Unionid Mussel Surveys at Selected Sites within Huron-Manistee National Forest, Summer 2014

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Inset cover photo: Wabash pigtoe (*Fusconaia flava*) and spike (*Elliptio dilatata*) at Site 8 in Triple Lakes Creek, a tributary of the Pere Marquette River.

Background cover photo: Triple Lakes Creek **(**Site 8) where the highest abundance of native unionid mussels was found. No zebra mussels were present at this site.

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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 during the summer of 2014. All sites were located within the Manistee River Watershed except one, which was in the Pere Marquette River Watershed. The aim of these surveys was to determine unionid mussel species presence/absence and relative abundance, and assess the status of zebra mussels (*Dreissena polymorpha*) at these sites. One Manistee River site surveyed in this study was previously surveyed by MNFI and Huron-Manistee National Forest staff in 2011. This study is part of an ongoing effort to document and assess the status of unionid mussels throughout Michigan.

Methods

Location 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 mussel surveys in Michigan that have used 128m^2 as a standard search area. The search area was defined by dividing stream width into 128 to get a reach length that would give 128m^2. In some cases more or less area is searched based on amount of available habitat. 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.

Live unionids and shells were located with a combination of visual and tactile means. Glass bottom buckets were used to facilitate visual searches. At sites where visual detection was difficult (e.g. where mussels were found buried in the substrate) 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 into the substrate anterior end down (siphon end up) in the immediate vicinity of where they were found. Shells were identified to species. One survey site was located within a lake, while the others were located in river habitats. Due to the presence of dense, tall aquatic vegetation and a thick layer of silt over a mucky bottom, standard wading surveys were not possible in Dickson Lake. Clear, still water allowed for good visibility of the bottom from a dock that extended into the lake. The area around the dock was visually searched. The presence/absence of zebra mussels, and Asian clams (*Corbicula fluminea*) was recorded. In cases where zebra mussels were found attached to live native unionid mussels, the number attached to each was counted. Zebra mussels attached to live unionid mussels were removed by hand before the unionid was placed back in the substrate.

Habitat data were taken to describe and document conditions at the time of the surveys. The substrate within each transect was characterized by estimating 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 (<0.0625mm) (Hynes 1970). Woody debris, aquatic vegetation, exposed solid clay substrate, and erosion were noted when observed. Conductivity and pH were recorded with an Oakton handheld meter. Alkalinity was measured with a LaMotte kit (model DR-A) and hardness was measured with a Hach kit. Latitude and longitude of sites were recorded with handheld GPS units.

Results

Locations of survey sites are given in Table 1 and numbers of individuals found at each site in Table 2. Live unionid mussels were found at four of the eight sites surveyed. Spike (*Elliptio dilatata*) was by far the most abundant species and the only one to be found at three survey sites. The state threatened wavy-rayed lampmussel (*Lampsilis fasciola*) was found at Site 5 in the Manistee River near High Bridge (Figures 1 and 2). Relatively high native mussel density was documented at Site 8 in Triple Lakes Creek, with no sign of zebra mussels. Zebra mussels were found attached to live unionid mussels at Sites 5 and 7 in the Manistee River. They were also present at Site 6 in the Manistee River, but this site lacked unionid mussels. The proportion of unionid mussels colonized by zebra mussels was 43% at Site 5 and 13% at Site 7 (Table 3). Asian clams were not found at any of the survey sites.

The occurrence of wavy-rayed lampmussel near High Bridge at Site 5 is the first documented occurrence in the Manistee River watershed. This species is known only from the watersheds of southeast Michigan, except for a 2010 record in Crystal River, Leelanau County and an historical record in Gun Lake, Barry County (Natural Heritage Database; University of Michigan, Museum of Zoology Mollusk Collection). Many of the watersheds of southeast Michigan have persistent zebra mussel

populations in them. For example, of 21 sites surveyed by MNFI in the Huron River, live wavy-rayed lampmussels were found at 14 sites (Badra 2010). Zebra mussels were found attached to individuals of this species at nine of the 14 sites. Intensity of infestation was as high as 6.7 zebra mussels per individual in the Huron River, as compared to the two zebra mussels found attached to the wavy-rayed lampmussel at Site 5 in the Manistee River.

Physical and chemical habitat measures are provided in Tables 4, 5, and 6. Site 6 in Dickson Lake, where a single giant floater was found, had a substrate of thick silt and muck. Giant floater are one of the most adapt of all the unionid mussel species at living in still water conditions with high levels of silt and muck. Water clarity was generally high and visibility good at the time of surveys, at least until the substrate was disturbed. Since some live mussels were found to be completely buried within the stream substrate at Site 8 in Triple Lakes Creek, primarily tactile methods of detection were used there.

Conductivity measures taken at the time of surveys were within normal expected values, ranging from 294µS in Boswell Creek to 352µS at Site 6 in the Manistee River. Conductivity of rivers in the United States ranges between 50 and 1500µS. Streams supporting good fisheries typically measure between 150 and 500µS. The geology of a given watershed is normally a strong factor in determining conductivity, but conductivity can be affected by point and non-point discharges into streams as well. Input of chlorides, phosphate, and nitrates can raise conductivity in rivers and lakes. Unusually high conductivity measures can be indicative of impacts such as excessive input of fertilizer or sewage overflows. Alkalinity and hardness measures were also within normal expected values, ranging from 152mg/l CaCO3 in Bear Creek to 184mg/l CaCO3 in Chicken Creek. These measures indicate enough buffering capacity to help protect aquatic life from normal fluctuations in pH.

Site 5, near High Bridge, was previously surveyed in 2011, when it was known as Site 19 (Badra 2012). Only three mussel species were represented by live individuals in 2014 as compared to four in 2011 (Table 7). An additional six live spike at Site 5 had remenants of zebra mussel bysal threads attached to their shells, and an additional two spike at Site 7 had bysal thread remenants attached. The frequency of zebra mussel colonization was less in 2014 (43%) than it was in 2011 (95%)(Table 8). The average number of zebra mussels per unionid mussel was also less in 2014 (1.73) than it was in 2011 (9.91). All zebra mussels found attached to native mussels in 2011 were removed before returning them to the stream bottom. Presumably only a relatively small proportion of these have been recolonized by zebra mussels in the three years after the 2011 survey. Further investigation could help determine if manual removal of zebra mussels from unionid mussels is effective and cost efficient enough to utilize in the conservation of native mussel populations within the Huron Manistee National Forest.

Table 1. Locations of sites surveyed for mussels in Huron Manistee National Forest, Summer 2014.

Site #	Waterbody	Access	Latitude (N)	Longitude (W)	County
1	Bear Creek	Coates Hwy, Spirit of the Wood	44.31284	86.04884	Manistee
2	Chicken Creek	High Bridge Rd.	44.33422	86.02054	Manistee
3	Boswell Creek	Brewer Rd.	44.31766	85.98494	Manistee
4	Dickson Lake	Swihart Rd.	44.30815	86.00094	Manistee
5	Manistee River	Motor boat - High Bridge	44.26752	86.01285	Manistee
6	"	Motor boat - downstream of High Bridge	44.26804	86.02308	Manistee
7	"	Motor boat - downstream of High Bridge	44.26231	86.03190	Manistee
8	Triple Lakes Creek	West 13 Mile Rd.	43.74263	85.93813	Newaygo

Table 2. Numbers of unionid mussels (#), relative abundance (RA), and density (D, indvs./m2) recorded at each survey site, Summer 2014. Presence/absence of non-native bivalves is noted. (T = listed as state threatened)

		1	2	3	4			5			6	7			8		
Species	Common name	#	#	#	#	RA	D	#	RA	D	#	#	RA	D	#	RA	D
Elliptio dilatata	Spike							111	0.97	0.87		47	0.90	0.37	111	0.88	1.71
Fusconaia flava	Wabash pigtoe											1	0.02	0.01	15	0.12	0.23
Lampsilis fasciola (T)	Wavy-rayed lampmussel							1	0.01	0.01							
Lampsilis siliquoidea	Fatmucket							S							S		
Lampsilis ventricosa	Pocketbook							3	0.03	0.02		4	0.08	0.03			
Pyganodon grandis	Giant floater				1	1	0.05										
Total # individuals and density		0	0	0	1		0.05	115		0.90	0	52		0.41	126		1.94
# species live		0	0	0	0			3			0	3			2		
# species live or shell		0	0	0	1			4			0	3			3		
Area searched (m^2)		128	128	128	20*			128			69	128			65		
Corbicula fluminea																	
Dreissena polymorpha								LA			L	LA					

Figure 1. The Manistee River at Site 5 near High Bridge.

Figure 2. Wavy-rayed lamp mussel (*Lampsilis fasciola*) with two zebra mussels attached, at Site 5 in the Manistee River near High Bridge.

Table 3. Zebra mussel (*Dreissena polymorpha*) colonization intensity (zm/u) and frequency (%cu) for sites where live zebra mussels were attached to live unionid mussels. (ucz = number of unionid mussels colonized by zebra mussels; zm/u = mean number of zebra mussels attached to each unionid mussel; %cu = percentage of unionids colonized by zebra mussels)

		5			7		
Species		ucz	zm/u	%cu	ucz	zm/u	%cu
Elliptio dilatata	Spike	47	1.74	42	6	1.17	13
Fusconaia flava	Wabash pigtoe						
Lampsilis fasciola (T)	Wavy-rayed lampmussel	1	2.00	100			
Lampsilis siliquoidea	Fatmucket						
Lampsilis ventricosa	Pocketbook	1	1.00	33	1	1.00	25
Pyganodon grandis	Giant floater						
	Total	49	1.73	43	7	1.14	13

Table 4. Substrate particle size composition based on visual estimation within the area surveyed at each survey site. Particle size classes are based on Hynes (1970): boulder (>256mm), cobble (256-64mm), pebble (64-16mm), gravel (16-2mm), sand (2-0.0625mm), and silt/clay (<0.0625mm).

Site #	Waterbody	Boulder	Cobble	Pebble	Gravel	Sand	Silt	Other
1	Bear Creek		10	30	20	30	10	
2	Chicken Creek			10	20	40	30	
3	Boswell Creek			10	35	45		
4	Dickson Lake							100 muck/organic
5	Manistee River				30	50	20	
6	"					85	15	
7	"					70	30	
8	Triple Lakes Creek					60	40	

Table 5. Physical habitat characteristics at mussel survey sites.

Site #	Waterbody	Current speed*	Aquatic vegetation?	Woody debris?	%Pool	%Riffle	%Run
1	Bear Creek	medium	N	Y		5	95
2	Chicken Creek	slow	N	Y	10	10	80
3	Boswell Creek	med./slow	N	Y	20	40	40
4	Dickson Lake	-	Y	Y	100		
5	Manistee River	medium	Y	Y			100
6	"	medium	Y	Y			100
7	"	slow	Y	Y			100
8	Triple Lakes Creek	slow	Y	Y			100

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

Table 6. Water chemistry measurements taken at mussel survey sites.

Site #	Waterbody	pH	Conductivity (µS)	Alkalinity (mg/l CaCO3)	Hardness (mg/l)	Water temp. (C)
1	Bear Creek	8.53	350.0	152	260	17.0
2	Chicken Creek	7.90	351.0	184	260	15.8
3	Boswell Creek	8.25	294.0	164	260	14.5
4	Dickson Lake	7.75	318.0	-	280	22.0
5	Manistee River	8.31	351.0	-	280	20.7
6	"	8.31	352.0	165	260	20.9
7	"	8.32	350.0	176	260	21.3
8	Triple Lakes Creek	8.32	350.0	164	260	21.3

Table 7. A comparison of 2011 and 2014 survey results of Site 5 in the Manistee River near High Bridge. (Site 5 in 2014 was the same location as Site 19 in 2011.)

		2011			2014		
Species	Common name	#	RA	D	#	RA	D
Alasmidonta marginata (SC)	Elktoe						
Alasmidonta viridis (T)	Slippershell						
Anodontoides ferussacianus	Cylindrical papershell						
Elliptio dilatata	Spike	146	0.97	1.13	111	0.97	0.87
Fusconaia flava	Wabash pigtoe						
Lampsilis fasciola (T)	Wavy-rayed lampmussel				1	0.01	0.01
Lampsilis siliquoidea	Fatmucket	1	0.01	0.01	S		
Lampsilis ventricosa	Pocketbook	2	0.01	0.02	3	0.03	0.02
Lasmigona complanata	White heelsplitter						
Lasmigona compressa	Creek heelsplitter						
Ligumia recta (E)	Black sandshell						
Pyganodon grandis	Giant floater						
Strophitus undulatus	Strange floater	2	0.01	0.02			
Utterbackia imbecillis (SC)	Paper pondshell						
Total # individuals and density		151		1.17	115		0.90
# species live		4			3		
# species live or shell		4			4		
Area searched (m^2)		129			128		
Corbicula fluminea	Asian clam						
Dreissena polymorpha	Zebra mussel	LA			LA		

Table 8. A comparison of 2011 and 2014 zebra mussel (*Dreissena polymorpha*) colonization intensity (zm/u) and frequency (%cu) at Site 5. (ucz = number of unionid mussels colonized by zebra mussels; zm/u = mean number of zebra mussels attached to each unionid mussel; %cu = percentage of unionids colonized by zebra mussels)

		2011			2014		
Species		ucz	zm/u	%cu	ucz	zm/u	%cu
Elliptio dilatata	Spike	140	9.96	96	47	1.74	42
Lampsilis fasciola (T)	Wavy-rayed lampmussel				1	2.00	100
Lampsilis siliquoidea	Fatmucket	1	19.00	100			
Lampsilis ventricosa	Pocketbook	2	4.00	100	1	1.00	33
Strophitus undulatus	Strange floater	1	6.00	50			
	Total	144	9.91	95	49	1.73	43

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