Characterization of the Microbial Fauna found in four local waterways of East Bridgewater, MA

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INTRODUCTION

Watersheds are geographically distinct areas of land where surface water converges into a single point. As ground water is funneled through the watershed it collects and spreads nutrients and pollutants across the watershed area. This study focuses on four bodies of water, in East Bridgewater , which are part of the Matfield River sub-basin of the Taunton River watershed. The sub-basin contains some of the most densely developed areas in Massachusetts, and has a recent history of not meeting EPA water quality standards. We sampled from Robbins Pond, Poor Meadow Brook, Satucket River and Salisbury River to characterize the microbial fauna, and determine their chemical and nutrient contents. We compared our findings with pristine waters (Robbins Pond and Poor Meadow Brook) with those known to suffer from poor water quality (Salisbury and Matfield Rivers).

Collection of Water Samples:

GPS coordinates were recorded using an iPhone app, and water pH was measured using standard test strips on site. Water was collected in three sterile 50 ml tubes. Additional water and mud was collected at Robbins Pond, Matfield River and Poor Meadow Brook for Winogradsky columns.

Nutrient & pH test:

Once in the lab we tested our water samples for pH Salinity, Nitrate, and Phosphate levels. On-site pH readings were compared with a Mettler pH meter. For the nutrient tests we used a LaMotte Direct Reading Titrator Salinity Test Kit, LaMotte Low Range Comparator Phosphate Kit, and LaMotte Nitrate Nitrogen Tablet Kit. All our results fell within the acceptable ranges based on EPA criteria.

Microbial Content

In order to characterize the microbial fauna found in our water samples we performed the following procedures:

Total Colony & Coliform Counts:

We spread 0.1mL of water samples diluted 10^{-1}, and 10^{-2}, and undiluted on Tryptic Soy Agar plates to determine the total number of bacteria /1 mL. We similarly plated samples on Eosin-Methylene Blue and MacConkey agar plates to determine the amount of coliforms and *Escherichia coli*/1ml.

Isolation of Bacterial Colonies:

We isolated 51 bacterial isolates based on colony morphology. We recorded images of each isolate and performed a gram stain.

Biochemical Test:

We performed the following biochemical test to aid in the classification of the 51 isolates:

Citrate, Gelatin Hydrolysis, Glucose fermentation, Indole , Lactose fermentation, Methyl Red, NaCl, Nitrate Reduction, Oxidase, Sucrose, Triple Sugar Iron, Voges – Proskauer

The results were used to generate two dichotomous keys.

Winogradsky Column and Wet Mount:
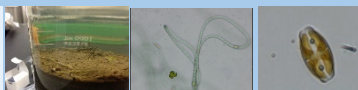
Winogradsky Columns were constructed by filling 1 Liter bottles with water and mud collected from Robbins Pond, Poor Meadow Brook, and Matfield River. Wet mounts were examined under the microscope to identify non-bacterial microorganisms present in the waterways.

RESULTS

(Table 1) Nutrient, pH, and bacterial count data:

Matfield River Watershed chemical and bacteria results (June 2013 - August 2013)

	Nitrate (ppm)	Phosphate (ppm)	Salinity (ppt)	Ph	Total Bacteria Count (cfu/ml)	Total Coliform Count (cfu/ml) EMB Plates	Total Coliform Count (cfu/ml) MacConkey Plates	Total E.coli Count (cfu/ml) EMB Plates
Matfield River (Farm)	0	0.2	1.25	6.74	2783 - 930 $	117	45	5
Poor Meadow Brook (Power Lines)	0	0 - 0.4	0.275 - 0.75	6.87 - 7.15	2210 *** - 1680 $	160	440	0 - 30
Robbins Pond site 1 (boat launch)	0 - 0	0 - 0.6	0.475 - 1	5.84 - 6.47	1255 (<20)	100	45	0 - 0
Robbins Pond site 2 (bridge)	0	0.6	0.25	6.47	3740$	NA	210	0
Salisbury river (Matfield Rd)	2	0.2	0.25	6.88	5143 - 1,590 $	702	145	30
Sawtuket River (Rt 27)	0	0.2	0.25	6.22	1933 - 755 $	108	70	5
Taunton River	0 - 0	0 - .06	0.275 - 1.25	6.75 - 7.13	875 - 105 - 3050$	95	455	0 - 75

* EMB plate (gram negative), **10^{-2} dilution not included in average, *** undiluted sample not included in average, $- unfiltered

Dichotomous keys based on gram staining and biochemical test:
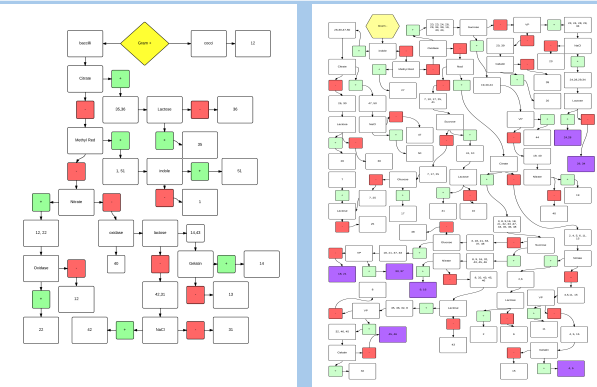
CONCLUSION

	# of Bacteria Colonies
Matfield	4
Poor MeadowBrook (Power Lines)	11
Poor MeadowBrook (Rt 27)	10
Robbins Pond	4
SalisburyRiver	10
Satucket	7
Retention pond (cranberry Bog)	5

	diatoms	algae	protozoa	desmids
Matfield	2	0	6	6
Poor MeadowBrook (Power Lines)	4	1	1	1
Robbins Pond	0	1	2	13