

Unionid Mussel Surveys at Selected Sites in Osborn Creek, Swinton Creek, and White River - White River Watershed, Michigan



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Background photo: Survey Site 1 in Osborn Creek. **Inset photo:** Cylindrical papershell (*Anodontoidea ferussacianus*) juveniles from Site 1. Photos by Peter Badra.

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Introduction

Michigan Natural Features Inventory (MNFI), along with Huron-Manistee National Forest, performed unionid mussel surveys at selected sites in Osborn Creek, Swinton Creek, North and South Branches of the White River, and the main stem of the White River. Locations of survey sites were determined with guidance from Oceana County Road Commission and Huron-Manistee National Forest. The primary purpose of the surveys was to determine unionid mussel species presence/absence and composition at these sites.

Methods

Surveys were performed in wadeable habitats (less than approx. 70cm depth) and utilized tactile and visual methods of detection. Presence/absence and abundance of unionid mussel species were determined at each site. A measured search area was used to standardize sampling effort among sites and allow unionid density estimates to be made. Typically around 128m² provides a good compromise between amount of search effort per site and the number of sites to be completed within the scope of a project. Slightly less or more area was searched at some sites depending on available habitat. The search area was defined by taking stream width measurements and dividing it into 128 to get a reach length that would give 128m². When possible, sites are searched from bank to bank so that the full range of micro habitats is covered and the area equals the stream width times the reach length. Search areas in river reaches with larger widths, e.g. the White River main stem, did not span the full width of river.

A combination of tactile and visual means was used to locate live mussels and shells within each search area. Glass bottom buckets were used to facilitate visual detection. At sites where visual detection was difficult (e.g. high turbidity or pebble sized substrate with silt) the entire area was searched tactilely. Hands were passed through the substrate down to approximately 5cm during tactile searches. Frequent tactile searches through the substrate were also made at sites where visual detection was used to help ensure buried unionids were not overlooked. Live individuals were identified to species and planted back in the substrate anterior end down. Shells were identified to species. The presence/absence of dreissenid mussels (*Dreissena polymorpha* and *Dreissena bugensis*), and Asian clams (*Corbicula fuminea*) was recorded.

Latitude and longitude of sites was recorded with handheld GPS units. The substrate within each transect was characterized by estimating the percent composition of each of the following six particle size classes (diameter); boulder (>256mm), cobble (256-64mm), pebble (64-16mm), gravel (16-2mm), sand (2-0.0625mm), silt/clay (<0.0625) (Hynes

1970). Percent pool/riffle/run habitat within each survey area was estimated visually. The presence of aquatic vegetation and woody debris were noted, and a rough estimate of current speed was made for each survey site.

Results

A total of eleven sites were surveyed (Table 1 and Figure 1). The six sites surveyed in the South Branch and Main Stem of the White River were accessed by canoe and kayak. All other sites were accessed from road crossings. Coordinates of survey sites are given in Table 1.

Eight unionid mussel species were found, including three represented by live individuals and five by shell alone (Table 2). All three species represented by live individuals were documented at Site 1 in Osborn Creek (cylindrical papershell, *Anodontoidea ferussacianus*; spike, *Elliptio dilatata*; and Wabash pigtoe, *Fusconaia flava*). This is the only site where live mussels were found. Fifteen of the 21 cylindrical papershell found at this site were juveniles with 1-2 external annuli visible (Figures 2 and 3). Shells representing five species were found in the South Branch of the White River at Sites 6, 7, and 8. No exotic bivalves (zebra mussels or Asian clams) were found. Two shells of the state threatened slippershell (*Alasmidonta viridis*) were found at Site 8.

The entire river reach between Pines Point and Diamond Point was floated by canoe and kayak. Visibility of the river bottom in this reach was very good, except for occasional areas with deeper water or riffles. A qualitative visual search of the substrate was made while floating down this reach, but no additional shells or live individuals were spotted. A distinct change in substrate was noted downstream of Site 7 at Point A in Figure 1. Substrate upstream of this point was predominately a mix of pebble, gravel, sand, and silt. Downstream of this point the substrate was heavily dominated by sand, with some silt and very little, if any pebble or gravel (Table 3). There appeared to be more downed trees near the bank of the river in the reach dominated by sand, compared to the reach with a mix of substrate types. Additional physical habitat measures are given in Table 4.

Discussion

Although a complete survey of the watershed has not been done, the White River watershed is known to support a relatively high number of unionid mussel species. A survey in 2004 by Michigan Natural Features Inventory documented ten unionid mussel species in White Lake and the lower main stem of the White River just upstream from US-31, including the state endangered black sandshell (*Ligumia recta*), and exotic zebra mussel (*Dreissena*

polymorpha) and Asian clam (*Corbicula fluminea*) (Badra 2004). Earlier records for nine mussel species (1949 and 1934) are documented in the University of Michigan Museum of Zoology mollusk collection (Table 5).

Two of the eight species documented in this survey were not found in either the 2004 survey by MNFI, or in earlier surveys documented in the University of Michigan Museum of Zoology. This brings the total number of unionid mussels known in the watershed up to 16.

Zebra mussels and Asian clams were found only in White Lake in the 2004 mussel survey. Based on the results of the 2012 survey these exotic bivalves seem to be absent from the mid and upper reaches of the White Lake watershed. Zebra mussel larvae are often accidentally transported by boats. White Lake receives boat traffic from Lake Michigan and several boat ramps/marinas. The lack of zebra mussels in the mid and upper portions of the White River watershed may be explained by a lack of power boat traffic. Zebra mussels are known to have dramatic negative impacts on unionid mussels (Schloesser and Nalepa 1994; Schloesser et al. 2006).

Cobmoosa Lake is approximately 0.5 river miles upstream of the only site with live mussels (Site 1). The water temperature at this site was also noticeably warmer than at sites further downstream. This lake may help explain the presence of mussels at Site 1 and absence from other

sites. Cobmoosa Lake could be acting as a source for host fish populations for the cylindrical papershell, spike, and Wabash pigtoe. Hosts for these species include some warm water species that would be more likely to occur in Cobmoosa Lake than the relatively cold Osborn and Swinton Creeks, and North Branch of the White River. Juvenile unionid mussels are rarely found during surveys for adult unionid mussels. The presence of a fairly large number of juvenile cylindrical papershell at Site 1 is notable and might also be connected to the proximity of Cobmoosa Lake. Cylindrical papershell is primarily a headwater stream species, while spike and Wabash pigtoe both occur in a wide range of stream/river sizes, and lakes. Barriers to host fish passage also act as barriers to unionid mussel migration and gene flow (Watters 1995).

Fish species known to act as hosts for cylindrical papershell are white sucker, mottled sculpin, brook stickleback, spotfin shiner, Iowa darter, Tippecanoe darter, bluegill, common shiner, largemouth bass, blacknose shiner, sea lamprey, bluntnose minnow, fathead minnow, and black crappie. Fish species known to act as hosts for spike are rock bass, banded sculpin, gizzard shad, rainbow darter, yellow perch, white crappie, black crappie, flathead catfish, and sauger. Fish species known to act as hosts for Wabash pigtoe are bluegill, silver shiner, white crappie, black crappie, and creek chub (Watters et al. 2009). The suitability of host species has largely been determined in laboratory studies. Additional species may be utilized as hosts in the wild.

Table 1. Location of sites surveyed in Osborn Creek, Swinton Creek, and White River (Summer 2012).

Site #	Waterbody	Access	Latitude (N)	Longitude (W)
1	Osborn Creek*	Filmore Rd.	43.65641	86.18965
2	"	Baseline Rd.	43.64237	86.18028
3	"	Buchanan Rd.	43.62766	86.18425
4	Swinton Creek	Johnson Rd.	43.59858	86.18104
5	N. Branch White River	Yale Rd.	43.54820	86.20643
6	S. Branch White River	Canoe (Pines Pt. to Sischo Bayou)	43.52696	86.11435
7	"	"	43.52269	86.11846
8	"	"	43.50475	86.12535
9	"	Canoe (Sischo Bayou to Diamond Pt.)	43.48598	86.15708
10	Main Stem White River	"	43.47582	86.18977
11	"	"	43.47581	86.21202

*Osborn creek is also known as Cobmoosa Creek.

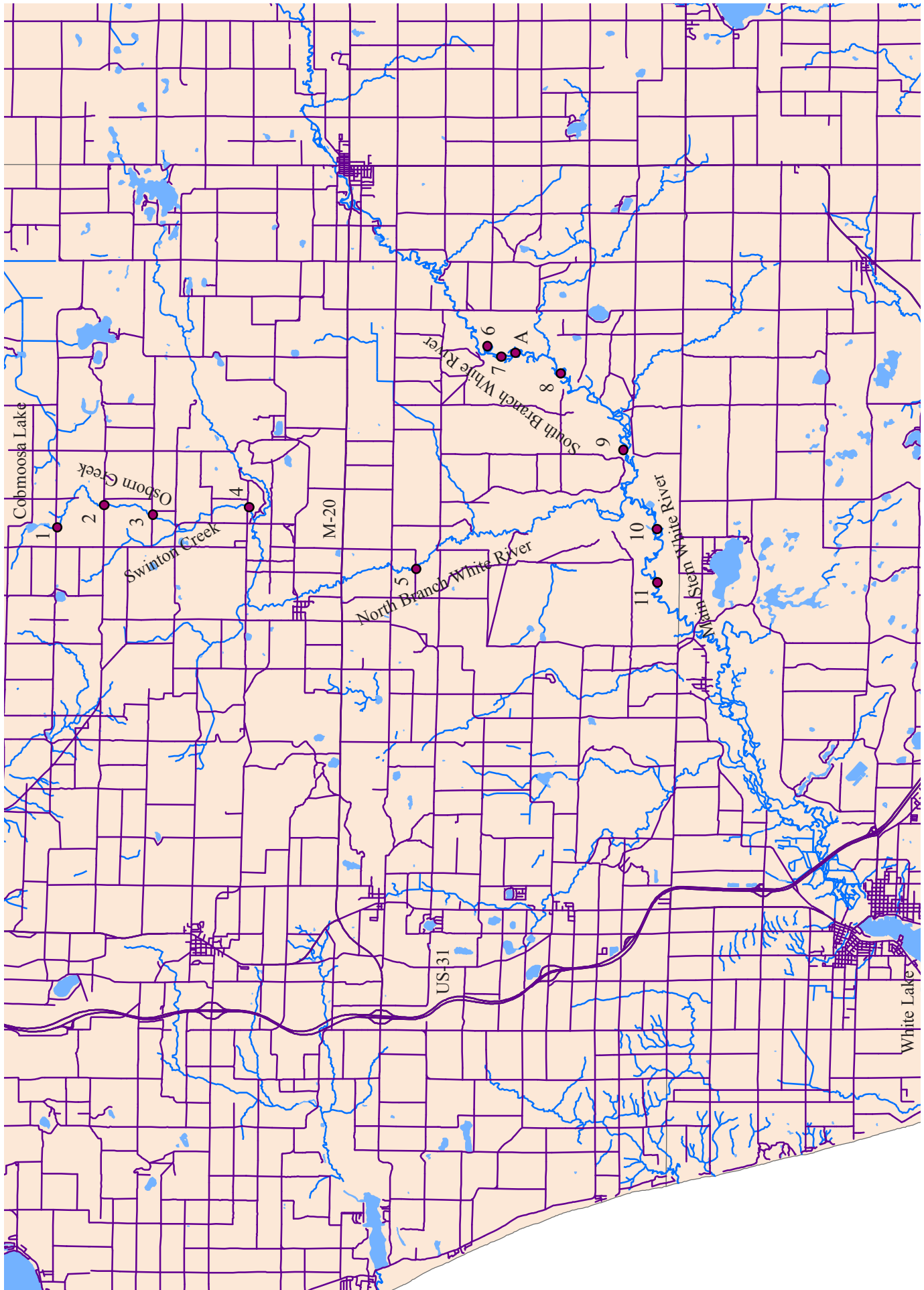


Figure 1. Map of survey sites 1-11. Point A marks the substrate composition change from a mix of pebble, gravel, sand, and silt (upstream), to heavily dominated by sand (downstream).

Table 2. Numbers of unionid mussels (#), relative abundance (RA), and density (D, indivs./m²) recorded at each survey site in Osborn Creek, Swinton Creek, the North and South Branches of the White River, and the Main Stem of the White River (Summer 2012). Numbers of unionid shells found are given in parentheses, S(#). No live individuals or shells of non-native bivalves were observed.

Species	Common name	Osborn Creek						Swinton Creek			N. Br. White River		
		1		2		3		4			5		
		#	RA	D	#	RA	D	#	RA	D	#	RA	D
<i>Actinonaias ligamentina</i>	Mucket												
<i>Alasmidonta viridis</i> (T)	Slippershell												
<i>Anodontooides ferussacianus</i>	Cylindrical papershell	21 ^A	0.38	0.18									
<i>Elliptio dilatata</i>	Spike	32	0.57	0.28									
<i>Fusconaia flava</i>	Wabash pigtoe	3	0.05	0.03									
<i>Lampsilis siliquoidea</i>	Fatmucket												
<i>Lampsilis ventricosa</i>	Pocketbook												
<i>Lasmigona complanata</i>	White heelsplitter												
<i>Lasmigona costata</i>	Fluted shell												
<i>Leptodea fragilis</i>	Fragile papershell												
<i>Ligumia recta</i> (E)	Black sandshell												
<i>Pyganodon grandis</i>	Giant floater												
<i>Strophitus undulatus</i>	Strange floater												
<i>Truncilla truncata</i> (SC)	Deertoe												
<i>Utterbackia imbecillis</i> (SC)	Paper pondshell												
Total # live individuals and density		56	0.48										
# Species live or shell		3	0		123	0		0	0	0	0		
Area searched (m ²)		116	128		108	128		108	128	128			
<i>Corbicula fluminea</i>	Asian clam												
<i>Dreissena polymorpha</i>	Zebra mussel												

^A Including 15 juveniles with 1-2 annular rings and 7 adults.

Table 2. cont.

Species	Common name	S. Branch White River												Main Stem White River					
		6			7			8			9			10			11		
		#	RA	D	#	RA	D	#	RA	D	#	RA	D	#	RA	D	#	RA	D
<i>Actinonaias ligamentina</i>	Mucket																		
<i>Alasmidonta viridis</i> (T)	Slippershell																		
<i>Anodontooides ferussacianus</i>	Cylindrical papershell																		
<i>Elliptio dilatata</i>	Spike																		
<i>Fusconaia flava</i>	Wabash pigtoe																		
<i>Lampsilis siliquoidea</i>	Fatmucket																		
<i>Lampsilis ventricosa</i>	Pocketbook																		
<i>Lasmigona complanata</i>	White heelsplitter																		
<i>Lasmigona costata</i>	Fluted shell																		
<i>Leptodea fragilis</i>	Fragile papershell																		
<i>Ligumia recta</i> (E)	Black sandshell																		
<i>Pyganodon grandis</i>	Giant floater																		
<i>Strophitus undulatus</i>	Strange floater																		
<i>Truncilla truncata</i> (SC)	Deertoe																		
<i>Utterbackia imbecillis</i> (SC)	Paper pondshell																		
Total # live individuals and density																			
	# Species live or shell	2			3			1			0			0			0		
	Area searched (m ²)	126			126			105			150			150			150		
<i>Corbicula fluminea</i>	Asian clam																		
<i>Dreissena polymorpha</i>	Zebra mussel																		

^B Shell fragments, from *Lampsilis siliquoidea* , Fatmucket

^C One worn shell, from *Strophitus undulatus* , Strange floater, found outside measured search area in a meander search



Figure 2. Juvenile cylindrical papershell (*Anodontoidea ferussacianus*) found in Osborn Creek at Site 1.



Figure 3. Site 1 in Osborn Creek.

Table 3. Percent composition of each substrate size class, estimated visually within each survey area.

Site #	Waterbody	Boulder	Cobble	Pebble	Gravel	Sand	Silt
1	Osborn Creek		1		4	70	25
2	"		5		10	70	15
3	"				10	80	10
4	Swinton Creek				20	70	10
5	N. Branch White River				5	85	10
6	S. Branch White River			25	35	35	5
7	"			20	40	30	10
8	"				15	75	10
9	"					90	10
10	Main Stem White River					80	20
11	"					85	15

Table 4. Physical habitat characteristics, including percent pool/riffle/run estimated visually within each survey area.

Site #	Waterbody	Current speed*	Aquatic vegetation?	Woody debris?	%Pool	%Riffle	%Run
1	Osborn Creek	medium	Y	Y	10		90
2	"	medium	N	Y			100
3	"	medium	N	Y	10		90
4	Swinton Creek	medium	N	Y	10		90
5	N. Branch White River	medium	N	Y			100
6	S. Branch White River	medium/fast	N	N			100
7	"	medium	N	Y		10	90
8	"	medium	N	Y			100
9	"	medium/slow	N	Y			100
10	Main Stem White River	medium	Y	Y			100
11	"	medium/slow	N	Y			100

*slow = approx. 0.2m/second; medium = approx. 1m/second; fast = approx. 2m/second

Table 5. Michigan's unionid mussel species. Species documented in the White River Watershed are noted. (SC= Species of special concern; T= threatened; E= endangered)

Species	Common Name	Documented in White River Watershed	MI Status	Federal Status
<i>Actinonaias ligamentina</i>	Mucket	C		
<i>Alasmidonta marginata</i>	Elktoe		SC	
<i>Alasmidonta viridis</i>	Slippershell	AC	T	
<i>Amblyma plicata</i>	Threeridge			
<i>Anodontoides ferussacianus</i>	Cylindrical papershell	ABC		
<i>Cyclonaias tuberculata</i>	Purple wartyback		T	
<i>Elliptio complanata</i>	Eastern elliptio			
<i>Elliptio crassidens</i>	Elephant-ear			
<i>Elliptio dilatata</i>	Spike	C		
<i>Epioblasma obliquata perobliqua</i>	White catspaw		E	E
<i>Epioblasma torulosa rangiana</i>	Northern riffleshell		E	E
<i>Epioblasma triquetra</i>	Snuffbox		E	E
<i>Fusconaia flava</i>	Wabash pigtoe	ABC		
<i>Lampsilis fasciola</i>	Wavy-rayed lampmussel		T	
<i>Lampsilis siliquoidea</i>	Fatmucket	ABC		
<i>Lampsilis ventricosa</i>	Pocketbook	AB		
<i>Lasmigona complanata</i>	White heelsplitter	B		
<i>Lasmigona compressa</i>	Creek heelsplitter	A		
<i>Lasmigona costata</i>	Fluted-shell	AC		
<i>Leptodea fragilis</i>	Fragile papershell	B		
<i>Leptodea leptodon</i>	Scaleshell		SC	E
<i>Ligumia nasuta</i>	Eastern pondmussel		E	
<i>Ligumia recta</i>	Black sandshell	B	E	
<i>Obliquaria reflexa</i>	Three-horned wartyback		E	
<i>Obovaria olivaria</i>	Hickorynut		E	
<i>Obovaria subrotunda</i>	Round hickorynut		E	
<i>Pleurobema clava</i>	Clubshell		E	E
<i>Pleurobema sintoxia</i>	Round pigtoe		SC	
<i>Potamilus alatus</i>	Pink heelsplitter			
<i>Potamilus ohiensis</i>	Pink papershell		T	
<i>Ptychobranchus fasciolaris</i>	Kidney-shell		SC	
<i>Pyganodon grandis</i>	Giant floater	AB		
<i>Pyganodon lacustris</i>	Lake floater		SC	
<i>Pyganodon subgibbosa</i>	Lake floater		T	
<i>Quadrula pustulosa</i>	Pimpleback			
<i>Quadrula quadrula</i>	Mapleleaf			
<i>Simpsonaias ambigua</i>	Salamander mussel		E	
<i>Strophitus undulatus</i>	Strange floater	AC		
<i>Toxolasma lividus</i>	Purple lilliput		E	
<i>Toxolasma parvus</i>	Lilliput		E	
<i>Truncilla donaciformis</i>	Fawnsfoot		T	
<i>Truncilla truncata</i>	Deertoie	B	SC	
<i>Utterbackia imbecillis</i>	Paper pondshell	B	SC	
<i>Venustaconcha ellipsiformis</i>	Ellipse		SC	
<i>Villosa fabalis</i>	Rayed bean		E	E
<i>Villosa iris</i>	Rainbow		SC	
<i>Corbicula fluminea</i>	Asian clam	B	Exotic	Exotic
<i>Dreissena bugensis</i>	Quagga mussel		Exotic	Exotic
<i>Dreissena polymorpha</i>	Zebra mussel	B	Exotic	Exotic

A= Records from Univ. of Michigan Museum of Zoology, documented in 1949 and 1934.

B= Documented by Michigan Natural Features Inventory in a 2004 survey (Badra 2004).

C= Documented by Michigan Natural Features Inventory in this 2012 survey.

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