

Freshwater Mussel (Bivalvia: Unionidae) Survey of Kyte River, Ogle County, Illinois

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ABSTRACT

The freshwater mussel fauna of Kyte River, Ogle County, Illinois, was investigated during a 2004 survey. Live individuals of 15 species, including one individual of the state-threatened black sandshell *Ligumia recta*, were collected during 32 person-hours of sampling at eight mainstem stations; three additional species, including the state-threatened slippershell mussel *Alasmidonta viridis*, also were found but only as valves. Five stations supported sufficient species richness and abundance and qualify for the Illinois Natural Areas Inventory.

Key Words: Mollusca, unionids, bivalve, Rock River

INTRODUCTION

Freshwater mussels are important components of stream ecosystems (Strayer and Smith, 2003). Due to their sensitivity to stream flow and substrate, filter feeding habits, and relative inability to move far in response to environmental stresses, freshwater mussels act as biological indicators of stream condition and integrity. They have undergone a drastic decline during the past century and have become one of the most imperiled groups of animals in North America (Williams et al., 1993). More than two-thirds of the approximately 300 historical species in North America are extinct, federally-listed as endangered or threatened, or in need of conservation status.

This study was undertaken to determine the current freshwater mussel fauna of Kyte River. The objectives were to obtain information concerning status of the fauna and to collect data that can serve as a basis for comparison with other stream basins in Illinois. Prior to this survey, no comprehensive freshwater mussel survey of Kyte River had been conducted, and both historical and current data on the fauna were limited. Only five species (cylindrical papershell *Anodontoidea ferussacianus*, plain pocketbook *Lampsilis cardium*, fatmucket *Lampsilis siliquoidea*, pink papershell *Potamilus ohioensis*, and pimple-back *Quadrula pustulosa*) from the Kyte River basin have been recorded in museum and literature records (Illinois Natural History Survey [INHS] Mollusk Collection data).

Kyte River is about 32 mi long and drains an area of nearly 200 mi². It is in the Rock River Hill Country and the Grand Prairie natural divisions of DeKalb, Lee, and Ogle counties (Schwegman, 1973). The river originates near Kings in Ogle County and flows south through Rochelle, bending near the Ogle-Lee county line to flow west-northwest before reaching its confluence with the Rock River south of Oregon in Ogle County (Fig. 1).

METHODS AND MATERIALS

Freshwater mussel data were collected at eight mainstem stations (Fig. 1; Appendix 1) in Kyte River from 21-22 September 2004. Live freshwater mussels and valves of dead specimens were collected by hand during for four person-hours at each station. Shell material was classified as live, dead (valves with tissue present or shiny nacre and intact periostracum), or relict (valves with chalky nacre and worn periostracum) based on condition of best specimen found. Efforts covered all substrate types at each station. All specimens were identified to species using Cummings and Mayer (1992), and common and scientific names follow Turgeon et al. (1998) except for the recognition of subspecies. Voucher specimens (usually valves) of each species from each station were retained and deposited in the INHS Mollusk Collection, Champaign. For each species, the following data were recorded: 1) number of live individuals or condition of best shell found, and 2) evidence of juveniles, where juveniles were live individuals with three or fewer external growth rings. All non-vouchered live individuals were returned to the stream reach where they were collected.

Regression analysis was used to test whether extant species richness, historic species richness, and abundance increased from upstream to downstream. A species was considered extant at a station if it was represented there by live specimens or dead (not relict) valves, and a species was considered historic at a station if it was collected there either as live, dead, or relict. A t-test was applied to determine if historic species richness was significantly different from extant species richness. Statistical analyses were performed with SAS, Version 8 (SAS Institute Inc, Cary, North Carolina).

A Mussel Classification Index, or MCI, (Szafoni, 2002) was calculated for each station. Freshwater mussel resources at each station were classified as Unique, Highly Valued, Moderate, Limited, or Restricted based on the following parameters: 1) extant species richness; 2) abundance estimates expressed as catch-per-unit-effort; 3) presence and number of intolerant species; and 4) recruitment proportion of live species represented by juveniles (Appendix 2).

RESULTS / DISCUSSION

Kyte River Freshwater Mussel Survey

A total of 681 live individuals of 15 species, including one individual of the state-threatened black sandshell *Ligumia recta* (IESPB, 2005), was collected in 32 person-hours in Kyte River; three additional species, including the state-threatened slippershell mussel *Alasmidonta viridis* (IESPB, 2005), also were found but only as valves (Table 1). These numbers are comparable to the 13 live species and 19 historic species found in the Green River basin (mainstem and tributaries), which is another Rock River tributary (Schanzle

and Kruse, 1994). The Rock River drainage historically had 44 species but only 30 have been collected alive since 1969 (Cummings and Mayer, 1997). Both extant and historic species richness from the Kyte River basin was conservative since tributaries were not sampled.

The most widespread species in Kyte River were plain pocketbook *Lampsilis cardium*, recorded as live at all eight stations sampled, and fragile papershell *Leptodea fragilis*, recorded as live at seven stations (Table 1). Other widespread species include elktoe *Alasmidonta marginata*, white heelsplitter *Lasmigona complanata*, giant floater *Pygandon grandis*, creeper *Strophitus undulatus*, and pimpleback *Quadrula pustulosa*, all documented as extant at five stations (Table 1). This distribution suggests that most species in Kyte River are widely distributed and not confined to isolated populations. In the Green River mainstem, only *L. cardium* was collected alive at more than half of the nine stations (Schanzle and Kruse, 1994).

The number of extant species observed in Kyte River ranged from three to 12 per station, whereas the number of historic species varied from four to 14 (Table 1). These numbers exceeded those from the Green River mainstem, where zero to five extant species and one to six historic species were collected during four person-hours at each of nine stations (Schanzle and Kruse, 1994). Extant species richness and historic species richness did not significantly differ in Kyte River ($t = 0.01$, $P > 0.20$) suggesting that its freshwater mussel fauna still remains relatively intact. The difference in species richness between historic and extant ranged from zero to six per station. There was no statistical difference in either extant species richness ($r^2 = 0.48$, $P = 0.06$) or historic species richness ($r^2 = 0.18$, $P = 0.29$) from upstream to downstream in the 15 mi stretch of Kyte River sampled (Fig. 2a). This pattern might have been observed if more headwater stations were examined. An increase in species richness from upstream to downstream has been observed in the Rock River mainstem (Baker, 1926) and is typical of undisturbed, intermediate-sized rivers (Watters, 1992). Species richness in these types of streams typically increases as a function of enlarging drainage area, which usually offers decreased gradients, expanded habitat complexities, and higher fish diversity to serve as glochidia hosts (Vannote et al., 1980; Watters, 1992).

Abundance in Kyte River increased significantly ($r^2 = 0.63$, $P = 0.02$) from upstream to downstream (Fig. 2b). Abundance ranged from 14 to 202 live individuals per station (Table 1) and exceeded abundances in the Green River mainstem stations, which ranged from zero to 17 live individuals (Schanzle and Kruse, 1994). The most abundant species collected in Kyte River was *L. cardium* (66% of all live individuals); no other species made up more than 10% of live individuals collected (Table 1). *Lampsilis cardium* (60% of all live individuals), followed by *P. grandis* (12.5%) and *L. complanata* (10%), were the most abundant species collected in the Green River mainstem (Schanzle and Kruse, 1994). Notable in Kyte River was the abundance of *A. marginata* (8% of all live individuals), which prefers clean gravel substrates with good flow (Cummings and Mayer, 1992). This species was once considered a candidate for federal listing and although it is relatively uncommon, it is generally distributed in the northern half of Illinois (Cummings and Mayer, 1997). No live *A. marginata* was reported from the Green River basin (Schanzle and Kruse, 1994), but it has been found in the Rock River mainstem, the Pecatonica and Kishwaukee river basins, and Dry Creek (INHS Mollusk Collection data).

Two state-threatened species, live *L. recta* and relict shells of *A. viridis*, were collected in Kyte River (Table 1). *Ligumia recta* is found sporadically in northern Illinois where it is currently known from one-third of the drainages that historically supported it; the species is currently known from the Rock, Kankakee, and Galena/Apple river drainages as well as the Mississippi and Ohio rivers (Cummings & Mayer, 1997). Within the Rock River system, *L. recta* was not reported from the Green River basin (Schanzle and Kruse, 1994) but it has been recorded in the Rock River mainstem and the Pecatonica and Kishwaukee river basins (INHS Mollusk Collection data). *Alasmidonta viridis* was formerly widely distributed in the northern half of Illinois but is now sporadically found in a few Illinois River tributaries, including the Fox, Kankakee, Mackinaw, Sangamon, and Vermilion rivers as well as the Vermilion River of the Wabash River drainage (Cummings & Mayer, 1997). In the Rock River drainage, *A. viridis* was historically known from the Kishwaukee River basin and Kent Creek (INHS Mollusk Collection data) but not from the Green River basin (Schanzle and Kruse, 1994).

Recruitment was zero at one station but moderate to very high at the other seven (Table 2). Smaller (e.g., younger) individuals are difficult to locate and large samples are needed to accurately assess population demographics (Strayer and Smith, 2003). However, a small sample can provide evidence of recruitment if it includes individuals that are small or possess few external growth rings. Alternatively, a sample consisting of very large individuals with numerous external growth rings suggests a senescent population. Given the difficulties in assessing recruitment through detection of small individuals, these Kyte River data are biologically significant and suggest that the stream not only supports an abundant and diverse freshwater mussel fauna but also that populations of several species are reproducing.

Freshwater Mussel Fauna Classification

Based on MCI calculations, several sections of Kyte River support significant freshwater mussel resources and qualify for the Illinois Natural Areas Inventory (Table 2). One station ranked as Unique due to high species richness and abundance, intolerant species present, and evidence of recruitment for 90% of live species. Four stations ranked as Highly Valued due to high species richness and abundance and evidence of recruitment for at least 25% of live species. Two stations ranked Moderate due to low species richness and abundance, lack of intolerant species, and evidence of recent recruitment for <10% of live species. One station ranked Limited due to low species richness and abundance, lack of intolerant species, and no evidence of recent recruitment.

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Table 1. Data from the 2004 freshwater mussel survey of Kyte River in Ogle County, Illinois (see Appendix 1 for station localities). D indicates those species collected as fresh-dead shell and R denotes those species collected as relict shell. Extant species are those that were represented by live or dead shell material. CPUE (catch-per-unit-effort) is number of live individuals per hour collected (all stations sampled for four person-hours). Recruitment is number live species with juvenile individuals per number of extant species. Illinois state-threatened species are marked with superscript ST.

Species	Common Name	Station No.								Mainstem Total	Relative Abundance
		1	2	3	4	5	6	7	8		
Subfamily Anodontinae											
<i>Alasmidonta marginata</i>	elktoe			10	21	12	10	R	1	54	7.93%
<i>Alasmidonta viridis</i> ST	slippershell mussel				R					0	0.00%
<i>Anodontoides ferussacianus</i>	cylindrical papershell	R			R		1	D	1	2	0.29%
<i>Lasmigona complanata</i>	white heelsplitter		6	21	8		4	2		41	6.02%
<i>Lasmigona compressa</i>	creek heelsplitter			R	R		1			1	0.15%
<i>Pyganodon grandis</i>	giant floater		7	3	R	2	1	1		14	2.06%
<i>Strophitus undulatus</i>	creeper	1	R		2	2	D	9	2	16	2.35%
Subfamily Ambleminae											
<i>Amblema plicata</i>	threeridge		R	R	R			R		0	0.00%
<i>Fusconaia flava</i>	Wabash pigtoe			1				6		9	1.32%
<i>Quadrula pustulosa</i>	pimpleback			1	1		1	23	16	42	6.17%
Subfamily Lampsilinae											
<i>Actinonaias ligamentina</i>	mucket			1				3	R	4	0.59%
<i>Lampsilis cardium</i>	plain pocketbook	40	1	24	42	15	35	118	174	449	65.93%
<i>Lampsilis siliquioidea</i>	fatmucket		R	2	3		3	3		11	1.62%
<i>Leptodea fragilis</i>	fragile papershell	1	D	3	3	1	2	18	5	33	4.85%
<i>Ligumia recta</i> ST	black sandshell							1		1	0.15%
<i>Potamilus ohioensis</i>	pink papershell		D					2	1	3	0.44%
<i>Toxolasma parvus</i>	lilliput						1			1	0.15%
<i>Venustaconcha ellipsiformis</i>	ellipse			R	R					0	0.00%
Number of individuals		42	14	66	80	32	59	186	202	681	
Number of extant species		3	5	9	7	5	11	12	8	15	
Number of historic species		4	8	12	13	5	11	14	9	18	
CPUE		10.5	3.5	16.5	20.0	8.0	14.8	46.5	50.5	21.3	
Recruitment		03/03	0/3	03/09	05/07	02/05	06/10	09/10	02/08		

Table 2. Mussel Classification Index (MCI) data from the 2004 freshwater mussel survey of Kyte River in Ogle County, Illinois (see Appendix 1 for station localities and Appendix 2 for calculating the MCI). Stations scoring Unique or Highly Valued or stations supporting 10+ extant species qualify for the Illinois Natural Areas Inventory.

Station	Number of extant species	Number of intolerant species	Catch-per-unit-effort	% species recruit	Species richness factor	Intolerant species factor	Abundance factor	Reproduction factor	MCI score	Resource Value
1	3	0	10.5	100%	2	1	3	5	11	Moderate
2	5	0	3.5	0%	3	1	2	1	7	Limited
3	9	0	16.5	33%	4	1	3	4	12	Highly Valued
4	7	0	20.0	71%	4	1	3	5	13	Highly Valued
5	5	0	8.0	40%	3	1	2	4	10	Moderate
6	11	0	14.8	60%	5	1	3	5	14	Highly Valued
7	12	1	46.5	90%	5	3	4	5	17	Unique
8	8	0	50.5	25%	4	1	4	3	12	Highly Valued

Figure 1. Station locations from the 2004 freshwater mussel survey of Kyte River in Ogle County, Illinois.

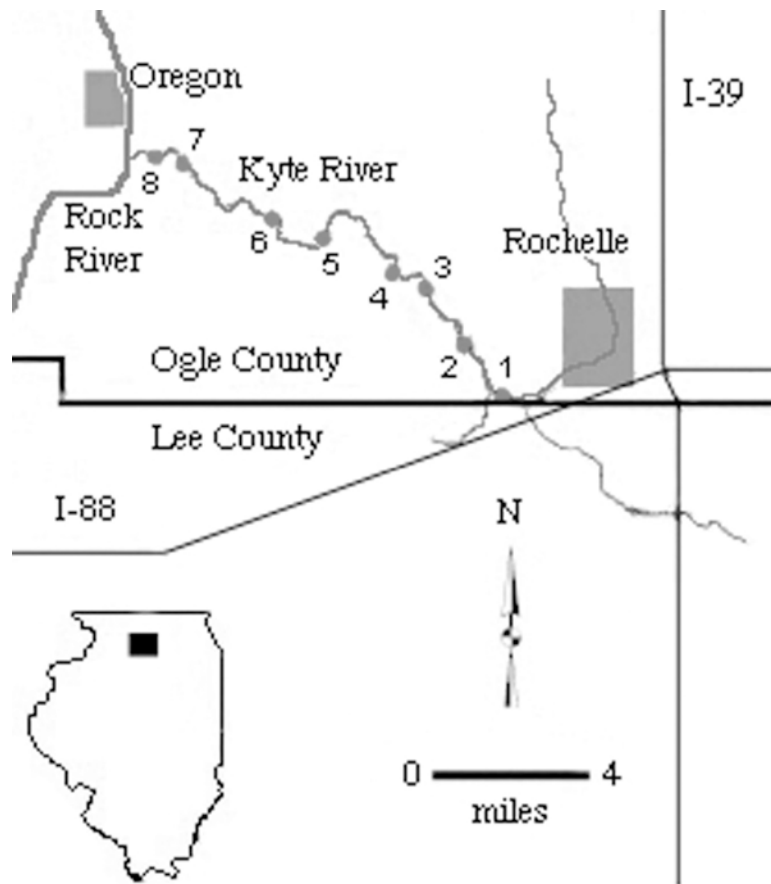
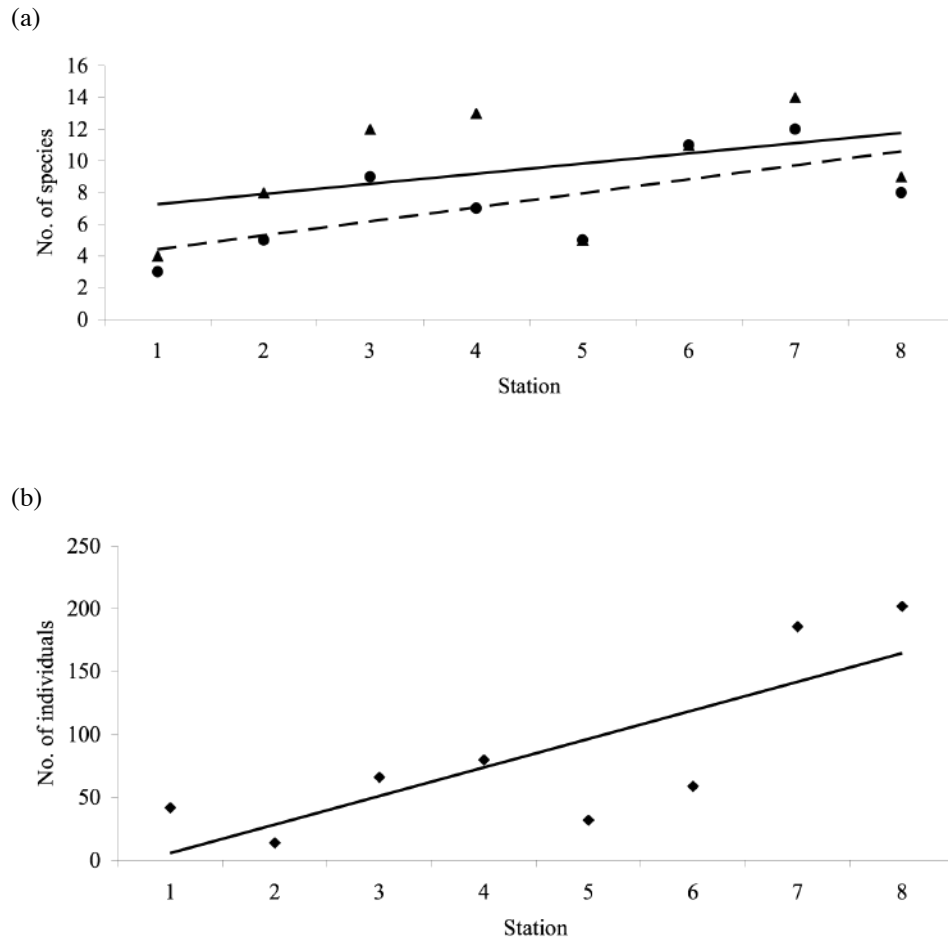


Figure 2. (a) Freshwater mussel extant species richness ($r^2 = 0.48$, $P = 0.06$) (circles with dashed line) and historic species richness ($r^2 = 0.18$, $P = 0.29$) (triangles with solid line) and (b) abundance ($r^2 = 0.63$, $P = 0.02$) versus stations arranged from upstream to downstream Kyte River (see Appendix 1 for station localities).



Appendix 1. Station localities from the 2004 freshwater mussel survey of Kyte River in Ogle County, Illinois. All stations were sampled for four person-hours.

Station	General Location	Location	T	R	Sec 1/4	Latitude	Longitude	Date	Comments
1	2 mi SW Rochelle	upstream Brush Grove Road bridge	40N	1E	34 SW	41.8927°	-89.1113°	22 Sep 04	gravel riffles with sand; ditched with grassy banks
2	3.5 mi W Rochelle	downstream & upstream Route 38 bridge	40N	1E	29 NE	41.9139°	-89.1333°	21 Sep 04	gravel riffles with silt/sand; ditched with grassy banks
3	4 mi ENE Rochelle, Skare Park	~400 yds downstream Flagg Road bridge	40N	1E	18 SE	41.9376°	-89.1568°	22 Sep 04	gravel-cobble riffles with sand/silt; woody banks
4	5.5 mi WNW Rochelle	private property	23N	11E	36 NE	41.9452°	-89.1769°	22 Sep 04	gravel-cobble riffles with sand/silt; woody banks
5	1.75 mi S Chana	upstream Chana Road bridge	23N	11E	27 NE	41.9575°	-89.2153°	21 Sep 04	gravel-cobble riffles with sand; woody banks
6	1.25 mi SW Chana	upstream Rocky Hollow Road bridge	23N	11E	21 SW	41.9642°	-89.2441°	21 Sep 04	gravel riffles with silt/sand; sandy-woody banks
7	1.0 mi E Daysville	upstream Honey Creek Road bridge	23N	10E	13 NW	41.9858°	-89.2941°	21 Sep 04	gravel riffles with sand; sandy-woody banks
8	2 mi SSE Oregon	private property	23N	10E	11 SW	41.9912°	-89.3175°	21 Sep 04	gravel riffles with sand; old pasture with woody banks

Appendix 2. Mussel Classification Index (MCI) is used for identifying freshwater mussel assemblages of state-wide significance and has values ranging from Restricted to Unique (Szafoni, 2002). $MCI = \text{Species richness factor} + \text{Intolerant species factor} + \text{Abundance factor} + \text{Recruitment factor}$.

Score	Species richness (# of extant species)	Intolerant species (# of intolerant species)	Factor Abundance (catch-per-unit-effort)	Recruitment (% of live species with recent recruitment)
1	0	0	0	0
2	1-3	-	1-10	-
3	4-6	1	11-30	1-30
4	7-9	-	31-60	31-50
5	10+	2+	61+	51+

MCI		
Score	Classification	Definition
16+	Unique	Very high species richness and/or abundance, intolerant species common, and evidence of recruitment. A resource of state-wide significance.
12-15	Highly Valued	High species richness and/or abundance, intolerant species present, and evidence of recent recruitment for at least a third of species present. A resource of state-wide significance.
8-11	Moderate	Species richness and/or abundance typical for stream of given location and order and evidence of recent recruitment for at least one species. May be a resource of local significance or recovering from degradation.
5-7	Limited	Low species richness and/or abundance and no evidence of recent recruitment (all individuals old or large for the species). May be recoverable or recovering with improved conditions.
0-4	Restricted	No live mussels present and only weathered dead, sub-fossil, or no shell material found. Unlikely to be recoverable except through immigration from better sites after improved conditions.

