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# Freshwater mussels of the Des Plaines River and Lake Michigan tributaries in Illinois

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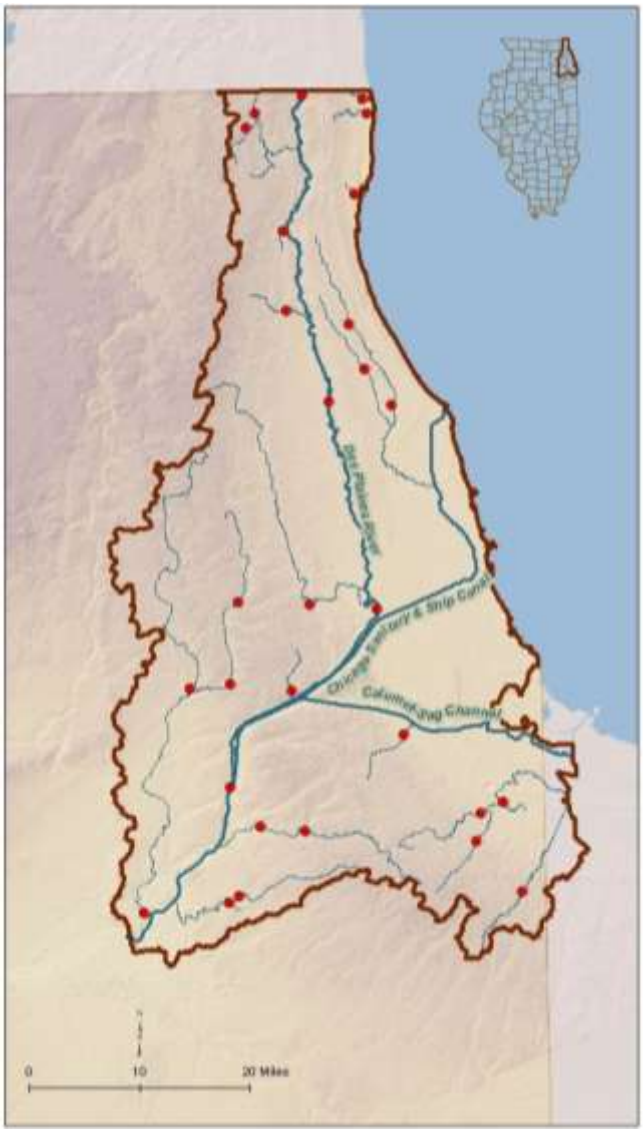


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## Preface

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 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). This report focuses solely on sites sampled in 2009 and 2011 in the Des Plaines River basin and Lake Michigan tributaries in conjunction with IDNR and IEPA basin surveys.

The Des Plaines River basin and Lake Michigan tributaries drain approximately 4200 $km^2$ (1621 $mi^2$) in north-eastern Illinois and lie just west of Lake Michigan. Ninety percent of the Des Plaines River basin flows through the Northeastern Morainal natural division, and the remainder flows through the Grand Prairie natural division. Streams located in the Lake Michigan drainage flow through the Lake Michigan Dunes section or the Chicago Lake Plain section of the Northeastern Moraine (Schwegman 1973). The location of the Des Plaines River basin and Lake Michigan tributaries overlaps with the city of Chicago and surrounding suburbs, which is home to three-fourths of the population of the state of Illinois (US Census Bureau 2010). The development of the Chicago region brought many modifications to the Des Plaines River basin and the Lake Michigan tributaries, including several artificial drainage connections between the Des Plaines River and Lake Michigan.

### River Modifications, Land-use, and Instream Habitat

Prior to the settlement of the Chicago region, the Chicago River was a tributary to Lake Michigan, with the North Branch and Skokie River flowing southward from Lake County and the South Branch flowing eastward from Cook County. The I and M canal was created in 1848 and connected the Chicago River with the Des Plaines River as a travel and shipping route. Industrial pollution, sewage runoff, and the need for a deeper shipping channel led to the completion of the Chicago Sanitary and Ship Canal in 1900, which reversed the flow of the Chicago River and diverted sewage and waste into the Des Plaines River (Hill 2000). The Calumet River, historically a Lake Michigan tributary, was joined with the Sanitary and Ship Canal in 1922 through the completion of the Calumet-Sag Channel (Hill 2000). Because the Chicago River and Calumet River were modified to flow westward rather than eastward into Lake Michigan, both are now essentially Des Plaines River tributaries (Figure 1). The Des Plaines River rises in Kenosha County, Wisconsin, enters Illinois in Lake County, and flows south through Cook, Dupage, Will, and Grundy counties. It eventually merges with the Kankakee River and their confluence forms the Illinois River.

Streams in the Des Plaines River basin have rockier substrates than streams in the Lake Michigan drainage, and are primarily comprised of a mixture of cobble, gravel, and sand. Some areas of bedrock exist in this basin. The Lake Michigan tributaries located in the Lake Michigan Dunes section in Lake County have substrate composition of primarily sand and silt and are very low gradient. Substrate composition in Lake Michigan tributaries located in Cook County consists of primarily sand, with gravel or cobble present occasionally.

The population of the Chicago metro area (including Cook, DuPage, Lake, Kane, and Will counties, Illinois, and Lake County, Indiana) is nearly nine million people, and the watershed is highly urbanized (US Census Bureau 2010). Land use of the Des Plaines River basin is around 70% urban, the DuPage River drainage is 50% urban, and the Chicago River and tributaries are 95% urban (IDNR 2001, Post 2001, Krohe 2004). Urbanization in the region has profoundly impacted the aquatic habitat available for freshwater mussels. The navigable waterways throughout the Des Plaines River basin are highly modified for navigation and waste disposal, and waterways that were formerly rivers exist now as dredged canals with artificial walls. Forest preserves, natural areas, and nature preserves do exist throughout the basin and preserve some aquatic habitat in smaller streams. However, many streams sampled in our surveys had low-head dams, bank stabilization structures, or channel modifications (Figure 2). Beyond structural changes throughout the basin that may influence freshwater mussel habitat, many streams contain wastewater effluent, residual pollution from industries, and have elevated flows due to lawn watering (IDNR 2001). Many of the streams in the Des Plaines, Chicago, and Calumet Rivers are considered “not supporting” of aquatic life, primary contact, or secondary contact based on IPEA standards, and causes include elevated levels of fecal coliform, metals, suspended solids, contaminants, and sedimentation (IEPA 2010).

## Methods

During the 2009 and 2011 surveys, freshwater mussel data were collected at 29 sites: 18 sites in the Des Plaines River basin and 11 sites in the Lake Michigan drainage (Figure 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, although not all Intensive Basin Survey sites were sampled for freshwater mussels. Following consultation with IDNR and IEPA biologists, particular Intensive Basin Survey sites were eliminated that were deemed non-wadeable or unsafe for human contact. Streams eliminated from the sampling list are classified as unsuitable for primary or secondary contact due to contaminants in the waterway or physical configuration of the waterway (e.g., modifications that have deemed the stream unsafe for swimming or wading; IEPA 2010).

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 sites (Table 1) and 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 indicated recent recruitment if individuals with lengths less than 30mm or with 3 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

A total of 19 species of freshwater mussels were observed in the Des Plaines River basin (18) and Lake Michigan tributaries (11), and 9 of those 19 were found live (Table 2). The number of live species collected ranged from 0 to 5, the number of extant species collected (live + dead) ranged from 0 to 6, and the total number of species collected (live + dead + relict) ranged from 0 to 11. In both basins, the giant floater (*Pyganodon grandis*) had the most occurrences and was collected at 9 of 18 Des Plaines sites and 7 of 11 Lake Michigan sites (Figure 3). The white heelsplitter (*Lasmigona complanata*) was another commonly collected species in both basins and was collected at 6 of 18 Des Plaines sites and 5 of 11 Lake Michigan sites. Other commonly occurring species were the cylindrical papershell (*Anodontoides ferussacianus*) and the fatmucket (*Lampsilis siliquoidea*).

**Abundance and Recruitment**

A total of 683 individuals were collected across 21 sites (8 sites had 0 live individuals) and the number of live specimens collected at a given site ranged from 1 to 391. The range of live specimens collected at Des Plaines River basin sites ranged from 1 to 141 and from 4 to 46 at mainstem sites. A total of 116 collector-hours were spent sampling, with an average of 6 mussels collected per hour across all sites. The most abundant species across all sites was the white heelsplitter, which comprised 69% of all individuals collected. In Des Plaines sites, white heelsplitters accounted for over 80% of all mussels collected and was the most abundant species in that basin (Table 2). In Lake Michigan sites, the giant floater was the most common species and accounted for 55% of all mussels in that drainage (Table 2).

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 may suggest a senescent population.

Recruitment at individual sites ranged from none observed to high across the basin. Recruitment levels, referred to in Table 3 as Reproduction Factor, varied from 1 to 4, and over 90% of sites had no reproduction observed. In the Des Plaines River basin, reproduction was not observed at any site. In the Lake Michigan drainage, only two sites had evidence of reproduction in our surveys. Sites 28 and 29, North and Plum Creeks, had Reproduction Factors of 4 and 3, respectively, which indicates that greater than 30% of species exhibited reproduction.

**Mussel Community Classification**

Based on the data collected in the 2009 and 2011 basin surveys, approximately half of the sites in the Des Plaines River basin and Lake Michigan tributaries are classified as Limited mussel resources under the current MCI classification system (Table 4, Figure 4). Three sites are Moderate mussel resources (sites 15, 28, and 29) and only site 5, Indian Creek, stands out as a Highly Valued mussel resource. The remaining sites are classified as Restricted mussel resources (Figure 4).

**Noteworthy Finds**

This survey collected nine live species and 19 total species, and 38 species were known historically from the Des Plaines River and Lake Michigan basins. Fifty-percent of the species known historically from the basins were not collected at all during this survey and these species

are documented in Table 5. While many species have been extirpated, our survey did document a new record for the pondmussel (*Ligumia subrostrata*) at site 9, Sawmill Creek.

One state-threatened species, the slippershell (*Alasmidonta viridis*), was found live in our survey at site 14, Manhattan Creek (Table 2). Relict shells were found at five additional sites. Another state-threatened species, the spike (*Elliptio dilatata*), was located by relict shell at sites 11 and 12, both located on Hickory Creek.

## Discussion

### Richness, Abundance, and Recruitment

Our survey documented 19 species from the Des Plaines River basin and Lake Michigan tributaries, although less than half of these were found live. If we consider the extant population of mussels, less than a third of the species found historically in these basins exist today. Of particular note is the near absence of members of the subfamily Ambleminae (Table 2 and 5). This taxonomic group is also typically found in larger rivers with flowing water (Cummings and Mayer 1997), thus the absence of appropriate habitat or suite of host fishes may have led to the decline of Amblemines in this basin. The exception to the absence of Amblemines is the collection of six Wabash pigtoes (*Fusconaia flava*) at site 29, Plum Creek, and one dead shell of threeridge (*Amblema plicata*) at site 4, Bull Creek. The greatest number of live species (nine) collected across all sites occurred at site 29, Plum Creek. The portion of this creek sampled drains an area outside of the urban influence of Chicago and its suburbs.

In contrast to the absence of Amblemines, nearly every site (80%) had live or dead records of giant floaters and over half of the sites (59%) had live or dead records of white heelsplitters. These species belong to the subfamily Anodontinae, which use a myriad of fish hosts and are found in practically every type of habitat. The giant floater is considered the most widespread freshwater mussel in North America, thus its success in the Des Plaines River and Lake Michigan basins is not unexpected (Williams et al. 2008).

The number of individuals collected at a site was fairly low compared to other basins throughout Illinois. One exception to low numbers of collected individuals was at site 5, Indian Creek. We collected nearly 400 white heelsplitters at this site, and it was the only site in our survey that ranked as a Highly Valued mussel resource.

In our survey, only two sites, 28 and 29, exhibited recent recruitment. At site 29, one of five live species collected (20% of species; cylindrical papershell) had an individual with three or fewer growth rings. At site 28, only two species were collected alive, and several individuals of giant floaters at this site had three or fewer growth rings. Data collected during this survey indicate that very recent recruitment may not be occurring at most sites in the Des Plaines and

Lake Michigan basins, but sampling methods to target juvenile mussels would be necessary to better assess the reproductive status of these populations.

**Noteworthy species**

A relict shell of a pondmussel was found during our survey, and it has never been documented in the Des Plaines River basin (INHS Mollusk Collection). The pondmussel is fairly common throughout its range and uses Centrarchid fish hosts, such as Green Sunfish, Bluegill, or Largemouth Bass (Williams et al. 2008). The most likely theory to explain the occurrence of this species is through a fish introduction, since many Centrarchids are commonly stocked in ponds and waterways throughout Illinois. As noted in Table 2, many sites sampled during our survey had no previous sampling data available; it is possible that the pondmussel or other species have simply been undetected in this basin.

**Summary**

Our surveys documented the presence (live, dead or relict) of 18 of the 38 species known historically from the Des Plaines River and Lake Michigan basins, and we found one species not known historically. Only 13 of the 38 species known historically are considered extant based on the results of our survey, and it is difficult to ascertain when the species' loss in this basin occurred. Recently published reports on the freshwater mussel fauna of the Des Plaines River basin or the Lake Michigan tributaries are scarce or unavailable at this time. Reports based on data collected in the late 1800s and early 1900s do exist and can serve as baseline data for the freshwater mussels of the region. F. C. Baker published an extensive review (1898) of the molluscan fauna of the Chicago region, B. Walker published a note regarding the origin of the Great Lakes mussel fauna (1913), and a report on the mussels of Lake Calumet was published by L. L. Getz (1966) based on data collected in 1870. These papers were published prior to drainage modifications in the basin. Our survey results and the collection records maintained by INHS indicate that many species in these basins are not present at this time (Table 5). Many species that were not collected in our surveys have not been documented in the basin since at least 1920 (based on collection records maintained by INHS), and water quality degradation from industrial development, significant modifications to the watershed, and introduction of non-native species are just a few of the likely causes of these mass extirpations (Krohe 2004). These basins have undergone significant freshwater mussel species loss, and unless water and sediment quality improve, species loss will likely continue.

## Literature Cited


Baker, F.C. 1898. The Mollusca of the Chicago Area, The Pelecypoda. The Chicago Academy of Sciences. Bulletin III, Part I. 410 pp.

Bogan, A.E. 1993. Freshwater bivalve extinctions (Mollusca: Unionoida): a search for causes. American Zoologist 33(6):599-609.

Getz, L.L. 1966. An 1870 Collection of Mussels from the Calumet River, Illinois. Nautilus 79(4):118-120.

Hill, L. 2000. The Chicago River: A Natural and Unnatural History. Lake Claremont Press, Chicago, Illinois.

Illinois Department of Natural Resources. 2001. The Upper Des Plaines River Basin: An Inventory of the Region's Resources. Published by the Illinois Department of Natural Resources Office of Realty and Environmental Planning with assistance from the Nature of Illinois Foundation. Springfield, Illinois.

Illinois Endangered Species Protection Board. 2011. Checklist of Endangered and Threatened Animals and Plants of Illinois. Illinois Endangered Species Protection Board, Springfield, Illinois. 18 pp.

Illinois Environmental Protection Agency. 2010. Illinois Integrated Water Quality Report and Section 303(d) List. http://www.epa.state.il.us/water/tmdl/303d-list.html

Krohe, J. 2004. The Chicago River/Lake Shore: An Inventory of the Region's Resources. Published by the Illinois Department of Natural Resources, product of the Critical Trends Assessment Program. Springfield, Illinois.

Post, S. 2001. The DuPage River Basin: An Inventory of the Region's Resources. Published by the Illinois Department of Natural Resources, product of the Critical Trends Assessment Program. Springfield, Illinois.

Page, L.M., K.S. Cummings, C.A. Mayer, S.L. Post, and M.E. Retzer. 1992. Biologically significant Illinois streams, an evaluation of the streams of Illinois based on aquatic biodiversity. Technical Report. Illinois Department of Conservation and Illinois Department of Energy and Natural Resources, Springfield, Illinois. 498 pp.

Schwegman, J.E. 1973. Comprehensive plan for the Illinois nature preserves system. Part 2. The natural divisions of Illinois. Illinois Nature Preserves Commission, Springfield, Illinois.

Strayer, D.L., J.A. Downing, W.R. Haag, T.L. King, J.B. Layzer, T.J. Newton, and S.J. Nichols. 2004. Changing perspective on pearlymussels, North America's most imperiled animals. BioScience 54(5):429-439.

Szafoni, R. E. 2001. Protocol for integrating freshwater mussel surveys into IDNR / IEPA stream basin surveys. Version 2.0. IDNR/ORC/Natural Heritage, Charleston, IL. 5pp.

Turgeon, D.D., A.E. Bogan, E.V. Coan, F.G. Hochberg, W.G. Lyons, P.M. Mikkelsen, J.F. Quinn, Jr., C.F.E. Roper, G. Rosenberg, B. Roth, A. Scheltema, M.J. Sweeney, F.G. Thompson, M. Vecchione, and J.D. Williams. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks. 2nd Edition. American Fisheries Society, Special Publication 26: ix-526.

U.S. Census Bureau; 2010 Census National Summary File of Redistricting Data; generated by Alison Price; using Quick Facts; <http:// quickfacts.census.gov >; (1 November 2011)

Walker, B. 1913. The unione fauna of the Great Lakes. Nautilus 27:18–34, 29-34, 40–47, 56–59.

Williams, J.D., A. E. Bogan, J. T. Garner. 2008. Freshwater mussels of Alabama and the Mobile Basin in Georgia, Mississippi, and Tennessee. The University of Alabama Press, Tuscaloosa, Alabama. 908 pages.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18(9):6-22.

**Table 1.** 2009 - 2011 Des Plaines River and Lake Michigan Tributaries Intensive Basin Survey. Types of samples include MU-mussel sampling, BE-boat electrofishing, ES-fish electric seine, SH- fish seine hauls, FF-fish flesh contaminate, H-habitat, M-macroinvertebrate, S-sediment, W-water chemistry.

| Site Number | IEPA Code | Stream | Types of Samples | County | Location | Watershed area ($km^2$) |
|---|---|---|---|---|---|---|
| **Des Plaines drainage** | | | | | | |
| 1 | G-08 | Des Plaines River | MU, W, S, H, M, ES | Lake | 0.7 mi W Russell, Russell Rd. | 312.15 |
| 2 | GWA-01 | North Mill Creek | MU, W, S, H, M, ES | Lake | 2.8 mi N Millburn, Rt. 173 | 56.10 |
| 3 | GWAA-L-C2 | Hastings Creek | MU, W, S, H, M, ES | Lake | 1.9 mi NW Millburn, Miller Rd., Raven Glen Forest Preserve | 14.55 |
| 4 | GV-01 | Bull Creek | MU, W, S, H, M, ES | Lake | 2 mi N Libertyville, Rt. 21 | 30.07 |
| 5 | GU-06 | Indian Creek | MU, W, S, H, M, ES | Lake | 0.6 mi NNW Prairie View, Buffalo Grove Rd., Prairie View Park | 94.81 |
| 6 | G-46 | Des Plaines River | MU, W, S, H, M | Cook | 0.7 mi W Northfield Woods, off Euclid Ave, forest preserve | 927.08 |
| 7 | GL-01 | Salt Creek | MU, W, S, H, M, BE/SH | DuPage | 0.8 mi S Oakbrook, York Rd. | 304.78 |
| 8 | G-33 | Des Plaines River | MU, W, S, H, M, BE/SH | Cook | 0.4 mi E Lyons, off 43rd St. | 1651.97 |
| 9 | GJ-01 | Sawmill Creek | MU, W, S, H, M, ES | DuPage | 1.9 mi NNE Hastings, near Argonne National Laboratory, Bluff Rd. | 32.14 |
| 10 | G-11 | Des Plaines River | MU, W, S, H, M, BE/SH | Will | 0.9 mi SW Lockport, W Division St. | 1796.58 |
| 11 | GG-06 | Hickory Creek | MU, W, S, H, M, ES | Will | 2 mi SSW Marley, Marley Rd. | 127.78 |
| 12 | GG-04 | Hickory Creek | MU, W, S, H, M, ES | Will | 1.1 mi ESE Ridgewood, 0.6 mi NW Cherry Hill, Pilcher Park | 212.52 |
| 13 | GC-03 | Jackson Creek | MU, W, S, H, M, ES | Will | 3.6 mi NE Elwood, Rowell Rd. | 75.84 |
| 14 | GCA-01 | Manhattan Creek | MU, W, S, H, M, ES | Will | 2.5 mi NE Elwood, Co. Hwy. 17 | 32.89 |
| 15 | GBL-07 | East Branch DuPage River | MU, W, S, H, M, BE | DuPage | 2 mi NNE Lisle, Hidden Lake Forest Preserve | 69.37 |
| 16 | GBL-19 | East Branch DuPage River | MU, W, S, H, M, BE | Will | 1.4 mi N Bolingbrook, Royce Rd. | 194.61 |
| 17 | GBK-02 | West Branch DuPage River | MU, W, S, H, M, BE/SH | Will | 5 mi S Naperville, Knoch Knolls Park, Knoch Knolls Rd. | 316.14 |
| 18 | GB-01 | DuPage River | MU, W, H, M, BE/SH | Will | 0.7 mi S Channahon, off Bridge St., I & M Canal State Park | 961.60 |
| **Lake Michigan, Chicago River, and Calumet River drainages** | | | | | | |
| 19 | QE-01 | Un-named tributary (Dead Dog Creek) | MU, W, M, H, ES | Lake | 0.4 mi NE Winthrop Harbor | 4.55 |
| 20 | QF-02 | Kellogg Creek | MU, W, M, H, ES | Lake | 1.3 mi SE Winthrop Harbor, Illinois Beach State Park | 17.31 |
| 21 | QC-03 | Waukegan River | MU, W, M, H, ES | Lake | 0.6 mi SE Waukegan, Washington Park | 27.84 |
| 22 | HCCC-06 | Middle Fork North Branch Chicago River | MU, W, M, H, ES | Lake | 0.6 mi NE Deerfield, off North Rd./Woodvale Ave. | 62.04 |
| 23 | HCCB-13 | West Fork North Branch Chicago River | MU, W, M, H, ES | Cook | Northbrook, Northbrook Park, Walters Ave. | 43.31 |
| 24 | HCCC-08 | North Branch Chicago River | MU, W, M, H, ES, FF | Cook | 0.8 mi ENE Glenview, Harms Woods | 164.00 |
| 25 | HF-01 | Tinley Creek | MU, W, M, H, ES | Cook | 1.2 mi SW Crestwood, 135th St., Elizabeth Conkey Woods | 29.08 |
| 26 | HBD-05 | Thorn Creek | MU, W, M, H, ES | Cook | 0.5 mi W Chicago Heights, Rt. 30 bridge | 62.24 |
| 27 | HBDB-03 | Butterfield Creek | MU, W, M, H, ES | Cook | Holbrook, Veterans Memorial Park | 67.16 |
| 28 | HBDA-01 | North Creek | MU, W, M, H, ES | Cook | 1 mi SE Thornton, Sweet Woods Forest Preserve | 57.49 |
| 29 | HBE-02 | Plum Creek | MU, W, M, H, ES | Will | 3 mi E Crete, Exchange Ave. bridge | 52.54 |

**Table 2.** Mussel data for sites sampled during 2009 - 2011 surveys (Table 1). 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. 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.

| Species | Des Plaines River basin | | | | | | | | | | | | | | | | | | Lake Michigan tributaries | | | | | | | | | | | Proportion of total | Prop. of Des Plaines | Prop. of L. Michigan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | | | |
| **Subfamily Anodontinae** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Alasmidonta marginata* | | | | | | | | | | | | | | | | | | R | | | | | | | | | | | | 0.0% | 0.0% | 0.0% |
| ***Alasmidonta viridis*** | | R | | | R | | | | | | R | R | | 1 | | | | | | | | | | | | | R | | | 0.1% | 0.2% | 0.0% |
| *Anodontoides ferussacianus* | | R | | R | 1 | | | | | | R | 1 | 3 | R | | R | | | | | | | | | 1 | | R | | 9 | 2.2% | 0.9% | 7.5% |
| *Lasmigona complanata* | 3 | 12 | | 9 | 374 | | | | | | D | D | 1 | R | 48 | D | D | | | | | 1 | 2 | D | 5 | | 6 | | 12 | 69.3% | 81.4% | 19.4% |
| *Lasmigona compressa* | | | | | | | R | | | | R | | | | | | | | | | | | | | | | | | R | 0.0% | 0.0% | 0.0% |
| ***Lasmigona costata*** | | | | | | | | R | | | | | | | | | | | | | | | | | | | | | | 0.0% | 0.0% | 0.0% |
| *Pyganodon grandis* | 7 | 5 | D | 2 | 16 | D | 1 | | 3 | D | D | 1 | D | R | 15 | 1 | D | D | | | | 5 | 2 | 11 | 1 | R | 9 | 45 | 1 | 18.3% | 9.3% | 55.2% |
| *Strophitus undulatus* | | | | | | | | | | | D | D | | | | | D | R | | | | | | | | | | | | 0.0% | 0.0% | 0.0% |
| *Utterbackia imbecillis* | D | | | D | D | | | R | | R | | | | | 6 | D | | | | | | | | 7 | | | | | | 1.9% | 1.1% | 5.2% |
| **Subfamily Ambleminae** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Amblema plicata* | | | | D | R | | R | | | | | | | | | | | | | | | | | | | | | | | 0.0% | 0.0% | 0.0% |
| ***Elliptio dilatata*** | | | | | | | | | | | R | R | | | | | | | | | | | | | | | | | | 0.0% | 0.0% | 0.0% |
| *Fusconaia flava* | | | | | R | | R | | | | R | R | | | | | R | R | | | | | | | | | | | 6 | 0.9% | 0.0% | 4.5% |
| **Subfamily Lampsilinae** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Actinonaias ligamentina* | | | | | | | | | | | | | | | | | | | | | | | | | R | | | | | 0.0% | 0.0% | 0.0% |
| *Lampsilis cardium* | | | | | | | | | | | | 1 | | | | 1 | D | 1 | | | | | | | | | | | | 0.4% | 0.5% | 0.0% |
| *Lampsilis siliquoidea* | D | 1 | | 3 | | | D | | | R | 21 | 10 | D | R | R | D | 1 | R | | | | | | | 1 | R | R | | 1 | 5.6% | 6.6% | 1.5% |
| *Ligumia subrostrata* | | | | | | | | | D | | | | | | | | | | | | | | | | | | | | | 0.0% | 0.0% | 0.0% |
| *Toxolasma parvum* | | D | | R | R | | | | D | | | R | | | D | R | | | | | | | | 8 | R | | R | 1 | | 1.3% | 0.0% | 6.7% |
| ***Venustaconcha ellipsiformis*** | | | | R | D | | R | | | | R | R | | R | | | R | | | | | | | | | | R | | | 0.0% | 0.0% | 0.0% |
| ***Villosa iris*** | | | | | | | | | | | | | | | | | R | | | | | | | | | | | | | 0.0% | 0.0% | 0.0% |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | **Totals** | **Des Plaines** | **L. Michigan** |
| **Individuals collected** | 10 | 18 | 0 | 14 | 391 | 0 | 1 | 0 | 3 | 0 | 21 | 13 | 4 | 1 | 69 | 2 | 1 | 1 | 0 | 0 | 0 | 6 | 4 | 26 | 8 | 0 | 15 | 46 | 29 | 683 | 549 | 134 |
| **Live species collected** | 2 | 3 | 0 | 3 | 3 | 0 | 1 | 0 | 1 | 0 | 1 | 4 | 2 | 1 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 2 | 2 | 3 | 4 | 0 | 2 | 2 | 5 | 9 | 7 | 7 |
| **Extant species** | 4 | 0 | 1 | 5 | 4 | 1 | 2 | 0 | 3 | 1 | 4 | 6 | 4 | 1 | 4 | 5 | 5 | 2 | 0 | 0 | 0 | 2 | 2 | 4 | 4 | 0 | 2 | 2 | 5 | 13 | 12 | 7 |
| **Total species collected** | 4 | 0 | 1 | 8 | 8 | 1 | 6 | 2 | 3 | 3 | 10 | 11 | 4 | 6 | 5 | 7 | 7 | 6 | 0 | 0 | 0 | 2 | 2 | 4 | 6 | 2 | 7 | 2 | 6 | 19 | 18 | 11 |
| **Historical species richness** | 3 | NDA | 1 | 5 | NDA | NDA | 9 | NDA | NDA | NDA | 4 | NDA | NDA | 3 | NDA | NDA | NDA | NDA | NDA | NDA | NDA | NDA | NDA | NDA | NDA | NDA | NDA | 1 | 3 | 38 | 36 | 18 |
| **Catch per unit effort (CPUE)** | 2.5 | 4.5 | 0 | 3.5 | 97.8 | 0 | 0.25 | 0 | 0.75 | 0 | 5.25 | 3.25 | 1 | 0.25 | 17.3 | 0.5 | 0.25 | 0.25 | 0 | 0 | 0 | 1.5 | 1 | 6.5 | 2 | 0 | 3.75 | 11.5 | 7.25 | | | |
| **Mussel Community Index (MCI)** | 7 | 7 | 0 | 7 | 12 | 0 | 4 | 0 | 4 | 0 | 7 | 7 | 5 | 6 | 8 | 5 | 5 | 4 | 0 | 0 | 0 | 6 | 6 | 7 | 7 | 0 | 6 | 10 | 9 | | | |
| **Resource Classification** | L | L | R | L | HV | R | R | R | R | R | L | L | L | L | M | L | L | R | R | R | R | L | L | L | L | R | L | M | M | | | |

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

| | |
|---|---|
| Unique Resource<br>MCI ≥ 16 | Very high species richness (10 + species) &/or abundance (CPUE > 80); intolerant species typically present; recruitment noted for most species |
| Highly Valued Resource<br>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<br>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<br>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<br>MCI = 0 - 4 | No live mussels present; only weathered dead, sub-fossil, or no shell material found |

**Table 5.** Species known from the Des Plaines River and Lake Michigan basins from our survey and previous surveys. *denotes relict shell that was collected during our surveys in 2009 and 2011. **denotes a new record for the basin that was not included in the historical total in Table 2.

| | Des Plaines River drainage | | Lake Michigan drainage | |
|---|---|---|---|---|
| | **Presumed extant** | **Presumed extirpated** | **Presumed extant** | **Presumed extirpated** |
| *Margaritiferidae* | | | | |
| Cumberlandinae | | *Cumberlandia monodonta* | | |
| *Unionidae* | | | | |
| Anodontinae | *Alasmidonta viridis*<br>*Anodontoides ferussacianus*<br>*Lasmigona complanata*<br>*Pyganodon grandis*<br>*Strophitus undulatus*<br>*Utterbackia imbecillis* | *Alasmidonta marginata**<br>*Lasmigona compressa**<br>*Lasmigona costata**<br>*Simpsonaias ambigua* | *Anodontoides ferussacianus*<br>*Lasmigona complanata*<br>*Pyganodon grandis*<br>*Utterbackia imbecillis* | *Alasmidonta viridis**<br>*Lasmigona compressa**<br>*Lasmigona costata* |
| Ambleminae | *Amblema plicata* | *Cyclonaias tuberculata*<br>*Elliptio crassidens*<br>*Elliptio dilatata**<br>*Fusconaia flava**<br>*Plethobasus cyphyus*<br>*Pleurobema sintoxia*<br>*Quadrula metanevra*<br>*Quadrula pustulosa*<br>*Quadrula quadrula*<br>*Tritogonia verrucosa*<br>*Uniomerus tetralasmus* | *Fusconaia flava* | *Amblema plicata*<br>*Cyclonaias tuberculata*<br>*Elliptio dilatata*<br>*Pleurobema sintoxia*<br>*Quadrula quadrula* |
| Lampsilinae | *Lampsilis cardium*<br>*Lampsilis siliquoidea*<br>*Ligumia subrostrata***<br>*Toxolasma parvum*<br>*Venustaconcha ellipsiformis* | *Actinonaias ligamentina*<br>*Epioblasma triquetra*<br>*Lampsilis fasciola*<br>*Lampsilis teres*<br>*Leptodea fragilis*<br>*Ligumia recta*<br>*Obliquaria reflexa*<br>*Potamilus alatus*<br>*Villosa iris** | *Lampsilis siliquoidea*<br>*Toxolasma parvum* | *Actinonaias ligamentina**<br>*Leptodea fragilis*<br>*Truncilla donaciformis*<br>*Truncilla truncata*<br>*Venustaconcha ellipsiformis** |
| | **Total extant: 14** | **Total extirpated: 25** | **Total extant: 7** | **Total extirpated: 13** |

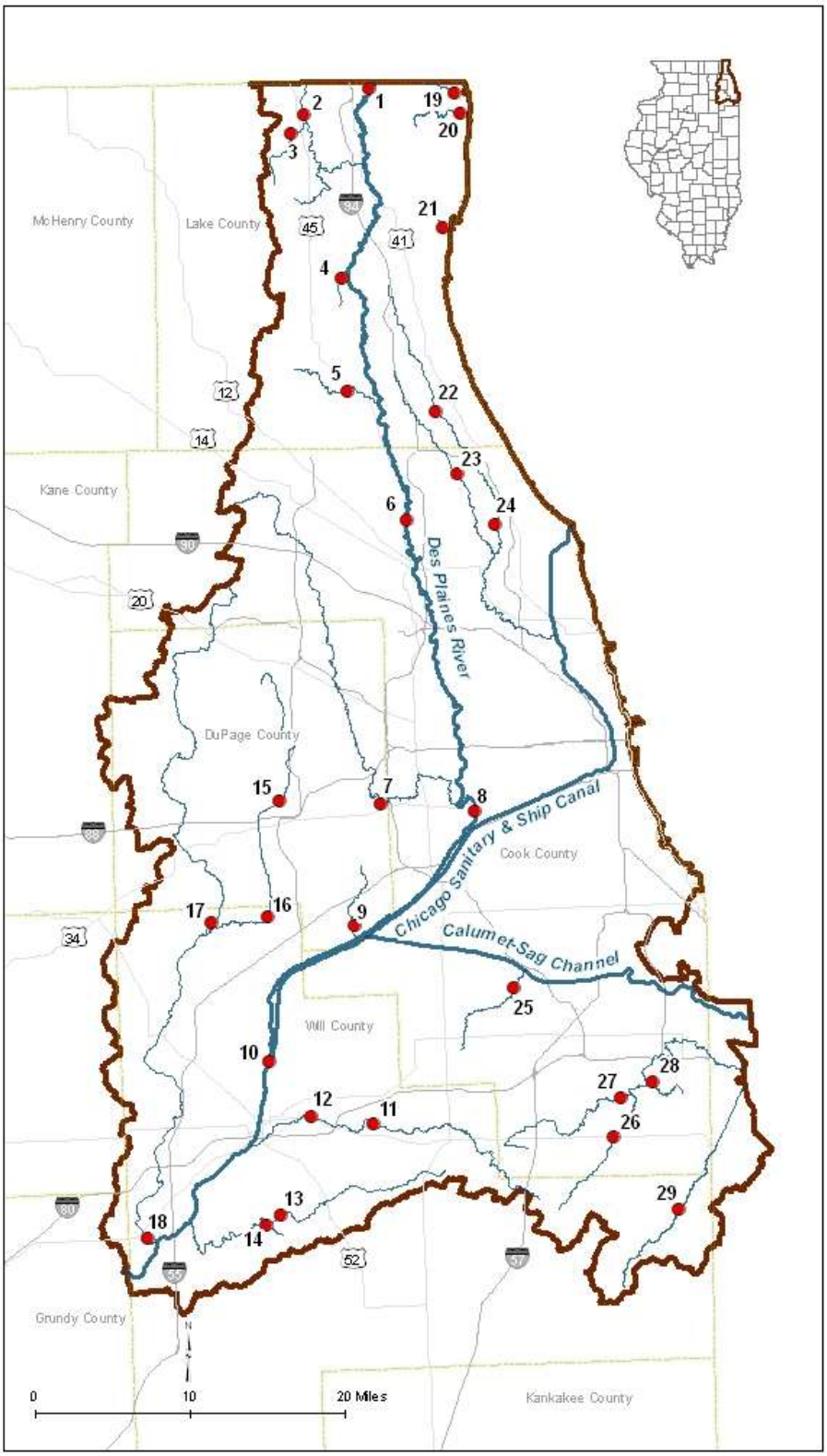
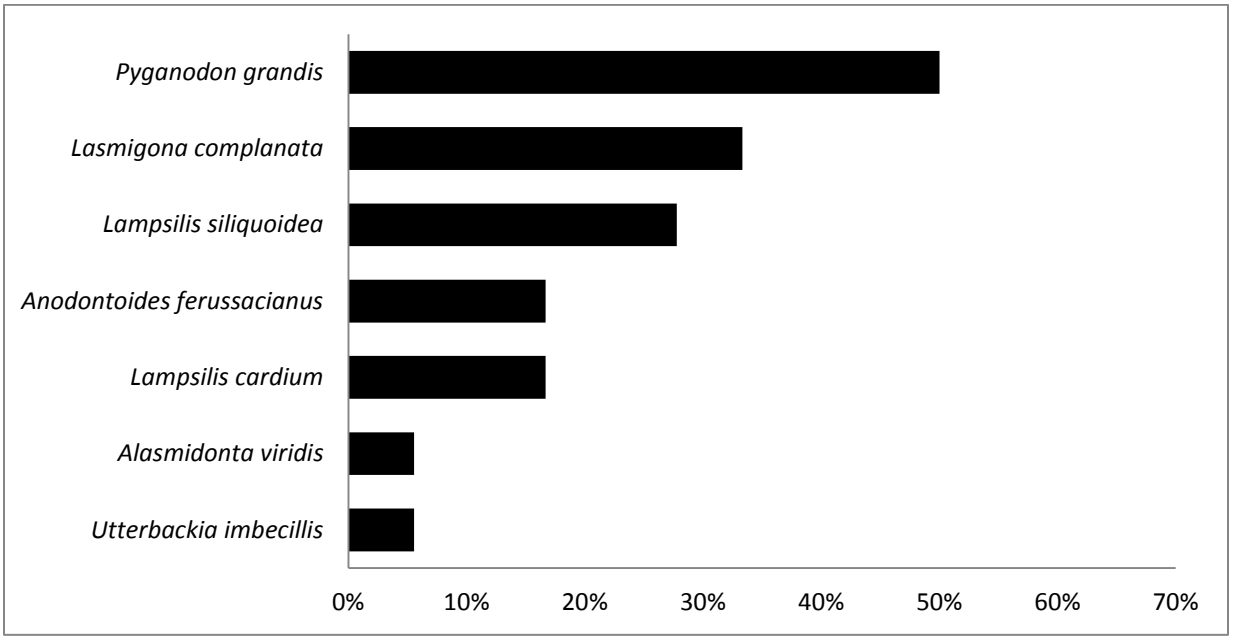



**Figure 1.** Sites sampled in the Des Plaines River basin and Lake Michigan tributaries in 2009 - 2011. Site codes referenced in Table 1.

**Figure 2**. Many sites had modifications in the form of lowhead dams or bank stabilization structures (clockwise from top left: site 4, site 7, site 9, and site 18).

**a)**




**b)**

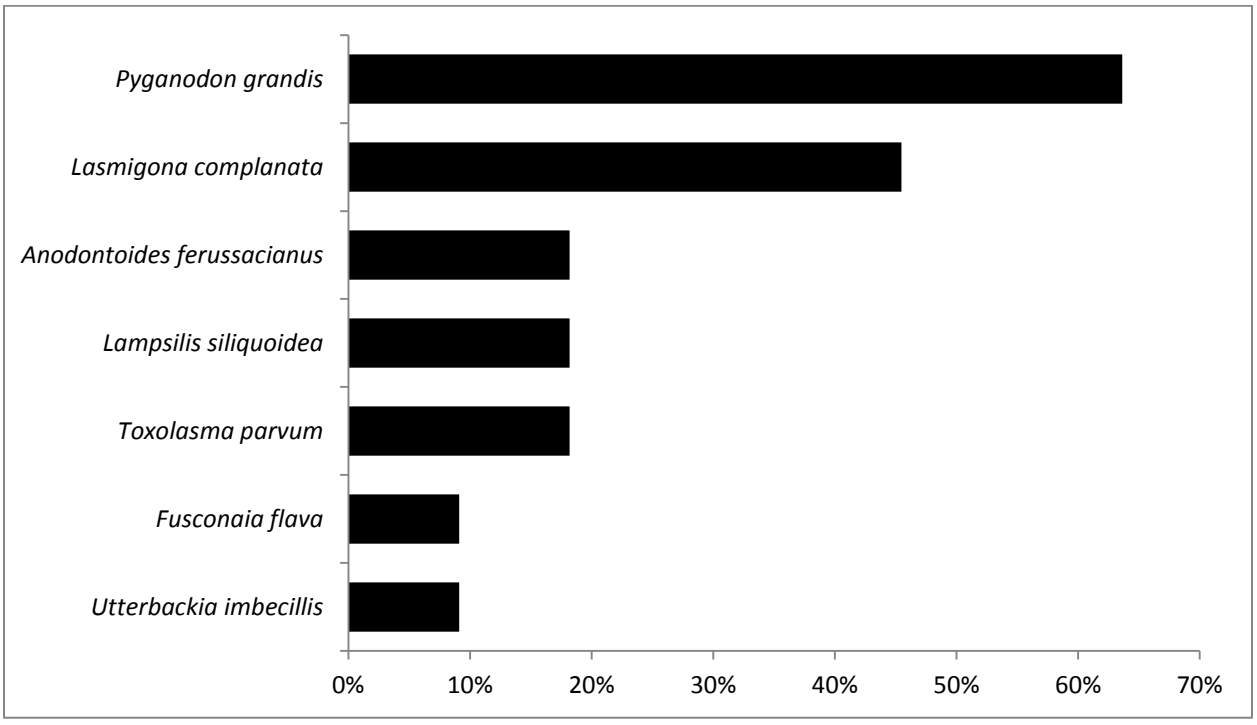



**Figure 3**. Number of sites where a species was collected live compared to the total number of sites sampled in a) the Des Plaines River basin (18 sites) and b) the Lake Michigan tributaries (11 sites).

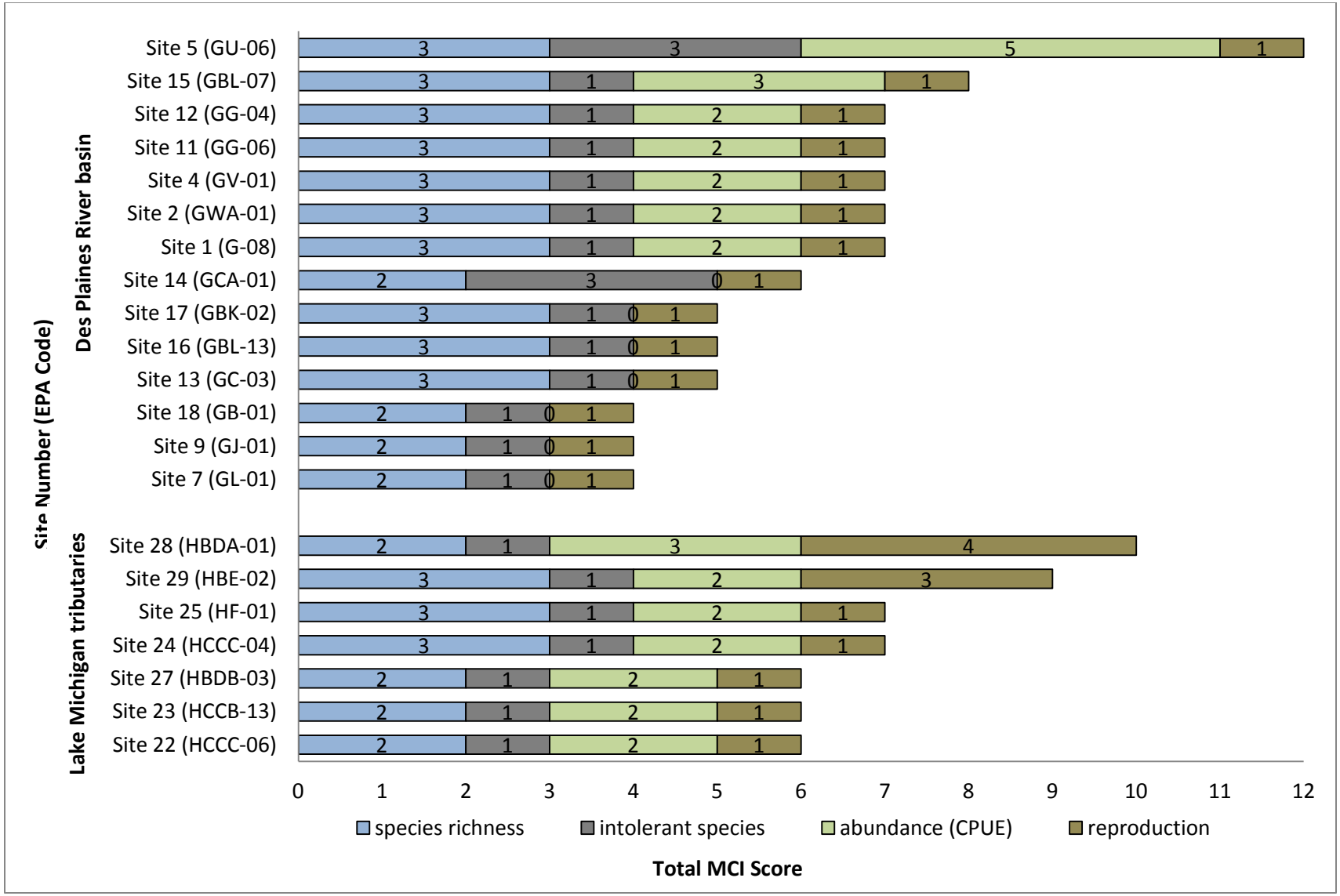



**Figure 4.** Comparison of Mussel Community Index (MCI) and MCI component scores for Des Plaines River basin sites (top) and Lake Michigan Basin tributary sites (bottom) based on factor values from Table 3.

**Appendix 1.** Scientific and common names of mussels in report. ST=state threatened, SE=state endangered, FE=federally endangered.

| Scientific name | Common name | Status |
|---|---|---|
| **Subfamily Cumberlandinae** | | |
| *Cumberlandia monodonta* | spectaclecase | FE |
| **Subfamily Anodontinae** | | |
| *Alasmidonta marginata* | elktoe | |
| *Alasmidonta viridis* | slippershell | ST |
| *Anodontoides ferussacianus* | cylindrical papershell | |
| *Lasmigona complanata* | white heelsplitter | |
| *Lasmigona compressa* | creek heelsplitter | |
| *Lasmigona costata* | flutedshell | |
| *Pyganodon grandis* | giant floater | |
| *Simpsonaias ambigua* | salamander mussel | SE |
| *Strophitus undulatus* | creeper | |
| *Utterbackia imbecillis* | paper pondshell | |
| **Subfamily Ambleminae** | | |
| *Amblema plicata* | threeridge | |
| *Cyclonaias tuberculata* | purple wartyback | ST |
| *Elliptio crassidens* | elephantear | ST |
| *Elliptio dilatata* | spike | ST |
| *Fusconaia flava* | Wabash pigtoe | |
| *Plethobasus cyphyus* | sheepnose | FE |
| *Pleurobema sintoxia* | round pigtoe | |
| *Quadrula metanevra* | monkeyface | |
| *Quadrula pustulosa* | pimpleback | |
| *Quadrula quadrula* | mapleleaf | |
| *Tritogonia verrucosa* | pistolgrip | |
| *Uniomerus tetralasmus* | pondhorn | |
| **Subfamily Lampsilinae** | | |
| *Actinonaias ligamentina* | mucket | |
| *Epioblasma triquetra* | snuffbox | SE |
| *Lampsilis cardium* | plain pocketbook | |
| *Lampsilis fasciola* | wavy-rayed lampmussel | SE |
| *Lampsilis siliquoidea* | fatmucket | |
| *Lampsilis teres* | yellow sandshell | |
| *Leptodea fragilis* | fragile papershell | |
| *Ligumia recta* | black sandshell | ST |
| *Ligumia subrostrata* | pondmussel | |
| *Obliquaria reflexa* | threehorn wartyback | |
| *Potamilus alatus* | pink heelsplitter | |
| *Toxolasma parvum* | lilliput | |
| *Truncilla donaciformis* | fawnsfoot | |
| *Truncilla truncata* | deertoe | |
| *Venustaconcha ellipsiformis* | ellipse | |
| *Villosa iris* | rainbow | SE |