

Freshwater Mussel Inventory of the Wild & Scenic Westfield River

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SUMMARY

Biodrawversity LLC conducted a freshwater mussel survey in the Westfield River watershed of western Massachusetts, focusing on the Wild & Scenic portion of the upper watershed. A total of 38 sites were surveyed over a period of six days in June and July of 2009; 13 additional sites surveyed between 2007-2009 were included in the analyses. Biologists conducted qualitative surveys for 30-120 minutes per site and collected data on mussel and crayfish diversity, mussel population parameters (abundance, size range, and shell condition), and habitat. Six mussel species were found, including eastern elliptio (*Elliptio complanata*), eastern pearlshell (*Margaritifera margaritifera*), creeper (*Strophitus undulatus*), triangle floater (*Alasmidonta undulata*), eastern floater (*Pyganodon cataracta*), and eastern lampmussel (*Lampsilis radiata*). A seventh mussel species—alewife floater (*Anodonta implicata*) was not found but is likely to occur in the lower mainstem Westfield River. The creeper and triangle floater are Species of Special Concern in Massachusetts. Three crayfish species were found, including *Orconectes rusticus*, *Orconectes virilis*, and *Orconectes propinquus*.

Mussels were absent at nearly all stream survey sites in the Wild & Scenic portion of the watershed; the Middle Branch Westfield River below the Littleville Dam was the only river in the Wild & Scenic portion that contained mussels (five species found) although these may be relict non-reproducing populations. Viable mussel populations were detected in the Dead Branch (one species) and most ponds (two species). The mainstem Westfield River and its larger tributaries in the lower watershed (Great Brook and Little River) supported large and viable mussel populations, especially of eastern elliptio and eastern pearlshell. Possible explanations for the lack of mussels throughout most of the river miles in the upper watershed include a dynamic and harsh river environment, and the cumulative effects of large dams and natural barriers that impede the movement of migratory fish into the upper watershed. We recommend the following to protect or restore the mussel fauna of the upper watershed:

1. Protect the only known viable river population in low-gradient sections of the Dead Branch and perhaps other low-gradient and wetland-influenced reaches that were not surveyed.
2. Protect the health of ponds that contain source populations of eastern elliptio and eastern floater and encourage linkages between ponds and suitable stream habitat.
3. Monitor the relict mussel populations in the Middle Branch below the Littleville Dam.
4. Develop and implement strategies to restore connectivity between the lower and upper watershed so that migratory species, which are also potential hosts for freshwater mussels, can expand their range and help mussels colonize suitable habitats.



East Branch Westfield River.

STUDY AREA

The survey focused on the Wild & Scenic designated sections of the upper Westfield River watershed, plus additional surveys in non-designated sections including the Dead Branch and the Westfield River from the confluence of the East and West Branches downstream through Russell and Westfield. Surveys generally focused on the larger streams that could potentially support mussels and small high-gradient streams were omitted from the study. Four ponds were surveyed; two under this contract (Buckley Dunton Lake and Yokum Pond) and two (Center Pond and Windsor Pond) as part of a Phase I zebra mussel study of Berkshire County lakes completed by Biodrawversity in September 2009 (Biodrawversity 2009a). Biodrawversity also conducted mussel surveys in the Little River (Westfield) and Great Brook (Southwick and Westfield) for the Massachusetts Natural Heritage and Endangered Species Program (Biodrawversity 2009b). Five additional survey sites in the Westfield River (Agawam to Russell) conducted by Biodrawversity from 2007-2009 were also included in the analyses.

A total of 51 survey sites are included in the analyses (Table 1). These included 38 sites surveyed for the Wild & Scenic study and 13 additional sites. For distribution analyses and mapping purposes, the watershed was divided according to the subbasins (12-digit) from the *NRCS*

HUC Basins GIS datalayer downloaded from the Massachusetts Office of GIS. At least two sites were surveyed in each of the HUC-12 subbasins in the watershed except for no survey sites in the Cobble Mountain Reservoir subbasin (Table 2, Figure 1).

METHODS

Surveys completed for the Wild & Scenic contract were conducted on six days between June 25 and July 10, 2010. Two or three biologists conducted surveys on each day, working as a two-person team or independently.



All surveys were conducted by snorkeling.

Table 1. Survey site information

River/Pond	Branch	Town	Date	HUC_12*	Site	Latitude	Longitude
Westfield River							
Westfield River	West	Huntington	7/7/09	7	7-1	42.241312	-72.907111
Westfield River	West	Becket	6/29/09	6	6-1	42.333386	-73.080547
Westfield River	West	Chester	6/29/09	6	6-2	42.312791	-72.993821
Westfield River	East	Cummington	6/30/09	2	2-1	42.466058	-72.904749
Westfield River	East	Windsor	6/30/09	2	2-2	42.495538	-72.983624
Westfield River	East	Cummington	6/30/09	2	2-3	42.481952	-72.929198
Westfield River	East	Chesterfield	6/30/09	3	3-1	42.389888	-72.880211
Westfield River	East	Huntington	7/6/09	3	3-2	42.276809	-72.864358
Westfield River	East	Huntington	7/6/09	3	3-3	42.236038	-72.872096
Westfield River	East	Huntington	7/7/09	3	3-4	42.272198	-72.865932
Westfield River	East	Huntington	7/7/09	3	3-5	42.259141	-72.865839
Westfield River	East	Huntington	7/6/09	3	3-6	42.340164	-72.846526
Westfield River	East	Huntington	7/6/09	3	3-7	42.310604	-72.860968
Westfield River	Dead	Chesterfield	6/30/09	5	5-1	42.374941	-72.819089
Westfield River	Dead	Chesterfield	7/6/09	5	5-2	42.355871	-72.820941
Westfield River	Dead	Chesterfield	7/6/09	5	5-3	42.340535	-72.846414
Westfield River	Middle	Huntington	7/7/09	4	4-1	42.259477	-72.866745
Westfield River	Middle	Huntington	7/10/09	4	4-2	42.259622	-72.877325
Westfield River	Middle	Huntington	7/10/09	4	4-3	42.258576	-72.871064
Westfield River	Middle	Huntington	7/10/09	4	4-4	42.263343	-72.880074
Westfield River	Middle	Middlefield	7/6/09	4	4-5	42.385814	-72.977736
Westfield River	Middle	Chester	7/6/09	4	4-6	42.322601	-72.926021
Westfield River	Middle	Huntington	7/7/09	4	4-7	42.258888	-72.873801
Westfield River	Middle	Chester	7/7/09	4	4-8	42.293576	-72.899521
Westfield River	Main	Montgomery	7/6/09	9	9-1	42.222237	-72.866169
Westfield River	Main	Russell	7/6/09	9	9-2	42.197368	-72.847941
Westfield River	Main	Westfield	7/7/09	9	9-3	42.145478	-72.809332
Westfield River	Main	Russell	7/10/07	9	9-4	42.189901	-72.850191
Westfield River	Main	Russell	7/10/07	9	9-5	42.182001	-72.845981
Westfield River	Main	Westfield	6/12/07	9	9-6	42.129003	-72.746075
Westfield River	Main	Westfield	8/19/09	10	10-1	42.116178	-72.732332
Westfield River	Main	West Springfield	9/4/09	10	10-2	42.099352	-72.643388
Westfield River	Main	Agawam	6/13/08	10	10-3	42.085315	-72.599838
Tributaries/Ponds							
Buckley Dunton Lake		Becket	6/29/09	6	6-3	42.312167	-73.131987
Center Pond		Becket	9/17/09	6	6-4	42.298421	-73.069671
Depot Brook		Becket	6/25/09	6	6-5	42.334113	-73.084977
Great Brook		Southwick	6/5/09	12	12-1	42.065562	-72.735998
Great Brook		Southwick	6/5/09	12	12-2	42.049139	-72.775115
Great Brook		Westfield	6/5/09	12	12-3	42.086119	-72.727487
Little River		Huntington	7/6/09	3	3-8	42.311765	-72.860704
Little River		Worthington	7/6/09	3	3-9	42.362901	-72.909206
Little River		Westfield	7/7/09	11	11-1	42.130401	-72.822575
Little River		Westfield	6/5/09	11	11-2	42.113044	-72.779344
Little River		Westfield	6/5/09	11	11-3	42.103228	-72.743838
Shaker Mill Brook		Becket	6/25/09	6	6-6	42.333103	-73.084011
Stones Brook		Goshen	6/30/09	1	1-1	42.455991	-72.833668
Swift River		Goshen	6/30/09	1	1-2	42.455374	-72.843056
Walker Brook		Becket	6/29/09	7	7-2	42.268031	-73.031541
Windsor Pond		Windsor	10/2/09	2	2-4	42.537051	-72.981011
Yokum Brook		Becket	6/25/09	6	6-7	42.328916	-73.083481
Yokum Pond		Becket	6/29/09	6	6-8	42.303644	-73.121671

HUC_12 = Subwatershed (12-digit) hydrologic units from the NRCS HUC Basins GIS datalayer downloaded from MassGIS. The names of these hydrologic units are provided in Table 2, and for simplicity, this table only shows identifiers (1-12) for each subbasin as shown on Table 2 and Figure 1.

Three to 12 sites were surveyed per day; the number of sites depended on the number of biologists working and the survey duration at each site. Survey duration ranged from 30-120 minutes per site although most surveys were relatively short in duration (30-45 minutes) because of unsuitable habitat and absence of mussels. Longer surveys were conducted in areas where mussels were found or where habitat appeared to be suitable. Snorkeling was the only survey method used.

Surveys were qualitative, designed to detect species (if present) and to collect basic habitat data. Surveyors recorded the following information for mussels at each site: species found, number of each species, shell length, and shell condition. Shell condition refers to the degree of shell erosion; it was subjectively given a numeric score between 0 and 1 (0.0, 0.25, 0.5, 0.75, or 1.0) with 0.0 indicating no shell erosion and 1.0 indicating very heavy shell erosion. Condition values were then averaged for a

Table 2. Names of the HUC-12 subbasins from the *NRCS HUC Basins* datalayer available from the MassGIS (from MassGIS datalayer) and number of mussel survey sites for each subbasin. See Figure 1 for locations of subbasins and survey site locations.

Code	HUC-12 Subbasin Name	Survey Sites
1	Swift River	2
2	Westfield River: Headwaters to Swift River	4
3	Westfield River: Swift River to West Branch	9
4	Middle Branch Westfield River	8
5	Dead Branch Westfield River	3
6	West Branch Westfield River: Headwaters to Walker Brook	8
7	West Branch Westfield River: Walker Brook to Confluence with East Branch	2
8	Cobble Mountain Reservoir	0
9	Westfield River: West Branch to Little River	6
10	Westfield River: Little River to Mouth	3
11	Little River	3
12	Great Brook	3
	Total	51

sample to produce a shell condition index for the population. Surveyors also described and photographed habitat and recorded GPS coordinates of survey sites. Adult crayfish were collected at many of the survey sites, preserved in alcohol, and identified using keys of Smith (1995). Surveys intended to collect snails but snails were found very infrequently and usually only two common species (*Amnicola limosa* and *Ferrissia rivularis*) were found, and therefore we stopped surveying for these animals.

RESULTS AND DISCUSSION

A total of six mussel species were found during the survey, including eastern elliptio, eastern pearlshell, creeper, triangle floater, eastern floater, and eastern lampmussel (Table 3, 4). Distribution maps for each of these six species are provided in Figure 2. Of the 51 sites included in the analyses, mussels were not detected at 30 sites (59

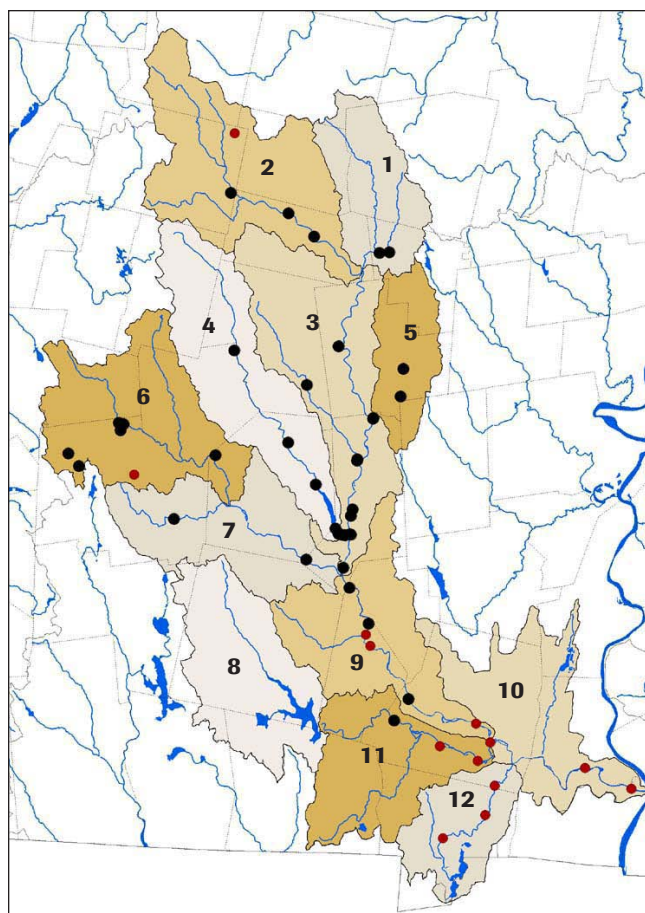


Figure 1. Locations of HUC-12 subbasins (labelled with code from Table 2) and mussel survey sites within each. Black dots indicate surveys completed for the Wild & Scenic contract and red dots indicate other surveys completed by Biodrawversity from 2007-2009.

percent) and most of these were in the Wild & Scenic portion of the watershed (Figure 3). Of the survey sites in streams of the Wild & Scenic designated portions of the watershed, mussels were only detected in the Middle

Table 3. Mussel survey results for each of the HUC-12 subbasins.

Code	HUC-12 Subbasin Name	Richness	Mussel Species	Waterbodies With Mussels
1	Swift River	0	-	-
2	Westfield River: Headwaters to Swift River	1	Eastern floater	Windsor Pond
3	Westfield River: Swift River to West Branch	1	Eastern elliptio (1 live animal)	Westfield River
4	Middle Branch Westfield River	5	Eastern elliptio, eastern floater, eastern lampmussel, creeper, eastern pearlshell	Middle Branch Westfield River, Littleville Dam to Mouth
5	Dead Branch Westfield River	2	Eastern elliptio, eastern floater	Dead Branch Westfield River
6	West Branch Westfield River: Headwaters to Walker Brook	2	Eastern elliptio, eastern floater	Center Pond and Yokum Pond
7	West Branch Westfield River: Walker Brook to Confluence with East Branch	0	-	-
8	Cobble Mountain Reservoir	-	-	-
9	Westfield River: West Branch to Little River	6	Eastern elliptio, eastern floater, eastern lampmussel, creeper, eastern pearlshell, triangle floater	Westfield River
10	Westfield River: Little River to Mouth	6	Eastern elliptio, eastern floater, alewife floater, creeper, eastern pearlshell, triangle floater	Westfield River
11	Little River	3	Eastern elliptio, eastern pearlshell, creeper	Little River
12	Great Brook	3	Triangle floater, eastern pearlshell, eastern elliptio	Great Brook

Table 4. Mussel species found at each survey site.

River/Pond	Branch	Site	Mussel Species***					Richness
			AlUn	EiCo	StUn	MaMa	PyCa	
Westfield River								
Westfield River	West	7-1	0	0	0	0	0	0
Westfield River	West	6-1	0	0	0	0	0	0
Westfield River	West	6-2	0	0	0	0	0	0
Westfield River	Dead	5-1	0	1	0	0	1	0
Westfield River	Dead	5-2	0	1	0	0	0	0
Westfield River	Dead	5-3	0	0	0	0	0	0
Westfield River	East	2-1	0	0	0	0	0	0
Westfield River	East	2-2	0	0	0	0	0	0
Westfield River	East	2-3	0	0	0	0	0	0
Westfield River	East	3-1	0	0	0	0	0	0
Westfield River	East	3-2	0	0	0	0	0	0
Westfield River	East	3-3	0	1	0	0	0	1
Westfield River	East	3-4	0	0	0	0	0	0
Westfield River	East	3-5	0	0	0	0	0	0
Westfield River	East	3-6	0	0	0	0	0	0
Westfield River	East	3-7	0	0	0	0	0	0
Westfield River	Middle	4-1	0	0	0	1	0	0
Westfield River	Middle	4-2	0	0	0	0	0	0
Westfield River	Middle	4-3	0	1	1	0	0	2
Westfield River	Middle	4-4	0	1	1	0	1	4
Westfield River	Middle	4-5	0	0	0	0	0	0
Westfield River	Middle	4-6	0	0	0	0	0	0
Westfield River	Middle	4-7	0	0	0	0	0	0
Westfield River	Middle	4-8	0	0	0	0	0	0
Westfield River	Main	9-1	0	0	0	0	0	0
Westfield River	Main	9-2	0	0	0	0	0	0
Westfield River	Main	9-3	1	1	1	1	0	4
Westfield River	Main	9-4	0	1	1	0	0	3
Westfield River	Main	9-5	0	1	1	0	0	2
Westfield River	Main	9-6	1	1	1	1	1	5
Westfield River	Main	10-1	1	1	1	1	0	4
Westfield River	Main	10-2	1	1	1	1	1	5
Westfield River	Main	10-3	0	1	0	0	0	1
Tributaries/Ponds								
Buckley Dunton Lake		6-3	0	0	0	0	0	0
Center Pond		6-4	0	1	0	0	1	0
Depot Brook		6-5	0	0	0	0	0	0
Great Brook		12-1	0	0	0	1	0	1
Great Brook		12-2	1	1	0	0	0	2
Great Brook		12-3	0	0	0	1	0	1
Little River		3-8	0	0	0	0	0	0
Little River		3-9	0	0	0	0	0	0
Little River		11-1	0	0	0	0	0	0
Little River		11-2	0	0	1	1	0	2
Little River		11-3	0	1	0	0	0	1
Shaker Mill Brook		6-6	0	0	0	0	0	0
Stones Brook		1-1	0	0	0	0	0	0
Swift River		1-2	0	0	0	0	0	0
Walker Brook		7-2	0	0	0	0	0	0
Windsor Pond		2-4	0	0	0	0	1	0
Yokum Brook		6-7	0	0	0	0	0	0
Yokum Pond		6-8	0	1	0	0	1	0
		Sites	5	16	9	8	7	2

*Species: AlUn = *Alasmidonta undulata* (triangle floater), EiCo = *Elliptio complanata* (eastern elliptio), StUn = *Strophitus undulatus* (creeper), MaMa = *Margaritifera margaritifera* (eastern pearlshell), PyCa = *Pyganodon cataracta* (eastern floater), LaRa = *Lampsilis radiata* (eastern lampmussel).

** 0 = not found, 1 = found.

Branch Westfield River between Littleville Dam and the East Branch (five species), and a single adult eastern elliptio was also detected in the East Branch in Huntington along Route 112. Eastern elliptio and eastern floater were present throughout the upper watershed but not in Wild & Scenic designated reaches; they were either found in ponds (three of four ponds surveyed) or in the Dead

Branch in Chesterfield that contained the only viable river population of freshwater mussels found in the entire upper watershed.

The Middle Branch Westfield River in an anomaly because it supported relatively high species richness compared to all other aquatic habitats in the upper watershed. However, mussel densities were very low and there are

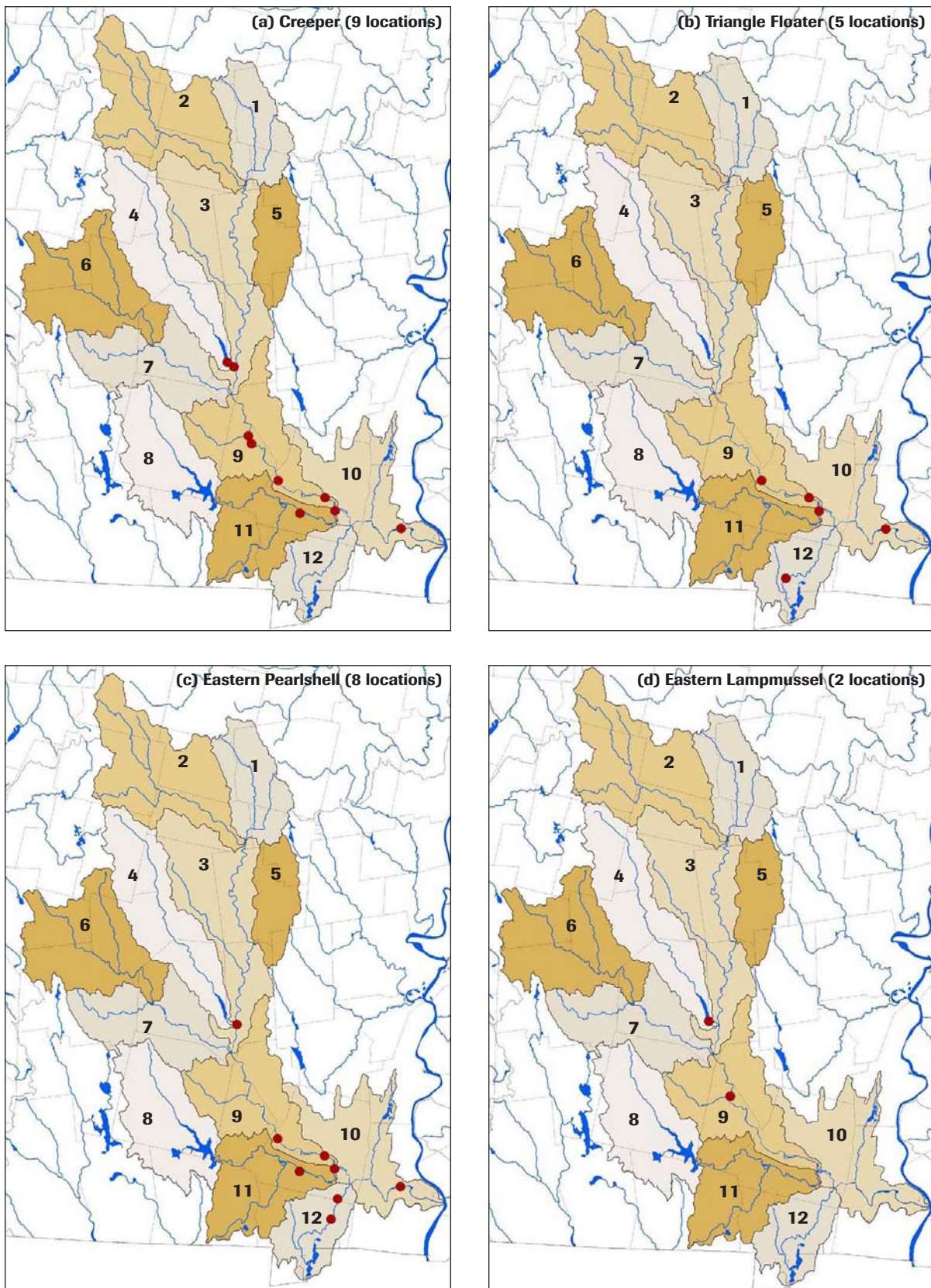


Figure 2. Survey sites where each mussel species was found by Biodrawversity biologists during studies from 2007-2009 in the Westfield River watershed (red dots). A total of 51 sites were surveyed. Subbasins are labelled with the code from Table 2 and Figure 1.

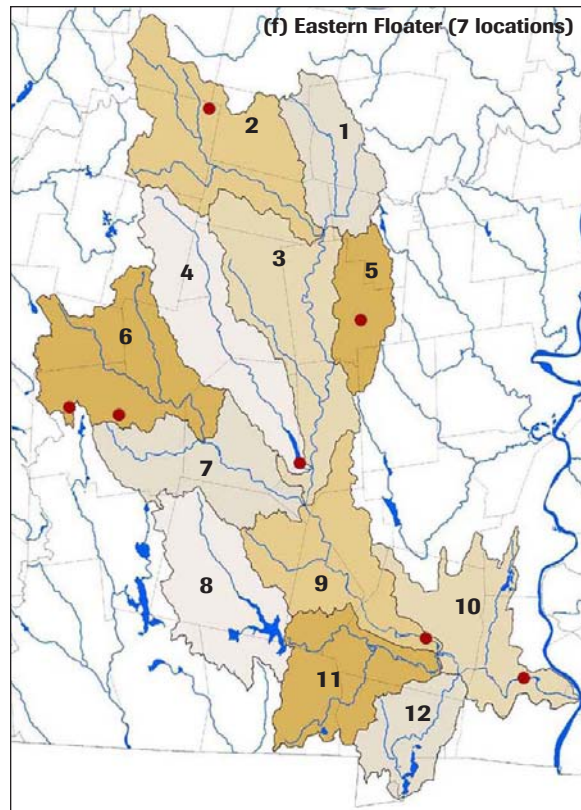
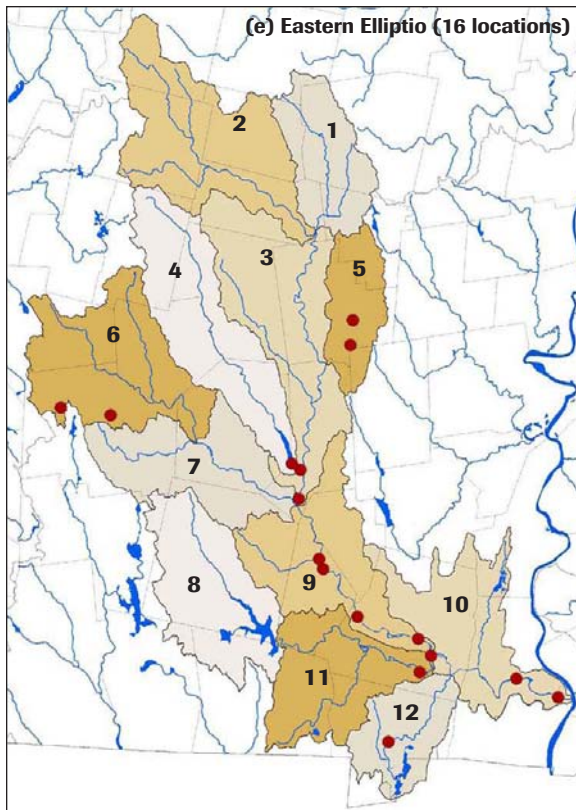


Figure 2 (continued from previous page).

indications that these are relict, non-reproducing populations. Only two eastern pearlshell were found and these were very large adults (138 and 131 mm); these were only three feet from each other yet the closest known “population” in the watershed was almost 15 miles downstream in the Westfield River in Westfield and there are three dams (Woronoco, Russell, and Crescent) separating these animals. A single large eastern lampmussel was found in the pool below the Littleville Dam; this species was only found at one other location in the watershed (a single large adult from the impoundment of the Russell Dam in

Russell). Five creepers were found in the Middle Branch and these were all large adults (average size = 71.2 mm). Three eastern elliptio and six eastern floater were found in the Middle Branch and these were mainly confined to the pool at the base of the Littleville Dam. It is unclear whether the relict populations in the Middle Branch reflect the species composition of the mussel assemblage that may have once been more widely distributed and abundant in the upper watershed, or if this short reach provides unique conditions that attracted wide-ranging host fish and supported random recruits from distant source populations



Heavily eroded creeper from the Middle Branch Westfield River.



Large, old eastern pearlshell from the Middle Branch Westfield River.



Looking across the East Branch Westfield River to the mouth of the Middle Branch.

that never achieved self-sustaining populations. Littleville Lake is the likely source for the eastern floaters, and possibly the eastern elliptio, but presence of the other three species is more difficult to explain.

The Dead Branch in Chesterfield contained a large and viable population of eastern elliptio and a small number of eastern floater. This is the only known viable mussel population in streams of the upper Westfield River watershed. The Dead Branch is distinctive because it passes through a low-gradient valley (particularly from Fisk Meadows WMA down through Bisbee Mill to Northwest Road) with extensive wetland influence. Fish and crayfish were also more numerous in this river than they were in

most other survey sites, and this may be related to more stable flows (due to wetland influence), warmer water temperatures, and greater habitat diversity. Knowing that these types of habitats may be more likely to support mussel populations, future surveys that try to document where mussels occur in the watershed might target other low-gradient streams, especially those influenced by wetlands.

Mussels were detected in three of four ponds surveyed in the upper watershed and it is likely that most ponds contain eastern floater (a species often inadvertently introduced via stocking of centrarchid fishes such as bass and sunfish) and eastern elliptio. Inlet or outlet streams might not necessarily contain mussels despite their proximity to



One of only two live eastern lampmussels found in the watershed.



Large eastern floater from the Middle Branch Westfield River.



Dead Branch Westfield River upstream of Bisbee Mill (Chesterfield).

a source population, especially if habitat is unsuitable. But larger, low-gradient streams connected to ponds probably support one or more mussel species. These types of habitats were generally not surveyed in 2009.

The largest mussel populations in the Westfield River watershed occur in the mainstem Westfield River from Westfield to the Connecticut River and in Great Brook in Southwick and Westfield. The Westfield River contains large and reproducing populations of eastern elliptio and eastern pearlshell, smaller and more patchy populations of creeper and triangle floater, and low numbers of eastern floater and alewife floater. Great Brook contains an extraordinary population of eastern pearlshell, especially

in the lower half of its watershed. The upper part of Great Brook is a low-gradient warmwater stream, influenced by lakes and wetlands, and contains eastern elliptio and triangle floater. Little River in Westfield contains a small but significant population of creepers and eastern pearlshell in free-flowing sections upstream of Crane Pond but otherwise, few mussels were found in the Little River.

Three crayfish species were found in the upper Westfield River, including *Orconectes rusticus*, *Orconectes virilis*, and *Orconectes propinquis*. All had been documented in the watershed prior to this survey. Crayfish were present and often abundant and most survey sites. *Orconectes rusticus* is a recently introduced species that has been quickly



Very large, old, and eroded eastern elliptio.



Fairly young but heavily eroded triangle floater.

spreading throughout the Connecticut River watershed and southern New England. *Orconectes virilis* is one of the most common crayfish species in Massachusetts, occupying most permanent aquatic habitats, and is thought to have been introduced in the early 1900s. Smith (1995) reported that *Orconectes propinquis* is probably native to the Hoosic watershed of Massachusetts and has been introduced into Westfield and Housatonic watersheds.

Protection and Restoration?

It is not known whether mussels were always rare in the upper Westfield River watershed or if current patterns are the result of centuries of human land use and habitat modifications. There are clearly large and viable mussel populations in the lower Westfield River and its tributaries, but despite these large source populations most of the upper watershed is currently nearly devoid of mussels. Possible explanations for the lack of mussels throughout most of the river miles in the upper watershed include a dynamic and harsh river environment, chemical conditions unsuitable for growth and survival (e.g., acidic, cold,



Rocky, high-gradient section of the East Branch Westfield River.

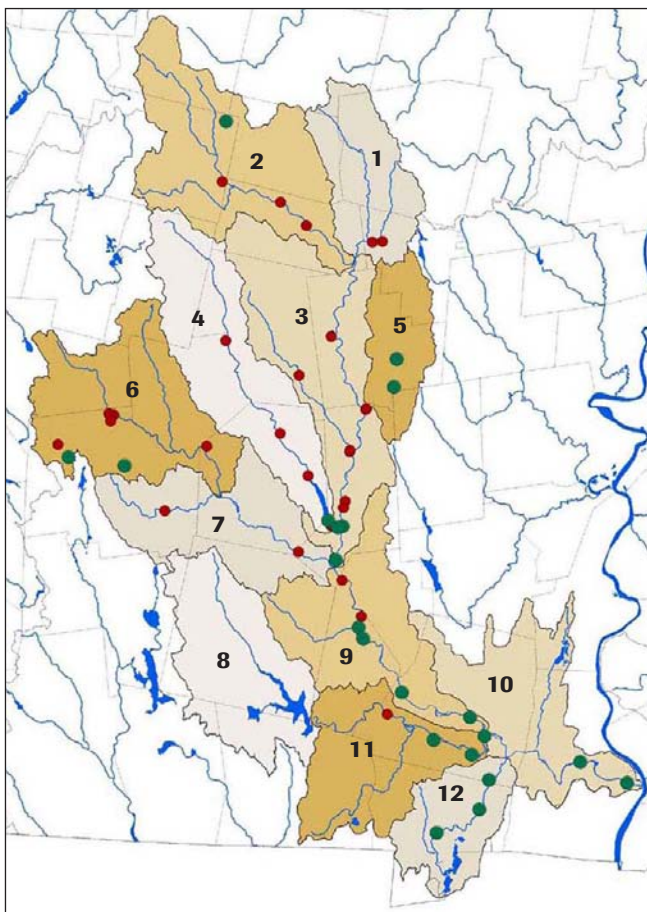


Figure 3. Locations where mussels of any species were detected (green dots) and not detected (red dots) by Biodrawersity biologists in the Westfield River watershed. Subbasins labelled with code from Table 2 and Figure 1.

low in nutrients), and the cumulative effects of large dams and natural barriers that impede the movement of migratory fish into the upper watershed. If the lack of mussels is due to natural causes (e.g., poor habitat), then there is little point in designing protection or restoration efforts to help mussels colonize unoccupied habitats. But if the lack of mussels is due to anthropogenic causes, then some steps could be taken to help protect existing mussel populations and to encourage them to disperse into new areas. General strategies for protection and restoration are outlined in Nedeau (2008). Despite whether lack of mussels is natural or due to anthropogenic influence, some specific recommendations to protect or restore mussels and their habitat in the Westfield watershed might include:

1. Protect the only known viable river population in low-gradient sections of the Dead Branch and perhaps other low-gradient and wetland-influenced reaches that were not surveyed.
2. Protect the health of ponds that contain source populations of eastern elliptio and eastern floater and encourage linkages between ponds and suitable stream habitat.



East Branch Westfield River downstream of the Knightville Dam and upstream of Route 112.

3. Monitor the relict mussel populations in the Middle Branch below the Littleville Dam.
4. Develop and implement strategies to restore connectivity between the lower and upper watershed so that migratory species, which are also potential hosts for freshwater mussels, can expand their range and help mussels colonize suitable habitats. A critical migratory host fish is the American eel.

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