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Freshwater mussels of the Iroquois River in Illinois

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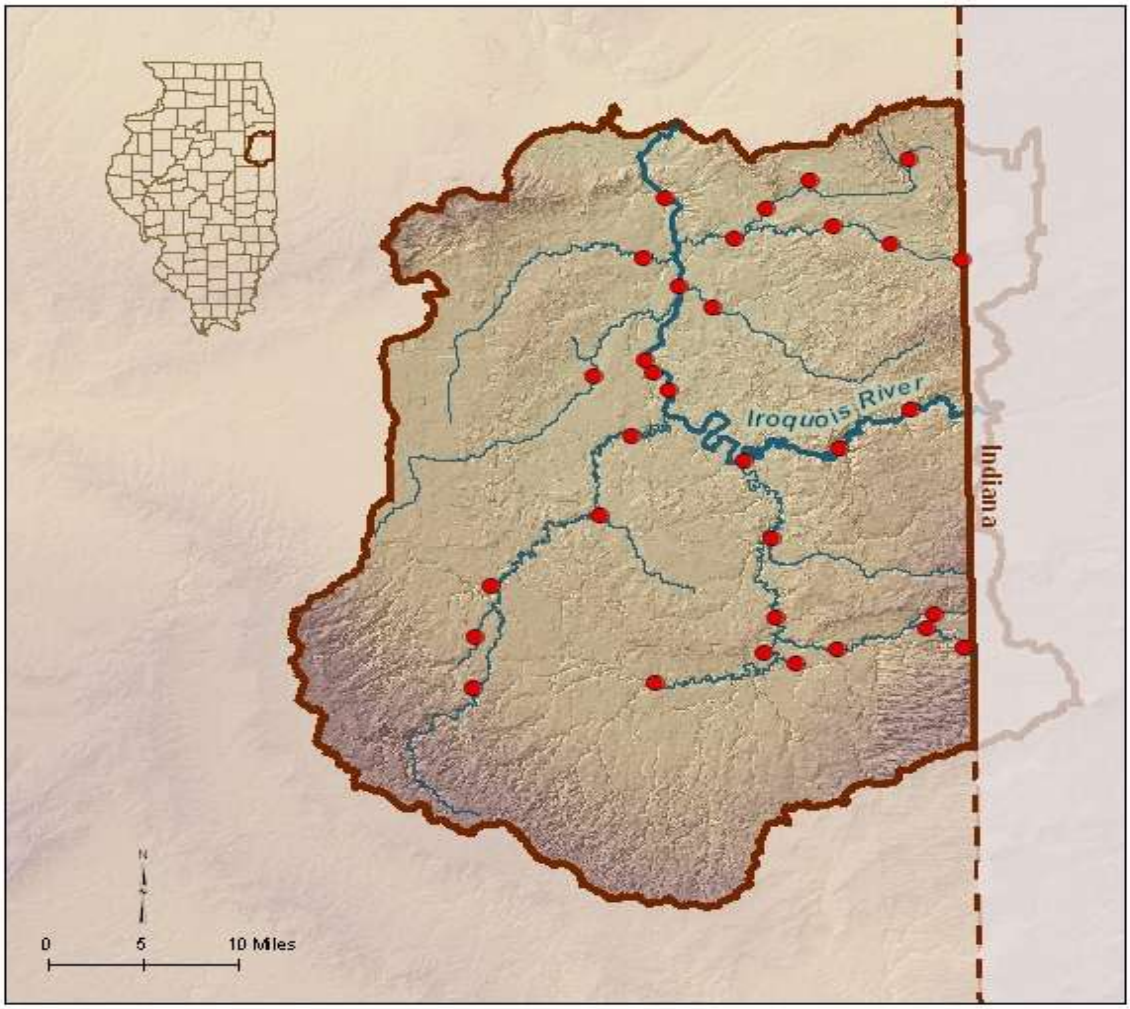

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Illinois Department of Natural Resources

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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.

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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 either federally-listed as endangered or threatened, extinct, 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) and an additional 5 species are species in greatest need of conservation (SGNC; IDNR 2005a). This report summarizes the mussel survey conducted in the Iroquois River basin in 2010 at IEPA/IDNR basin survey sites.

The Iroquois River originates in Jasper County, Indiana and flows southwesterly through Watseka and then northerly before it empties into the Kankakee River near Aroma Park, Illinois (Figure 1). It is a major tributary of the Kankakee River and flows for 55 miles in Illinois, draining approximately 3,200 km^2 (1,240 mi^2) (Page et al. 1992). The portion of the Iroquois River basin within Illinois spans Iroquois County and the lower part of Kankakee County. The basin resides within the eastern portion of the Grand Prairie Section Natural Division and is characterized by gently rolling moraines and occasional steep ravines (Schwegman 1973).

Land use and Instream Habitat

Historically, much of the land cover within the Iroquois basin consisted of prairie, but today, land use is primarily agricultural (Knapp 1992). The Iroquois River flows through the town of Watseka, population 5,400 (US Census Bureau 2010), and the river has never been dammed or dredged (Page et al. 1992). Channelization of small tributaries has occurred; however, modification of larger tributaries appears limited.

Typical late summer hydrology and habitat in the Iroquois River consists of shallow water, cobble riffles and gravel shoals (Figure 2). Substrates in the main channel of the Iroquois River vary from predominately gravel/sand, to sand and silt in slack water areas and along banks. The tributaries have varied substrate composition, from predominantly claypan with silt banks to a consolidated gravel/sand mixture (Figure 3). All streams in this basin, except one site on the Iroquois River (site 5, FL-05; Figure 1), are normally wadeable with average depths less than a meter at base flow.

Methods

During the 2010 survey, freshwater mussel data were collected at 32 sites: 8 mainstem and 24 tributary sites in the Iroquois River basin (Figure 1; Table 1). Locations of sampling sites are listed in Table 1 along with IDNR/IEPA sampling type information for the site. In most cases,

mussel survey locations were the same as IDNR/IEPA basin survey sites.

Live mussels and shells were collected at each sample station 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 each station. 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 (if applicable), and an estimate of the number of growth rings were recorded. Shell material was classified as recent dead or relict based on condition of the best shell found. A species was considered extant at a station 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.

Other parameters recorded were comprised of 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 30mm in length or with three or fewer growth rings were observed. Finally, mussel resources were classified as Unique, Highly Valued, Moderate, Limited, or Restricted (Table 2) based on the above parameters (Table 3) and following criteria outlined in Table 4 (Szafoni 2001).

Results

Species Richness

In this survey, 26 total species and 24 live and extant species were observed (Table 2). Across all sites, the number of live species collected ranged from 0 to 17, extant species collected (live + dead) ranged from 0 to 18, and total number of species collected (live + dead + relict) ranged from 1 to 19. Across tributary sites, species richness ranged from 0 to 17 live and extant species, and 1 to 17 total species. Mainstem species richness ranged from 7 to 17 live species, 8 to 18 extant species, and 13 to 19 total species. In tributary sites, the fatmucket (*Lampsilis siliquoidea*) and Wabash pigtoe (*Fusconaia flava*) were the most widespread species, collected at 13 and 15 of 24 sites, respectively (54% and 63%; Figure 4b). In mainstem sites, giant floater (*Pyganodon grandis*), white heelsplitter (*Lasmigona complanata*), pimpleback (*Quadrula*

pustulosa), round pigtoe (*Pleurobema sintoxia*), and Wabash pigtoe were encountered at all 8 sites (100%; Figure 4a).

Abundance and Recruitment

A total of 3633 live individuals were collected across 32 sites. Live individuals collected in tributary sites ranged from 1 to 296 and in mainstem sites ranged from 29 to 306. A total of 128 collector-hours were spent sampling, with an average of 21 mussels collected per hour at tributary sites and 46 mussels per hour at mainstem sites. The most abundant species across all sites included pimpleback (n=1074), plain pocketbook (n=336), round pigtoe (n=311), threeridge (*Amblema plicata*, n=302), and giant floater (n=290) comprising 64% of total collections (Table 2). In the mainstem, pimpleback (n= 825) was the most common species and comprised 52% of mussels observed. In the tributaries, threeridge (n=290) was collected most frequently at 14% and three other species—pimpleback, giant floater, plain pocketbook—equally at 12% of all individuals collected (Table 2).

Recruitment for each species was determined by the presence of individuals less than 30mm 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, referred to as Reproduction Factor in Table 3, at individual sites ranged from none (1) to high (4) across the basin. Seventeen sites exhibited high (30-50%) recruitment while the remaining fifteen sites had none to minimal recruitment (0-30%) observed (Figure 5). Among mainstem sites, seven of eight sites exhibited high recruitment (sites 1-4, 6-8) with no reproduction observed at one site (site 5; Figure 5a). Among tributary sites, 11 sites (9-10, 12, 15, 18, 20-24, 32) exhibited high recruitment and nine sites had no recruitment observed (sites 11, 13, 16, 19, 27-29, 30-31; Figure 5b).

Mussel Community Classification

Based on data collected in the 2010 basin survey, 72% of sites in the Iroquois River basin are classified as Moderate, Highly Valued, or Unique mussel resources based under the current MCI classification system (Table 4; Figure 5). Six mainstem sites (2-4, 6-8) rank as Unique mussel resources due to the species richness, presence of intolerant species, recruitment observed, and number of mussels collected at these sites. Sites 1 and 5 on the mainstem were classified as Highly Valued and Moderate mussel resources, respectively, since moderate species richness and minimal recruitment were observed. The tributaries classified as Unique mussel resources were Mud Creek-East (site 10), Pike Creek (site 24), and Beaver Creek (site 32). Sites classified

as Highly Valued mussel resources include Sugar Creek (sites 9 and 12), Mud Creek-West (site 15), and Spring Creek (site 22). The remaining seventeen tributary sites were considered Moderate, Limited, or Restricted mussel resources.

Noteworthy Finds

Three state-listed species, purple wartyback (*Cyclonaias tuberculata*, state-threatened), spike (*Elliptio dilatata*, state-threatened), and black sandshell (*Ligumia recta*, state-threatened), were found alive in the mainstem during our surveys (Table 2). Black sandshell was found alive at five sites (2-3, 6-8) and relict shell was collected at site 4. Spike was located alive at sites 4, 6, and 8 and dead or relict shell was collected at four other sites (2-3, 5, 7). Purple wartyback was found alive at four sites (sites 3, 6-8) with no shell collected at other sites. One species in greatest need of conservation (SGNC), flutedshell (*Lasmigona costata*), was found alive at four sites (2-3, 7-8), and dead and relict shells were found at the remaining four mainstem sites. Other SGNC species, ellipse (*Venustaconcha ellipsiformis*) and monkeyface (*Quadrula metanevra*) were documented by relict shell at two sites (2-3) and live specimens observed at sites 6 and 8, respectively.

In the tributaries, slippershell mussel (*Alasmidonta viridis*, state-threatened) was found only by relict shell in Mud Creek-East and Sugar Creek sites (10-12). Similarly, a relict shell of spike was found in Sugar Creek (site 12). Black sandshell, purple wartyback, monkeyface, and washboard (*Megalonaias nervosa*) were newly recorded from Beaver Creek (site 32). Other new records included one live black sandshell in Pike Creek and washboards in Spring Creek at Rt. 49 bridge. Ellipse (SGNC) was found alive in Mud Creek-East and Sugar Creek (sites 9-11; Table 2).

Discussion

Twenty-four species were found alive and, historically, 26 species were known within the basin. For the mainstem, 21 extant species were collected and, historically, 22 species were documented. In the tributaries, 23 extant species were found, and 26 species were known historically. Three relict species, spike, slippershell mussel, and the yellow sandshell, had been documented by only a few records (INHS Mollusk Collection). The slippershell mussel and yellow sandshell were two species represented only by relict shell. These two species were not collected during the Kankakee River basin survey (Price et al. 2012). Prior to our survey, only one relict shell record for yellow sandshell (Coon Creek) and slippershell mussel (Mud Creek) had been collected, thus suggesting minimal presence historically. The Iroquois basin is at the northeasterly edge of the range for yellow sandshell; hence its minimal presence within the Kankakee and Iroquois drainage. Slippershell mussel was generally distributed in headwater streams across northern Illinois but now only sporadically occurs (Cummings and Mayer 1997, Tiemann et al. 2007), and, with the species' small size, can be difficult to find alive. Spike was

found alive in the mainstem but only relict shell was collected at a tributary site (Sugar Creek, site 12). This was the first record collected for spike in any tributary within the Iroquois basin (INHS Mollusk Collection). Since the completion of this survey, spike has been documented alive in Beaver Creek (pers. observation, INHS Mollusk Collection). Spike has declined in its range in Illinois (once distributed across Illinois), and it only exists in patches at this time (Tiemann et al. 2007).

Moderately high recruitment was observed at approximately half of the sites surveyed, while minimal or no recruitment was observed at the remaining sites. In the mainstem, most sites displayed moderately high recruitment indicating viable, reproducing populations**.** Certain streams, such as Spring, Pike, and Beaver Creeks (sites 22, 24, and 32) should be recognized as potential nursery habitat or source populations for the mainstem and other tributaries. These streams had high recruitment and species richness (Pike and Beaver Creeks) or contained populations of relatively rare mussels for the basin, such as the washboard in Spring Creek (site 22).

The most recent IEPA assessments for three sites on the Iroquois River list it as fully supporting aquatic life (IEPA 2012). According to current MCI classification, all sites, with the exception of FL-05, had Unique or Highly Valued mussel resources. Water levels at site 5 (FL-05) hindered sampling effectiveness, limiting sampling efforts to the banks. Of the tributary sites, only three streams (Mud Creek-East, Beaver, and Langan Creeks) are listed as fully supporting aquatic life (IEPA 2012). Both Mud and Beaver Creeks had Unique and Highly Valued mussel resources (Table 2; Figure 5b). We did not find any live mussels in this stretch of Langan Creek nor has there been live individuals collected since 1998 (INHS Mollusk Collection). Ten to twelve species were historically present in Langan Creek, but currently it appears live mussel presence is minimal. Even though the IEPA (2012) listed this site as fully supporting aquatic, degradation of some form appears to have impacted the mussel communities in this stream. Compact cobble and claypan banks was the predominate substrate; however, water quality issues exist for other portions of Langan Creek (e.g., boron, phosphorus, dissolved oxygen issues), which may be influencing this portion of the stream as well (IEPA 2012). Additional sampling should be completed to further assess mussel communities in Langan Creek. Nine other streams assessed (Coon, Louis, Little Beaver, Pike, Prairie, Spring, Sugar, Shavetail, and Mud Creek-West) do not fully support aquatic life with reasons cited due to channelization, sedimentation, intensive agricultural practices, stream bank and instream alterations, dissolved oxygen issues, and fecal coliform present within these stream reaches (IEPA 2012). Even with these current impacts, several of these streams from the IEPA assessment have Unique (Pike Creek, site 24), Highly Valued (sites 12, 15, 22), or Moderate mussel resources (sites 19, 21, 23, 31). In this case, species diversity typical for the stream size exists, and intolerant species and recruitment is observed (Figure 5b). The mussel communities continue to persist throughout this basin and

should be protected from further disturbance.

Summary

Early surveys of the Iroquois River basin were often in conjunction with the Kankakee River basin, which were highlighted in Page et al. (1992). Since the 1900s, only sporadic sampling has occurred in this basin and has documented 26 species (excluding the Kankakee drainage; INHS Mollusk Collection). In this most recent systematic survey, 24 species were found alive and 26 total species were observed. In contrast to the Kankakee River basin, the mussel communities of the Iroquois basin remain largely intact. One possible explanation for this species intactness could be the lack of damming or dredging of the Iroquois River. However, sedimentation, agricultural and industrial pollution are prominent threats to mussel fauna, and still highly influence this region as well (Watters 2000). Alongside the Kankakee, the Iroquois River has been recognized as a Highly Valued aquatic resource (Page et al. 1992). Maintaining the integrity of this system not only benefits its aquatic species' intactness, but also that of the Kankakee River basin.

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Table 1. 2010 Iroquois River survey sites. Sites are listed from upstream to downstream, mainstem (1-8) and its tributaries (9-32). Types of samples include MU-mussel sampling, BE-boat electrofishing, ES-electric fish seine, W-water chemistry, H-habitat, and M-macroinvertebrate.

Site Number	IEPA Code	Stream	Types of Samples	County	Location	Watershed Area (km^2)
1	FL-04	Iroquois River	MU,BE,W,H,M	Iroquois	Rt 52 bridge at Iroquois	1748.87
2	FL-06	Iroquois River	MU,BE,W,H,M	Iroquois	3.5 mi ENE Watseka; 2500 E bridge	1822.49
3	FL-07	Iroquois River	MU,BE,W,H,M	Iroquois	Watseka; Rt. 1 bridge at public boat launch	1881.78
4	FL-13	Iroquois River	MU	Iroquois	1.5 mi S Plato; 1630 E Co Rd	4048.42
5	FL-05	Iroquois River	MU,W,H,M	Iroquois	3 mi S L'Erable; 2400 N at boat ramp	4048.42
6	FL-12	Iroquois River	MU	Iroquois	Old boat ramp, 1/4 mi S of 2500 N and 1480 E Co Rd	4048.42
7	FL-11	Iroquois River	MU	Iroquois	6 mi E Clifton; 2900 N bridge	4100.80
8	FL-02	Iroquois River	MU,W,H,M	Kankakee	4 mi E Chebanse, Sugar Island bridge	5371.31
9	FLI-06	Sugar Creek	MU,ES,W,H,M	Iroquois	3 mi NNE Stockland; 3000 E bridge	232.15
10	FLIC-03	Mud Creek-East	MU	Iroquois	3 mi E Stockland; 880 N bridge	54.21
11	FLIC-04	Mud Creek-East	MU,ES,W,H,M	Iroquois	2 mi NNE Stockland; 1000 N bridge	81.55
12	FLI-03	Sugar Creek	MU,ES,W,H,M	Iroquois	2.0 mi SE Milford; 2440 E bridge	400.64
13	FLID-01	Mud Creek-West	MU	Iroquois	3 mi NE Cissna Park; 1470 E bridge	312.23
14	FLIDE-01	U-Trib Mud Creek West	MU,ES,W,H,M	Iroquois	1.5 mi S Milford Rd; 2250 E bridge	92.19
15	FLID-02	Mud Creek-West	MU,ES,W,H,M	Iroquois	2.0 mi SW Milford; 900N bridge	731.65
16	FLI-05	Sugar Creek	MU,ES,W,H,M	Iroquois	1.5 mi Nw Milford; 1100N Co Rd	1151.05
17	FLIA-01	Coon Creek	MU,ES,W,H,M	Iroquois	0.5 mi E Woodland; Woodland Rd bridge	122.13
18	FLH-01	Spring Creek	MU,ES,W,H,M	Iroquois	0.5 mi Se Buckley, 700 N Co Rd	127.65
19	FLHB-01	Louis Creek	MU,ES,W,H,M	Iroquois	3 mi Ne Buckley; Co Rd 1000N bridge	60.17
20	FLH-03	Spring Creek	MU,ES,W,H,M	Iroquois	2.5 mi S Onarga; 1200 N bridge	358.25
21	FLHA-01	Shavetail Creek	MU	Iroquois	4.5 mi ENE Onarga Co Rd; 1220 E bridge	80.40
22	FLH-02	Spring Creek	MU,W,H,M	Iroquois	2 mi N Crescent City; Rt 49 bridge	631.41
23	FLG-02	Prairie Creek	MU,ES,W,H,M	Iroquois	3.0 mi SE of Ashkum; 2400 N bridge	151.76
24	FLF-01	Pike Creek	MU,ES,W,H,M	Iroquois	2.5 mi W Martinton; 1850 E bridge	182.14
25	FLE-01	Langan Creek	MU,ES,W,H,M	Iroquois	4.5 mi ENE Clifton; 1500E bridge	251.25
26	FLD-07	Beaver Creek	MU	Iroquois	IN/IL State Line; 3200 E bridge	189.01
27	FLD-01	Beaver Creek	MU,ES,W,H,M	Iroquois	3 mi ENE Beaverville; 3100 N bridge	190.08
28	FLD-02	Beaver Creek	MU	Iroquois	2 mi N Beaverville; 2500 E bridge	304.32
29	FLDA-06	St. Anne trib	MU,ES,W,H,M	Kankakee	7 mi E St. Anne; 6000 S bridge	54.35
30	FLDAE-01	Little Beaver Creek	MU	Kankakee	1 mi E of St. Anne; Co Rd 7000 S bridge	31.36
31	FLDA-01	Little Beaver Creek	MU,ES,W,H,M	Iroquois	2 mi S St Anne; 2150 E bridge	143.56
32	FLD-03	Beaver Creek	MU,W,H,M	Iroquois	2.0 mi W Papineau; 2000 E bridge	496.32

Table 2. Mussel data for the Iroquois River basin sampled during 2010 surveys (Table 1). Numbers in columns are live individuals collected, "D" and "R" indicates only dead or relict shells collected. Shaded boxes indicate historic collections at the specific site location obtained from the INHS Mollusk Collection database. Extant species is live + dead shell and total species is live + dead + relict shell. Proportion of total is number of individuals of a species divided by total number of individuals at all sites. 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). NDA = no data available. Species in bold are federally or state-listed species or species in Greatest Need of Conservation by IL DNR.

	Iroquois River Site Number								Tributary Site Number																								Proportion	Proportion	Proportion
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	of total	of tributaries	of mainstem
Subfamily Anodontinae																																			
Alasmidonta marginata	D	D	5			4	1	6	D	1	D	R			D	R						1								4	1	0.6%	0.3%	1.0%
Alasmidonta viridis										R	R	R																				0.0%	0.0%	0.0%
Anodontoides ferussacianus				D					3	1	R	D		R					10				2	5	R	R	R	R	5	D	R		0.7%	1.3%	0.0%
Lasmigona complanata	2	1	7	8	1	4	4	1		R			16	D	6			12	27	7	9	9		14	R	D	2	D			5	2	3.8%	5.3%	1.8%
Lasmigona compressa									2	1	D	D			R			1						2					2	D	1		0.2%	0.4%	0.0%
Lasmigona costata	D	6	2	R	R	R	2	7							1							1			R								0.5%	0.1%	1.1%
Pyganodon grandis	7	1	7	5	15	1	1	1				1	2	D		D		24	84	20	11	9	54	35	R	R	R	R		1	9	2	8.0%	12.3%	2.4%
Strophitus undulatus			D			1				2	1	D			33										R	R	2				2	4	1.2%	2.1%	0.1%
Utterbackia imbecillis	13	1	5	1	2			1												1										R	1		0.7%	0.1%	1.5%
Subfamily Ambleminae																																			
Amblema plicata	R	R	R	4		4	3	1	1	4	6	D			R	R				D	2	2		24	R	R	247	3				1	8.3%	14.1%	0.8%
Cyclonaias tuberculata			1			9	5	110																								7	3.6%	0.3%	7.9%
Elliptio dilatata		R	R	1	R	3	D	3				R																					0.2%	0.0%	0.4%
Fusconaia flava	10	5	10	14	1	11	1	2	4	2	1	1			47	3			1		16	18		26		R	3	D			20	15	5.8%	7.6%	3.4%
Megalonaias nervosa	2	D	2	3	D	2	D	11														9										2	0.9%	0.5%	1.3%
Pleurobema sintoxia	7	8	23	13	1	78	13	8		3		D			6	2						12			R							137	8.6%	7.8%	9.6%
Quadrula metanevra						1		6																								1	0.2%	0.0%	0.4%
Quadrula pustulosa	54	74	189	196	6	165	119	22				D	2		21	8		1				62		28	R	R	4				13	110	29.6%	12.1%	52.3%
Quadrula quadrula	19	16	4	D	R	D	R	D					30		89	2		6		5	6	8		14	D		3					1	5.6%	8.0%	2.5%
Uniomerus tetralasmus													R						1				1										0.1%	0.1%	0.0%
Subfamily Lampsilinae																																			
Actinonaias ligamentina	D	15	2	R	R	1	8	56		1												1					1					6	2.5%	0.4%	5.2%
Lampsilis cardium	1	20	7	6	R	3	8	31	174	42	8	5			1	4						4		1	D	R	16	R			2	3	9.2%	12.6%	4.8%
Lampsilis siliquoidea	3	1	1		3			2	1	18	1	D	D	R	2		R	57	4	14	2	1	2	21	D	R	1	R	15		7	2	4.3%	7.2%	0.6%
Lampsilis teres																						R											0.0%	0.0%	0.0%
Ligumia recta		1	1	R		1	4	38																1								1	1.3%	0.1%	2.9%
Toxolasma parvum	1									R		R						1	2				4	6	R							1	0.4%	0.7%	0.1%
Venustaconcha ellipsiformis		R	R						67	59	5	D																					3.6%	6.4%	0.0%
																																	Totals	**Tributaries**	**Mainstem**
Individuals collected	119	149	266	251	29	288	169	306	252	134	22	7	50	0	206	19	0	102	129	47	46	137	63	177	0	0	279	3	22	1	64	296	3633	2056	1577
Live Species	11	12	15	10	7	15	12	17	7	11	6	3	4	0	9	5	0	7	7	5	6	13	5	12	0	0	9	1	3	1	10	17	24	23	20
Extant Species	14	14	16	12	8	16	14	18	8	11	8	11	5	2	10	6	0	7	7	6	6	13	5	12	3	1	9	3	3	3	10	17	24	23	21
Total Species Collected	15	17	19	15	13	17	15	18	8	14	10	15	6	4	12	8	1	7	7	6	6	14	5	12	12	9	11	7	3	4	11	17	26	26	22
Historical Species Richness	14	14	8	12	12	NDA	16	20	6	NDA	9	7	NDA	NDA	11	9	1	3	NDA	4	8	10	NDA	10	10	NDA	14	NDA	NDA	7	8	4	26		
CPUE	29.8	37.3	66.5	62.8	7.3	72.0	42.3	50.3	63.0	34.4	5.6	1.8	12.8	0.0	45.1	4.8	0.0	25.5	32.6	12.0	11.5	34.5	16.2	46.4	0.0	0.0	71.5	5.0	5.6	0.3	16.4	74.4			
MCI	14	17	19	18	10	18	17	17	15	17	10	13	8	0	15	4	0	11	10	10	10	15	10	16	0	0	11	5	6	4	10	16			
Resource Classification	HV	U	U	U	M	U	U	U	HV	U	M	HV	M	R	HV	R	R	M	M	M	M	HV	M	U	R	R	M	L	L	L	M	U			

Table 3. Mussel Community Index 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 4. Freshwater mussel resource categories based on species richness, abundance, and population structure. MCI = Mussel Community Index Score

Unique Resource MCI ≥ 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.

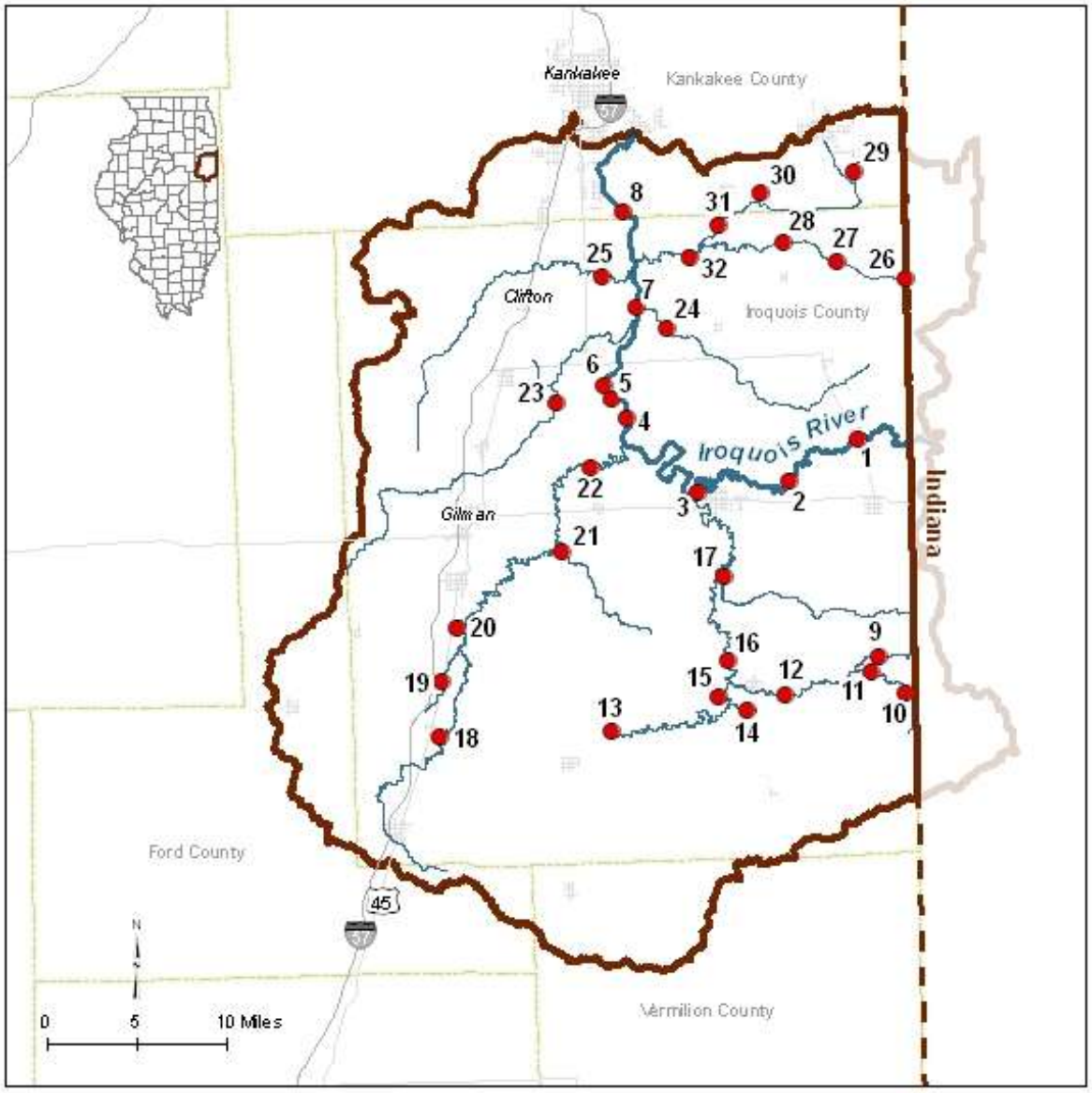


Figure 1. Sites sampled in the Iroquois River basin during 2010. Site codes referenced in Table 1.

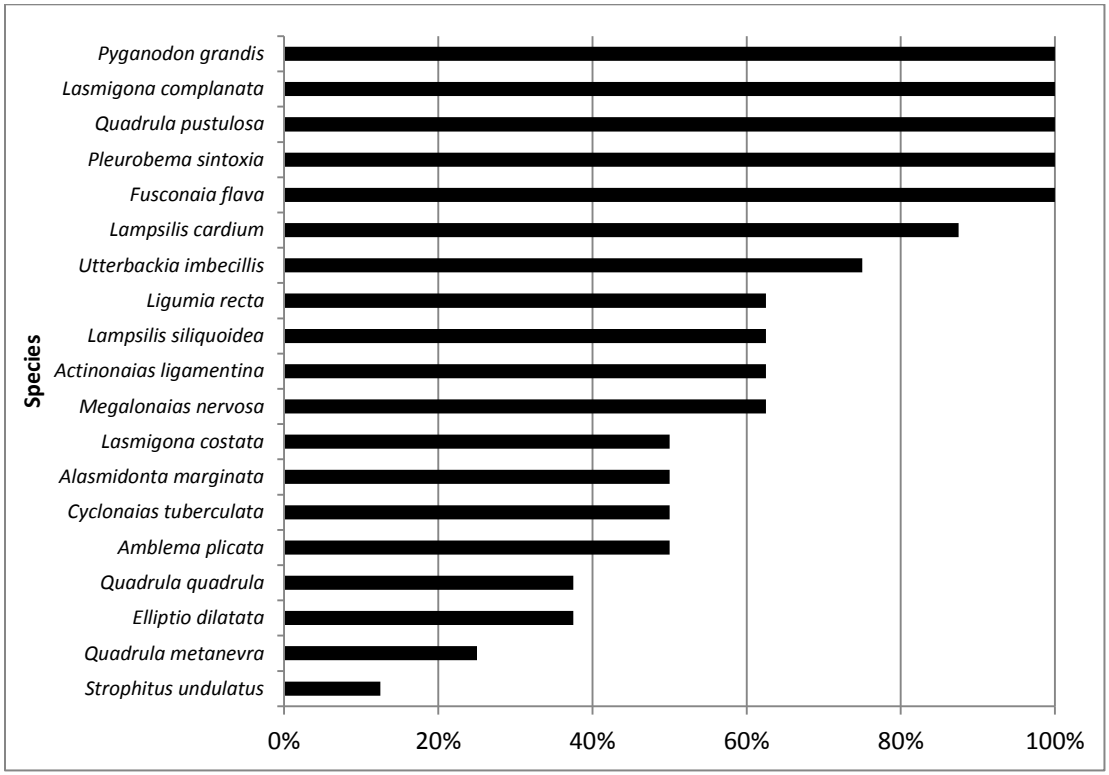
Figure 2. Iroquois River (site 8)–substrate predominately cobble and gravel/sand at riffle.

a)

b)

Figure 3a. Pike Creek (site 24) notice silt banks, with claypan. **b.** Beaver Creek (site 32) with consolidated gravel/sand and firm sand.

a) Iroquois River



b) Tributaries

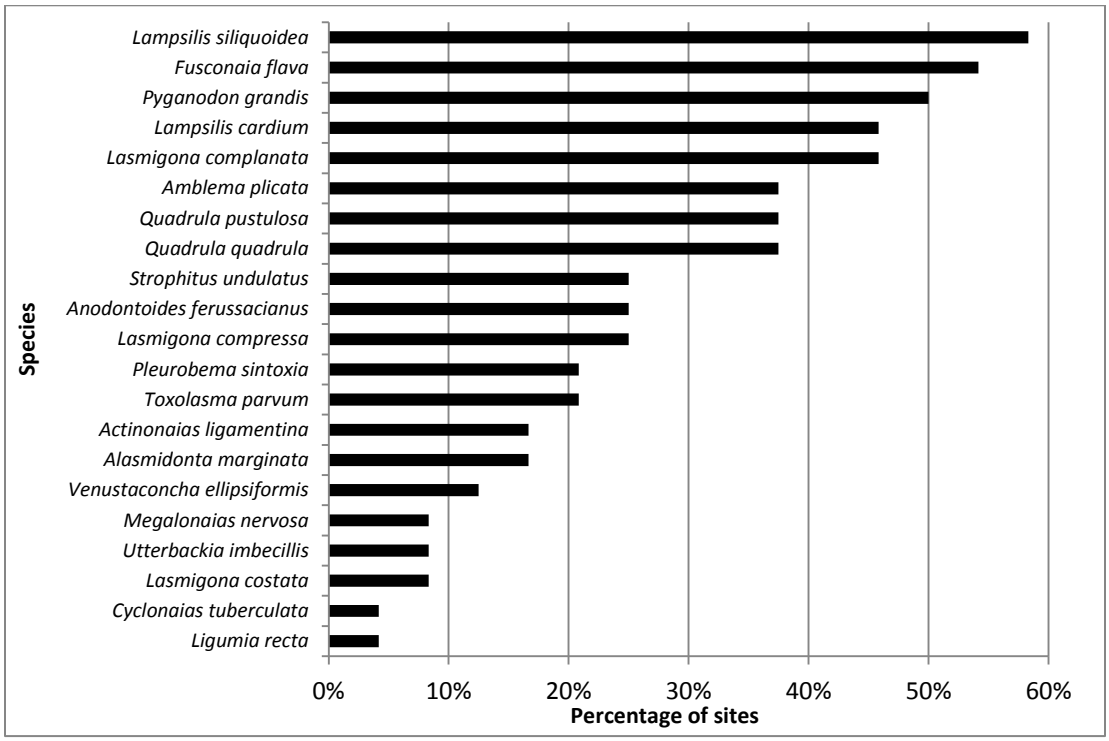
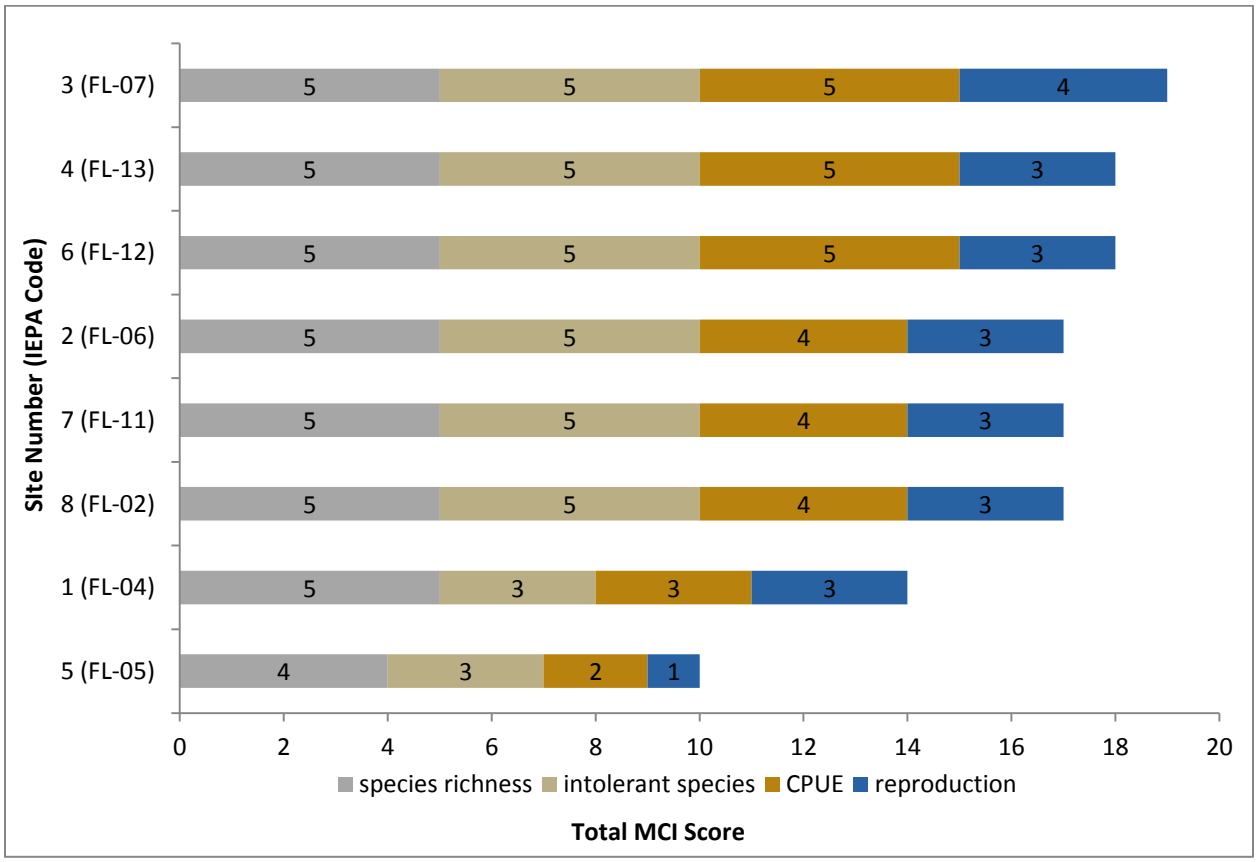


Figure 4. Iroquois River basin species occurrence by percentage: number of sites with live species collected compared to the number of total sites sampled (8 mainstem, 24 tributary).

a) Iroquois River



b) Tributaries

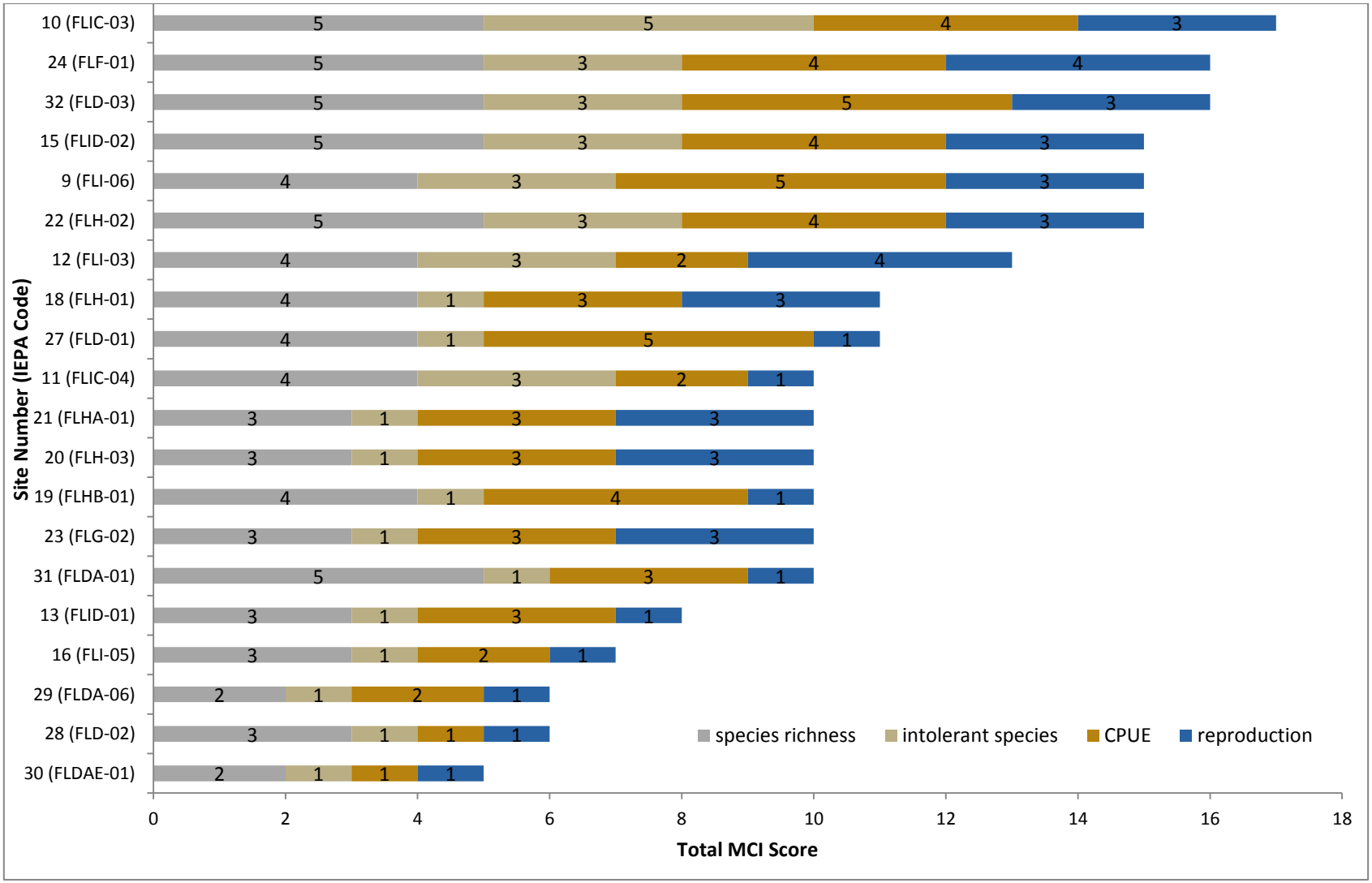


Figure 5a-b. Comparison of Mussel Community Index (MCI) and its parameter scores for the Iroquois River basin based on factor values from Table 3.

Appendix 1. Scientific and common names of species. Status refers to conservation status in Illinois in 2012; SGNC- Illinois' species in greatest need of conservation, ST-state threatened.

Scientific name	Common name	Status
Subfamily Anodontinae		
Alasmidonta marginata	elktoe	
Alasmidonta viridis	slippershell mussel	ST
Anodontoides ferussacianus	cylindrical papershell	
Lasmigona complanata	white heelsplitter	
Lasmigona compressa	creek heelsplitter	SGNC
Lasmigona costata	flutedshell	SGNC
Pyganodon grandis	giant floater	
Strophitus undulatus	creeper	
Utterbackia imbecillis	paper pondshell	
Subfamily Ambleminae		
Amblema plicata	threeridge	
Cyclonaias tuberculata	purple wartyback	ST
Elliptio dilatata	spike	ST
Fusconaia flava	Wabash pigtoe	
Megalonaias nervosa	washboard	
Pleurobema sintoxia	round pigtoe	
Quadrula metanevra	monkeyface	SGNC
Quadrula pustulosa	pimpleback	
Quadrula quadrula	mapleleaf	
Uniomerus tetralasmus	pondhorn	
Subfamily Lampsilinae		
Actinonaias ligamentina	mucket	
Lampsilis cardium	plain pocketbook	
Lampsilis siliquoidea	fatmucket	
Lampsilis teres	yellow sandshell	
Ligumia recta	black sandshell	ST
Toxolasma parvum	lilliput	
Venustaconcha ellipsiformis	ellipse	SGNC