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Benthic Macroinvertebrate Exploration in the Rumford River

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Benthic Macroinvertebrate

Exploration In The Rumford River

Chauncy Street Location

Mansfield, MA 02048



Presented by Qualters Middle School Students:



Leah Tori Taylor



Gina



Colleen Josh



Karim Nick



Dylan



Dan

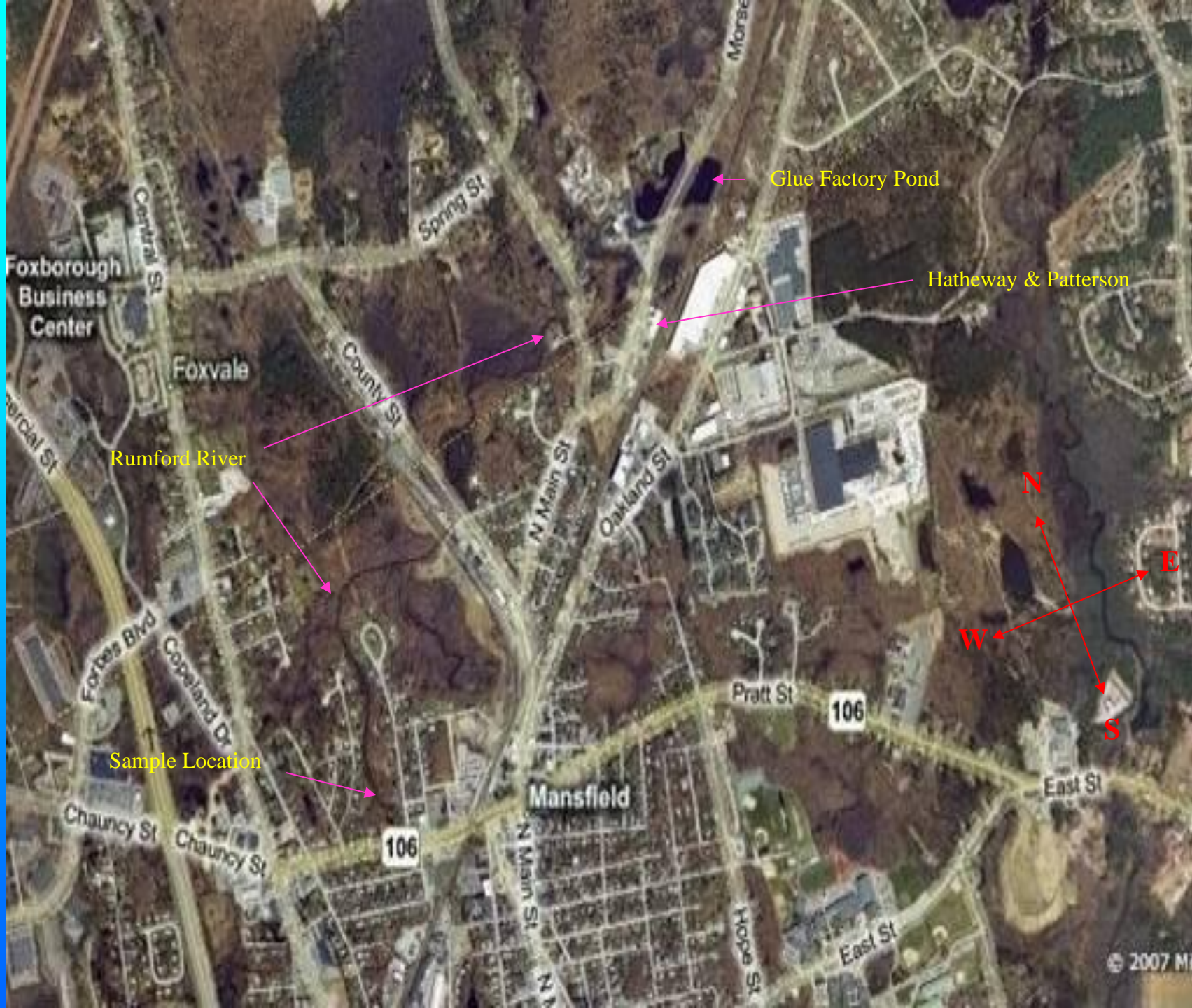


Kelsey Katie

Location:

The Rumford River is a tributary of the Taunton River.

The river runs from Glue Factory Pond in Foxboro, MA, through the town of Mansfield and into the Norton Reservoir in Norton, MA.



Glue Factory Pond

Hatheway & Patterson

Rumford River

Sample Location

Purpose of Study

- Collect initial benthic macroinvertebrate measurements.
- Collect initial physical habitat data.
- Gain an understanding of benthic macroinvertebrate community diversity.
- Utilize state of the art equipment and techniques.
- Identification of benthic macroinvertebrates to Order level utilizing dichotomous keys.
- Gain insight as to the water quality of the Rumford River based on benthic macroinvertebrate diversity.

Rumford River Background Information

- Listed on EPA's National Priority List

- Hatheway and Patterson Company (1953-1993)
 - Wood preserving facility
 - Release of Dioxins, Furans, Phenols

- Groundwater contamination
 - Arsenic, Chromium, Copper, PCP's, PAH's

- 2005 EPA report stated:

• “Benthic invertebrate community in the Rumford River is not at a substantial risk of harm from exposure to site-related sediment contaminants (EPA, 2005).”

Stream Biomonitoring: Physical Habitat Data Field Sheet



The gang recording habit data

Stream Biomonitoring: Physical Habitat Data Field Sheet modified from CABIN Page 1

Field Sheet: _____ Collectors: Gina Valeri

Date: 10/10/07

Province/State: Mansfield, Massachusetts Site: RUM-01-07

River: Rumbold River Site Code: _____

Weather Conditions

Temperature: F 58° C _____ Water pH: _____ Notes: Sunny, no clouds

Air: _____

Water: _____

Dominant Flow State: Put a check next to the dominant flow state for the study area.
☐ Riffle/Race ☒ Straight/Run ☐ Pool/Eddy

% Aquatic Macrophyte Cover on Stream Bottom: less than 5%

% Overhead Canopy Coverage: 85%

Riparian Zone Vegetation: Check as many as apply.
 Grasses 1 ☐ Shrubs 2 ☐ Conifers 3 ☐ Deciduous 4 ☒

Dominant Vegetation: Deciduous trees

Three Stream Widths: (circle units) (m or ft) (m or ft) (m or ft)

Bankfull (BF): BF1 30 ft BF2 _____ BF3 _____

Wetted Channel (WC): WC1 22 ft WC2 _____ WC3 _____

Stream Gauge Reading: _____

Wetted Width X-Section: Determine segment width by dividing Total Wetted Width (WC) by 10.
 Note: Minimum segment width should be ≥ 2 ft or 0.6m

Segment Width:	Xsec 1	Avg. Seg. Depth	Xsec 2	Avg. Seg. Depth	Xsec 3	Avg. Seg. Depth
Depth at Left Bank						
Depth at End of Seg 1						
Depth Seg 2						
Depth Seg 3						
Depth Seg 4						
Depth Seg 5						
Depth Seg 6						
Depth Seg 7						
Depth Seg 8						
Depth Seg 9						
Depth Seg 10						
Depth at Right Bank						

Flow: Tennis Ball or Meter Ball Time (in seconds) to travel a set distance (1-5m): Meter flow in m/s

X Section	Flow length: m	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average
Xsec1							
Xsec2							
Xsec3							

Dominant Substrates Sizes: Note: C.O.D. = coarse organic debris: logs, sticks, leaves
 Circle size: Bedrock Boulder > 25cm Cobble 6-25mm Gravel 2-6mm Sand < 0.25mm Silt C.O.D.

% Embeddedness of 5 Stones: 1 100% 2 100% 3 85% 4 90% 5 50%

Substrate Dimension (units): Measure length (L) and width (W) of 10 randomly selected substrates in kick sample area.

	1	2	3	4	5	6	7	8	9	10
L (cm)	15 cm	24 cm	37 cm	45 cm	54 cm					
W (cm)	2 cm	2 cm	5 cm	5 cm	2 cm					
L (cm)	64 cm	7 cm	8 cm	9 cm	10 cm					
W (cm)	12 cm	2 cm	2 cm	2 cm	1 cm					

Curry - Stream Biomonitoring 30



Katie and Colleen estimating percent embeddedness

- The field data sheet is used to record critical habitat data.
- Data can aid in explanation of macroinvertebrate findings.
- Data can show changes of the river and surrounding area.

Physical Habitat Data



Karim measuring stream widths

Location	Avg. Wetted Stream Width (ft)	Avg. Bankfull Stream Width (ft)	Percent Embeddedness of 5 stones (%)		Percent Canopy Cover (%)	Percent Aquatic Macrophyte Cover (%)
Chauncy Street	22	32	~ 60 ~ 90	~70 ~30	~ 85	< 5

Location	Average Substrate size at collection sites Length (cm)	Average Substrate size at collection sites Width (cm)
Chauncy Street	11.05	5.97



Kelsey and Josh measuring substrate size



Dan recording flow data at sampling sites with Dr. Curry

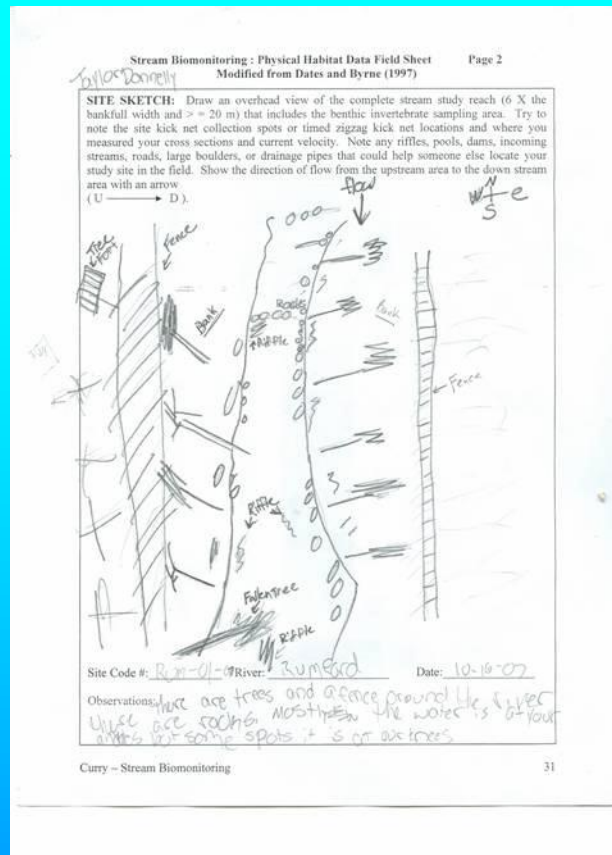
Location	Dominant Substrate Size (cm)	Dominant Vegetation
Chauncy Street	Cobble 5 - 25 Sand < 0.25	Deciduous Trees

Location	Average flow at collection sites ft/s
Chauncy Street	0.74



Nick estimating percent embeddedness of stones

Site Sketch of Rumford River



- The site sketch gives a detailed layout of the sampling location.
- The site sketch can show sampling locations, landmarks and if any changes occur to the sampling location.

Benthic Macroinvertebrate Sampling

- Kick net sample
- Flow measurements at sampling sites
- Physical habitat data collection



Benthic Macroinvertebrate Identification

Identification Tools

- Stereomicroscopes
- Flex Camera
- Dichotomous Keys
- Level 1 Major Group Biotic Index data sheet



A day of identification during science class.



Level 1 Major Group Biotic Index Data Sheet

Samples 1, 2 & 3



Tori showing off some bugs.

Stream Biomonitoring: Level 1 Major Group Biotic Index Data Sheet

Date Code: *RVM-01-07* River or Stream: *Rumford River*
 Date Sampled: *10/16/07* Collectors: *GMS, Students*
 Type of Sample: *0.5m Kick* Artificial Substrate: _____ Number Per Replicate: _____

Major Group	Count Replicate 1	Count Replicate 2	Count Replicate 3	Avg. Count per Group	Avg. Org. Density	Group %	Group Tot. Value	Tot. X Avg. Org. Density
Ephemeroptera	8	15	4				2(4)	
Plecoptera							1	
Trichoptera	49	38	48				3	
Diptera:							7	
Chironomidae							4	
Diptera: Other	25	31	19				5	
Odonata	1	1					2	
Megaloptera							4	
Coleoptera	29	22	13				8	
Hemiptera							7	
Amphipoda	92	113	133				8	
Isopoda							6	
Decapoda	1	3	2				7	
Gastropoda								
Pelecypoda							7	
Oligochaeta	2	1	3				9	
Hirudinea							10	
Turbellaria							4	
TOTALS	212	224	222					
Total Grabs Picked								
DAF = Density Adjustment Factor								
Major Group Biotic Index = Sum of (Reference X Avg. Org. Density Values for Group) / Sum of Avg. Org. Density								
MGBI =								

Density = calculated organism density using the DAF or actual density in a subsample if the entire sample is counted. If only one sample, then place this density value in the Avg. Org. Density column.
 () = recommended modification of group reference values based on most common families for Southwestern Massachusetts

Curry - Stream Biomonitoring



Mike looking at some bugs.

Level 1 Major Group Biotic Index Data Sheet

Sample 4



Jake sorting some bugs.

Stream Biomonitoring: Level 1 Major Group Biotic Index Data Sheet

Site Code: RUM-01-07 River or Stream: Rumford River
 Date Sampled: 10/11/07 Collectors: AMS Students
 Type of Sample: 0.5m Kick Artificial Substrate: 3 min kick: Multihabitat Number Per Replicate:

Major Group	Count Replicate 1	Count Replicate 2	Count Replicate 3	Avg. Count per Group	Avg. Org. Density	Group %	Group Tot. Value	Tot. X Avg. Org. Density
Ephemeroptera	2						2(4)	
Plecoptera	1						1	
Trichoptera	34						3	
Diptera:							7	
Chironomidae							4	
Diptera: Other	27						5	
Odonata							2	
Megaloptera							4	
Coloptera	9-1						8	
Hemiptera							7	
Amphipoda	109						8	
Isopoda							6	
Decapoda	1						7	
Gastropoda							7	
Pelecypoda							7	
Oligochaeta	2						9	
Hirudinea							10	
Turbellaria							4	
TOTALS	202							
Total Grids Picked								
DAF = Density Adjustment Factor								
Major Group Biotic Index = Sum of (Tolerance x Avg. Org. Density) (all but Group %)								
MGBI =								

Density = calculated organism density using the DAF or actual density in a subsample if the entire sample is counted. If only one sample, then place this density value in the Avg. Org. Density column.
 (1) = recommended modification of group tolerance values based on most common families for Southeastern Massachusetts

Curry - Stream Biomonitoring 25



Alex and the gang doing some classifying.

Major Group Biotic Index

Rumford River - MGBI											
Chauncy Street - Mansfield, MA											
RUM101607											
October 16, 2007											
		Date: October 16, 2007						Name: QMS Students			
		Actual	Actual	Actual	Actual	Avg.	Avg.		Group	Tolerance	
		Count	Count	Count	Count	Count per	Organism		Tolerance	X Avg. Org	
Group		Rep. 1	Rep. 2	Rep. 3	Rep. 4	Group	Density	Group %	Value	Density	
Ephemeoptera		8	15	4	7	8.5	9.83	0.99	4	39.31	
Plecoptera					1	1	1.16	0.12	1	1.16	
Trichoptera		49	38	48	34	42.25	48.84	4.91	3	146.53	
Diptera (Chironomidae)									7		
Diptera (Other)		25	31	19	27	25.5	29.48	2.97	4	117.92	
Odonata		1	1			1	1.16	0.12	5	5.78	
Megaloptera									2		
Coleoptera		29	22	13	21	21.25	24.57	2.47	4	98.27	
Hemiptera									8		
Amphipoda		97	113	133	109	113	130.63	13.14	7	914.44	
Isopoda									8		
Decapoda		1	3	2	1	1.75	2.02	0.20	6	12.14	
Gastropoda									7		
Pelecypoda									7		
Oligochaeta		2	1	3	2	2	2.31	0.23	9	20.81	
Hirudinae									10		
Turbellaria									4		
Totals		212	224	222	202	860	250.00		N/A	1356.35	
Ttl. Sqs. Examined		12	9	10	11						
Ttl. Psb. Squares		12	12	12	12						
Density Adjustment						Avg. DAF					
Factor (DAF)		1	1.33	1.2	1.09	1.156061			MGBI	5.43	
									(Major Group Biotic Index)		

10 MAX Major Group Biotic Index

Rumford River - 10 MAX MGBI											
Chauncy Street - Mansfield, MA											
RUM101607											
October 16, 2007											
		Date: October 16, 2007						Name: QMS Students			
		Actual	Actual	Actual	Actual	Avg.	Avg.		Group	Tolerance	
		Count	Count	Count	Count	Count per	Organism		Tolerance	X Avg. Org	
Group		Rep. 1	Rep. 2	Rep. 3	Rep. 4	Group	Density	Group %	Value	Density	
Ephemeoptera		8	10	4	7	7.25	8.38	3.50	4	33.53	
Plecoptera					1	1	1.16	0.48	1	1.16	
Trichoptera		10	10	10	10	10	11.56	4.83	3	34.68	
Diptera (Chironomidae)								0.00	7		
Diptera (Other)		10	10	10	10	10	11.56	4.83	4	46.24	
Odonata		1	1			1	1.16	0.48	5	5.78	
Megaloptera								0.00	2		
Coleoptera		10	10	10	10	10	11.56	4.83	4	46.24	
Hemiptera								0.00	8		
Amphipoda		10	10	10	10	10	11.56	4.83	7	80.92	
Isopoda								0.00	8		
Decapoda		1	3	2	1	1.75	2.02	0.85	6	12.14	
Gastropoda								0.00	7		
Pelecypoda								0.00	7		
Oligochaeta		2	1	3	2	2	2.31	0.97	9	20.81	
Hirudinae								0.00	10		
Turbellaria								0.00	4		
Totals		52	55	49	51	207	61.27		N/A	281.50	
Ttl. Sqs. Examined		12	9	10	11						
Ttl. Psb. Squares		12	12	12	12						
Density Adjustment						Avg. DAF					
Factor (DAF)		1	1.33	1.2	1.09	1.156061		10 MAX MGBI		4.59	
								(Major Group Biotic Index)			

Data Breakdown

Order level Average Count

Chauncy Street	
Order	Average Count
Ephemeroptera	8.5
Plecoptera	1
Trichoptera	42.25
Diptera:Other	25.5
Odentata	1
Coleoptera	21.25
Amphipoda	113
Decapoda	1.75
Oligochaeta	2

Order Level Average Organism Density

Chauncy Street	
Order	Avg. Org. Density
Ephemeroptera	9.83
Plecoptera	1.16
Trichoptera	48.84
Diptera:Other	29.48
Odentata	1.16
Coleoptera	24.57
Amphipoda	130.63
Decapoda	2.02
Oligochaeta	2.31

Percent Composition of 5 Dominant Orders

Rumford River			
Order	Average Density	Total Average Density for Site	% Comp.
Ephemeroptera	9.83	250	3.932
Trichoptera	48.84	250	19.536
Diptera (Other)	29.48	250	11.792
Coleoptera	24.57	250	9.828
Amphipoda	130.63	250	52.252

Identified Orders Within The Rumford River

Amphipoda (Scuds)

Points of Interest:

- Average Count: 113
- Average Org. Dens.: 130.63
- % Comp. 5 Dominant Orders: 52.252
- Laterally flattened organisms
- Most yellow. Some pinkish
- Generally omnivorous-detritivores



Identified Orders Within The Rumford River

Trichoptera (Caddisflies)

Points of Interest



- Average Count: 42.25
- Average Org. Dens.: 48.84
- % Comp. 5 Dominant Orders: 19.536
- Respiration through soft skin
- Respiration through filamentous gills
- Case-makers
- Net-spinners
- Mainly predaceous



Identified Orders Within The Rumford River

Diptera

(Midges, Mosquitos, Aquatic Gnats & Flies)

Points of Interest

- Average Count: 25.5
- Average Org. Dens.: 29.48
- % Comp. 5 Dominant Orders: 11.792
- Possibly Family *Tipulidae*
- Partially or completely retracted head
- Cylindrical abdomen
- End of abdomen exhibits variously developed lobes surrounding spiracal disk



Identified Orders Within The Rumford River

Coleoptera (Water Beetles)

Points of Interest

- Average Count: 21.25
- Average Org. Dens.: 24.57
- % Comp. 5 Dominant Orders: 9.828
- Possibly Family *Elmidae*
- Suture lines visible on abdominal segments 1-6
- Large number are highly predaceous



Identified Orders Within The Rumford River

Ephemeroptera (Mayflies)

Points of Interest

- Average Count: 8.5
- Average Org. Dens.: 9.83
- % Comp. 5 Dominant Orders: 3.932
- Possible Family *Heptageniidae*
- Distinctly flattened body with outspread legs
- Three distinct tails
- Detritivores/herbivores



Identified Orders Within The Rumford River

Oligochaeta **Oligochaeta** (Aquatic Earthworms)

Points of Interest

- Average Count: 2.0
- Average Org. Dens.: 2.31
- Elongate/cylindrical worms
- Segmented body
- Can Tolerate low dissolved oxygen
- Mainly detritivores



Identified Orders Within The Rumford River

Decapoda (Crayfishes & Shrimps)

Points of Interest

- Average Count: 1.75
- Average Org. Dens.: 2.02
- Head and Thorax (Cephalothorax)
covered by a carapace
- First 2 or 3 pairs of legs are pincer-like
at ends
- Can be herbivores, omnivores, carnivores
or detritivores



Identified Orders Within The Rumford River

Odonata

(Damselflies & Dragonflies)

Points of Interest

- Average Count: 1.0
- Average Org. Dens.: 1.16
- Carnivorous



Identified Orders Within The Rumford River

Plecoptera (Stoneflies)

Points of Interest

- Average Count: 1.0
- Average Org. Dens.: 1.16
- Primarily carnivores or leaf detritivores
- Adapted to crawling and clinging on substrate



Water Quality

Correspondence Between HBI Values and Water Quality		
Rumford River		
Chauncy Street Location		
Mansfield, MA 02048		
10/16/07		
HBI Score Range	Chauncy Location	Water Quality Rating
0.0 - 3.75		Excellent
3.76 - 4.25		Very Good
4.26 - 5.00	10 MAX MGBI 4.59	Good
5.01 - 5.75	MGBI 5.43	Fair
5.76 - 6.50		Fairly-Poor
6.51 - 7.25		Poor
7.26 - 10.00		Very-Poor

- MGBI data shows water quality to be in the “Fair” Category.
- 10 Max MGBI data shows water quality to be in the “Good” category.
- Data indicates similarities to 2005 EPA report which stated that benthic macroinvertebrates were not at a substantial risk of harm due to pollutants.

Bibliography

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THE END

