Rapid Bioassessment in Wadeable Streams and Rivers By Volunteer Monitors

Year 2000 Summary Report

State of Connecticut
Department of Environmental Protection
Bureau of Water Management
Planning and Standards Division
Ambient Monitoring Program
Arthur J., Rocque, Jr., Commissioner

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Year 2000 Summary Report

Michael Beauchene
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Executive Summary

Rapid Bioassessment in Wadeable Streams and Rivers by Volunteer Monitors (**RBV**), http://dep.state.ct.us/wtr/volunmon/volopp.htm, is a macroinvertebrate collection protocol developed by the Connecticut Department of Environmental Protection, Bureau of Water Management, Ambient Monitoring Program (herein referred to as DEP). The goal of RBV is to provide volunteer monitoring programs with a quick, efficient, and standardized methodology for the collection of macroinvertebrate community data from wadeable streams. This data can be used to screen for either very high or very low water quality. During the field test season (fall 1999) and the first official sampling season (fall 2000) 7 volunteer groups collected 35 macroinvertebrate samples. The protocol was completed at 32 sites on 25 different waterbodies across Connecticut. To obtain additional information about RBV or to become involved, please contact Mike Beauchene, volunteer monitoring coordinator, by phone (860) 424-4185 or email mike.beauchene@po.state.ct.us

Acknowledgements:

Without participation from the following this program would not be possible. Central Connecticut State University-Biology Class, Manchester Community Technical College-Science and Technology Club, Naubesatuck Watershed Council, Naugatuck Valley Chapter of Trout Unlimited, Pequabuck River Watershed Association, Quinnipiac River Watershed Association, and Trinity College-Environmental Issues Seminar. Partial funding for this program was obtained through a CT DEP section 319 Non-Point Source Grant.

Introduction:

Stream and River Water Quality Monitoring: Staff assigned to the ambient water quality monitoring and assessment program are responsible for monitoring Connecticut's approximately 5,800 miles of perennial streams and rivers. The monitoring program supports activities of the DEP by providing data (chemical, physical, and biological) and related expertise to assess surface water quality conditions and trends. Monitoring activities are prioritized and focus on the most significant resources, selected reference sites, and in response nuisance complaints or concerns regarding pollution impacts. Approximately 20% of state rivers and streams are monitored.

Biological Indicators of Water Quality: The DEP utilizes the riffle-dwelling benthic macroinvertebrate community as the primary indicator of biological integrity. Methods follow the USEPA Rapid Bioassessment Protocol III (RBPIII) for Streams and Rivers (*http://www.epa.gov/owow/monitoring/rbp*). The RBPIII involves collecting, sub-sampling, and identifying macroinvertebrates collected from riffle areas in wadeable streams. The list of macroinvertebrates and their quantity from each site are converted into a series of community structure metrics. The metrics from each site are then compared to metrics from a reference site. The final result is an assessment of the impairment level of the benthic community for each site.

The primary use of RBPIII assessments is to determine whether a section of stream supports or does not support aquatic life goals http://dep.state.ct.us/wtr/wqs.pdf . These assessments are also used for priority setting, trend monitoring, establishing baseline conditions, and evaluating the effects of wastewater discharges and non-point source (NPS) pollution.

RIFFLE-DWELLING: A *riffle* is an erosion al section of a stream or river characterized by rapid turbulent flow, a stable rocky substrate, and is wadeable most of the time. Other major stream habitats are pools and runs/glides.
Dwelling means living at least part of the life cycle within the riffle habitat.

BENTHIC: Living in or on the substrate (bottom) of an aquatic environment.

MACRO: Large enough to be seen with the unaided eye. The US EPA further defines a macro-organism as one retained by a Standard Number 30-mesh sieve (0.595 mm).

INVERTEBRATE: An animal without a backbone.

SUB-SAMPLING: A process to generate a non-visually biased statistically representative sample from all of the macroinvertebrates collected at a riffle site.

COMMUNITY STRUCTURE METRICS: Are calculations based on the types and number of macroinvertebrates collected at a station. The mathematical value provide the base for comparing biological communities from 2 distinct samples.

Why use the macroinvertebrate community?

Macroinvertebrates are a good indicator of water quality because of the biology of the organisms themselves. First, there are a large number of different types. This results in a spectrum of responses to environmental stress. Second, the organisms are small and have limited mobility. This allows for efficient collection and the ability to assess water quality including the recent past. Third, established scientific methods for using macroinvertebrates to assess water quality are readily available.

Advantages for using macroinvertebrates:
(http://www.epa.gov/ceisweb1/ceishome/atlas/bioindicators/invertsasindicators.html)

Macroinvertebrates are found in almost every type of aquatic habitat even those with very low water quality.

Methods for sample collection, processing, and data analyses are widely accepted, established, and documented.

Collectors can capture a representative sample of the macroinvertebrate community with relative ease, over a short period of time, and with relatively inexpensive equipment.

Macroinvertebrate populations recover rapidly from repeated sampling.

Knowledge of changes in the community structure and function of benthic macroinvertebrates helps to indicate water quality status and trends in the aquatic environment.

The characteristics of the macroinvertebrate community serve as a useful tool for detecting environmental perturbation provided that the habitat and other environmental variables (including time of year) are controlled. The composition of the macroinvertebrate community is usually a reflection of water quality during the recent past, including any infrequently discharged pollutants and non-point sources of pollution which are difficult to detect by periodic chemical sampling.

Volunteer Monitoring and Macroinvertebrates:

Due to the utility of macroinvertebrate data, some volunteer monitoring groups have implemented programs similar to RBPIII used by the DEP. However, many monitors will agree that this process is anything but rapid. Even the most dedicated volunteers can struggle with the tedium of sub-sampling and family level identification. RBV capitalizes on the utility of macroinvertebrate data while keeping the methods and equipment straightforward, standardized, inexpensive, and most importantly “rapid”.

THE RBV ORGANISMS

Additional information including Field Identification Cards can be found on the web at:
(http://dep.state.ct.us/wtr/volunmon/volopp.htm)

Each RBV organism has distinct shape, structure, color, or behavior and provides key ecological information about the stream environment. Each of the organisms are grouped into one of three "wanted" categories; Most, Moderate, or Least.

Most Wanted: In general these organisms require a narrow range of high quality environmental conditions. When found in abundance one can infer very good water quality.

Moderately Wanted: These organisms can be found in a variety of environmental conditions from high to medium quality. When found in abundance and in the absence of most wanted types, water quality may be reduced.

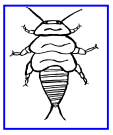
Least Wanted: These organisms tend to be tolerant of a wide range of environmental conditions. When found in abundance and in the absence of either most or moderate representatives, one can infer some level of water quality impairment.

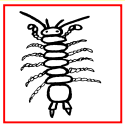
It is important to note that the "least wanted" are able to thrive in many environmental conditions while the "most wanted" thrive only under non-impacted high quality conditions. Therefore the most definitive RBV data are the collections with good representation of organisms in the "most wanted" category.

RBV Program Implementation:

Prior to collecting the macroinvertebrates most groups sponsored a 3-hour training session which described the program and to introduced the participants to the RBV methodology. Approximately 82 people attended at least one of these training sessions. In most cases, the organization implemented RBV either immediately following the training session or within a week.

Seven volunteer monitoring programs participated during the field test season (fall 1999) or the first sampling season (fall 2000). In general each participating program was concerned about overall water quality, however, the specific objective varied (Table 1). Several major categories for involvement were watershed conservation, outdoor recreation/restoration, and education.





Groups who participated in RBV were provided with a list of macroinvertebrates (Appendix A). Each organism on the list has distinct shape, structure, color, or behavior and provides key ecological information about the stream environment. Following the standard procedures, volunteers collected benthic macroinvertebrates in the fall and determined the relative abundance (none, few, some or many) of each macroinvertebrate on the list. At least one specimen of each type was preserved in a labeled vial containing rubbing alcohol (voucher collection). The final products from the RBV protocol were a completed data sheet and a voucher collection. The datasheet was submitted to DEP via phone, fax, or email. The voucher collection was delivered to DEP soon after the protocol was completed. In general the entire process occurred at the stream site and was completed by most monitors within a few hours.

The most meaningful information for the DEP came from those groups who completed the RBV process at multiple sites (**during a single day in the fall**) along a reach of river not routinely monitored by DEP. As a result samples were collected from 22 stations which were not prioritized for DEP monitoring.

Table 1: The groups that participated and their major objective during fall 1999 and fall 2000.

Group Name	**Objective**
Central Connecticut State University	Education
Manchester Community Technical College	Education
Naubesatuck Watershed Council	Watershed Conservation
Pequabuck River Watershed Association	Watershed Conservation, Outdoor Recreation/Restoration
Quinnipiac River Watershed Association	Watershed Conservation
Trinity College	Education
Trout Unlimited-Naugatuck Valley Chapter	Watershed Conservation, Outdoor Recreation/Restoration

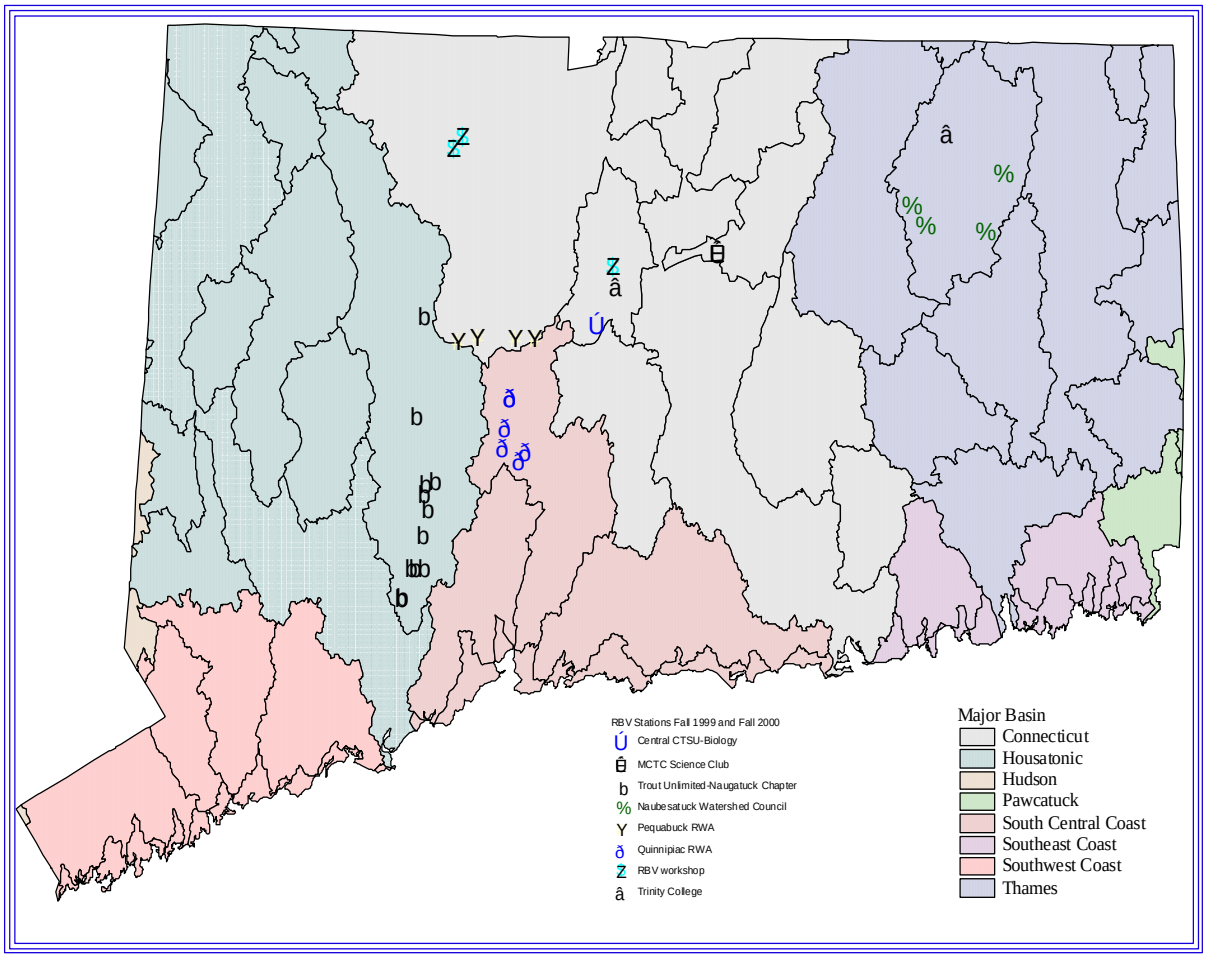


Figure 1. Location of the 32 RBV sampling sites during fall 1999 & 2000.

Results:

The RBV protocol has 26 macroinvertebrates, each with distinct shape, structure, color, or behavior. Detailed information about each organism can be found on the field identification cards/panels (http://dep.state.ct.us/wtr/volunmon/rbvcards.pdf). Each of these organisms have been placed into 1 of 3 categories ***most wanted*** (card/panels 1-8), ***moderately wanted*** (card/panels 9-14), and ***least wanted*** (card/panel 15). The most wanted category consists of macroinvertebrates typically found in streams characterized by high water quality. The moderately wanted category consists of those found in both high and slightly impaired water quality. The least wanted category consists of those found in all types of water quality from high to severely impaired.

Every RBV organism was documented from at least 1 sample location (Table 2). The most commonly collected (greater than 75% of samples) were Hydropsychidae (panel 9), *Stenonema* (panel 11), and *Chimarra* (panel 10) and the least (less than 10% of samples) were *Lepidostoma* (panel 8), Pteronarcyidae (panel 5), and *Brachycentrus* (panel 8). As expected, the moderately wanted organisms (panels 9-14) were the most commonly collected category (Figure 3).

Table 2. Occurrence of each type of RBV organism by sample. Samples are sorted in decreasing order of total number of "Most Wanted". Water quality at the sites with good representation in the most wanted category is assumed to be very good.

				RBV organism panel number																	
				most									moderate							least	
				1	2	3	4	5	6	7	8	Total	9	10	11	12	13	14	Total	15	Total
Waterbody Name	**Basin Code**	**Site number**	**Collection Date**																		
Farmington River	4300	19-003	10/14/00		1	1	1	2	2	1	1	**9**	1	1	1	1	1		**5**	3	**3**
Natchaug River	3200	11-001	10/28/00	1	1	1		2	1	1		**7**	1	1	1	1	2	1	**7**	2	**2**
Still River	3202	11-002	12/03/99		1			2	2	1		**6**	1	1	1	1	1		**5**	2	**2**
Fenton River	3207	11-004	11/04/00		1		1	2	1	1		**6**	1	1	1	1	2	1	**7**	2	**2**
Mount Hope River	3206	18-002	10/24/00	1	1	1		2		1		**6**		1	1		1	1	**4**	1	**1**
Natchaug River	3200	11-001	11/26/99		1			3	1			**5**	1	1	1	1	1	1	**6**	3	**3**
Fulling Mill Brook	6915	5-006	11/07/00			1	1	1	1	1		**5**	1	1			1		**3**		**0**
Fenton River	3207	11-003	11/21/99		1	1		2				**4**			1	1	1	1	**4**	1	**1**
Trib to Morgan Bk	4305	19-002	11/04/00				1	2			1	**4**	1	1	1		1	1	**5**	4	**4**
Beacon Hill Brook	6918	5-003	10/19/00	1				1	1	1		**4**	1	1			1		**3**	1	**1**
Bladdens River	6919	5-009	10/15/00					1	2	1		**4**	1	1	1	1	1	1	**6**		**0**
Kinneytown Brook	6900	5-012	10/13/00	1			1		1	1		**4**	1						**1**	1	**1**
Eightmile River	5201	3-001	11/18/00					1	1		1	**3**		1	1			1	**3**	1	**1**
Tenmile River	5202	3-013	11/18/00		1			1	1			**3**	1	1	1		1	1	**5**	4	**4**
Leadmine Brook	6908	5-001	10/14/00		1	1		1				**3**	1		1	1	1	1	**5**	1	**1**
Long Meadow Pond Bk	6917	5-005	10/14/00		1			1	1			**3**	1					1	**2**	1	**1**
Judd Brook	5202	3-008	11/18/00							1	1	**2**	1	1	1		1		**4**	2	**2**
Honeypot Brook	5200	3-011	11/18/00					1		1		**2**	1	1	1		1		**4**	2	**2**
Hop Brook	6916	5-004	10/14/00		1				1			**2**	1		1	1	1		**4**		**0**
Hockanum Brook	6900	5-007	10/14/00		1			1				**2**	1	1	1		1		**4**		**0**
S. Br. Hop Brook	4504	20-001	12/01/00					1				**1**	1				1		**2**	5	**5**
Dayton Brook	5201	3-003	11/18/00							1		**1**	1	1	1		1	1	**5**	2	**2**
Bladdens River	6919	5-008	10/14/00		1							**1**	1	1	1	1			**4**	1	**1**
Little River	6920	5-010	10/14/00		1							**1**	1	1	1	1			**4**	3	**3**
Pequabuck River	4315	8-001	10/30/99					1				**1**	1				1	1	**3**	2	**2**
Pequabuck River	4315	8-002	11/05/00							1		**1**	1	1	1		1		**4**	1	**1**
Pequabuck River	4315	8-004	11/05/00							1		**1**	1	1	1				**3**	2	**2**
Bass Brook	4401	16-001	10/05/99									**0**	1					1	**2**	7	**7**
Trout Brook	4403	18-001	10/26/00									**0**	1		1				**2**	6	**6**
Trout Brook	4403	19-001	11/04/99									**0**	1		1		1	1	**4**	3	**3**
Honeypot Brook	5200	3-010	11/18/00									**0**		1	1		1	1	**4**	5	**5**
Steele Brook	6912	5-002	10/14/00									**0**	1						**1**	4	**4**
Pequabuck River	4315	8-002	10/30/99									**0**	1	1					**2**	2	**2**
Pequabuck River	4315	8-003	10/31/99									**0**	1		1				**2**	4	**4**
Pequabuck River	4315	8-004	10/31/99									**0**	1	1	1				**3**	5	**5**

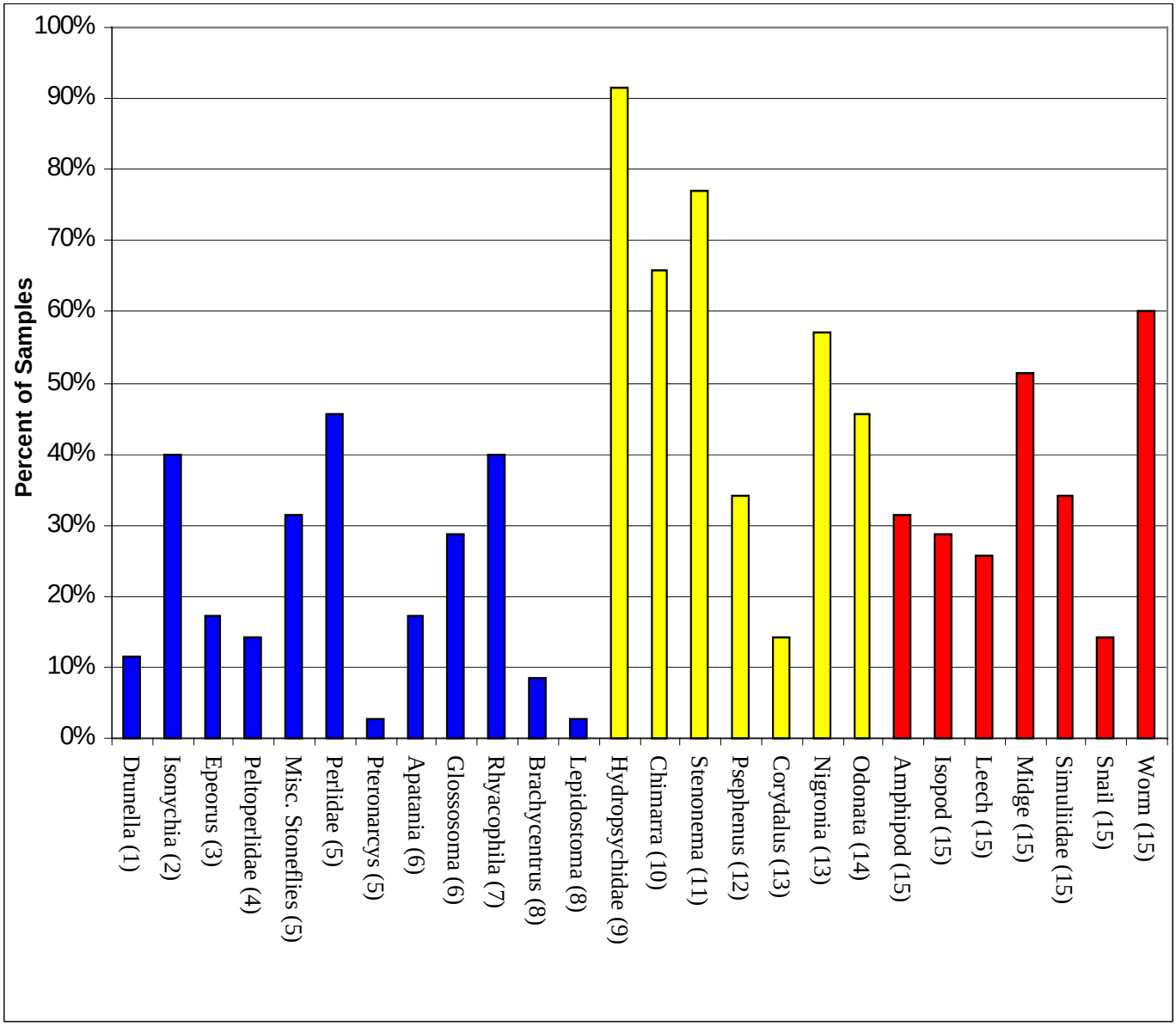


Figure 3. Percent occurrence of each type of organism included in the RBV protocol. Samples were collected from 35 stations during fall 1999 and fall 2000 combined. "Most Wanted" organisms are blue (panel numbers 1-8), "Moderately Wanted" are organisms are yellow (panel numbers 9-14), and "Least Wanted" organisms are red (panel 15).

Most of the stations sampled had a balanced community with good representation of organisms in the most wanted category. In contrast, each of the 8 stations lacking most wanted organisms are located in watersheds characterized by dense development and intense land use (Figure 4). In several of these watersheds, implementation of best management practices, removal of point sources and other in-steam restoration efforts are underway. Continued RBV monitoring can hopefully identify an improving water quality trend.

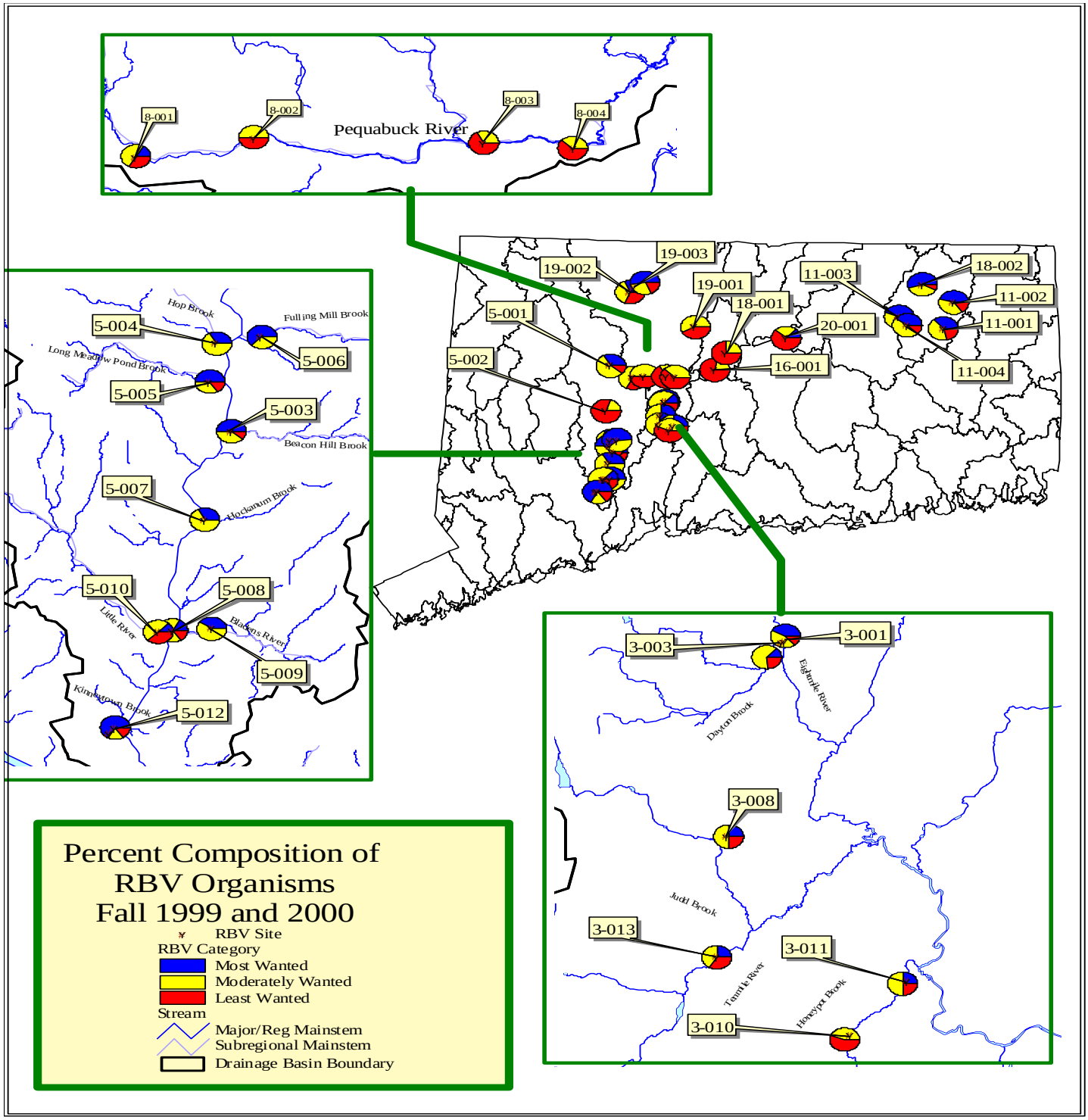


Figure 4. Distribution of each RBV category for samples collected during fall 1999 and fall 2000 combined. A blue wedge indicates the proportion of the "most wanted" types of macroinvertebrates. In general these sites can be characterized as having very good water quality.

Discussion

Successes: The major success of the RBV program during the first sampling season was the level of participation by volunteer monitoring programs. During the early to mid 1990's volunteer monitoring using macroinvertebrates was very popular. Most groups implemented the family-level bioassessment method. Unfortunately the extensive time commitment required to complete the process at a single site caused many groups to abandon or reduce their monitoring. During the RBV field trial year (1999), the DEP encouraged these programs to "try" the new RBV protocol. Most groups agreed the new method would enable their monitoring to re-start and/or expand. Following the first field season (fall 2000), most groups were very successful and intend to participate in fall 2001. Of equal if not greater importance, was the sense of accomplishment by the volunteers. After completing the protocol many volunteers were satisfied that they had (1) helped their program meet it's goals, (2) they provided some useful information to the DEP, and (3) they successfully used a tool to obtain additional knowledge about a stream based upon the resident aquatic life. Compared to traditional family-level bioassessment, most volunteers agree the RBV program is better for their needs.

The most efficient implementation of RBV was through an "RBV day". An "RBV day" is a daylong event sponsored by a volunteer group. All participants meet at a central location where the morning is dedicated to training and the afternoon to collection and data analysis. Each team of monitors are assigned a sampling site(s) and provided with an equipment kit borrowed from the DEP. The participants then travel to their site, collect, identify, and preserve their voucher collection. The samples and equipment are then returned to the DEP. The entire "RBV day" lasts 6-7 hours. Additionally, on such days, Mike Beauchene (DEP) was able to attend to provide both technical assistance and quality assurance/quality control (QA/QC).

The DEP encourages implementation of the RBV protocol through "RBV-days". By having the day split between training (or refresher training) and actual sample collection, DEP resources (loaner equipment and QA/QC) are maximized while reducing the time commitment for each volunteer.

DEP Concerns and Potential Solution:

While some minor issues were discovered during these first two sampling seasons the method seems to be a useful tool. It is assumed that with experience each volunteer program will become more efficient at implementing the program.

Concern: "Too rapid": The major concern regarding the RBV protocol is the volunteer's perception of "ease". One major advantage of RBV is the reduced total time commitment for volunteers. The reduced time is a result of the elimination of post collection processing (sub-sampling), family level identification, metric calculations, and metric comparison. However, the field component of the RBV protocol (collection and observation of the organisms) is not any less time consuming than more intensive methods like family-level bioassessment. In fact, to collect high quality data, the collection and observation of the organisms must involve **more time** than traditional methods. Participants must take significant time and care to (1) select an appropriate riffle sampling location (2) perform an adequate kick sample, and (3) observe and sort the organisms carefully to insure representation of all types of macroinvertebrates present.

Potential Solution: *Develop additional support materials and emphasize "Good Technique" during training. Microsoft Power-point presentations can serve to compare and contrast good vs. poor techniques. Good techniques for the above include; look for loosely embedded cobbles in moderate to swift moving sections of a riffle, carefully rub each rock in order to remove all organisms, and spread the collected debris thin enough with limited water in each tray to optimize organism visibility. The integrity of the protocol is greatly reduced by poorly selected riffles, limited kick effort, and/or hasty organism sorting.*

Concern: "Other organism(s)": The potential for collection of organisms not included in the RBV protocol is very high because RBV focuses on relatively few stream macroinvertebrates. While all participants understood the issue when discussed, the what to do with the "other organism(s)" created some minor confusion during identification and enumeration.

Potential Solution: *Add a box for "Other Organisms" on the datasheet. Encourage use of support materials like the laminated cards. The cards have information that may help the participant refine the identification. Emphasize placing one of each into the voucher sample. This enables DEP to gain additional information about the community and helps to correct mis-identifications.*

Additional Sources of Related Information

Connecticut Department of Environmental Protection

DEP Web site: http://dep.state.ct.us/
DEP Bureau of water management: http://dep.state.ct.us/wtr/index.htm
RBV web page: http://dep.state.ct.us/wtr/volunmon/volopp.htm

United States Environmental Protection Agency:

Volunteer monitoring: http://www.epa.gov/OWOW/monitoring/vol.html
Rapid Bioassessment Protocols: http://www.epa.gov/owow/monitoring/rbp/
Biological Monitoring: http://www.epa.gov/ceisweb1/ceishome/atlas/bioindicators/

Regional Web Sites:

New England Regional Monitoring Collaborative:
http://www.umass.edu/tei/mwwp/nermc.html

RBV Participant Program web sites:

Quinnipiac River Watershed Association: http://www.qrwa.org/
Naugatuck Trout Unlimited: http://murp.home.att.net/trout.html

Other Volunteer Monitoring Organizations In Connecticut Who Have Submitted Wadeable Stream Data to DEP:

A national directory of volunteer monitoring organization can be found at:
http://www.epa.gov/OWOW/monitoring/vol.html

Connecticut River Watch Program
Haddam, Contact Jane Brawerman (860) 345-3219.

Housatonic Valley Association
Cornwall, Contact: Ruth Malins (860)

Natural Resource Conservation Service
Brooklyn, Contact: Glenn Miller (860) 774-8397.

Nature Center for Environmental Activities
Westport, Contact: Richard Harris (203) 227-7253.

Project SEARCH
Bethany, Contact: Chris Sullivan (203) 393-2705.

Appendix A: Ecological information for RBV organisms.

The RBV protocol has 26 types of macroinvertebrates, each with distinct shape, structure, color, or behavior. Detailed information about each organism can be found on the field identification cards/panels (http://dep.state.ct.us/wtr/volunmon/rbvcards.pdf). Each of these organisms have been placed into 1 of 3 categories most wanted (card/panels 1-8), moderately wanted (card/panels 9-14), and least wanted (card/panel 15). The "most wanted" category contains the macroinvertebrates typically found in streams characterized by high water quality. The "moderately wanted" category contains those typically found in both high and slightly impaired water quality. The "least wanted" category contains those typically found in all types of water quality from high to severely impaired.

RBV Panel Number	Taxa Name	Common Name	Tolerance Value*	Feeding Group**	RBV wanted Category	Order
1	*Drunella*	Body Builder Mayfly	0	scraper	Most	Ephemeroptera
2	*Isonychia*	Minnow Mayfly	2	collector filterer	Most	Ephemeroptera
3	*Epeorus*	2-tailed Flat Head Mayfly	0	scraper	Most	Ephemeroptera
4	Peltoperlidae	Roach-like Stonefly	0	shredder	Most	Plecoptera
5	Perlidae	Common Stonefly	1	predator	Most	Plecoptera
5	*Pteronarcys*	Giant Stonefly	0	shredder	Most	Plecoptera
5	Misc. Stoneflies	Stonefly	1	shredder	Most	Plecoptera
6	*Apatania*	Cornucopia Case Maker	0	scraper	Most	Trichoptera
6	*Glossosoma*	Saddle Case Maker	0	scraper	Most	Trichoptera
7	*Rhyacophila*	Michelin-man Caddisfly	0	predator	Most	Trichoptera
8	*Brachycentrus*	Mid-size Plant Case Builder	1	shredder	Most	Trichoptera
8	*Lepidostoma*	Mid-size Plant Case Builder	1	shredder	Most	Trichoptera
9	Hydropsychidae	Common Net Spinner	4	collector filterer	Moderately	Trichoptera
10	*Chimarra*	Orange Head Caddisfly	3	collector filterer	Moderately	Trichoptera
11	*Stenonema*	Flat Headed Mayfly	4	scraper	Moderately	Ephemeroptera
12	*Psephenus*	Water Penny Beetle Larva	4	scraper	Moderately	Coleoptera
13	*Corydalus*	Dobsonfly larva	6	predator	Moderately	Megaloptera
13	*Nigronia*	Fishfly larva	4	predator	Moderately	Megaloptera
14	Odonata	Dragonfly and Damselfly Nymphs	5	predator	Moderately	Odonata
15	Amphipod	Amphipod, Scud	8	collector gatherer	Least	Amphipoda
15	Worm	Aquatic Earthworm	9	collector gatherer	Least	Oligochaeta
15	Isopod	Aquatic Sowbug	8	collector gatherer	Least	Isopoda
15	Simuliidae	Black Fly	6	collector filterer	Least	Diptera
15	Leech	Leech	8	predator	Least	Hirudinea
15	Midge	Midge	7	collector gatherer	Least	Diptera
15	Snail	Snail	7	scraper	Least	Gastropoda

***Tolerance values** are a relative scale from 0 (least tolerant) to 10 (most tolerant) these values were developed to summarize overall pollution tolerance of the benthic arthropod community with a single value. The values are used in the Hilsenhoff Biotic Index (HBI) which was developed as a means of detecting organic pollution in communities inhabiting rock or gravel riffles. Although it may be applicable for other types of pollutants, use of the HBI in detecting non-organic pollution effects has not been thoroughly evaluated. This scale forms the base for the RBV protocol. A stream segment supporting a diverse community of organisms with low tolerance values indicates little organic enrichment and high water quality (EPA-600-4-90-030 Marcroinvertebrate Field and Laboratory Techniques).

****Feeding Group:** Most aquatic insects are grouped into 1 of 5 general categories based on the type of food utilized and the feeding mechanism. Predators are secondary consumers generally feeding on other aquatic macroinvertebrates. Shredders use cutting mouthparts to feed on coarse organic matter like leaves. Scrapers

use file-like mouthparts to feed primarily on microscopic algae. Collector-filterers and collector-gatherers both utilize fine organic material as the primary food but differ in feeding mechanism. Filterers allow the stream flow to carry the food to them while the gatherers actively search. Feeding groups can reflect the food base of the riffle and provide insight into the nature of potential disturbance factors. Proportion of feeding groups is important because predominance of a particular type may indicate an unbalanced community responding to an overabundance of a particular food type. The predominant feeding strategy reflects the type of impact detected. In general shredders and scrapers are dominant in high quality stream while collector-filterers and gatherers dominate in disturbed systems.

Appendix B Table of locations sorted by name and site number.

Monitoring Group	Site number	Waterbody name	DEP Basin Code	General Location (US= Upstream of, DS= Downstream of)	Town
Central Connecticut State University	16-001	Bass Brook	4401	At Parking Garage	New Britain
MCTC Science and Technology Club	20-001	S. Br. Hop Brook	4504	US Mouth	Manchester
Naubesatuck Watershed Council	11-001	Natchaug River	3200	DS N. Bear Hill Rd.	Chaplin
Naubesatuck Watershed Council	11-002	Still River	3202	US Piffershire Rd.	Eastford
Naubesatuck Watershed Council	11-003	Fenton River	3207	DS Old Turnpike Rd.	Mansfield
Naubesatuck Watershed Council	11-004	Fenton River	3207	DS Stone Mill Rd.	Mansfield
Pequabuck River Watershed Association	8-001	Pequabuck River	4315	US Plymouth WPCF	Plymouth
Pequabuck River Watershed Association	8-002	Pequabuck River	4315	in Rockwell Park	Bristol
Pequabuck River Watershed Association	8-003	Pequabuck River	4315	At USGS gage	Bristol
Pequabuck River Watershed Association	8-004	Pequabuck River	4315	At 97 E. Main St.	Plainville
Quinnipiac River Watershed Association	3-001	Eightmile River	5201	DS Jude Lane	Southington
Quinnipiac River Watershed Association	3-003	Dayton Brook	5201	US Mouth	Southington
Quinnipiac River Watershed Association	3-008	Judd Brook	5202	DS Burrit St.	Southington
Quinnipiac River Watershed Association	3-010	Honeypot Brook	5200	DS Creamery Rd.	Cheshire
Quinnipiac River Watershed Association	3-011	Honeypot Brook	5200	DS Blacks Rd.	Cheshire
Quinnipiac River Watershed Association	3-013	Tenmile River	5202	At sewer crossing	Cheshire
RBV Workshop Prep	19-001	Trout Brook	4403	At Science Center of CT	West Hartford
RBV Workshop Prep	19-002	Trib to Morgan Bk	4305	Adjacent Eddy Rd.	Barkhamsted
RBV Workshop Prep	19-003	Farmington River	4300	Adjacent W. River Rd.	Barkhamsted
Trinity College	18-001	Trout Brook	4403	In Beachland Park	W. Hartford
Trinity College	18-002	Mount Hope River	3206	At Church Farm	Ashford
Trout Unlimited-Naugatuck Valley Chapter	5-001	Leadmine Brook	6908	At Mouth	Thomaston
Trout Unlimited-Naugatuck Valley Chapter	5-002	Steele Brook	6912	At Municipal Stadium	Watertown
Trout Unlimited-Naugatuck Valley Chapter	5-003	Beacon Hill Brook	6918	US Rte. 8	Naugatuck
Trout Unlimited-Naugatuck Valley Chapter	5-004	Hop Brook	6916	US Jct. Rte. 63 and Rte. 68	Naugatuck
Trout Unlimited-Naugatuck Valley Chapter	5-005	Long Meadow Pond Brook	6917	US Mouth	Naugatuck
Trout Unlimited-Naugatuck Valley Chapter	5-006	Fulling Mill Brook	6915	US Rte 68	Naugatuck
Trout Unlimited-Naugatuck Valley Chapter	5-007	Hockanum Brook	6900	At Mouth	Beacon Falls
Trout Unlimited-Naugatuck Valley Chapter	5-008	Bladdens River	6919	At Mouth	Seymour
Trout Unlimited-Naugatuck Valley Chapter	5-009	Bladdens River	6919	At Seymour Emergency Services Building	Seymour
Trout Unlimited-Naugatuck Valley Chapter	5-010	Little River	6920	At Mouth	Seymour
Trout Unlimited-Naugatuck Valley Chapter	5-011	Fountain Lake Brook	6900	US Ames Plaza	Seymour
Trout Unlimited-Naugatuck Valley Chapter	5-012	Kinneytown Brook	6900	US Rte 8 and Derby Ave.	Seymour