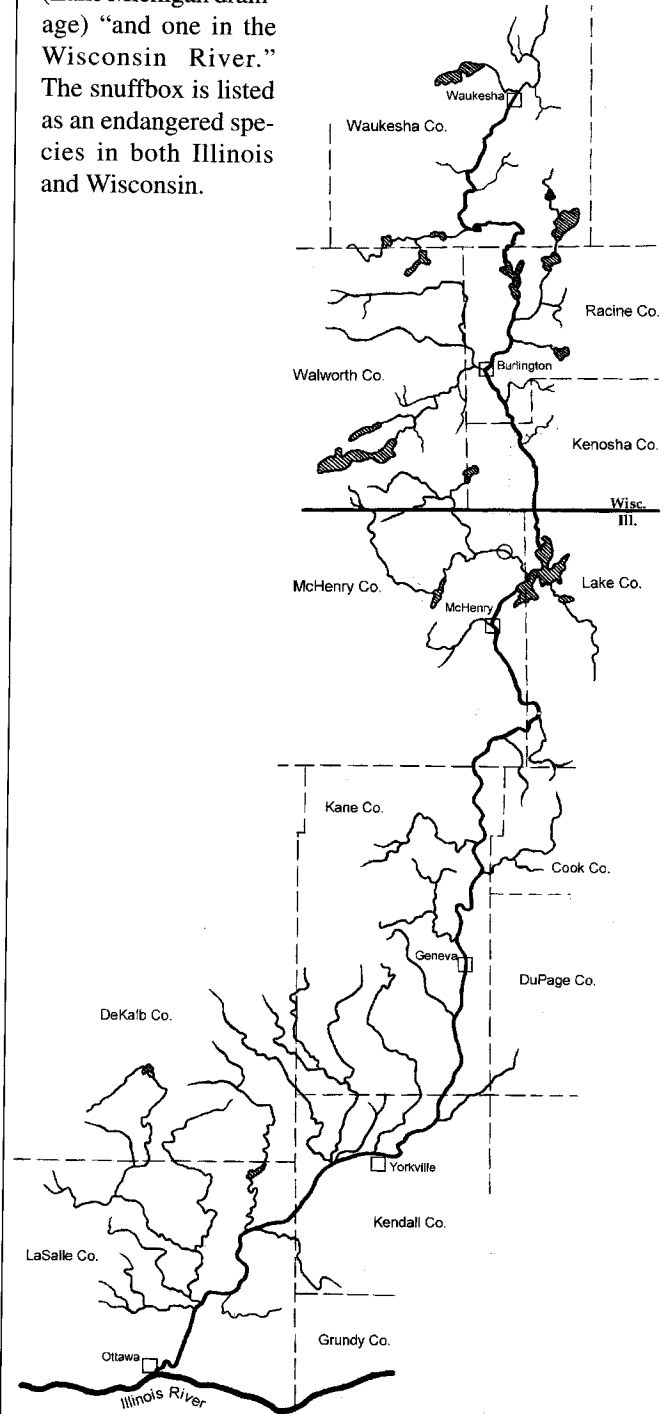


*Elliptio dilatata* (Rafinesque, 1820) — spike

Considered widespread but sporadic in distribution in the Midwest (Cummings and Mayer 1992), the spike has declined in Illinois and is currently listed as a threatened species. Matteson (unpublished data) collected a total of 49 *E. dilatata* at 5 mainstem stations during his 1957–58 sampling, but only 1 live individual was collected in the mainstem during the current survey. Small numbers of spikes were also collected from Ferson Creek, Big Rock Creek, and Little Indian Creek in Illinois. The spike is not considered threatened or endangered in Wisconsin, and although the species was found at only 1 Wisconsin station during the current survey, 51 live individuals were collected.

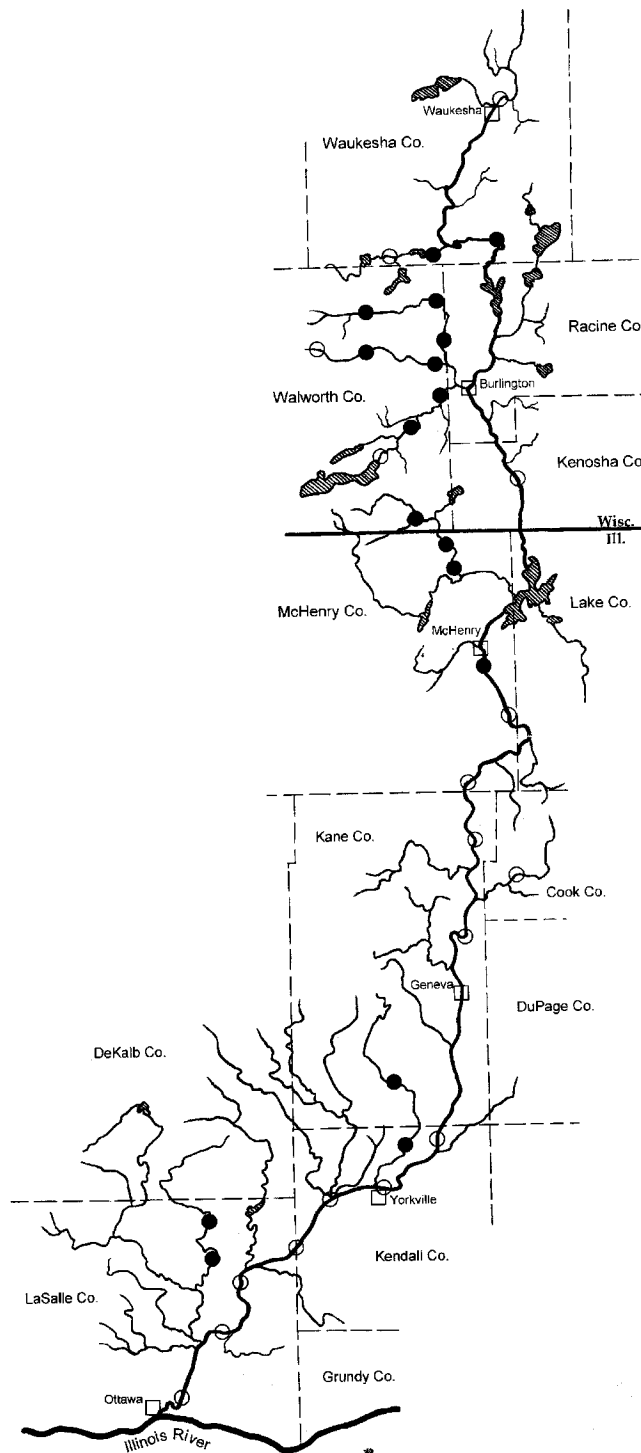
*Epioblasma triquetra* (Rafinesque, 1820) — snuffbox

Considered widespread but rare throughout the Midwest (Cummings and Mayer 1992), the snuffbox was represented in the Fox River basin by a single, weathered valve collected at Station 43 on Nippersink Creek (IL). The absence of dead, weathered, or subfossil shells at the other 95 stations sampled during the current study suggests that this species was never widely distributed or abundant in the Fox River drainage, and it is quite likely extirpated. Baker (1928) noted only 2 records of *E. triquetra* from Wisconsin, "one in the Fox River" (Lake Michigan drainage) "and one in the Wisconsin River." The snuffbox is listed as an endangered species in both Illinois and Wisconsin.



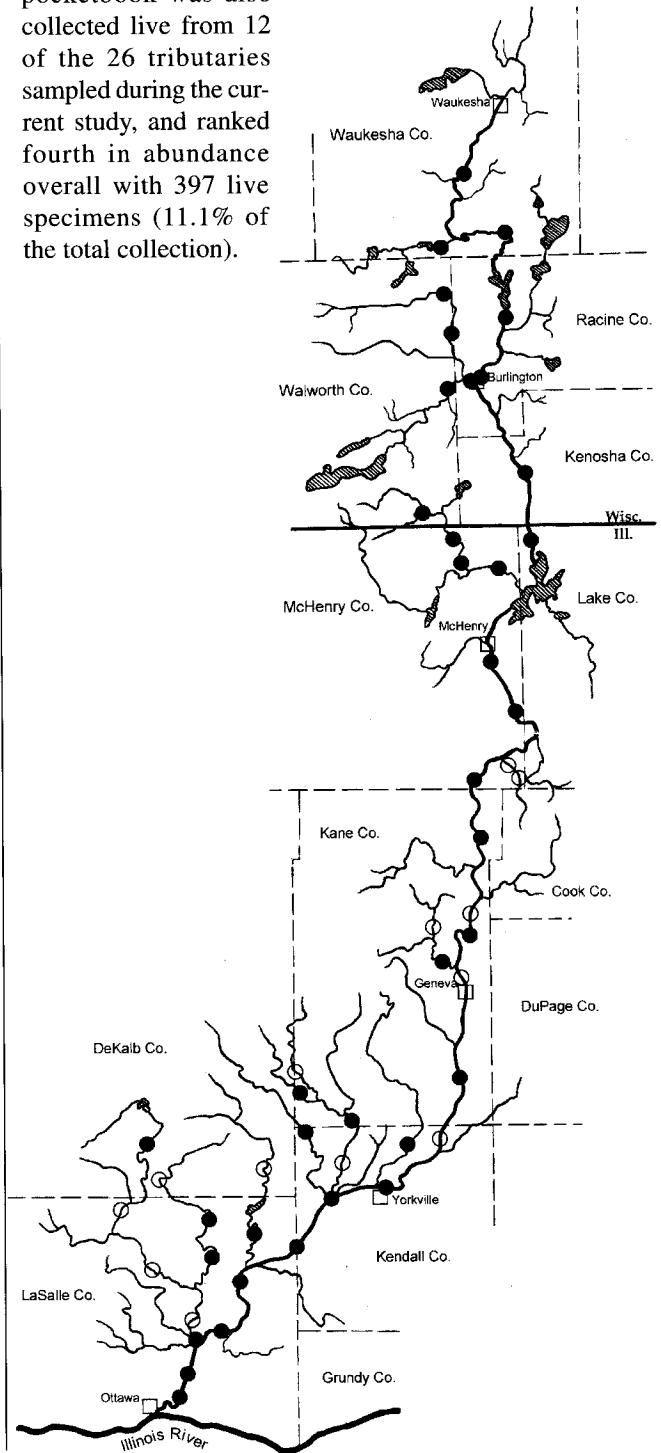
***Fusconaia flava*** (Rafinesque, 1820) — Wabash pigtoe

The Wabash pigtoe ranked sixth in abundance in the current survey, and was represented by a total of 189 individuals. Though collected at only 2 mainstem stations, 1 in Illinois (2 specimens) and 1 in Wisconsin (7 specimens), live *F. flava* were collected from 7 of the tributary streams sampled. The Wabash pigtoe was collected at 5 of Matteson's mainstem stations during 1957-58, totaling 30 individuals.



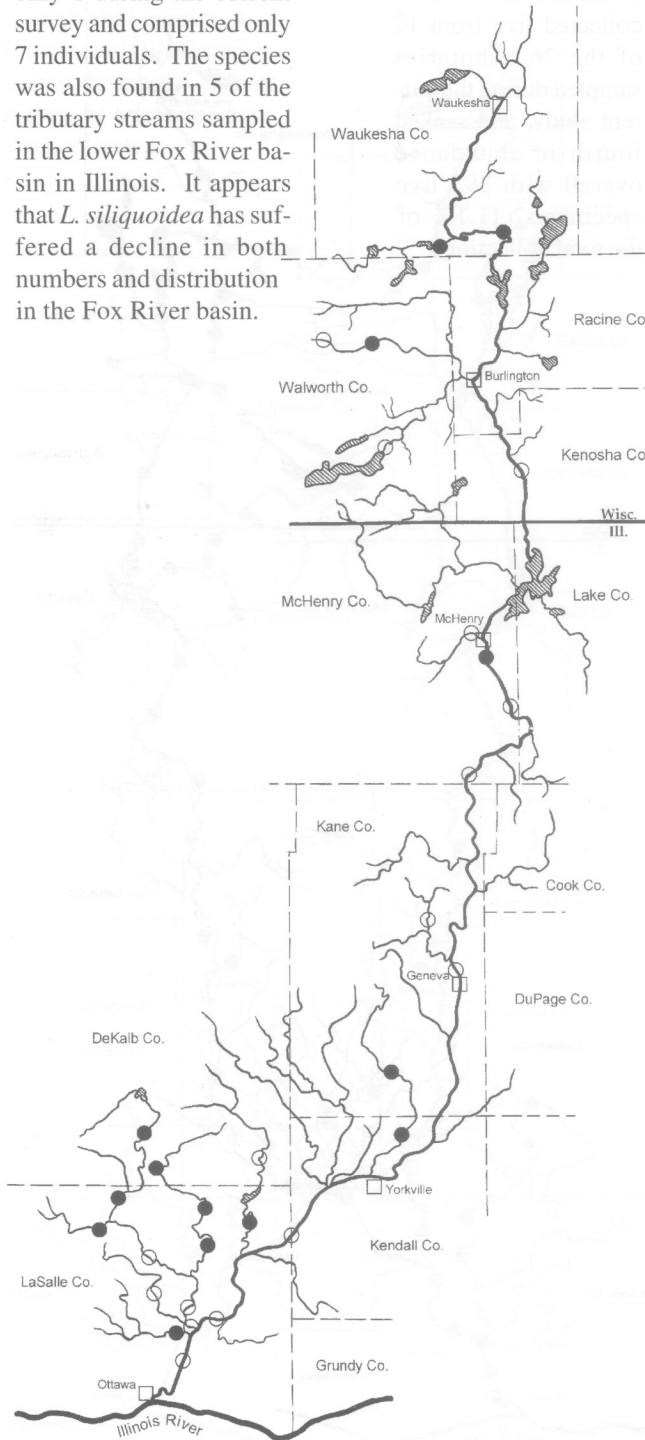
***Lampsilis cardium*** Rafinesque, 1820 — plain pocketbook

Baker (1928) recognized several varieties of *L. cardium* and believed one, *occidens*, would "probably be found to inhabit all of the stream drainages" of Wisconsin. Matteson (unpublished data) found the plain pocketbook throughout the Fox River mainstem in Illinois, collecting it at 9 of his stations. Similarly, live specimens were found at 19 of the 23 mainstem stations sampled during the current study, a frequency greater than any other species, and occurred from the headwaters of the river to its mouth. The plain pocketbook was also collected live from 12 of the 26 tributaries sampled during the current study, and ranked fourth in abundance overall with 397 live specimens (11.1% of the total collection).



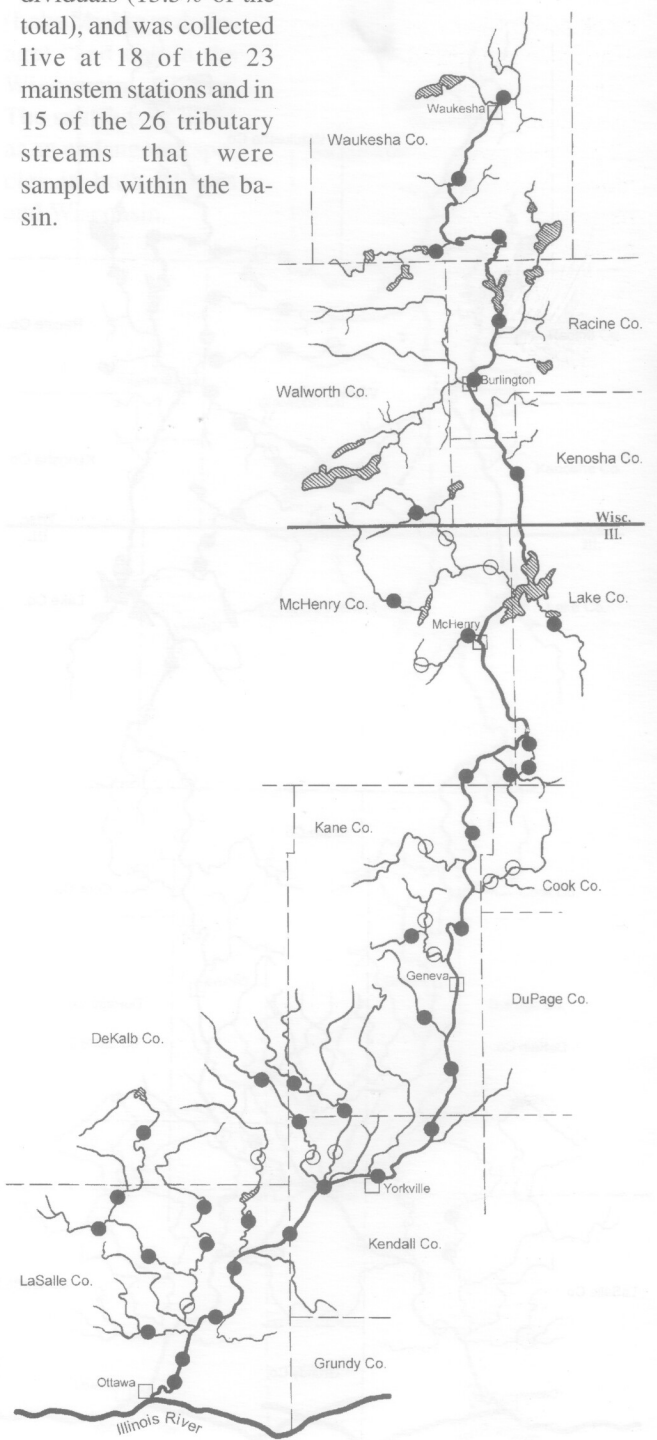
*Lampsilis siliquoidea* (Barnes, 1823) — fatmucket

Baker (1928) considered the fatmucket “the most widely distributed mussel (in Wisconsin), occurring in all of the drainage areas...” Surprisingly scarce during the current survey, it was represented in Wisconsin by only 1 live individual from the Fox River’s mainstem, 4 from the Mukwonago River, and 1 from Sugar Creek. While Matteson (unpublished data) collected live fatmuckets totaling 45 individuals at 4 of his mainstem stations in Illinois, they were found at only 1 during the current survey and comprised only 7 individuals. The species was also found in 5 of the tributary streams sampled in the lower Fox River basin in Illinois. It appears that *L. siliquoidea* has suffered a decline in both numbers and distribution in the Fox River basin.



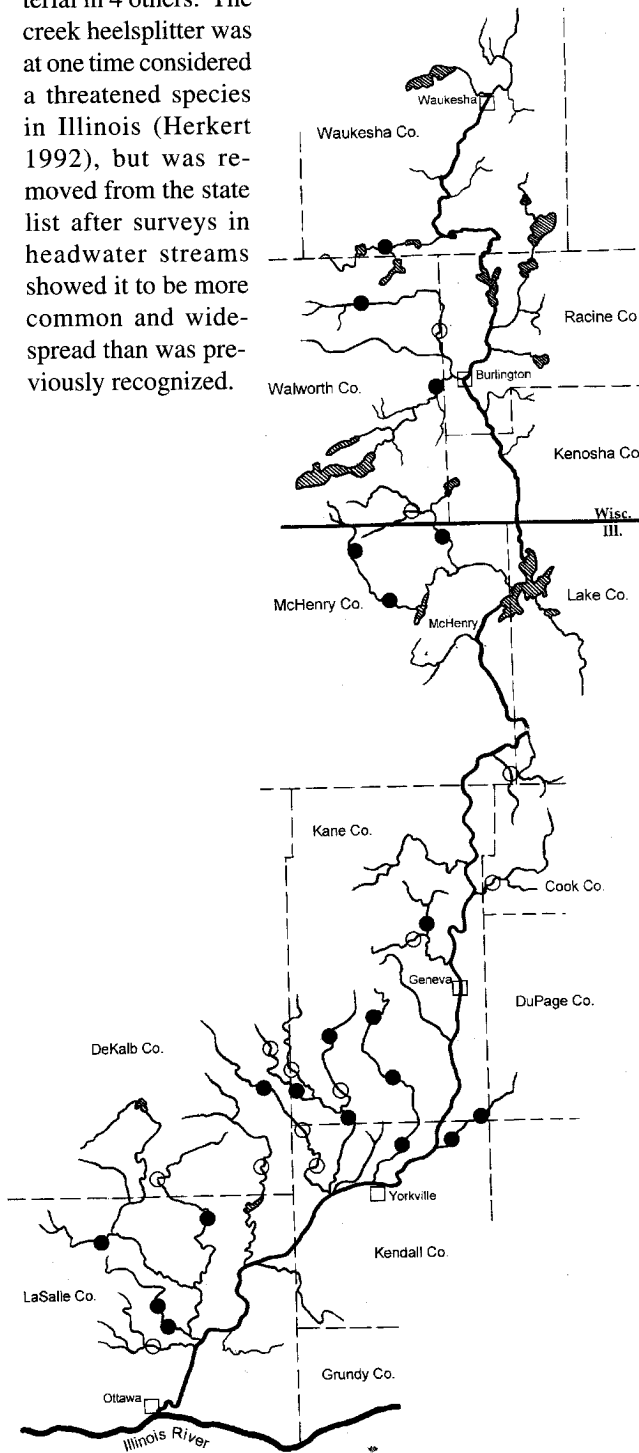
*Lasmigona complanata* (Barnes, 1823) — white heelsplitter

A widespread and common species in the Midwest (Cummings and Mayer 1992), the white heelsplitter has been collected in large numbers in several recent mussel surveys in Illinois (Schanzle and Kruse 1994; Schanzle and Cummings 1991; Cummings et al. 1988a, 1988b, 1989; Suloway et al. 1981). Baker (1928) found it to be “widely, though irregularly distributed” in Wisconsin. *Lasmigona complanata* ranked third in abundance in the current survey, numbering 483 individuals (13.5% of the total), and was collected live at 18 of the 23 mainstem stations and in 15 of the 26 tributary streams that were sampled within the basin.



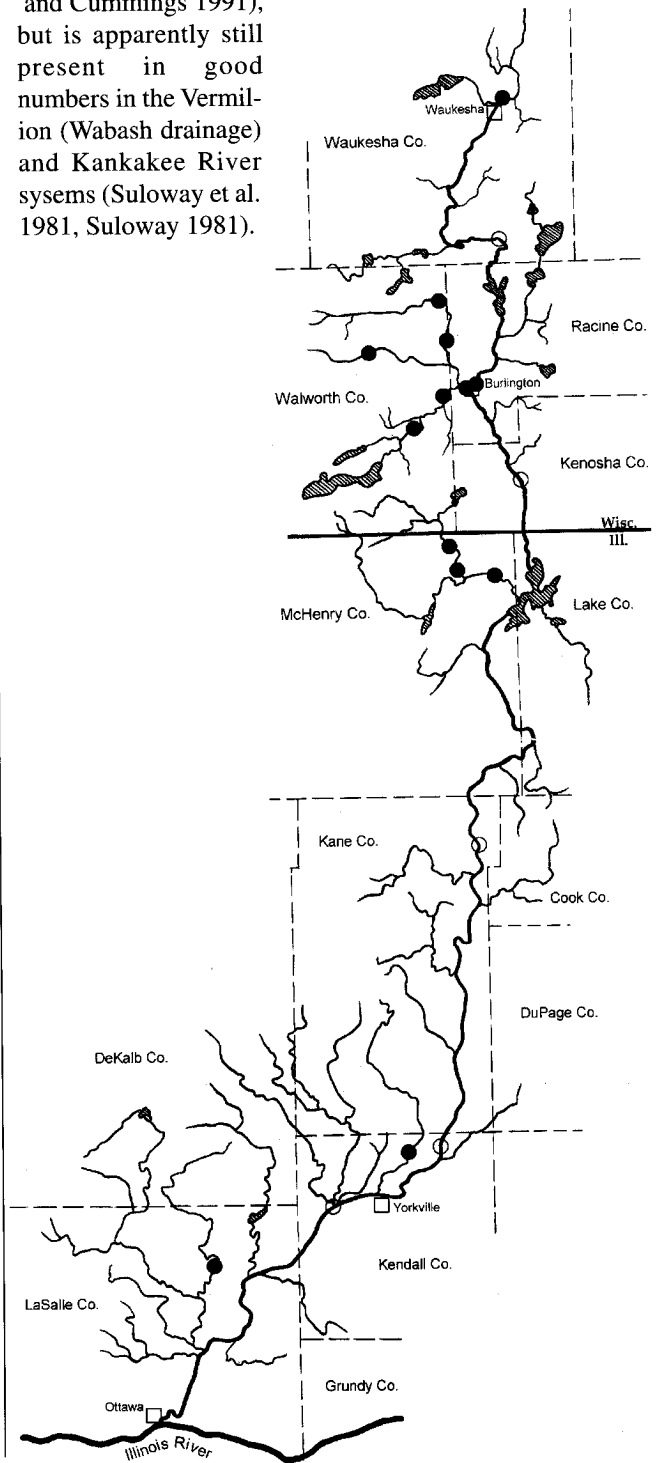
*Lasmsgona compressa* (I. Lea, 1829) — creek heelsplitter

Baker (1928) found the creek heelsplitter to be widely distributed in the Mississippi and Great Lakes drainages in Wisconsin, but did not specifically list it in the “Fox River of Illinois.” A species found in “Creeks and the headwaters of small to medium rivers” (Cummings and Mayer 1992), *L. compressa* was not collected from the Fox River’s mainstem but was represented by live specimens (totaling 61 individuals) in 13 of the tributary streams that were sampled, and by dead or weathered material in 4 others. The creek heelsplitter was at one time considered a threatened species in Illinois (Herkert 1992), but was removed from the state list after surveys in headwater streams showed it to be more common and widespread than was previously recognized.



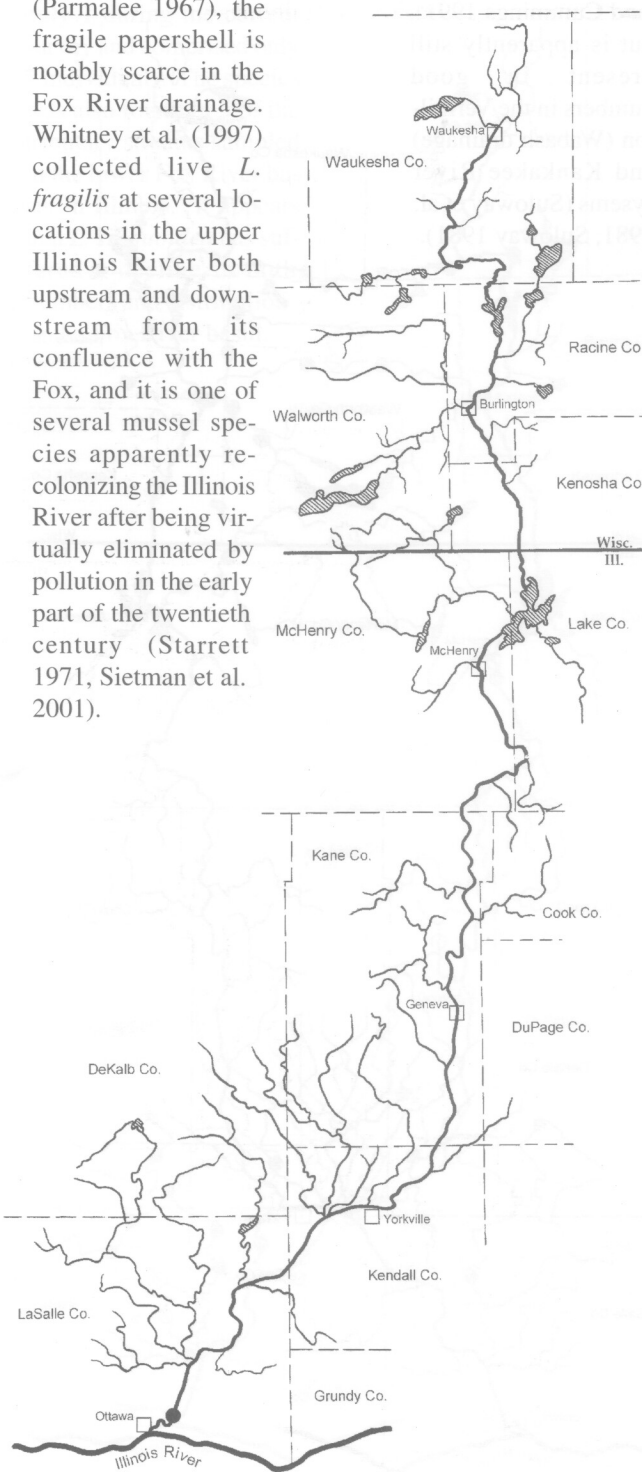
*Lasmsgona costata* (Rafinesque, 1820) — flutedshell

Matteson (unpublished data) collected live flutedshells at only 1 Fox River mainstem station, and only weathered material was found in the Illinois section of the mainstem during the 1997–2001 survey. However, live flutedshells were collected at 2 mainstem stations in Wisconsin, including 20 at a station in Burlington, and small numbers were also collected in 4 tributary streams in Illinois and 3 in Wisconsin. The flutedshell appears to be on the decline in many streams in Illinois (Schanzle and Cummings 1991), but is apparently still present in good numbers in the Vermilion (Wabash drainage) and Kankakee River systems (Suloway et al. 1981, Suloway 1981).



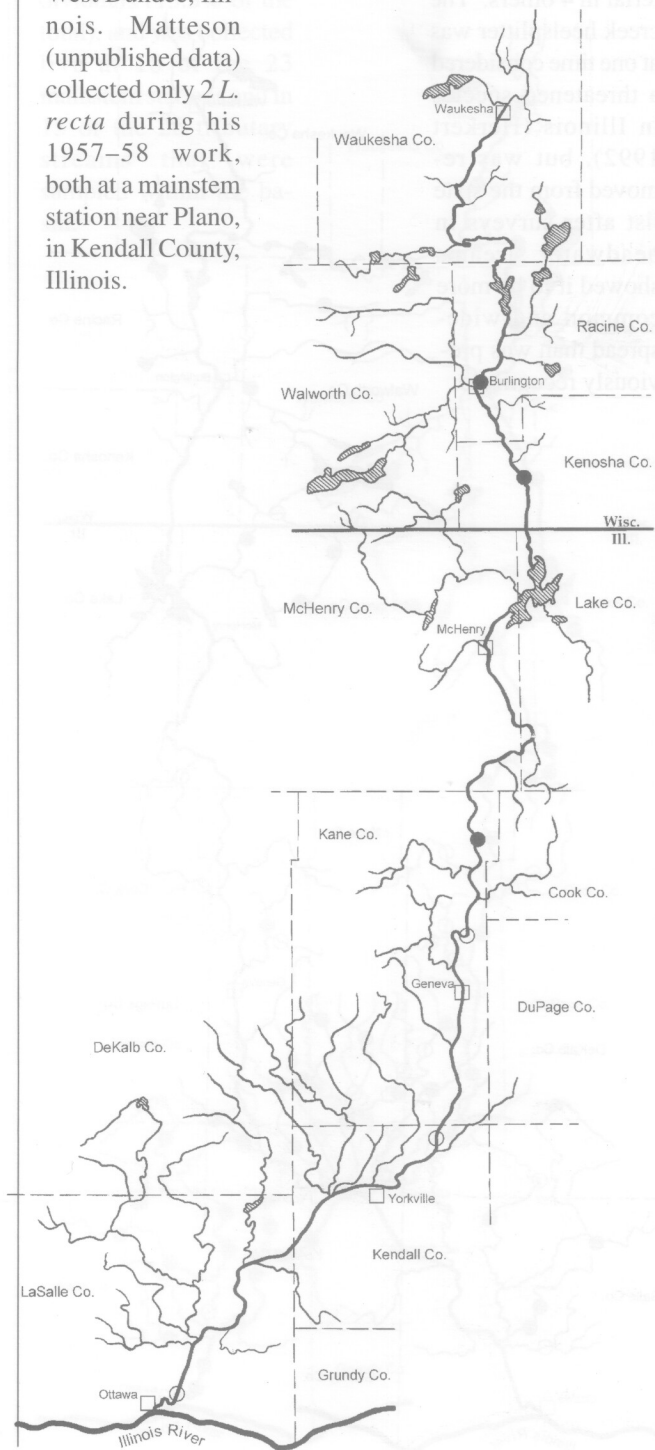
***Leptodea fragilis*** (Rafinesque, 1820) — fragile papershell

The fragile papershell was represented in the Fox River basin by only 2 live specimens, both collected at Station 23 in the lower portion of the river downstream from the dam at Dayton in LaSalle County, Illinois. No specimens of *L. fragilis*, live or dead, were collected upstream from Dayton or in any of the tributary streams sampled during the 1997–2001 survey. Although considered “wide-ranging and usually common in both the smaller streams and large rivers...” (Parmalee 1967), the fragile papershell is notably scarce in the Fox River drainage. Whitney et al. (1997) collected live *L. fragilis* at several locations in the upper Illinois River both upstream and downstream from its confluence with the Fox, and it is one of several mussel species apparently re-colonizing the Illinois River after being virtually eliminated by pollution in the early part of the twentieth century (Starrett 1971, Sietman et al. 2001).



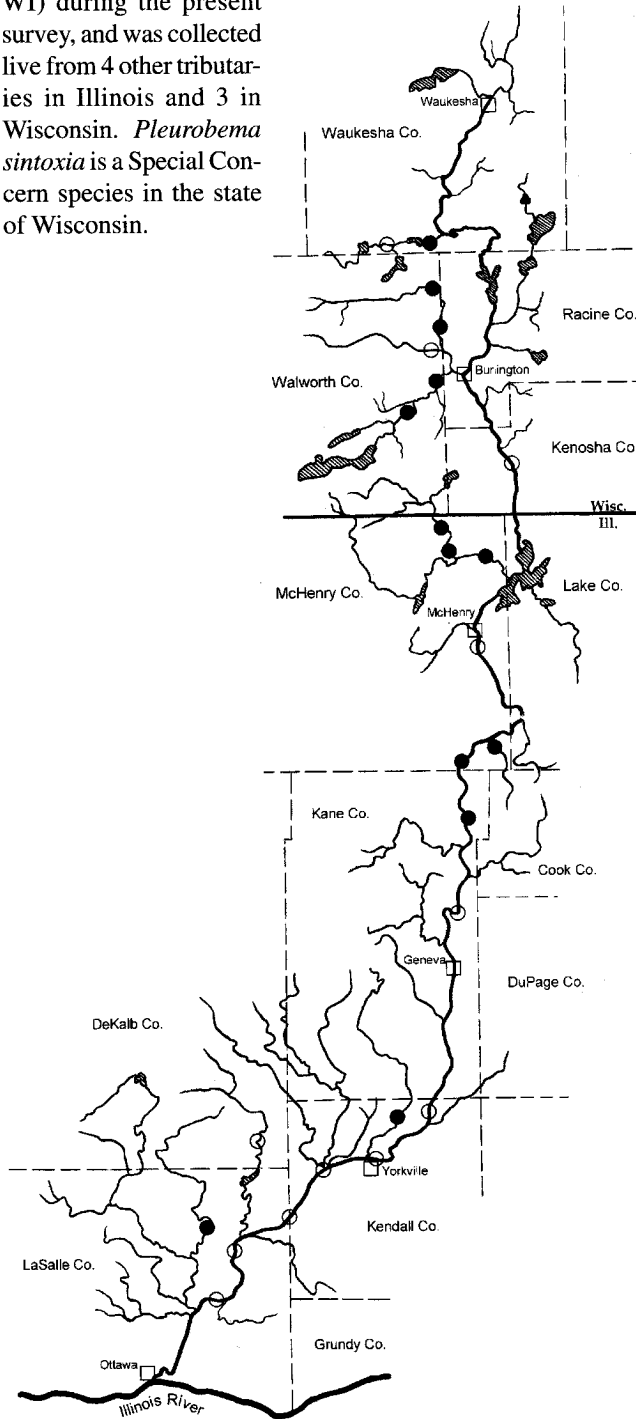
***Ligumia recta*** (Lamarck, 1819) — black sandshell

The black sandshell has become scarce in Illinois and was recently added to the state’s threatened species list (Illinois Endangered Species Protection Board 1999). The species is not listed in Wisconsin, where Baker (1928) found it to occur “in all of the drainage areas excepting that of Lake Superior.” Only 4 black sandshells were collected during the current survey, 1 each at Stations 5 and 6 on the Fox River’s mainstem in Wisconsin, and 2 at Station 11 on the mainstem at West Dundee, Illinois. Matteson (unpublished data) collected only 2 *L. recta* during his 1957–58 work, both at a mainstem station near Plano, in Kendall County, Illinois.



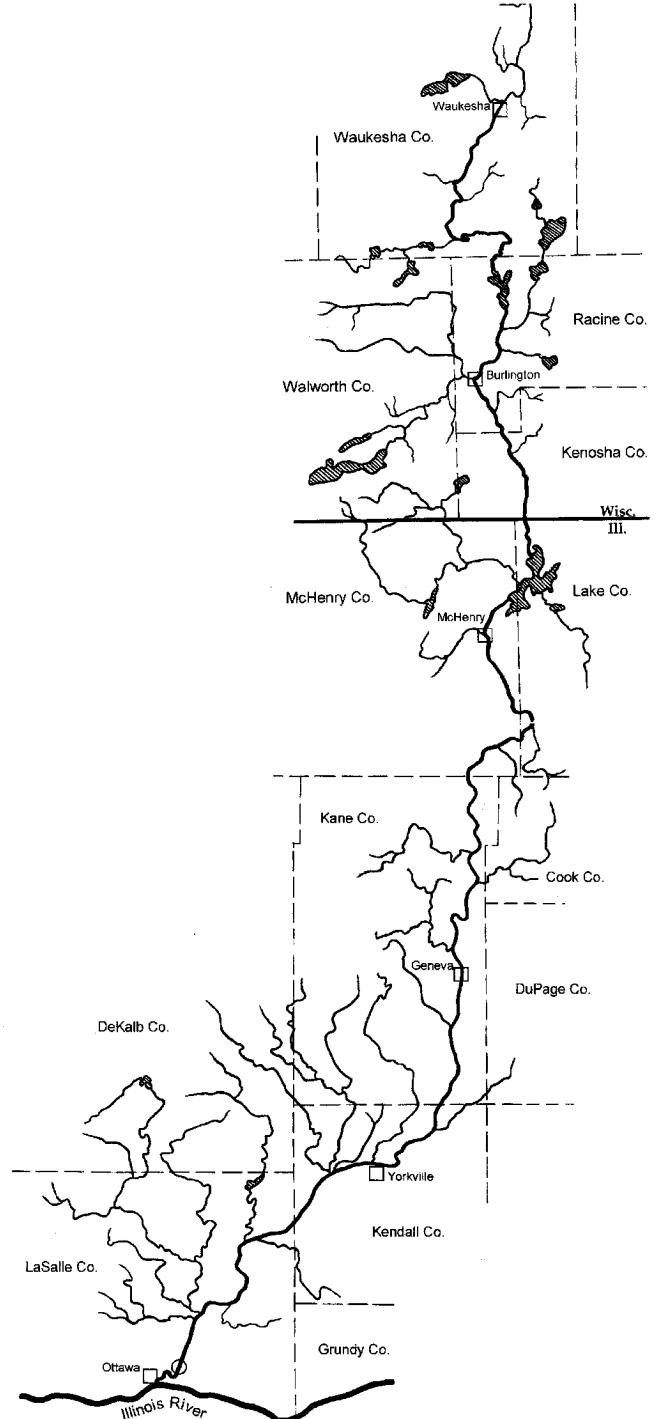
***Pleurobema sintoxia*** (Rafinesque, 1820) — round pigtoe

Cummings and Mayer (1992) considered the round pigtoe “Widespread but usually uncommon” in the Midwest. The species appears to be on the decline in the Fox River mainstem. Whereas Matteson (unpublished data) collected live *P. sintoxia* (27 specimens) both upstream and downstream from the highly urbanized section of the river in Kane County, live material was found during the current survey only at 2 upper-river stations in Illinois (6 specimens). The species was found in large numbers in the North Branch of Nippersink Creek (IL/WI) during the present survey, and was collected live from 4 other tributaries in Illinois and 3 in Wisconsin. *Pleurobema sintoxia* is a Special Concern species in the state of Wisconsin.



***Potamilus alatus*** (Say, 1817) — pink heelsplitter

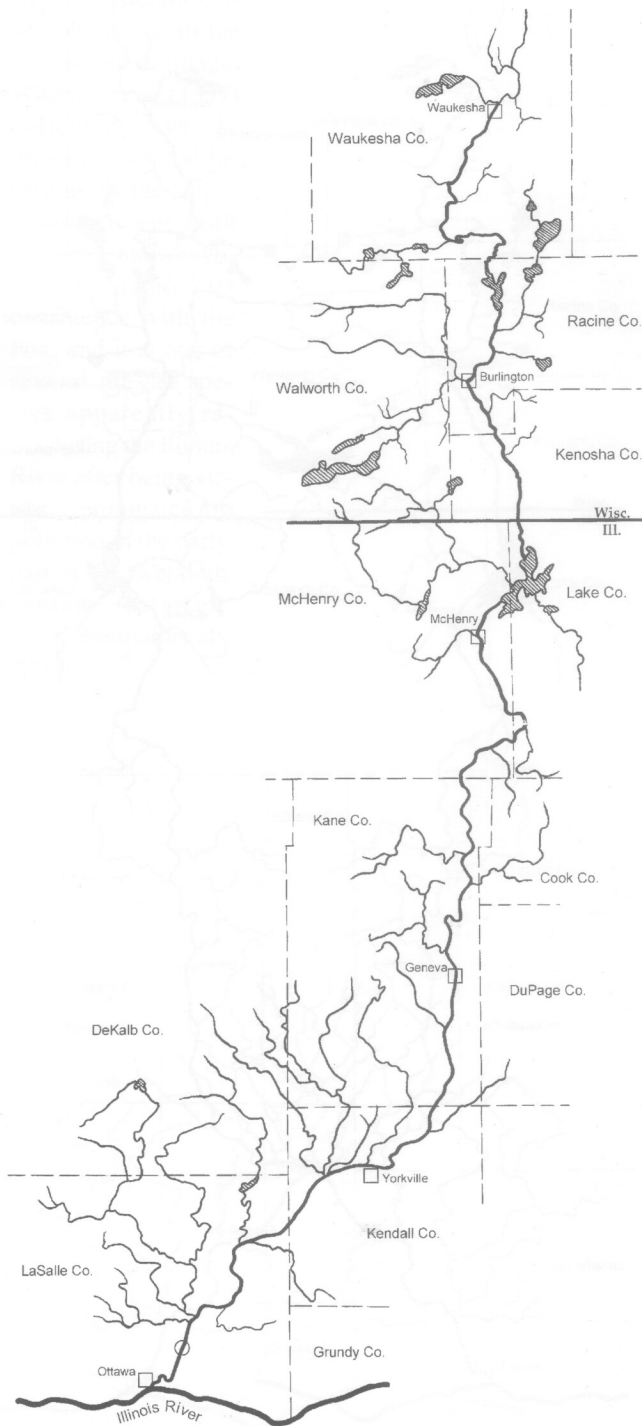
The pink heelsplitter was represented in the current survey by a single weathered dead specimen collected at the farthest downstream station (23) near the Fox River’s confluence with the Illinois River at Ottawa. No specimens of *P. alatus*, live or dead, were collected in any of the tributary streams sampled. It was historically found in the Fox River at Dundee (CHAS 5740) by Calkins. Although considered “widespread and relatively common” in the upper Midwest (Cummings and Mayer 1992), the pink heelsplitter is notably scarce in the Fox River drainage.



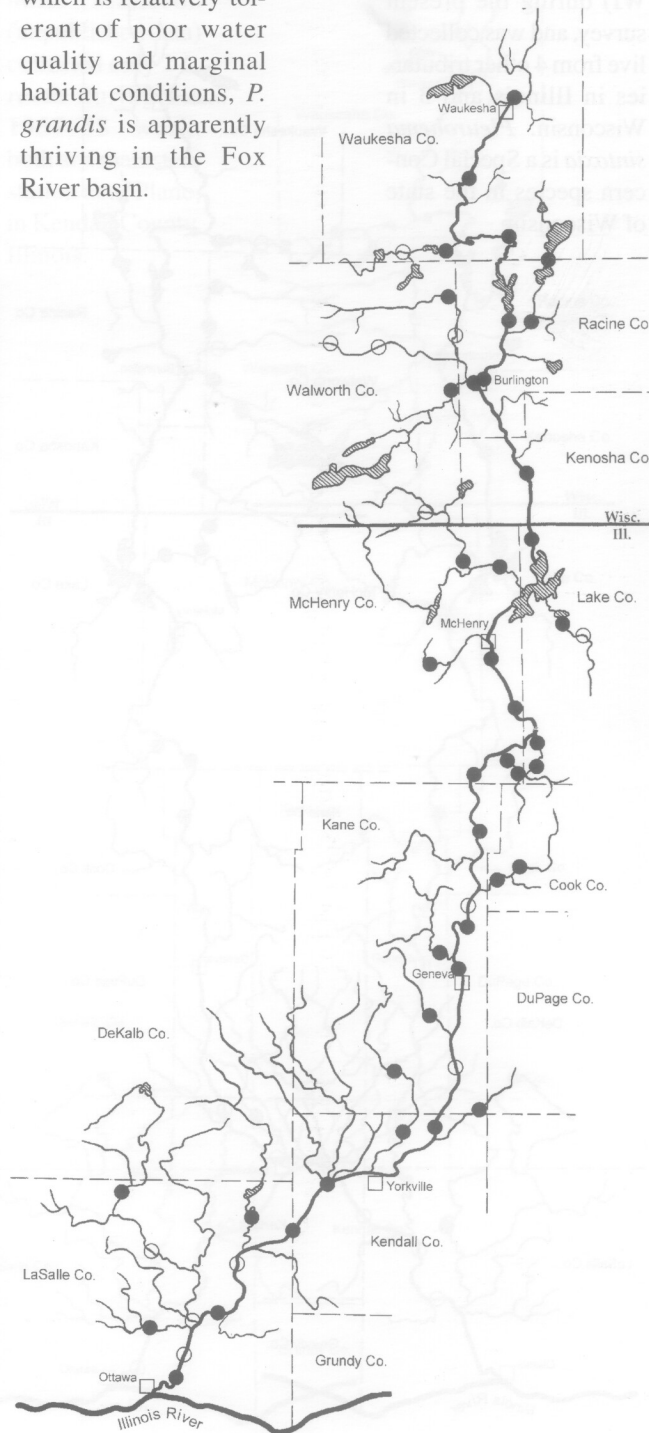


*Potamilus ohiensis* (Rafinesque, 1820) — pink papershell

The pink papershell is also poorly represented in the Fox River drainage as evidenced by the single dead individual collected during the present survey at Station 22 in the downstream portion of the Fox River's mainstem. Matteson (unpublished data) collected only 1 live pink papershell (at the same location) during his 1957–58 survey of several mainstem stations. Baker (1928) noted that the pink papershell was known in Wisconsin "only from the Mississippi River", and though "not common in Wisconsin, ...in Illinois it is fairly common in many streams."

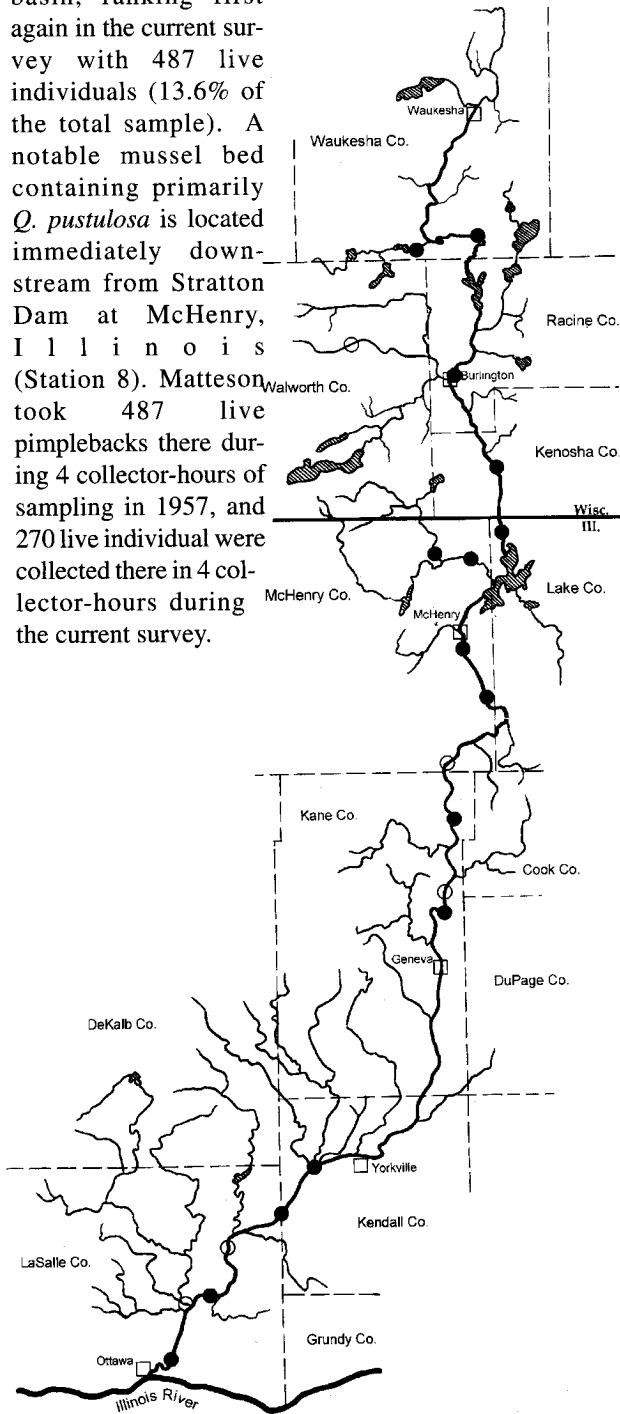
*Pyganodon grandis* (Say, 1829) — giant floater

Considered widespread and common in the Midwest (Cummings and Mayer 1992), the giant floater was the second most frequently collected species in the current survey with 486 live individuals and made up 13.6% of the total sample. Interestingly, while Matteson (unpublished data) collected only 11 live *P. grandis* at 5 mainstem stations, 258 were taken at the 23 mainstem stations sampled during the current survey (111 of these at stations common to both surveys). The giant floater was also collected live in 18 of the 26 tributary streams sampled. A species which is relatively tolerant of poor water quality and marginal habitat conditions, *P. grandis* is apparently thriving in the Fox River basin.



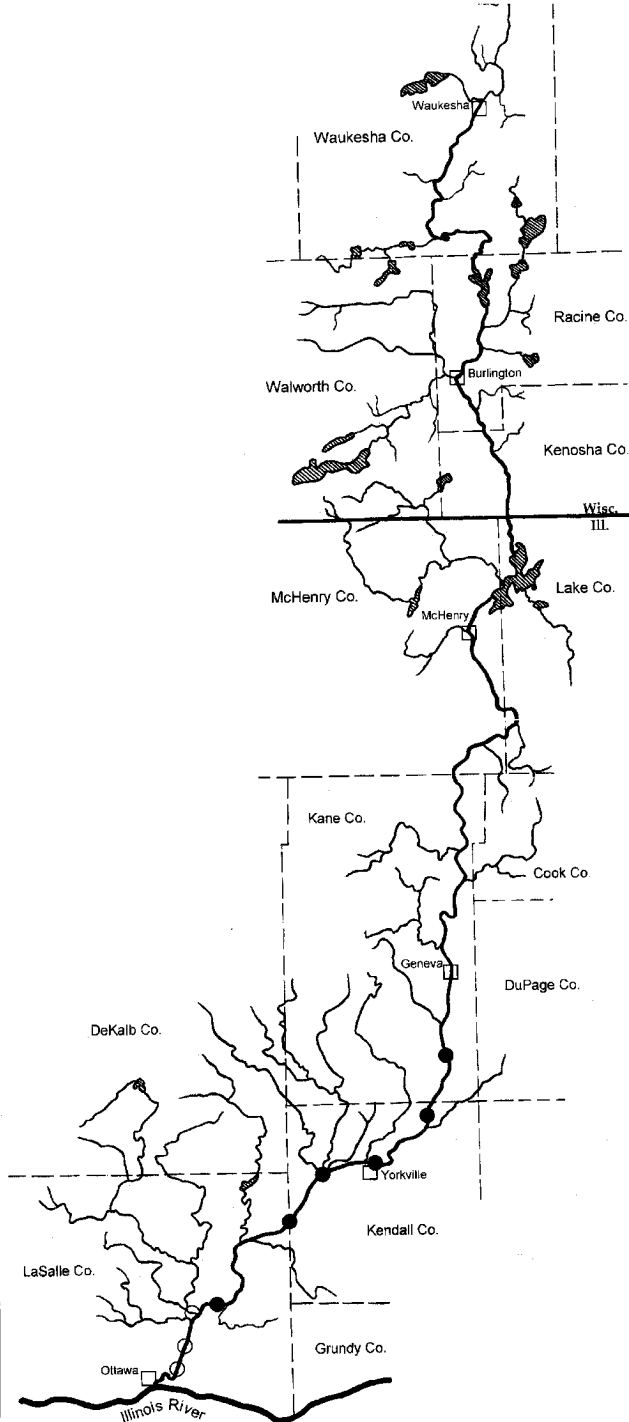
***Quadrula pustulosa* (I. Lea, 1831) — pimpleback**

Eldridge (1914) reported that the “warty-back”, as he called it, “is extremely rare (in the Fox), but two specimens of this species being seen during the investigation out of thousands of shells along the river.” However, he added that “...it is stated (by shellers) that it was once common.” The pimpleback was far and away the most common species collected in the Fox River mainstem during Matteson’s 1957–58 survey, when 620 individuals representing more than 36% of the total collection were taken. The species is still quite common in the basin, ranking first again in the current survey with 487 live individuals (13.6% of the total sample). A notable mussel bed containing primarily *Q. pustulosa* is located immediately downstream from Stratton Dam at McHenry, Illinois (Station 8). Matteson took 487 live pimplebacks there during 4 collector-hours of sampling in 1957, and 270 live individual were collected there in 4 collector-hours during the current survey.



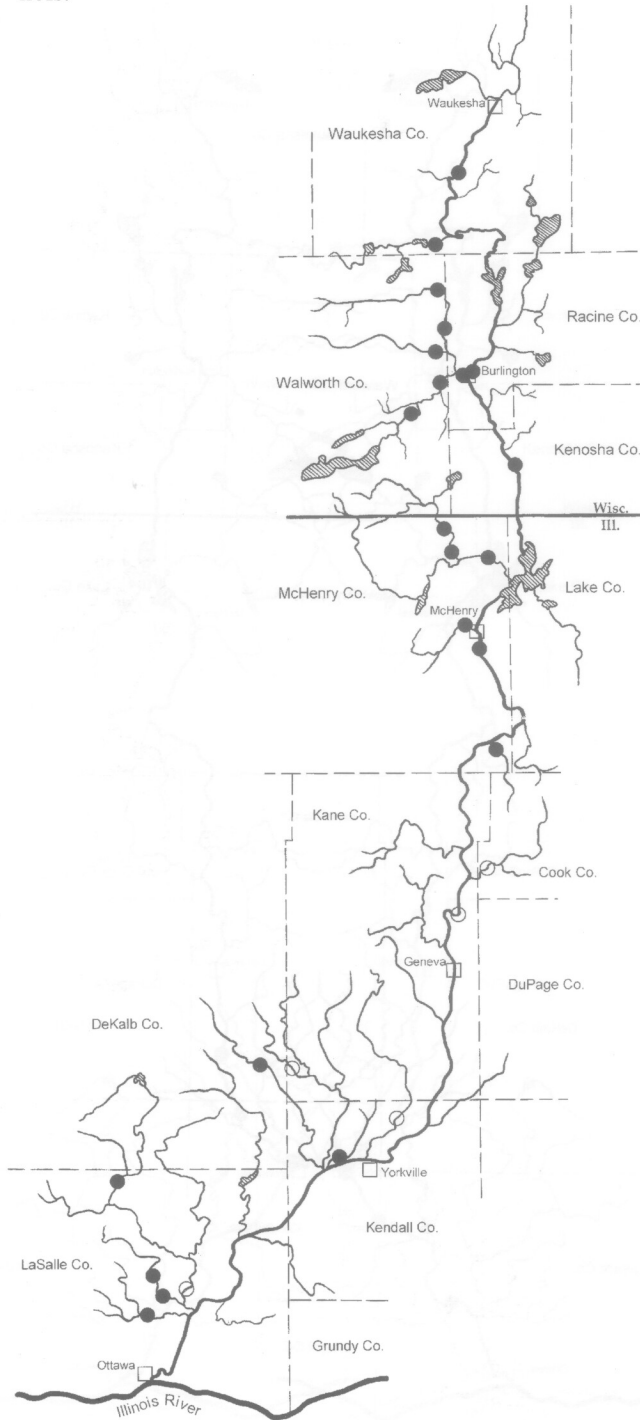
***Quadrula quadrula* (Rafinesque, 1820) — mapleleaf**

Matteson (unpublished data) collected 51 mapleleaves during his 1957–58 survey of mainstem stations in Illinois, and 31 were taken during the current survey. Interestingly, in both cases, live individuals of this species were collected only at stations on the lower Fox River between Geneva and the river’s mouth at Ottawa. A single weathered dead *Q. quadrula* from Indian Creek (IL) was the only tributary collection of the species. Neither Baker (1928) nor Mathiak (1979) listed the mapleleaf from the Fox River within Wisconsin.



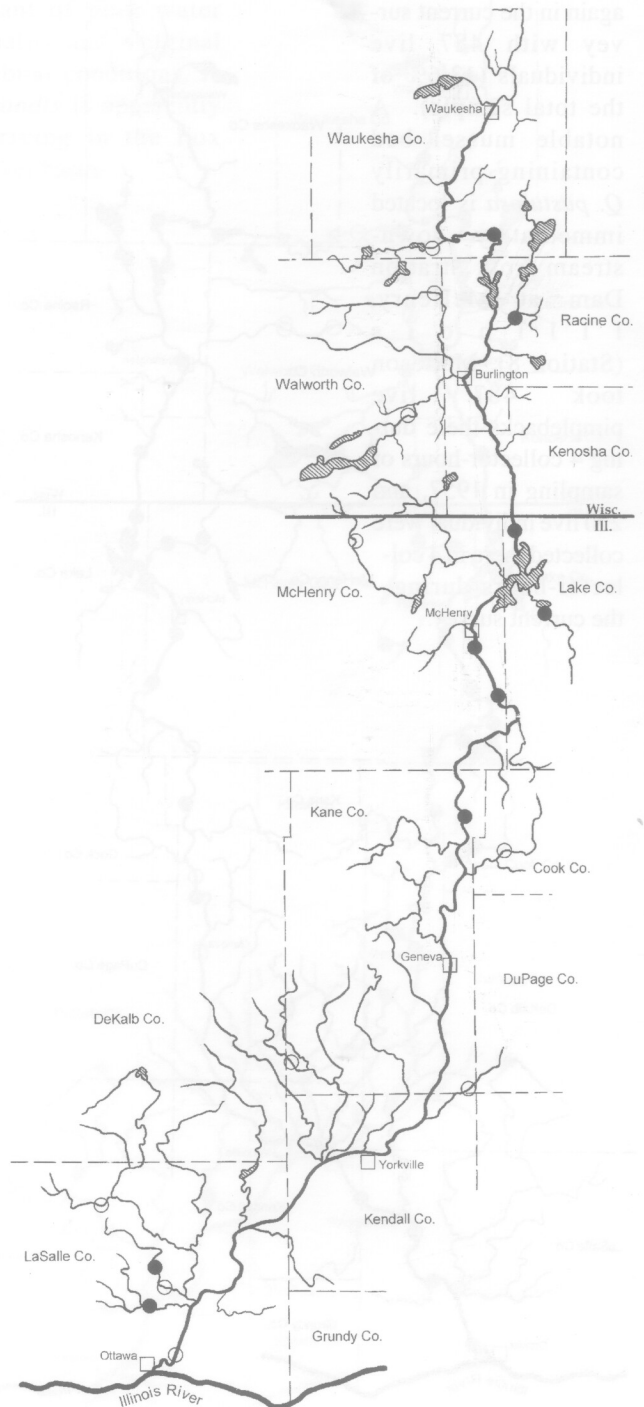
*Strophitus undulatus* (Say, 1817) — creeper

Considered widespread and common in the Midwest (Cummings and Mayer, 1992), the creeper is well represented in the upper portions of the Fox River basin. While only 1 live *S. undulatus* was collected in the river's mainstem in Illinois, 21 were collected at 3 mainstem stations in Wisconsin. Live creepers were also found in 13 of the 26 tributary streams sampled, and dead or weathered material was present in 3 additional tributaries. Matteson (unpublished data) collected only 2 live creepers during his 1957–58 work, both from the lower Fox River mainstem near Ottawa, Illinois.



*Toxolasma parvus* (Barnes, 1823) — lilliput

The lilliput was collected in small numbers from the Fox River mainstem during the current survey, totaling only 6 specimens. Sporadic in the tributaries sampled during this study, the species was collected live only in Crooked Leg Creek, Buck Creek, and Squaw Creek (IL), and the Muskego/Wind Lake Drainage Canal (WI). Of the 73 live lilliputs collected, 61 came from a single station on Buck Creek. The lilliput is typically very small in size and may be easily overlooked where it occurs.

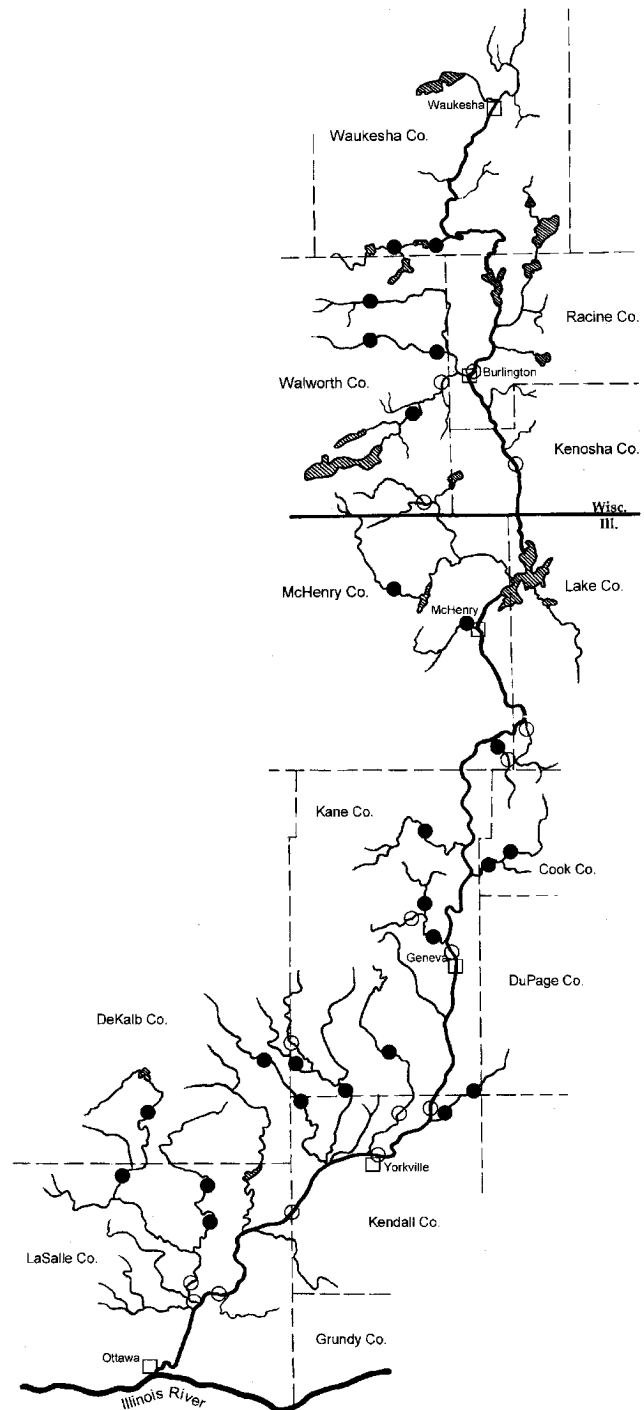
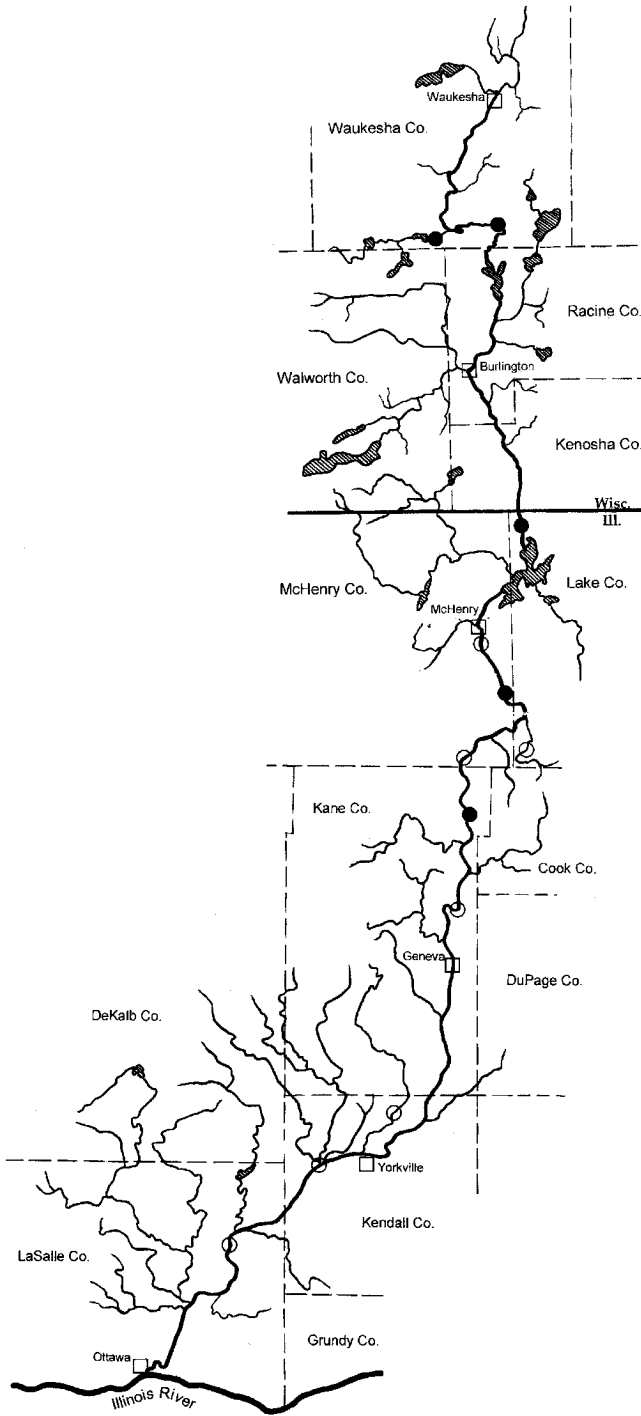


***Utterbackia imbecillis* (Say, 1829) — paper pondshell**

“Widespread and locally abundant” in the Midwest (Cummings and Mayer 1992), the paper pondshell was not found in large numbers in the Fox River basin during the current survey. Only 12 live individuals were collected at 4 mainstem stations, and only 2 were taken from the 73 tributary stations sampled—both at Station 25 on the Mukwonago River (WI). Dead or weathered material was collected at 5 additional mainstem stations, and at 2 tributary stations.

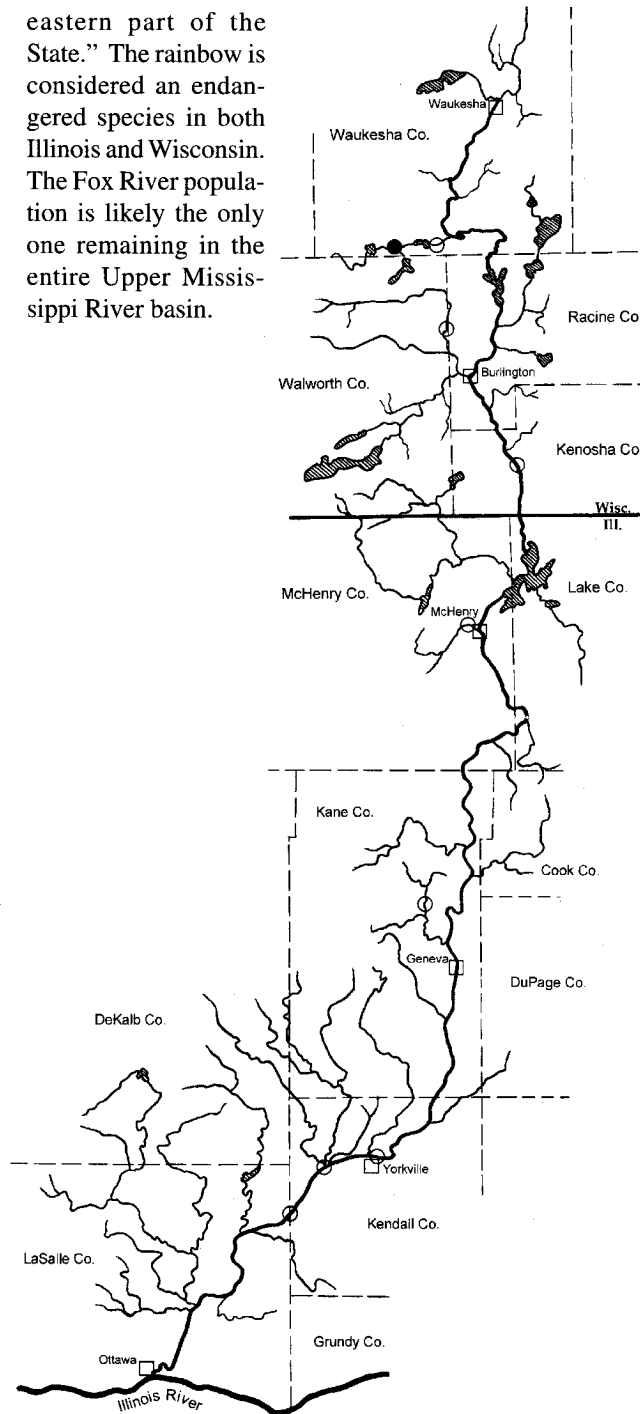
***Venustaconcha ellipsiformis* (Conrad, 1836) — ellipse**

The ellipse is listed as a threatened species in Wisconsin, but currently has no special status in Illinois. The species is not uncommon in the Fox River basin. Typically found in headwater areas, *V. ellipsiformis* was collected live in 16 of the 26 tributaries sampled in Illinois and Wisconsin (174 specimens total), and was represented by weathered material in 2 other tributaries. Baker (1928) noted that the ellipse, “a rare shell” in Wisconsin, “appears to be more abundant in the southeastern part of the state.”



*Villosa iris* (I. Lea, 1829) — rainbow

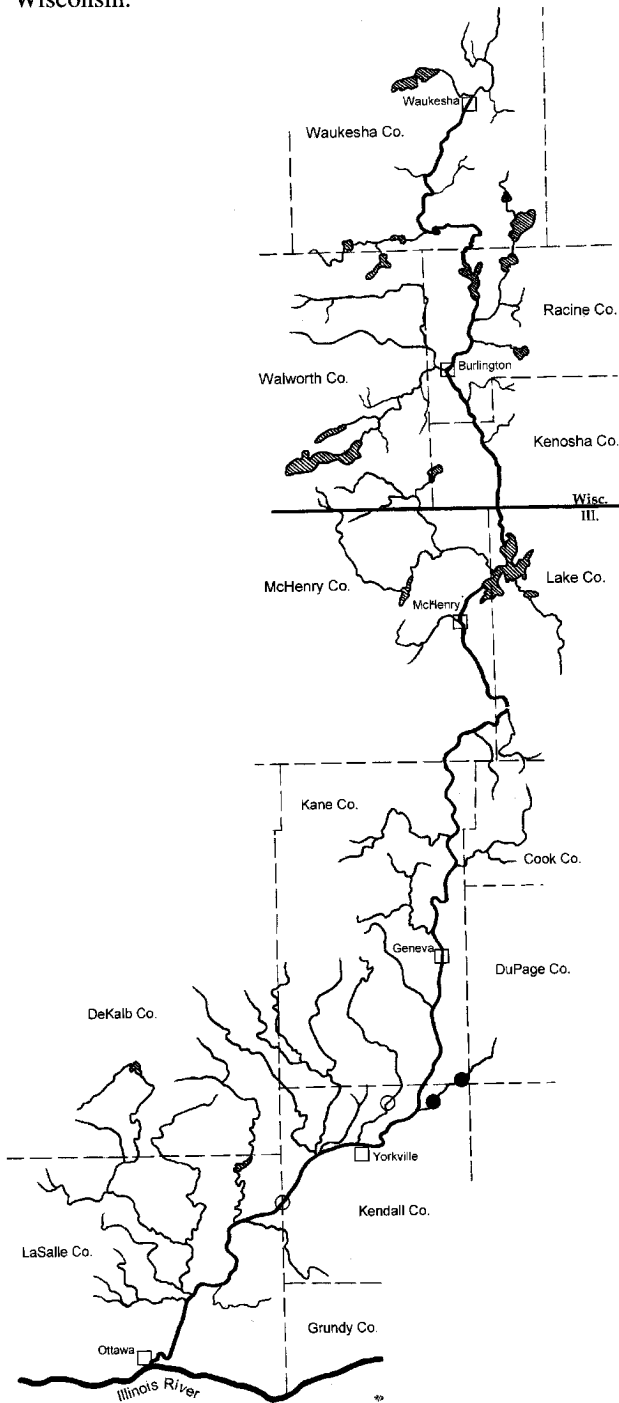
Considered widespread but disappearing from the western part of its range (Cummings and Mayer 1992), the rainbow was represented in the Illinois portions of the Fox River basin only by weathered or subfossil material. However, several live rainbows were collected in the Mukwonago River in Wisconsin, where the species was found in association with the spike (*E. dilatata*), another uncommon mussel. Baker (1928) noted the rainbow's presence in the Mukwonago River, and stated that the species in Wisconsin was "Apparently restricted to the southeastern part of the State." The rainbow is considered an endangered species in both Illinois and Wisconsin. The Fox River population is likely the only one remaining in the entire Upper Mississippi River basin.



INTRODUCED SPECIES

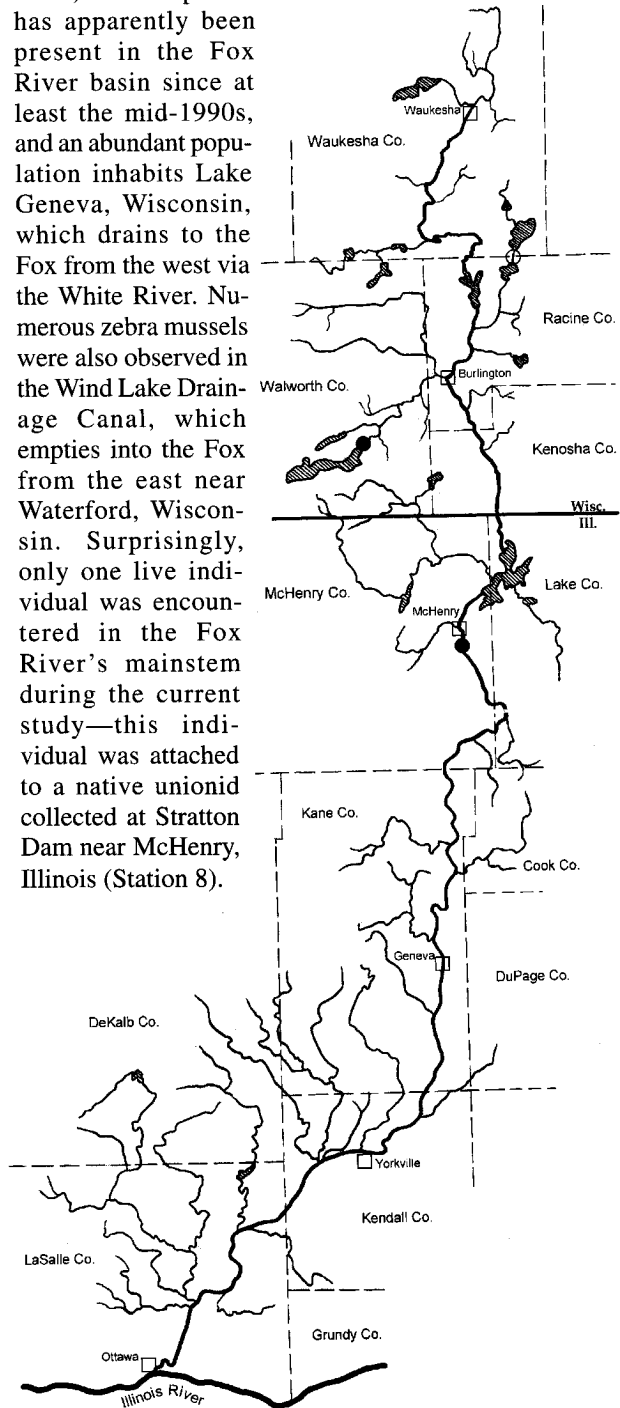
*Corbicula fluminea* (Müller, 1774) — Asian clam

Although the Asian clam is well established in many Mid-west lakes and streams, it does not appear to be particularly abundant in the Fox River basin at this time. Except in Waubonsie Creek (IL), where 31 live specimens were collected, no live *C. fluminea* were found. While weathered shells were collected at 1 mainstem station and at 1 station on Blackberry Creek, both in Illinois, none were found in Wisconsin.



*Dreissena polymorpha* (Pallas, 1771) — zebra mussel

Apparently introduced into the Great Lakes in 1985 or 1986 (Hebert et al. 1989), the zebra mussel was first collected in the Illinois and Mississippi rivers during the summer of 1991 (Sparks and Marsden 1991). Within a year, it was being reported throughout the Illinois River, and in the upper Mississippi River from LaCrosse, Wisconsin, to Alton, Illinois (National Fisheries Research Center 1992). The species has apparently been present in the Fox River basin since at least the mid-1990s, and an abundant population inhabits Lake Geneva, Wisconsin, which drains to the Fox from the west via the White River. Numerous zebra mussels were also observed in the Wind Lake Drainage Canal, which empties into the Fox from the east near Waterford, Wisconsin. Surprisingly, only one live individual was encountered in the Fox River's mainstem during the current study—this individual was attached to a native unionid collected at Stratton Dam near McHenry, Illinois (Station 8).



## SPECIES OF POSSIBLE HISTORIC OCCURRENCE

*Arcidens confragosus* (Say, 1829) — rock pocketbook

Baker (1906) attributed the rock pocketbook to “Northern Illinois (Calkins)...and Fox River (Call).” However, no specimens of *A. confragosus*, live, dead, or subfossil, were collected during the current study, and no museum records of the species attributable to the Fox River are known to exist. The Fox River is not included in the rock pocketbook’s presumed range in the Midwest (Cummings and Mayer 1992), and it is uncertain whether the species historically occurred there. It is possible that the Call collections cited by Baker actually came from another Fox River, a small stream in White County, Illinois, opposite New Harmony, Indiana, from which the type specimens of *P. grandis* (Say 1829) were collected. *Arcidens confragosus* is listed as a threatened species in the state of Wisconsin.

*Lampsilis fasciola* Rafinesque, 1820 — wavyrayed lampmussel

Baker (1906) listed *L. fasciola* (as *L. multiradiata* Lea) among the mussel species occurring in the Fox River, citing a collection by E.W. Engleholm from “Dundee, Kane Co.” Page et al. (1998) stated: “Four specimens of the wavy-rayed lampmussel...labeled ‘Dundee’ are in the collections of the Chicago Academy of Sciences,” but noted “This species is largely restricted to the Wabash River drainage in Illinois” and “No other wavy-rayed lampmussels have ever been collected in the Fox River...” No live, dead or subfossil *L. fasciola* were collected during the current survey, and it is likely that the species, if it was ever extant in the Fox River basin, has been extirpated. The wavyrayed lampmussel is an endangered species in Illinois.

*Obovaria olivaria* (Rafinesque, 1820) — hickorynut

Baker (1906) listed *O. olivaria* (as *O. ellipsis* Lea) among the mussel species occurring in northern Illinois, citing a collection by W.W. Calkins. A Calkins specimen labeled “Fox River, Illinois” resides in the National Museum of Natural History, Smithsonian Institution collection (USNM 58171). The hickorynut has not been reported in the Fox River by recent researchers, and no live, dead, or subfossil specimens were collected during the current survey. If the hickorynut was once extant in the Fox River basin, it has likely been extirpated.

*Plethobasus cyphus* (Rafinesque, 1820) — sheepnose

Baker (1906) attributed *P. cyphus* (as *Pleurobema aesopus* Green) to the “Fox River, Dundee, Kane Co.,” citing a specimen collected by A. W. Connor which resides in the collec-

tion of the Chicago Academy of Science (CHAS 5748). Page et al. (1998) stated “A single record of the sheepnose...from ‘Dundee, Illinois’ is present in the collections of the Chicago Academy of Sciences. No live individuals have been collected in over 50 years and it is likely extirpated from the (Fox River) drainage.” The sheepnose was not reported by other Fox River researchers (Table 1), and no live, dead, or subfossil specimens were collected during the current survey. The sheepnose is listed as a threatened species in Illinois and an endangered species in Wisconsin.

*Quadrula metanevra* (Rafinesque, 1820) — monkeyface

Although the monkeyface was not represented by live, dead, or subfossil specimens in the current survey, the Illinois Natural History Survey collection contains a specimen taken from the Fox River at Yorkville in 1991 (INHS 13153). In addition, a *Q. metanevra* specimen labeled “Fox River, Aurora” is in the collection of the Field Museum of Natural History (FMNH 22586). While the monkeyface is, at best, quite scarce in the Fox River basin, it appears to be relatively common in the nearby Kankakee River (Suloway 1981). The monkeyface is considered a threatened species in Wisconsin.

*Tritogonia verrucosa* (Rafinesque, 1820) — pistolgrip

No live, dead, or subfossil specimens of the pistolgrip were collected during the present survey, but the Illinois Natural History Survey database contains two records attributable to the Fox River. The first (INHS 583) is labeled “Fox River, Ottawa,” but bears no information identifying the collector or date of collection. The second is a specimen in the collection of the Chicago Academy of Sciences (CHAS 5741), which bears the notation “Fox River, Dundee.” The latter specimen, collected by E.W. Engleholm, was mentioned by Baker in his 1906 publication. The pistolgrip is a threatened species in Wisconsin.

*Truncilla donaciformis* (I. Lea, 1828) — fawnsfoot

The fawnsfoot was not collected either live or dead during the current survey, but is likely present in at least the lower portion of the Fox River as indicated by a specimen collected in 1992. The specimen, a juvenile with byssal thread (INHS 13842), was taken from the mainstem of the Fox near Ottawa in LaSalle County. Though not documented in the Fox River by earlier researchers (Table 1), the fawnsfoot is present in the Illinois River (Whitney et al. 1997) and presumably inhabits the Fox River at least as far upstream as the dam at Dayton. *Truncilla donaciformis* is a Special Concern species in the state of Wisconsin.

## LITERATURE CITED

- Baker, F.C. 1906. A catalogue of the Mollusca of Illinois. Bulletin of the Illinois State Laboratory of Natural History 7(6):53–136.
- Baker, F.C. 1928. The fresh water Mollusca of Wisconsin. Part II. Pelecypoda. Bulletin of the Wisconsin Geological and Natural History Survey, Vol. 70, No. 2. University of Wisconsin. vi + 495 pp.
- Calkins, W.W. 1874. The land & fresh water shells of LaSalle County, Ills. Proceedings of the Ottawa Academy of Natural Sciences. H. Mcallaster & Co., Printers, Chicago. 48 pp.
- Chadwick, G.H. 1905. List of Wisconsin shells. The Nautilus 19(5):57–60.
- Cummings, K.S., L. Suloway, and L.M. Page. 1988a. The freshwater mussels (Mollusca: Bivalvia: Unionidae) of the Embarras River in Illinois: 30 years of stream change. Technical Report 1988(2) Section of Faunistic Surveys and Insect Identification, Ill. Nat. Hist. Surv. 22 pp.
- Cummings, K.S., C.A. Mayer, and L.M. Page. 1988b. The freshwater mussels (Mollusca: Bivalvia: Unionidae) of the Mackinaw River in Illinois. Technical Report 1988(3) Section of Faunistic Surveys and Insect Identification, Ill. Nat. Hist. Surv. 20 pp.
- Cummings, K.S., C.A. Mayer, and L.M. Page. 1989. Survey of the freshwater mussels (Bivalvia: Unionidae) in the Little Wabash River drainage, Illinois. Technical Report 1989(1) Section of Faunistic Surveys and Insect Identification, Ill. Nat. Hist. Surv. 37 pp.
- Cummings, K.S., and C.A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.
- Cummings, K.S., and C.A. Mayer. 1997. Distributional checklist and status of Illinois mussels (Mollusca: Unionacea). Pages 129–145 in K.S. Cummings, A.C. Buchanan, C.A. Mayer and T.J. Naimo, eds. Conservation and management of freshwater mussels II: initiatives for the future. Proceedings of a UMRCC Symposium, 16–18 October 1995, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois. 293 pp.
- Day, D.M., H. Brown, K. Clodfelter, J. Ferencak, J. Langbein, and R. Miller. 1992. The Fox River: temporal and spatial relationships in the fish community of an increasingly urbanized watershed (1978–1990). Streams Program, Illinois Department of Conservation, Aledo, Illinois. 36 pp.
- Eldridge, J.A. 1914. The mussel fishery of the Fox River. Appendix VII:1–8. to the Report of the U.S. Commissioner of Fisheries for 1913.
- Fritz, A.W. Mussel survey of the Rock River in Illinois, 1986–1989. Illinois Department of Conservation. (Unpublished).
- Healy, R.W. 1979. River mileages and drainage areas for Illinois streams. Vol. 2. Illinois River basin. U.S. Geological Survey. Water-Resources Investigations 79-111. 302 pp.
- Hebert, P.D.N., B.W. Muncaster, and G.L. Mackie. 1989. Ecological and genetic studies on *Dreissena polymorpha* (Pallas): a new mollusc in the Great Lakes. Canadian Journal of Fisheries and Aquatic Sciences 46(9):1587–1591.
- Herkert, J.R. Ed. 1992. Endangered and threatened species of Illinois: status and distribution. Vol. 2. animals. Illinois Endangered Species Protection Board, Springfield, Illinois. 142 pp.
- Illinois Endangered Species Protection Board. 1999. Checklist of endangered and threatened animals and plants of Illinois. Illinois Endangered Species Protection Board, Springfield, Illinois. 20 pp.
- Knapp, H.V. 1988. Fox river basin streamflow assessment model: hydrologic analysis. Illinois State Water Survey, Surface Water Section. SWS Contract Report 454. 109 pp.
- Mathiak, H.A. 1979. A river survey of the unionid mussels of Wisconsin 1973–1977. Sand Shell Press, Horicon, Wisconsin. 75 pp.
- Metcalf-Smith, J.L., S.K. Staton, G.L. Mackie, and N.M. Lane. 1998. Changes in the biodiversity of freshwater mussels in the Canadian waters of the lower Great Lakes drainage basin over the past 140 years. Journal of Great Lakes Research 24(4):845–858.
- National Fisheries Research Center. 1992. Zebra mussel distribution in North America, 10 September 1992. Gainesville, Florida.
- Neves, R.J. 1993. A state-of-the-unionids address. Pages 1–10 in K.S. Cummings, A.C. Buchanan, and L.M. Koch, eds. Conservation and management of freshwater mussels. Proceedings of a UMRCC Symposium, 12–14 October 1992, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois. 189 pp.
- Page, L.M., K.S. Cummings, and C.A. Mayer. 1998. Mussels and crustaceans in Fox River area assessment. Volume 3: living resources. Illinois Department of Natural Resources, Natural History Survey Division, Champaign, Illinois. ii–225.



- Parmalee, P.W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series. Vol. 8. 108 pp.
- Sauer, R.W. 1989. Biological survey of the Little Vermilion River. Illinois Department of Conservation, Springfield. 9 pp.
- Schanzle, R.W., and K.S. Cummings. 1991. A survey of the freshwater mussels (Bivalvia: Unionidae) of the Sangamon River basin, Illinois. Illinois Natural History Survey Biological Notes 137. 25 pp.
- Schanzle, R.W., and G.W. Kruse. 1994. A survey of the freshwater mussels (Bivalvia: Unionidae) of the Green River basin, Illinois. Transactions of the Illinois State Academy of Science 87(3 & 4):135-144.
- Sietman, B.E., S.D. Whitney, D.E. Kelner, K.D. Blodgett, and H.L. Dunn. 2001. Post-extirpation recovery of the freshwater mussel (Bivalvia:Unionidae) fauna in the upper Illinois River. Journal of Freshwater Ecology 16(2):273-281.
- Smith, P.W. 1971. Illinois streams: a classification based on their fishes and an analysis of factors responsible for disappearance of native species. Illinois Natural History Survey Biological Notes 76. 14 pp.
- Sparks, R., and E. Marsden. 1991. Zebra mussel alert. Illinois Natural History Survey Reports 310:1-2.
- Starrett, W.C. 1971. A survey of the mussels (Unionacea) of the Illinois River: a polluted stream. Illinois Natural History Survey Bulletin 30(5):267-403.
- Suloway, L. 1981. The unionid (Mollusca:Bivalvia) fauna of the Kankakee River in Illinois. American Midland Naturalist 105(2):233-239.
- Suloway, L., J.J. Suloway, and W.E. LaBerge. 1981. The unionid mollusk (mussel) fauna of the Vermilion River system in Illinois. Illinois Natural History Survey Technical Report. 24 pp.
- Szafoni, R.E., K.S. Cummings, and C.A. Mayer. 2000. Freshwater mussels (Mollusca:Unionidae) of the Middle Branch, North Fork Vermilion River, Illinois/Indiana. Transactions of the Illinois State Academy of Science 93(3):229-237.
- Turgeon, D.D., J.F. Quinn, Jr., A.E. Bogan, E.V. Coan, F.G. Hochberg, W.G. Lyons, P.M. Mikkelson, R.J. Neves, C.F.E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F.G. Thompson, M. Vecchione, and J.D. Williams. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks. 2<sup>nd</sup> Edition. American Fisheries Society, Special Publication 26:ix-526.
- Watters, G.T. 1996. Small dams as barriers to freshwater mussels (Bivalvia, Unionoida) and their hosts. Biological Conservation 75(1):79-85.
- Watters, G.T. 2000. Freshwater mussels and water quality: a review of the effects of hydrologic and instream habitat alterations. Pages 261-274 in R.A. Tankersley, D.I. Warmolts, G.T. Watters, B.J. Armitage, P.D. Johnson, and R.S. Butler, eds. Freshwater Mollusk Symposia Proceedings. Part II. Proceedings of the First Freshwater Mollusk Conservation Society Symposium. Ohio Biological Survey Special Publication, Columbus. 274 pp.
- Whitney, S.D., K.D. Blodgett, and R.E. Sparks. 1997. A comprehensive mussel survey of the Illinois River, 1993-95. Illinois Natural History Survey Aquatic Ecology Draft Technical Report.

**APPENDIX I**

**Collection stations in the Fox River basin, and date of sampling, 1997–2001.**

<u>STATION #</u>	<u>LOCATION</u>
1.	Fox River, Watertown Road bridge, T7N, R19E, Sec.24, Waukesha Co., WI. August 15, 2001.
2.	Fox River, County Road "H" bridge, T6N, R19E, Sec.20s, Waukesha Co., WI. August 15, 2001.
3.	Fox River, Big Bend, T5N, R19E, Sec.23se, Waukesha Co., WI. August 16, 2001.
4.	Fox River, Waterford, T4N, R19E, Sec.35e, Racine Co., WI. August 2, 2001.
5.	Fox River, Burlington, T3N, R19E, Sec.32ne, Racine Co., WI. August 17, 2001.
6.	Fox River, 2.0 mi NW of Silver Lake, T1N, R19E, Sec.1se, Kenosha Co., WI. September 5, 2001.
7.	Fox River, Route 173 bridge, T46N, R9E, Sec.10sw, Lake Co., IL. September 2, 1999.
8.	Fox River, below Stratton Dam, T44N, R8E, Sec.12nw, McHenry Co., IL. September 2, 1999.
9.	Fox River, Rawson Road bridge, T44N, R9E, Sec.32sw, McHenry Co., IL. September 7, 2000.
10.	Fox River, below dam at Algonquin, T43N, R8E, Sec.34nw, McHenry Co., IL. September 1, 1999.
11.	Fox River, south edge of West Dundee, T42N, R8E, Sec.27se, Kane Co., IL. September 7, 2000.
12.	Fox River, State Street bridge at South Elgin, T41N, R8E, Sec.35, Kane Co., IL. July 9, 1999.
13.	Fox River, Blackhawk Forest Preserve, T40N, R8E, Sec.11nw, Kane Co., IL. September 8, 2000.
14.	Fox River, Prairie Street bridge, St. Charles, T40N, R8E, Sec.34, Kane Co., IL. July 9, 1999.
15.	Fox River, Route 56 bridge, T38N, R8E, Sec.4ne, Kane Co., IL. September 8, 2000.
16.	Fox River, 1.25 mi N of Oswego, T37N, R8E, Sec.8, Kendall Co., IL. August 31, 1999.
17.	Fox River, Village of Yorkville, T37N, R7E, Sec.33nw, Kendall Co., IL. June 25, 1998.
18.	Fox River, Fox River Road S of Plano, T37N, R6E, Sec.34sw, Kendall Co., IL. July 27, 1999.
19.	Fox River, Fox River bridge at Millington, T36N, R5E, Sec.25ne, LaSalle Co., IL. September 1, 1999.
20.	Fox River, Burlington-Northern RR at Sheridan, T35N, R5E, Sec.7, LaSalle Co., IL. July 27, 1999.
21.	Fox River, south side of Indian Island, T34N, R4E, Sec.2ne, LaSalle Co., IL. August 31, 1999.
22.	Fox River, .25 mi below Dayton Dam, T34N, R4E, Sec.29, LaSalle Co., IL. July 27, 1999.
23.	Fox River, east side of Ottawa, T33N, R4E, Sec.6ne, LaSalle Co., IL. July 8, 1999.
24.	Mukwonago River, Marsh Road Bridge, T5N, R18E, Sec.32n, Waukesha Co., WI. June 26, 2001.
25.	Mukwonago River, Route 83 bridge, T5N, R18E, Sec.35ne, Waukesha Co., WI. June 26, 2001.
26.	Muskego Canal, Route 36 bridge, T5N, R20E, Sec.33se, Waukesha Co., WI. August 1, 2001.
27.	Wind Lake Drainage Canal, East Main Drive bridge, T4N, R20E, Sec.32w, Racine Co., WI. August 1, 2001.
28.	Honey Creek, Bowers Road bridge, T4N, R17E, Sec.26ne & 25nw, Walworth Co., WI. May 25, 2000.
29.	Honey Creek, Bell School Road, T4N, R18E, Sec.24nw, Walworth Co., WI. May 25, 2000.

30. Honey Creek, County Road "D" bridge, T3N, R18E, Sec.1ne, Walworth Co., WI. August 16, 2001.
31. Sugar Creek, Hodges Road bridge, T3N, R17E, Sec.7nw, Walworth Co., WI. May 26, 2000.
32. Sugar Creek, Bowers Road bridge, T3N, R17E, Sec.12sw, Walworth Co., WI. June 25, 2001.
33. Sugar Creek, Potter Road bridge, T3N, R18E, Sec.14sw, Walworth Co., WI. June 25, 2001.
34. White River, Lake Geneva, T2N, R17E, Sec.36ne, Walworth Co., WI. June 27, 2001.
35. White River, Sheridan Springs Road, T2N, R18E, Sec.16sw, Walworth Co., WI. August 2, 2001.
36. White River, Route 36 bridge, T2N, R18E, Sec.1nw, Walworth Co., WI. August 16, 2001.
37. White River, Echo Lake dam, Burlington, T3N, R19E, Sec.32n, Racine Co., WI. June 26, 2001.
38. North Branch Nippersink Creek, 0.25 mi below Thunderbird Road, T1N, R18E, Sec.27sw, Walworth Co., WI. May 24, 2000.
39. North Branch Nippersink Creek, Richmond, T46N, R8E, Sec. 9nw, McHenry Co., IL. June 12, 1997.
40. North Branch Nippersink Creek, Route 12 bridge, T46N, R8E, Sec.21se, McHenry Co., IL. June 11, 1997.
41. Nippersink Creek, Route 173 bridge, T46N, R7E, Sec.18sw, McHenry Co., IL. June 12, 1997.
42. Nippersink Creek, Queen Anne Road, T45N, R7E, Sec.10nw, McHenry Co., IL. June 11, 1997.
43. Nippersink Creek, Richardson Road bridge, T46N, R9E, Sec.30nw, McHenry Co., IL. June 12, 1997.
44. Squaw Creek, Forest Avenue culvert, T45N, R10E, Sec.29sw, Lake Co., IL. June 12, 1998.
45. Squaw Creek, Route 134 bridge, T45N, R9E, Sec.24ne, Lake Co., IL. September 5, 2001.
46. Boone Creek, Bull Valley Road bridge, T44N, R7E, Sec.1sw, McHenry Co., IL. June 11, 1998.
47. Boone Creek, Village of McHenry, T45N, R8E, Sec.27sw, McHenry Co., IL. June 12, 1998.
48. Flint Creek, Route 14 bridge, T43N, R9E, Sec.28ne, Lake Co., IL. July 9, 1998.
49. Flint Creek, Kelsey Road bridge, T43N, R9E, Sec.15nw, Lake Co., IL. June 12, 1998.
50. Spring Creek, Rock Ridge Road bridge, T43N, R9E, Sec.29nw, McHenry Co., IL. July 9, 1998.
51. Spring Creek, Fox River Grove, T43N, R9E, Sec.19nw, McHenry Co., IL. September 19, 2001.
52. Tyler Creek, Big Timber Road bridge, T42N, R7E, Sec.36se, Kane Co., IL. July 8, 1998.
53. Tyler Creek, Tyler Creek Forest Preserve, T41N, R8E, Sec.2sw, Kane Co., IL. July 8, 1998.
54. Poplar Creek, Route 58 bridge, T41N, R9E, Sec.16nw, Cook Co., IL. September 7, 2000.
55. Poplar Creek, Route 19 bridge, T41N, R9E, Sec.17sw, Cook Co., IL. September 9, 1998.
56. Otter Creek, Silver Glen Road, T40N, R8E, Sec.8nw, Kane Co., IL. July 10, 1998.
57. Ferson Creek, Denker Road bridge, T40N, R7E, Sec.12sw, Kane Co., IL. September 9, 1998.
58. Ferson Creek, Leroy Oakes Forest Preserve, T40N, R8E, Sec.20se, Kane Co., IL. July 8, 1998.
59. Mill Creek, Brundige Road bridge, T39N, R7E, Sec.1ne, Kane Co., IL. Sept. 10, 1998.
60. Mill Creek, Wenmoth Road bridge, T39N, R8E, Sec.19ne, Kane Co., IL. August 28, 1997.
61. Waubonsie Creek, Farnsworth Road bridge, T38N, R8E, Sec.36sw, Kane Co., IL. September 10, 1998.
62. Waubonsie Creek, Village of Oswego, T37N, R8E, Sec.9se, Kendall Co., IL. September 10, 1998.

63. Blackberry Creek, Smith Road bridge, T39N, R7E, Sec.17s, Kane Co., IL. July 3, 1997.
64. Blackberry Creek, Camp Ke-De-Ka Road, T38N, R7E, Sec.9sw, Kane Co., IL. June 13, 1997.
65. Blackberry Creek, Galena Road bridge, T37N, R7E, Sec.10se, Kendall Co., IL. June 13, 1997.
66. Rob Roy Creek, Faxon Road bridge, T37N, R7E, Sec.19ne, Kendall Co., IL. September 10, 1998.
67. Rob Roy Creek, Blackhawk Road bridge, T37N, R6E, Sec.35ne, Kendall Co., IL. September 14, 2001.
68. Welch Creek, Main Street bridge, T39N, R6E, Sec.27ne, Kane Co., IL. July 10, 1998.
69. Welch Creek, Dauberman Road bridge, T38N, R6E, Sec.14sw, Kane Co., IL. July 10, 1998.
70. Big Rock Creek, County Line Road bridge, T38N, R6E, Sec.7nw, Kane Co., IL. August 26, 1997.
71. Battle Creek, McGirr Road bridge, T39N, R5E, Sec.26sw, DeKalb Co., IL. September 11, 1998.
72. West Branch Big Rock Creek, Hinckley Road, T38N, R6E, Sec.18se, Kane Co., IL. September 11, 1998.
73. Big Rock Creek, Jericho Road bridge, T38N, R6E, Sec.35ne & 36nw, Kane Co., IL. July 3, 1997.
74. Big Rock Creek, Klatt Park at Plano, T37N, R6E, Sec.23sw, Kendall Co., IL. August 26, 1997.
75. Little Rock Creek, U.S. Route 30 bridge, T38N, R5E, Sec.15sw, DeKalb Co., IL. August 27, 1997.
76. Little Rock Creek, Galena Road bridge, T37N, R6E, Sec.5nw, Kendall Co., IL. August 26, 1997.
77. Little Rock Creek, 1.5 mi WNW Plano, T37N, R6E, Sec.21nw, Kendall Co., IL. August 27, 1997.
78. Roods Creek, 4.0 mi E of Sheridan, T35N, R5E, Sec.1se & 12ne, LaSalle Co., IL. July 8, 1999.
79. Roods Creek, 1.5 mi ENE of Sheridan, T35N, R5E, Sec.3nw, LaSalle Co., IL. September 14, 2001.
80. Somonauk Creek, Shabbona Grove Road, T38N, R5E, Sec.30se, DeKalb Co., IL. August 27, 1997.
81. Somonauk Creek, Pratt Road bridge, T37N, R5E, Sec.22se, DeKalb Co., IL. August 27, 1997.
82. Somonauk Creek, Scheidecker Bridge, T36N, R5E, Sec.16sw & 21nw, LaSalle Co., IL. August 28, 1997.
83. Little Indian Creek, Sanderson Road bridge, T37N, R3E, Sec.25sw, DeKalb Co., IL. July 2, 1997.
84. Little Indian Creek, N4600 bridge, T36N, R4E, Sec.10se/ 15ne, LaSalle Co., IL. September 14, 2001.
85. Little Indian Creek, 4.0 mi NW Sheridan, T36N, R4E, Sec.34ne, LaSalle Co., IL. July 2, 1997.
86. Indian Creek, Chicago Road bridge, T37N, R3E, Sec.10se, DeKalb Co., IL. July 1, 1997.
87. Paw Paw Run, 7.5 mi SSW of Shabbona, T37N, R3E, Sec.19se/ 20sw, DeKalb Co., IL. July 8, 1999.
88. Indian Creek, 4700N bridge, T36N, R3E, Sec.5se, LaSalle Co., IL. September 6, 2000.
89. Sutphens Run, 1.25 mi SSW of Earlville, T36N, R2E, Sec.25ne, LaSalle Co., IL. July 7, 1999.
90. Indian Creek, Shabbona County Park, T35N, R3E, Sec.2nw, LaSalle Co., IL. July 1, 1997.
91. Indian Creek, 2 mi NNW Wedron, T35N, R4E, Sec.33nw, LaSalle Co., IL. July 2, 1997.
92. Crooked Leg Creek, 3800N bridge, T35N, R3E, Sec.23se & 26ne, LaSalle Co., IL. September 6, 2000.
93. Crooked Leg Creek, 2.5 mi NW of Wedron, T34N, R3E, Sec.1ne, LaSalle Co., IL. July 7, 1999.
94. Indian Creek, Burlington Northern RR bridge, T34N, R4E, Sec.4se, LaSalle Co., IL. July 2, 1997.
95. Buck Creek, 1600E bridge, T34N, R3E, Sec.10e, LaSalle Co., IL. September 6, 2000.
96. Buck Creek, 1.5 mi west of Wedron, T34N, R4E, Sec.8nw, LaSalle Co., IL. July 7, 1999.







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