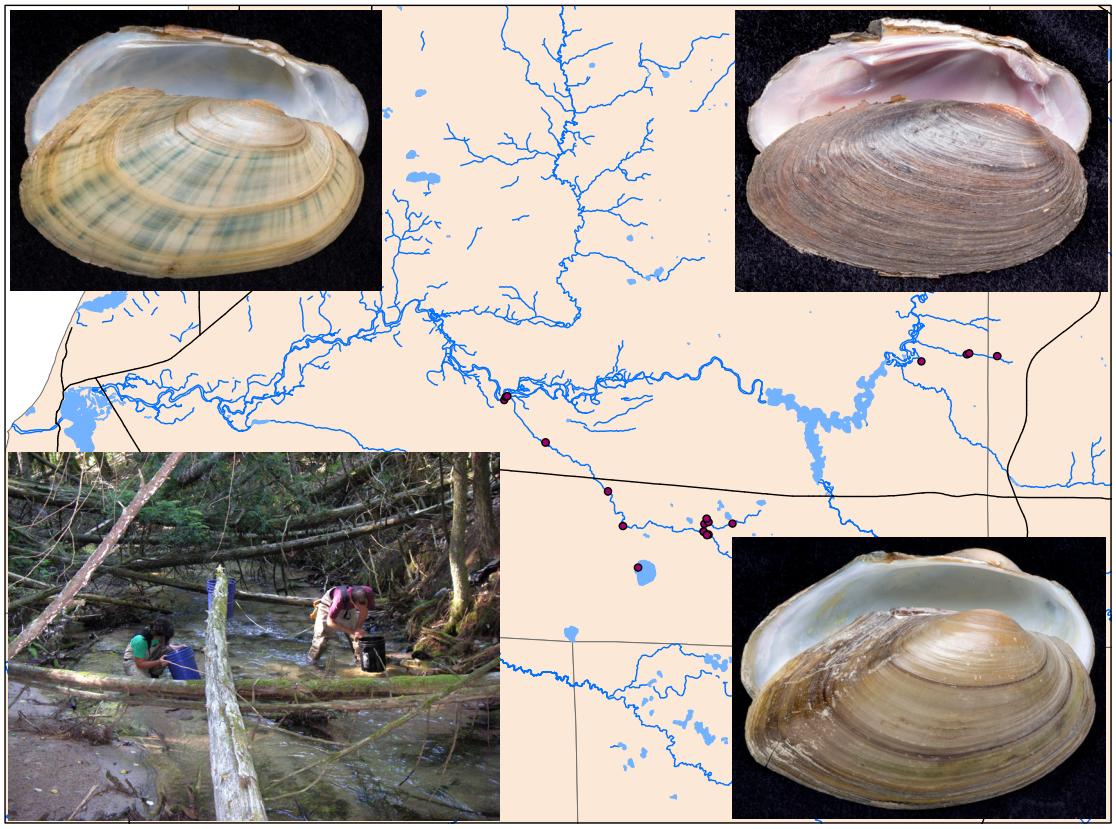
Unionid Mussel Surveys at Selected Sites in Hinton Creek, Pine Creek, and Pine Lake - Manistee River Watershed, Michigan



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Background image: Survey area in the Manistee River Watershed. **Inset photos:** bottom-left, Hinton Creek Site 4; top-left, Fatmucket (*Lampsilis siliquoidea*); top-right, Spike (*Elliptio dilatata*); bottom-right, Giant floater (*Pyganodon grandis*)

Photos on cover by Kurt Stepnitz and Chris Riley; Photos in report body by Sarah Coury and Peter Badra.

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Acknowledgments

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Purpose

Michigan Natural Features Inventory (MNFI), in cooperation with Huron-Manistee National Forest staff, performed unionid mussel surveys at selected sites in Hinton Creek, Pine Creek, and Pine Lake during the summer of 2011. The aim of these surveys was to determine unionid mussel species presence/absence and composition at these sites.

Methods

Locations of survey sites were chosen with guidance from Huron-Manistee National Forest staff. Surveys took place in wadable habitats (less than approx. 70cm depth) and utilized visual and tactile methods of detection. The number of individuals, both live and shells, was determined for each unionid mussel species at each site.

A measured search area was used to standardize sampling effort among sites and allow mussel density estimates to be made. Typically $128m^2$ provides a good compromise between the amount of search effort per site and the number of sites to be completed within the scope of the project. The size of this search area is also consistent with a number of past mussel surveys in Michigan that have used $128m^2$ as a standard search area. Less area was searched at two sites where there was a lack of habitat to survey. The search area was defined by dividing stream width into 128 to get a reach length that would give $128m^2$. When possible, sites were searched from bank to bank so that the full range of micro habitats was covered and the area equaled the stream width times the reach length.

A combination of visual and tactile means was used to locate live mussels and shells within the search area. Glass bottom buckets were used to facilitate visual searches. At sites where visual detection was difficult (e.g. pebble sized substrate with silt) hands were passed through the substrate throughout the entire search area. Occasional tactile searches through the substrate were made at sites where primarily visual detection was used to help ensure that buried mussels 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 zebra mussels (*Dreissena polymorpha*), and Asian clams (*Corbicula fluminea*) were recorded.

Latitude and longitude of sites were 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 seventeen sample sites were surveyed, including Site 7, which consisted of an incidental find. Sites in Hinton Creek and Pine Lake were accessed from nearby roads or road/stream crossings. Four sites in Pine Creek were accessed by motor boat from the Manistee River, and the remaining five sites were accessed by nearby roads (Table 1, Figures 1 and 2).

Three unionid mussel species were found during the survey (Table 2). All three were represented by empty shell alone. These were found at three of the 12 sites surveyed in Pine Creek. None were found at the four sites surveyed in Hinton Creek. Spike (*Elliptio dilatata*) shells were found at three sites in Pine Creek. A single fatmucket (*Lampsilis siliquoidea*) shell was present at one site in Pine Creek outside of the measured search area. In Pine Lake, three giant floater (*Pyganodon grandis*) shells were found at the one site surveyed. No shells or live individuals of endangered, threatened, or special concern mussel species were found at any sites. Live zebra mussels were attached to the spike shell incidentally found at Site 7 in Pine Creek. No other zebra mussels, live or shell, were found during the survey. Asian clams were not found at any of the survey sites.

Stream substrate at Hinton Creek survey sites was generally a mix of pebble, gravel, sand, and silt size classes (Table 3). In contrast, most sites in Pine Creek were dominated by sand and silt (Figure 3). The exceptions were Site 5, which had a mix of substrate classes from cobble to silt, and Sites 8 and 9, which each had a significant component of clay slab on the stream bottom. The substrate in Pine Lake was composed mainly of silt along with a lesser amount of sand.

Stream current in Hinton Creek (approx. 1.5-2m/second) was noticeably faster than most survey sites in Pine Creek (Table 4). Aquatic vegetation was present at one of the four sites and woody debris was present at all four. Stream morphology varied within each site in Hinton Creek, with three of the four sites having pools, riffles, and run habitat (Figure 4). Current speed at survey sites in Pine Creek were generally slower than Hinton Creek but ranged from fast to medium/slow (approx. 0.6-2m/second). Aquatic vegetation was present at all but three sites in Pine Creek, and woody debris was present at all Pine Creek sites. In general, Pine Creek was dominated by run habitat. The

lower portion had a substantial riffle component in addition to run, while the upper portion had a moderate amount of pool habitat in addition to run. Pine Lake had both aquatic vegetation and woody debris (Figure 5).

Discussion

The species found in this study are quite widespread in Michigan, all three occurring in greater than 20 major watersheds in the state (Badra 2010). Fatmucket and giant floater have adapted to living in both streams and lakes, being relatively tolerant to siltation and non-flowing water conditions compared to other mussel species. Spike is one of several unionid species that are often found in small streams.

Fish species known to be suitable hosts for spike are rock bass, banded sculpin, gizzard shad, rainbow darter, yellow perch, white and black crappie, flathead catfish, and sauger. These were determined in laboratory studies that tested a subset of potential host species. The actual host species used by unionid mussels in the field could be greater or less. Spike reach maturity at four to six years of age. The glochidia (larvae) of spikes are discharged into the water in white, elongate conglutinates (a package of glochidia formed by the females of some unionid mussel species that often resemble host fish prey items). Giant floater is a generalist known to utilize at least 41 host fish species in several different families. Glochidia of this species are released in a tangle of larval threads. Fatmucket, also a generalist, is known to use 20 host species, representing six families (host information compiled in Watters et al. 2009). Female fatmuckets display a lure resembling a small fish when glochidia are mature. When a potential host fish bites the lure the glochidia are released and have a greater chance of attaching to a suitable host than if they were released by chance.

A total of 13 species of uniond mussel have been documented in the Manistee River Watershed in recent surveys and historic records from the University of Michigan Museum of Zoology Mollusk Collection (Table 5) (Badra 2010). These include one state endangered species, one state threatened species, and two species of special concern. Two of these, the state threatened slippershell (*Alasmidonta viridis*) and special concern elktoe (*Alasmidonta marginata*), were documented in a separate 2011 MNFI survey of sites in the Pine River and Manistee River. Several other non-listed species were found in that survey as well (Badra 2012a).

The number of unionid mussel species present in a river can depend on the number fish species, the size of the watershed, or both (Watters 1992). Small watersheds, like Pine Creek and Hinton Creek, tend to have fewer fish species and mussel species than large watersheds. Though streams of this size can support important mussel populations, including listed species. The slippershell, for example, is a state threatened species that is strongly associated with smaller headwater streams. The substrate composition in Hinton Creek was generally favorable for unionid mussels, however the stream's high gradient/fast current result in a high amount of scour. This instability could prevent the establishment of any unionid mussels transported there by fish hosts.

MNFI has performed unionid mussel surveys in most of the major watersheds in Michigan, and documented the presence/absence of zebra mussels (*Dreissena polymorpha*) at each survey site. One pattern in the distribution of zebra mussels that is clear, is their association with large impoundments and lakes commonly used for boating. Zebra mussels tend to be absent from rivers without impoundments (e.g. Belle and Looking Glass Rivers) and present in rivers with large impoundments (e.g. Manistee, Huron, and Muskegon Rivers). This observation matches patterns seen in Wisconsin that impoundments have facilitated the invasion of zebra mussel and other aquatic invasive species (Johnson et al. 2008).

Zebra mussels have free swimming larvae, called veligers. Unlike unionid mussels, which have larvae that attach to host fish, zebra mussels are poorly suited to maintaining populations in flowing river habitat. Free swimming larvae drift downstream with the river current. Unionid mussel larvae (glochidia) are transported to new habitats, including upstream habitats while they are attached to host fish. Inadvertent transport of zebra mussel larvae (on boats, trailers, live wells, etc.) facilitates the establishment and maintenance of zebra mussel populations in Michigan's rivers. Pine Creek and Hinton Creek are largely zebra mussel free, most likely due to the fact that these streams see relatively little boat traffic compared to the main stem of the Manistee, where zebra mussels are plentiful (Badra and Goforth 2003, Badra 2005). Similarly, no zebra mussels were found in surveys of the upper portion of the White River Watershed in 2012 (Badra 2012b), though live zebra mussels were found at five out of five sites surveyed in White Lake in 2004 (Badra 2004).

Table 1. Locations sites surveyed in Hinton Creek, Pine Creek, and Pine Lake.

Site #	Waterbody	Access	Latitude (N)	Longitude (W)
1	Hinton Creek	S. Warfield Rd.	44.27765	85.83160
2	"	"	44.27776	85.83094
3	"	"	44.27659	85.81613
4	"	Peterson Creek Rd. / 7180	44.28129	85.85447
5	Pine Creek	N. Huff Rd.	44.24364	86.05781
6	"	motor boat from Manistee River	44.25960	86.08039
7*	"	"	44.25986	86.07996
8	"	"	44.26116	86.07913
9	"	"	44.26136	86.07843
10	"	Bosschem Rd.	44.20829	85.97066
11	"	"	44.20935	85.97318
12	"	"	44.21226	85.97275
13	"	"	44.21292	85.97067
14	"	Pine Lake Rd. (corner)	44.21145	86.01642
15	"	Steinberg Rd.	44.22485	86.02430
16	"	Seaman Rd.	44.21245	85.95764
17	Pine Lake	Pine Lake Campground	44.19550	86.00829

*Location of incidental find at the confluence of Pine Creek and Manistee River:

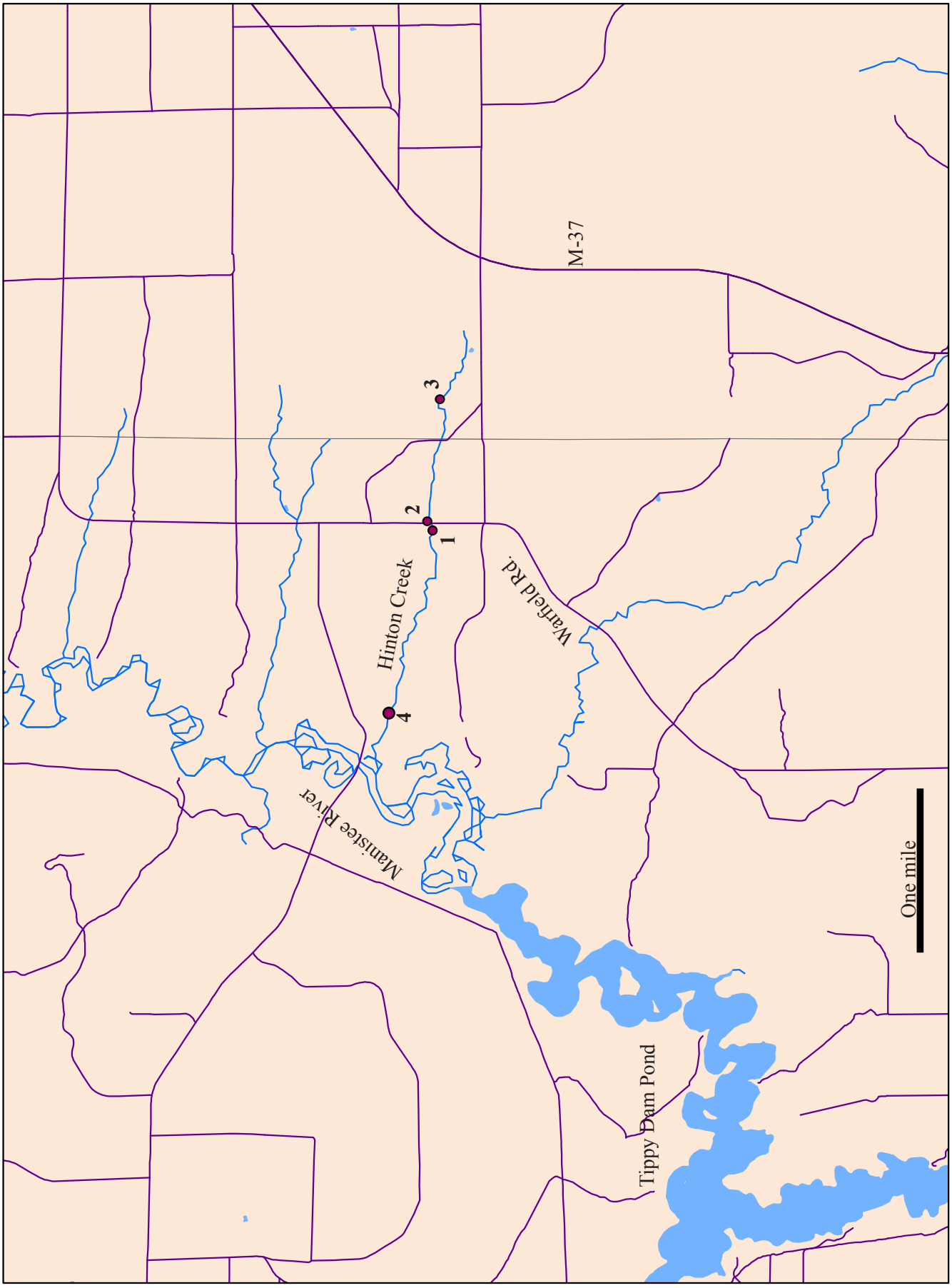

Figure 1. Survey Sites 1-4 in Hinton Creek.

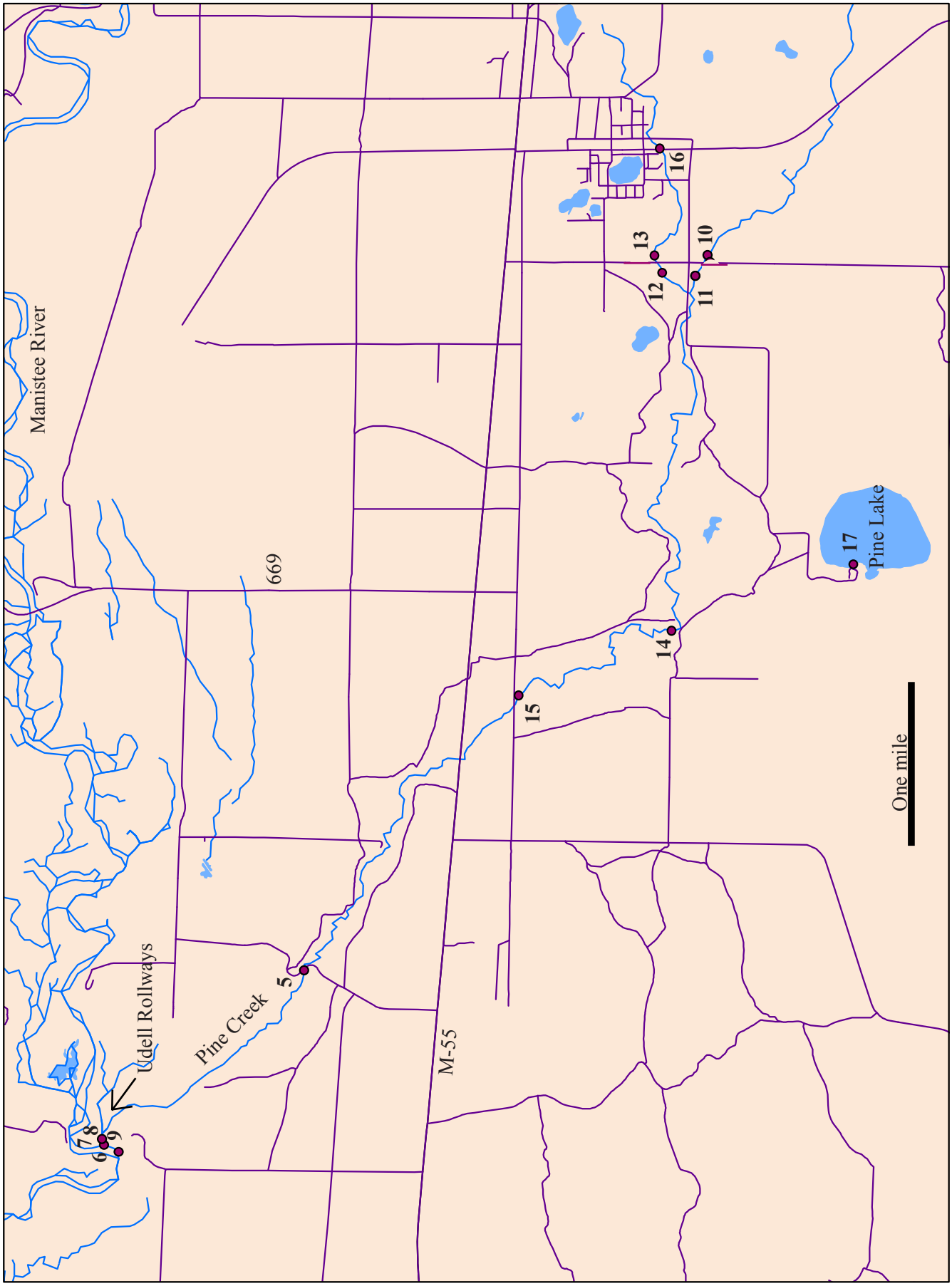

Figure 2. Survey Sites 5-16 in Pine Creek, and Site 17 in Pine Lake.

Table 2. Numbers of unionid mussels (#), relative abundance (RA), and density (D, indvs./m^2) recorded at each survey site in Hinton Creek, Pine Creek, and Pine Lake (Summer 2011). Numbers of unionid shells found are given in parentheses, S(#). No live unionid mussels were found. Presence/absence of non-native bivalves are given (S=shell only, L=live individuals) (E=endangered; T= threatened; SC=species of special concern)

		Hinton Creek				Pine Creek								
		1	2	3	4	5	6	7[A]			8			
Species	Common name	#	#	#	#	#	#	#	RA	D	#	RA	D	
Alasmidonta marginata (SC)	Mucket													
Alasmidonta viridis (T)	Slippershell													
Anodontoides ferussacianus	Cylindrical papershell													
Elliptio dilatata	Spike							S(1)[B]	1.00	na	S(2)	1.00	0.02	
Fusconaia flava	Wabash pigtoe													
Lampsilis siliquoidea	Fatmucket													
Lampsilis ventricosa	Pocketbook													
Lasmigona complanata	White heelsplitter													
Lasmigona compressa	Creek heelsplitter													
Ligumia recta (E)	Black sandshell													
Pyganodon grandis	Giant floater													
Strophitus undulatus	Strange floater													
Utterbackia imbecillis (SC)	Paper pondshell													
# Species		0	0	0	0	0	0	1		na	1		0.02	
Area searched (m^2)		128	128	128	128	128	50	na			128			
Corbicula fluminea														
Dreissena polymorpha								L						

[A] Incidental find on the bank of the Manistee River adjacent to the mouth of Pine Creek

[B] A few live zebra mussels were attached to this shell

Table 2. cont.

		Pine Creek										Pine Lake		
		9			10	11	12	13	14	15	16	17		
Species	Common name	#	RA	D	#	#	#	#	#	#	#	#	RA	D
Alasmidonta marginata (SC)	Mucket													
Alasmidonta viridis (T)	Slippershell													
Anodontoides ferussacianus	Cylindrical papershell													
Elliptio dilatata	Spike	S(2)	0.66	0.02										
Fusconaia flava	Wabash pigtoe													
Lampsilis siliquoidea	Fatmucket	S(1)[C]	0.33	na										
Lampsilis ventricosa	Pocketbook													
Lasmigona complanata	White heelsplitter													
Lasmigona compressa	Creek heelsplitter													
Ligumia recta (E)	Black sandshell													
Pyganodon grandis	Giant floater											S(3)	1.00	0.02
Strophitus undulatus	Strange floater													
Utterbackia imbecillis (SC)	Paper pondshell													
# Species		2		0.02	0	0	0	0	0	0	0	1		0.02
Area searched (m^2)		128			128	128	128	128	128	128	56	128		
Corbicula fluminea														
Dreissena polymorpha														

[C] Found outside measured search area

Table 3. Composition of each substrate size class, estimated visually as a percentage within each survey area.

Site #	Waterbody	Boulder	Cobble	Pebble	Gravel	Sand	Silt	Other
1	Hinton Creek		10	30	30	25	5	
2	"			20	40	30	10	
3	"			10	45	35	10	
4	"	5	15	20	20	40		
5	Pine Creek		5	30	30	30	5	
6	"					80	20	
7*	"					80	20	
8	"					80		20% clay slab
9	"				25	45		30% clay slab
10	"					70	30	
11	"				5	65	30	
12	"					80	20	
13	"					80	20	
14	"			10	20	50	20	
15	"				10	70	20	
16	"				15	65	20	
17	Pine Lake					30	70	

*Location of incidental find at the confluence of Pine Creek and Manistee River:

Figure 3. Pine Creek with predominantly sand substrate.

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

Site #		Current speed[B]	Aquatic vegetation?	Woody debris?	%Pool	%Riffle	%Run
1	Hinton Creek	med/fast	N	Y	33	33	33
2	"	med/fast	Y	Y		50	50
3	"	med/fast	N	Y	20	40	40
4	"	fast	N	Y	20	40	40
5	Pine Creek	fast	N	Y	10	50	40
6	"	medium	N	Y		20	80
7[A]	"	medium	Y	Y		20	80
8	"	med/fast	N	Y		40	60
9	"	medium	Y	Y		20	80
10	"	med/slow	Y	Y			100
11	"	med/slow	Y	Y			100
12	"	med/slow	Y	Y		20	80
13	"	med/slow	Y	Y	10		90
14	"	med/slow	Y	Y			100
15	"	med/slow	Y	Y	20		80
16	"	med/slow	Y	Y	10		90
17	Pine Lake	zero	Y	Y	-	-	-

[A]Location of incidental find at the confluence of Pine Creek and Manistee River.

[B]slow = approx. 0.2m/second; medium = approx. 1m/second; fast = approx. 2m/second

Figure 4. Hinton Creek near Warfield Road.

Figure 5. Pine Lake overlooking Site 17.

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

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

A= Documented by MNFI in this 2011 survey of Hinton Creek, Pine Creek, and Pine Lake.
B= Documented in a separate 2011 survey of Pine River and Manistee River (Badra 2012a).
C= Records from previous surveys and/or University of Michigan Museum of Zoology Mollusk Collection.

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