RBV

CTDEEP Riffle Bioassessment by Volunteers Program

Riffle Bioassessment by Volunteers (RBV)

Volunteer Training

A CT DEEP Tier 2
Volunteer Water Quality Monitoring Network
www.ct.gov/deep/rbv

Last revised 10/09/2015

Connecticut Department of Energy and Environmental Protection

Riffle Bioassessment by Volunteers (RBV)

Volunteer Training Presentation:

Part 1 - Program Background& Overview

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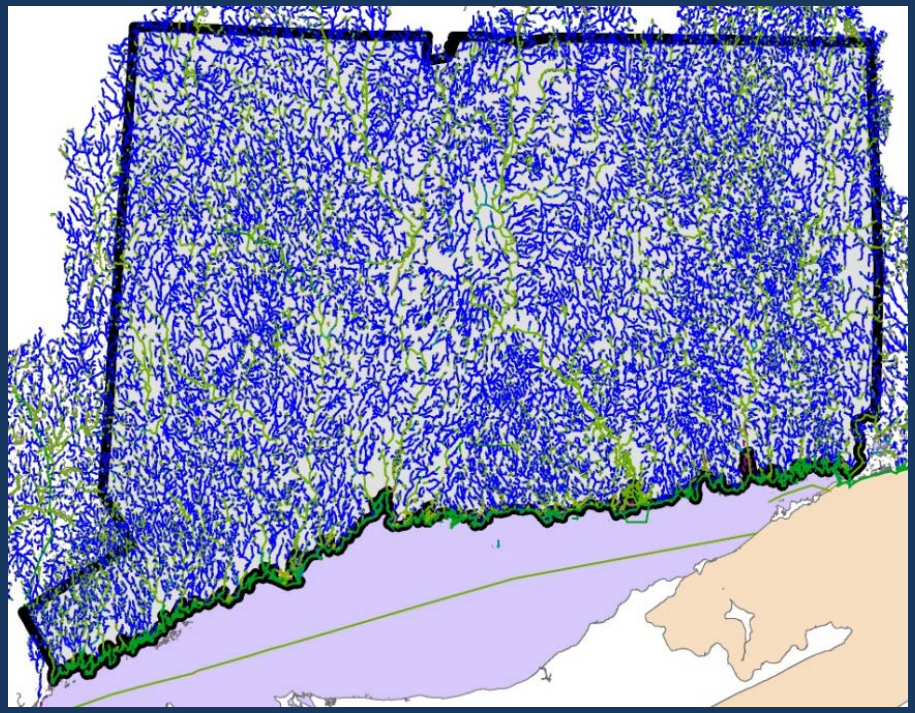
Connecticut Department of Energy and Environmental Protection

The Need for RBV: So Many Stream Miles!

- CT has ~5,830 miles of rivers and streams
  - That's about the length of the US-Canada and US-Mexico borders combined!
- CT DEEP conducts annual monitoring of CT's waters
  - Able to directly monitor and assess on average only about 20% of all streams and rivers.



The Need for RBV: So Many Stream Miles!

- RBV was developed by CT DEEP in 1999
  - Provides volunteers with a relatively fast, low technology macroinvertebrate collection and identification method
  - Allows volunteers to generate data usable by CT DEEP for state and Federal water quality assessment purposes
  - Increases the number of stream miles assessed by CT DEEP during each two-year reporting cycle

- Between 1999-2014, RBV volunteers have collected <u>more than 3,100 samples</u>!
  - Over 280 'Four or More' samples submitted
  - On average 20 active local programs per year – monitor over 100 stations per year together

What the RBV Program IS…

- A relatively quick, easy to learn ‘citizen science’ volunteer program coordinated by the State of Connecticut.
- A simple screening tool that uses macroinvertebrates to find and document good water quality in your local streams.
- A way to help your community and the State collect meaningful data.
- An opportunity to explore some beautiful locations in your community with other like-minded individuals!

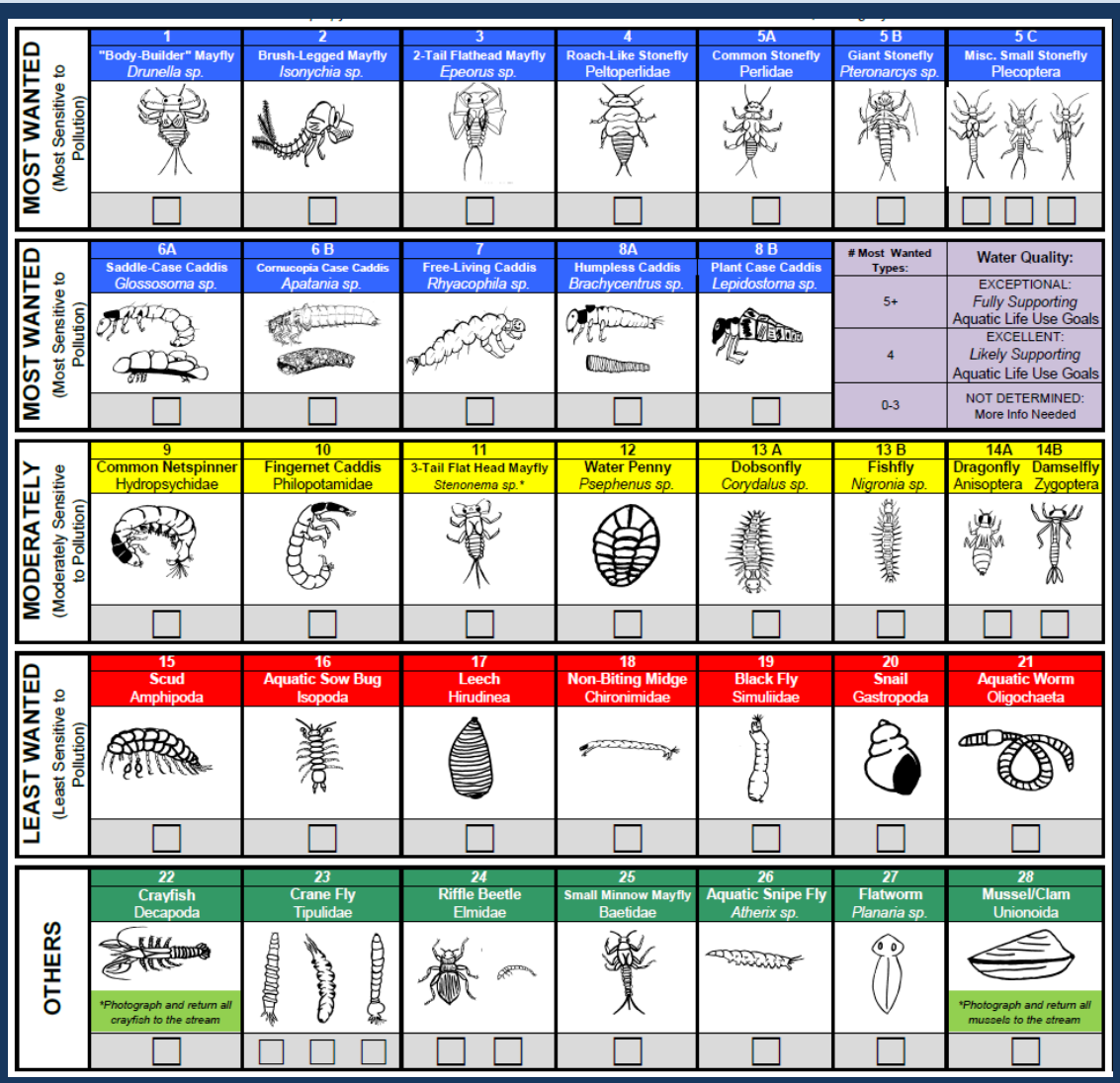
Why Use Macroinvertebrates to Study Water Quality?

- They are in almost every stream in CT
- They have limited mobility and therefore 'absorb' water quality conditions around them
- Their response to water quality is very well known and documented
- They are easy to capture
- They recover rapidly from sampling

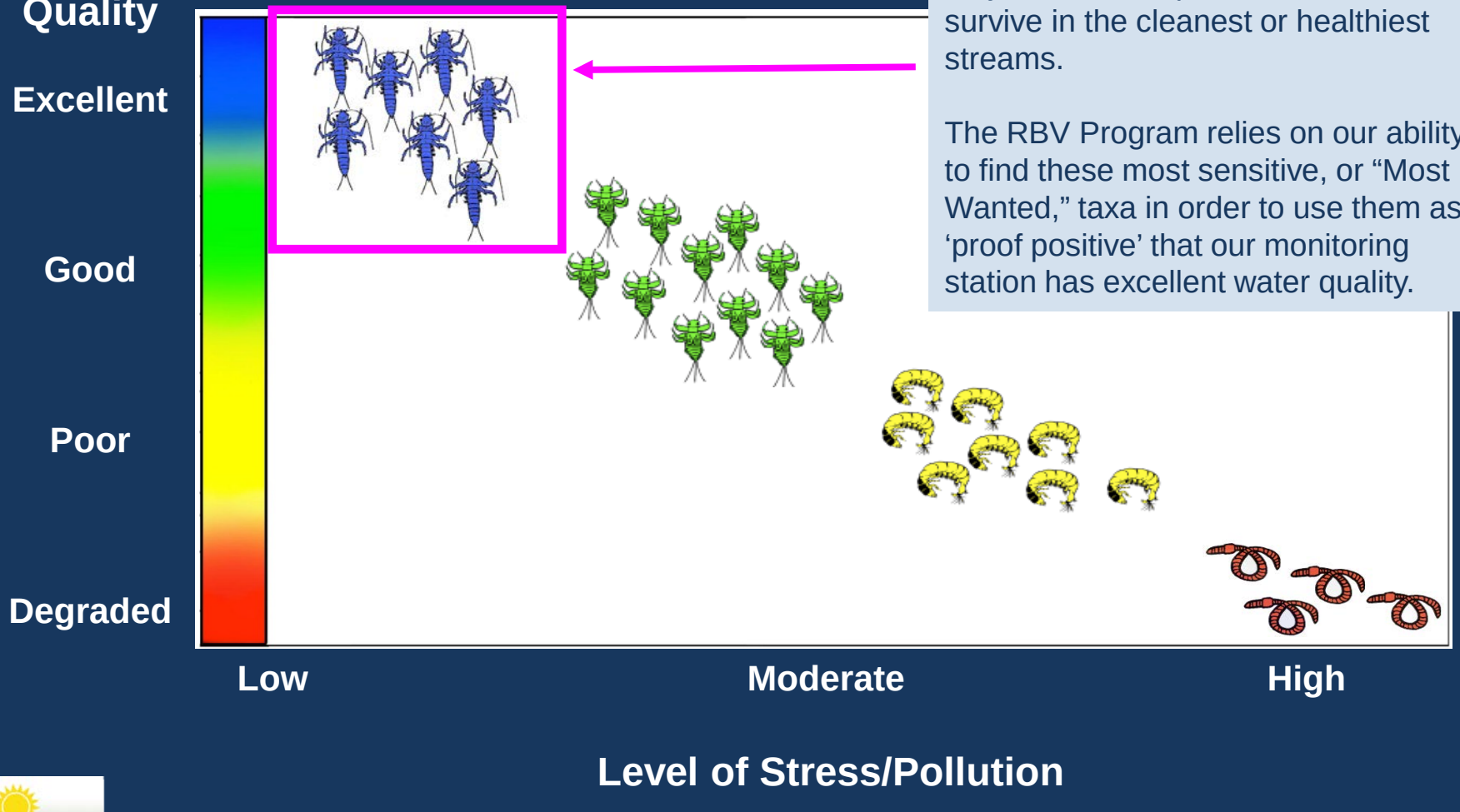
The RBV Organisms

28 RBV organism ‘types’ selected for inclusion in the program based upon:

- Known pollution sensitivities
- Easily identified
- Relatively common with statewide distribution
- Unique identifying features such as color, shape or behavior



Why Use Macroinvertebrates to Study Water Quality?



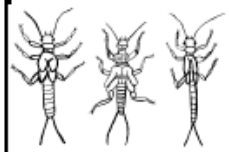
Certain macroinvertebrate species are very sensitive to pollution, and can only survive in the cleanest or healthiest streams.

The RBV Program relies on our ability to find these most sensitive, or "Most Wanted," taxa in order to use them as 'proof positive' that our monitoring station has excellent water quality.

CT's Healthy Stream Treasure Hunt

The "Four or More Rule": RBV is a 'treasure hunt' for the State's healthiest streams. We are looking for those streams that have 4 or more "Most Wanted" macroinvertebrate types at them. These macroinvertebrates are very sensitive to pollution, so if we find them it is strong evidence that the stream is very clean!

MOST WANTED (Most Sensitive to Pollution)

1	2	3	4	5A	5 B	5 C
"Body-Builder" Mayfly *Drunella sp.*	Brush-Legged Mayfly *Isonychia sp.*	2-Tail Flathead Mayfly *Epeorus sp.*	Roach-Like Stonefly Peltoperlidae	Common Stonefly Perlidae	Giant Stonefly *Pteronarcys sp.*	Misc. Small Stonefly Plecoptera
						
☐	☐	☐	☐	☐	☐	☐ ☐ ☐

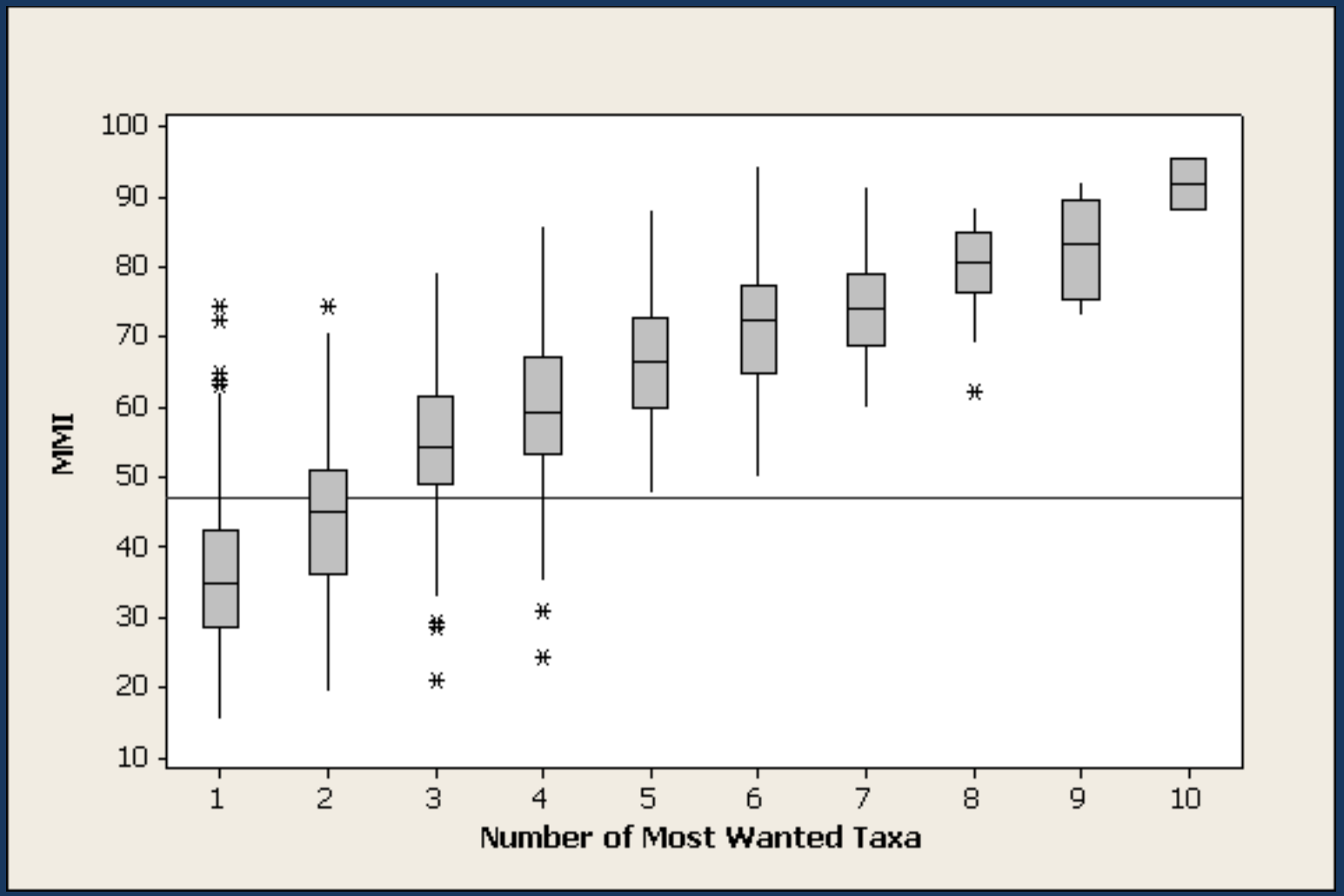
MOST WANTED (Most Sensitive to Pollution)

6A	6 B	7	8A	8 B
Saddle-Case Caddis *Glossosoma sp.*	Cornucopia Case Caddis *Apatania sp.*	Free-Living Caddis *Rhyacophila sp.*	Humpless Caddis *Brachycentrus sp.*	Plant Case Caddis *Lepidostoma sp.*
☐	☐	☐	☐	☐

# Most Wanted Types:	Water Quality:
5+	EXCEPTIONAL: *Fully Supporting* Aquatic Life Use Goals
4	EXCELLENT: *Likely Supporting* Aquatic Life Use Goals
0-3	NOT DETERMINED: More Info Needed

How Does the '4 or More' Rule Work?

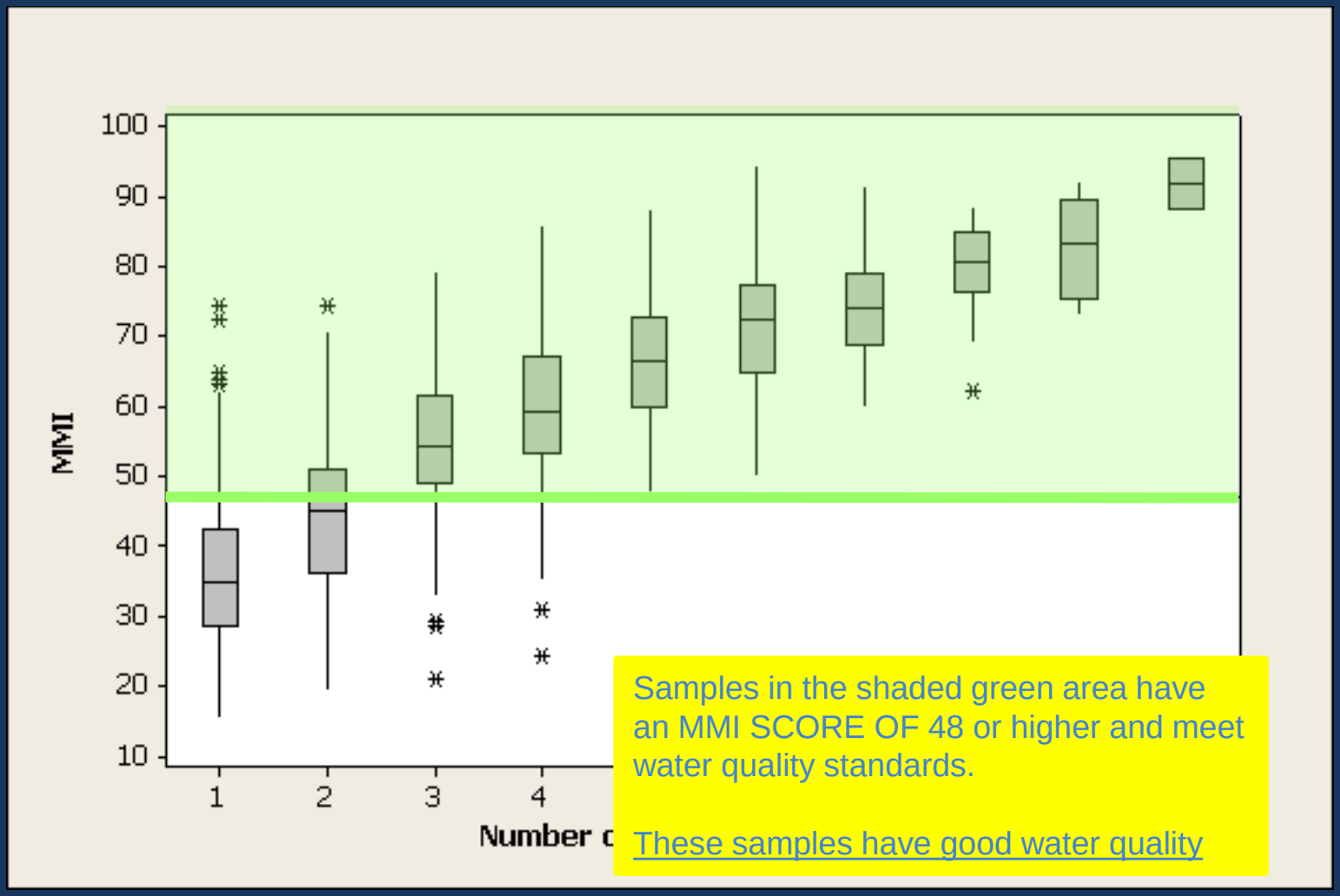
Shown at right are over 1,000 macro-invertebrate samples collected by DEEP between 1999-2011 as part of the general statewide monitoring program (e.g. not RBV samples).



How Does the '4 or More' Rule Work?

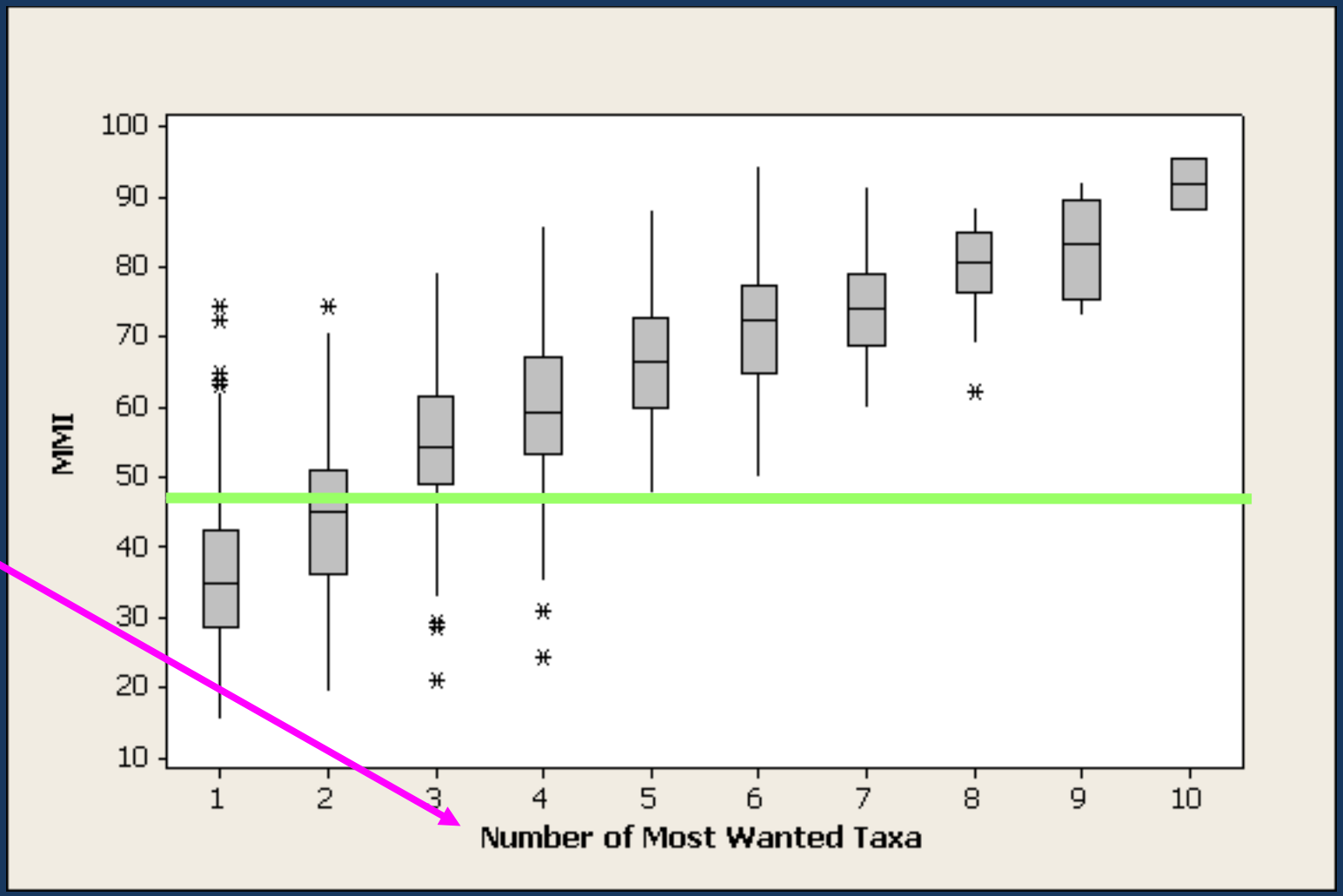
For each sample CT DEEP calculates a **multi-metric index (MMI) score** to determine if the water quality is good enough to meet state standards.

A MMI score of 48 or higher is needed to pass State water quality requirements.



How Does the '4 or More' Rule Work?

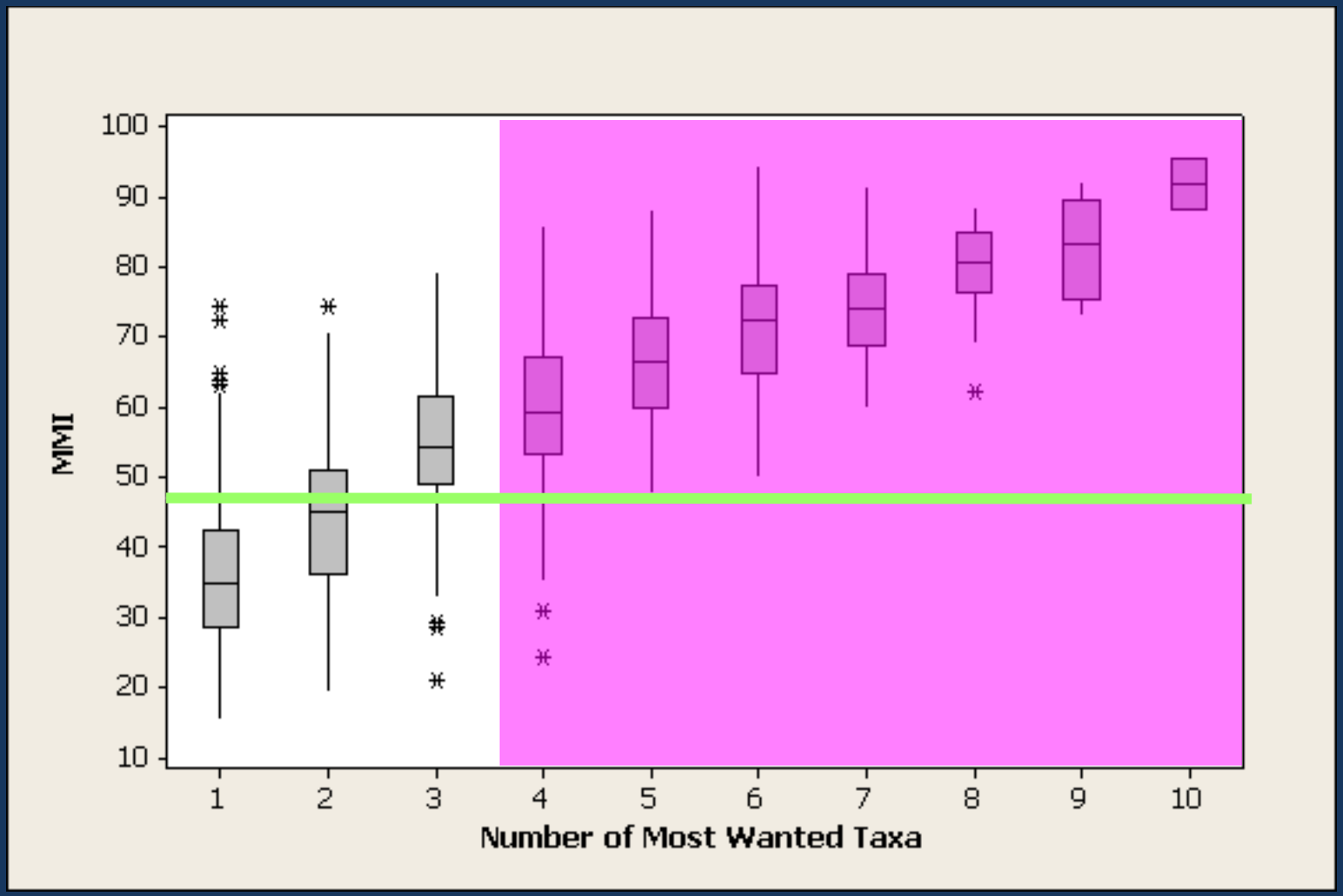
The samples in the chart are grouped by the number of RBV most wanted types they contained (bottom axis).



How Does the '4 or More' Rule Work?

The pink box highlights samples with 4 or more Most Wanted RBV types.

>99%* of these '4 or More' samples also had an MMI score greater than 48, indicating they were collected from sites with excellent water quality.

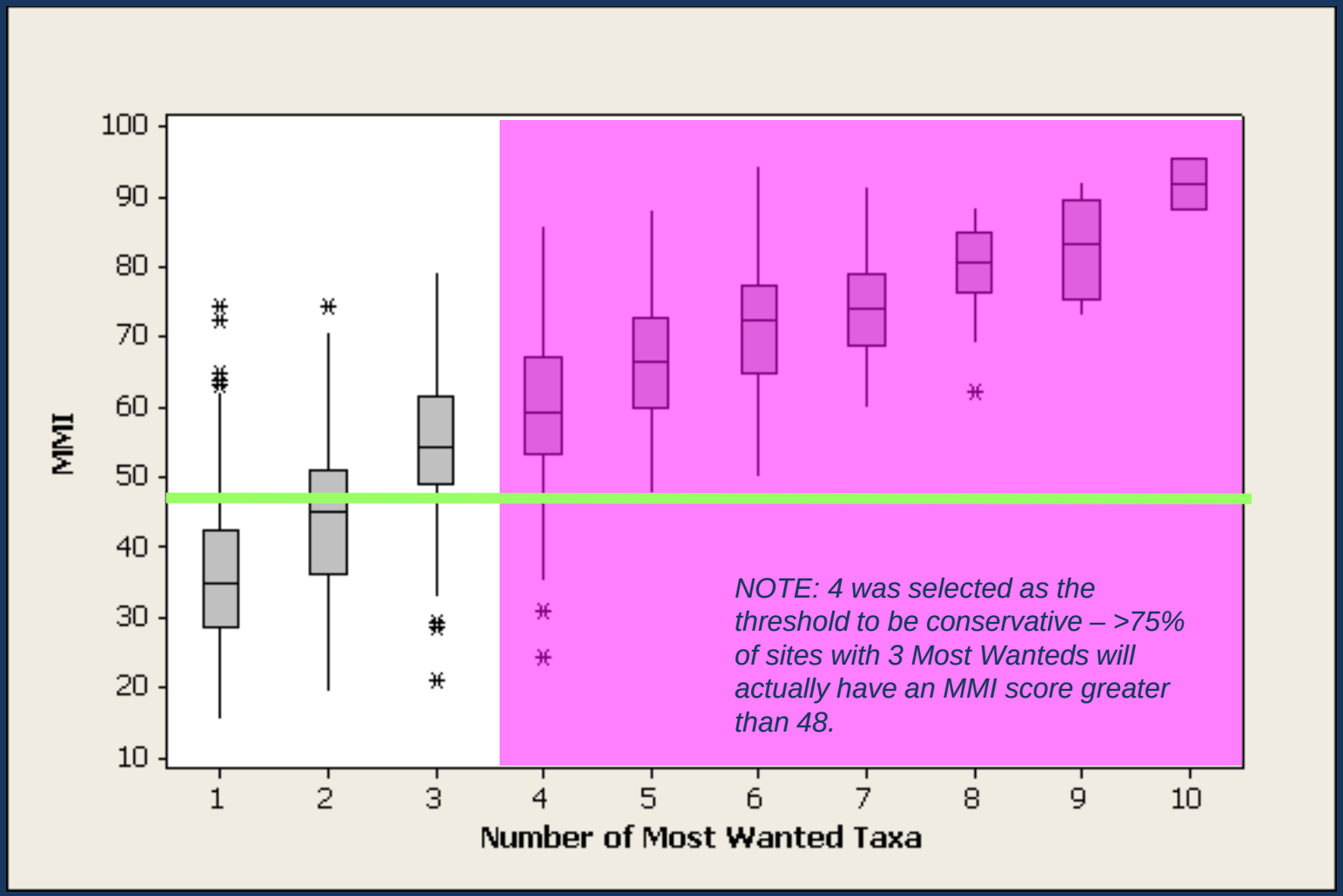


*7 out of 1152 samples had 4 Most Wanteds but an MMI score less than 48; all were sites that we would not use RBV on (e.g. large rivers)

How Does the '4 or More' Rule Work?

RBV Program Basis:

If we find 4 or More Most Wanted Types in an RBV sample, it can be used as evidence of excellent water quality.

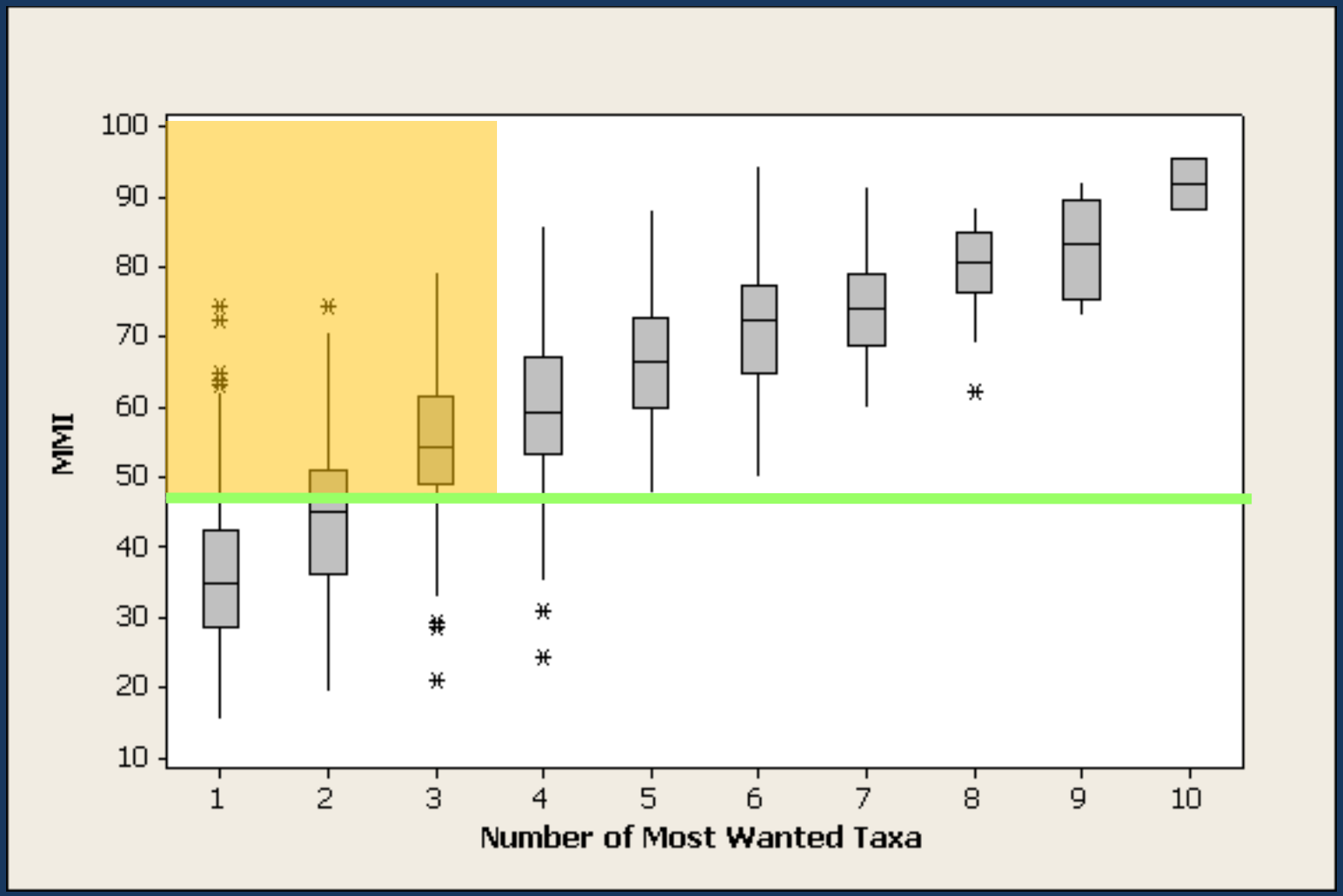


**The 7 samples that had 4 Most Wanteds but an MMI score less than 48 were very large rivers that we would not use RBV on.*

Does <4 Most Wanteds Indicate Bad Water Quality?

NO!!!

Low numbers of most wanted types is not a reliable indicator of reduced water quality.

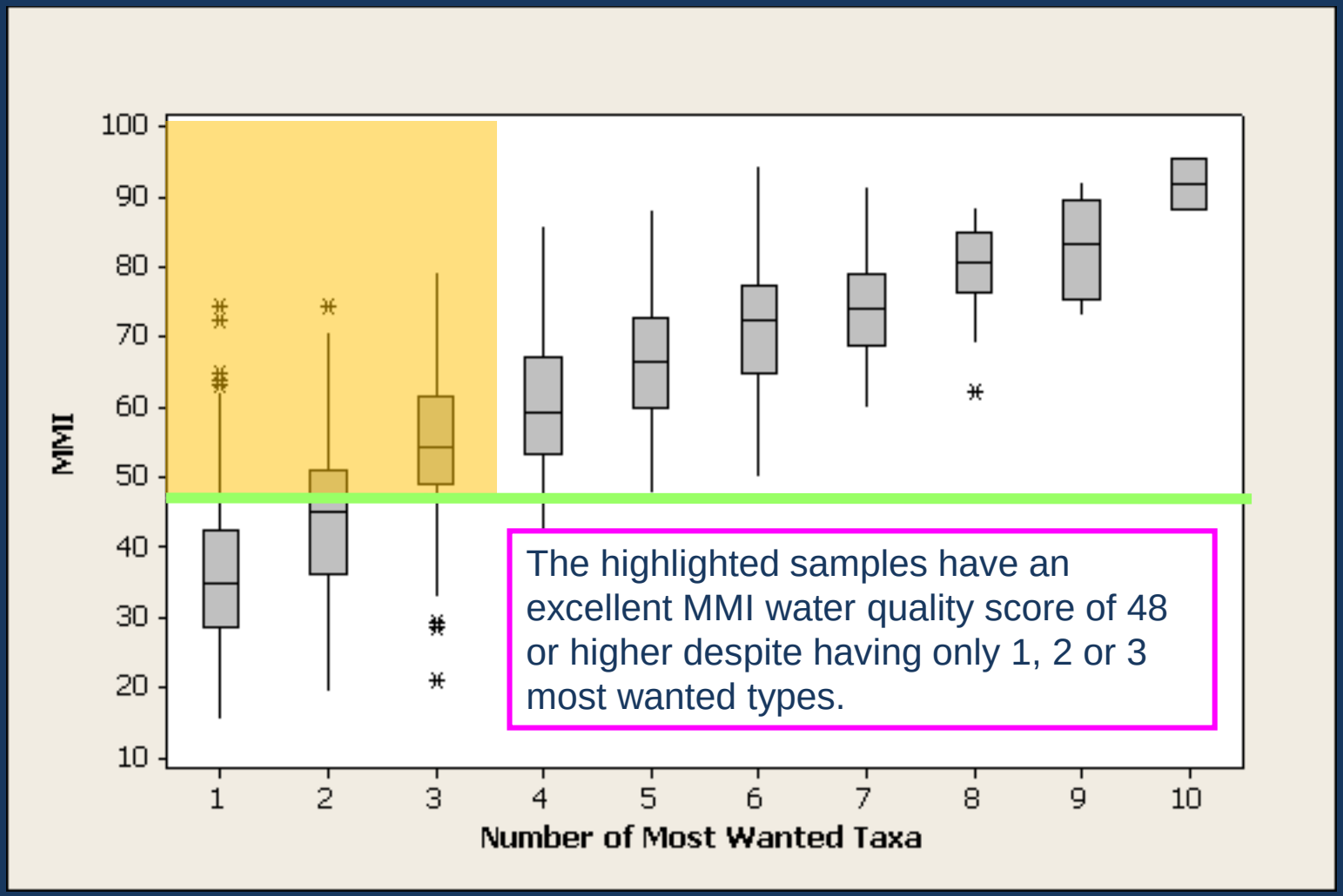


**The 7 samples that had 4 Most Wanteds but an MMI score less than 48 were very large rivers that we would not use RBV on.*

Does <4 Most Wanteds Indicate Bad Water Quality?

NO!!!

Because CT has so many species of macroinvertebrates and the 26 RBV types represent only a tiny fraction of these, not all sites with good water quality will have 4 or More RBV Most Wanted taxa present.



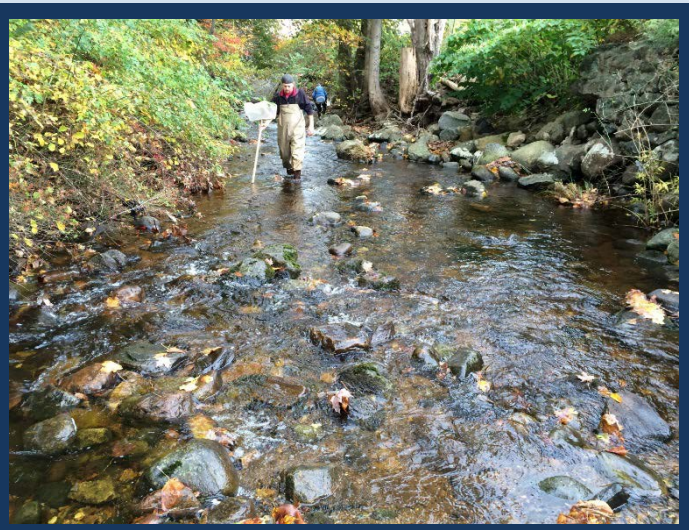
Where Do We Use RBV?

Not all waterbodies can be successfully monitored with RBV – we are primarily looking to document high quality headwater streams.

RBV monitoring locations must be:

- Smaller streams and rivers, approximately 1st-3rd order in size (<15 mi2 watershed)
- Characterized by plenty of riffle habitat
- Free of discharges, dams, or other obvious factors that would reduce water quality.
- Flow year-round under normal conditions

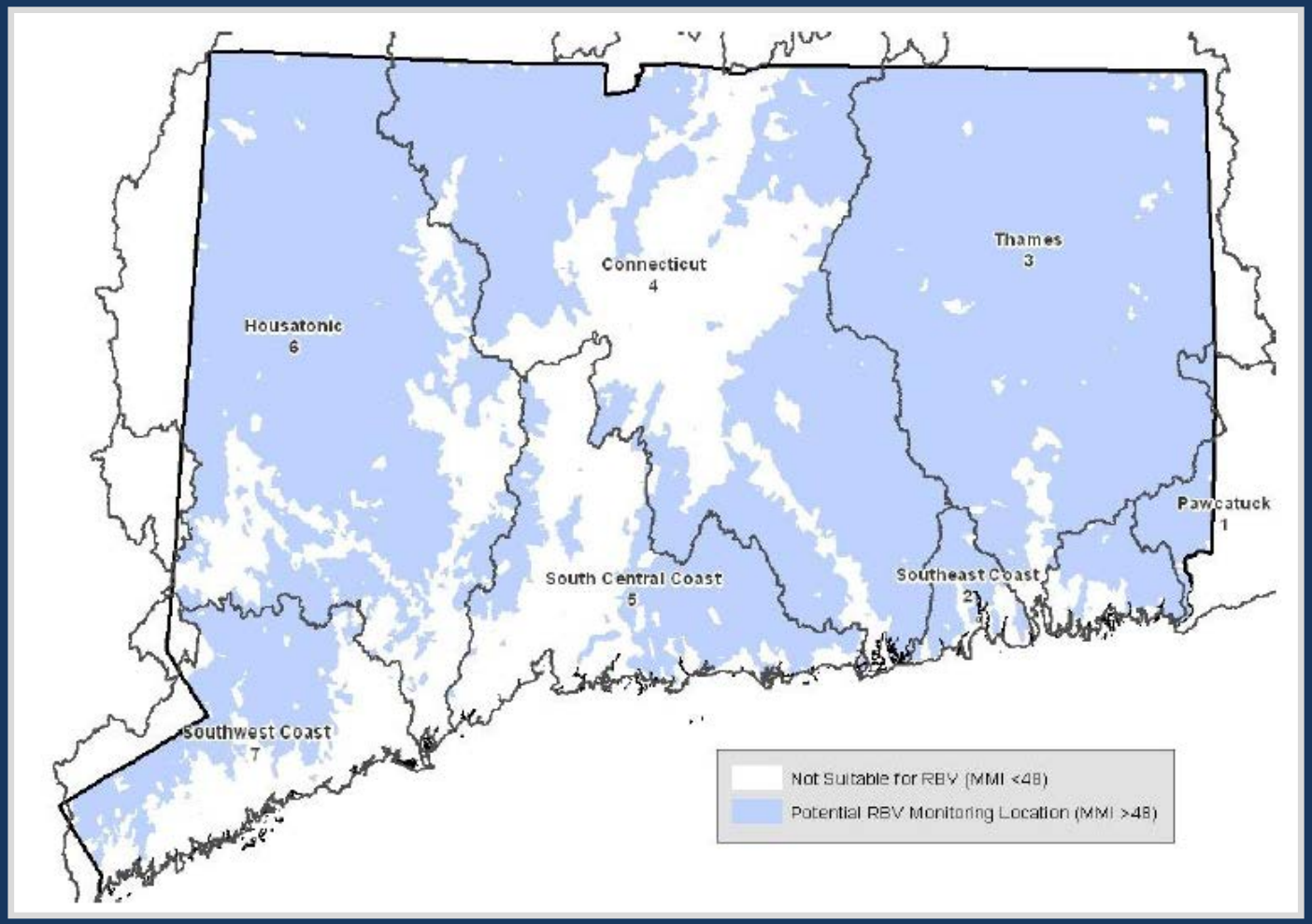
Don't forget - we are on a treasure hunt for Connecticut's healthiest streams!



Recommended RBV Monitoring Regions

RBV is a 'treasure hunt' for CT's healthiest streams!

Volunteers will be targeting streams predicted to have an MMI score of 48 or greater (i.e. predicted to have excellent water quality.)



Want to Learn More? Go to the Website!

RBV Webpage:
www.ct.gov/deep/rbv

- Additional Overview Information
- Annual Summary Reports
- State Coordinator Information
- Copies of Training Presentations
- Downloadable field materials

Riffle Bioassessment by Volunteers (RBV)

Volunteer Training Presentation:

Part 2 – RBV Methods & Procedures

A CT DEEP Tier 2

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Connecticut Department of Energy and Environmental Protection

The Field Team

RBV volunteers sample in groups referred to as "Field Teams."

- Groups consist of at least 2 volunteers ('team members') typically no more than 5
- Each field team is supervised by a **Field Team Leader**
    - Experienced volunteer (at least 1 year of prior experience)
    - Assigned to team by Local RBV Coordinator; reports to the Local RBV Coordinator
    - Responsible for reviewing and submitting field data package (photos, datasheet, voucher) at end of sample

Experienced Volunteer – 1 or more years of training and experience within past two years.

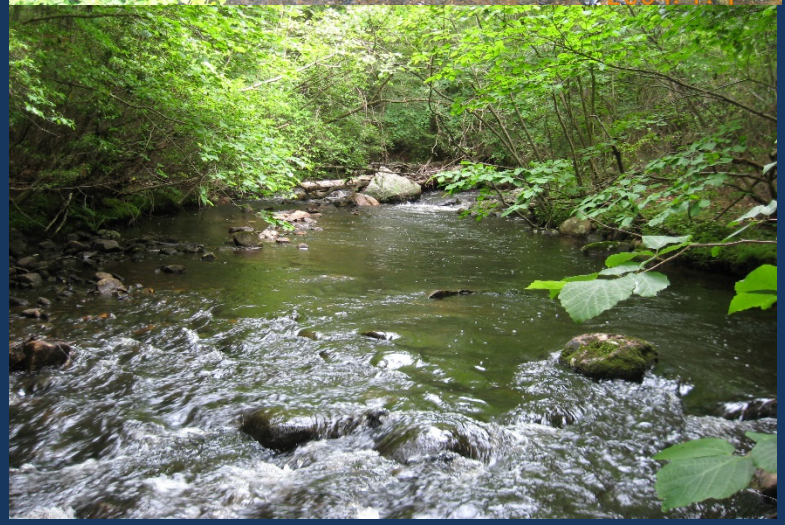
New Volunteer – no prior RBV experience OR has not participated in more than 2 years

Youth Volunteer – anyone under 18 regardless of past experience; refer to local program rules regarding participation limitations

Overview of the RBV Protocol

- Site selection (set up)
- Site photographs and GPS
- Collect (scrub & kick)
- Process (observe & Sort)
- Identify
- Voucher
- Submit
- Congratulations!

Monitoring Station Selection



Sites are selected in advance by the Local RBV Coordinator

- RBV Site Requirements:
  - Safely accessible by volunteers
  - Characterized by riffle habitat
  - Small, perennial 1st-3rd order streams (no large rivers!!)
  - Not listed as impaired or immediately downstream of a discharge or dam

*Ideal Sites are headwater streams thought to be high quality but which have not been monitored or assessed by DEEP within the past two years.

RIFFLES!!

Step 1: Site Set Up

Establish the Sampling Station:

- Select an appropriate riffle area

NOTE:

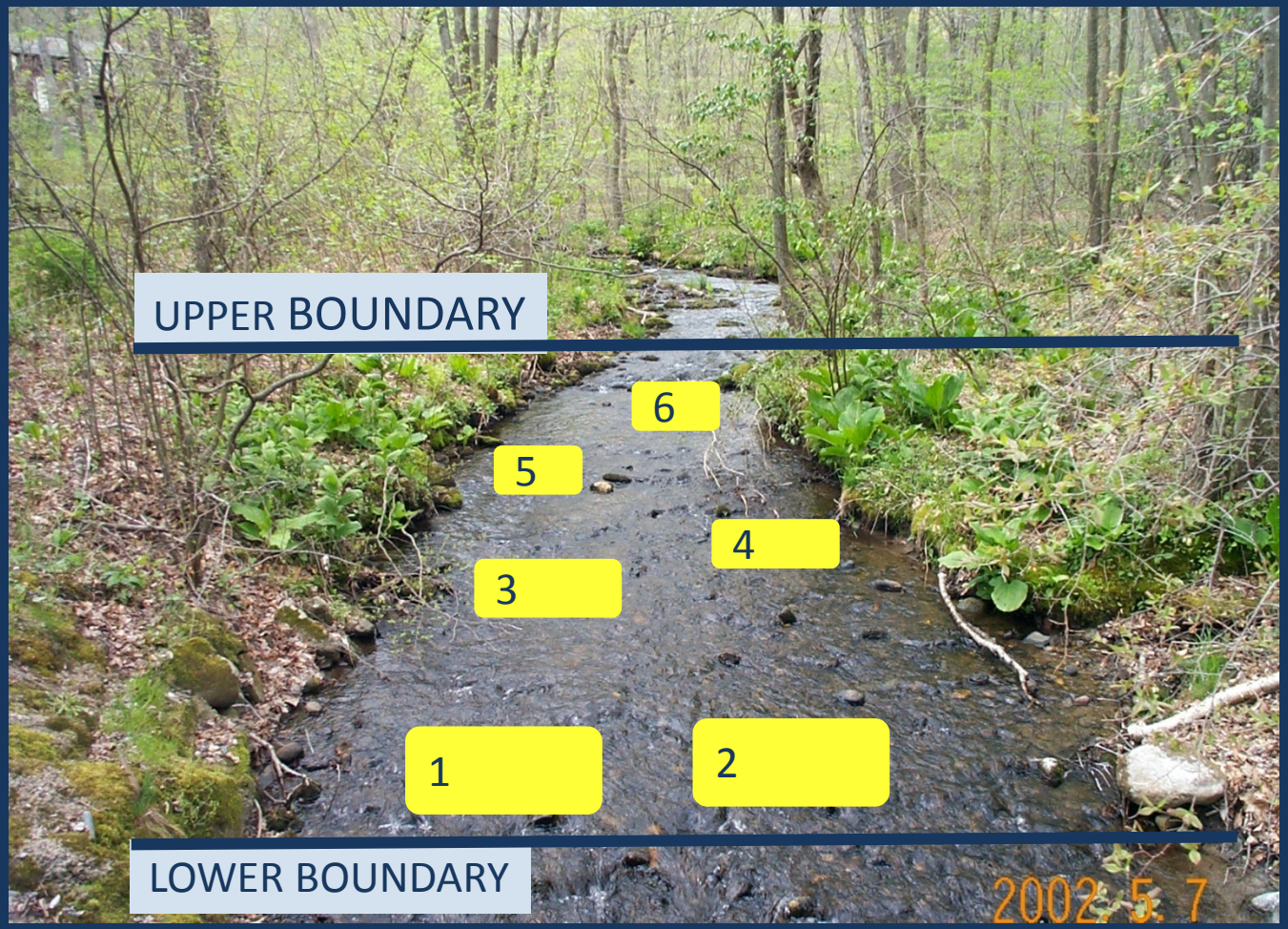
If sampling at a road crossing – sample UPSTREAM of the crossing whenever possible

Step 1: Site Set Up

Establish the Sampling Station:

- Select an appropriate riffle area
- Define the <u>upper and lower boundaries</u> of the riffle

Step 1: Site Set Up



Establish the Sampling Station:

- Select an appropriate riffle area
- Define the upper and lower boundaries of the riffle
- Visualize where you can put the net into the water 6 times

Note: One Site may require several riffles

Note: One Site may require several riffles

Step 2: Site Photographs & GPS Location

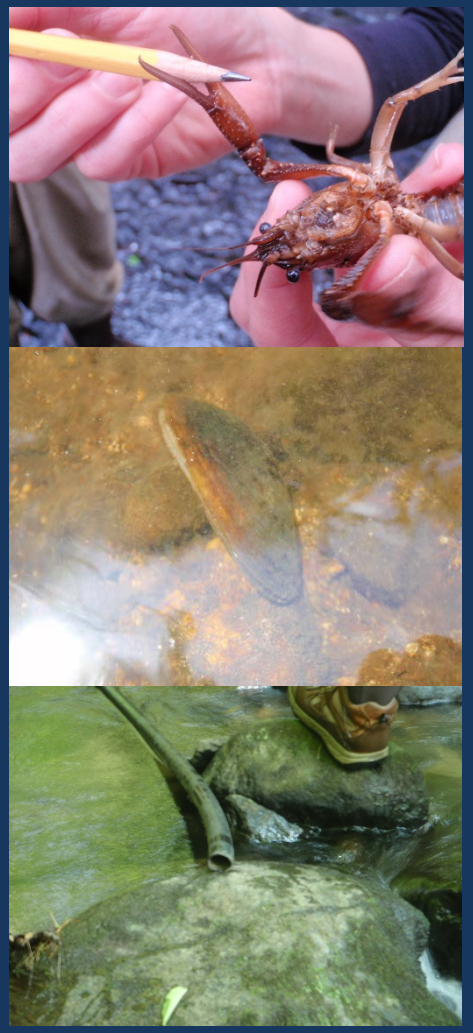
- For each site take two photographs:
  - Stand in the middle of your riffle and face **upstream** → take photo #1
  - Turn 180 degrees so that you are now facing **downstream** → take photo #2

Example upstream site photograph

Remember: The goal is to take a photograph to document the area from which you will collect the sample!

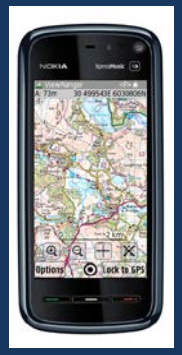
Step 2: Site Photographs & GPS Location

- Take photographs the same day as conducting the RBV event
- Try to capture the field conditions at the time of sampling - Include as much of the riparian vegetation and upstream/downstream area as possible
- Take additional photographs of unusual or unique features as needed



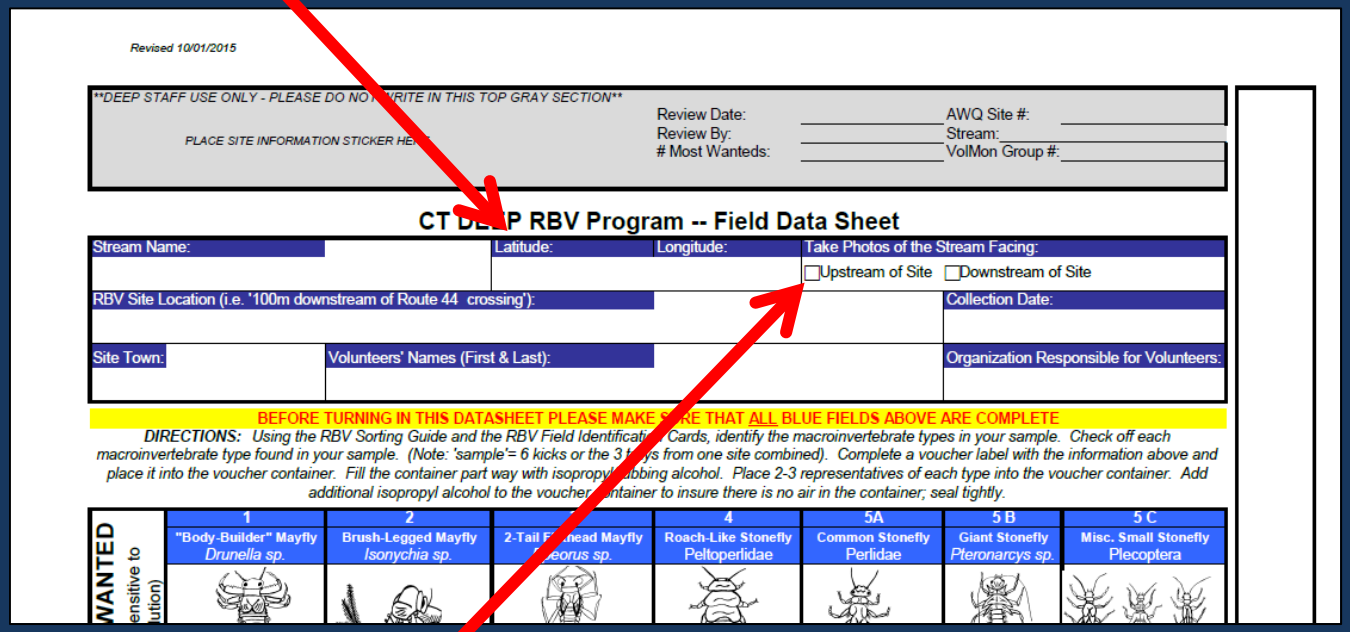
Step 2: Site Photographs & GPS Location

- Use a GPS unit or cell-phone with GPS feature to collect the latitude and longitude of the site. <u>Record the lat/long on your datasheet!!</u>



Step 2: Site Photographs & GPS Location

- Record the site latitude/longitude information on your datasheet.



Revised 10/01/2015

DEEP STAFF USE ONLY - PLEASE DO NOT WRITE IN THIS TOP GRAY SECTION

PLACE SITE INFORMATION STICKER HERE

Review Date: _____ AWQ Site #: _____
Review By: _____ Stream: _____
Most Wanteds: _____ VolMon Group #: _____

CT DEEP RBV Program -- Field Data Sheet

Stream Name:	Latitude:	Longitude:	Take Photos of the Stream Facing: ☐Upstream of Site ☐Downstream of Site
RBV Site Location (i.e. '100m downstream of Route 44 crossing'):			Collection Date:
Site Town:	Volunteers' Names (First & Last):		Organization Responsible for Volunteers:

BEFORE TURNING IN THIS DATASHEET PLEASE MAKE SURE THAT ALL BLUE FIELDS ABOVE ARE COMPLETE

DIRECTIONS: Using the RBV Sorting Guide and the RBV Field Identification Cards, identify the macroinvertebrate types in your sample. Check off each macroinvertebrate type found in your sample. (Note: 'sample'= 6 kicks or the 3 trays from one site combined). Complete a voucher label with the information above and place it into the voucher container. Fill the container part way with isopropyl rubbing alcohol. Place 2-3 representatives of each type into the voucher container. Add additional isopropyl alcohol to the voucher container to insure there is no air in the container; seal tightly.

WANTED (sensitive to pollution)	1	2	3	4	5A	5 B	5 C
	"Body-Builder" Mayfly *Drunella sp.*	Brush-Legged Mayfly *Isonychia sp.*	2-Tail Flathead Mayfly *Heptageorus sp.*	Roach-Like Stonefly Peltoperlidae	Common Stonefly Perlidae	Giant Stonefly *Pteronarcys sp.*	Misc. Small Stonefly Plecoptera

- Check off the boxes on the datasheet to confirm you have taken each of the required site photographs.

Step 3: Collect (Scrub & Kick!!)

Collect aquatic macroinvertebrates from each of the six locations within your site. Scrub any rocks within the net first before kicking the area in front of the net vigorously (max 2 minutes per kick). Kick in a "Z" pattern for 1 minute. Empty the contents of each pair of kicks into a white tray.

Step 3: Collect

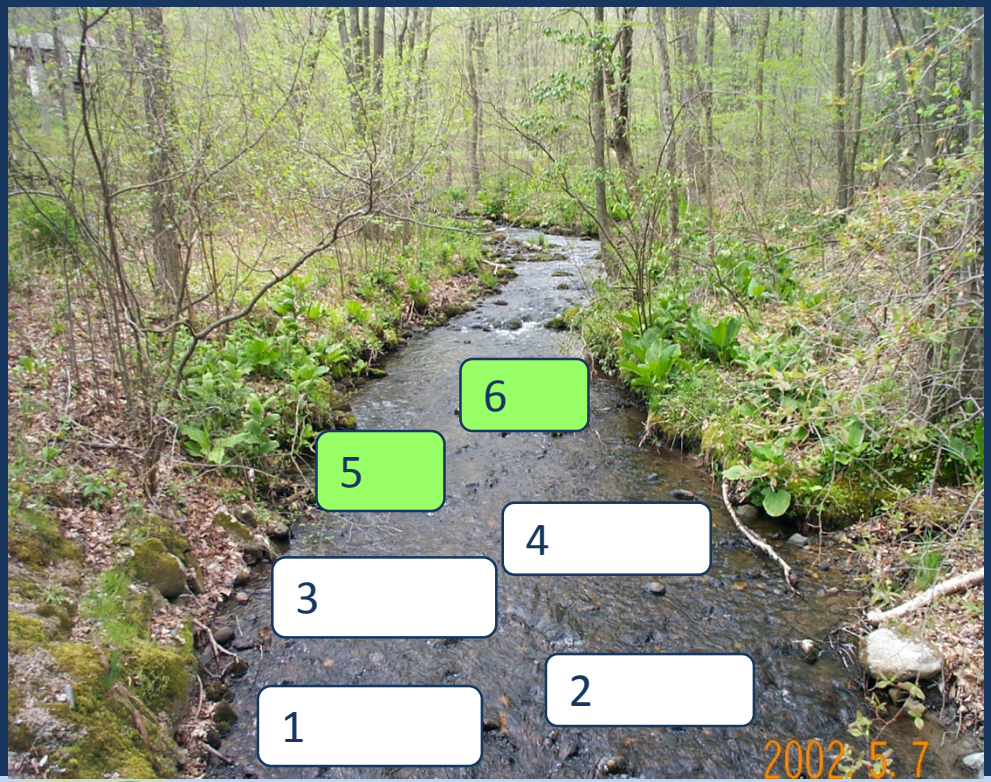
- Collect Samples from Locations 1 & 2
- EMPTY CONTENTS OF KICKS 1&2 INTO TRAY A

Step 3: Collect

- Collect Samples from Locations 3 & 4
- EMPTY CONTENTS OF KICKS 3&4 INTO TRAY B

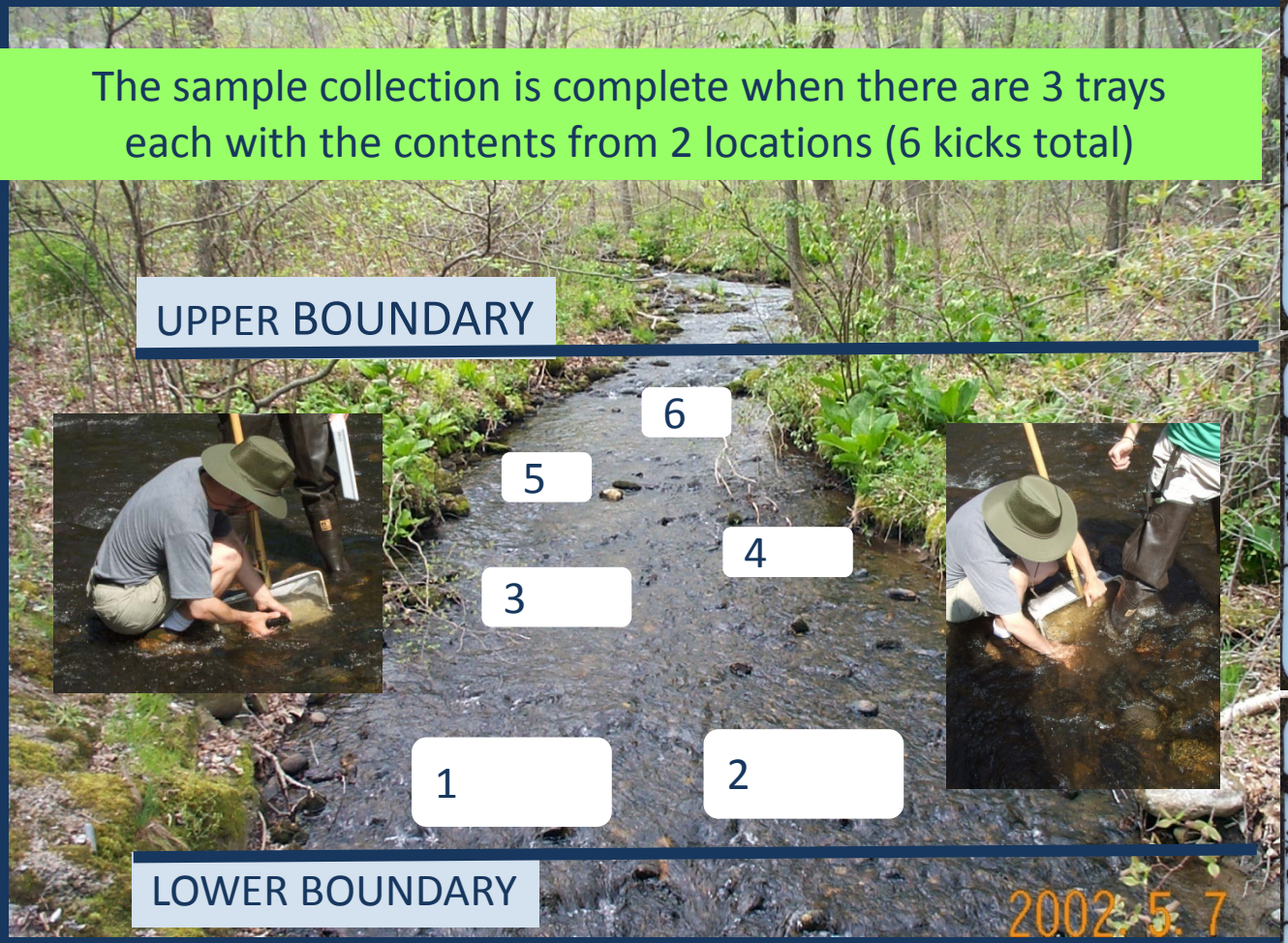
Step 3: Collect

- Collect Samples from Locations 5 & 6
- EMPTY CONTENTS OF KICKS 5&6 INTO TRAY C



Step 3: Collect

The sample collection is complete when there are 3 trays each with the contents from 2 locations (6 kicks total)



Step 4: Process the Sample (Sorting)

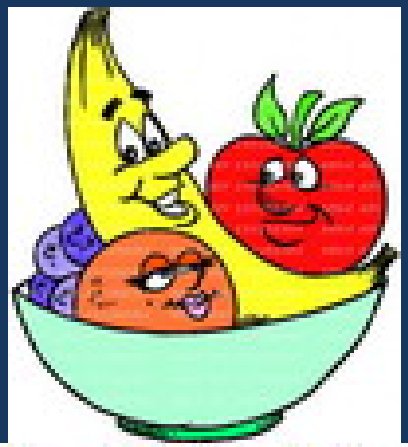
- Use tweezers and spoons
- Pick out organisms and place in ice cube tray
- Sort similar looking organisms into the same cube
- <u>Look carefully – some are very small and/or camouflaged</u>
- Experienced team leaders oversee the process

Step 4: Sorting

Processing is complete when you have found
as many of the different TYPES as possible and put representatives of each type into the ice cube trays

Step 5: Identify the Macroinvertebrates

Step 5: Identify the Macroinvertebrates



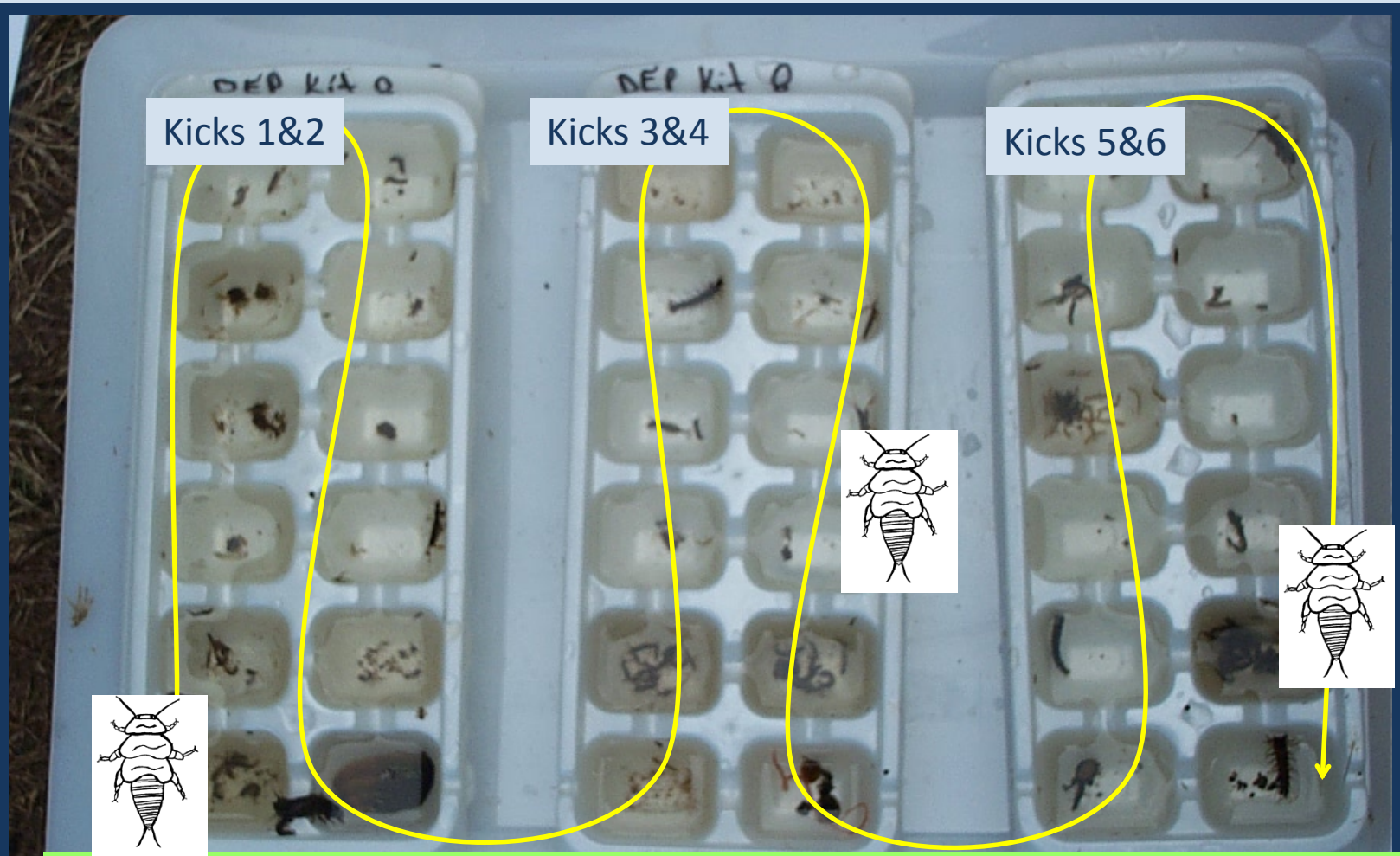
Do not stress over identifications!!
RBV volunteers are not expected to identify 100% of all organisms correctly!

Sorting your sample into different types and then adding 2-3 of each type to your voucher - *even if you don't know what they actually are* - is what is most important.

RBV is like making a fruit bowl from a big pile of random produce…

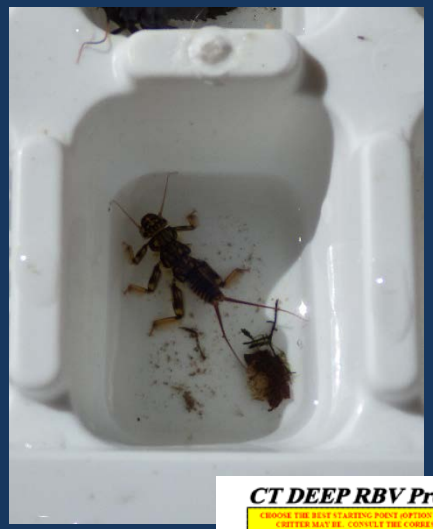
You probably know many of the fruit shown at left but there are also probably a few you aren't sure about, right? So imagine you were given a big pile of these different fruits and someone needs your help making a fruit bowl for display. The display needs to contain at least one of each type of fruit - would you be able to sort the pile into similar looking fruits and then place 2-3 of each type of fruit into a bowl? Sure you could! ☺

Step 5: Identify



Start with the one ice cube well and weave your way through, identifying the organisms as you go. Check off each organisms you identify on the data sheet.

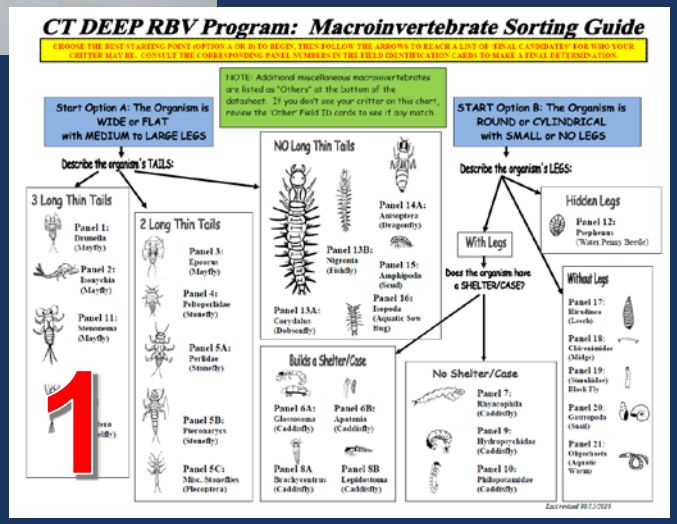
3-Part Identification Process

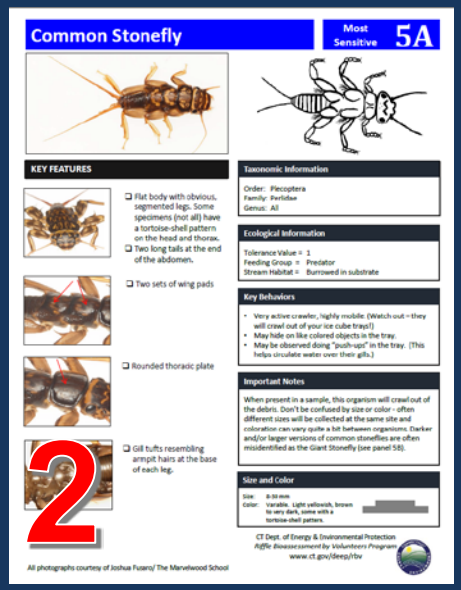


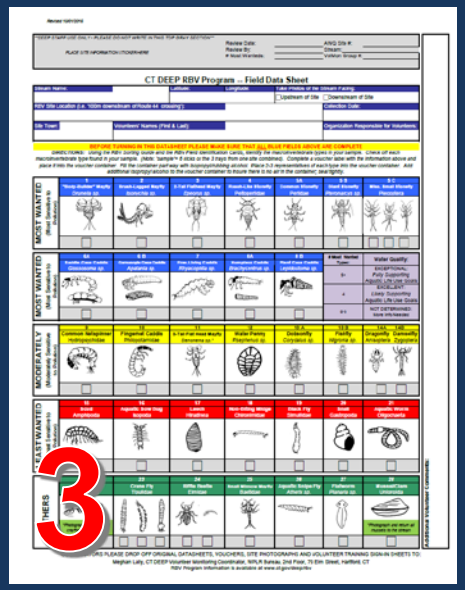
Step 1 –MACROINVERTEBRATE SORTING GUIDE

Step 2 –FIELD IDENTICATION CARDS

Step 3 – Check off **DATASHEET**

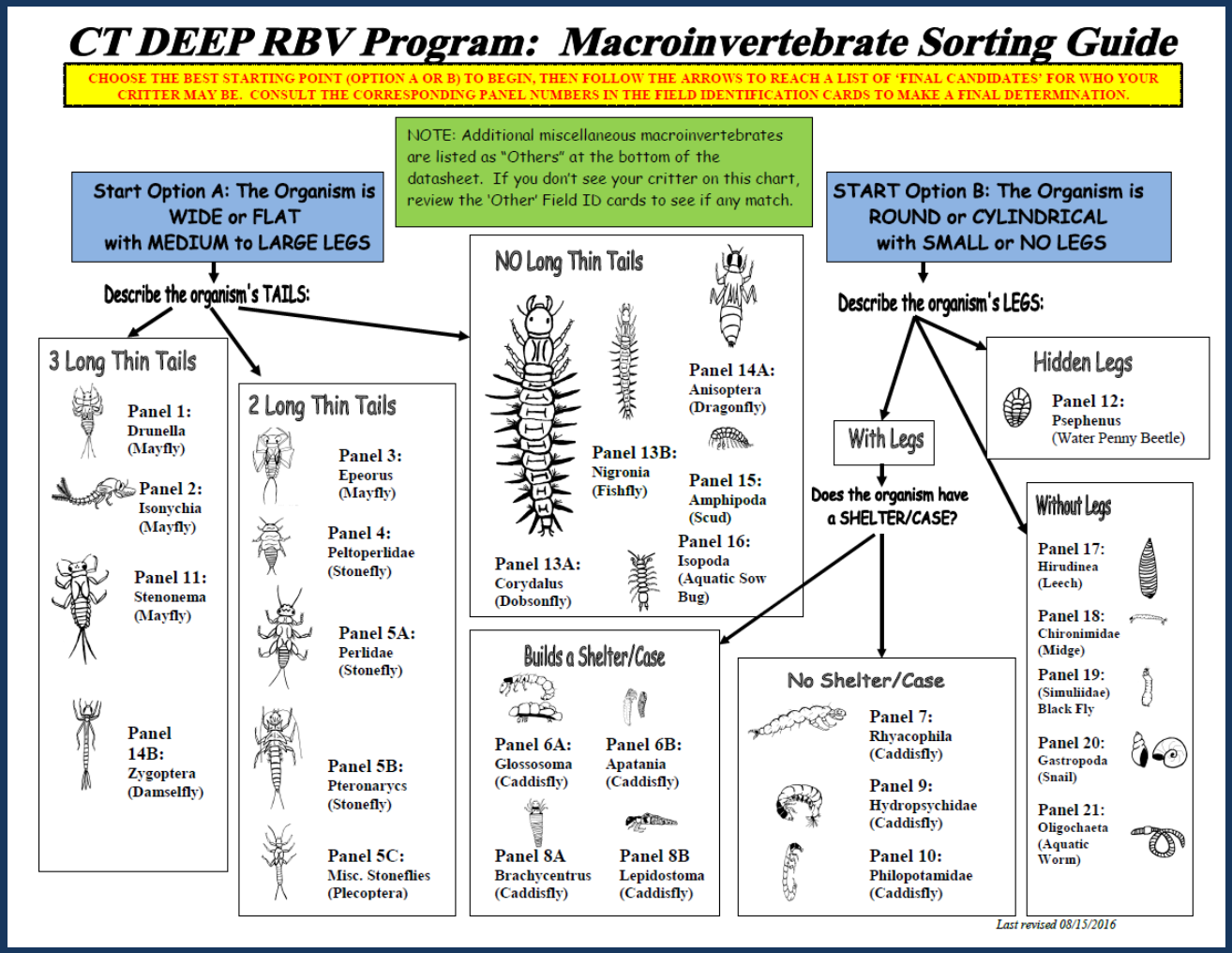






Connecticut Department of Energy and Environmental Protection

Start with the Sorting Guide



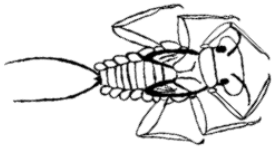
STEP 1:
Use the sorting guide and field ID cards to identify each type of macroinvertebrate present in your sample.

<u>Note the numbers on the ID cards correspond to those on the sorting guide and datasheet.</u>

Review Field Identification Cards

Two-Tailed Flathead Mayfly

Most Sensitive 3



KEY FEATURES

- ❑ Extremely flat, almost translucent body, long thin legs.

- ❑ Small round gills on the sides of the abdomen.
- ❑ Two Long thin tails at the end of the abdomen (easily broken)

- ❑ Single set of wing pads.
- ❑ Wide flat head, obvious eyes.

Taxonomic Information

Order: Ephemeroptera
Family: Heptageniidae
Genus: *Epeorus*

Ecological Information

Tolerance Value = 0
Feeding Group = Scraper
Stream Habitat = Cobble and organic substrates

Key Behaviors

- This mayfly nymph crawls very fast on the surface of stones.
- Will move quickly in the tray and try to hide under any leaves or sticks present.
- *Epeorus* may try to swim by wiggling side to side.

Important Notes

The best way to find *Epeorus* is to carefully 'wash off' cobbles in the net before kicking. When present, these mayflies will scurry along the surface of the rock. Because of the body color and shape, they can be very difficult to spot. *Epeorus* can be extremely abundant when conditions are appropriate.

Size and Color

Size: 2-10 mm
Color: Tan to dark brown, sometimes with lighter gills and markings on the legs and head.

Photographs courtesy of (top to bottom): Kelsey Quartuccio / CT DEEP; DEEP files, author unknown; NY DEC Biomonitoring Unit; DEEP files, author unknown

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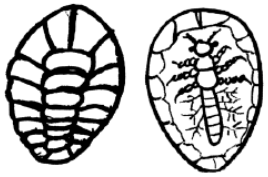
Water Penny Beetle

Moderately Sensitive 12



KEY FEATURES

- ❑ Small, flat, disc-shaped organism.
- ❑ Uniform in color
- ❑ Head and legs only visible from ventral view (i.e. from underneath)

Don't be Fooled by This Imposter!

- ❑ Often confused with the False Water Penny (*Eubriidae*). *Eubriidae* is more ovoid in shape and has a serrated or more jagged outer edge.

Taxonomic Information

Order: Coleoptera
Family: Psephenidae
Genus: *Psephenus*

Ecological Information

Tolerance Value = 4
Feeding Group = Scraper
Stream Habitat = Attached to rocks in fast flows

Key Behaviors

- Cling very well to rocks and smooth surfaces such as the sorting tray (see image at left)
- May glide along the bottom of the tray
- May curl up when disturbed

Important Notes

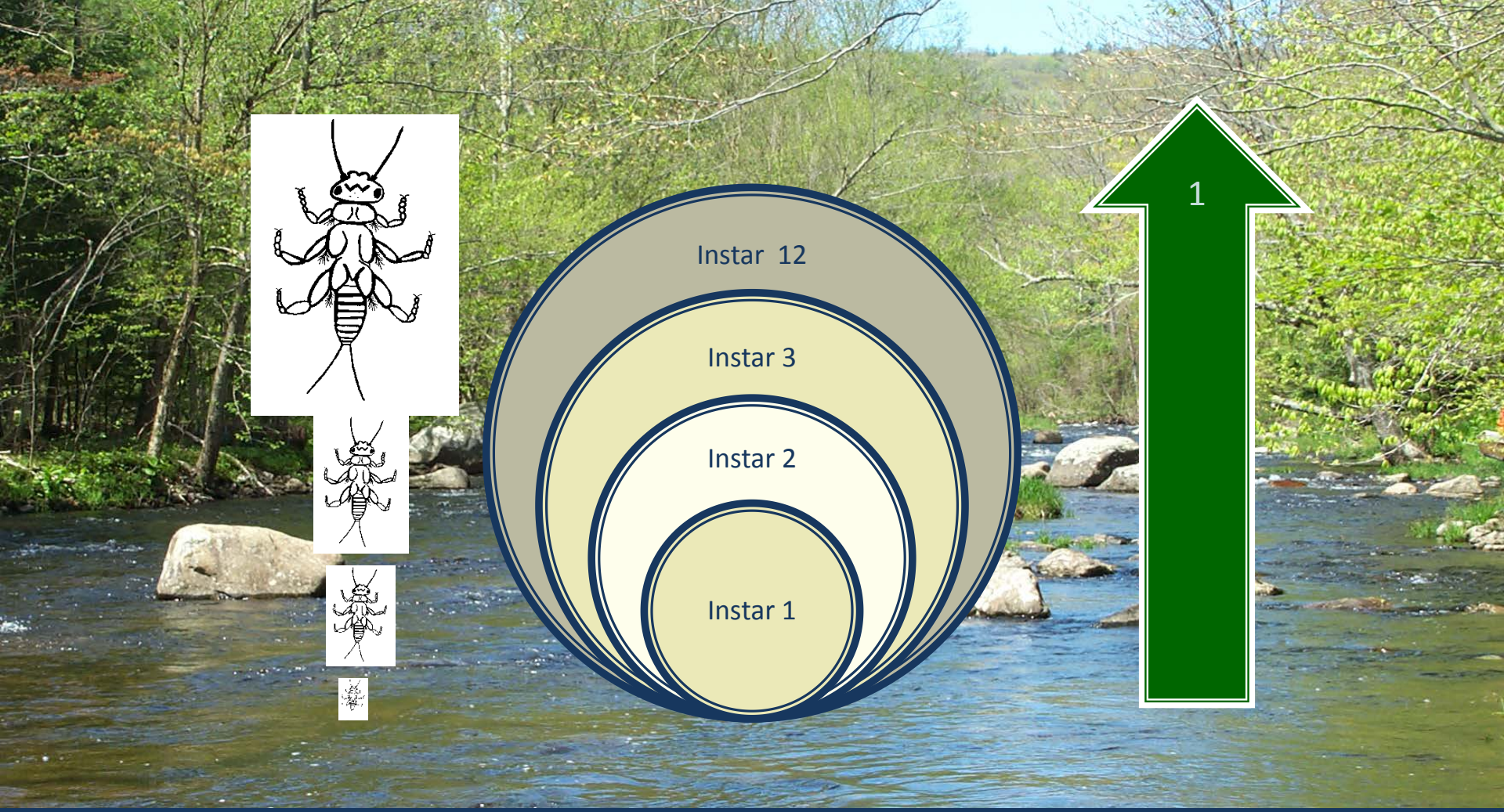
Water penny beetle larvae are common in RBV samples, but can be very hard to locate in the field due to their cryptic nature. Look very closely at any cobbles in your sample area; water penny beetle larva will adhere strongly to rock surfaces. They are very distinctive due to their penny like shape and coloration. These organisms can be locally abundant when conditions are appropriate.

Size and Color

Size: 3-10 mm
Color: Uniform in color. Ranges from golden to dark brown.

Photographs courtesy of (top to bottom): Jake Renkert / The Marvelwood School (top three); Meghan Lally/CT DEEP; The Marvelwood School/Kent Conservation Commission RBV program; The

CT Dept. of Energy & Environmental Protection
Riffle Bioassessment by Volunteers Program
www.ct.gov/deep/rbv



Don’t be fooled by size!

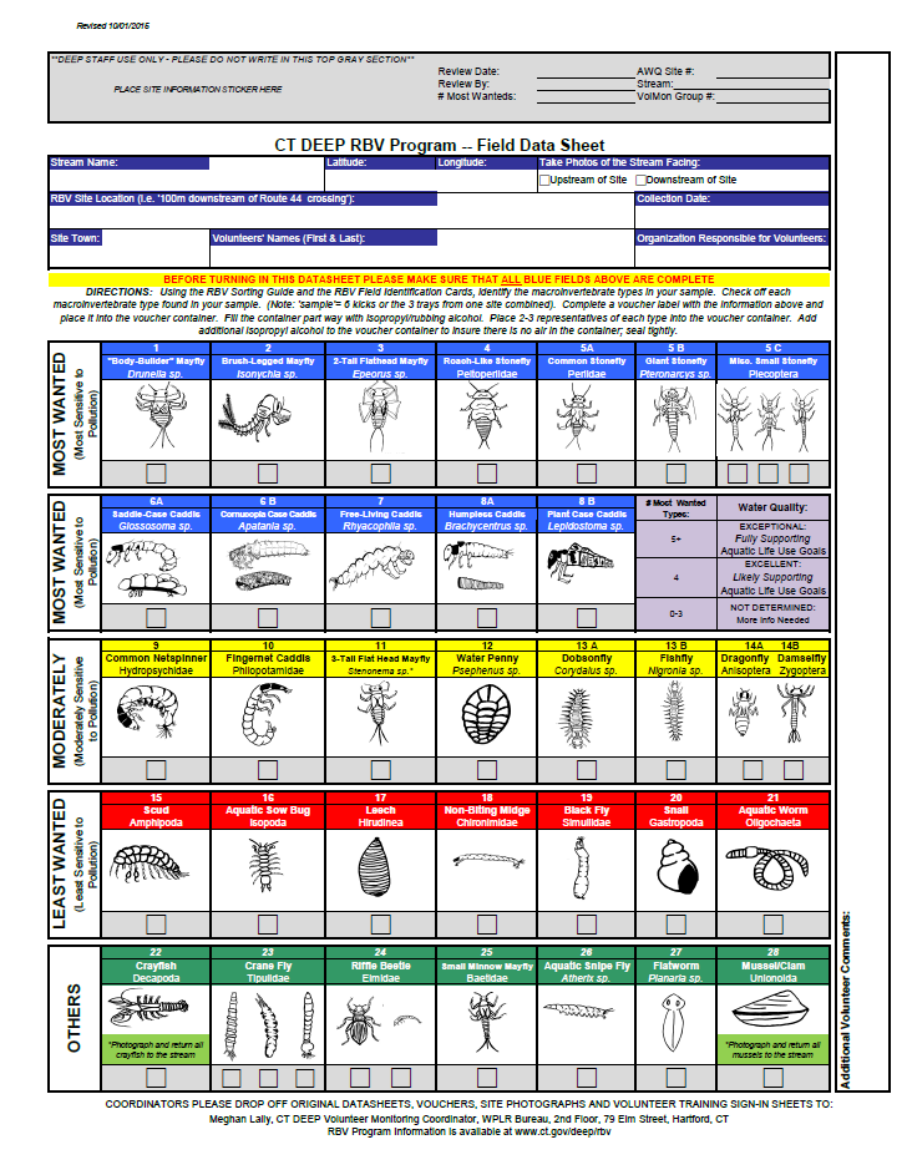
Connecticut Department of Energy and Environmental Protection

Check off ID on Datasheet

Complete the top of your datasheet!!!

Check to make sure the top of your datasheet is complete.

Check off all of the macroinvertebrate types that were present in your sample (all 6 kicks combined).



Revised 10/01/2015

DEEP STAFF USE ONLY - PLEASE DO NOT WRITE IN THIS TOP GRAY SECTION

PLACE SITE INFORMATION STICKER HERE

Review Date: ____ Review By: ____ # Most Wanteds: ____

AWQ Site #: ____ Stream: ____ VolMon Group #: ____

CT DEEP RBV Program -- Field Data Sheet

Stream Name:	Latitude:	Longitude:	Take Photos of the Stream Facing: ☐Upstream of Site ☐Downstream of Site
RBV Site Location (i.e. '100m downstream of Route 44 crossing'):			Collection Date:
Site Town:	Volunteers' Names (First & Last):		Organization Responsible for Volunteers:

BEFORE TURNING IN THIS DATASHEET PLEASE MAKE SURE THAT ALL BLUE FIELDS ABOVE ARE COMPLETE

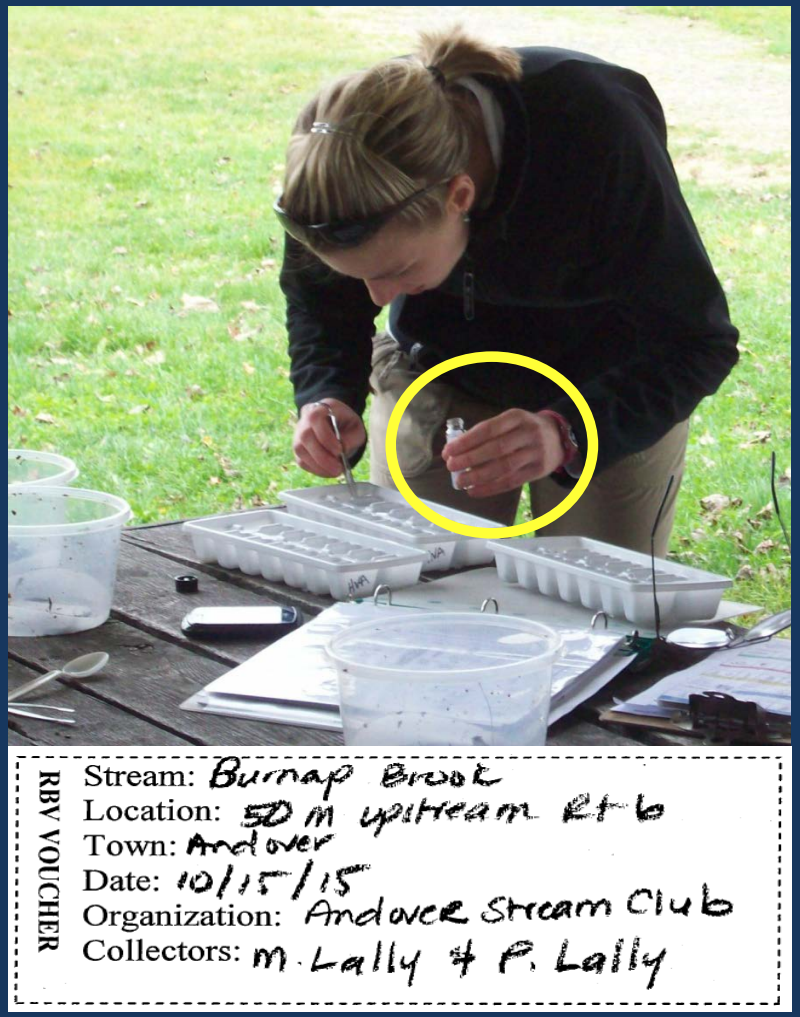
DIRECTIONS: Using the RBV Sorting Guide and the RBV Field Identification Cards, identify the macroinvertebrate types in your sample. Check off each macroinvertebrate type found in your sample. (Note: 'sample'= 6 kicks or the 3 trays from one site combined). Complete a voucher label with the information above and place it into the voucher container. Fill the container part way with isopropyl/rubbing alcohol. Place 2-3 representatives of each type into the voucher container. Add additional isopropyl alcohol to the voucher container to insure there is no air in the container; seal tightly.

MOST WANTED (Most Sensitive to Pollution)	1 "Body-Builder" Mayfly *Drunella sp.*	2 Brush-Legged Mayfly *Isonychia sp.*	3 2-Tail Flathead Mayfly *Epeorus sp.*	4 Roach-Like Stonefly Peltoperlidae	5A Common Stonefly Perlidae	5 B Giant Stonefly *Pteronarcys sp.*	5 C Misc. Small Stonefly Plecoptera
MOST WANTED (Most Sensitive to Pollution)	6A Saddle-Case Caddis *Glossosoma sp.*	6 B Cornucopia Case Caddis *Apatania sp.*	7 Free-Living Caddis *Rhyacophila sp.*	8A Humpless Caddis *Brachycentrus sp.*	8 B Plant Case Caddis *Leptodostoma sp.*	# Most Wanted Types: / Water Quality: 5+ EXCEPTIONAL: *Fully Supporting* Aquatic Life Use Goals; 4 EXCELLENT: *Likely Supporting* Aquatic Life Use Goals; 0-3 NOT DETERMINED: More Info Needed	
MODERATELY (Moderately Sensitive to Pollution)	9 Common Netspinner Hydropsychidae	10 Fingernet Caddis Philopotamidae	11 3-Tail Flat Head Mayfly *Stenonema sp.*	12 Water Penny *Psephenus sp.*	13 A Dobsonfly *Corydalus sp.*	13 B Fishfly *Nigronia sp.*	14A Dragonfly Anisoptera; 14B Damselfly Zygoptera
LEAST WANTED (Least Sensitive to Pollution)	15 Scud Amphipoda	16 Aquatic Sow Bug Isopoda	17 Leech Hirudinea	18 Non-Biting Midge Chironimidae	19 Black Fly Simuliidae	20 Snail Gastropoda	21 Aquatic Worm Oligochaeta
OTHERS	22 Crayfish Decapoda *Photograph and return all crayfish to the stream	23 Crane Fly Tipulidae	24 Riffle Beetle Elmidae	25 Small Minnow Mayfly Baetidae	26 Aquatic Snipe Fly *Atherix sp.*	27 Flatworm *Planaria sp.*	28 Mussel/Clam Unionoida *Photograph and return all mussels to the stream

Additional Volunteer Comments:

COORDINATORS PLEASE DROP OFF ORIGINAL DATASHEETS, VOUCHERS, SITE PHOTOGRAPHS AND VOLUNTEER TRAINING SIGN-IN SHEETS TO:
Meghan Lally, CT DEEP Volunteer Monitoring Coordinator, WPLR Bureau, 2nd Floor, 79 Elm Street, Hartford, CT
RBV Program Information is available at www.ct.gov/deep/rbv

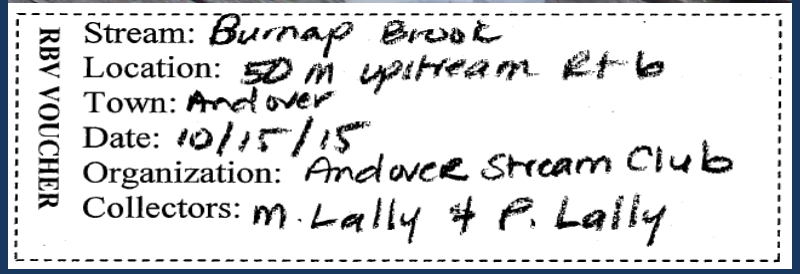
Step 6: Prepare a Voucher



CRITICAL STEP!!

- Steps To Create and Preserve a Voucher Collection of RBV Organisms:
  1. Complete your label and insert it into your container.
  2. Fill the container half way with preservative (alcohol).
  3. Put 2-3 of each RBV organism type found into the container (no mussels or crayfish).
  4. Add any unknown organisms to the container.
  5. Fill the container the remaining way with preservative.
  6. Optional: complete and tape a second label to the outside of the voucher container.
  7. Seal tightly for transport and give to your Field Team Leader.

Step 6: Prepare a Voucher



****THE VOUCHER IS YOUR DATA – THE VOUCHER IS THE PROOF THAT AN ORGANISM TYPE WAS PRESENT IN YOUR SAMPLE****

IMPORTANT:

- Use only pencil to write!! The preservative will dissolve ink.
- Site information on the voucher label and the datasheet MUST be the same.
- Be sure to fill your container COMPLETELY with preservative before sealing.
- Do not use baby jars or containers with ribbed sides (e.g. water or sports drink bottles).

Step 7: Crayfish & Mussels

- Crayfish and mussels should not be placed in the voucher!!
- Photograph any live crayfish found and return to the stream.
- Live mussels should be left in place if observed – photograph if possible.

- **If empty mussel shells are found (dead mussels), place them in a plastic bag with a completed RBV voucher label and submit with your RBV materials to your Local RBV Coordinator.

Step 8: Submit Data, Voucher, Photos

- For each site monitored, **the Field Team Leader is responsible for submitting** the following to their Local RBV Coordinator:
  - **Two digital photographs** for each site monitored: one facing upstream and one facing downstream from the center of your sampling area.
  - **One preserved and labelled RBV voucher** per site. Remember to place a COMPLETE label inside the container and fill completely with preservative. A second label can be taped to the outside if desired.
  - **One datasheet** per site. Make sure to complete ALL fields, and write legibly!
  - Optional: labelled mussel specimens, additional site/critter photographs

Questions?