IPSWICH RIVER WATERSHED ASSOCIATION

BioMonitoring at Bostik Dam, Middleton

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June 25, 2011

Proposal number: IRWA2

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Summary

Objective

To acquire baseline ecological conditions for comparison with future changes in the Ipswich River if the Bostik Dam is removed.

Goals

Acquire the necessary benthic macro-invertebrate information to establish existing conditions for comparison to conditions after dam removal.

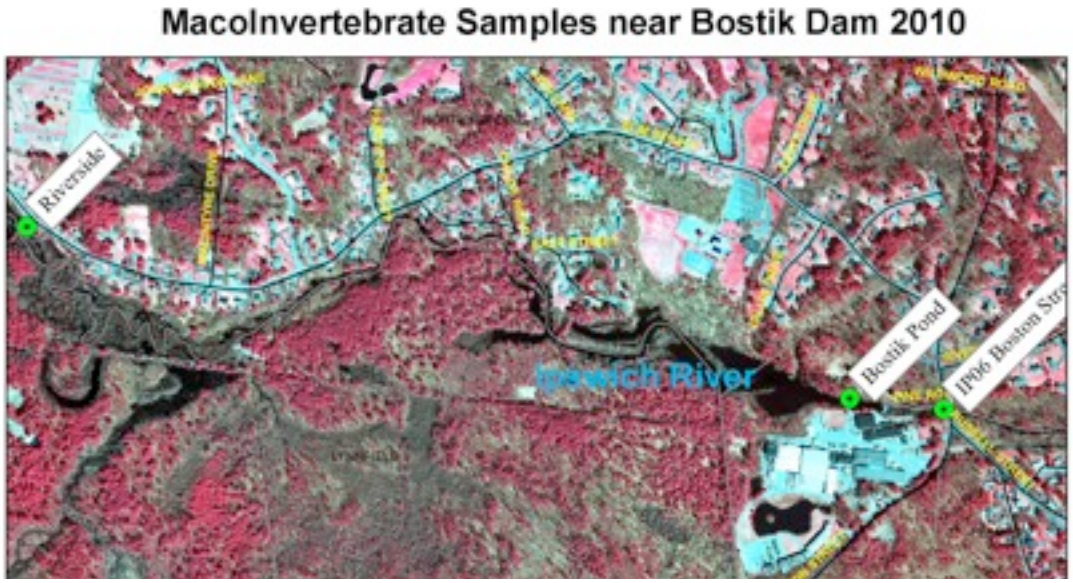
This will be accomplished by:

1. organizing long-term monitoring points and transects,
2. compiling historic macro-invertebrate data,
3. deploying and assessing artificial substrate method,
4. curating macro-invertebrate specimens.

Summary of Methods

To acquire and organize this baseline of information, we used the record keeping format, as defined in the "Quality Assurance Project Plan For the Ipswich River Watershed Assoc. Macroinvertebrate Sampling Program" and combined this with EPA's bioassessment of surfaces waters using an artificial substrate. The Hester-Dendy (HD) multiplate sampler offers a standard collector for both ponds and rivers and is the easiest quantitative analysis method for normally disparate aquatic systems. This paper describes the HD method of benthic macroinvertebrate sampling in detail (Appendix 1,) compares the results of this method with historic kick sampling methods and compiles all available macroinvertebrate data for this site into one archive. Methods for kick sampling can be found in the "Quality Assurance Project Plan For the Ipswich River Watershed Assoc. Macroinvertebrate Sampling Program."

The H-D samplers were deployed on August 3, 2010 at the 3 locations shown on the map below.



Macroinvertebrate Sampling stations at Bostik Dam

The most downstream station is IP06, a RiverWatch water monitoring site and the site for an earlier invertebrate kick sampling site from 1991, 1997, 1998, 1999 and 2001. Sampling at Bostik Pond and "Riverside" are new sites. The samples were collected on December 7, 2010 exceeding the minimum of 6 weeks as recommended by EPA.

Results

2010 was a low water or "dry"summer year. The Hester-Dendy method results in Table 1 show comparable water quality between the Bostik Pond (lentic) and below the dam at Boston Street(lotic.) The sample at Riverside (lotic) which is upstream of the Pond and immediately downstream of a large swamp, reflects a much more impaired water quality condition. This leads one to two possible conclusions: the pond is more riverine than pond-like and large swamps impact water quality for fluvial/riverine organisms.

Locale Code	Locale Common Name	Binomial		Number
550	**Riverside**	Richness	4	196
	Hemiptera	Lethocerus sp		1
	Midges	Chironomid sp		180
	Odonate	Unk.		1
	Sowbugs	Caecidotea sp		14
565	**Bostik Pond**	Richness	8	39
	Beetle	Unk.		2
	Caddisfly	Unk.		3
	Mayfly	Stenacron sp		14
	Midges	Chironomid sp		6
	Odonate	Unk.		12
	Scuds	Gammarus sp		1
	Snail	Unk.		1
IP06	**Ipswich River Bostik**	Richness	8	92
	Beetle	Unk.		17
	Mayfly	Stenacron sp		9
	Midges	Chironomid sp		60
	Odonate	Calopteryx sp		1
	Scuds	Gammarus SP		4
	Snail	Physella sp		1

Table 1

The historic sampling at Boston Street using a kick method are comparable to the HD method for richness and biotic index (Table 2). Although slightly different taxa inhabit the HD sampler than are found in the natural benthos. Dry and Wet categories reflect summer-time flows of the preceding summer.

	Fall 1997	Spring 1998	Fall 1998	1999	2001	2010	Average
Organism Density/Sample Unit	520	836	1200	1528	680	276	
EPT Richness	1	3	4	3	5	2	3
Total Taxa Richness	5	8	11	6	16	8	9
EPT/EPT+Chironomidae Ratio				1.00	1.00	0.13	
Biotic Index	6.54	6.74	3.74	2.27	3.94	5.96	4.86
% Contribution of Dominant Family				0%	42%	65.22%	
% Model Affinity	20%	17%	44%	17.36%	27%	46.30%	28.62%
	Dry	Wet	Wet	Dry	Wet/Dry	Dry	

Table 2

Appendix 1 - Methodology

Hester-Dendy Macroinvertebrate Sampling

After researching all benthic macroinvertebrate sampling techniques for a wide range of physical and chemical characters, an artificial substrate such as a Hester-Dendy multiplate sampler would work best in lentic and lotic aquatic environs. It is the easiest quantitative method and accommodates a sufficient diversity of macroinvertebrates that a qualitative assessment should reflect water quality.[1]

Excerpt from EPA manual:

> "The multiple-plate samplers are usually colonized by a wide variety of invertebrates which have some means of mobility that are borne in the current. The organisms that colonize the artificial substrates are primarily aquatic insects, aquatic oligochaetes, crustaceans, cnidarians, turbellarians, bryozoans, and mollusks. The colonization of these organisms should be relatively equal in similar habitats and reflect the capacity of the water to support aquatic life. Although these samplers may exclude certain mollusks or worms, they collect a sufficient diversity of benthic fauna to be useful in assessing water quality."
>
> "Recovery techniques are critical for insuring collection of all organisms retained int eh sampler."
>
> "Uniform substrate type reduces the effects of substrate differences"
>
> "Optimum time for substrate colonization is 6 weeks for most water in the United States"

1 EPA Macroinvertebrate Field and laboratory Methods for Evaluating the Biological Integrity of Surface Waters, Nov 1990.

"Quantitatively comparable data can be obtained in environments from which it is virtually impossible to obtain samples with conventional devices."

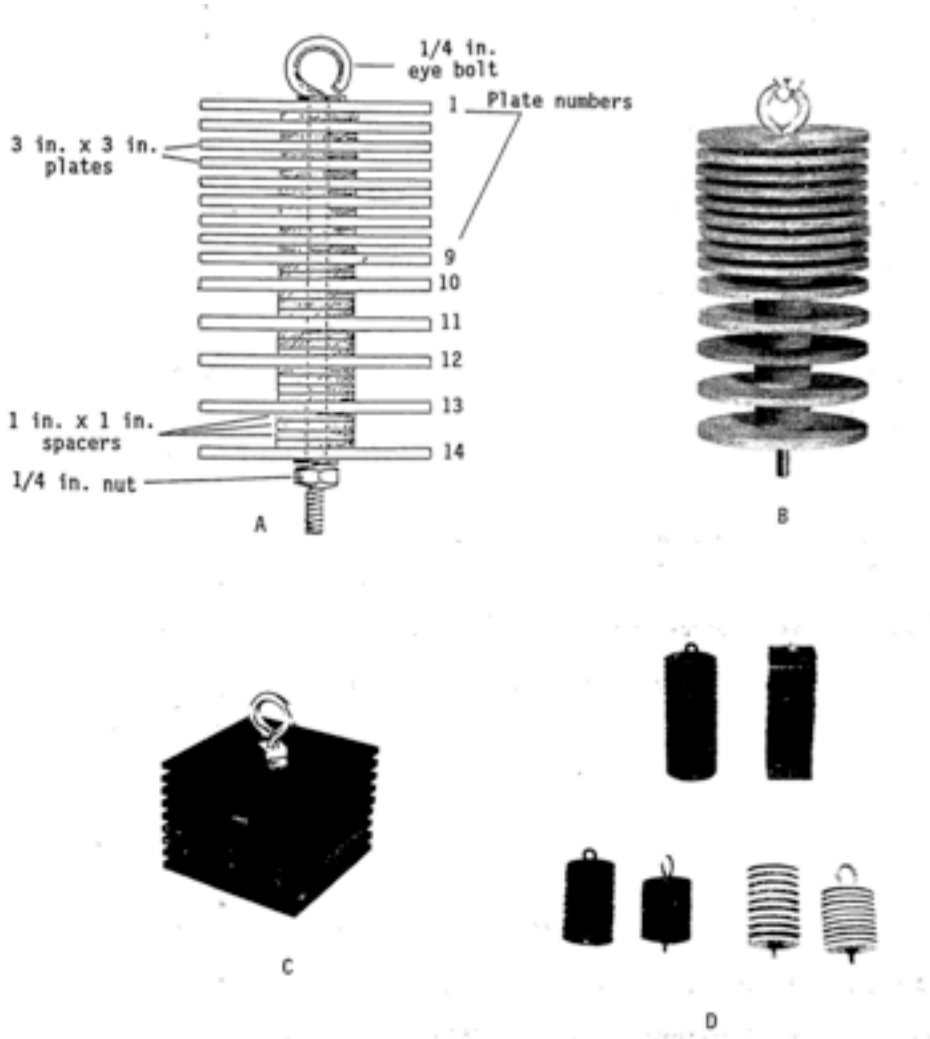


Figure 9. Artificial Substrate Samplers: (A) Schematic drawing of multiplate Sampler; (B) Typical round multiplate type; (C) Original Hester-Dendy multiplate, square design; (D) Jumbo and standard hardboard and porcelain multiplate designs

Place the Hester-Dendy (H-D) in the water so that:

1. If the water level falls the H-D will not become stranded on the shore
2. It is not in the middle of the stream to block navigation or become entangled with debris
3. Will remain submerged the entire duration of deployment (minimum 6 weeks).
4. Will be exposed to flow velocity of at least 0.2 feet per second for the duration of deployment.

5. Will be in a location that will be accessible should depth in the stream rise.
6. It will not be easily visible from bridges, known fishing locations, trails, etc. so as to minimize the chance of disturbance and or vandalism.
7. Place marker stakes or flagging tape along bank of stream to identify location of sampler for later retrieval.

Hester-Dendy samplers bolted to concrete block

Retrieval procedures

1. Enter the stream being sure not to disturb areas around H-D samplers
2. Place the 500-micron D-Frame net down stream of the H-D sampler to catch any organisms that may detach during removal of the H-D.
3. Carefully lift the H-D sampler.
4. Place the H-D sampler and any material from the net into a RubberMaid Tote.

Picking and Sorting of Macroinvertebrate Samples

This procedure explains how to process the macroinvertebrate samples that were collected in the field. Sample processing will occur at IRWA Headquarters.

Equipment	Equipment Use
#30 Sieve	Used to strain sample from the preservative (denatured alcohol).
Labeling tape and pencils	For labeling sample vials.
Small vials (3-4 per sample)	Used to store sorted or identified samples in.
Lighted magnifiers	Help to view samples.
Shallow (1” deep) white tray with numbered grid on the bottom. The grid should consist of 12 equal sized squares.	Used to select sub-sample.
4-compartment Petri plates	Holds sorted sample during picking procedure.
forceps with fine tips	Allows efficient picking and manipulating organisms.
Wash bottle with preservative (90% Denatured alcohol)	Used to preserve organisms.
Sample processing record	Record data results.
Squirt bottle / wash bottle with tap water	To help transfer organisms.
Pair of Dice	To select the random sub sample.

Step by Step procedure:

1. Obtain necessary equipment.
2. Obtain the sample you will be sorting. This sample should consist of the HD sampler in a sealed plastic tote of appropriate size.
3. Fill out the macroinvertebrate sample processing record form with site ID, replicate number (if applicable), sampling date, date sample picked and names of volunteers completing sample pick. The sampling date should be the date on the bag containing the sample.
4. Pour the field sample into a #30 sieve or sieve bucket and wash with water.
    1. Remove any rocks, twigs or leaves from the sample making sure that no organisms are attached to the material.
    2. If you have a lot of gravel or sand in the sample (more than half the sample jar) you can use the swirl technique to remove this material.
    3. Swirling the sample is accomplished by taking the sample from the #30 sieve and putting it into a 5 gallon bucket.
    4. Fill the bucket about half full with tap water and swirl the contents of the bucket. The lighter material, including the organisms tends to come to the top.
    5. Pour off the water and the material floating in it into a sieve, leaving the sand and gravel in the bucket.
    6. Repeat steps 2 and 3 until when you pour off the water no lighter material comes out of the bucket. You might have to complete this procedure 15 to 20 times to get all the lighter material out of the sand and gravel.
5. After you have removed any sediment, leaves and debris from the sample either by picking it out or using the swirl method, turn the sieve upside down over the tray and tap it several times to empty contents into the white tray with the grid on the bottom.
    1. Using the squirt bottle filled with tap water, flush any organisms remaining in the sieve into the sampling tray.
    2. Cover the bottom of the tray with about ¼" of tap water.
6. If stopping for the day, transfer the organisms from each compartment of the Petri plate to its own vial. Otherwise, begin sorting sample.
    1. The contents of several compartments of the Petri dish can be combined if there are only a few organisms or you think they will be easy to resort later.

2. After putting the organisms in the vials fill each one completely with 90% denatured alcohol and cap tightly.
3. Label each vial with the site ID, replicate number (if applicable), the date and the number of vials that you have for this sample. For example, if you have 3 vials they should be labeled 1 of 3, 2 of 3 and 3 of 3

Identifying specimens

We will be sorting samples by family and identifying specimens to their most detailed taxon.

To help us identify organisms we will use "Freshwater Macroinvertebrates of Northeastern North America, by B.A. Peckarsky, etal 1990 and Doug Smith's "Keys to the Freshwater Macroinvertebrates of Massachusetts", 1991

Step by Step procedure:

Equipment	Equipment Use
Labeling tape and pencils	For labeling sample vials.
Small vials (3-4 per sample)	Used to store sorted or identified samples in.
Dissecting scope (at least 40 power), 1 per work station	Magnifies organisms for easier identification.
4-compartment Petri plates (4 per work station)	Holds sorted samples.
Forceps with fine tips (2 per work station)	Allows efficient picking and manipulating of organisms.
Wash bottle with preservative (70% Denatured alcohol)	Used to preserve organisms.
Macrinvertebrate database	Record data results in this.
Taxonomy keys and references	Helps to identify organisms.
Plain white paper	Place under the Petri plates when on microscope or table for contrast.

1. Obtain necessary equipment.
2. Mark the bottom of several Petri plates with the station ID and replicate (if appropriate) of the sample you are working with.

3. Fill in the appropriate fields of the Benthic Macroinvertebrate Identification database with site #, replicate (if appropriate), date sampled, date of lab work (today), your name and the names of those you are working with.
4. Place the Petri dish with some of the sample under the dissection scope. Focus the scope until you can see one whole organism under the scope.
    1. Use the white paper to provide contrast by placing it under the Petri dish.
5. Use the keys to identify the major group for each organism. Place organisms identified into appropriately labeled compartments of Petri dishes.
6. Place organisms that you can't identify using the key into a separate Petri plate compartment labeled "unknowns".
7. If stopping for the day, transfer the organisms from each compartment of the Petri plate to its own vial. Otherwise, begin sorting sample by family.
    1. The contents of several compartments of the Petri dish can be combined if there are only a few organisms or you think they will be easy to resort later.
    2. After putting the organisms in the vials fill each one completely with 70% denatured alcohol and cap tightly.
    3. Label each vial with the site ID, replicate number (if applicable), the date, the group the samples belong to and the number of vials that you have for this sample. For example, if you have 3 vials they should be labeled 1 of 3, 2 of 3 and 3 of 3.

Keeping Records

Macroinvertebrate Sample Processing Record Using the attached form's format, catalog your samples by major groups, taxon and number of each. This is entered into a database for sorting data and generating reports.

Storing Samples

After putting the organisms in the vials fill each one completely with 70% denatured alcohol and cap tightly.

Label each vial with the site ID, replicate number (if applicable), the date, the group the samples belong to and the number of vials that you have for this sample. For example, if you have 3 vials they should be labeled 1 of 3, 2 of 3 and 3 of 3.

Store in cabinet. Check samples annually and replace alcohol.

IRWA Benthic Macroinvertebrate Identification Lab Sheet - Level 1

Site ID:	Name(s) of persons doing lab work:
Replicate #: (if applicable)	
Date Sampled:	Number of Squares Picked:
Date of Lab Work:	Total Number of Squares in Grid:

SELECTED MAJOR GROUPS	Density (D)
MAYFLIES (Ephemeroptera)	
STONEFLIES (Plecoptera)	
CADDISFLIES (Trichoptera)	
MIDGES (Chironomidae, Diptera)	
BEETLES (Coleoptera)	
BRISTLE WORMS (Oligochaeta)	
OTHER MAJOR GROUPS (Total from below)	
GRAND TOTAL (Selected Major Groups + Other Major Groups)	

OTHER MAJOR GROUPS	
CRANE FLIES (Tipulidae, Diptera)	
BLACK FLIES (Simuliidae, Diptera)	
OTHER TRUE FLIES:	
DRAGONFLIES/DAMSELFLIES (Odonata)	
DOBSONFLIES/ALDERFLIES (Megaloptera)	
SCUDS (Amphipoda)	
SOWBUGS (Isopoda)	
CRAYFISH (Decapoda)	
SNAILS/LIMPETS (Gastropoda)	
CLAMS/MUSSELS (Pelecypoda)	
LEECHES (Hirudinea)	
OTHER:	
OTHER:	
TOTAL: OTHER MAJOR GROUPS	

IRWA Benthic Macroinvertebrate Identification Lab Sheet - Level 2

Site ID:
Replicate #: (if applicable)
Date Sampled:
Date of Lab Work:

Name(s) of persons doing lab work:

Notes: T = Family Pollution Tolerance Values
FFG = Functional Feeding Groups:
SC = Scraper, PR = Predator, FC = Filtering Collector
SH = Shredder, GC = Gathering Collector

FAMILIES IN MAJOR GROUPS

EPHEMEROPTERA (Mayflies)

FAMILY	T	FFG	Density (D)
Baetidea	4	GC/SC	
Baetiscidae	3	GC	
Caenidae	7	GC	
Ephemerellidae	1	GC/SC	
Ephemeridae	4	GC	
Heptageniidae	4	SC/GC	
Leptophlebiidae	2	GC	
Metretopodidae	2	GC	
Oligoneuriidae	2	FC	
Polymitarcylidae	2	GC	
Potomanthidae	4	GC	
Siphlonuridae	7	GC	
Tricorythldae	4	GC	
Subtotal Ephemeroptera			

PLECOPTERA (Stoneflies)

FAMILY	T	FFG	Density (D)
Capniidae	1	SH	
Chloroperlidae	1	GC/PR	
Leuctridae	0	SH	
Nemouridae	2	SH	
Peltoperlidae	0	SH	
Perlidae	1	PR	
Perlodidae	2	PR	
Pteronarcyidae	0	SH	
Taeniopterygidae	2	SH	
Subtotal Plecoptera			

TRICHOPTERA (Caddisflies)

FAMILY	T	FFG	Density (D)
Brachycentridae	1	FC/CG	
Glossosomatidae	0	SC	
Helicopsychidae	3	SC	
Hydropsychidae	4	FC	
Hydroptilidae	4	GC/SC/SH	
Lepidostomatidae	1	SH	
Leptoceridae	4	GC/SH/PR	
Limnephilidae	4	SH/SC/GC	
Molanniidae	6	SC	
Odontoceridae	0	SH	
Philopotamidae	3	FC	
Phryganeidae	4	SH	
Polycentropodidae	6	FC/PR	
Psychomyiidae	2	GC	
Rhyacophilidae	0	PR	
Sericostomatidae	3	SH	
Subtotal Trichoptera			

DIPTERA (True Flies)

FAMILY	T	FFG	Density (D)
Athericidae	2	PR	
Blephariceridae	0	SC	
Ceratopogonidae	6	PR	
Chironomidae	7	ALL	
Empididae	6	PR	
Simuliidae	6	FC	
Tabanidae	6	PR	
Tipulidae	3	CG/PR/SH	
Subtotal Diptera			

IRWA Benthic Macroinvertebrate Identification Lab Sheet - Level 2

Site ID:	Name(s) of persons doing lab work:
Replicate #: (if applicable)	
Date Sampled:	
Date of Lab Work:	

Notes: T = Family Pollution Tolerance Values
FFG = Functional Feeding Groups:
SC = Scraper, PR = Predator, FC = Filtering Collector
SH = Shredder, GC = Gathering Collector

FAMILIES IN MAJOR GROUPS

MEGALOPTERA (Dobsonflies, alderflies, fishflies)

FAMILY	T	FFG	Density (D)
Corydalidae	0	PR	
Sialidae	4	PR	
Subtotal Megaloptera			

AMPHIPODA (Scuds)

FAMILY	T	FFG	Density (D)
Gammaridae	4	GC	
Talitridae	8	GC	
Subtotal Amphipoda			

LEPIDOPTERA (Moths)

FAMILY	T	FFG	Density (D)
Pyralidae	5	SH	
Subtotal Lepidoptera			

ISOPODA (Sowbugs)

FAMILY	T	FFG	Density (D)
Asellidae	8	SH/GC	
Subtotal Isopoda			

COLEOPTERA (Beetles)

FAMILY	T	FFG	Density (D)
Dryopidae	5	SC	
Elmidae	4	GC/SC/SH	
Psephenidae	4	SC	
Subtotal Coleoptera			

DECAPODA (Crayfish)

FAMILY	T	FFG	Density (D)
Cambaridae	6	GC	
Subtotal Decapoda			

ODONATA (Dragonflies, damselflies)

FAMILY	T	FFG	Density (D)
Aeshnidae	3	PR	
Calopterygidae	5	PR	
Coenagrionidae	9	PR	
Cordulegastridae	3	PR	
Corduliidae	5	PR	
Gomphidae	1	PR	
Lestidae	9	PR	
Libellulidae	9	PR	
Macromiidae	3	PR	
Subtotal Odonata			

OTHER (non-families w/tolerance values)

FAMILY	T	FFG	Density (D)
Class Oligochaeta	8	GC	
Class Hirudinea	10	PR	
Class Gastropoda	7	SC	
Class Pelecypoda	7	FC	
Unidentified			
Subtotal Other			

TOTAL NUMBER OF MACROINVERTS. IDENTIFIED	

2 of 2

Appendix 2 -Species List

MacroInvertebrates of the Ipswich River Watershed

Common Name	Genus species	Date	Locale	Observer
Water penny	Psephenus sp	4/28/1991	Ipswich River Bostik	P. Bell-
Water penny	Psephenus sp	12/7/2010	Ipswich River Bostik	JSM
Beetle	Unk.	12/7/2010	Ipswich River Bostik	JSM
Beetle	Unk.	12/7/2010	Bostik Pond	JSM
Caddisfly	Goera sp	4/28/1991	Ipswich River Bostik	P. Bell-
Caddisfly	Neophylax sp	4/28/1991	Ipswich River Bostik	P. Bell-
Caddisfly	Unk.	12/7/2010	Bostik Pond	JSM
Dobsonfly	Nigronia sp	4/28/1991	Ipswich River Bostik	P. Bell-
Giant water bug	Lethocerus sp	12/7/2010	Riverside	JSM
Black Quill	Paraleptophlebia sp	12/7/2010	Ipswich River Bostik	JSM
Light Cahill	Stenacron sp	12/7/2010	Ipswich River Bostik	JSM
Light Cahill	Stenacron sp	12/7/2010	Bostik Pond	JSM
Midge	Chironomid sp	12/7/2010	Ipswich River Bostik	JSM
Midge	Chironomid sp	12/7/2010	Bostik Pond	JSM
Midge	Chironomid sp	12/7/2010	Riverside	JSM
Ebony Jewelwing	Calopteryx sp	12/7/2010	Ipswich River Bostik	JSM
Dragonfly	Unk.	12/7/2010	Bostik Pond	JSM
Damselfly	Unk.	12/7/2010	Bostik Pond	JSM
Damselfly	Unk.	12/7/2010	Riverside	JSM
Amphipod	Gammarus SP	12/7/2010	Ipswich River Bostik	JSM
Amphipod	Gammarus sp	12/7/2010	Bostik Pond	JSM
Snail	Physella sp	12/7/2010	Ipswich River Bostik	JSM
Snail	Unk.	12/7/2010	Bostik Pond	JSM
Isopoda	Caecidotea sp	12/7/2010	Riverside	JSM

Species List for Bostik Area, 1991-2010.

Appendix 3 - IP06 Boston Street Riffle Site Assessment 2001[2]

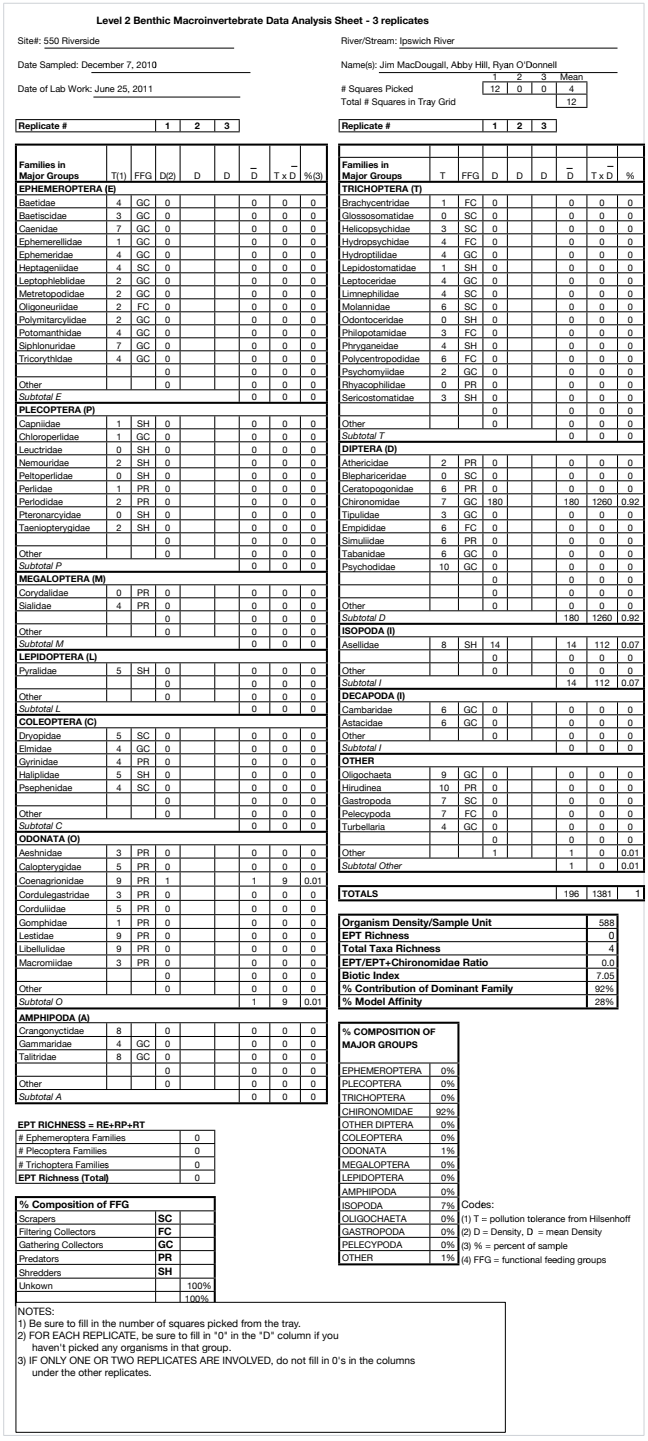
The Ipswich River is also sampled approximately 100 feet downstream of the Boston Street crossing of the Ipswich River in Middleton.

In 1999 habitat assessment of IP06 gave it a score of 67 percent. All primary habitat characteristics were in the good range. Secondary habitat characteristics were mostly excellent. Velocity/depth regime, bank/channel alteration, and sediment deposition had much lower scores of fair and poor. The percent similarity rating was 79.5 percent.

In 2001 overall habitat assessment remained fairly constant from 1999 with a score of 73 percent. Primary habitat characteristics averaged at good with embeddedness improving to excellent, velocity deteriorating to fair, and percent cobble remaining good. Secondary habitat characteristics were split excellent and good, with only bank vegetation falling to fair. The percent similarity was excellent with a rating of 92 percent.

[2] 2001 Ipswich River MacroInvertebrate Sampling file from IRWA office, no date, no author

Appendix 4 - Data Sheets 1999, 2001, 2010



Level 2 Benthic Macroinvertebrate Data Analysis Sheet - 3 replicates

Site#: 550 Riverside

River/Stream: Ipswich River

Date Sampled: December 7, 2010

Name(s): Jim MacDougall, Abby Hill, Ryan O'Donnell

Date of Lab Work: June 25, 2011

	1	2	3	Mean
# Squares Picked	12	0	0	4
Total # Squares in Tray Grid				12

Replicate #	1	2	3

Families in Major Groups	T(1)	FFG	D(2)	D	D	D	T x D	%(3)
EPHEMEROPTERA (E)								
Baetidae	4	GC	0			0	0	0
Baetiscidae	3	GC	0			0	0	0
Caenidae	7	GC	0			0	0	0
Ephemerellidae	1	GC	0			0	0	0
Ephemeridae	4	GC	0			0	0	0
Heptageniidae	4	SC	0			0	0	0
Leptophlebiidae	2	GC	0			0	0	0
Metretopodidae	2	GC	0			0	0	0
Oligoneuriidae	2	FC	0			0	0	0
Polymitarcyiidae	2	GC	0			0	0	0
Potomanthidae	4	GC	0			0	0	0
Siphlonuridae	7	GC	0			0	0	0
Tricorythidae	4	GC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal E						0	0	0
PLECOPTERA (P)								
Capniidae	1	SH	0			0	0	0
Chloroperlidae	1	GC	0			0	0	0
Leuctridae	0	SH	0			0	0	0
Nemouridae	2	SH	0			0	0	0
Peltoperlidae	0	SH	0			0	0	0
Perlidae	1	PR	0			0	0	0
Perlodidae	2	PR	0			0	0	0
Pteronarcyidae	0	SH	0			0	0	0
Taeniopterygidae	2	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal P						0	0	0
MEGALOPTERA (M)								
Corydalidae	0	PR	0			0	0	0
Sialidae	4	PR	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal M						0	0	0
LEPIDOPTERA (L)								
Pyralidae	5	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal L						0	0	0
COLEOPTERA (C)								
Dryopidae	5	SC	0			0	0	0
Elmidae	4	GC	0			0	0	0
Gyrinidae	4	PR	0			0	0	0
Haliplidae	5	SH	0			0	0	0
Psephenidae	4	SC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal C						0	0	0
ODONATA (O)								
Aeshnidae	3	PR	0			0	0	0
Calopterygidae	5	PR	0			0	0	0
Coenagrionidae	9	PR	1			1	9	0.01
Cordulegastridae	3	PR	0			0	0	0
Corduliidae	5	PR	0			0	0	0
Gomphidae	1	PR	0			0	0	0
Lestidae	9	PR	0			0	0	0
Libellulidae	9	PR	0			0	0	0
Macromiidae	3	PR	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal O						1	9	0.01
AMPHIPODA (A)								
Crangonyctidae	8		0			0	0	0
Gammaridae	4	GC	0			0	0	0
Talitridae	8	GC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal A						0	0	0

Families in Major Groups	T	FFG	D	D	D	D	T x D	%
TRICHOPTERA (T)								
Brachycentridae	1	FC	0			0	0	0
Glossosomatidae	0	SC	0			0	0	0
Helicopsychidae	3	SC	0			0	0	0
Hydropsychidae	4	FC	0			0	0	0
Hydroptilidae	4	GC	0			0	0	0
Lepidostomatidae	1	SH	0			0	0	0
Leptoceridae	4	GC	0			0	0	0
Limnephilidae	4	SC	0			0	0	0
Molannidae	6	SC	0			0	0	0
Odontoceridae	0	SH	0			0	0	0
Philopotamidae	3	FC	0			0	0	0
Phryganeidae	4	SH	0			0	0	0
Polycentropodidae	6	FC	0			0	0	0
Psychomyiidae	2	GC	0			0	0	0
Rhyacophilidae	0	PR	0			0	0	0
Sericostomatidae	3	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal T						0	0	0
DIPTERA (D)								
Athericidae	2	PR	0			0	0	0
Blephariceridae	0	SC	0			0	0	0
Ceratopogonidae	6	PR	0			0	0	0
Chironomidae	7	GC	180			180	1260	0.92
Tipulidae	3	GC	0			0	0	0
Empididae	6	FC	0			0	0	0
Simuliidae	6	PR	0			0	0	0
Tabanidae	6	GC	0			0	0	0
Psychodidae	10	GC	0			0	0	0
			0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal D						180	1260	0.92
ISOPODA (I)								
Asellidae	8	SH	14			14	112	0.07
			0			0	0	0
Other			0			0	0	0
Subtotal I						14	112	0.07
DECAPODA (I)								
Cambaridae	6	GC	0			0	0	0
Astacidae	6	GC	0			0	0	0
Other			0			0	0	0
Subtotal I						0	0	0
OTHER								
Oligochaeta	9	GC	0			0	0	0
Hirudinea	10	PR	0			0	0	0
Gastropoda	7	SC	0			0	0	0
Pelecypoda	7	FC	0			0	0	0
Turbellaria	4	GC	0			0	0	0
			0			0	0	0
Other			1			1	0	0.01
Subtotal Other						1	0	0.01
TOTALS						196	1381	1

Organism Density/Sample Unit	588
EPT Richness	0
Total Taxa Richness	4
EPT/EPT+Chironomidae Ratio	0.0
Biotic Index	7.05
% Contribution of Dominant Family	92%
% Model Affinity	28%

EPT RICHNESS = RE+RP+RT	
# Ephemeroptera Families	0
# Plecoptera Families	0
# Trichoptera Families	0
EPT Richness (Total)	0

% Composition of FFG		
Scrapers	**SC**	
Filtering Collectors	**FC**	
Gathering Collectors	**GC**	
Predators	**PR**	
Shredders	**SH**	
Unkown		100%
		100%

% COMPOSITION OF MAJOR GROUPS	
EPHEMEROPTERA	0%
PLECOPTERA	0%
TRICHOPTERA	0%
CHIRONOMIDAE	92%
OTHER DIPTERA	0%
COLEOPTERA	0%
ODONATA	1%
MEGALOPTERA	0%
LEPIDOPTERA	0%
AMPHIPODA	0%
ISOPODA	7%
OLIGOCHAETA	0%
GASTROPODA	0%
PELECYPODA	0%
OTHER	1%

Codes:
(1) T = pollution tolerance from Hilsenhoff
(2) D = Density, D = mean Density
(3) % = percent of sample
(4) FFG = functional feeding groups

NOTES:
1) Be sure to fill in the number of squares picked from the tray.
2) FOR EACH REPLICATE, be sure to fill in "0" in the "D" column if you haven't picked any organisms in that group.
3) IF ONLY ONE OR TWO REPLICATES ARE INVOLVED, do not fill in 0's in the columns under the other replicates.

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Level 2 Benthic Macroinvertebrate Data Analysis Sheet - 3 replicates

Site#: 565 Bostik Pond

River/Stream: Ipswich River

Date Sampled: December 7, 2010

Name(s): Jim MacDougall, Abby Hill, Ryan O'Donnell

Date of Lab Work: June 25, 2011

	1	2	3	Mean
# Squares Picked	12	0	0	4
Total # Squares in Tray Grid				12

Replicate #	1	2	3

Families in Major Groups	T(1)	FFG	D(2)	D	D	D	T x D	%(3)
EPHEMEROPTERA (E)								
Baetidae	4	GC	0			0	0	0
Baetiscidae	3	GC	0			0	0	0
Caenidae	7	GC	0			0	0	0
Ephemerellidae	1	GC	0			0	0	0
Ephemeridae	4	GC	0			0	0	0
Heptageniidae	4	SC	12			12	48	0.31
Leptophlebiidae	2	GC	2			2	4	0.05
Metretopodidae	2	GC	0			0	0	0
Oligoneuriidae	2	FC	0			0	0	0
Polymitarcyiidae	2	GC	0			0	0	0
Potomanthidae	4	GC	0			0	0	0
Siphlonuridae	7	GC	0			0	0	0
Tricorythidae	4	GC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal E						14	52	0.36
PLECOPTERA (P)								
Capniidae	1	SH	0			0	0	0
Chloroperlidae	1	GC	0			0	0	0
Leuctridae	0	SH	0			0	0	0
Nemouridae	2	SH	0			0	0	0
Peltoperlidae	0	SH	0			0	0	0
Perlidae	1	PR	0			0	0	0
Perlodidae	2	PR	0			0	0	0
Pteronarcyidae	0	SH	0			0	0	0
Taeniopterygidae	2	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal P						0	0	0
MEGALOPTERA (M)								
Corydalidae	0	PR	0			0	0	0
Sialidae	4	PR	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal M						0	0	0
LEPIDOPTERA (L)								
Pyralidae	5	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal L						0	0	0
COLEOPTERA (C)								
Dryopidae	5	SC	0			0	0	0
Elmidae	4	GC	2			2	8	0.05
Gyrinidae	4	PR	0			0	0	0
Haliplidae	5	SH	0			0	0	0
Psephenidae	4	SC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal C						2	8	0.05
ODONATA (O)								
Aeshnidae	3	PR	0			0	0	0
Calopterygidae	5	PR	0			0	0	0
Coenagrionidae	9	PR	10			10	90	0.26
Cordulegastridae	3	PR	0			0	0	0
Corduliidae	5	PR	0			0	0	0
Gomphidae	1	PR	2			2	2	0.05
Lestidae	9	PR	0			0	0	0
Libellulidae	9	PR	0			0	0	0
Macromiidae	3	PR	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal O						12	92	0.31
AMPHIPODA (A)								
Crangonyctidae	8		0			0	0	0
Gammaridae	4	GC	1			1	4	0.03
Talitridae	8	GC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal A						1	4	0.03

Replicate #	1	2	3

Families in Major Groups	T	FFG	D	D	D	D	T x D	%
TRICHOPTERA (T)								
Brachycentridae	1	FC	0			0	0	0
Glossosomatidae	0	SC	0			0	0	0
Helicopsychidae	3	SC	0			0	0	0
Hydropsychidae	4	FC	3			3	12	0.08
Hydroptilidae	4	GC	0			0	0	0
Lepidostomatidae	1	SH	0			0	0	0
Leptoceridae	4	GC	0			0	0	0
Limnephilidae	4	SC	0			0	0	0
Molannidae	6	SC	0			0	0	0
Odontoceridae	0	SH	0			0	0	0
Philopotamidae	3	FC	0			0	0	0
Phryganeidae	4	SH	0			0	0	0
Polycentropodidae	6	FC	0			0	0	0
Psychomyiidae	2	GC	0			0	0	0
Rhyacophilidae	0	PR	0			0	0	0
Sericostomatidae	3	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal T						3	12	0.08
DIPTERA (D)								
Athericidae	2	PR	0			0	0	0
Blephariceridae	0	SC	0			0	0	0
Ceratopogonidae	6	PR	0			0	0	0
Chironomidae	7	GC	6			6	42	0.15
Tipulidae	3	GC	0			0	0	0
Empididae	6	FC	0			0	0	0
Simuliidae	6	PR	0			0	0	0
Tabanidae	6	GC	0			0	0	0
Psychodidae	10	GC	0			0	0	0
			0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal D						6	42	0.15
ISOPODA (I)								
Asellidae	8	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal I						0	0	0
DECAPODA (I)								
Carnbaridae	6	GC	0			0	0	0
Astacidae	6	GC	0			0	0	0
Other			0			0	0	0
Subtotal I						0	0	0
OTHER								
Oligochaeta	9	GC	0			0	0	0
Hirudinea	10	PR	0			0	0	0
Gastropoda	7	SC	1			1	7	0.03
Pelecypoda	7	FC	0			0	0	0
Turbellaria	4	GC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal Other						1	7	0.03

TOTALS	39	217	1

Organism Density/Sample Unit	117
EPT Richness	3
Total Taxa Richness	9
EPT/EPT+Chironomidae Ratio	0.7
Biotic Index	5.56
% Contribution of Dominant Family	31%
% Model Affinity	74%

EPT RICHNESS = RE+RP+RT

# Ephemeroptera Families	2
# Plecoptera Families	0
# Trichoptera Families	1
EPT Richness (Total)	3

% Composition of FFG		
Scrapers	**SC**	
Filtering Collectors	**FC**	
Gathering Collectors	**GC**	
Predators	**PR**	
Shredders	**SH**	
Unkown		100%
		100%

% COMPOSITION OF MAJOR GROUPS	
EPHEMEROPTERA	36%
PLECOPTERA	0%
TRICHOPTERA	8%
CHIRONOMIDAE	15%
OTHER DIPTERA	0%
COLEOPTERA	5%
ODONATA	31%
MEGALOPTERA	0%
LEPIDOPTERA	0%
AMPHIPODA	3%
ISOPODA	0%
OLIGOCHAETA	0%
GASTROPODA	3%
PELECYPODA	0%
OTHER	0%

Codes:
(1) T = pollution tolerance from Hilsenhoff
(2) D = Density, D = mean Density
(3) % = percent of sample
(4) FFG = functional feeding groups

NOTES:
1) Be sure to fill in the number of squares picked from the tray.
2) FOR EACH REPLICATE, be sure to fill in "0" in the "D" column if you haven't picked any organisms in that group.
3) IF ONLY ONE OR TWO REPLICATES ARE INVOLVED, do not fill in 0's in the columns under the other replicates.

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Level 2 Benthic Macroinvertebrate Data Analysis Sheet - 3 replicates

Site#: IP06

River/Stream: Ipswich River

Date Sampled: 10/17/01

Name(s): Bonny P.

Date of Lab Work: 12/12/01

	1	2	3	Mean
# Squares Picked	3			3
Total # Squares in Tray Grid				12

Replicate #	1	2	3

Families in Major Groups	T(1)	FFG	D(2)	D	D	D̄	T x D̄	%(3)
EPHEMEROPTERA (E)								
Baetidae	4	GC					0	0
Baetiscidae	3	GC					0	0
Caenidae	7	GC					0	0
Ephemerellidae	1	GC					0	0
Ephemeridae	4	GC					0	0
Heptageniidae	4	SC					0	0
Leptophleblidae	2	GC					0	0
Metretopodidae	2	GC					0	0
Oligoneuriidae	2	FC					0	0
Polymitarcyiidae	2	GC					0	0
Potomanthidae	4	GC					0	0
Siphlonuridae	7	GC					0	0
Tricorythidae	4	GC					0	0
							0	0
Other							0	0
Subtotal E						0	0	0
PLECOPTERA (P)								
Capniidae	1	SH					0	0
Chloroperlidae	1	GC					0	0
Leuctridae	0	SH					0	0
Nemouridae	2	SH					0	0
Peltoperlidae	0	SH					0	0
Perlidae	1	PR				1	1	0.01
Perlodidae	2	PR					0	0
Pteronarcyidae	0	SH				1	0	0.01
Taeniopterygidae	2	SH					0	0
							0	0
Other							0	0
Subtotal P						2	1	0.01
MEGALOPTERA (M)								
Corydalidae	0	PR				1	0	0.01
Sialidae	4	PR					0	0
							0	0
Other							0	0
Subtotal M							0	0
LEPIDOPTERA (L)								
Pyralidae	5	SH					0	0
							0	0
Other							0	0
Subtotal L							0	0
COLEOPTERA (C)								
Dryopidae	5	SC					0	0
Elmidae	4	GC				3	12	0.02
Gyrinidae	4	PR					0	0
Haliplidae	5	SH					0	0
Psephenidae	4	SC				5	20	0.03
							0	0
Other							0	0
Subtotal C						8	32	0.05
ODONATA (O)								
Aeshnidae	3	PR					0	0
Calopterygidae	5	PR					0	0
Coenagrionidae	9	PR					0	0
Cordulegastridae	3	PR					0	0
Corduliidae	5	PR					0	0
Gomphidae	1	PR					0	0
Lestidae	9	PR					0	0
Libellulidae	9	PR					0	0
Macromiidae	3	PR					0	0
							0	0
Other							0	0
Subtotal O						0	0	0
AMPHIPODA (A)								
Crangonyctidae	8					33	264	0.19
Gammaridae	4	GC				72	288	0.42
Talitridae	8	GC					0	0
							0	0
Other						5	0	0.03
Subtotal A						77	288	0.45

Replicate #	1	2	3

Families in Major Groups	T	FFG	D	D	D	D̄	T x D̄	%
TRICHOPTERA (T)								
Brachycentridae	1	FC					0	0
Glossosomatidae	0	SC					0	0
Helicopsychidae	3	SC					0	0
Hydropsychidae	4	FC				66	264	0.39
Hydroptilidae	4	GC					0	0
Lepidostomatidae	1	SH					0	0
Leptoceridae	4	GC					0	0
Limnephilidae	4	SC					0	0
Molannidae	6	SC					0	0
Odontoceridae	0	SH					0	0
Philopotamidae	3	FC				7	21	0.04
Phryganeidae	4	SH					0	0
Polycentropodidae	6	FC				4	24	0.02
Psychomyiidae	2	GC					0	0
Rhyacophilidae	0	PR					0	0
Sericostomatidae	3	SH					0	0
							0	0
Other							0	0
Subtotal T						77	309	0.45
DIPTERA (D)								
Athericidae	2	PR					0	0
Blephariceridae	0	SC					0	0
Ceratopogonidae	6	PR					0	0
Chironomidae	7	GC				1	7	0.01
Tipulidae	3	GC				1	3	0.01
Empididae	6	FC					0	0
Simuliidae	6	PR					0	0
Tabanidae	6	GC					0	0
Psychodidae	10	GC					0	0
							0	0
							0	0
Other							0	0
Subtotal D						2	10	0.01
ISOPODA (I)								
Asellidae	8	SH					0	0
							0	0
Other							0	0
Subtotal I							0	0
DECAPODA (I)								
Cambaridae	6	GC					0	0
Astacidae	6	GC					0	0
Other							0	0
Subtotal I							0	0
OTHER								
Oligochaeta	9	GC				1	9	0.01
Hirudinea	10	PR				2	20	0.01
Gastropoda	7	SC					0	0
Pelecypoda	7	FC					0	0
Turbellaria	4	GC					0	0
							0	0
Other						1	0	0.01
Subtotal Other						4	29	0.02

TOTALS	170	669	1

Organism Density/Sample Unit	680
EPT Richness	5
Total Taxa Richness	16
EPT/EPT+Chironomidae Ratio	1.0
Biotic Index	3.94
% Contribution of Dominant Family	42%
% Model Affinity	27%

EPT RICHNESS = RE+RP+RT

# Ephemeroptera Families	0
# Plecoptera Families	2
# Trichoptera Families	3
EPT Richness (Total)	5

% Composition of FFG		
Scrapers	**SC**	3%
Filtering Collectors	**FC**	45%
Gathering Collectors	**GC**	46%
Predators	**PR**	2%
Shredders	**SH**	1%
Unkown		3%
		100%

% COMPOSITION OF MAJOR GROUPS	
EPHEMEROPTERA	0%
PLECOPTERA	1%
TRICHOPTERA	45%
CHIRONOMIDAE	1%
OTHER DIPTERA	1%
COLEOPTERA	5%
ODONATA	0%
MEGALOPTERA	0%
LEPIDOPTERA	0%
AMPHIPODA	45%
ISOPODA	0%
OLIGOCHAETA	1%
GASTROPODA	0%
PELECYPODA	0%
OTHER	2%

Codes:
(1) T = pollution tolerance from Hilsenhoff
(2) D = Density, D = mean Density
(3) % = percent of sample
(4) FFG = functional feeding groups

NOTES:
1) Be sure to fill in the number of squares picked from the tray.
2) FOR EACH REPLICATE, be sure to fill in "0" in the "D" column if you haven't picked any organisms in that group.
3) IF ONLY ONE OR TWO REPLICATES ARE INVOLVED, do not fill in 0's in the columns under the other replicates.

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Level 2 Benthic Macroinvertebrate Data Analysis Sheet - 3 replicates

Site#: IP06

River/Stream: Ipswich River

Date Sampled: 11/7/99

Name(s): Emily King, Joan and Ben Bogel

Date of Lab Work: 11/29/99

	1	2	3	Mean
# Squares Picked	3			3
Total # Squares in Tray Grid				12

Replicate #			1		2		3			
Families in Major Groups	T(1)	FFG	D(2)	D	D	D	T x D	%(3)		
EPHEMEROPTERA (E)										
Baetidae	4	GC					0			
Baetiscidae	3	GC					0			
Caenidae	7	GC					0			
Ephemerellidae	1	GC					0			
Ephemeridae	4	GC					0			
Heptageniidae	4	SC					0			
Leptophlebiidae	2	GC					0			
Metretopodidae	2	GC					0			
Oligoneuriidae	2	FC					0			
Polymitarcyiidae	2	GC					0			
Potomanthidae	4	GC					0			
Siphlonuridae	7	GC					0			
Tricorythidae	4	GC					0			
							0			
Other							0			
Subtotal E						0	0	0		
PLECOPTERA (P)										
Capniidae	1	SH					0			
Chloroperlidae	1	GC					0			
Leuctridae	0	SH					0			
Nemouridae	2	SH					0			
Peltoperlidae	0	SH					0			
Perlidae	1	PR					0			
Perlodidae	2	PR				330	660			
Pteronarcyidae	0	SH					0			
Taeniopterygidae	2	SH					0			
							0			
Other							0			
Subtotal P						330	660	0.86		
MEGALOPTERA (M)										
Corydalidae	0	PR					0			
Sialidae	4	PR					0			
							0			
Other							0			
Subtotal M						0	0	0		
LEPIDOPTERA (L)										
Pyralidae	5	SH					0			
							0			
Other							0			
Subtotal L						0	0	0		
COLEOPTERA (C)										
Dryopidae	5	SC					0			
Elmidae	4	GC					0			
Gyrinidae	4	PR					0			
Haliplidae	5	SH					0			
Psephenidae	4	SC				1	4			
							0			
Other							0			
Subtotal C						1	4	0		
ODONATA (O)										
Aeshnidae	3	PR					0			
Calopterygidae	5	PR					0			
Coenagrionidae	9	PR					0			
Cordulegastridae	3	PR					0			
Corduliidae	5	PR					0			
Gomphidae	1	PR					0			
Lestidae	9	PR					0			
Libellulidae	9	PR					0			
Macromiidae	3	PR					0			
							0			
Other							0			
Subtotal O						0	0	0		
AMPHIPODA (A)										
Crangonyctidae	8						0			
Gammaridae	4	GC				42	168			
Talitridae	8	GC					0			
							0			
Other							0			
Subtotal A						42	168	0.11		

Replicate #			1		2		3			
Families in Major Groups	T	FFG	D		D	D	D	T x D	%	
TRICHOPTERA (T)										
Brachycentridae	1	FC						0		
Glossosomatidae	0	SC						0		
Helicopsychidae	3	SC						0		
Hydropsychidae	4	FC					6	24		
Hydroptilidae	4	GC						0		
Lepidostomatidae	1	SH						0		
Leptoceridae	4	GC						0		
Limnephilidae	4	SC						0		
Molannidae	6	SC						0		
Odontoceridae	0	SH						0		
Philopotamidae	3	FC					2	6		
Phryganeidae	4	SH						0		
Polycentropodidae	6	FC						0		
Psychomyiidae	2	GC						0		
Rhyacophilidae	0	PR						0		
Sericostomatidae	3	SH						0		
								0		
Other								0		
Subtotal T							8	30	0.02	
DIPTERA (D)										
Athericidae	2	PR						0		
Blephariceridae	0	SC						0		
Ceratopogonidae	6	PR						0		
Chironomidae	7	GC						0		
Tipulidae	3	GC						0		
Empididae	6	FC						0		
Simuliidae	6	PR					1	6		
Tabanidae	6	GC						0		
Psychodidae	10	GC						0		
								0		
								0		
Other								0		
Subtotal D							1	6	0	
ISOPODA (I)										
Asellidae	8	SH						0		
								0		
Other								0		
Subtotal I							0	0	0	
DECAPODA (I)										
Cambaridae	6	GC						0		
Astacidae	6	GC						0		
Other								0		
Subtotal I							0	0	0	
OTHER										
Oligochaeta	9	GC						0		
Hirudinea	10	PR						0		
Gastropoda	7	SC						0		
Pelecypoda	7	FC						0		
Turbellaria	4	GC						0		
								0		
Other								0		
Subtotal Other							0	0	0	

TOTALS	382	868	1

Organism Density/Sample Unit	1528
EPT Richness	3
Total Taxa Richness	6
EPT/EPT+Chironomidae Ratio	1.0
Biotic Index	2.27
% Contribution of Dominant Family	0%
% Model Affinity	17%

EPT RICHNESS = RE+RP+RT

# Ephemeroptera Families	0
# Plecoptera Families	1
# Trichoptera Families	2
EPT Richness (Total)	3

% Composition of FFG		
Scrapers	**SC**	0%
Filtering Collectors	**FC**	2%
Gathering Collectors	**GC**	11%
Predators	**PR**	87%
Shredders	**SH**	0%
Unkown		0%
		100%

% COMPOSITION OF MAJOR GROUPS	
EPHEMEROPTERA	0%
PLECOPTERA	86%
TRICHOPTERA	2%
CHIRONOMIDAE	0%
OTHER DIPTERA	0%
COLEOPTERA	0%
ODONATA	0%
MEGALOPTERA	0%
LEPIDOPTERA	0%
AMPHIPODA	11%
ISOPODA	0%
OLIGOCHAETA	0%
GASTROPODA	0%
PELECYPODA	0%
OTHER	0%

Codes:
(1) T = pollution tolerance from Hilsenhoff
(2) D = Density, D = mean Density
(3) % = percent of sample
(4) FFG = functional feeding groups

NOTES:
1) Be sure to fill in the number of squares picked from the tray.
2) FOR EACH REPLICATE, be sure to fill in "0" in the "D" column if you haven't picked any organisms in that group.
3) IF ONLY ONE OR TWO REPLICATES ARE INVOLVED, do not fill in 0's in the columns under the other replicates.

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Level 2 Benthic Macroinvertebrate Data Analysis Sheet - 3 replicates

Site#: IP06 Boston ST, Middleton

River/Stream: Ipswich River

Date Sampled: December 7, 2010

Name(s): Jim MacDougall, Abby Hill, Ryan O'Donnell

Date of Lab Work: June 25, 2011

	1	2	3	Mean
# Squares Picked	12	0	0	4
Total # Squares in Tray Grid				12

Replicate #	1	2	3

Families in Major Groups	T(1)	FFG	D(2)	D	D	D	T x D	%(3)
EPHEMEROPTERA (E)								
Baetidae	4	GC	0			0	0	0
Baetiscidae	3	GC	0			0	0	0
Caenidae	7	GC	0			0	0	0
Ephemerellidae	1	GC	0			0	0	0
Ephemeridae	4	GC	0			0	0	0
Heptageniidae	4	SC	7			7	28	0.08
Leptophlebiidae	2	GC	2			2	4	0.02
Metretopodidae	2	GC	0			0	0	0
Oligoneuriidae	2	FC	0			0	0	0
Polymitarcyiidae	2	GC	0			0	0	0
Potomanthidae	4	GC	0			0	0	0
Siphlonuridae	7	GC	0			0	0	0
Tricorythidae	4	GC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal E						9	32	0.1
PLECOPTERA (P)								
Capniidae	1	SH	0			0	0	0
Chloroperlidae	1	GC	0			0	0	0
Leuctridae	0	SH	0			0	0	0
Nemouridae	2	SH	0			0	0	0
Peltoperlidae	0	SH	0			0	0	0
Perlidae	1	PR	0			0	0	0
Perlodidae	2	PR	0			0	0	0
Pteronarcyidae	0	SH	0			0	0	0
Taeniopterygidae	2	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal P						0	0	0
MEGALOPTERA (M)								
Corydalidae	0	PR	0			0	0	0
Sialidae	4	PR	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal M						0	0	0
LEPIDOPTERA (L)								
Pyralidae	5	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal L						0	0	0
COLEOPTERA (C)								
Dryopidae	5	SC	0			0	0	0
Elmidae	4	GC	13			13	52	0.14
Gyrinidae	4	PR	0			0	0	0
Haliplidae	5	SH	0			0	0	0
Psephenidae	4	SC	4			4	16	0.04
			0			0	0	0
Other			0			0	0	0
Subtotal C						17	68	0.18
ODONATA (O)								
Aeshnidae	3	PR	0			0	0	0
Calopterygidae	5	PR	1			1	5	0.01
Coenagrionidae	9	PR	0			0	0	0
Cordulegastridae	3	PR	0			0	0	0
Corduliidae	5	PR	0			0	0	0
Gomphidae	1	PR	0			0	0	0
Lestidae	9	PR	0			0	0	0
Libellulidae	9	PR	0			0	0	0
Macromiidae	3	PR	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal O						1	5	0.01
AMPHIPODA (A)								
Crangonyctidae	8		0			0	0	0
Gammaridae	4	GC	4			4	16	0.04
Talitridae	8	GC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal A						4	16	0.04

Replicate #	1	2	3

Families in Major Groups	T	FFG	D	D	D	D	T x D	%
TRICHOPTERA (T)								
Brachycentridae	1	FC	0			0	0	0
Glossosomatidae	0	SC	0			0	0	0
Helicopsychidae	3	SC	0			0	0	0
Hydropsychidae	4	FC	0			0	0	0
Hydroptilidae	4	GC	0			0	0	0
Lepidostomatidae	1	SH	0			0	0	0
Leptoceridae	4	GC	0			0	0	0
Limnephilidae	4	SC	0			0	0	0
Molannidae	6	SC	0			0	0	0
Odontoceridae	0	SH	0			0	0	0
Philopotamidae	3	FC	0			0	0	0
Phryganeidae	4	SH	0			0	0	0
Polycentropodidae	6	FC	0			0	0	0
Psychomyiidae	2	GC	0			0	0	0
Rhyacophilidae	0	PR	0			0	0	0
Sericostomatidae	3	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal T						0	0	0
DIPTERA (D)								
Athericidae	2	PR	0			0	0	0
Blephariceridae	0	SC	0			0	0	0
Ceratopogonidae	6	PR	0			0	0	0
Chironomidae	7	GC	60			60	420	0.65
Tipulidae	3	GC	0			0	0	0
Empididae	6	FC	0			0	0	0
Simuliidae	6	PR	0			0	0	0
Tabanidae	6	GC	0			0	0	0
Psychodidae	10	GC	0			0	0	0
			0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal D						60	420	0.65
ISOPODA (I)								
Asellidae	8	SH	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal I						0	0	0
DECAPODA (I)								
Carnbaridae	6	GC	0			0	0	0
Astacidae	6	GC	0			0	0	0
Other			0			0	0	0
Subtotal I						0	0	0
OTHER								
Oligochaeta	9	GC	0			0	0	0
Hirudinea	10	PR	0			0	0	0
Gastropoda	7	SC	1			1	7	0.01
Pelecypoda	7	FC	0			0	0	0
Turbellaria	4	GC	0			0	0	0
			0			0	0	0
Other			0			0	0	0
Subtotal Other						1	7	0.01

TOTALS	92	548	1

Organism Density/Sample Unit	276
EPT Richness	2
Total Taxa Richness	8
EPT/EPT+Chironomidae Ratio	0.1
Biotic Index	5.96
% Contribution of Dominant Family	65%
% Model Affinity	46%

EPT RICHNESS = RE+RP+RT

# Ephemeroptera Families	2
# Plecoptera Families	0
# Trichoptera Families	0
EPT Richness (Total)	2

% Composition of FFG		
Scrapers	**SC**	
Filtering Collectors	**FC**	
Gathering Collectors	**GC**	
Predators	**PR**	
Shredders	**SH**	
Unkown		100%
		100%

% COMPOSITION OF MAJOR GROUPS	
EPHEMEROPTERA	10%
PLECOPTERA	0%
TRICHOPTERA	0%
CHIRONOMIDAE	65%
OTHER DIPTERA	0%
COLEOPTERA	18%
ODONATA	1%
MEGALOPTERA	0%
LEPIDOPTERA	0%
AMPHIPODA	4%
ISOPODA	0%
OLIGOCHAETA	0%
GASTROPODA	1%
PELECYPODA	0%
OTHER	0%

Codes:
(1) T = pollution tolerance from Hilsenhoff
(2) D = Density, D = mean Density
(3) % = percent of sample
(4) FFG = functional feeding groups

NOTES:
1) Be sure to fill in the number of squares picked from the tray.
2) FOR EACH REPLICATE, be sure to fill in "0" in the "D" column if you haven't picked any organisms in that group.
3) IF ONLY ONE OR TWO REPLICATES ARE INVOLVED, do not fill in 0's in the columns under the other replicates.

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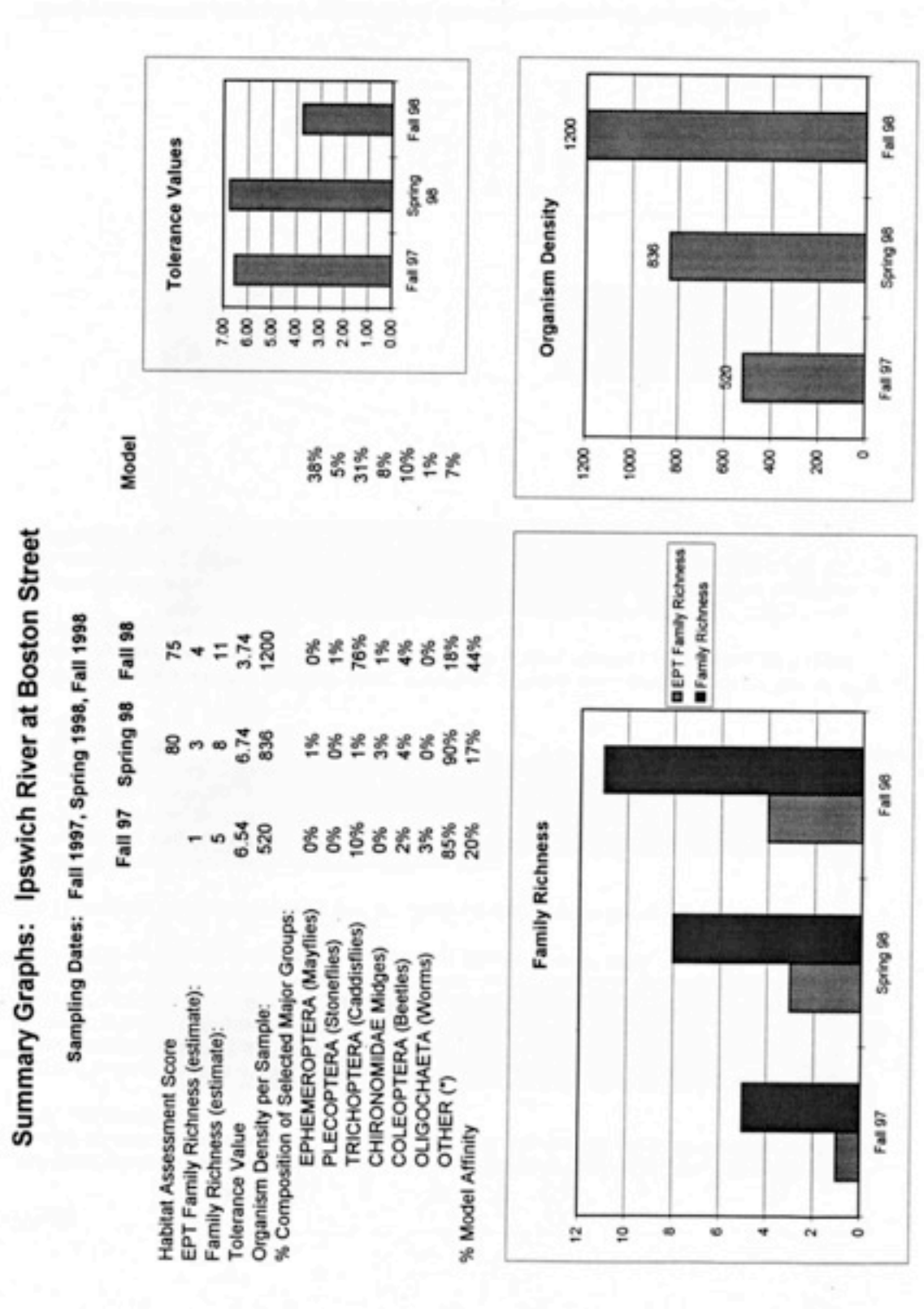
Appendix 5 - Summary Graphs for 1997-1998 Sampling



Summary Graphs: Ipswich River at Boston Street

Sampling Dates: Fall 1997, Spring 1998, Fall 1998

	Fall 97	Spring 98	Fall 98	Model
Habitat Assessment Score		80	75	
EPT Family Richness (estimate):	1	3	4	
Family Richness (estimate):	5	8	11	
Tolerance Value	6.54	6.74	3.74	
Organism Density per Sample:	520	836	1200	
% Composition of Selected Major Groups:				
EPHEMEROPTERA (Mayflies)	0%	1%	0%	38%
PLECOPTERA (Stoneflies)	0%	0%	1%	5%
TRICHOPTERA (Caddisflies)	10%	1%	76%	31%
CHIRONOMIDAE Midges)	0%	3%	1%	8%
COLEOPTERA (Beetles)	2%	4%	4%	10%
OLIGOCHAETA (Worms)	3%	0%	0%	1%
OTHER (*)	85%	90%	18%	7%
% Model Affinity	20%	17%	44%	

References

"Quality Assurance Project Plan For the Ipswich River Watershed Assoc. Macroinvertebrate Sampling Program", 2006, , IRWA files.

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"Macroinvertebrate Data Report for Fall 1997, Spring 1998, and Fall 1998 Samplings", IRWA files.

Geoff Dates & Jack Byrne, "Living Waters - Using Benthic Macroinvertebrates and Habitat to Assess Your River's Health", River Watch, 1997.

Jim MacDougall, Ipswich River Macroinvertebrate Samples database, 1991.

Jesse Darling, " Macroinvertebrate Data Report for 1999 and 2001", IRWA files.

"Freshwater Macroinvertebrates of Northeastern North America, by B.A. Peckarsky, etal 1990

Doug Smith's "Keys to the Freshwater Macroinvertebrates of Massachusetts", 1991

All samples are stored in 70% ethanol at the Ipswich River Watershed office, 143 County Road, Ipswich, MA 01938 in the wooden cabinet in the kitchen.