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MRWC Stream BMI Monitoring Program

2017 Volunteer Report



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Table of Contents:

1. Executive Summary	2
2. Introduction, Purpose	3
3. Approach	4
4. Procedures, QC, Equipment	5
5. Sampling sites	6
6. Results & Data interpretation	7
7. Evaluation and Future efforts	11
Appendices	
1. Voucher results: ID/BI	13

Executive Summary

Tributary streams are critical to the health of rivers and their watersheds. In 2017, MRWC conducted its second volunteer Benthic MacroInvertebrate (BMI) sampling program to provide water quality assessments of three tributary streams of the Millers River. Three different streams were evaluated by volunteers with professional assistance. This second year was another success and we hope to more regularly run the program within the watershed.

This effort is part of the management of the larger MRWC monitoring program: ***TribWatch*** which has the goal of collecting stream data from all named streams in the watershed. Having stream data from as many streams as possible will enable MRWC to better assess overall watershed conditions. *TribWatch* started with temperature sampling in 2013 and in 2014 began to phase in macroinvertebrate sampling and flow monitoring.

Aquatic macroinvertebrates or aquatic insects and other aquatic invertebrates, are a very useful water quality monitoring tool. Different types of organisms have unique tolerances to water conditions and can indicate a stream's health. Collection and identification of macroinvertebrates provides valuable water quality information. MRWC's chosen sampling protocol is an efficient, volunteer friendly screening approach. Results from sampling provide a baseline. Good results document a healthy standard to maintain whereas poor results would trigger a request to MassDEP to perform a more detailed survey.

In the late summer and fall of 2017, MRWC collected macroinvertebrate samples from three streams. Sample collection was done using a proven kick-net technique and were sorted using a modified volunteer method developed by CT DEEP. Vouchers of the collected samples were then professionally identified for use in analyzing stream condition. The protocol was a success for both how the collection process proceeded as well as the analysis review of the stream samples. The three streams monitored were found to have good to very good BMI scores.

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Introduction/Purpose

One of MRWC's major roles of watershed stewardship is monitoring the condition of rivers and streams in the basin. This role is best served when the effort includes engaging local people as it promotes watershed awareness. Long term monitoring provides key trending information which is most useful in stewardship planning. MRWC's *TribWatch* program hopes to provide such information while engaging citizen scientists.

Benthic Macro Invertebrate (BMI) sampling is widely used in stream ecological assessments. Aquatic insects and other invertebrates are useful because they live in the stream for the aquatic portion of their life cycle, often a year or more. Significant disruptive forces that occur in the stream impact the macroinvertebrate community. Water chemistry measures the water quality at a moment in time, while the macroinvertebrates reflect the water quality conditions over the last year or more.



These organisms have shown identifiable responses to ecological stressors such as pollution and sedimentation. Aquatic macroinvertebrates are simple to collect and with experience can be accurately identified. Collecting and identifying these organisms over a given stream reach using an approved protocol can then be used to gauge the diversity and population density of a stream. This data can then be compared to other streams or streams determined to be a reference (non-impacted) stream.

The collection process is straight forward and with proper training can be performed by volunteers. This is a rewarding activity for volunteers and engages watershed residents. MRWC has selected a proven volunteer protocol developed by CT DEEP.

Once a voucher sample is assembled, it is then submitted to a professional aquatic biologist for detailed identification. The results help MRWC to determine the stream's relative health.

BMI sampling can be performed readily wherever the stream is accessible. This enables MRWC to visit streams across the watershed to create a baseline record of a stream's condition. Longer streams can be sampled at multiple sites, particularly if the land uses varies along its length. Streams can be revisited periodically to monitor any changes, particularly if any land use changes occur.

Approach

MRWC reviewed a MassDEP list of all streams in the watershed and the available data for each to determine possible BMI monitoring sites. MRWC also conducted a more formal BMI survey over the 2005-09 time period. The size/area, length, flow, and access to a stream were considered. To begin this program, MRWC chose streams with no previous BMI data. Ultimately, MRWC will visit both new and some previously studied sites each season. Depending on the number of volunteer teams that can be assembled, the goal will be to visit 3-5 sites each season.

MRWC chose to use a volunteer friendly sampling protocol. A typical EPA RPB III protocol is too involved and complicated for volunteers. CT DEEP developed a volunteer protocol to screen stream conditions in Connecticut (presented at NEAEB). CT DEEP shared the program details with MRWC, which were readily modified to suit local conditions. MRWC prepared volunteer guides, assembled sampling kits, recruited volunteers, and held a training session. A volunteer professional biologist offered to perform macroinvertebrate identification of the voucher specimens.

The chosen approach is targeted to mid/high gradient streams where riffle habitat exists. This offers more reliable and consistent sampling results by volunteers. Low gradient streams are more challenging to sample and the protocol is applicable only in riffle habitats. The Millers River has many mid/high gradient streams so that this approach offers many opportunities for sampling.

The basic process is to place an aquatic kick net (rectangular frame with 590 u mesh) within the stream riffle, and then move the substrate above the net to free the macroinvertebrates living within and on the substrate. The current washes the macroinvertebrates into the net. The sample is placed in a sorting bin. The macroinvertebrates are then sorted by type into small trays, counted, and one is saved for the voucher. The voucher collection is sent for ID. MRWC scheduled three field sampling events in the fall. Fall is a good time to conduct such surveys due to the life cycle of aquatic macroinvertebrates.



Procedures/QC/Equipment

MRWC prepared a volunteer BMI sampling manual containing program information and outlining procedures for stream sampling. Data/field sheets were created for volunteers to record all observations and insects.

MRWC created a sampling kit which contained a variety of items needed for collection and sorting of the aquatic insects. Items ranged from a rectangular kick net (590 mesh size), collection basins, sorting basins, sorting tools, insect field guides, sample bottles, and sample preservative.

All volunteers received training on the use and care of the equipment. Volunteers were also acquainted to the macroinvertebrates they might find during a field day. Training covered the sorting process and recording needs.

MRWC staff conducted field site visits beforehand to determine access and the reach to be sampled. Teams then visited one site per field day, though two could be possible.

The basic sampling procedure was as follows:

1. Teams mobilized at the site, set up sorting area, reviewed kick sites.
2. Six kicks are performed at riffles over a 100+ foot length of stream.
3. Sites 1&2, 3&4, 5&6 are combined, each set dumped into a unique basin.
4. Volunteers sort through each basin, place like specimens into ice cube trays.
5. Each cube is counted and one of each type is placed into the voucher vial
6. The count is recorded onto the sites field data sheet.
7. Voucher is carefully labeled and sent to biologist for ID.

A site takes about 3-4 hours to sample.

Safety was always a high priority. If stream flows were too high, sampling would be postponed. Sampling can not be done too soon after a high flow event both due to safety concerns and scour of the macroinvertebrate community.

Sampling in 2017 was done in September and October, though it could have been done anytime from mid-summer onward.



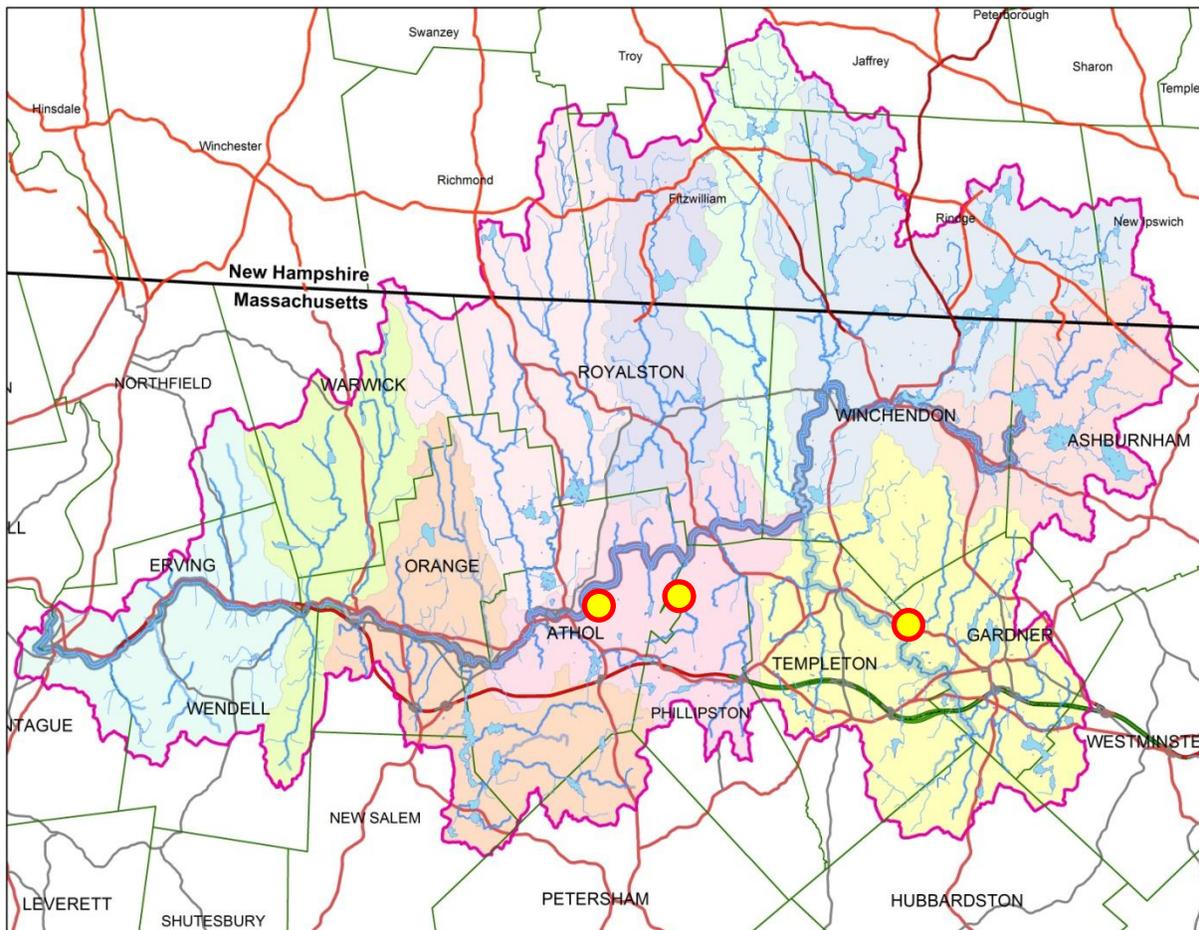
2017 Sampling Sites

Listed below are the streams and sites sampled, followed by a map of their location within the watershed.

Table 1: 2017 BMI Streams

Stream	town	location	Lat	Lon	order
Thousand Acre Bk	Phillipston	S Royalston Rd /Willis Rd	42.604	-72.145	2nd
Bailey Bk	Gardner	Bridge St	42.589	-72.038	1st
Mill Bk	Athol	Cottage St	42.588	-72.228	2nd

Map 1: 2017 BMI Sampling Sites



Results and Interpretation

Using the noted BMI technique, the three streams monitored were found to have good to very good/excellent water quality.

Thousand Acre Brook is a small tributary, which flows north from the Rt 2 area in Phillipston (Athol side) into the Millers River. It is a second order stream with a watershed area above the sample site of 2.3 square miles, 4.9% mean slope, a total streams length 4.32 miles, is 78.78% forested with 5.32% urban land cover and 0.49% impervious area (USGS). Total percentage of waterbodies in the area was 20.77%. The banks were stable and well canopied. The substrate was stone & cobble dominated. The wetted area of the brook was 8 feet wide with a 4"-6" deep riffles, visually a good habitat site. The site was situated between wetlands, which likely created modest results. It had lush aquatic moss, almost no silt and a balanced macroinvertebrate community. This location provided excellent riffle habitat to water quality sensitive stoneflies and caddisflies as well as riffle beetles and dragonflies. Amphipods were also found because of the shelter the aquatic moss offered. *The BMI finding suggests very good/excellent water quality.*

Bailey Brook is a first order stream. It flows from southern Winchendon south into Gardner, then to the Otter River near Bridge Street. It has a 3.36 square mile watershed above the sample point, 1.82% slope, total streams length of 6.14 miles, is 80.3% forested with 6.55% urban land cover and 1.89% impervious cover and about 16% total water body area (USGS). The banks were stable and well vegetated with very good habitat, geomorphically it offered excellent riffle habitat, however the macroinvertebrate community was subdued. The cobble dominated substrate was noticeable darkly stained, suggesting iron/manganese input from upstream. This can impact macroinvertebrate populations. The substrate was not silty. *The BMI still indicates good water quality.*

An impoundment upstream could be a factor as this can alter water chemistry. Perhaps sampling above the impoundment could shed light on this.

Mill Brook is a second order stream. It flows out a few small reservoirs along the Athol/Phillipston town line, and Rt 2, in a westerly direction, through Lake Ellis, then begins a elevation drop in Athol, before it levels off and enters the Millers River in Athol. It has a 4.42 square mile watershed area above the sample point, 4.9% slope, a total streams length 6.82 miles, is 63.49% forested with 21.4% urban land cover and 5.76% impervious area, with total waterbody area of 13.93% (USGS). Below the sample site, the gradient gets low and very sandy and parts of the stream are under parking areas in town. The banks were in good condition overall, but the substrate was somewhat imbedded with sand. The stream was partially canopied in the reach sampled. Some aquatic moss was present.

Its not that the benthic community wasn't impacted by the urban surroundings. There was a high proportion of filter feeders indicating a lot of particulate material available and there were a number of organisms associated with deposition of materials in the natural substrate (tipulids and worms). *Using the BMI, Mill Brook scored VG, but the dominant bug type favors good quality, so Mill brook was found to have good water quality for an urban stream.*

BMI Sampling Results Summary:

	Thousand Acre	Bailey	Mill
	2nd Order	1st order	2rd order
EPT#	6	5	6
Richness	9	10	11
Score	4	2	3
Rating	VG/EXCELLENT	GOOD	V GOOD
Note:			salamander found

Rating note: 1-2 is good, 3-V good, 4-5 is excellent and 5 or more is exceptional. Score is the number of high water quality preferring species.



EPT = Ephemeroptera, Plecoptera, and Trichoptera (mayflies, stoneflies, caddisflies) are the water quality sensitive component of the macroinvertebrate community. Higher counts are indicative of higher water quality conditions, except in very small streams.

Richness is the number of different types of macroinvertebrates found. The higher richness values indicate a healthier stream, unless the stream is very small.



Evaluation and Future Efforts

The results of this second effort indicate a very workable program for MRWC to continue to use to generate useful water quality data. The field day feedback made it clear that the volunteers enjoyed the field work.

MRWC can refine this program by optimizing the field datasheets to the ecoregion of the Millers River. MRWC had used the CT DEEP sheets which use data from the Connecticut ecoregion.

Appendices

Spread sheets: voucher & counts

MRWC Rapid Bioassessment 2017		Thousand Acre	Bailey Brook	Mill Brook
Scientific Name	Common Name	Sept. 16, 2017	Sept. 30, 2017	Oct. 21, 2017
Ephemeroptera	Mayflies			
Baetis		x	x	
Stenonema		x		
Plecoptera	Stoneflies			
Acroneura		x	x	
Paragnetina		x		
Nemouriidae				x
Trichoptera				
Chimarra		x	x	
Dolophiloides				x
Glossosoma				x
Diplectrona				x
Ceratopsyche		x	x	
Cheumatopsyche			x	
Brachycentrus		x		
Rhyacophila				x (2 species)
Megaloptera	Fishflies & Dobsonflies			
Nigronia	Fishfly	x	x	x
Coleoptera	Beetles			
Elmidae	Riffle beetles		x	
Odonata	Dragonflies			
Aeshnidae			x	
Diptera	Flies			
Tipulidae	Crane flies			
Dicranota				x
Molophilus				x
Tipula		x		x
Simuliidae	Blackflies		x	
Oligochaeta	Worms		x	x
	EPT	6	5	6
Outcome (RBI)		Very good	Very good	Very good
richness (kd) # species		9	10	11