Rapid Bioassessment in Wadeable Streams and Rivers By Volunteer Monitors

Year 2001 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 2001 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 second official sampling season (fall 2001) 9 volunteer groups collected 27 macroinvertebrate samples. The protocol was completed at 27 sites on 21 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.
Connecticut Audubon Centers at Glastonbury and Pomfret, Connecticut River Watch (Eightmile River Watershed), Granby Stream Team, Naugatuck Valley Chapter of Trout Unlimited, North Stonington Land Alliance, Quinnipiac River Watershed Association, Trinity College-Environmental Issues Seminar, and Windham Middle School.

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 5,484 miles of perennial streams and rivers (CT DEP 2000). 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 to nuisance complaints or concerns regarding pollution impacts. Approximately 20% of state rivers and streams are monitored (CT DEP 1999).

Biological Indicators of Water Quality:

The DEP utilizes the riffle-dwelling benthic macroinvertebrate community as a 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] (Plafkin et al 1989). The RBPIII involves collecting, sub-sampling, and identifying macroinvertebrates collected from riffle areas in wadeable streams. The variety and abundance of macroinvertebrates 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 goals for aquatic life use support as described in the CT Water Quality Standards [http://dep.state.ct.us/wtr/wqs.pdf] (CT DEP 1997). 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 erosional 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 of 100, 200 or 300 organisms collected in a sample.

COMMUNITY STRUCTURE METRICS: Are calculations based on the variety and abundance of Macroinvertebrates collected at a site. The values provide the mathematical basis for comparing biological communities from 2 distinct samples.

REFERENCE SITE: a specific locality on a waterbody, which is minimally impaired and is representative of the expected ecological integrity of other localities on the same waterbody or nearby waterbodies.

Why use the macroinvertebrate community?

Macroinvertebrates are a good indicator of water quality because of the biology of the organisms. First, there are a large number of different types with various environmental requirements. This results in a wide 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.

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.

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 poor 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.

Many macroinvertebrates are resident in a stream up to 2 years or more. This results in an integration of water quality conditions over time.

Macroinvertebrates have a wide range of environmental requirements.

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

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 very good water quality can be inferred.

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 less than optimal.

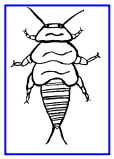
Least Wanted: These organisms tend to be tolerant of a wide range of environmental conditions including poor water quality. When found in abundance and in the absence of either most or moderate representatives, some level of water quality impairment can be inferred.

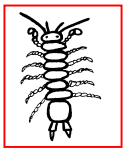
It is important to note that the "least wanted" are able to thrive in many environmental conditions while the "most wanted" thrive only under non-impacted high quality conditions. Therefore the most definitive RBV data are the collections with good representation of organisms in the "most wanted" category.

RBV Program Implementation:

Nine volunteer monitoring programs participated during the field season (fall 2001). Prior to collecting the macroinvertebrates most groups sponsored a 3-hour training session in which the DEP Volunteer Monitoring Coordinator described the program and introduced the participants to the RBV methodology. Approximately 100 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.

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 along a reach of river not routinely monitored by DEP. As a result samples were collected from 19 sites which were not prioritized for DEP monitoring.





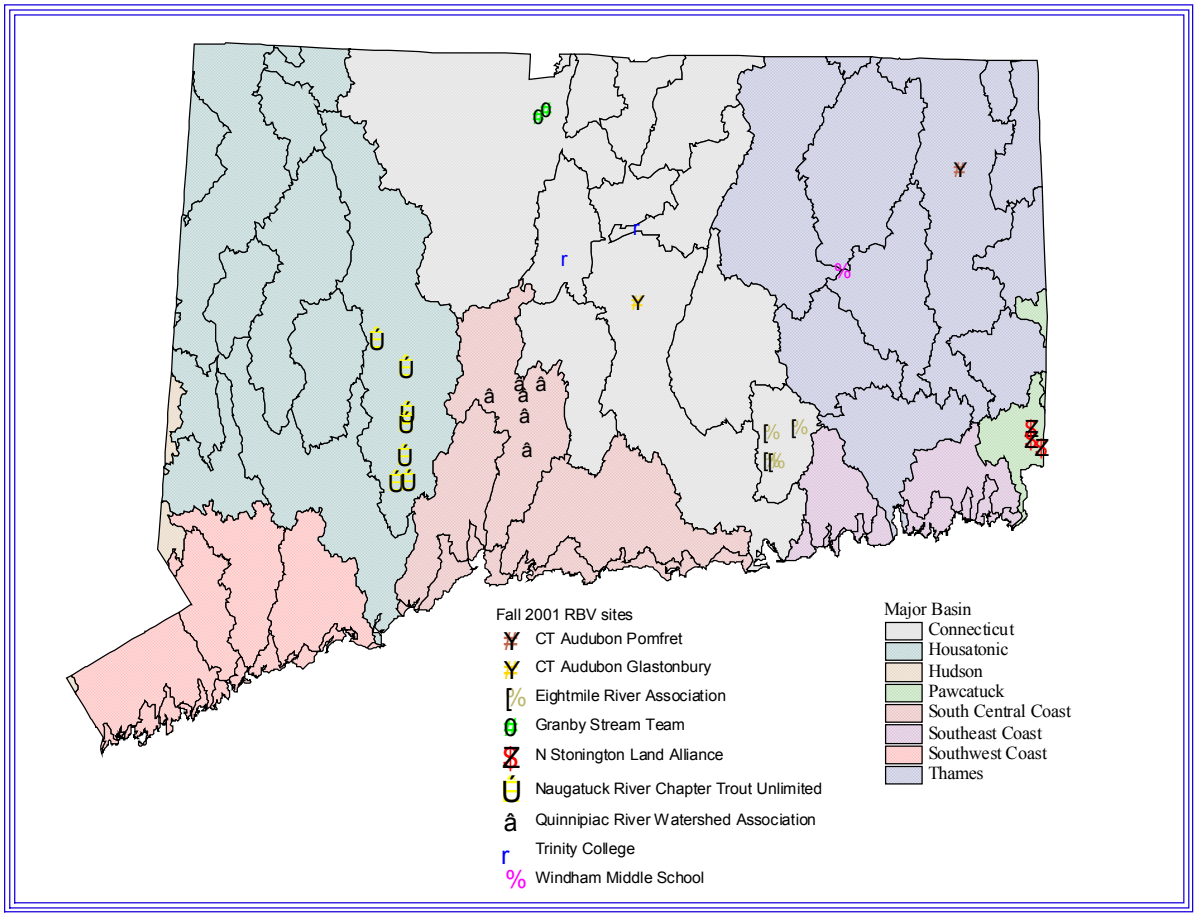


Figure 1. Location of the 27 RBV sampling sites during fall 2001. Specific location information for each site is listed in appendix B.

Results:

The RBV protocol includes 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 unimpaired and slightly impaired water quality. The least wanted category consists of those found in all types of water from unimpaired to severely impaired.

A list of the RBV organism categories collected at each site during fall 2001 is presented in Table 1. The variety of RBV organisms collected ranged from a high of 14 at the Eightmile River (site 26-001) to a low of 3 at Steele Brook (site 5-014). At least one representative from the "most wanted" category was collected at all but 3 of the 27 sites.

Table 1. Occurrence of each type of RBV organism category 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.

				Most Wanted									Moderately Wanted							Least Wanted		
Waterbody name	DB Code	Site number	collection date	1	2	3	4	5	6	7	8	Total Most	9	10	11	12	13	14	Total Moderate	15	Total Least	*Site Total*
East Branch Eightmile River	4802	26-003	10/20/01	1	1			1	2		1	**6**	1	1		1	1		**4**	1	**1**	***11***
Salmon Brook	4320	24-002	11/3/01	1	1			2	1	1		**6**	1	1	1		1	1	**5**	1	**1**	***12***
Eightmile River	4800	26-001	10/20/01	1	1			1	1		1	**5**	1	1	1	1	1	1	**6**	3	**3**	***14***
Eightmile River	4800	26-002	10/20/01	1	1					1	2	**5**		1		1		1	**3**	1	**1**	***9***
Green Falls River	1002	25-001	10/13/01		1		1	1		1	1	**5**	1	1	1		1	1	**5**	1	**1**	***11***
Roaring Brook	4009	28-001	9/26/01					2	1		2	**5**	1		1	1		1	**4**	4	**4**	***13***
Green Falls River	1002	25-002	10/13/01	1	1			1		1		**4**	1	1	1	1	2	1	**7**	2	**2**	***13***
Steele Brook	6912	5-015	10/26/01			1		1	1	1		**4**	1	1	1	1	1	1	**6**		**0**	***10***
West Branch Salmon Brook	4319	24-001	11/3/01	1	1			1		1		**4**	1	1	1		1	1	**5**		**0**	***9***
Willimantic River	3100	29-001	11/28/01		1	1		2				**4**	1	1	1	1			**4**	2	**2**	***10***
Day Brook	3709	21.001	9/8/01		1			1	1			**3**	1	1	1	1	1	1	**6**	2	**2**	***11***
East Branch Eightmile River	4802	26-004	10/20/01		1			1	1			**3**	1	1	1	1	2	1	**7**	2	**2**	***12***
Green Falls River	1002	25-003	10/13/01					1	1	1		**3**	1	1			1		**3**	2	**2**	***8***
Bladdens River	6919	5-013	10/20/01		1			1				**2**	1		1	1	1		**4**		**0**	***6***
Crow Hollow Brook	5205	3-014	11/17/01						1	1		**2**	1	1	1			1	**4**	3	**3**	***9***
Hockanum Brook/Bronson Brook	6900	5-007	10/27/01					2				**2**	1	1	1		1	1	**5**		**0**	***7***
Honeypot Brook	5200	3-010	11/17/01	1	1							**2**	1				1		**2**	2	**2**	***6***
Harbor Brook	5206	3-016	11/17/01						1			**1**	1		1		1		**3**	2	**2**	***6***
Harbor Brook	5206	3-017	11/17/01						1			**1**	1	1		1			**3**	3	**3**	***7***
Hockanum River	4500	18-003	10/23/01					1				**1**	1	1	1			1	**4**	5	**5**	***10***
Hop Brook	6916	5-004	10/20/01		1							**1**	1		1	1	1		**4**	1	**1**	***6***
Little River	6920	5-010	10/20/01						1			**1**	1	1	1				**3**		**0**	***4***
Steele Brook	6912	5-014	10/26/01						1			**1**	1				1		**2**		**0**	***3***
Wharton Brook	5207	3-018	11/17/01					1				**1**	1	1			1	1	**4**	4	**4**	***9***
Long Meadow Pond Brook	6917	5-005	10/20/01									**0**	1		1		1	1	**4**		**0**	***4***
Quinnipiac River	5200	3-015	11/17/01									**0**	1		1				**2**	5	**5**	***7***
Trout Brook	4403	18-001	10/18/01									**0**	1		1		1		**3**	5	**5**	***8***

The 3 most commonly collected organisms were Hydropsychidae (96% of sites), *Stenonema* (74% of sites), and *Chimarra* (67% of sites). The 3 least commonly collected were *Pteronarcys* and Peltoperlidae (4% of sites) and *Epeorus* (7% of sites). As expected, moderately wanted organisms (panels 9-14) were the most commonly collected category (Figure 3).

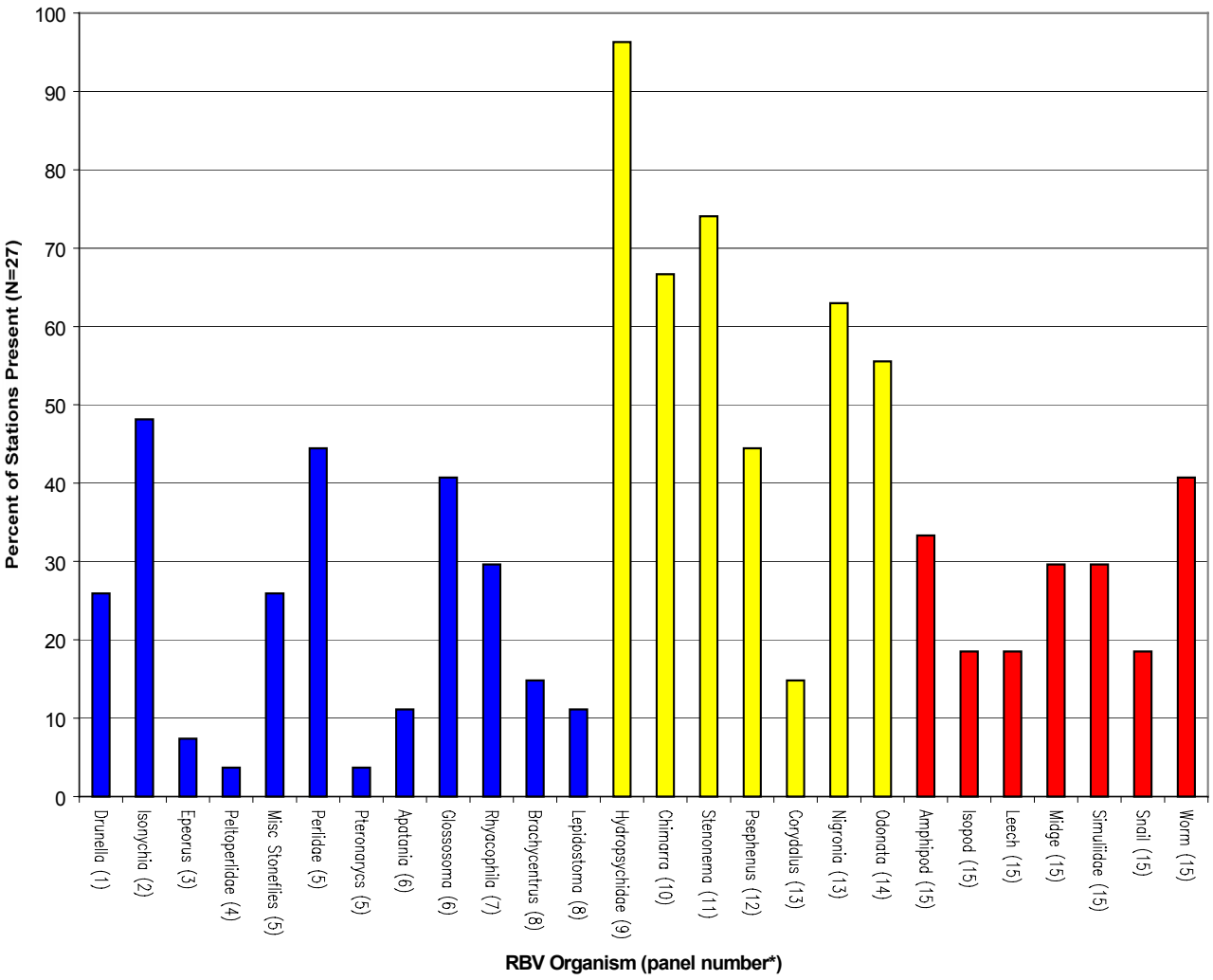


Figure 3. Percent occurrence of each type of organism included in the RBV protocol. Samples were collected from 27 sites during the fall of 2001**.** "Most Wanted" organisms are blue (panel numbers 1-8), "Moderately Wanted" are organisms are yellow (panel numbers 9-14), and "Least Wanted" organisms are red (panel 15).
*The panel number is an identification aid. The panel number refers to the category order on both the identification card and the datasheet.

Many of the sites had a balanced community with good representation of organisms in the most wanted category (Figure 4). At 3 sites (East Branch Eightmile River, Salmon Brook, and the Eightmile River) greater than 50% of the community was represented in the most wanted category. The diverse communities at these sites indicate very high water quality. At 3 sites (Quinnipiac River, Trout Brook, and the Hockanum River) the community was comprised of greater than 50% of the least wanted category. The diversity of least wanted coupled with the few or no most wanted types indicate water quality is impaired. At each of these collection locations dense development and intense land use characterize the watersheds. In these watersheds, implementation of best management practices, control of point sources and other in-steam restoration efforts are underway. Continued RBV monitoring can hopefully identify an improving water quality trend.

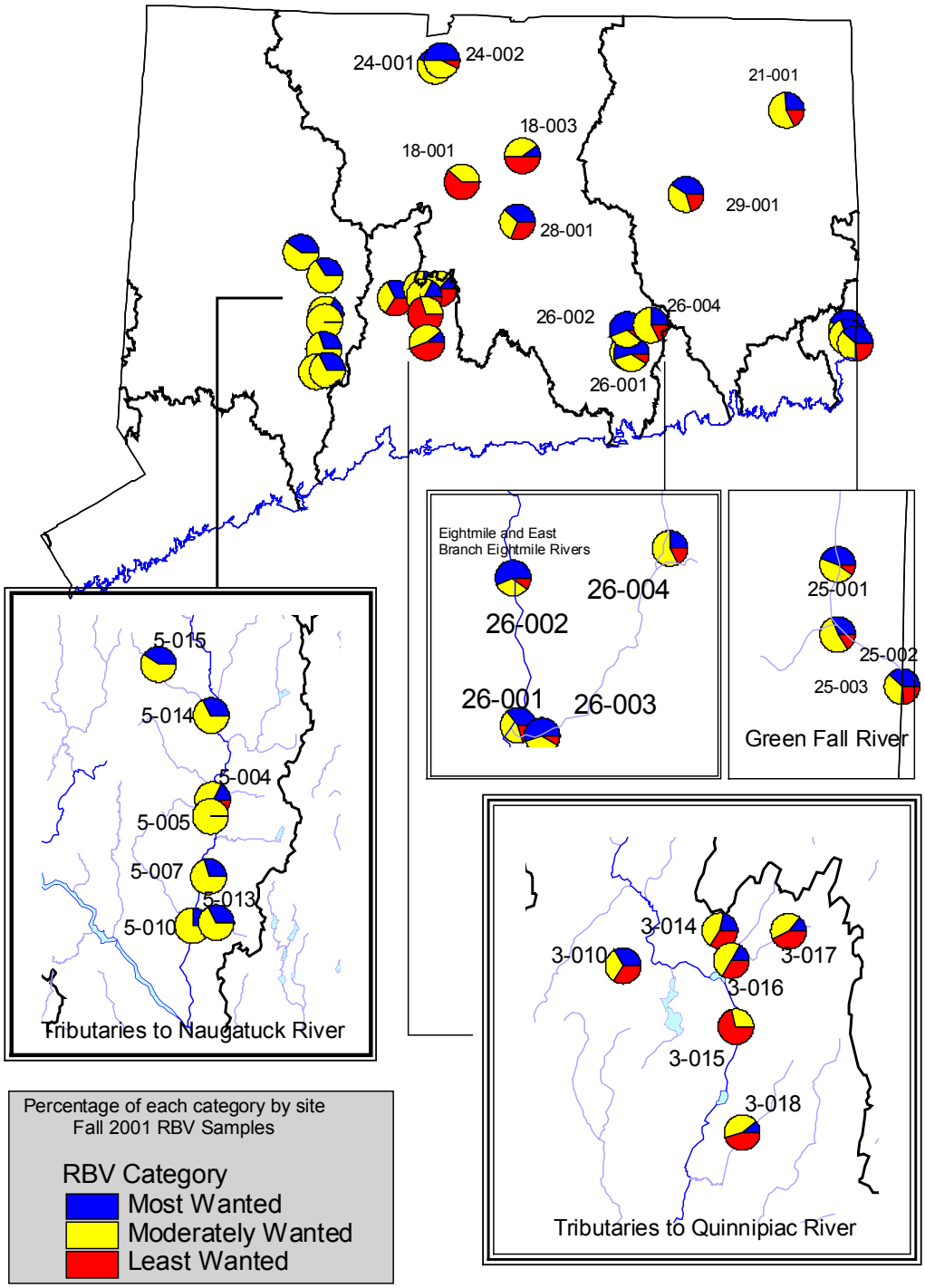


Figure 4. Distribution of each RBV category for samples collected during fall 2001**.** A blue wedge indicates the proportion of the "most wanted" types of macroinvertebrates, yellow "moderately wanted" and red "least wanted".

Stations monitored consecutive years

Six of the 27 sites were monitored during fall 2000 and fall 2001 (Table 2). The community structure remained stable at 3 of the 6 sites. The community structure appears to have improved slightly at the Honeypot Brook site with 2 "most wanted" types collected in 2001. At the remaining sites, the community structure appears to have decreased. The decrease is slight at the Little River site primarily due to the absence of the "least wanted" organisms while decrease at Long Meadow Pond Brook is due to the absence of "most wanted" types. Additional follow-up monitoring should occur at Long Meadow Pond Brook. Macroinvertebrate community sampling is inherently variable. The data presented below may be a reflection of this variability and not a reflection of subtle changes in water quality. Additional sampling events at these locations are necessary to determine long term trends.

Table 2. A comparison of the 6 sites that were monitored in both fall of 2000 and fall of 2001. The total numbers of each RBV category are listed. The change in the community structure is noted. *(Macroinvertebrate community sampling is inherently variable. The data presented below may be a reflection of this variability and not a reflection of subtle changes in water quality. Additional sampling events at these locations are necessary to determine long term trends).*

Stream name	site number	Fall of Year	Most	Moderate	Least	Community Structure
Honeypot Brook	3-010	2001	2	2	2	Slight Increase
		2000	0	4	5	
Hockanum Brook	5-007	2001	2	5	0	Stable
		2000	2	4	0	
Hop Brook	5-004	2001	1	4	1	Stable
		2000	2	4	0	
Trout Brook	18-001	2001	0	3	5	Stable
		2000	0	2	6	
Little River	5-010	2001	1	3	0	Slight Decrease
		2000	1	4	3	
Long Meadow Pond Brook	5-005	2001	0	4	0	**Decrease**
		2000	3	2	1	

Discussion

The major success of the RBV program during the second 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 activity. During the RBV field trial year (1999), the DEP encouraged these programs to "try" the new RBV protocol. Following the first field season (fall 2000), most groups were very successful and intended to participate in fall 2001. Approximately 50% of the groups originally trained in either 1999 or 2000 participated in the program during 2001. Most of the groups not returning to participate in 2001 were college-class based.

In 2001, 6 monitoring groups participated in the RBV program for the first time. Most of these groups agreed the new method would enable their monitoring to start and/or expand. All of the groups were able to take advantage of the equipment kits loaned by the DEP in order to complete the protocol.

Two Connecticut Audubon centers (Pomfret and Glastonbury) sponsored the RBV method as a program at each center. The Pomfret center led by Annie Guion, also received a grant to purchase 10 sets of equipment. Annie is hoping to lead both adult and school based monitoring programs during the upcoming year. The partnership with Connecticut Audubon is exciting and will allow substantial expansion of the program.

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 participants 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 volunteer monitoring coordinator) 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 support) are maximized while reducing the time commitment for each volunteer.

DEP Concerns and Potential Solution from year 2 and progress:

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

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.

Solution: *Additional support materials were developed to emphasize "Good Technique". A Microsoft Power-point presentation was implemented during the training sessions, which served to compare and contrast good vs. poor techniques.* Several "*Good techniques" for the RBV protocol 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.*

References:

CT DEP 2000. 2000 Water Quality Report To Congress. Bureau of Water Management, Planning and Standards Division, Hartford, CT.

CT DEP 1999. Ambient Monitoring Strategy for Rivers and Streams, Rotating Basin Approach. Bureau of Water Management, Planning and Standards Division, Hartford, CT.

CT DEP 1997. Water Quality Standards. Bureau of Water Management, Planning and Standards Division, Hartford, CT.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid Bioassessment Protocols for use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA/444/4-89-00.

RBV materials: All of the materials below are available on the DEP web page at this address: http://dep.state.ct.us/wtr/volunmon/volopp.htm

2000 Summary of Volunteer Monitoring Program (PDF, 433K)

Part 1: Program Description (PDF, 750 K) - This document describes the Rapid Bioassessment in Wadeable Streams and Rivers by Volunteer Monitors (RBV) program.

Part 2: Instructions (PDF, 1415 K) - This document provides step by step instructions for the RBV protocol and provides a consistent method for volunteer groups to use when submitting surface water quality information to DEP.
Macroinvertebrate Field Identification Cards (PDF, 676 K) - At the core of the RBV program are the macroinvertebrates represented on these cards. Each organism has distinct shape, structure, color, or behavior and provides key ecological information about the stream environment. Each card lists the common name across the top and the category at the bottom. These bands are color-coded based on the ecology of each organism.

- Blue = **Most Wanted**. In general these organisms require a narrow range of environmental conditions. When found in abundance one can infer non-impaired stream condition.
- Yellow = **Moderately Wanted**. These organisms can be found in a variety of water quality conditions. When found in abundance further information about the upstream watershed may be necessary to assess water quality.
- Red = **Least Wanted**. These organisms tend to be very tolerant of a wide range of environmental conditions. As a result when these organisms comprise the majority of a sample, one can infer some level of water quality impairment.

Data sheet (PDF, 133 K) **-** This is the official data sheet for the RBV protocol. It should be submitted along with the collection of macroinvertebrate vouchers to Mike Beauchene, Volunteer Monitoring Coordinator, at phone (860) 424-4185, fax (860) 424-4055

Macroinvertebrate Sorting Guide (PDF, 211 K) **-** This 1 page flow chart will assist volunteer monitors in focusing their macroinvertebrate identification choice. The flow chart is not designed to be a comprehensive key for macroinvertebrates. The chart should be used for preliminary sorting and grouping when implementing the RBV protocol.

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
Connecticut Audubon
Pomfret, Contact: Annie Guion (860) 928-4948
http://www.ctaudubon.org/centers/pomfret/pomfret.htm
Glastonbury, Contact: Judy Harper (860) 633-8402
http://www.ctaudubon.org/centers/glastonbury/glastonbury.htm

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) 672-6678.

Windham County Soil and Water Conservation District
Brooklyn, Contact: Scott Gravatt (860) 774-8397.

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

Project SEARCH
Derby, Contact: Chris Sullivan (203) 734-2513.

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.

Monitor	Site Number	Waterbody	DEP Basin	General Location (US = Upstream DS= Downstream)	Town
CT Audubon-Pomfret	21-001	Day Brook	3709	at trail crossing	Pomfret
CT Audubon- Glastonbury	28-001	Roaring Brook	4009	US Route 17	Glastonbury
Eightmile River Assoc.	26-001	Eightmile River	4800	DS Route 156	Lyme
Eightmile River Assoc.	26-002	Eightmile River	4800	At picnic area	East Haddam
Eightmile River Assoc.	26-003	East Branch Eightmile River	4802	At old bridge	Lyme
Eightmile River Assoc.	26-004	East Branch Eightmile River	4802	Walden Rd	Salem
Granby Stream Team	24-001	West Branch Salmon Brook	4319	Salmon Brook Park	Granby
Granby Stream Team	24-002	Salmon Brook	4320	DS Route 20	Granby
N. Stonington Land Alliance	25-001	Green Fall River	1002	US Putker Rd	North Stonington
N. Stonington Land Alliance	25-002	Green Fall River	1002	at Clark Falls Rd	North Stonington
N. Stonington Land Alliance	25-003	Green Fall River	1002	US Route 184	North Stonington
Quinnipiac River Watershed Assoc.	3-010	Honeypot Brook	5200	DS Creamery Rd	Cheshire
Quinnipiac River Watershed Assoc.	3-014	Crow Hollow Brook	5205	at Hubbard Park	Meriden
Quinnipiac River Watershed Assoc.	3-015	Quinnipiac River	5200	US Oak St	Wallingford
Quinnipiac River Watershed Assoc.	3-016	Harbor Brook	5206	US Coe Ave	Meriden
Quinnipiac River Watershed Assoc.	3-017	Harbor Brook	5206	Brookside Park	Meriden
Quinnipiac River Watershed Assoc.	3-018	Wharton Brook	5207	Doolittle Park	Wallingford
Trinity College	18-001	Trout Brook	4403	US S. Quaker Lane	West Hartford
Trinity College	18-003	Hockanum River	4500	USGS Gage	East Hartford
Trout Unlimited-Naugatuck Valley	5-004	Hop Brook	6916	JCT Route 63 & 68	Naugatuck
Trout Unlimited-Naugatuck Valley	5-005	Long Meadow Pond Brook	6917	DS Route 63	Naugatuck
Trout Unlimited-Naugatuck Valley	5-007	Hockanum Brook/Bronson Brook	6900	Mouth	Beacon Falls
Trout Unlimited-Naugatuck Valley	5-010	Little River	6920	Mouth	Seymour
Trout Unlimited-Naugatuck Valley	5-013	Bladdens River	6919	US Legion Pool	Seymour
Trout Unlimited-Naugatuck Valley	5-014	Steele Brook	6912	Mouth	Waterbury
Trout Unlimited-Naugatuck Valley	5-015	Steele Brook	6912	Route 6	Watertown
Windham Middle School	29-001	Willimantic River	3100	DS Windham Mills Bridge	Windham