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## **Freshwater mussels of the Kaskaskia River basin**

Diane K. Shasteen, Sarah A. Bales, Alison P. Stodola

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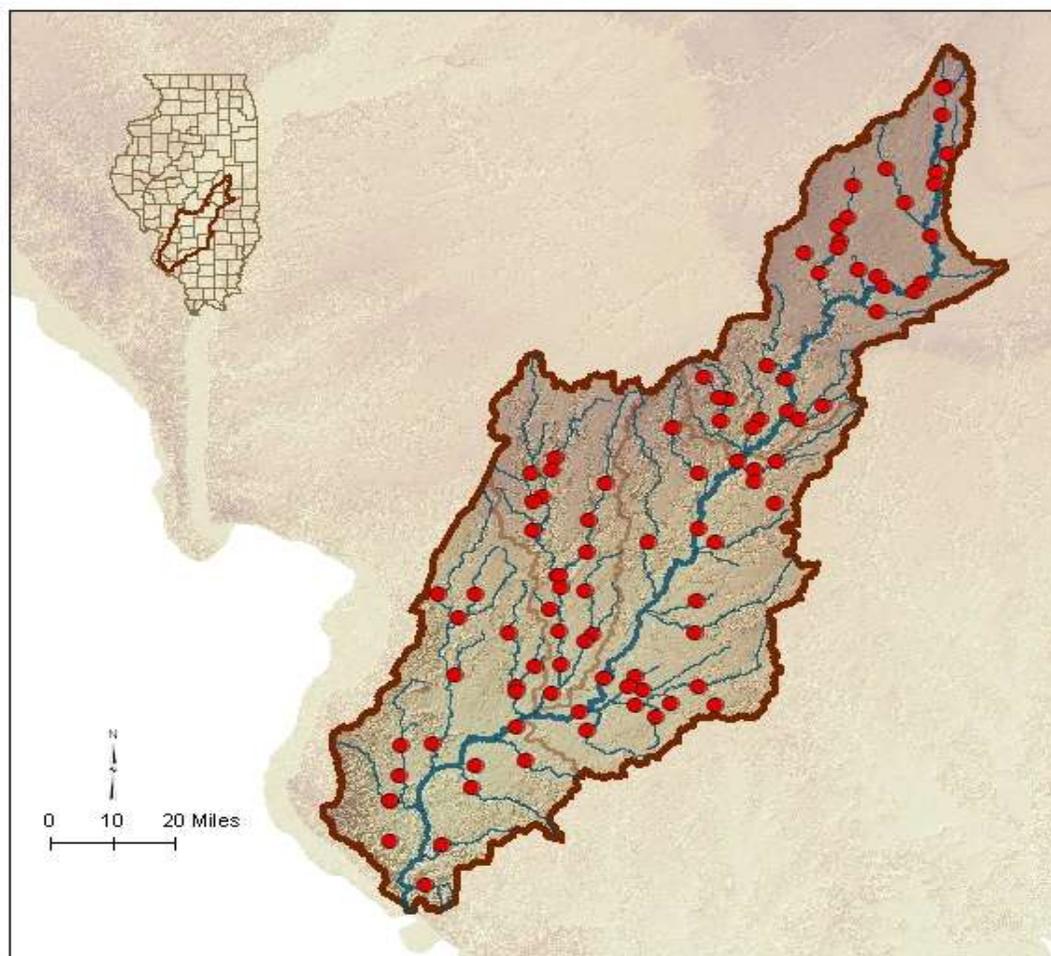
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Prairie Research Institute, University of Illinois at Urbana Champaign  
William Shilts, Executive Director

Illinois Natural History Survey  
Brian D. Anderson, Director  
1816 South Oak Street  
Champaign, IL 61820  
217-333-6830



# Freshwater Mussels of the Kaskaskia River Basin



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Illinois Natural History Survey, Prairie Research Institute, University of Illinois  
Illinois Department of Natural Resources

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## **Preface**

While broad geographic information is available on the distribution and abundance of mussels in Illinois, systematically collected mussel-community data sets required to integrate mussels into aquatic community assessments do not exist. In 2009, a project funded by a US Fish and Wildlife Service State Wildlife Grant was undertaken to survey and assess the freshwater mussel populations at wadeable sites from 33 stream basins in conjunction with the Illinois Department of Natural Resources (IDNR)/Illinois Environmental Protection Agency (IEPA) basin surveys. Inclusion of mussels into these basin surveys contributes to the comprehensive basin monitoring programs that include water and sediment chemistry, instream habitat, macroinvertebrate, and fish, which reflect a broad spectrum of abiotic and biotic stream resources. These mussel surveys will provide reliable and repeatable techniques for assessing the freshwater mussel community in sampled streams. These surveys also provide data for future monitoring of freshwater mussel populations on a local, regional, and watershed basis.

### **Agency Contacts**

Kevin S. Cummings, INHS, [ksc@inhs.illinois.edu](mailto:ksc@inhs.illinois.edu), (217) 333-1623

Bob Szafoni, IDNR, [Robert.szafoni@illinois.gov](mailto:Robert.szafoni@illinois.gov), (217) 348-0175

Ann Marie Holtrop, IDNR, [ann.holtrop@illinois.gov](mailto:ann.holtrop@illinois.gov), (217) 785-4325

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## **Introduction**

Freshwater mussel populations have been declining for decades and are among the most seriously impacted aquatic animals worldwide (Bogan 1993, Williams et al. 1993). It is estimated that nearly 70% of the approximately 300 North American mussel taxa are extinct, federally-listed as endangered or threatened, or in need of conservation status (Williams et al. 1993, Strayer et al. 2004). In Illinois, 25 of the 62 extant species (44%) are listed as threatened or endangered (Illinois Endangered Species Protection Board 2011). While broad geographic information is available on the distribution and abundance of mussels in Illinois, systematically collected mussel community data sets required to integrate mussels into aquatic community assessments do not exist. This report summarizes the mussel surveys conducted in the Kaskaskia River basin from 2009 to 2012 in conjunction with IDNR and IEPA basin surveys and other targeted survey sites. This report divides results into five major basins using HUC 8 digit delineation: tributaries of the Kaskaskia including the Upper, Middle, Lower, and Shoal Creek basins, and the Kaskaskia River mainstem (USGS 2013, Figure 1).

The Kaskaskia River basin, the largest contained entirely in Illinois, drains an area of approximately 14,880 km<sup>2</sup> (5800 mi<sup>2</sup>) in central and southwestern parts of the state (IDNR 2000). This basin drains four counties, Moultrie, Clinton, Bond, and Fayette, and parts of 18 additional counties (Page et al. 1992). The Kaskaskia River originates in Champaign County and flows southwesterly to its confluence with the Mississippi River in Randolph County. The drainage lies within four natural divisions originating in the Grand Prairie Division, flowing mainly through the Southern Till Plain, and parts of the Ozark and Lower Mississippi River Bottomlands and Wabash Border (Schwegman 1973, Page et al. 1992). Drainage topography varies from flat agricultural lands in the upper reaches to rough hilly landscapes that make up the majority of the basin. Principal tributaries in this basin include Crooked Creek in the east and Richland, Silver and Shoal Creek in the western portion (Page et al. 1992, Figure 2).

### **Land-use and Instream Habitat**

Approximately 70% of the Kaskaskia River basin is agricultural land, with the dominant crops being soybeans and corn (IDNR 2000, Illinois Department of Agriculture 2000). The Lower Kaskaskia encompasses two large cities, Belleville (pop. 44,478) and O'Fallon (pop. 28,281). Vandalia (pop. 7,042) is the largest city within the Upper and Middle Kaskaskia, thus this area lacks any sizeable urban areas (US Census Bureau 2010). Despite limited amount of urban development throughout most of the basin, the Kaskaskia River has been heavily altered by other anthropogenic development. During the 1960's and early 1970's the largest and third largest reservoirs in the state, Carlyle Lake and Lake Shelbyville, were constructed on the

Kaskaskia mainstem (IEPA 1996). Many miles of meandering channel in the mainstem and tributaries have been channelized and deepened for industrial, recreational, and agricultural purposes (Schanzle et al. 2008). Threats to water quality in this basin include agriculture runoff; municipal, industrial, and oil production discharges; and hydrologic and habitat modifications (Larimore and Fritz 1993, IEPA 1996, Sauer 2002).

Substrates in most streams of this basin are dominated by a mixture of sand, gravel, silt and claypan. In the Upper and Middle reaches of the Kaskaskia basin, sand interspersed with lesser amounts of gravel predominates. However, the lower regions of the basin contain a homogenous mixture of sand, silt, and claypan. Excessive sand deposits are located in many reaches of the Kaskaskia basin. With the exception of the upper portion of the basin, habitat types are limited with most streams containing runs and pools but very few riffles. Most sites had wadeable water depths; however, sampling sites on the lower portion of the Kaskaskia River mainstem were limited due to non-wadeable water depths (e.g., depth >1m).

## **Methods**

During the 2009-2012 survey, freshwater mussel data were collected at 95 sites; these include 16 Upper, 18 Middle, 28 Lower, 19 Shoal Creek, and 14 Mainstem Kaskaskia sites (Figure 2; Table 1). Locations of sampling sites are listed in Table 1 along with information regarding IDNR/IEPA sampling at the site. In most cases, mussel survey locations were the same as IDNR/IEPA sites. At three sites, mussel data were collected on more than one occasion to fulfill sampling objectives for other analyses (Table 1).

Live mussels and shells were collected at each sample site to assess past and current freshwater mussel occurrences. Live mussels were surveyed by hand grabbing and visual detection (e.g., trails, siphons, exposed shell) when water conditions permitted. Efforts were made to cover all available habitat types present at a site including riffles, pools, slack water, and areas of differing substrates. A four-hour timed search method was implemented at most sites, and a 16-hour survey was completed at one site to fulfill sampling objectives for another project (Table 1). Live mussels were held in the stream until processing.

Following the timed search, all live mussels and shells were identified to species and recorded (Table 2). For each live individual, shell length (mm), gender, and an estimate of the number of growth rings were recorded. Shell material was classified as recent dead (periostracum present, nacre pearly, and soft tissue may be present) or relict (periostracum eroded, nacre faded, shell chalky) based on condition of the best shell found. A species was considered extant at a site if it was represented by live or recently dead shell material (Szafoni 2001). The nomenclature employed in this report follows Turgeon et al. (1998) except for recent

taxonomic changes to the gender ending of lilliput (*Toxolasma parvum*), which follows Williams et al. (2008; Appendix 1). Voucher specimens were retained and deposited in the Illinois Natural History Survey Mollusk Collection. All non-vouchered live mussels were returned to the stream reach where they were collected.

Parameters recorded included extant and total species richness, presence of rare or listed species, and individuals collected, expressed as catch-per-unit-effort (CPUE; Table 2). A population was considered to indicate recent recruitment if individuals less than 30 mm in length or with 3 or fewer growth rings were recorded. Finally, mussel resources were classified as Unique, Highly Valued, Moderate, Limited, or Restricted (Table 2) based on the above parameters (Table 4) and following criteria outlined in Table 5 (Szafoni 2001).

## Results

### Species Richness

A total of 32 species of freshwater mussels were observed in the Kaskaskia River basin, 29 of which were live (Table 2). Across all sites, the number of live and extant (live + dead) species collected ranged from 0 to 16, and the total number of species collected (live + dead + relict) ranged from 0 to 20. The Upper Kaskaskia species richness ranged from 0 to 10 live species, 0 to 13 extant species and 1 to 14 total species. The Middle Kaskaskia species richness ranged from 0 to 7 live species, 0 to 10 extant species, and 0 to 11 total species. The Lower Kaskaskia species richness ranged from 0 to 10 live, extant, and total species. The Shoal Creek species richness ranged from 0 to 15 live species, 0 to 16 extant species, and 1 to 17 total species. Kaskaskia River mainstem species richness ranged from 5 to 16 live and extant species and 5 to 20 total species.

The giant floater (*Pyganodon grandis*) was the most widespread species in the Upper, Middle, and Lower Kaskaskia and Shoal Creek basins collected at 39 of 81 total sites (33%, 24%, 85%, and 60% of sites, respectively; Figures 3a- c). The pink heelsplitter (*Potamilus alatus*) and white heelsplitter (*Lasmigona complanata*) were encountered at 28% of Upper Kaskaskia sites (Figure 3a). In the Middle Kaskaskia, the pink heelsplitter and fragile papershell (*Leptodea fragilis*) were each encountered at 18% of the sites (Figure 3a). Widespread species in the Lower Kaskaskia included lilliput, pondmussel (*Ligumia subrostrata*) and pondhorn (*Unio merus tetralasmus*) occupying 65%, 40%, and 35% of the sites, respectively (Figure 3b). The fragile papershell and giant floater (60%) were equally the most widespread species in the Shoal Creek basin followed by the mapleleaf (*Quadrula quadrula*, 55%), pistolgrip (*Tritogonia verrucosa*; 40%), and pink papershell (*Potamilus ohioensis*, 35%; Figure 3c). In the Kaskaskia River mainstem, the white heelsplitter (*Lasmigona complanata*) was the most widespread species (11 of 14 sites, 79%). Two other species, the pink papershell and fragile papershell, were

encountered at 10 of 14 sites (71%; Figure 3d).

### **Abundance and Recruitment**

A total of 3524 individuals were collected across 95 sites. The number of live individuals collected at a site with live mussels detected ranged from 1 to 350, with an average of 37 mussels per site (Table 2a-e). Live individuals collected ranged from 1 to 350 at Upper Kaskaskia sites, from 2 to 204 at Middle Kaskaskia sites, from 2 to 162 at Lower Kaskaskia sites, from 2 to 275 at Shoal Creek sites and from 9 to 175 at mainstem Kaskaskia River sites. A total of 404 collector-hours were spent sampling with an average of nearly 9 mussels collected per hour. The most commonly collected species across all sites was the mapleleaf, which comprised 14% of all individuals collected (n=484), and also in the mainstem Kaskaskia River sites (n=122; Table 2e). The pondhorn (*Unio merus tetralasmus*) was the most commonly collected species in the Upper Kaskaskia (n=288) and the fatmucket (*Lampsilis siliquoidea*) was the most commonly collected species in the Middle Kaskaskia (n=156). These species were collected live at only two sites in these drainages with 99.3% of the individuals found at one site (Table 2a-b). The giant floater and pistolgrip were the most commonly collected species in the Lower Kaskaskia and Shoal Creek basins (n=282, n=352; Table 2c-d). Catch per unit effort (CPUE) at individual sites ranged from 0 to 89.75 individuals/collector-hour (Table 2a-e). With the exception of the Middle Kaskaskia, all basins had extant mussel populations of 84 to 100% (Upper-88%, Lower-89%, Shoal-84% and Mainstem-100%). Only 50% of sites in the Middle Kaskaskia had extant mussel populations (9 of 18; Table 2a-e).

Recruitment for each species was determined by the presence of individuals less than 30 mm or with 3 or fewer growth rings. Smaller (i.e., younger) mussels are harder to locate by hand grab methods and large sample sizes can be needed to accurately assess population reproduction. However, a small sample size can provide evidence of recruitment if it includes individuals that are small or possess few growth rings. Alternatively, a sample consisting of very large (for the species) individuals with numerous growth rings suggests a senescent population.

Recruitment at individual sites ranged from none observed to very high across the basin. Recruitment levels, referred to in Table 4 as Reproduction Factor, varied from 1 to 5, with 20 sites exhibiting high to very high recruitment. We observed recruitment in over 50% of species collected at one site in the Upper Kaskaskia (site 14; Asa Creek; Figure 4a), two sites in both the Middle and Lower Kaskaskia (sites 28, 45, 81, and 85; Beck, Wolf, Elkhorn, and Sugar Fork Silver Creeks; Figures 4a-b) and one site on the mainstem Kaskaskia (site 24; Figure 4d). Fourteen sites exhibited high recruitment (>30-50%) including a site in the Upper and the Middle Kaskaskia (sites 22 and 31) and six sites in the Lower Kaskaskia and Shoal Creek basins (sites 47, 50, 57, 63, 64, 68, 70, 72, 84, 86-88; Figures 4a-c). Sixteen other sites exhibited moderate recruitment, while no observed recruitment was recorded at 35 sites (Figures 4a-d).

## Mussel Community Classification

Based on data collected in the 2009-2012 basin surveys, nearly 50% of the sites in the Kaskaskia River basin are classified as Moderate or Highly Valued mussel resources under the current MCI classification system (Table 5, Figure 4). Fifteen sites were classified as Highly Valued and 31 sites were ranked as Moderate mussel resources. The 49 remaining sites were considered Limited or Restricted mussel resources.

## Noteworthy Finds

This survey documented 29 live species and 32 total species; historically 43 species were known from the Kaskaskia River basin (Tiemann et al. 2007). Twelve species known historically from this basin not collected during this survey include the spectaclecase (*Cumberlandia monodonta*), slippershell mussel (*Alasmidonta viridis*), flat floater (*Anodonta suborbiculata*), elephantear (*Elliptio crassidens*), ebonyshell (*Fusconaia ebena*), sheepnose (*Plethobasus cyphus*), winged mapleleaf (*Quadrula fragosa*), monkeyface (*Quadrula metanevra*), butterfly (*Ellipsaria lineolata*), scaleshell (*Leptodea leptodon*), black sandshell (*Ligumia recta*), and little spectaclecase (*Villosa lienosa*). All but two of these species (flat floater and monkeyface) are federally or state listed as threatened or endangered, or species of greatest need of conservation (SGNC; IDNR 2005) in Illinois.

Three species, creek heelsplitter (*Lasmigona compressa*), fluted shell (*Lasmigona costata*), and snuffbox (*Epioblasma triquetra*), which are state listed, or species of greatest need of conservation (SGNC) in Illinois, were represented by relict shell only. The creek heelsplitter specimen is the first record for this species in the Kaskaskia River basin, although it is found in most central to northern Illinois basins. Only two of the 15 listed species or SGNC known from this basin were collected alive. Ten individuals of spike (*Elliptio dilatata*, state-threatened) were collected at five mainstem Kaskaskia River sites and 34 rock pocketbooks (*Arcidens confragosus*, SGNC) were collected at six sites across the basin (1 Upper, 2 Lower, 1 Shoal, and 2 mainstem; Table 2) during our surveys.

## Discussion

The Kaskaskia River basin has been the subject of several previous surveys and publications including M. A. Matteson (1954-56 survey, 35 species), Suloway et al. (1981, 23 species), and Schanzle et al. (2008, 29 species). The earlier surveys were focused primarily on the Kaskaskia River mainstem, with Suloway et al. (1981) completing their assessment post-completion of Lakes Carlyle and Shelbyville. Species listings for the basin based on published reports and museum specimens have also been reported in Baker (1906), Page et al. (1992), Cummings and Mayer (1997), and Tiemann et al. (2007). The most recent mussel community assessment,

completed by R.W. Schanzle et al. (2008) between 2002 and 2006, recorded 29 total species with 27 species represented by live specimens collected from 59 mainstem and tributary sites (Table 3). Nearly all the sites surveyed by Schanzle were sampled at the exact location or close proximity during our surveys. Exceptions were four furthest downstream sites below Venedy Station on the Kaskaskia River located in St. Clair and Randolph counties, which were not wadeable during our surveys, and Jordan Creek, a tributary located in the Middle Kaskaskia that was sampled for 1.0 hour in 2002 with no mussels found. These 5 sites were not sampled during our survey; however, an additional 41 sites were sampled across the basin including 12 Upper, 7 Middle, 11 Lower, 8 Shoal Creek, and 3 Kaskaskia River sites. Even with these additional sites, results between the two surveys were very similar. Our survey found 29 live species and 32 total species, with all species recorded by Schanzle being collected during our surveys (Table 3). Our additional species included the elktoe (*Alasmodonta marginata*, n=1, site 10), round pigtoe (*Pleurobema sintoxia*, n=7, sites 10 & 12), plus relict shells of creek heelsplitter, snuffbox, and black sandshell.

Based on a comparison of the previous survey to the 2009-2012 surveys, it appears that the dominant species may have changed slightly over time (Table 3). However, it is important to note our survey includes a considerably higher proportion of tributaries sampled, which could account for these changes. During Schanzle's survey, the two dominant species were giant floater (n=310) and mapleleaf (n=305) followed closely by threeridge (*Amblema plicata*, n=227) accounting for nearly 50% of the mussels collected. These two species, mapleleaf (n=484), giant floater (n=469), along with pistolgrip (n=458) were the dominant species during our survey accounting for 40% of the mussels collected (Table 3). The occurrence of threeridge declined (13% to 4.7%) and pistolgrip increased (7.4% to 13%) between surveys. Other notable changes include an increase in lilliput collected, from less than 0.5% occurrence in 2006 to nearly 6% during our survey. Other explanations for these species differences besides stream size sampled include sampling conditions (e.g., water temperature or depth), sampling methods, dominant substrate, or fish species composition.

Based on our and recent surveys, we identified several species that are likely extirpated in the Kaskaskia River basin. Live or dead occurrences were not recorded for spectaclecase, slippershell mussel, flat floater, elephantear, ebonyshell, sheepnose, winged mapleleaf, monkeyface, butterfly, scaleshell, black sandshell, and little spectaclecase, all of which were known historically from the basin. Nearly all records for these species are shell records found pre-1960. The only exceptions are one live monkeyface collected in 1979 on the mainstem Kaskaskia below the dam at Carlyle and a relict little spectaclecase collected on the mainstem Kaskaskia in Douglas County in 1989. The range of several of these species including spectaclecase, ebonyshell, elephantear, and butterfly is limited to larger rivers, while others

such as monkeyface, sheepnose, and black sandshell occur statewide but are uncommon or rare throughout their range (Cummings and Mayer 1992). Two other species, slippershell mussel and little spectaclecase, would be outside of their normal ranges, while flat floater occupies areas such as backwaters and lakes which were not sampled during our surveys (Cummings and Mayer 1992). All of these species, with the exception of flat floater and monkeyface, are state or federally listed and are presumed extirpated from the basin (Appendix 1).

### **Recruitment**

Nearly 65% of sites sampled (61 of 95) displayed no recent recruitment. However, 63% of Shoal Creek sites, 50% of mainstem Kaskaskia River sites, and 40% of Lower Kaskaskia sites displayed moderate to very high recruitment. Recruitment in the Upper and Middle Kaskaskia was 12% and 22%, respectively. These findings suggest that many of the mussel communities of the mainstem Kaskaskia, Shoal Creek basin and Lower Kaskaskia basin are viable and self-maintaining at this time. Sampling methods to target juvenile mussels would be necessary to better assess the reproductive status of these populations.

### **Mussel community of the Kaskaskia River basin**

There appears to be a slight relationship between stream assessments completed by EPA biologists and mussel diversity in the Kaskaskia River Basin. In recent assessments, 35 sites that were sampled for mussels are considered full support and 19 sites are listed as impaired for aquatic life use based on biological, physiochemical, physical habitat, and toxicity data collected (IEPA 2012). Of the 35 sites considered full support, 11 sites (15, 23, 27, 30, 32, 39, 42, 61, 62, 69, and 95) had no live mussels, and 6 of these were located in the Middle Kaskaskia. Sixteen sites were classified as Moderate mussel resources, and 7 sites (4 mainstem, 2 Shoal Creek, and East Fork Kaskaskia River) were Highly Valued based on the current MCI values. Twelve of the 19 sites that were considered aquatic life impaired are located in the Lower Kaskaskia. Seven of those 12 sites had no live mussels. MCI classifications of the other twelve sites included, 4 Limited, 6 Moderate and 2 (site 14, Asa Creek; site 77, Sugar Creek) classified as Highly Valued mussel resources. Therefore, a slight relationship between the stream classification of full/non support and mussel diversity exists as over 65% of full support sites had Moderate to Highly Valued mussel communities and 60% of non support sites had Restricted or Limited mussel communities.

Our surveys documented the existence of 29 live and 32 total species in the Kaskaskia River basin. While these numbers are less than the historical species count (43), they are slightly higher than the mussel communities documented by Suloway (1981) and Schanzle (2008). Several surveys have been conducted in the Kaskaskia River basin; however, over 40% (40 of

95) of the sites sampled during this survey had no previous mussel data. Extant mussel populations ranging from 1 to 15 species were found at 29 (72.5%) of these sites. Furthermore, at 63% of the sites with historic data available (34 of 54), the 2009-2012 survey found as many or more species than were historically known. The mussel communities collected at these sites suggest relatively stable freshwater mussel communities, since the number of extant species was greater than or nearly the same as historic species records or relict shell collected.

In past biological assessments of the Kaskaskia River basin, Schanzle (2008) and Sauer (2002) rated the Shoal Creek basin as one of the highest quality areas based on the richness of the mussel and fish fauna. Results from our surveys would concur with this assessment. Nearly 70% (13 of 19) of sites in Shoal Creek basin were considered Moderate or Highly Valued mussel resources. In the other tributary basins, less than 40% of sites were considered Moderate or Highly Valued (Upper-37%, Middle-22%, Lower-39%). Five sites in the Shoal Creek basin (sites 67, 68, 70, 71, and 75) along with six sites on the mainstem Kaskaskia contained the highest number extant species (12 to 16). Average mussels collected per site were the highest in the Shoal Creek basin (65); nearly double the average 37 mussels per site recorded across the basin. Schanzle et al. (2008) reported that the sites with the greatest mussel diversity were located in the Shoal Creek basin and middle portion of the mainstem Kaskaskia (Douglas and Coles County) and the present survey confirmed those findings.

Although many threatened, endangered, and rare species have been lost from this basin, unique mussel communities still persist in locations on the mainstem Kaskaskia between Chesterville and Shelbyville (sites 9, 10, 11, 12, 24), Shoal Creek from Pocahontas to Germantown (sites 68, 70, 71, 75), East Fork Shoal Creek (site 67), Asa Creek (Upper, site 14), East Fork Kaskaskia River (Middle, site 45) and Crooked (site 47) and Sugar Creeks (site 77) in the Lower Kaskaskia. These fourteen sites are considered Highly Valued Mussel Resources according to the current MCI classification system. Our recent findings indicate that these areas have maintained relatively intact freshwater mussel communities and should be protected from further disturbance. Our survey indicated comparable results to Schanzle (2008) regarding individuals and species collected; however, there seemed to be a slight shift in species composition in the Kaskaskia River basin. Historical surveys followed by continuous monitoring are an invaluable tool for understanding these species shifts that occur during changing landscapes.

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**Table1a.** 2009-2012 Kaskaskia Basin (Upper, Middle, Lower). Types of samples include MU-mussel sampling, F-fish community sampling, FF-fish flesh contaminate, CM-continuous monitoring, H-habitat, M-macroinvertebrate, P-pesticide, S- sediment, W-water chemistry, and D-discharge. \*notes sites sampled on more than one occasion, \*\*notes sites where a 16-hour sample was completed.

Site Number	IEPA Code	Stream	Types of Samples	County	Location	Watershed area
<b>Upper Kaskaskia</b>						
1	OZYA-02	Copper Slough	MU,F,H,M,S,W	Champaign	Cr 1400 N, 2.3 mi W of Champaign	40.28
2	OZY-CH-D2 (O-70)	Kaskaskia Ditch	MU	Champaign	Co Rd 1400N, 3 mi W of Champaign	48.65
4	OZZX-01	Twomile Slough	MU,F,H,M,S,W	Champaign	3 mi W Pesotum	77.87
7	OW-03	Lake Fork	MU,F,H,M,S,W	Piatt	5 mi NW Atwood	297.01
8	OW-01	Lake Fork	MU,H,M,S,W	Douglas	Rt 36 Br at Atwood	408.52
13	OU-01	Jonathon Creek	MU,F,H,M,S,W	Moultrie	Rt 121 Br 2.5 mi E Sullivan	140.91
14	OZZT-01	Asa Creek	MU,F,H,M,S,W	Moultrie	Co Rd Br 0.8 mi N Sullivan	27.99
15*	OZZS-01	Whitley Creek	MU,F,H,M,S,W	Moultrie	2.5 mi SW Allenville	126.46
16	OTH-01	Ditch #4	MU	Piatt	Co Rd 300N, 3.0 mi N of Hammond	17.32
17	OT-08	West Okaw River/Hammond Ditch	MU	Moultrie	Co Rd 950E, 2.5 mi N of Lovington	75.16
18	OT-04	West Okaw River	MU,	Moultrie	Rt 32 Br NW Lovington	195.48
19	OT-01	West Okaw River	MU,	Moultrie	2 mi SW Lovington	357.48
20	OT-03	West Okaw River	MU,F,H,M,S,W	Moultrie	3 mi SW Lovington	404.46
21	OTB-01	Marrowbone Creek	MU,	Moultrie	1.5 mi NW Bethany	86.38
22	OT-05	West Okaw River	MU,	Moultrie	4 mi Nw Kirksville	613.89
23	OS-03	Robinson Creek	MU,F,H,M,S,W	Shelby	0.25 mi S And 3.7 mi E Tower Hill	257.46
<b>Middle Kaskaskia</b>						
26	ORA-01	Brush Creek	MU,	Shelby	4 mi W Stewardson	30.68
27	OR-01	Richland Creek North	MU,F,H,M,S,W	Shelby	3.5 mi E Cowden	201.53
28	OQ-PS-D2	Beck Creek	MU,	Shelby	Co Rd 500N Br, 5 mi N of Herrick	107.08
29	OQCA-02	Coal Creek	MU,	Shelby	5 mi NNE Oconee at Shelby Co Ln	21.72
30	OQC-01	Opossum Creek	MU,F,H,M,S,W	Shelby	4 mi E Oconee	107.33
31	OQ-02	Becks Creek	MU,	Fayette	2 mi S Herrick	316.52
32	OQA-01	Mitchell Creek	MU,F,H,M,S,W	Shelby	2 mi SW Cowden	96.80
33	OQA-99	Mitchell Creek	MU,	Shelby	3.6 mi SW Cowden	139.13
35	OPC-01	Wolf Creek	MU,F,H,M,S,W	Fayette	E of Wrights Corner	139.82
36	OP-01	Big Creek	MU,F,H,M,S,W	Fayette	1 mi NW Post Oak	248.63
37	OPAC-SE-C2	Brickyard Creek	MU,	Fayette	US 40 (W Cumerland Rd) Br	18.59
38	OPA-01	South Fork Big Creek	MU,	Fayette	1 mi SW Post Oak	87.36
39	OO-02	Ramsey Creek	MU,F,H,M,S,W	Fayette	6 mi NNW Ramsey	134.42
40	OO-01	Ramsey Creek	MU,F,H,M,S,W	Fayette	Rt 51 Br 3 mi S Ramsey	246.91
42	ON-01	Hickory Creek	MU,F,H,M,S,W	Fayette	2.7 mi S of Bluff City	201.03
43	OL-02	Hurricane Creek	MU,F,H,M,S,W	Fayette	Rt 140 Br 1 mi E of Mulberry Grove	389.94
44	OKA-01	North Fork Kaskaskia River	MU,F,H,M,S,W	Marion	Co Rd 250E Br 1.5 mi N of Patoka	103.27
45	OK-01	East Fork Kaskaskia River	MU,F,H,M,S,W	Marion	Rt 51 Br 6 mi N of Sandoval	287.90
<b>Lower Kaskaskia</b>						
47	OJ-12	Crooked Creek	MU,F,H,M,S	Marion	3 mi E of Central City	238.38
48	OJF-01	Raccoon Creek	MU,F,CM,H,M,W	Marion	2 mi N Walnut Hill, Copple Rd	101.67
49	OJCB-19	Sewer Creek	MU	Clinton	1.2 mi W of Wamac	9.40
50	OJC-03	Grand Point Creek	MU,F,H,M,S,W	Washington	3.9 mi NW Irvington on Sycamore Rd	88.84
51	OJ-08	Crooked Creek	MU,F,H,M,S,W	Washington	2.2 mi SW of Hoffman	654.87
52	OJB-05	Lost Creek	MU	Clinton	Hammel Rd, SE of Huey	63.12
53	OJBA-03	Prairie Creek	MU,F,H,M,S,W	Clinton	Creek Rd 0.6 mi NE Hoffman	57.03
54	OJB-02	Lost Creek	MU,F,H,M,S,W	Clinton	2 mi NW of Hoffman	180.71
55	OJA-01	Little Crooked Creek	MU,F,H,M,S,W	Washington	Rt 177 Br 2 mi E Covington	217.87
76	OH-05	Sugar Creek	MU,F,CM,H,M,W	Madison	Br. 2.5 mi S of Highland	138.38
77	OH-01	Sugar Creek	MU,F,H,M,S,W,P	Clinton	Rt 161 Br, W of Albers	320.80
78	OHAA-07	Bull Branch	MU	Clinton	1.7 mi E Aviston	9.03
79	OHA-01	Lake Branch East	MU	Clinton	0.7 mi NW Albers	56.35
81	OG-01	Elkhorn Creek	MU,F,H,M,S,W	Washington	3 mi SE of Venedy	138.91
82	OE-05	Mud Creek	MU,F,H,M,S,W	St Clair	3 mi E Lenzburg	212.59
83	OEA-01	Little Mud Creek	MU,F,CM,H,M,W	St Clair	2 mi WSW of St. Libory	56.28
84	OD-09	Silver Creek	MU,F,H,M,S,W	Madison	4 mi E of Edwardsville	294.76
85	ODLA-01	Sugar Fork Silver Creek	MU,F,H,M,S,W	Madison	1 mi E Marine	58.28
86	ODL-02	East Fork Silver Creek	MU,F,H,M,S,W	Madison	1.5 mi NW St Jacob	241.16
87	ODG-01	Little Silver Creek	MU,F,H,M,S,W	St Clair	1 mi S of Lebanon	92.16
88	OD-07	Silver Creek	MU,F,FF,H,M,S,W,P	St Clair	Rt 15 Br, 2.2 mi SE of Freeburg	1201.77
89	OC-90	Richland Creek-South	MU	St Clair	1 mi E of Smithton	143.04
90	OC-04	Richland Creek-South	MU,F,FF,H,M,S,W,P	St Clair	Rt 156 Br 1.6 mi NE of Hecker	327.56
91	OCB-99	Prairie du Long Creek	MU,F,H,M,S,W	St Clair	4.75 mi S Milstad	29.49
92	OCB-97	Prairie du Long Creek	MU,F,CM,H,M,W	Monroe	Rt 159, S of Hecker	199.04
93**	OZC-01	Plum Creek	MU,F,H,M,S,W	Randolph	2.5 mi S of Baldwin	166.57
94	OB-03	Horse Creek	MU,F,CM,H,M,W	Randolph	Rt 3, 1.5 mi N of Ruma	168.54
95	OA-01	Ninemile Creek	MU,F,H,M,S,W	Randolph	3.5 mi SSE Evansville	55.42

**Table 1b.** 2009-2012 Kaskaskia Basin (Shoal Creek basin and mainstem sites). Types of samples include MU-mussel sampling, F-fish community sampling, FF-fish flesh contaminate, CM-continuous monitoring, H-habitat, M-macroinvertebrate, P-pesticide, S- sediment, W-water chemistry, and D-discharge. \*notes sites sampled on more than one occasion, \*\*notes sites where a 16-hour sample was completed.

Site Number	IEPA Code	Stream	Types of Samples	County	Location	Watershed area
<b>Shoal Creek</b>						
57	OIL-02	Middle Fork Shoal Creek	MU	Montgomery	1 mi SW Hillsboro	261.13
58*	OIL-03	Middle Fork Shoal Creek	MU,F,H,M,S,W	Montgomery	2 mi SW Taylor Spring	290.54
59	OIM-02	West Fork Shoal Creek	MU,F,H,M,S,W	Montgomery	3 mi NE Walshville	389.48
60	OI-07	Shoal Creek	MU,F,H,M,S,W	Montgomery	2 mi NW Panama	737.55
61	OIJ-01	Lake Fork	MU	Montgomery	3.75 mi W of Panama	108.16
62	OIG-01	Dry Fork	MU,F,H,M,S,W	Bond	Ripson Bridge Ave 2.6 mi S Sorento	70.13
63	OI-06	Shoal Creek	MU	Bond	Rt 40, 1.5 mi NE Pocahontas	1218.34
64	OID-04	East Fork Shoal Creek	MU,F,CM,H,M,W	Montgomery	Rt. 185, SE of Coffeen	182.79
65	OID-03	East Fork Shoal Creek	MU	Bond	6 mi N of Greenville	291.57
66	OID-05	East Fork Shoal Creek	MU,F,H,M,S,W	Bond	Rt 140 Br Greenville	440.19
67	OID-01	East Fork Shoal Creek	MU	Bond	RT 40 6 mi SW Greenville	466.49
68	OI-15	Shoal Creek	MU,F,H,M,S	Bond	2 mi SE of Pocahontas	1710.72
69	OIC-02	Locust Fork	MU,F,H,M,S,W	Bond	4.5 mi S Pocahontas	27.91
70	OI-13	Shoal Creek	MU,F,CM,H,M	Clinton	Br. 3.25 mi ENE of St. Rose	1826.73
71	OI-08	Shoal Creek	MU,F,H,M,S	Clinton	Rt 50 Br, 1.4 mi E of Breese	1889.15
72	OIB-01	Beaver Creek	MU,F,CM,H,M,W	Bond	Br. 1.5 mi S of Dudleyville	83.67
73	OIBA-01	Flat Branch	MU,F,H,M,S,W	Clinton	5.5 mi NNW of Carlyle	60.57
74	OIB-02	Beaver Creek	MU,F,H,M,S,W	Clinton	4 mi N of Beckemeyer	282.59
75	OI-05	Shoal Creek	MU,F,FF,H,M,S,W	Clinton	Rt 161 Br, 1 mi SE Germantown	2280.86
<b>Mainstem</b>						
3	O-35	Kaskaskia River	MU,F,H,M,S,W	Champaign	Co Rd 900N Br 3 mi N Sadorus	167.31
5	O-31	Kaskaskia River	MU,F,H,M,S,W	Douglas	Co Rd 1450N Br 4.4 mi W of Hayes	292.48
6	O-34	Kaskaskia River	MU,	Douglas	3 mi S Champaign County line	314.59
9	O-17	Kaskaskia River	MU,F,H,M,S,W	Douglas	Rt 133 Br E edge of Chesterville	922.08
10	O-02	Kaskaskia River	MU,W	Coles	Co Rd 300E Br at Cooks Mills	1209.70
11	O-45	Kaskaskia River	MU,	Coles	1.5 mi SW Cooks Mills	1239.86
12*	O-15	Kaskaskia River	MU,F,H,M,S,W	Moultrie	Rt 121 Br 1 mi N of Allenville	1291.47
24	O-32	Kaskaskia River	MU,F,H,M,S,W	Shelby	Co Rd 1700E at Moore Br, 5 mi SSW Shelbyville	3061.46
25	O-47	Kaskaskia River	MU,	Champaign	Co Rd 1700E; Thompson Mill Covered Br	3175.91
34	O-33	Kaskaskia River	MU,F,H,M,S,W	Fayette	Co Rd 2700N Br, 7 mi E Ramsey US Big Creek	4027.87
41	O-08	Kaskaskia River	MU,F,H,M,S,W	Fayette	Rt 40-51 Br (Gallatin St), SE Edge of Vandalia	4976.01
46	O-07	Kaskaskia River	MU,F,FF,CM,H,M,W,P	Clinton	Rt 127, 3 mi S Carlyle	7001.60
56	O-25	Kaskaskia River	MU,F,CM,H,M,W	Washington	2.5 mi N Covington	8252.29
80	O-20	Kaskaskia River	MU,F,FF,CM,H,M,W,P	Washington	Rt 177, Venedy Station	11220.92

**Table 2.** Mussel data for sites sampled during 2009-2012 surveys (Tables 1a, b) in the Upper Kaskaskia (a), Middle Kaskaskia (b), Lower Kaskaskia (c), Shoal Creek (d), Kaskaskia River (e), and summary of Kaskaskia basin (f). Numbers in columns are live individuals collected; "D" and "R" indicates that only dead or relict shells were collected. Shaded boxes indicate historic collections at the specific site location obtained from the INHS Mollusk Collection records. Species in bold are federally or state-listed species or species in Greatest Need of Conservation by IL DNR. Proportion of total is number of individuals of a species divided by total number of individuals at all sites. Extant species is live + dead shell and total species is live + dead + relict shell. NDA represents no historical data available. MCI scores and Resource Classification are based on values in Tables 3 and 4 (R= Restricted, L= Limited, M= Moderate, HV= Highly Valued, and U= Unique). Sites with one or more samples denoted by A, B, \* denotes 16-hour sample

a. Upper Kaskaskia

Species	Site Number																	Proportion of total
	1	2	4	7	8	13	14	15A	15B	16	17	18	19	20	21	22	23	
<b>Subfamily Anodontinae</b>																		
<i>Anodontoides ferussacianus</i>	R	R	R	D		R				R	2		2	3			R	1.10%
<i>Arcidens confragosus</i>					2													0.32%
<i>Lasmigona complanata</i>				6	13								7	1		1		4.42%
<b><i>Lasmigona compressa</i></b>												R						0.00%
<i>Pyganodon grandis</i>		1		1	D	R	8	D			6	1	6	R	D		R	3.63%
<i>Strophitus undulatus</i>			D	10							D		1	2				2.05%
<i>Utterbackia imbecillis</i>						D	D									D		0.00%
<b>Subfamily Ambleminae</b>																		
<i>Amblema plicata</i>			27	38	D								R					10.25%
<i>Fusconaia flava</i>				4	R								3	3			R	1.58%
<i>Quadrula pustulosa</i>														1				0.16%
<i>Quadrula quadrula</i>				13	4								2	1				3.15%
<i>Tritogonia verrucosa</i>																		0.00%
<i>Unio merus tetralasmus</i>	D		R	2	R	R	286			R	D				D			45.43%
<b>Subfamily Lampsilinae</b>																		
<i>Actinonaias ligamentina</i>				D					R					D				0.00%
<i>Lampsilis cardium</i>			1	10		R							8	13				5.05%
<i>Lampsilis siliquoidea</i>			6	13	R	R					D	R	1	1			R	3.31%
<i>Leptodea fragilis</i>	R			D	4	D					R		11	40				8.68%
<i>Ligumia subrostrata</i>						D								R				0.00%
<i>Potamilus alatus</i>	1		2	1	1				1									0.95%
<i>Potamilus ohioensis</i>						D							2			3		0.79%
<i>Toxolasma parvum</i>	D			R		R	56		R		1	R		D	D	1		9.15%
<b>Total</b>																		
<b>Individuals</b>	1	1	36	98	24	0	350	0	1	0	9	1	43	65	0	5	0	634
<b>Live Species</b>	1	1	4	10	5	0	3	0	1	0	3	1	10	9	0	3	0	16
<b>Extant Species</b>	3	1	5	13	7	4	4	1	1	0	6	1	10	11	3	4	0	19
<b>Total Species</b>	5	2	7	14	10	10	4	1	3	2	7	4	11	13	3	4	4	20
<b>Historical Species</b>	NDA	NDA	4	NDA	NDA	NDA	3	NDA	NDA	NDA	NDA	NDA	NDA	10	NDA	4	6	
<b>Catch per unit effort (CPUE)</b>	0.25	0.25	9.23	25.13	6.15	0.00	89.74	0.00	0.25	0.00	2.31	0.25	10.75	16.67	0.00	1.25	0.00	
<b>Mussel Community Index (MCI)</b>	4	4	7	10	8	0	14	0	4	0	7	4	10	10	0	10	0	
<b>Resource Classification</b>	R	R	L	M	M	R	HV	R	R	R	L	R	M	M	R	M	R	

b. Middle Kaskaskia

Species	Site Number																		Proportion of total
	26	27	28	29	30	31	32	33	35	36	37	38	39	40	42	43	44	45	
<b>Subfamily Anodontinae</b>																			
<i>Anodontoides ferussacianus</i>			D		R	R			3										1.09%
<i>Arcidens confragosus</i>																			0.00%
<i>Lasmigona complanata</i>			R						R	D				D		1		D	0.36%
<i>Pyganodon grandis</i>	R		R		R	R			R	2	R	R	R			1	8	27	13.82%
<i>Strophitus undulatus</i>																			0.00%
<i>Utterbackia imbecillis</i>																			0.00%
<b>Subfamily Ambleminae</b>																			
<i>Amblema plicata</i>													R	R		2		12	5.09%
<i>Fusconaia flava</i>																		R	0.00%
<i>Quadrula quadrula</i>						D								1		33		D	12.36%
<i>Tritogonia verrucosa</i>																2			0.73%
<i>Unio merus tetralasmus</i>				R					R									1	0.36%
<b>Subfamily Lampsilinae</b>																			
<i>Lampsilis cardium</i>						R													0.00%
<i>Lampsilis siliquoidea</i>			R			1	R	R					R			R		155	56.73%
<i>Lampsilis teres</i>					R				R					R					0.00%
<i>Leptodea fragilis</i>		R	D			1				3				D		D		6	3.64%
<i>Ligumia subrostrata</i>									R									2	0.73%
<i>Potamilus alatus</i>			R							1				R		2		1	1.45%
<i>Potamilus ohioensis</i>						R				2				1		D			1.09%
<i>Toxolasma parvum</i>	R	R	6			R			R	1		D		D			D	D	2.55%
<i>Truncilla truncata</i>														R					0.00%
																			<b>Total</b>
<b>Individuals</b>	0	0	6	0	0	2	0	0	3	9	0	0	0	2	0	41	8	204	275
<b>Live Species</b>	0	0	1	0	0	2	0	0	1	5	0	0	0	2	0	6	1	7	13
<b>Extant Species</b>	0	0	3	0	0	3	0	0	1	6	0	1	0	5	0	8	2	10	13
<b>Total Species</b>	2	2	7	1	3	8	1	1	7	6	1	2	3	9	0	9	2	11	17
<b>Historical Species</b>	NDA	1	NDA	NDA	1	NDA	NDA	NDA	3	7	NDA	NDA	NDA	9	3	7	4	9	
<b>Catch per unit effort (CPUE)</b>	0.00	0.00	1.5	0.00	0.00	0.51	0.00	0	0.77	2.31	0.00	0.00	0.00	0.51	0.00	10.51	2.67	52.31	
<b>Mussel Community Index (MCI)</b>	0	0	10	0	0	7	0	0	8	7	0	0	0	5	0	9	6	13	
<b>Resource Classification</b>	R	R	M	R	R	L	R	R	M	L	R	R	R	L	R	M	L	HV	

c. Lower Kaskaskia

Species	Site Number																				Proportion of Total						
	47	48	50	51	52	53	54	55	76	77	78	81	82	83	84	85	86	87	88	89		90	92	93*	94	95	
<b>Subfamily Anodontinae</b>																											
<i>Anodontooides ferussacianus</i>																											0.00%
<i>Arcidens confragosus</i>	21			D													1										3.68%
<i>Lasmigona complanata</i>	11						R			1							R		1				6				3.18%
<i>Pyganodon grandis</i>	82	R	26	5	1	1	38	D	4	25	R	5	3	7	22		8	36	1				8	10	R		47.16%
<i>Utterbackia imbecillis</i>			2				R			7							D	10	1								3.34%
<b>Subfamily Ambleminae</b>																											
<i>Amblesma plicata</i>	R																								R		0.00%
<i>Megaloniais nervosa</i>																											0.00%
<i>Quadrula quadrula</i>	31									2									8				26		R		11.20%
<i>Tritogonia verrucosa</i>																			1								0.17%
<i>Uniomerus tetralasmus</i>		R	2		R	2	3					R	4	1	2	R				R			R	1	R		2.51%
<b>Subfamily Lampsilinae</b>																											
<i>Actinonaias ligamentina</i>																											0.00%
<i>Lampsilis siliquoidea</i>																						R					0.00%
<i>Lampsilis teres</i>	1			R						2						R	4	D							R		1.17%
<i>Leptodea fragilis</i>	16			D			R			2						D		2			1	2	R				3.85%
<i>Ligumia subrostrata</i>		2	1				1			3		2	R		6		1						1				2.84%
<i>Obliquaria reflexa</i>																				1							0.17%
<i>Potamilus alatus</i>																				R			1		R		0.17%
<i>Potamilus ohioensis</i>	R									2										1							0.50%
<i>Toxolasma parvum</i>		2	1		1	7	2			28		11	1		33	4	1	26					2		D		19.90%
<i>Truncilla donaciformis</i>										1																	0.17%
<i>Truncilla truncata</i>																											0.00%
																											<b>Total</b>
<b>Individuals</b>	162	4	32	5	2	10	44	0	4	73	0	18	4	11	62	6	11	76	16	0	0	2	45	11	0	598	
<b>Live Species</b>	6	2	5	1	2	3	4	0	1	10	0	3	2	2	4	2	4	4	8	0	0	2	6	2	0	15	
<b>Extant Species</b>	6	2	5	3	2	3	4	1	1	10	0	3	2	2	4	2	6	4	9	0	0	2	6	2	1	15	
<b>Total Species</b>	8	4	5	4	3	3	7	1	1	10	1	3	4	2	4	2	9	4	10	1	0	3	7	5	5	17	
<b>Historical Species</b>	6	NDA	NDA	3	NDA	NDA	NDA	2	NDA	5	NDA	4	4	NDA	4	NDA	3	2	9	NDA	1	3	6	4	2		
<b>Catch per unit effort (CPUE)</b>	40.50	1.00	8.02	1.67	0.50	2.50	11.03	0.00	1.00	18.25	0.00	4.51	1.00	2.75	15.50	1.50	2.75	19.00	4.00	0.00	0.00	0.50	2.81	2.75	0.00		
<b>Mussel Community Index (MCI)</b>	12	6	10	7	4	6	10	0	6	12	0	10	9	6	11	10	9	11	11	0	0	4	7	6	0		
<b>Resource Classification</b>	HV	L	M	L	R	L	M	R	L	HV	R	M	M	L	M	M	M	M	M	R	R	R	L	L	R		

d. Shoal Creek

Species	Site Number																				Proportion of total
	57	58A	58B	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	
<b>Subfamily Anodontinae</b>																					
<i>Anodontoides ferussacianus</i>									R	2				R							0.16%
<i>Arcidens confragosus</i>													1		R						0.08%
<i>Lasmigona complanata</i>				7				R			D	4	2		3	8				2	2.10%
<i>Pyganodon grandis</i>	6	1		3	D					2	32	6		R	1	1	60	2	3	1	9.51%
<i>Strophitus undulatus</i>					D							2									0.16%
<i>Utterbackia imbecillis</i>	1										1				D				1	2	0.40%
<b>Subfamily Ambleminae</b>																					
<i>Amblema plicata</i>		R										8	1		1					39	3.95%
<i>Elliptio dilatata</i>													R								0.00%
<i>Fusconaia flava</i>												22	3		14	2				9	4.03%
<i>Megaloniais nervosa</i>															R					1	0.08%
<i>Quadrula nodulata</i>																3				5	0.64%
<i>Quadrula pustulosa</i>												14	4		4	1				7	2.42%
<i>Quadrula quadrula</i>	2	6	2	1				12		4	12	19	44		27	36				76	19.42%
<i>Tritogonia verrucosa</i>		1						5			4	48	14		41	161				78	28.36%
<i>Uniomereus tetralasmus</i>							R								R				2	D	0.16%
<b>Subfamily Lampsilinae</b>																					
<i>Actinonaias ligamentina</i>														R							0.00%
<i>Lampsilis cardium</i>	4	10	3	51	1							1	R			1					5.72%
<i>Lampsilis siliquoidea</i>	R											R									0.00%
<i>Lampsilis teres</i>					R							6	D							D	0.48%
<i>Leptodea fragilis</i>	1	1	D	4	D			7	1	2	3	17	9		19	50				9	9.91%
<i>Ligumia subrostrata</i>	1				D		R		D								2			1	0.32%
<i>Obliquaria reflexa</i>								3						2		13	4			14	2.90%
<i>Potamilus alatus</i>	1	2	D	3	1						D	D								R	0.56%
<i>Potamilus ohioensis</i>				1				3			1	1	2		3	D				9	1.61%
<i>Toxolasma parvum</i>	2	1							1								22	D	1		2.18%
<i>Truncilla donaciformis</i>								2				1	9		11	2				17	3.38%
<i>Truncilla truncata</i>											4	2	5		R	1				6	1.45%
																					<b>Total</b>
<b>Individuals</b>	18	22	5	70	2	0	0	32	2	10	57	151	96	0	137	270	84	4	6	275	1241
<b>Live Species</b>	8	7	2	7	2	0	0	6	2	4	7	14	12	0	11	12	3	2	4	15	24
<b>Extant Species</b>	8	7	4	7	6	0	0	6	3	4	9	15	13	0	12	13	3	3	5	16	24
<b>Total Species</b>	9	8	4	7	7	0	2	7	4	4	9	16	16	3	15	13	3	3	5	17	27
<b>Historical Species</b>	NDA	6	6	7	NDA	1	NDA	2	4	NDA	12	NDA	20	NDA	12	NDA	NDA	NDA	3	18	
<b>Catch per unit effort (CPUE)</b>	4.50	5.50	1.25	17.50	0.50	0.00	0.00	8.00	0.50	2.50	14.25	37.75	24.00	0.00	34.25	67.50	21.00	1.00	1.50	68.75	
<b>Mussel Community Index (MCI)</b>	11	8	7	9	5	0	0	10	7	9	11	13	13	0	14	14	10	6	9	14	
<b>Resource Classification</b>	M	M	L	M	L	R	R	M	L	M	M	HV	HV	R	HV	HV	M	L	M	HV	

e. Kaskaskia River

Species	Site Number															Proportion of total
	3	5	6	9	10	11	12A	12B	24	25	34	41	46	56	80	
<b>Subfamily Anodontinae</b>																
<i>Alasmidonta marginata</i>				R	1											0.13%
<i>Anodontoides ferussacianus</i>		R	R													0.00%
<i>Arcidens confragosus</i>				8		D	1	D								1.16%
<i>Lasmigona complanata</i>	1	2	1	12	R	3	7	D	8	4		1	1		1	5.28%
<i>Lasmigona costata</i>						R	R									0.00%
<i>Pyganodon grandis</i>				D	1	D	1	R	1	D			4	1		1.03%
<i>Strophitus undulatus</i>	1	1		R	R			2								0.52%
<i>Utterbackia imbecillis</i>					1							1	4	2		1.03%
<i>Anodonta suborbiculata</i>																0.00%
<b>Subfamily Ambleminae</b>																
<i>Amblema plicata</i>	1	12	22	D	D	R	R	R	2	R		R	R	1		4.90%
<i>Elliptio dilatata</i>				1	1	3	1	4								1.29%
<i>Fusconaia flava</i>		1	1	2		D	1	D	2			R	R			0.90%
<i>Megaloniaias nervosa</i>						2	2	1					R			0.64%
<i>Plethobasus cyphus</i>																0.00%
<i>Pleurobema sintoxia</i>					3	D	2	2								0.90%
<i>Quadrula fragosa</i>																0.00%
<i>Quadrula metanevra</i>																0.00%
<i>Quadrula nodulata</i>													1	1		0.26%
<i>Quadrula pustulosa</i>				9	6	10	8	7	29	3	1	R	R			9.41%
<i>Quadrula quadrula</i>				31	2	16	24	9	29	8	1	1	R		1	15.72%
<i>Tritogonia verrucosa</i>			1	19	4	2	6	2	31	37	1		R			13.27%
<i>Uniomerus tetralasmus</i>																0.00%
<b>Subfamily Lampsilinae</b>																
<i>Actinonaias ligamentina</i>					6		2	R		R			R			1.03%
<i>Ellipsaria lineolata</i>																0.00%
<i>Epioblasma triquetra</i>						R										0.00%
<i>Lampsilis cardium</i>	3	2	14	8	1	2	8	3	16	6	R		R			8.12%
<i>Lampsilis siliquoidea</i>			R	R	R	R	R	R								0.00%
<i>Lampsilis teres</i>						R	R			R		R	R	1	2	0.39%
<i>Leptodea fragilis</i>				7	10	D	4	5	12	1	4	2	2	2	6	7.09%
<i>Leptodea leptodon</i>																0.00%
<i>Ligumia recta</i>										R		R				0.00%
<i>Ligumia subrostrata</i>																0.00%
<i>Obliquaria reflexa</i>									12				1	7		2.58%
<i>Potamilus alatus</i>	3		4	3		2	2	2	11	2			R			3.74%
<i>Potamilus ohiensis</i>				1	1		2	1	11	1	7	14	11	11	14	9.54%
<i>Toxolasma parvum</i>																0.00%
<i>Truncilla donaciformis</i>								1						5	2	1.03%
<i>Truncilla truncata</i>				4	38	5	10	7	11	2	1					10.05%
																<b>Total</b>
<b>Individuals</b>	9	18	43	105	75	45	81	46	175	64	15	19	24	31	26	776
<b>Live Species</b>	5	5	6	12	13	9	16	13	13	9	6	5	7	9	6	24
<b>Extant Species</b>	5	5	6	14	14	14	16	16	13	10	6	5	7	9	6	24
<b>Total Species</b>	5	6	8	17	17	19	19	20	13	14	7	10	17	9	6	29
<b>Historical Species</b>	6	17	14	15	18	23	8	8	17	14	18	15	14	23	5	
<b>Catch per unit effort (CPUE)</b>	2.25	4.62	10.75	26.25	19.23	11.25	20.77	11.50	43.75	16.00	3.75	4.75	6.00	7.75	6.50	
<b>Mussel Community Index (MCI)</b>	7	7	8	12	14	12	12	14	15	10	7	9	10	10	9	
<b>Resource Classification</b>	L	L	M	HV	HV	HV	HV	HV	HV	M	L	M	M	M	M	

**Table 3.** Summary of sites sampled during 2009-2012 (95 sites, 404 total hours) and summary of species collected by Schanzle et al. (2008); (59 sites, 205 total hours). \*\**Cumberlandia monodonta*, *Alasmidonta viridis*, *Anodonta suborbiculata*, *Elliptio crassidens*, *Fusconaia ebena*, *Plethobasus cyphus*, *Quadrula fragosa*, *Quadrula metanevra*, *Ellipsaria lineolata*, *Leptodea leptodon*, *Ligumia recta*, and *Villosa lienosa* are included in historical total but not represented in the table.

Species	Total individuals	# of sites live	# of sites extant	# of sites relict	Proportion of total live	Schanzle et al. 2002-2006		
						Total individuals	Proportion of total live	
<b>Subfamily Anodontinae</b>								
<i>Alasmidonta marginata</i>	1	1	1	2	0.03%	1 dead	0.00%	
<i>Anodontoides ferussacianus</i>	12	5	7	19	0.34%	8	0.46%	
<i>Arcidens confragosus</i>	34	6	9	10	0.96%	29	1.66%	
<i>Lasmigona complanata</i>	115	27	32	38	3.26%	92	5.27%	
<i>Lasmigona compressa</i>	0	0	0	1	-	0	-	
<i>Lasmigona costata</i>	0	0	0	2	-	1 dead	-	
<i>Pyganodon grandis</i>	469	44	52	67	13.31%	310	17.75%	
<i>Strophitus undulatus</i>	19	7	10	12	0.54%	19	1.09%	
<i>Utterbackia imbecillis</i>	33	12	17	18	0.94%	8	0.46%	
<b>Subfamily Ambleminae</b>								
<i>Amblema plicata</i>	166	13	16	28	4.71%	227	13.00%	
<i>Elliptio dilatata</i>	10	8	8	12	0.28%	10	0.57%	
<i>Fusconaia flava</i>	67	10	12	14	1.90%	24	1.37%	
<i>Megaloniais nervosa</i>	6	4	4	6	0.17%	3	0.17%	
<i>Pleurobema sintoxia</i>	7	3	4	4	0.20%	0	-	
<i>Quadrula nodulata</i>	10	4	4	4	0.28%	5	0.29%	
<i>Quadrula pustulosa</i>	104	14	14	16	2.95%	29	1.66%	
<i>Quadrula quadrula</i>	484	31	33	35	13.73%	305	17.47%	
<i>Tritogonia verrucosa</i>	458	19	19	20	13.00%	130	7.45%	
<i>Unio merus tetralasmus</i>	306	11	15	30	8.68%	15	0.86%	
<b>Subfamily Lampsilinae</b>								
<i>Actinonaias ligamentina</i>	8	2	4	9	0.23%	6	0.34%	
<i>Epioblasma triquetra</i>	0	0	0	1	-	0	-	
<i>Lampsilis cardium</i>	166	20	20	25	4.71%	99	5.67%	
<i>Lampsilis siliquoidea</i>	177	6	7	24	5.02%	74	4.24%	
<i>Lampsilis teres</i>	16	6	9	21	0.45%	1	0.06%	
<i>Leptodea fragilis</i>	266	34	44	49	7.55%	140	8.02%	
<i>Ligumia recta</i>	0	0	0	2	-	0	-	
<i>Ligumia subrostrata</i>	23	12	15	19	0.65%	10	0.57%	
<i>Obliquaria reflexa</i>	61	9	9	9	1.73%	21	1.20%	
<i>Potamilus alatus</i>	46	21	24	30	1.31%	46	2.63%	
<i>Potamilus ohioensis</i>	109	24	27	29	3.09%	44	2.52%	
<i>Toxolasma parvum</i>	204	23	32	40	5.79%	8	0.46%	
<i>Truncilla donaciformis</i>	51	10	10	10	1.45%	9	0.52%	
<i>Truncilla truncata</i>	96	13	13	15	2.72%	74	4.24%	
					<b>Totals</b>			
					<b>Individuals collected</b>	3524	1746	
					<b>Live species collected</b>	29	27	
					<b>Extant species</b>	29	29	
					<b>Total species collected</b>	32	29	
					<b>Historical species</b>	43*		

**Table 4.** Mussel Community Index (MCI) parameters and scores.

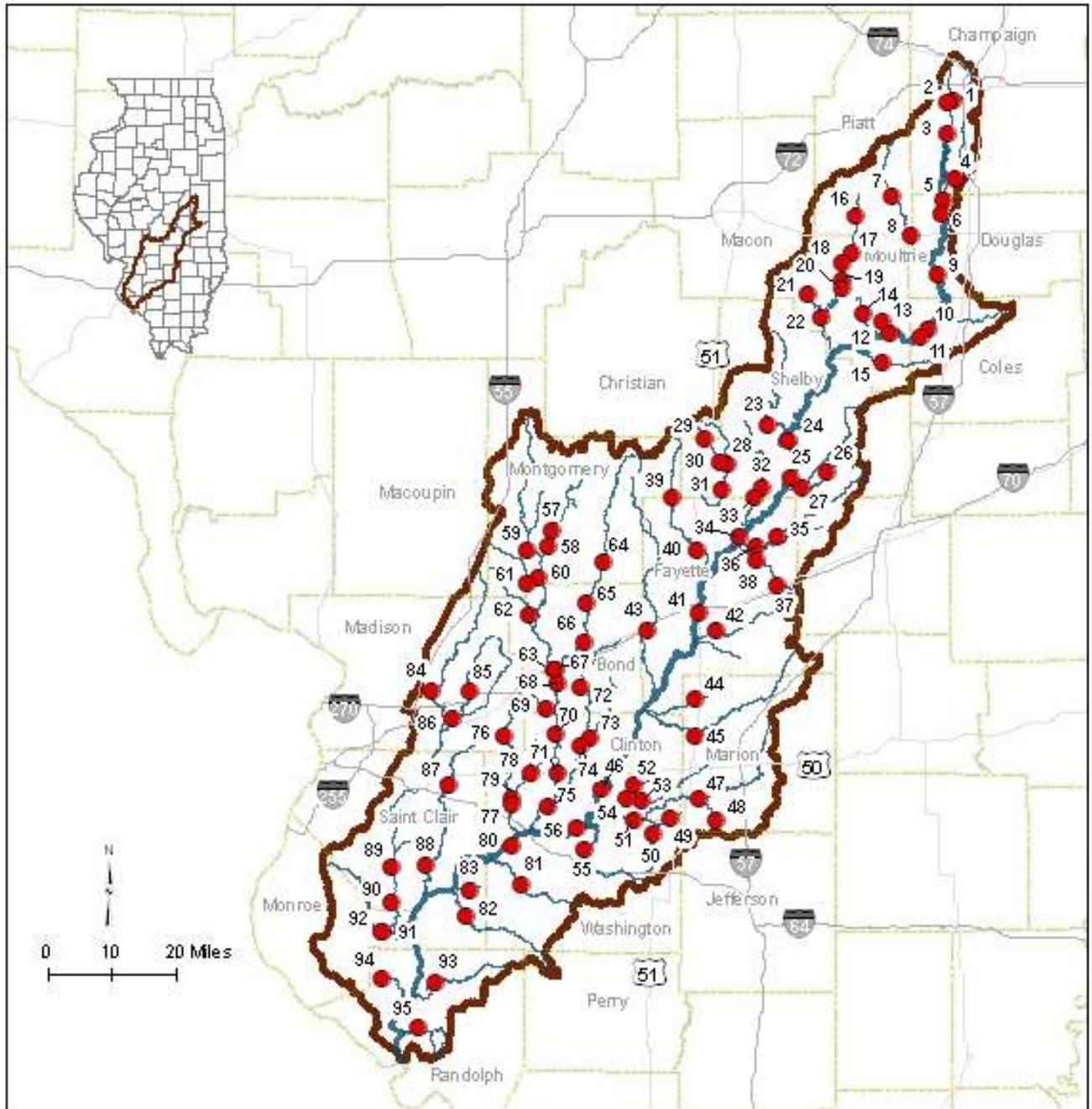
Extant species in sample	Species Richness	Catch per Unit Effort (CPUE)	Abundance (AB) Factor
0	1	0	0
1-3	2	1-10	2
4-6	3	>10-30	3
7-9	4	>30-60	4
10+	5	>60	5
% live species with recent recruitment	Reproduction Factor	# of Intolerant species	Intolerant species Factor
0	1	0	1
1-30	3	1	3
>30-50	4	2+	5
>50	5		

**Table 5.** Freshwater mussel resource categories based on species richness, abundance, and population structure. MCI = Mussel Community Index Score

Unique Resource MCI $\geq$ 16	Very high species richness (10 + species) &/or abundance (CPUE > 80); intolerant species typically present; recruitment noted for most species
Highly Valued Resource MCI = 12 - 15	High species richness (7-9 species) &/or abundance (CPUE 51-80); intolerant species likely present; recruitment noted for several species
Moderate Resource MCI = 8 - 11	Moderate species richness (4-6 species) &/or abundance (CPUE 11-50) typical for stream of given location and order; intolerant species likely not present; recruitment noted for a few species
Limited Resource MCI = 5 - 7	Low species richness (1-3 species) &/or abundance (CPUE 1-10); lack of intolerant species; no evidence of recent recruitment (all individuals old or large for the species)
Restricted Resource MCI = 0 - 4	No live mussels present; only weathered dead, sub-fossil, or no shell material found



**Figure 1.** Divisions of the Upper, Middle, Lower Kaskaskia and Shoal Creek basins as delineated by US Geological Survey Hydrologic Unit Codes (HUC) 8.



**Figure 2.** Sites sampled in the Kaskaskia River basin during 2009-2012. Site codes referenced in Table 1.

**Figure 3a.** Upper Kaskaskia (a. 16 sites) and Middle Kaskaskia (a. 18 sites)

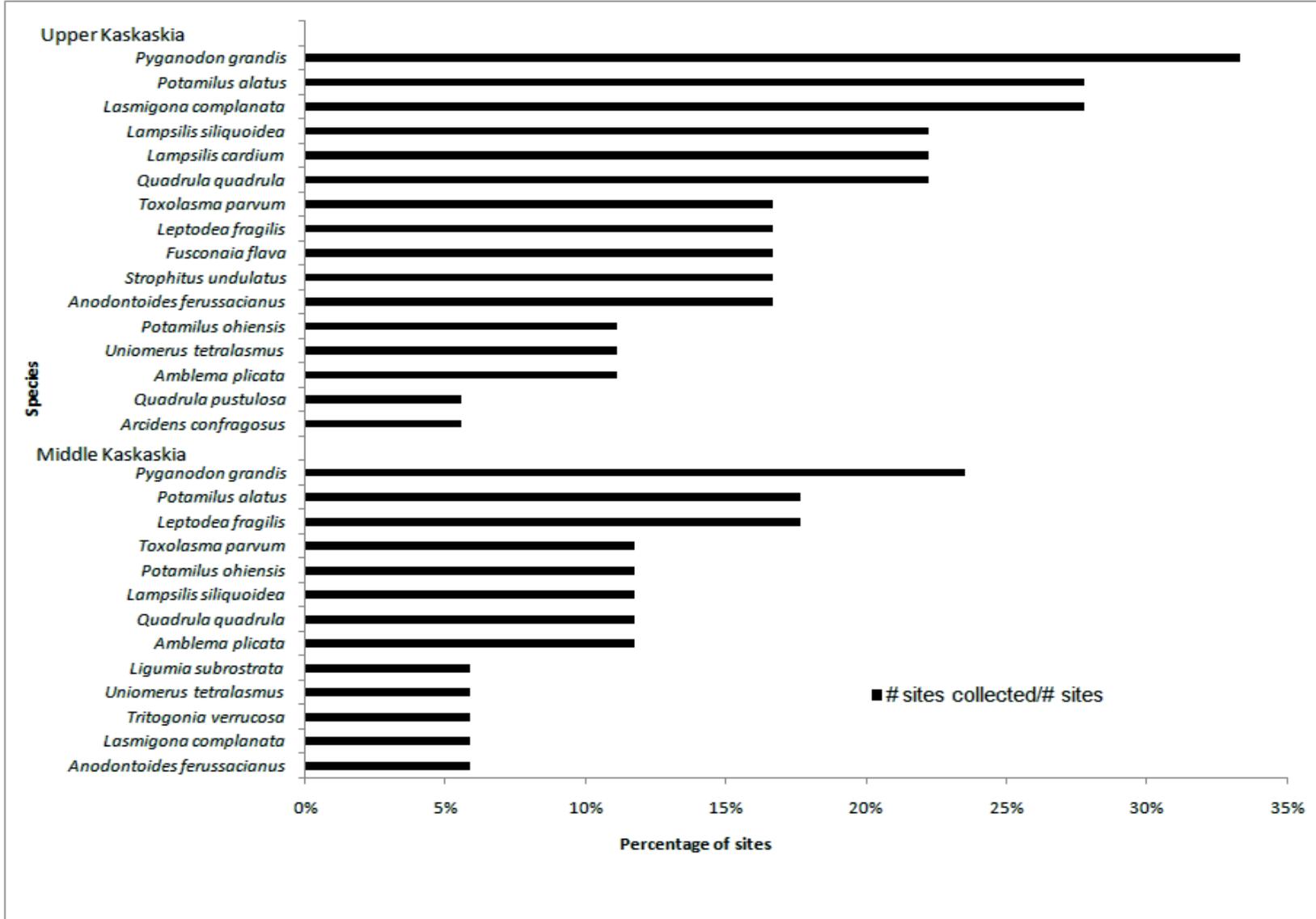


Figure 3b. Lower Kaskaskia (c. 28 sites)

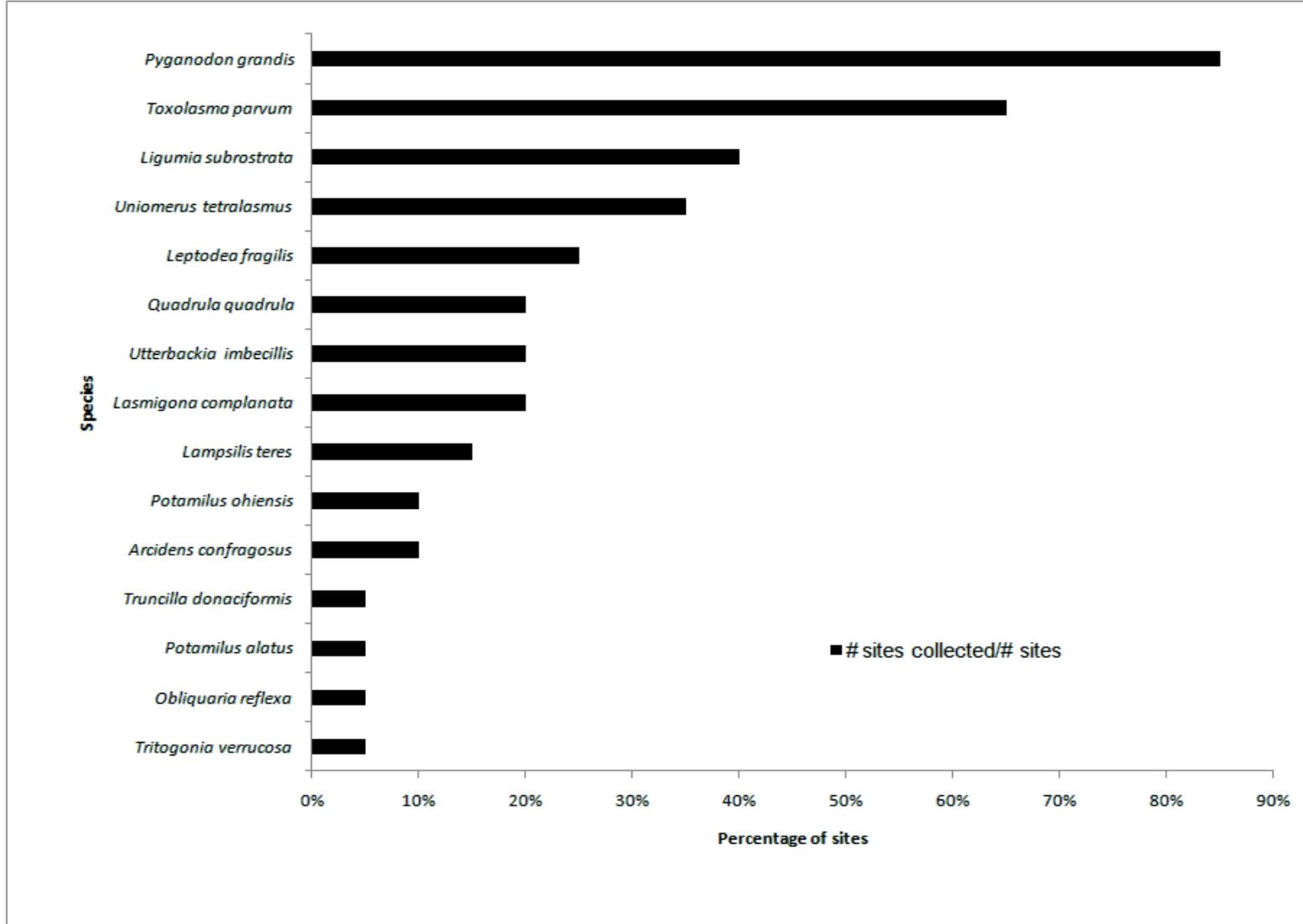
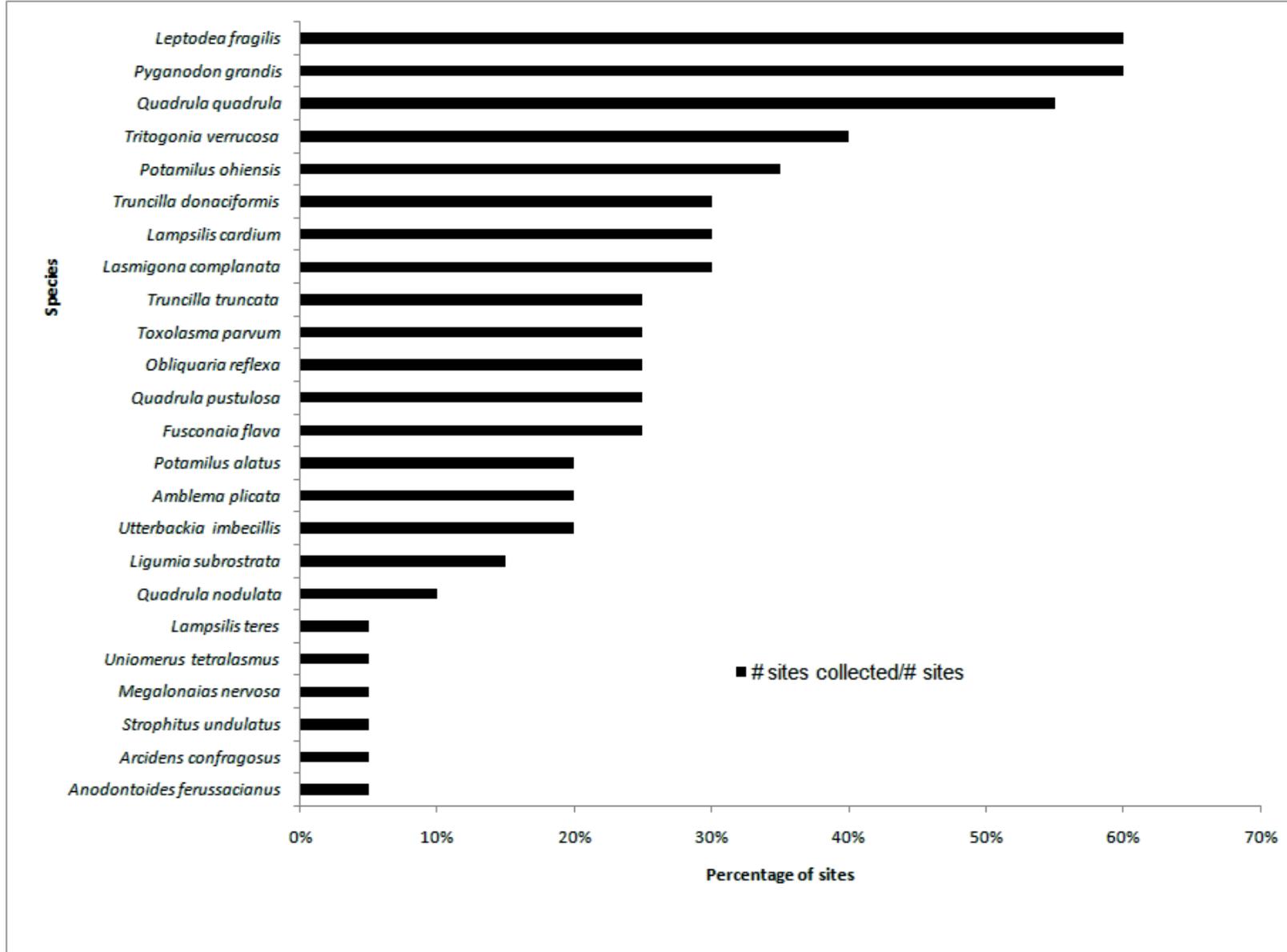
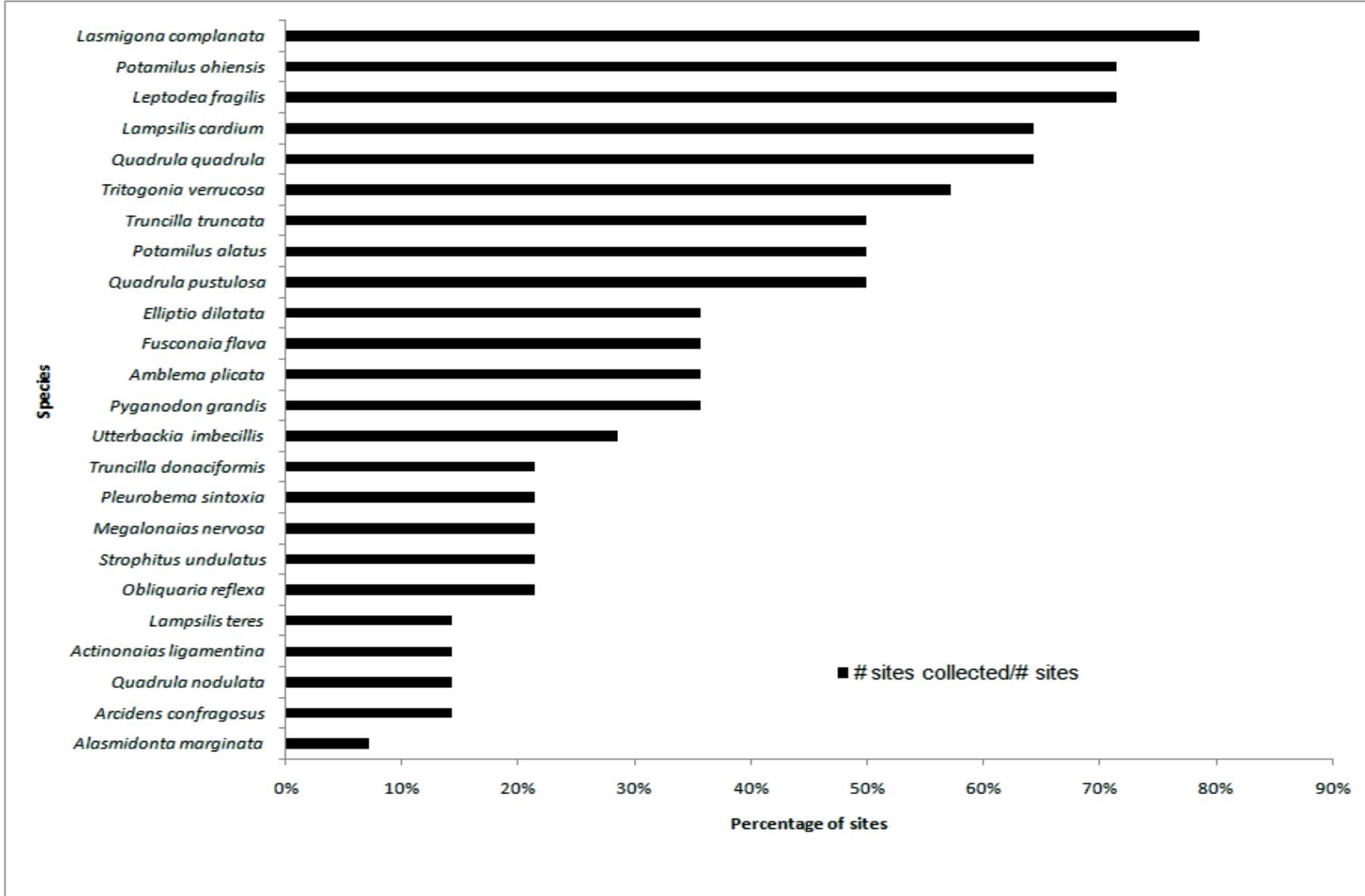


Figure 3c. Shoal Creek (d. 19 sites)



**Figure 3d.** Mainstem Kaskaskia River (d. 14 sites)



**Figure 3.** Number of sites where a species was collected live compared to the number of sites sampled in the Upper Kaskaskia (a. 16 sites), Middle Kaskaskia (a. 18 sites), Lower Kaskaskia (c. 28 sites), Shoal Creek (d. 19 sites), and mainstem Kaskaskia River (d. 14 sites).

Figure 4a.

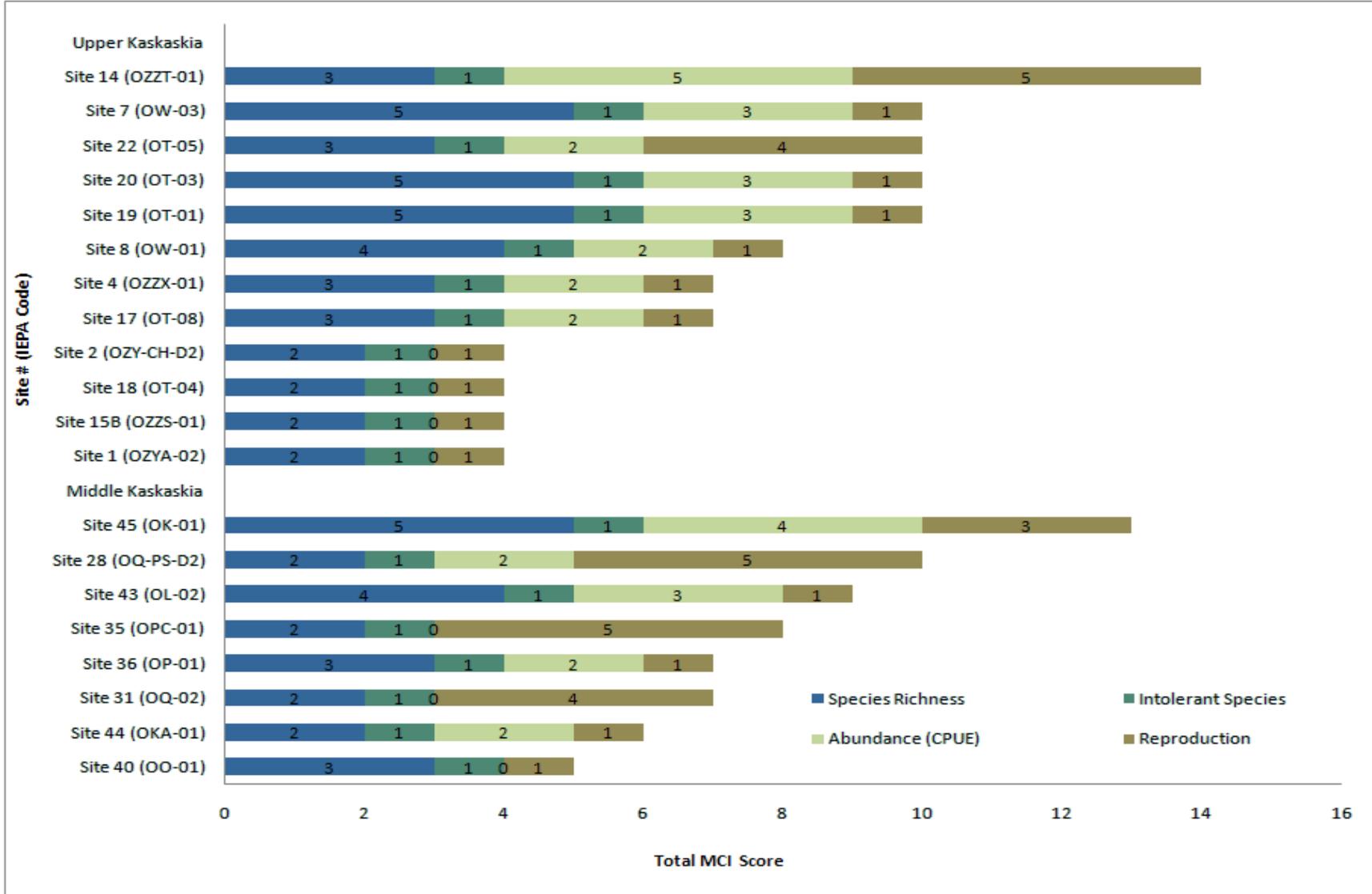


Figure 4b.

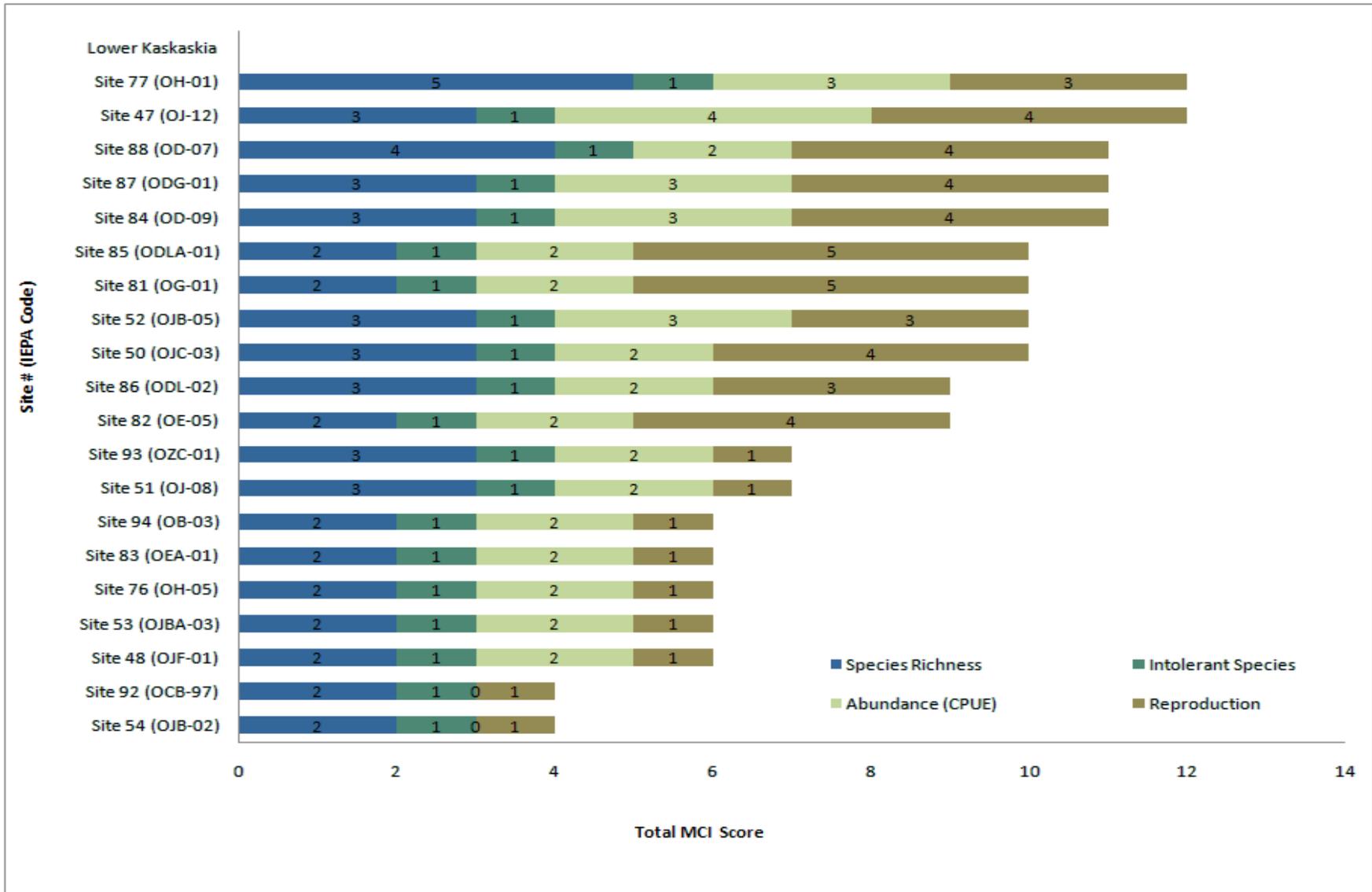


Figure 4c.

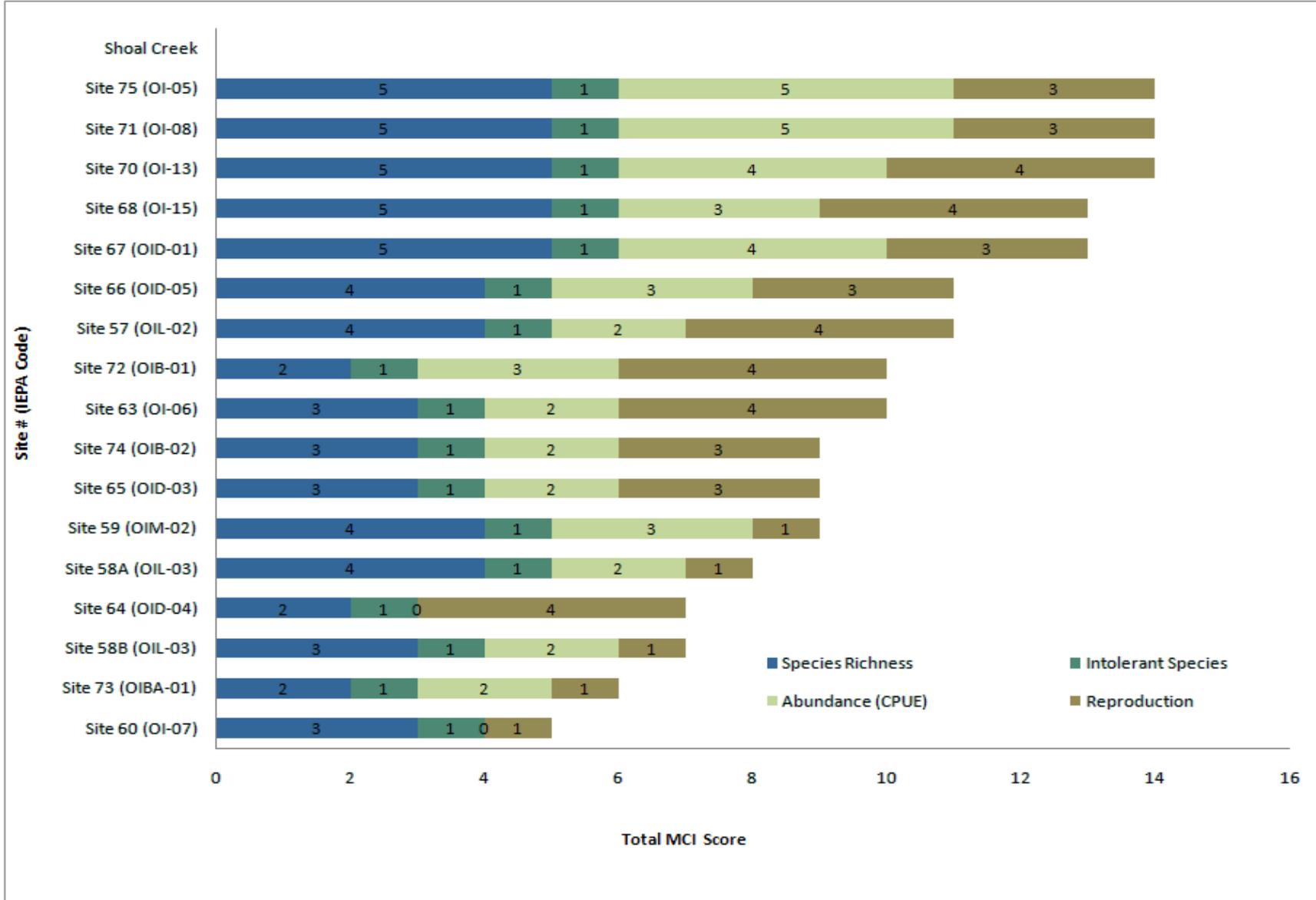


Figure 4d.

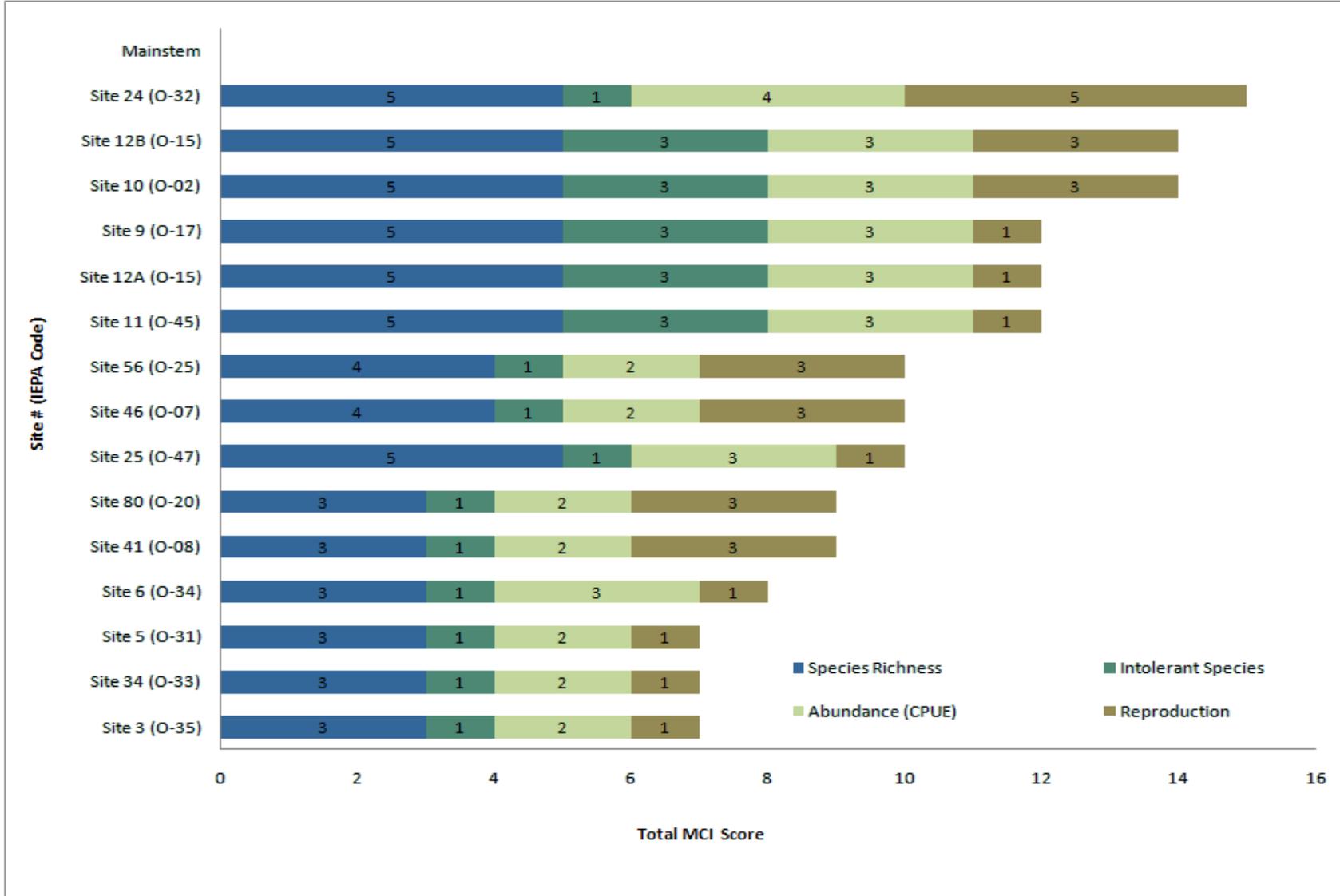


Figure 4. Comparison of Mussel Community Index (MCI) and MCI component scores for Kaskaskia River basin sites based on factor values from Table 3. Upper and Middle (a), Lower (b), Shoal Creek (c), and mainstem Kaskaskia River (d).

Appendix 1. Scientific and common names of species. Status refers to listing status at time of printing (2013). FE-federally endangered, SE- state endangered, ST- state threatened, SGNC- species in greatest need of conservation in Illinois, X- extirpated.

Scientific Name	Common Name	Status
<b>Subfamily Cumberlandinae</b>		
<i>Cumberlandia monodonta</i>	spectaclecase	SE
<b>Subfamily Anodontinae</b>		
<i>Alasmidonta marginata</i>	elktoe	
<i>Alasmidonta viridis</i>	slippershell mussel	ST
<i>Anodontoides ferussacianus</i>	cylindrical papershell	
<i>Arcidens confragosus</i>	rock pocketbook	SGNC
<i>Lasmigona complanata</i>	white heelsplitter	
<i>Lasmigona compressa</i>	creek heelsplitter	SGNC
<i>Lasmigona costata</i>	flutedshell	SGNC
<i>Pyganodon grandis</i>	giant floater	
<i>Strophitus undulatus</i>	creeper	
<i>Utterbackia imbecillis</i>	paper pondshell	
<i>Anodonta suborbiculata</i>	flat floater	
<b>Subfamily Ambleminae</b>		
<i>Amblema plicata</i>	threeridge	
<i>Elliptio crassidens</i>	elephantear	ST
<i>Elliptio dilatata</i>	spike	ST
<i>Fusconaia ebena</i>	ebonyshell	ST
<i>Fusconaia flava</i>	Wabash pigtoe	
<i>Megaloniaias nervosa</i>	washboard	
<i>Plethobasus cyphus</i>	sheepnose	FC, SE
<i>Plerobema sintoxia</i>	round pigtoe	
<i>Quadrula fragosa</i>	winged mapleleaf	FE, X
<i>Quadrula metanevra</i>	monkeyface	
<i>Quadrula nodulata</i>	wartyback	
<i>Quadrula pustulosa</i>	pimpleback	
<i>Quadrula quadrula</i>	mapleleaf	
<i>Tritogonia verrucosa</i>	pistolgrip	
<i>Uniomerus tetralasmus</i>	pondhorn	
<b>Subfamily Lampsilinae</b>		
<i>Actinonaias ligamentina</i>	mucket	
<i>Ellipsaria lineolata</i>	butterfly	ST
<i>Epioblasma triquetra</i>	snuffbox	SE
<i>Lampsilis cardium</i>	plain pocketbook	
<i>Lampsilis hydiana</i>	Louisiana fatmucket	
<i>Lampsilis siliquoidea</i>	fatmucket	
<i>Lampsilis teres</i>	yellow sandshell	
<i>Leptodea fragilis</i>	fragile papershell	
<i>Leptodea leptodon</i>	scaleshell	FE, X
<i>Ligumia recta</i>	black sandshell	ST
<i>Ligumia subrostrata</i>	pondmussel	
<i>Obliquaria reflexa</i>	threehorn wartyback	
<i>Potamilus alatus</i>	pink heelsplitter	
<i>Potamilus ohioensis</i>	pink papershell	
<i>Toxolasma parvum</i>	lilliput	
<i>Truncilla donaciformis</i>	fawnsfoot	
<i>Truncilla truncata</i>	deertoe	
<i>Villosa lienosa</i>	little spectaclecase	ST