

**Freshwater Mussel Survey of the Potomac Mainstem
2012 Summary Report for U.S. E.P.A.**

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Figure 1: Lampmussel extending its foot to burrow into Potomac substrate. (Photo by Adam Griggs, ICPRB)

Introduction

This is an annual summary report for a multi-year, two-phase freshwater mussel survey of the Potomac River mainstem initiated by the Interstate Commission on the Potomac River Basin in 2009. The primary long-term objectives of this survey are; 1) augment biological information collected at several study reaches established in the Potomac River's 2) improve our understanding of the status of Potomac River mussel species, their temporal variation and trends, relationship to the river's general health, and 3) help evaluate how mussel communities in typical sections of the river compare with sections potentially impacted by pollution or altered flows, especially where low-flows are exacerbated by consumptive water uses. Phase 1 qualitative habitat mapping and identification of mussel beds were completed in 2009. During Phase 2 we conducted quantitative in-situ surveys of identified mussel habitat. Survey parameters for Phase 2 include species richness, relative abundance, recruitment, and presence of any state or federally rare, threatened or endangered mussels.

Tasks Performed

Two Potomac River mainstem reaches, each approximately four kilometers in length, were evaluated in 2012. Maps of these reaches showing mussel habitat types and sites surveyed are provided in Appendix A, Figures 1-4. The first reach is within a large loop of the river in the Paw Paw Bends region, roughly adjacent to the bounds of C&O Canal locks 59 and 59 (centered by Canal Mile marker 145), approximately 8 kilometers upstream of Fifteen Mile Creek and adjacent to Alleghany County, MD and Morgan County, WV. The second reach bounds Mason Island near Whites Ferry, Montgomery County, MD and Loudon County, VA. These two reaches and a third reach surveyed in 2010 were randomly selected reaches used during the large river component of the USEPA's 2008-2009 National Rivers and Streams Assessment.

Prior to field work, site selection within each reach was performed through random selection of computer generated and numbered 25m² grids imposed over digital maps of each reach (see

Appendix A, Figure 5 for an example). Two scientific collecting permits, a General and an Endangered Species Permit, were obtained from the Maryland Department of Natural Resources to cover our field research activities. During field work, canoes were used to navigate the river reaches and access individual sites. A handheld global positioning system, or GPS (Garmin model Etrex 20) was employed to locate the centerpoint of each site (to within approximately 1 m). At those centerpoints timed visual and excavation mussel searches were conducted at ¼ m² quadrats. Each quadrat was first visually examined for mussels and then excavated to a depth of approximately 15 cm. Sand, gravel, gobble and any mussels from the excavations were placed in a ¼ m² box (with a 1 cm² (.375 in²) wire-mesh bottom), then removed from the water for examination in the canoes. Mussels encountered were identified, measured (length, width and height), recorded (See Appendix B: Field Form for Freshwater Mussel Evaluations), and then placed back into the quadrat site in their approximate original location and orientation. Digital images were taken for the purpose of vouchers or to document any questions or anomalies.

Field work was conducted between mid-July and early August, when the Potomac River is typically near its lowest flow levels. Storms and high flows do occur during this period, however, and the studies field protocols for gauging appropriate flow levels are flows near median (<1.2X) or lower which provide for excellent water clarity, shallow exposure of mussel beds, ease of prosecution, and safety.

Results:

Reach 1: Paw Paw Reach, upstream of 15 Mile Creek:

Figure 2, below, shows July 2012 flows recorded at the USGS gage near Paw Paw, West Virginia, which is the most proximal gage. Sampling at this reach occurred on 7/11-12/2012 and flow levels and clarity were excellent for the field work, hovered around 550 cfs, about 60% of the median flow for this time period (910 cfs).

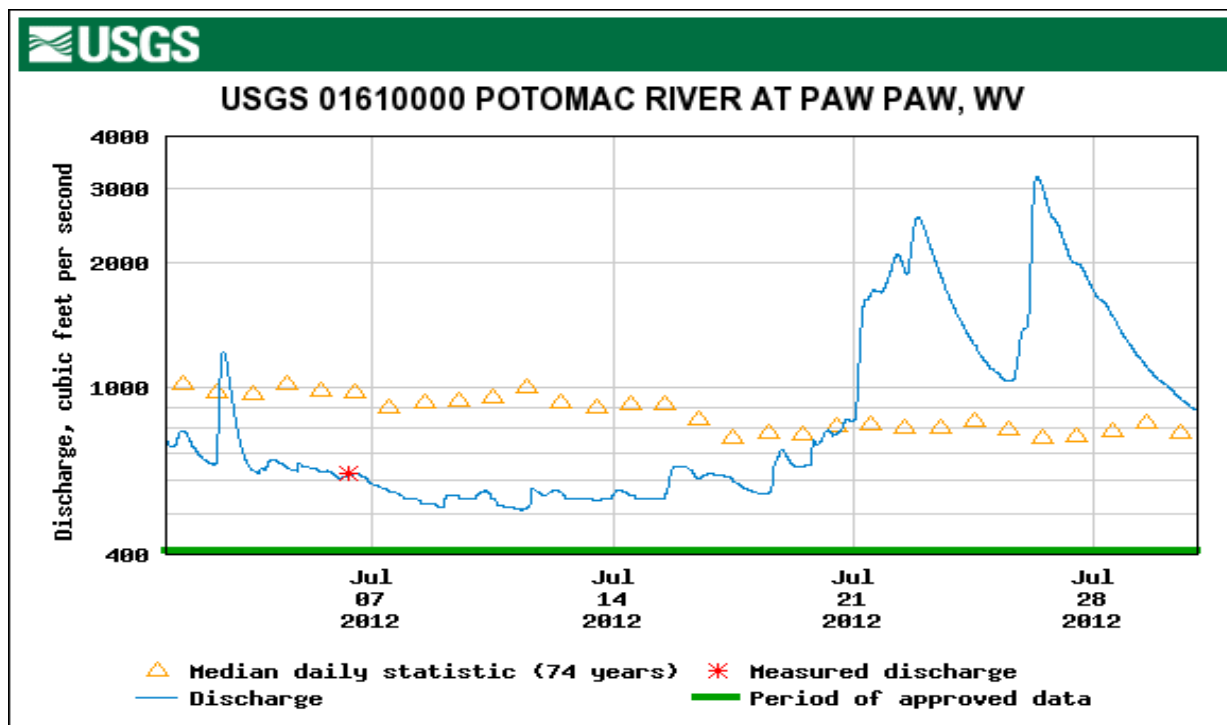


Figure 1: Flows recorded at USGS's Paw Paw Gage, Potomac River, July 2012. This gage is located approximately 10 kilometers (6 miles) upstream from the study reach

No mussels were found in any of the 19 randomly selected .25 m² sites in the Paw Paw reach, nor were any mussels observed in the areas immediately adjacent to the sites, i.e., within a 1 meter radius. Seven individuals of one mussel species, the Eastern Elliptio (*Eliptio complanata*), were observed in the vicinity (within a 3 meter radius) of 3 of the 19 sites. Furthermore, very few mussels were observed while navigating the approximately 5 river-km (3 mi) to the reach, within the 4 river-km (2.5 mi) reach, or in the 4 river-km downstream from the reach to the river takeout at Little Orleans, MD.

Reach 2: Mason Island upstream from Whites Ferry

Figure 2, below, shows August 2012 flows recorded at the USGS gage at Point of Rocks, Maryland, which is the most proximal gage to this reach. Sampling at this reach occurred on 8/9-10/2012 and flow levels and clarity were good for the field work, hovered around 2500 cfs, about 90% of the median flow for this time period (2800 cfs).

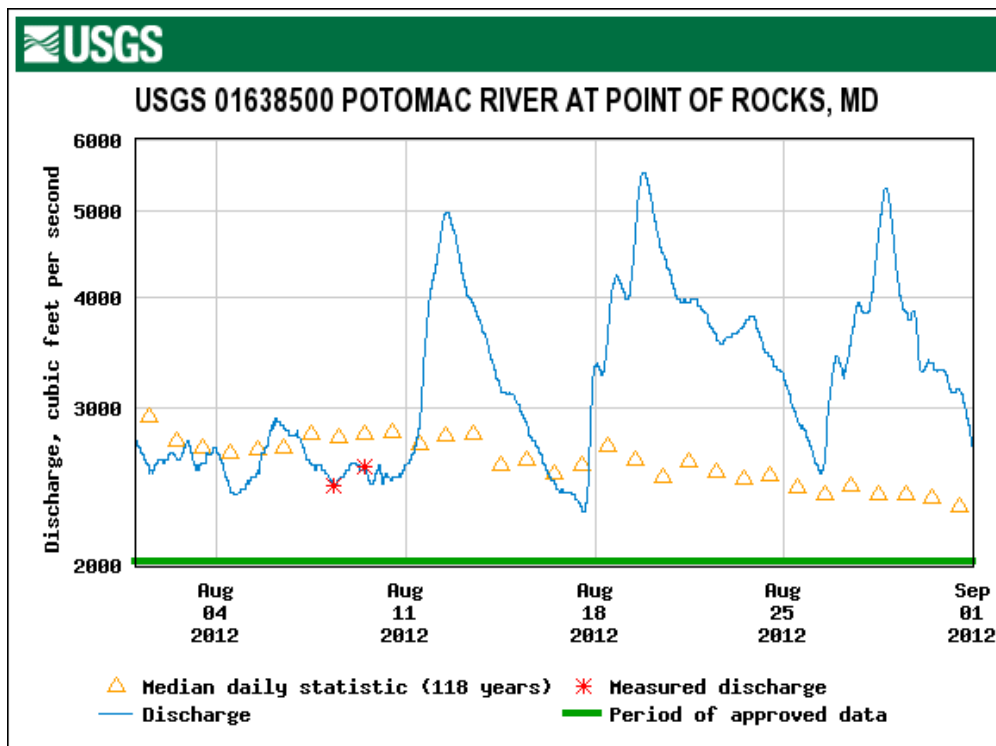


Figure 2: Flows recorded at the USGS's Point of Rocks Gage, Potomac River, August 2012. This gage is approximately 8 kilometers (5 miles) upstream from the reach.

At this reach forty-one sites were visually examined and excavated. Two mussel species represented by three individual Eastern Elliptios and four Lampmussels (*Lampsilis* sp.¹) were found within the quadrats. In the areas immediately adjacent to the quadrats, i.e., within a 1 meter radius, we observed one Lampmussel. We encountered fifteen Eastern Elliptios in the vicinity (within a 3 meter radius) of seven of the forty-one quadrats.

¹ There are outstanding taxonomic issues with *Lampsilis* species in the Potomac River. These may be *L. cariosa*, *L. cardium*, hybrids between the two, or a native subspecies *L. cardium cohongoroton*.

Discussion:

During the first phase of this study (2009) when we surveyed and mapped major mussel habitat types within the river reaches, we observed very few mussels in the Paw Paw bends area and found low numbers and patchy distribution of mussels in the vicinity of Mason Island. This survey confirmed those earlier observations. No mussels were found in the quadrats at Paw Paw and only two species and very few individuals were found at Mason Island sites.

These two reaches were substantially different in mussel taxa richness and abundance from the Potomac River’s Dam #5 reach evaluated through this study in 2010. That reach is located approximately two kilometers (1 mile) downstream from the Potomac River’s Dam #5, near Clear Spring, Maryland, and is approximately midway between Paw Paw and Mason Island reaches along the Potomac River’s mainstem. At the Dam #5 reach we found six mussel’s species represented by sixty-one individual mussels, including two Maryland endangered species; the Brook Floater (*Alasmidonta varicosa*) and the Green Floater (*Lasmigona subviridis*).

Species	Common Name	Site: Paw Paw, upstream of 15 Mile Creek	Site: Dam #5 Downstream, near Williamsport, Md	Site: Mason Island, upstream from Whites Ferry
<i>Alasmidonta varicosa</i>	Brook Floater		2	
<i>Elliptio complanata</i>	Eastern Elliptio		17	3
<i>Elliptio producta</i>	Atlantic Spike		4	
<i>Strophitus undulates</i> ^{s2}	Creepers		1	
<i>Lasmigona subviridis</i>	Green Floater		4	
<i>Lampsilis sp.</i> ³	Lampmussel		33	4
	<u>Total species</u>	0	<u>6 species</u>	<u>2 species</u>
	<u>Individuals</u>		<u>61 individuals</u>	<u>7 individuals</u>
Detection ¹ by time	# mussels/hour	0.00	5.4	2.4
Density ¹ by area	# mussels/m ²	0.00	1.6	0.7
Phase 1 estimate of % habitat with mussels		1	25	3
Phase 1 estimate of % good ² mussel habitat		74	42	34

¹Combining visual and excavation searches.

² Combining Type 1 and Type 2 habitats.

The paucity of mussels in the Paw Paw reach is puzzling because the reach has an abundance of good mussel habitat (74%). That section of the river suffered from decades of very poor water quality during the mid-20th century which likely extirpated mussels. Currently, however, that reach is noted for its good fishing, extensive beds of submerged aquatic vegetation and quality substrate. Downstream Dam #5 is restricting upstream movement of mussels, but several tributaries upstream of Dam #5 and along the Paw Paw section; Patterson Creek, Sideling Hill Creek, Cacapon and Little Cacapon River, have mussel populations (Villella et al 2004) (Ashton, 2010) which should serve as sources for mussel recolonization. Current numeric criteria for ammonia may not be protective of mussels (Augspurger et al, 2003) and upstream wastewater discharges, especially if they episodically spike high in ammonia, may be inhibiting recolonization in this portion of the mainstem.

² Based upon an image identification by Bill Lellis, USGS. See appendix xx, at bottom right.

³ There are outstanding taxonomic issues with *Lampsilis* species, these may be *L. cariosa*, *L. cardium*, hybrids between the two, or a native subspecies *L. cardium cohongoroton*.

The reach downstream of Dam #5 is doing the best of the three reaches. The presence of the two rare Maryland endangered species; the Brook and Green Floaters, is especially notable and good news. However, the mussel abundance at that reach, 5.4 mussels/hour and 1.6 mussels/m², is still well below the estimated abundance reported for the Delaware River, at 174 mussels/hour and 10.6 mussels/m² (Lellis, 2011).

Mussel abundance and diversity decreased at the most downstream reach near Mason Island. Much of that reach, 63%, is too deep (>1.2 m) for our observations which are limited to snorkeling. However, the sites evaluated within searchable areas of good mussel habitat did not have many mussels, even though Phase 2 surveys prioritized these habitats based upon observations during Phase 1. In addition, mussel distribution was patchy, with a slight clustering in the vicinity of the outlet to a small, un-named Virginia tributary.

Freshwater mussels are an important component of aquatic communities. These studies help us understand their status in the non-tidal mainstem of the Potomac River. Currently their diversity and abundance is low and they are occupying small amounts of potential habitat. Water quality in the non-tidal river is improving (Prochaska et al, 2009). Further monitoring will be necessary to determine if mussels are responding over time to environmental change, such as with increases in diversity, abundance and distribution. Mussel surveys are also being performed as part of ICPRB's ongoing Potomac mainstem biomonitoring project.

References:

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Augspurger et al (2003). Water quality guidance for protection of freshwater mussels. *Environmental Toxicology and Chemistry*, Vol. 22, No. 11 , pp. 2569–2575.

Lellis, W. (2011). *Freshwater Mussels and Eels: A Missing Ecological Link in the Susquehanna?* U.S. Geological Survey. Northern Appalachian Research Laboratory. Wellsboro, PA. A presentation provided at a January, 2011, meeting in Annapolis Maryland of freshwater mussel biologist.

Prochaska, Tony; Klauda, Ron; Roberson, Luke; Kashiwagi, Michael; Becker, Andrew Luke. (2009). *Long-term Monitoring Program Shows Improving Nitrogen Trends in Maryland's Rivers and Streams*. Annapolis, MD: Maryland Department of Natural Resources, Resource Assessment Service.

Villella, R. F., Smith, D. R., & Lemari. (2004). Estimating Survival and Recruitment in a Freshwater Mussel Population Using Mark-recapture Techniques. *American Midland Naturalist*, Vol. 151 Issue 1 , 114.

Appendix A: Maps of River Reaches and Sampling Sites for Freshwater Mussel Study, 2012.

Figure 1: Map of Paw Paw bend reach, Potomac River, upstream of Fifteen Mile Creek, showing the 4 mussel habitats characterized during Phase 1.

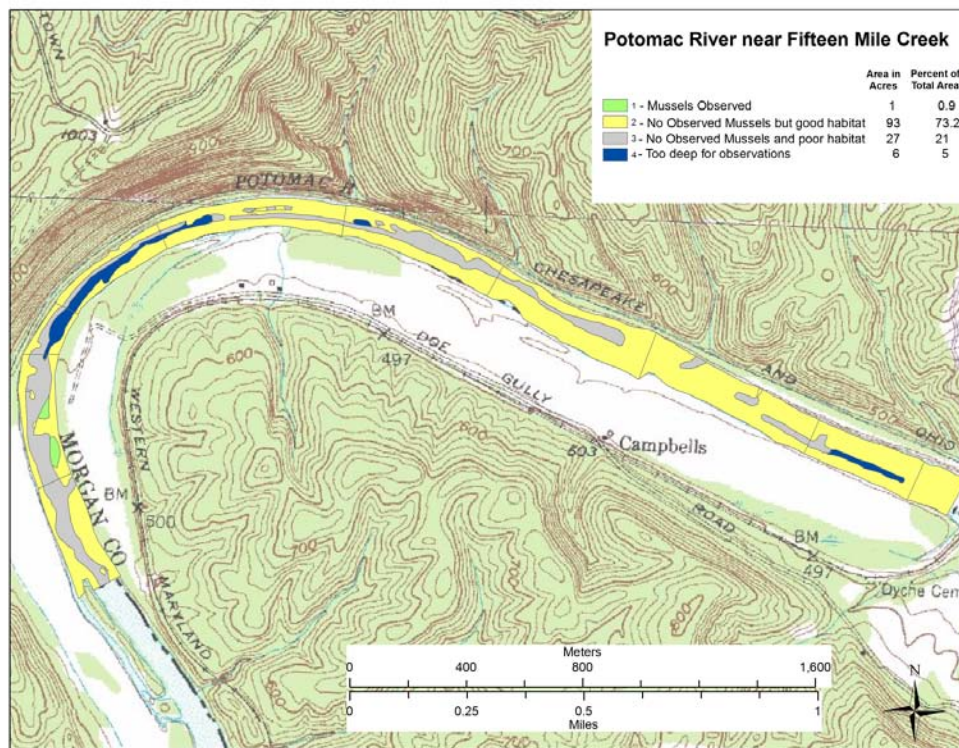


Figure 2: Image of Phase 2 sites surveyed within the Paw Paw Reach. This segment is in Figure 1, left side, which has the green, or mussels observed, habitat type.

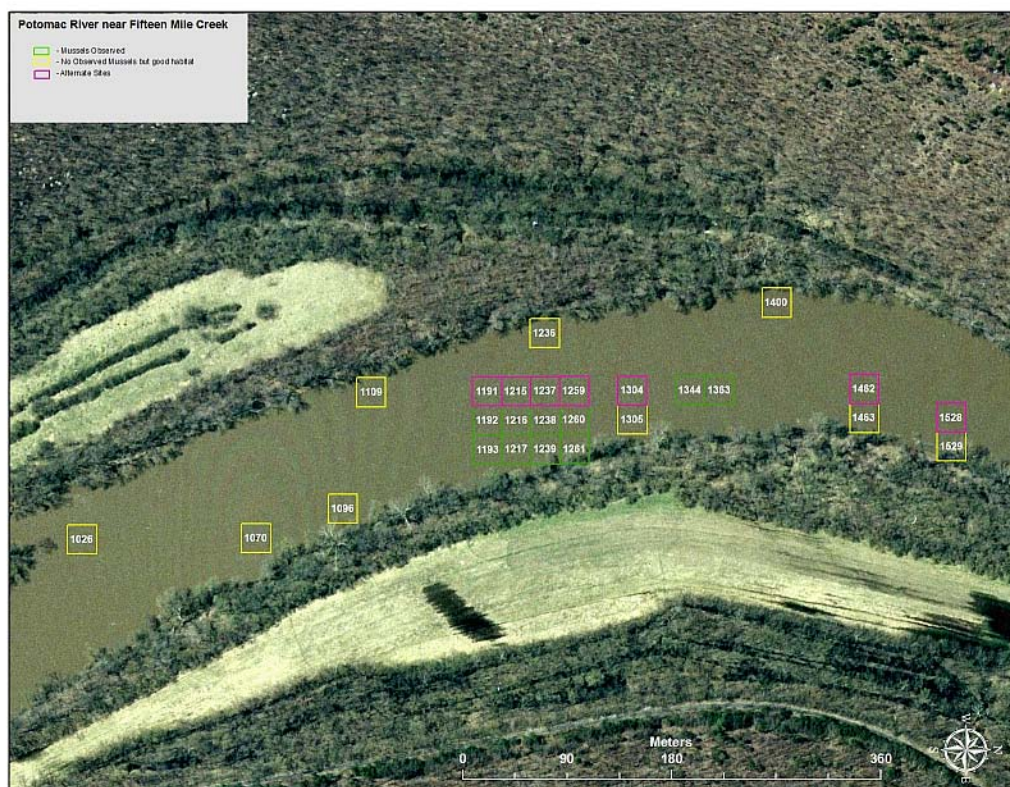


Figure 3. Map of Mason Island Reach, Potomac River, Montgomery County, near Whites Ferry showing habitat types characterized in Phase 1.

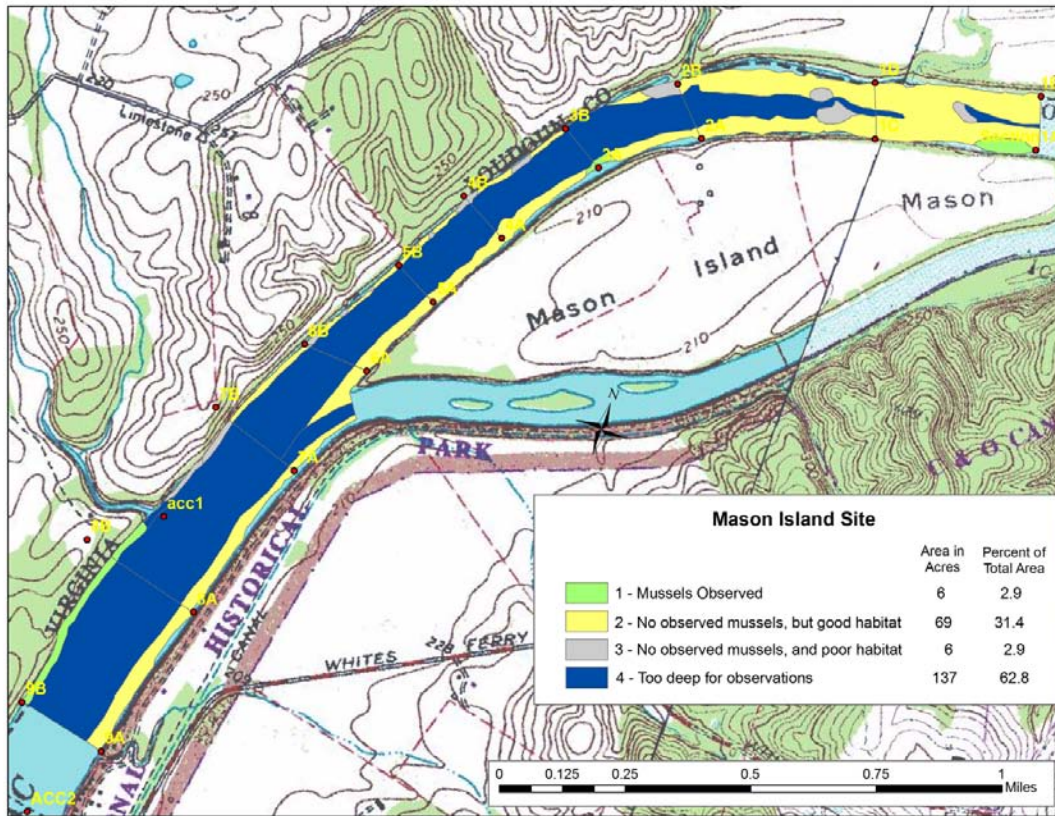
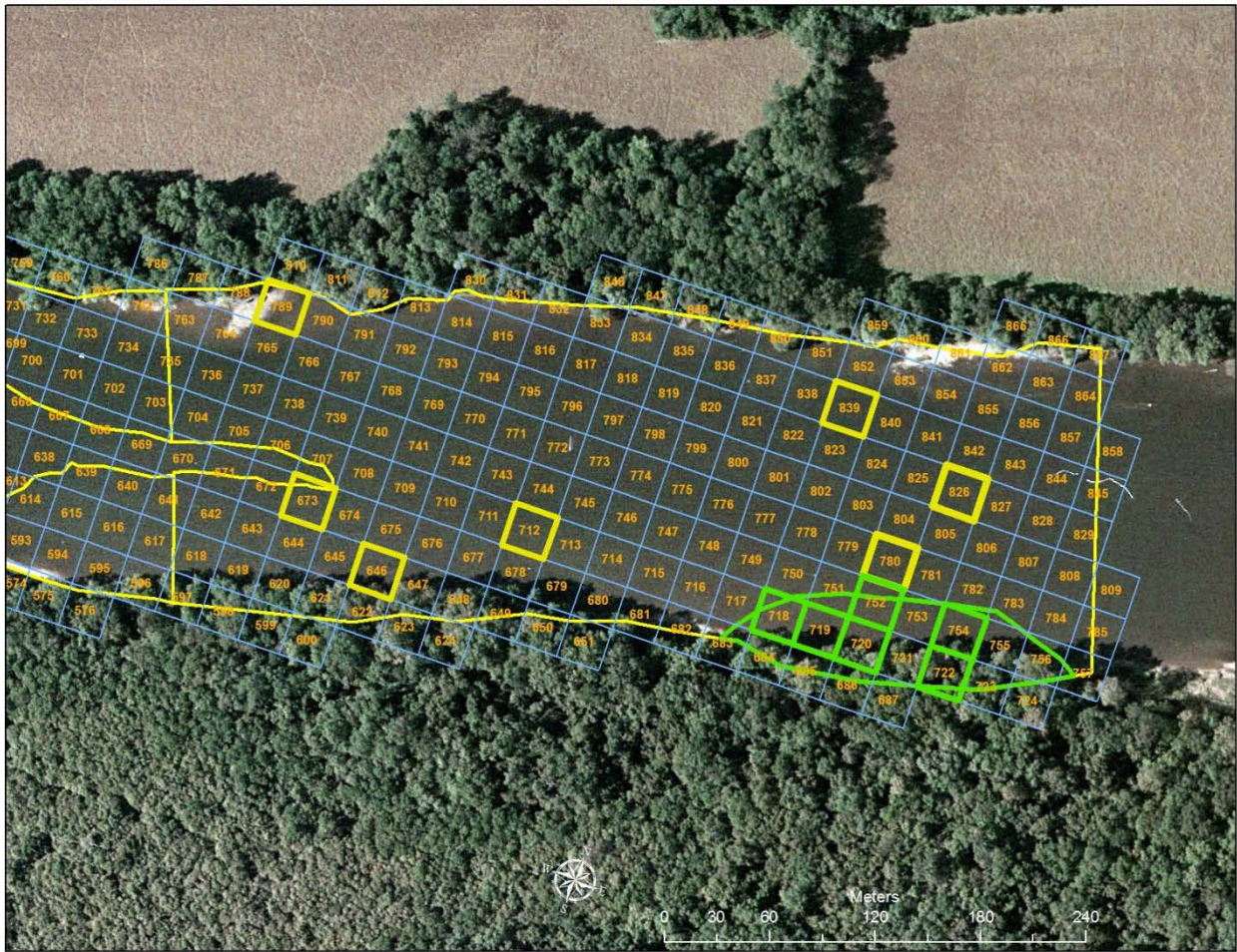


Figure 4: Image of same Mason Island Reach, Potomac River, Montgomery County, near Whites Ferry showing sites surveyed (red boxes) during Phase 2, which prioritized surveys at Type 1 and 2 habitats



Figure 5: An example of site selection.

This image is of the most upstream section of the Mason Island Reach (see the upper right sections in above Figures 3 and 4). It illustrates the computer overlay of 25 m² numbered grids within the river channel and has the randomly selected sites which were surveying in that section during Phase 2. The bold green sites are located in Type 1 habitat (= mussels observed during Phase 1), the bold yellow sites are in Type 2 habitat (= no mussels observed, but good habitat). By design, sampling is prioritized within known mussel beds (Type 1 habitats) during Phase 2.



Appendix B. Field Form for Freshwater Mussel Evaluations

River Reach _____ Section _____ Date: ____/____/2012
 StartTime ____:____ Air Temp _____ Water Temp _____ D.O. ____ Cond. _____ pH ____
 Water Clarity (least is 25 cm, then in 0.1 meter increments) _____ m
 Weather _____ Surveyor(s): _____

Site #	Time quad Vis + Excavated	Water Depth. In .1 m	Substrate (Est %) ----- Habitat Type (Circle)	Detects Species, Sizes (in mm) and number detected Label shells as Fresh, Dead, Subfossil	SAV Type % cov	Notes
	Vis = ____:____ Exc = ____:____		Bed= Bol = Cob= Gra = San = Silt = Oth = ----- Po Gl Ri Ra Ca Fa	Vis = Exc = Adjacent = In vicinity =		
	Vis = ____:____ Exc = ____:____		Bed= Bol = Cob= Gra = San = Silt = Oth = ----- Po Gl Ri Ra Ca Fa	Vis = Exc = Adjacent = In vicinity =		
	Vis = ____:____ Exc = ____:____		Bed= Bol = Cob= Gra = San = Silt = Oth = ----- Po Gl Ri Ra Ca Fa	Vis = Exc = Adjacent = In vicinity =		
	Vis = ____:____ Exc = ____:____		Bed= Bol = Cob= Gra = San = Silt = Oth = ----- Po Gl Ri Ra Ca Fa	Vis = Exc = Adjacent = In vicinity =		