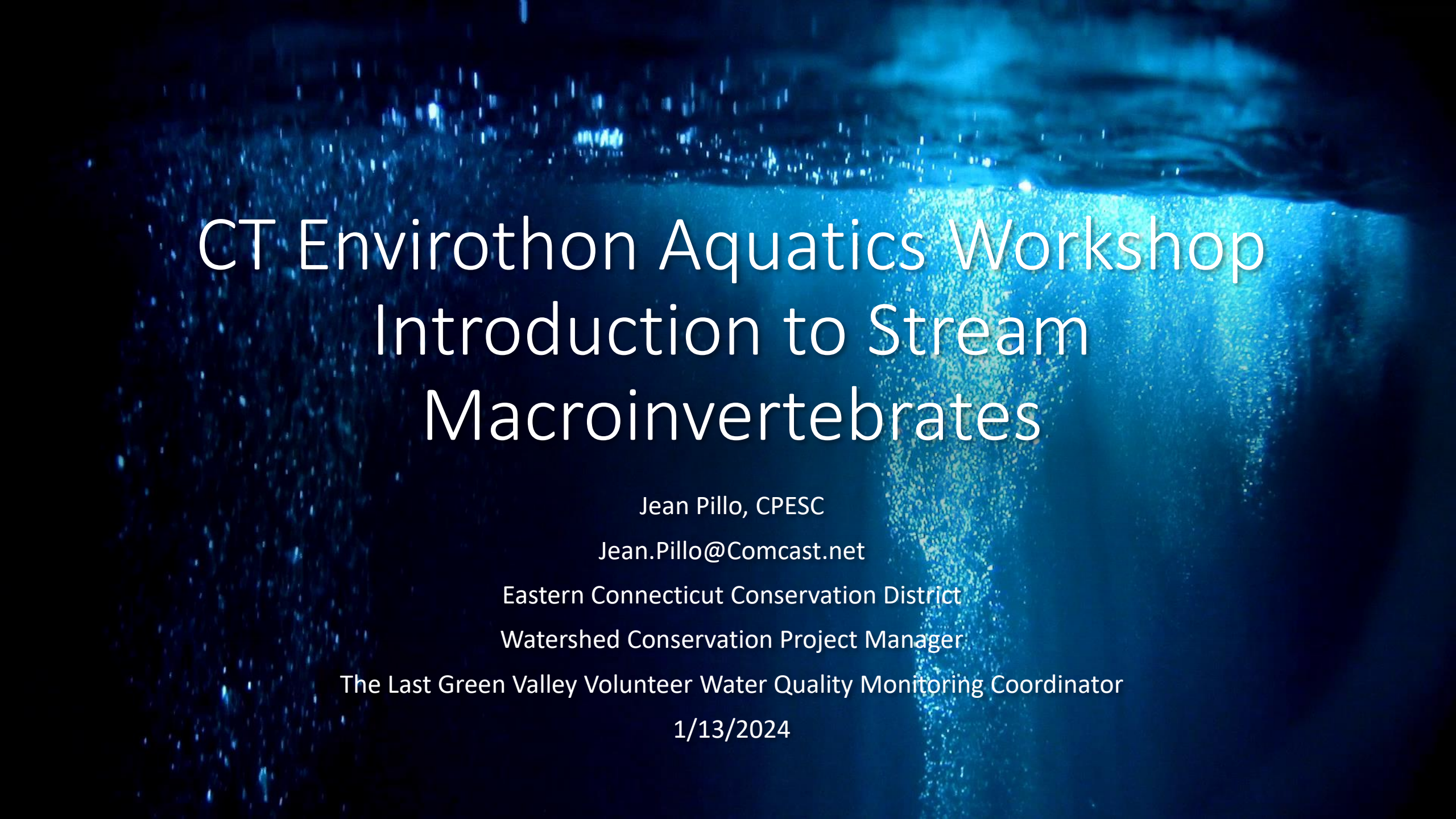


CT Envirothon Aquatics Workshop Introduction to Stream Macroinvertebrates

Jean Pillo, CPESC

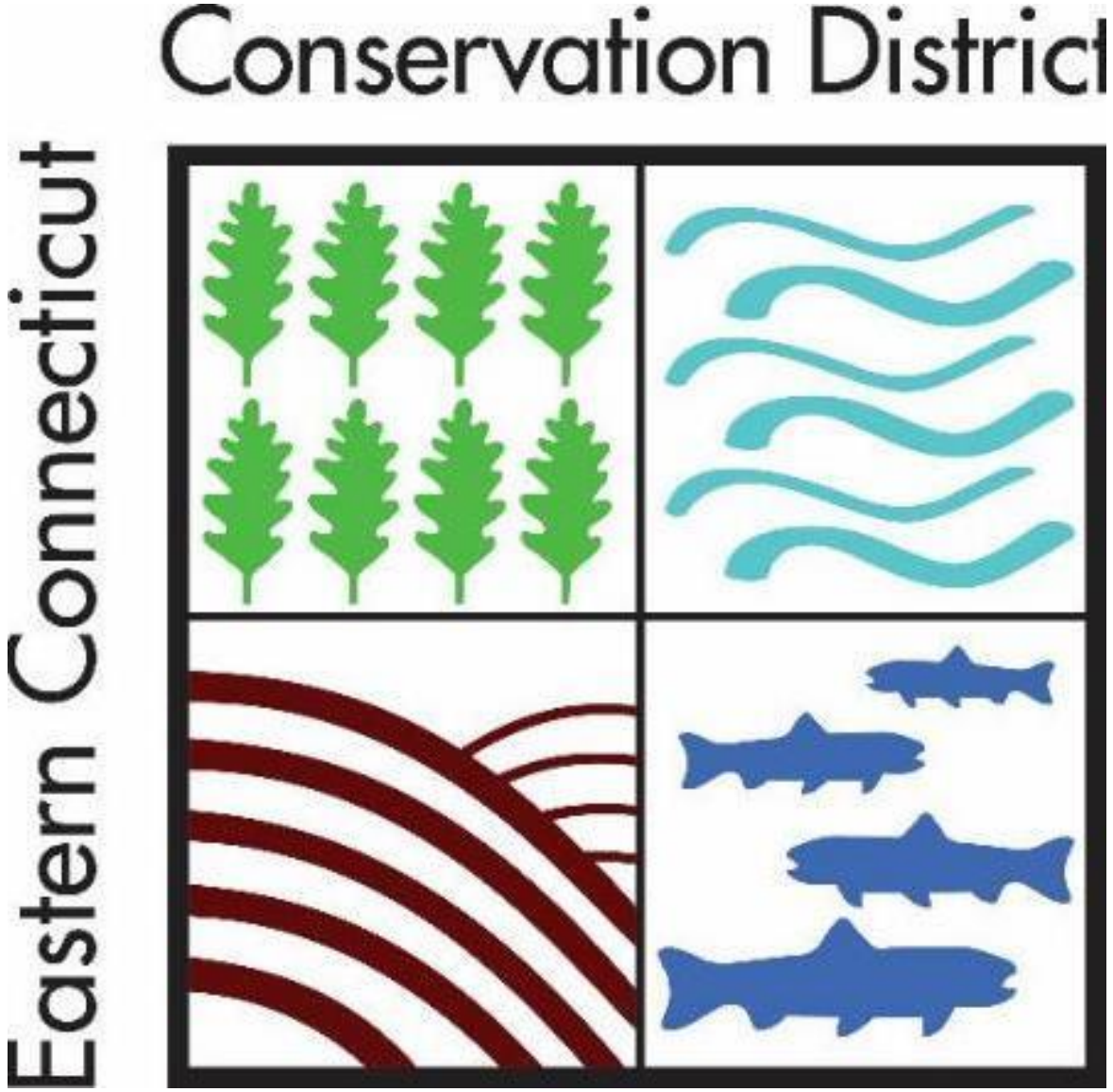
Jean.Pillo@Comcast.net

Eastern Connecticut Conservation District

Watershed Conservation Project Manager

The Last Green Valley Volunteer Water Quality Monitoring Coordinator

1/13/2024



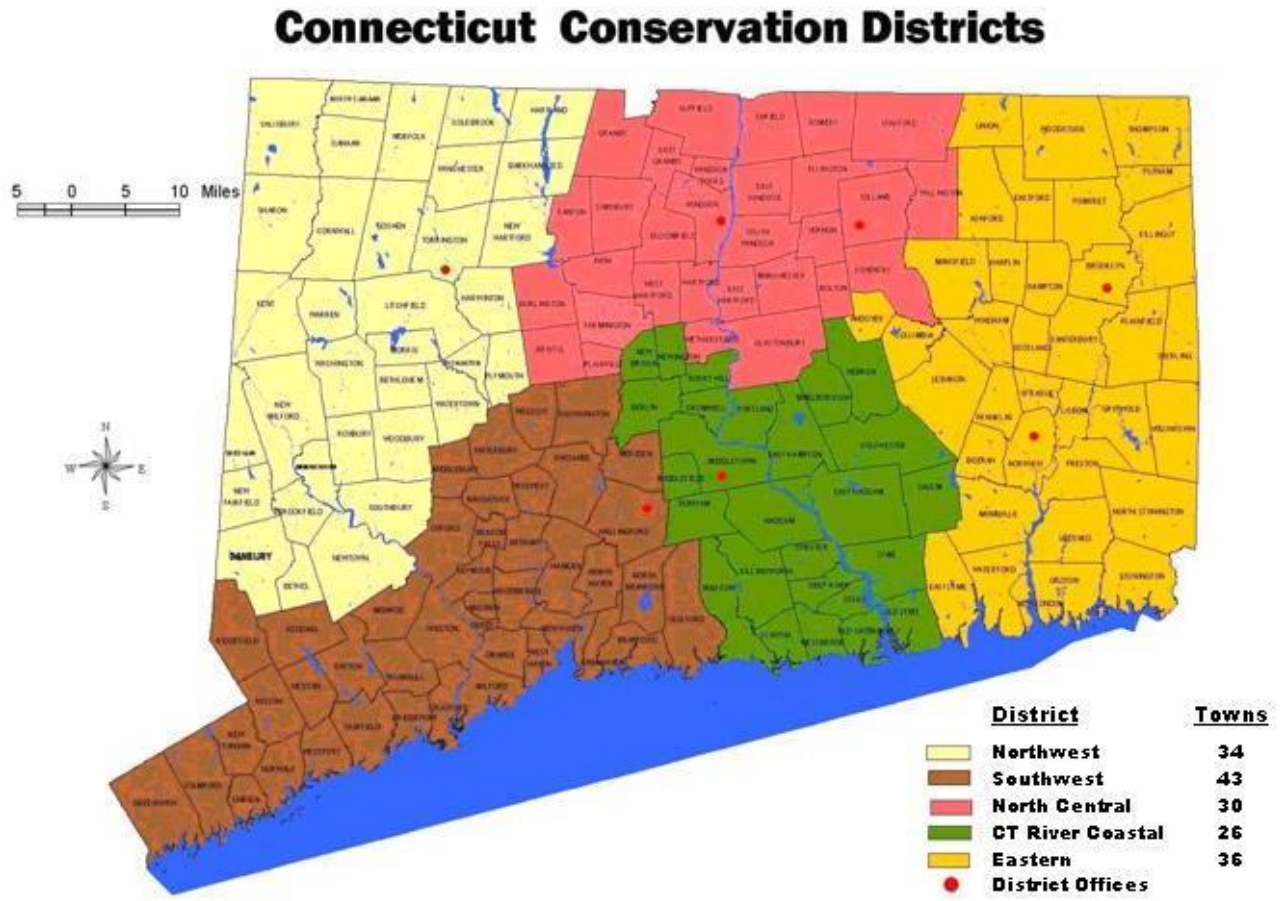
http://www.ConserveCT.org/eastern

The Eastern Connecticut Conservation District, Inc.

A Not-For-Profit
Natural Resource Conservation
Organization

Connecticut's Five Conservation Districts

- Quasi-governmental organizations created by State Statute 22a-315 (amended to 22a-315-11) in 2002.
- Independent Non-profit organization overseen by an elected Board of Directors.
- Primary activities:
  - Conduct projects, watershed management investigations and test new conservation methods;
  - Present workshops on natural resource topics;
  - Assist Town "Land Use" Commissions with environmental reviews of development plans;
  - Work with local citizens and towns to raise awareness of natural resource concerns



Macroinvertebrate definition

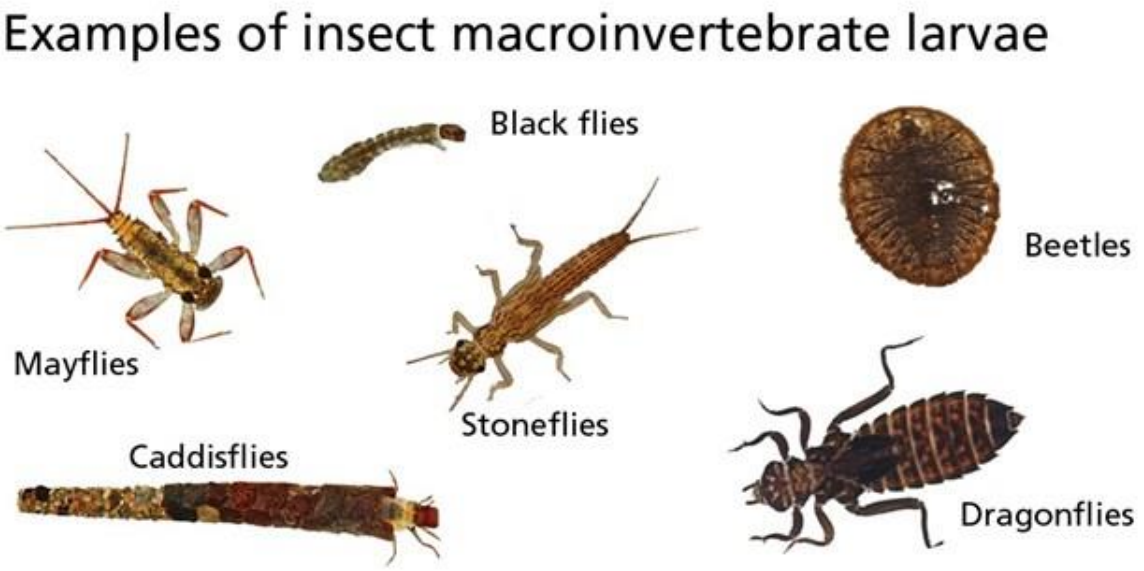
Macroinvertebrates are organisms that are large (macro) enough to be seen with the naked eye and lack a backbone (invertebrate).

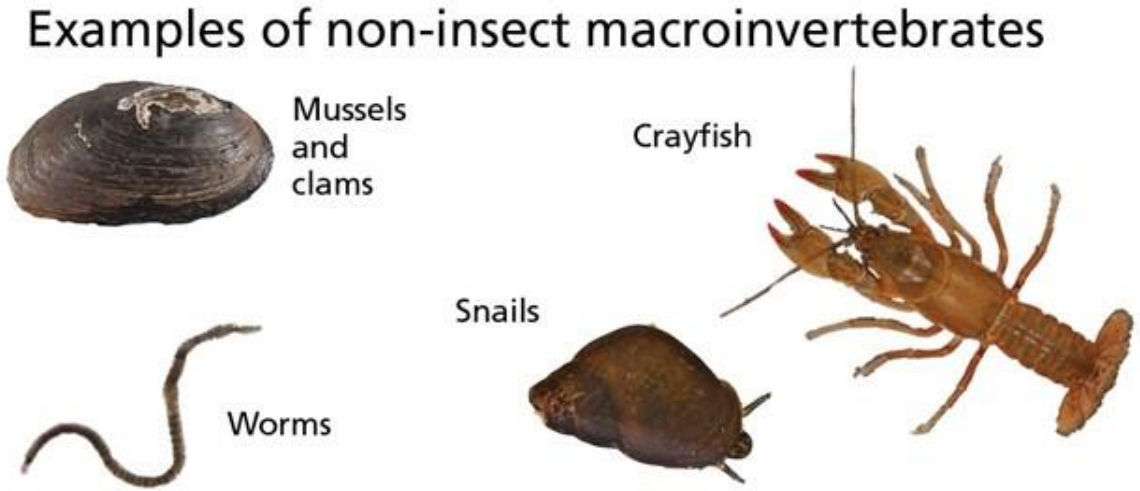
Stream macroinvertebrates inhabit all types of running waters, from fast flowing mountain streams to slow moving muddy rivers.

Source: US EPA

https://archive.epa.gov/water/archive/web/html/vms40.html

Stream Macroinvertebrates are Diverse





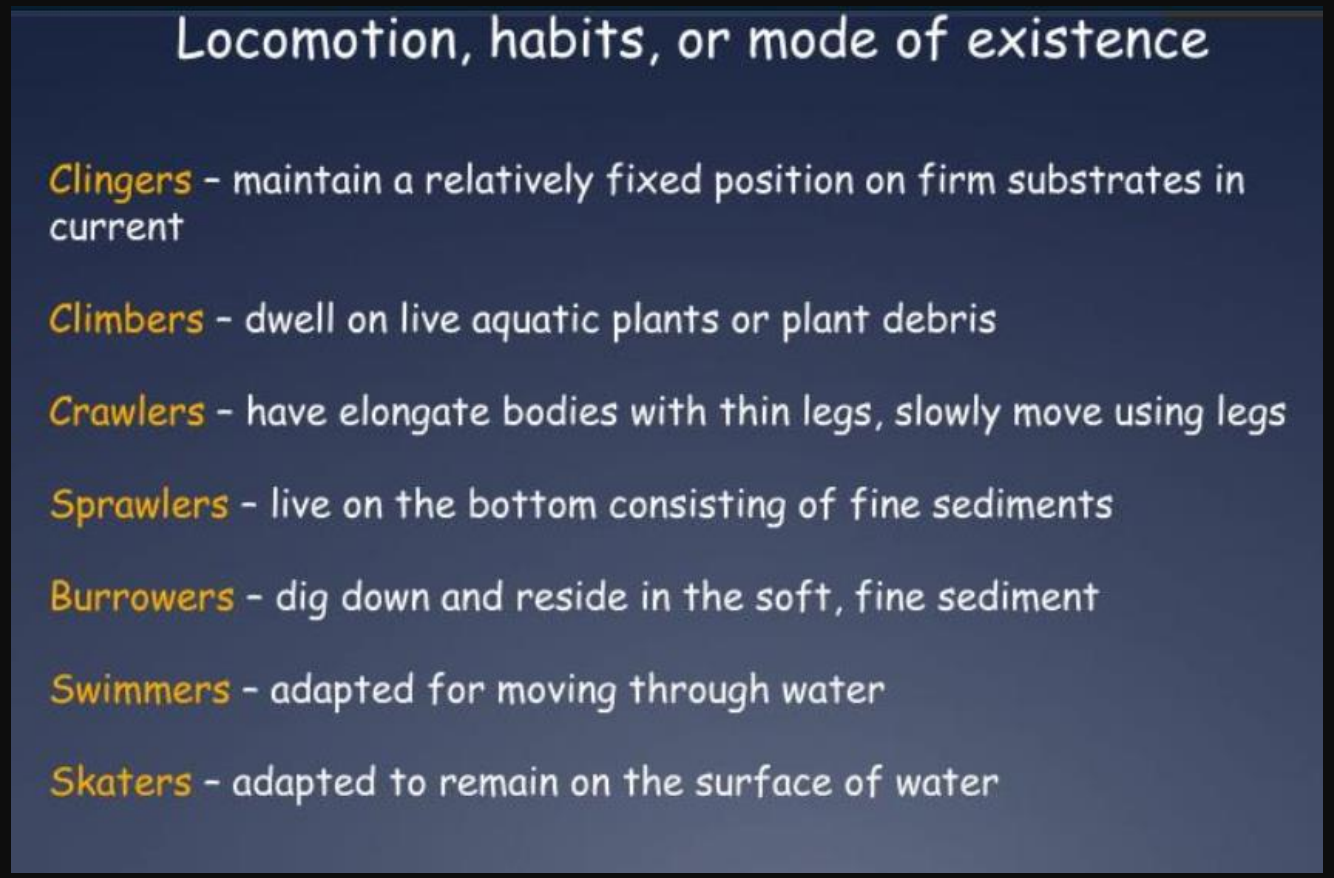
https://www.nps.gov/articles/000/macroinvertebrate_community_bowa.htm

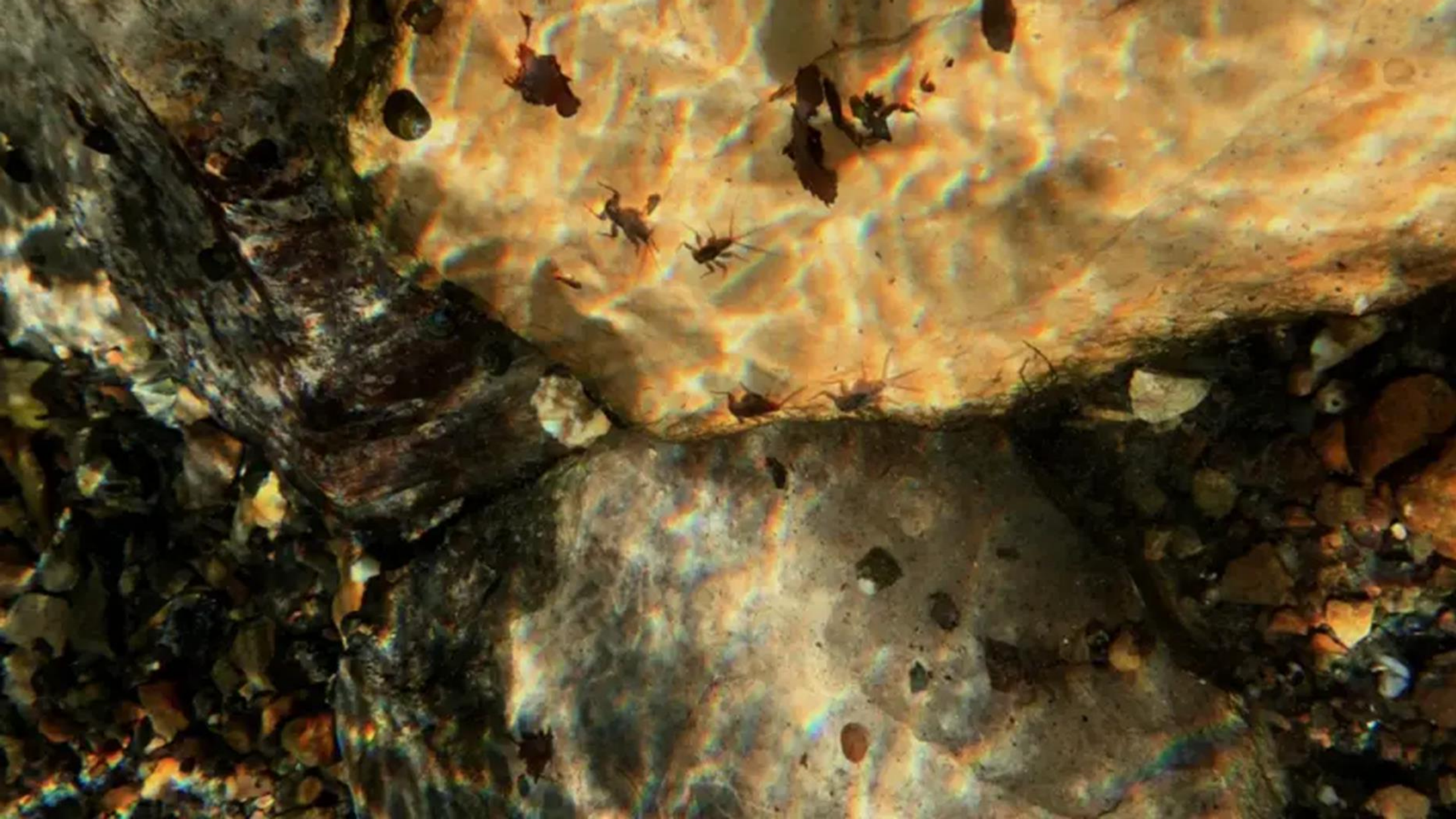
Niche Specialists

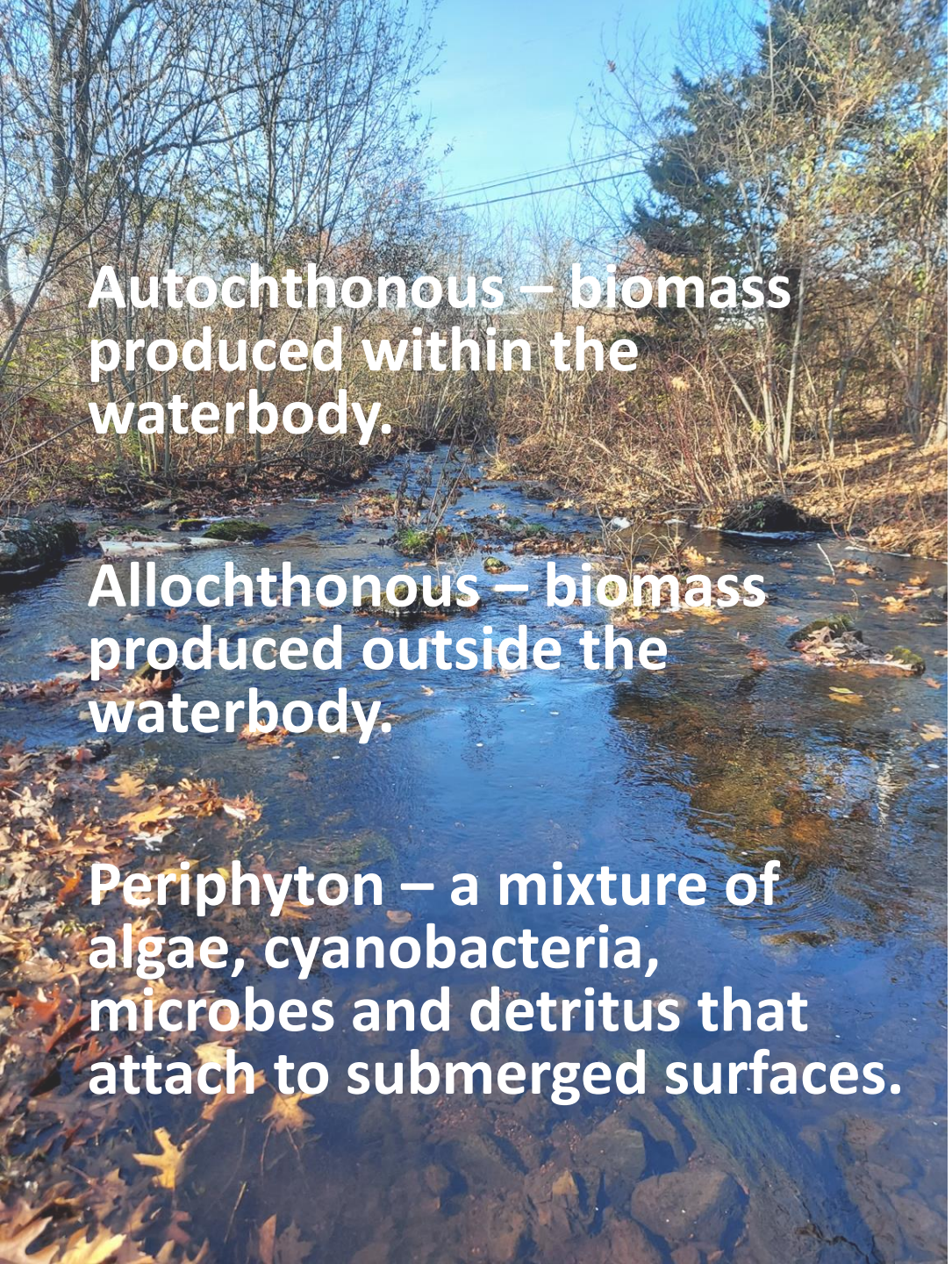
In ecology, the term “niche” describes the role an organism plays in a community.

A species’ niche encompasses both the physical and environmental conditions it requires (like temperature or terrain) and the interactions it has with other species (like predation or competition).

Source: National Geographic Society
https://education.nationalgeographic.org/resource/niche/







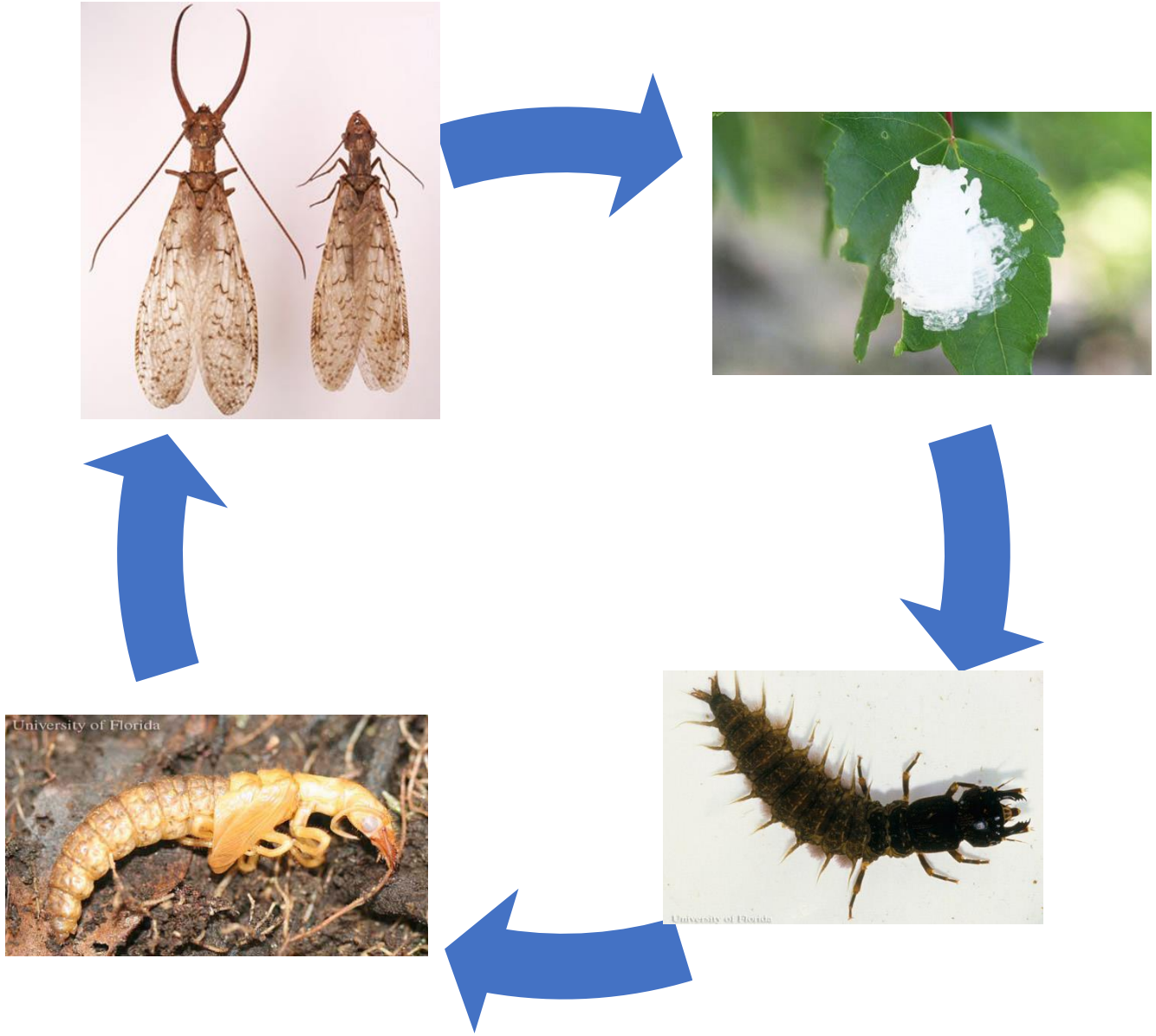
The primary source of energy in an aquatic ecosystem is the sun. Light availability determines what the base of the food chain is in an aquatic environment.

Feeding Groups

- Shredders
- Collector-gatherers
- Collector-filterers
- Piercer-herbivores
- Piercer-predators
- Scraper/grazers
- Predators

Metamorphosis

The process of transformation from an immature form to an adult form in two or more distinct stages.



Life cycle of a Dobson Fly

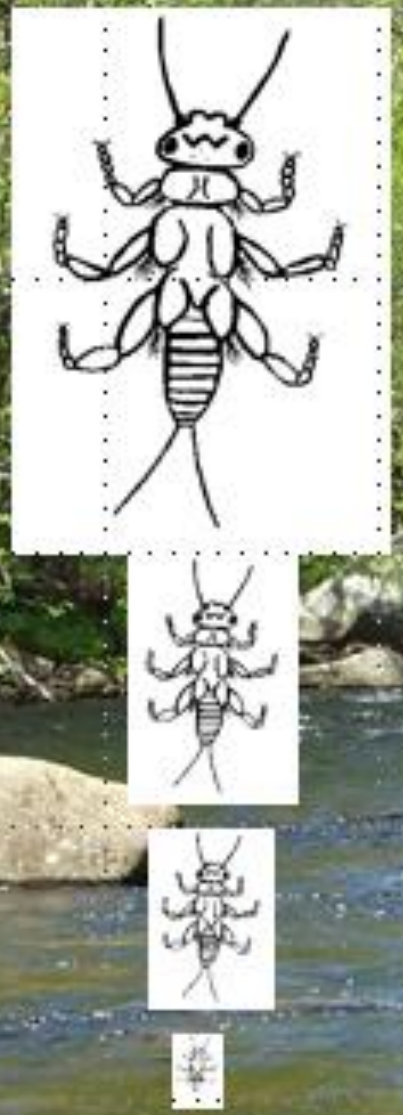
Insect Anatomy Overview

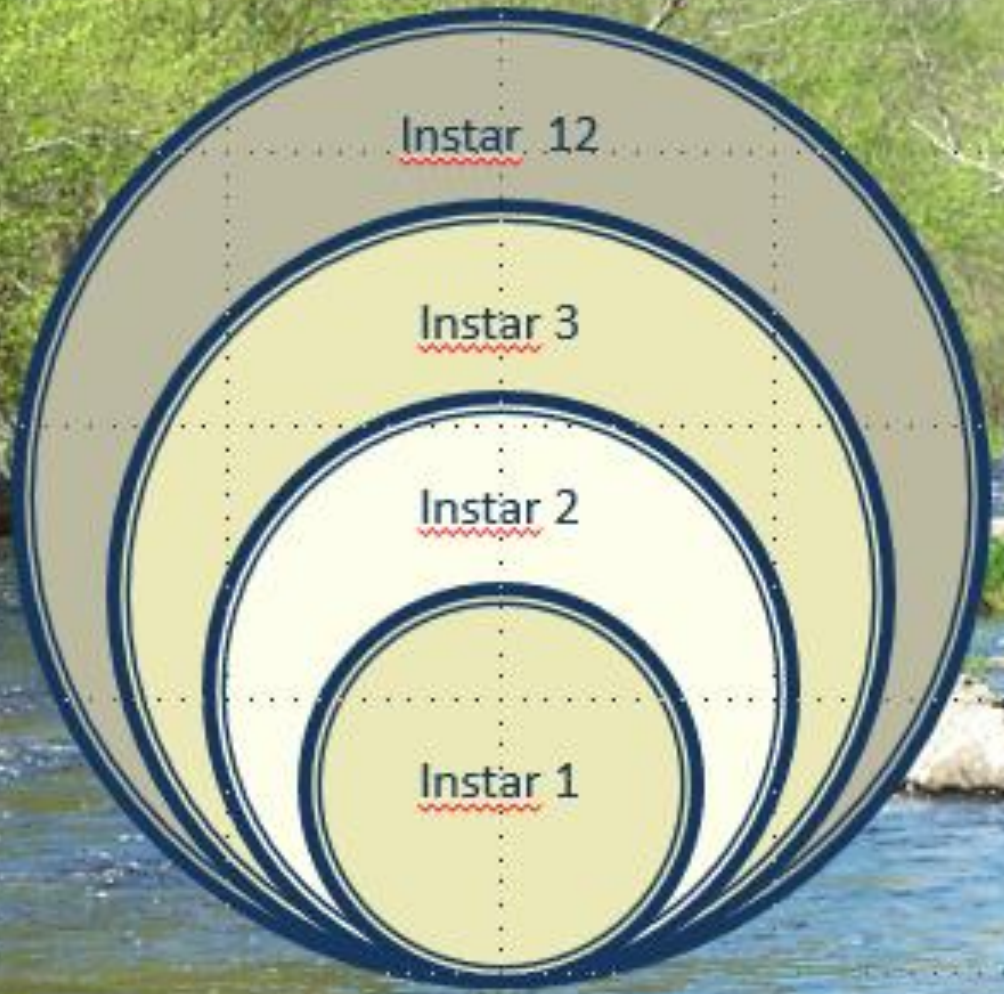
- Source: CT DEEP

Common stonefly

Gill tufts located on thorax region

Instar: a phase between two periods of molting in the development of an insect larva or other invertebrate animal.





Source: CT DEEP

Underwater respiration

Some macroinvertebrates breathe through gills. Others, like diving beetles, trap air bubbles under their exoskeletons. Gill location (on the body, legs or even on the tail) helps scientists to identify different species.

Stress Tolerance

Freshwater macroinvertebrates vary in their ability to cope with environmental stress, both natural or anthropogenic.

Certain pollution sensitive macroinvertebrates with a limited stress tolerance can be used as water quality indicators.

CT DEEP has a volunteer water quality monitoring program know as Riffle Bioassessments for Volunteers.

Common Stressors to Stream Macroninvertebrates

- **Toxic metals/hydrocarbons**
- **Low stream flow**
- **Low dissolved oxygen**
- **Improper pH**
- **Temperature**
- **Sediment laden runoff**
- **Deforestation**
- **Removal of riparian (streamside) vegetation**
- **Grub killer products for lawns**

What is the most common pollutant in rivers, streams, lakes and reservoirs according to the US EPA?

The US Environmental Protection Agency lists **sediment** as the most common pollutant in rivers, streams, lakes and reservoirs.

Sources of Stress to Stream Macroinvertebrates

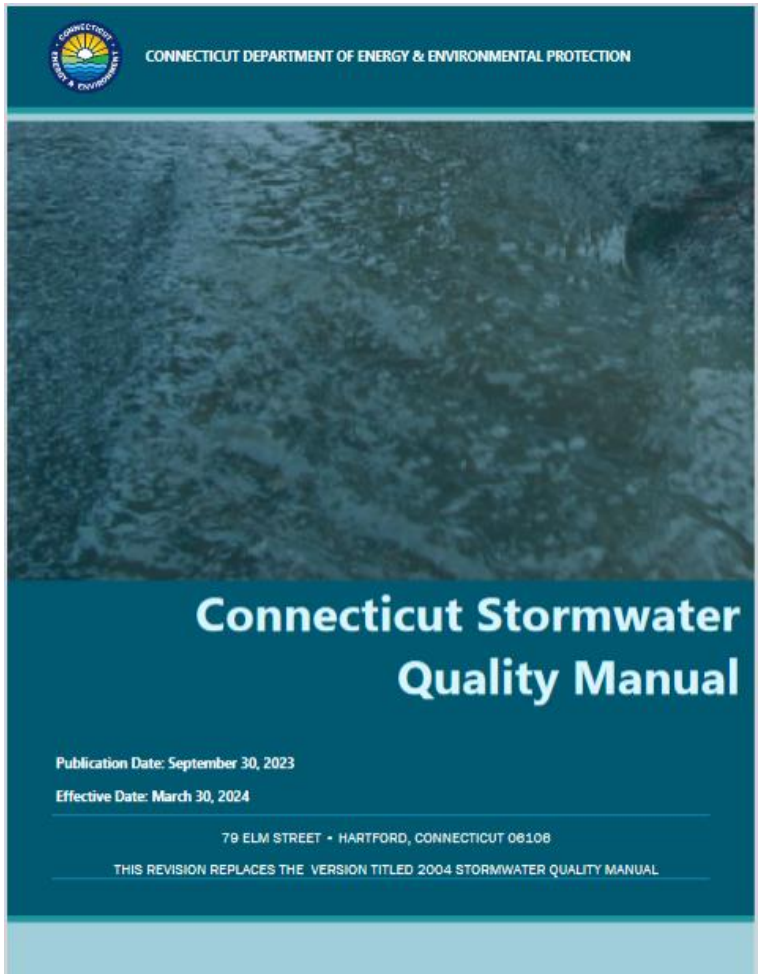
Natural

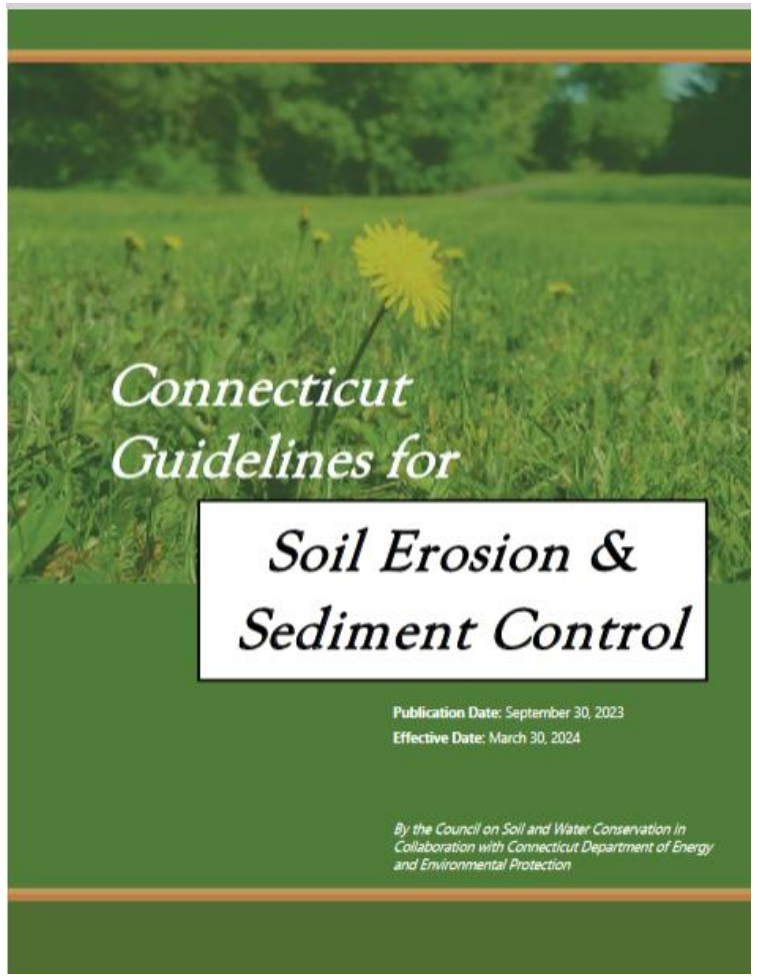
Courtesy of NOAA

Anthropogenic

Courtesy of https://www.extension.purdue.edu/extmedia/fnr/fnr-426-w.pdf

New guidelines effective March 30, 2024





Potential impacts and influences on macroinvertebrate diversity from improperly managed solar farm installations

Always Read the Label!

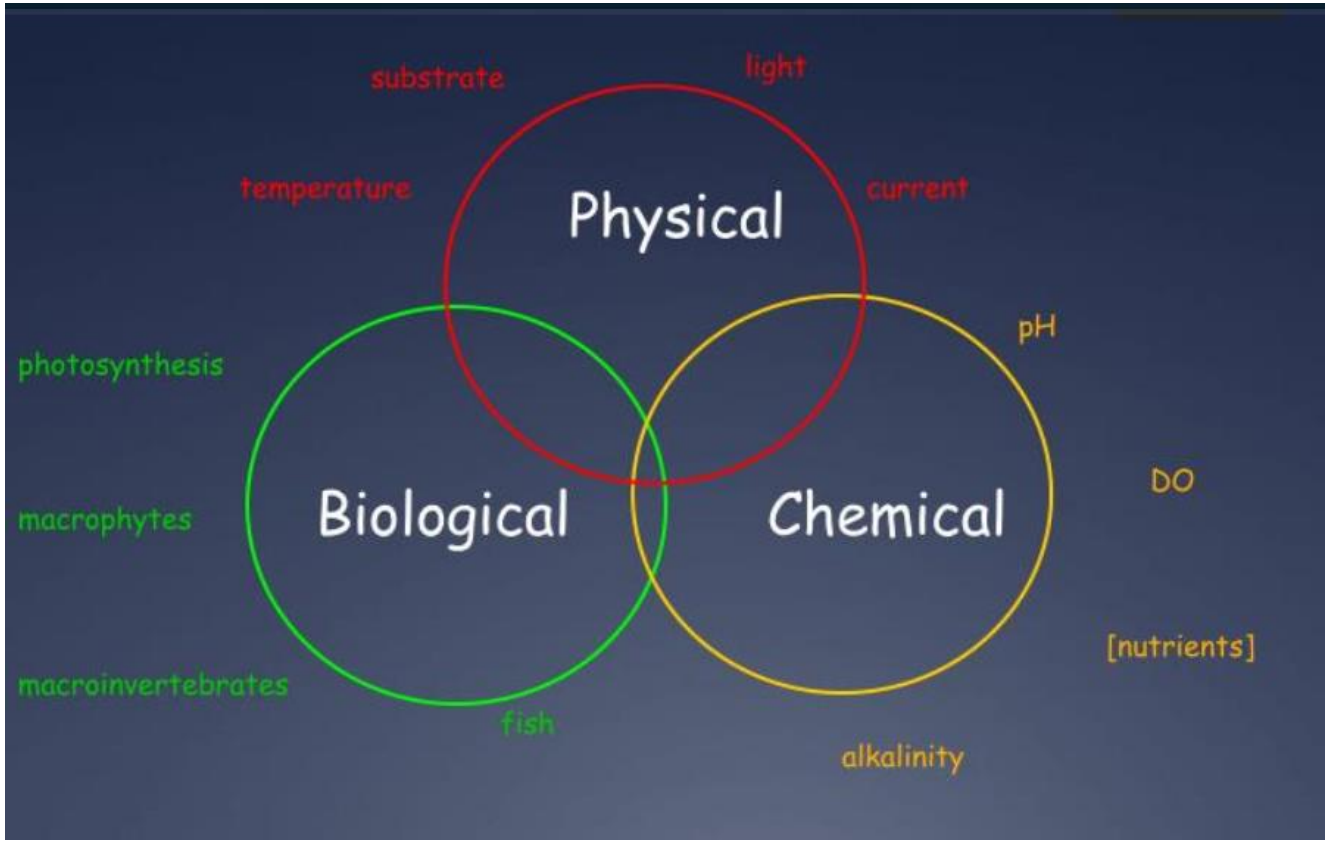
...treatment. Call 1-800-543-TURF (8873).

ENVIRONMENTAL HAZARDS: This pesticide is toxic to fish. Runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area. Sweeping any product that lands on a driveway, sidewalk, or street, back onto the treated area of the lawn or garden will help to prevent run off to water bodies or drainage systems. In case of spills, either collect for use or dispose of properly.

STAINING NOTE: Can cause staining to cement, stone, metallic surfaces (such as automobiles and garden furniture), clothing or shoes. If contact occurs, brush off particles to prevent staining and / or unwanted tracking into the house. If necessary, rinse off with water.

STORAGE AND...

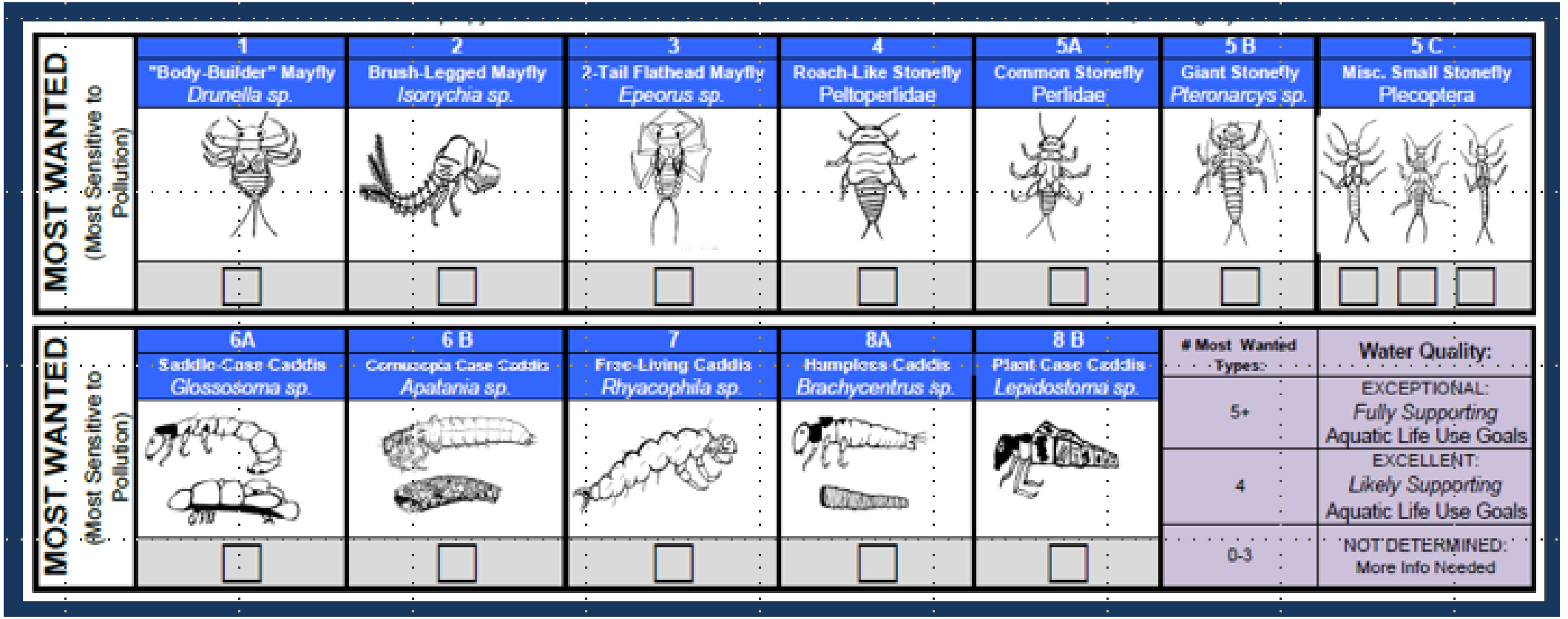
CT DEEP Multi-metric Index >48 meets the CT Water quality standard for Aquatic Life Use



Source: CT DEEP

- Full measure of chemical, physical and biological parameters that are used to determine water quality.
- Labor intensive, expensive equipment, highly trained staff, laboratory analysis of water samples.
- Careful comparative analysis of a full suite of sampling protocols and results (multi-metric index or MMI) were compared to subsample of macroinvertebrate diversity.

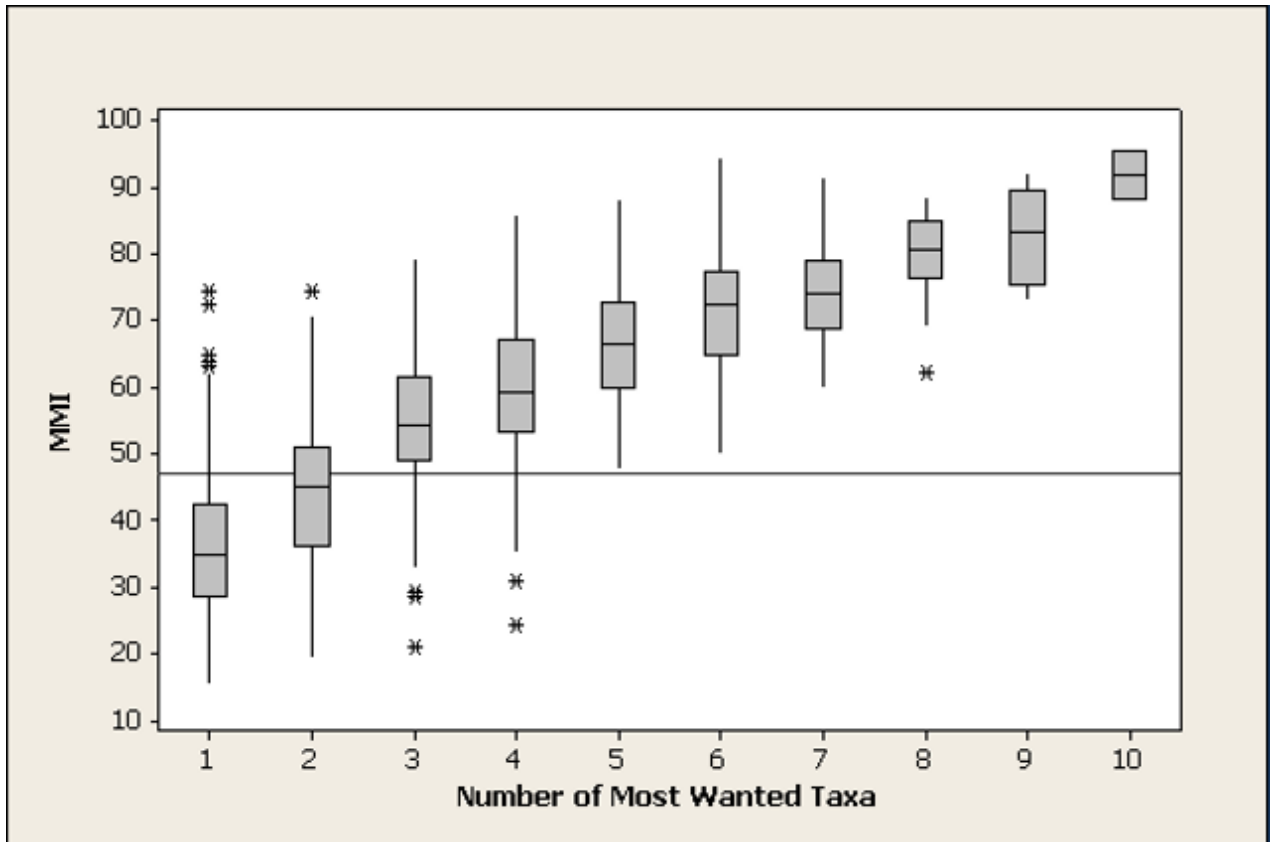
Riffle Bioassessment for Volunteers uses riffle dwelling stream macroinvertebrates with known sensitivities to Pollutants



Source: CT DEEP

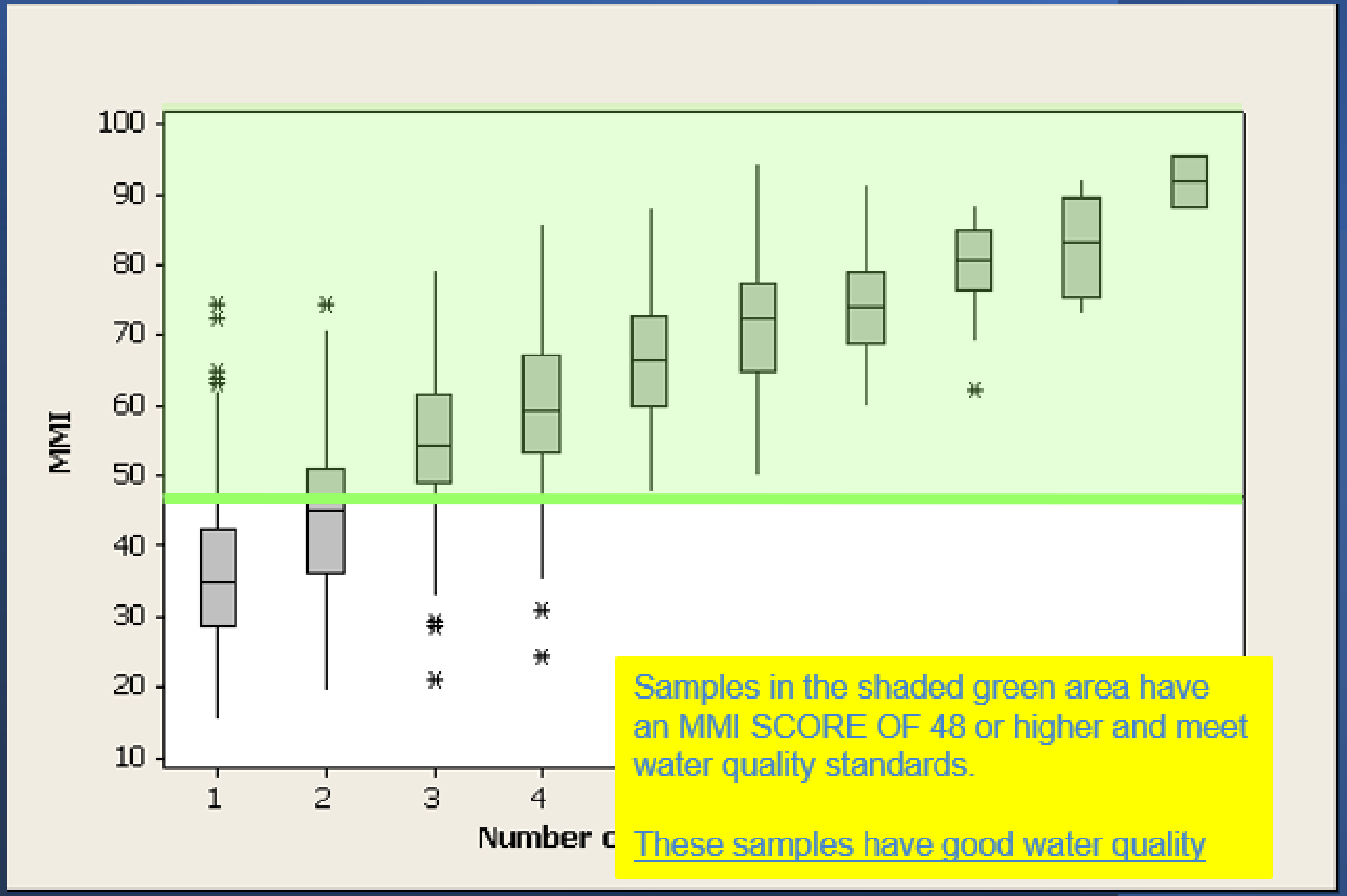
- Mike Beauchene established the RBV program in 1999.
- The program uses subset of bugs commonly found statewide.
- The bugs must have a known limited tolerance to water pollution.
- Trained volunteers help to collect important data documenting healthy stream habitat.

The Science behind RBV



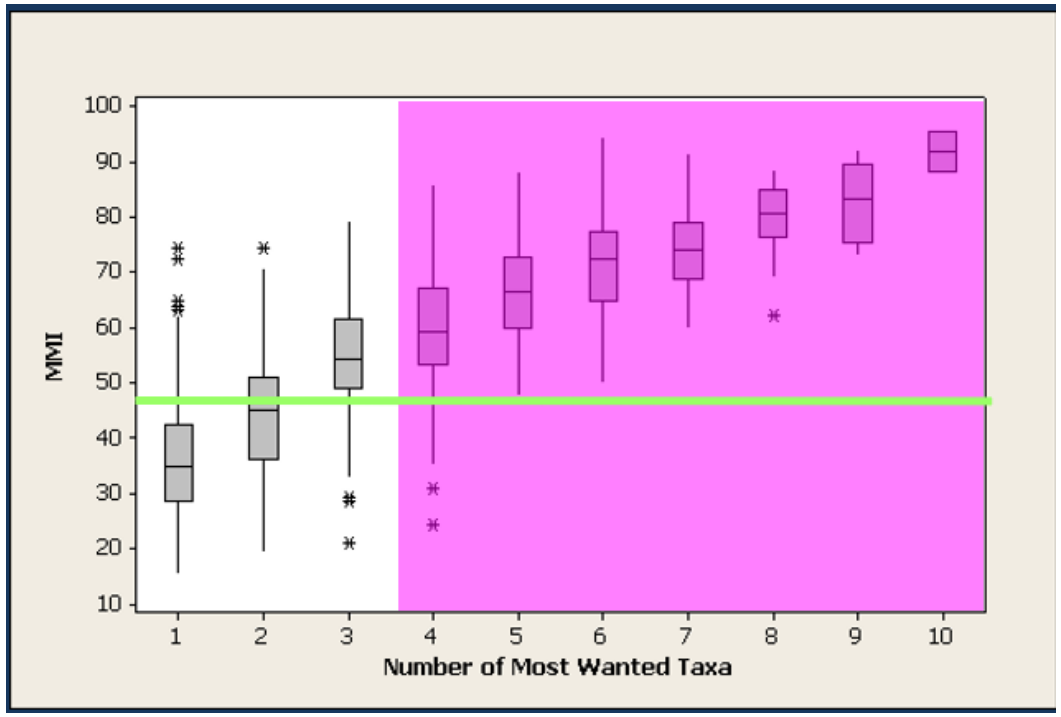
Source: CT DEEP

- Over 1000 macroinvertebrate samples from the professional statewide monitoring program were reviewed.
- The number of “Most Wanted Species” from the abbreviated list were compared to the MMI score of 48.



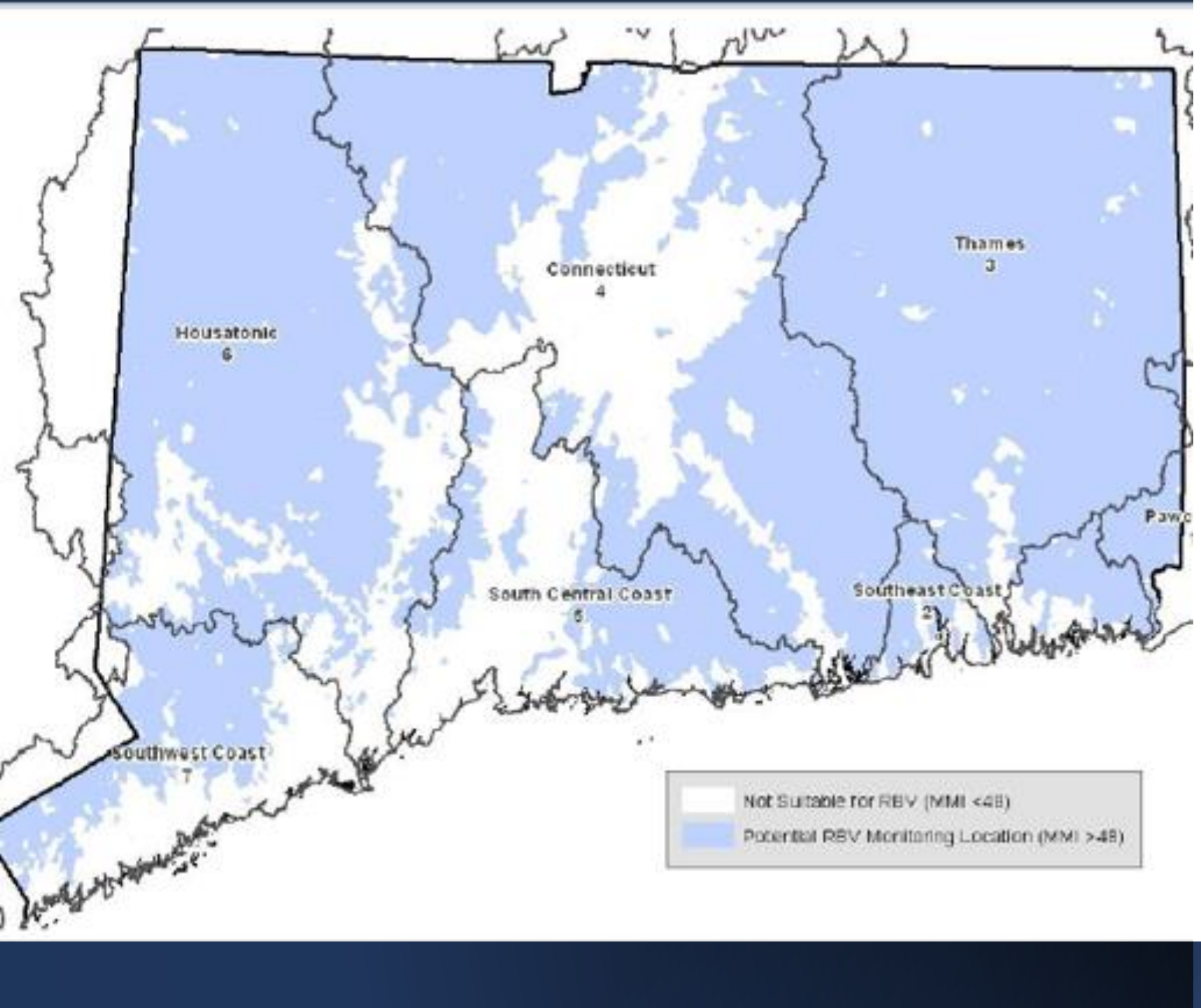
Source: CT DEEP

What is 4 or More an important threshold?



Source: CT DEEP

- >99% 0f the samples with 4 or more “most wanted” types had an MMI Score of 48 or more.
- 75% of the sites with 3 “most wanted” had an MMI score of 48 or more.
- Some samples with less than 3 “most wanted” still had an MMI score of 48 or more.



Site selection is important

- Areas in blue are predicted to have an MMI score >48
- Stream must be wadeable and have riffles.
- Avoid down stream of a dam or large wetlands
- Avoid downstream of a road/storm drain outlet

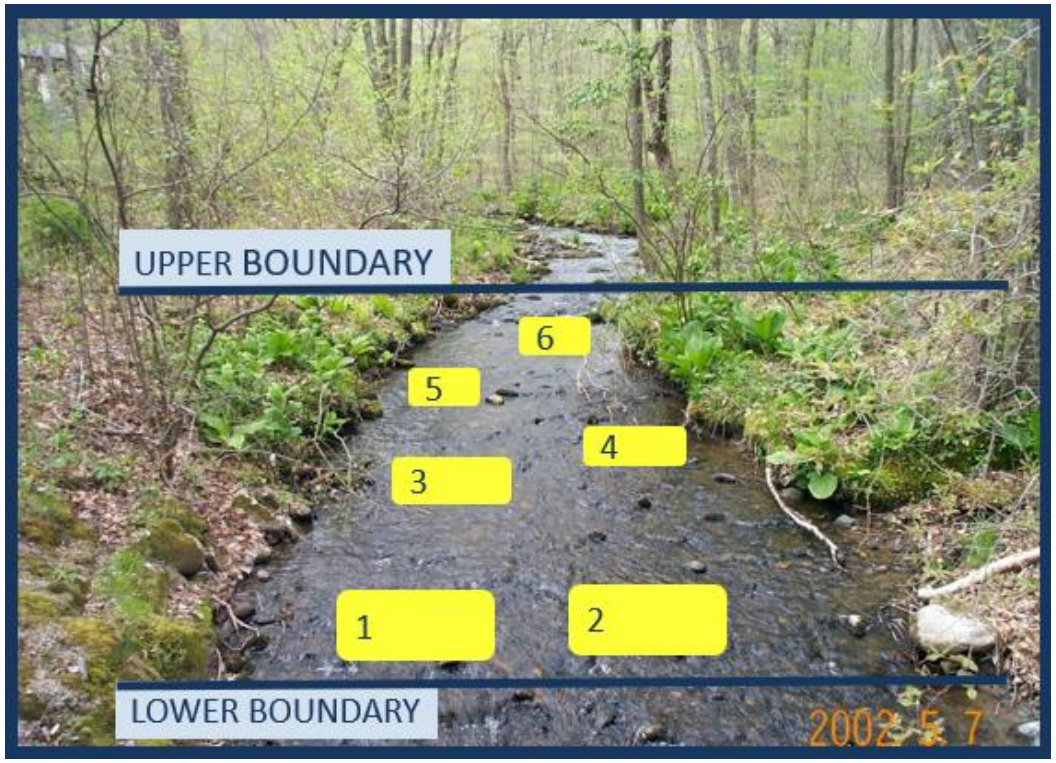
Source: CT DEEP

Riffle habitat – shallow fast moving streams areas where the bottom substrate impacts the water surface

Bottom substate typically a mixture of cobbles, gravel and sand

The fun part

Select a sampling area



Source: CT DEEP

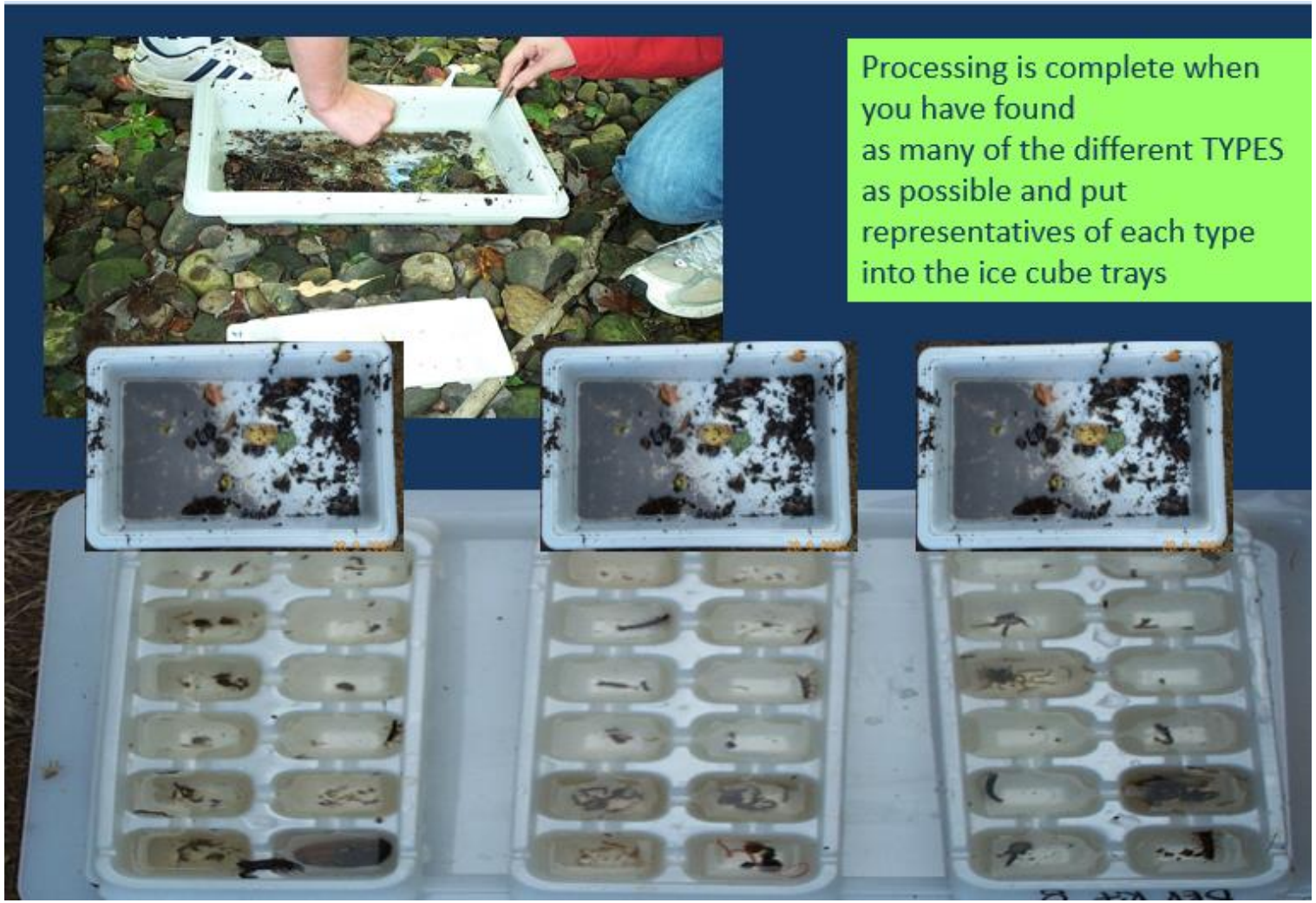
Source: TLGV WQM Program

Source: CT DEEP

Complete 6 “kicks” to make up trays for sorting

Source: TLGV WQM Program

Sort by type



Source: CT DEEP

Attempt to ID

Source: TLGV WQM Program

CT DEEP RBV Program: Macroinvertebrate Sorting Guide

CHOOSE THE BEST STARTING POINT (OPTION A OR B) TO BEGIN, THEN FOLLOW THE ARROWS TO REACH A LIST OF 'FINAL CANDIDATES' FOR WHO YOUR CRITTER MAY BE. CONSULT THE CORRESPONDING PANEL NUMBERS IN THE FIELD IDENTIFICATION CARDS TO MAKE A FINAL DETERMINATION.

NOTE: Additional miscellaneous macroinvertebrates are listed as "Others" at the bottom of the datasheet. If you don't see your critter on this chart, review the 'Other' Field ID cards to see if any match.

Start Option A: The Organism is WIDE or FLAT with MEDIUM to LARGE LEGS

Describe the organism's TAILS:

3 Long Thin Tails

Panel 1: Drunella (Mayfly)

Panel 2: Isonychia (Mayfly)

Panel 11: Stenonema (Mayfly)

Panel 14B: Zygoptera (Damselfly)

2 Long Thin Tails

Panel 3: Epeorus (Mayfly)

Panel 4: Peltoperlidae (Stonefly)

Panel 5A: Perlidae (Stonefly)

Panel 5B: Pteronarcys (Stonefly)

Panel 5C: Misc. Stoneflies (Plecoptera)

NO Long Thin Tails

Panel 14A: Anisoptera (Dragonfly)

Panel 13B: Nigronia (Fishfly)

Panel 15: Amphipoda (Scud)

Panel 16: Isopoda (Aquatic Sow Bug)

Panel 13A: Corydalus (Dobsonfly)

Builds a Shelter/Case

Panel 6A: Glossosoma (Caddisfly)

Panel 6B: Apatania (Caddisfly)

Panel 8A Brachycentrus (Caddisfly)

Panel 8B Lepidostoma (Caddisfly)

START Option B: The Organism is ROUND or CYLINDRICAL with SMALL or NO LEGS

Describe the organism's LEGS:

Hidden Legs

Panel 12: Psephenus (Water Penny Beetle)

With Legs

Does the organism have a SHELTER/CASE?

No Shelter/Case

Panel 7: Rhyacophila (Caddisfly)

Panel 9: Hydropsychidae (Caddisfly)

Panel 10: Philopotamidae (Caddisfly)

Without Legs

Panel 17: Hirudinea (Leech)

Panel 18: Chironimidae (Midge)

Panel 19: (Simuliidae) Black Fly

Panel 20: Gastropoda (Snail)

Panel 21: Oligochaeta (Aquatic Worm)

Last revised 08/15/2016

Source: CT DEEP

The actual data is in the voucher

Source: CT DEEP

RBV VOUC

Stream: B

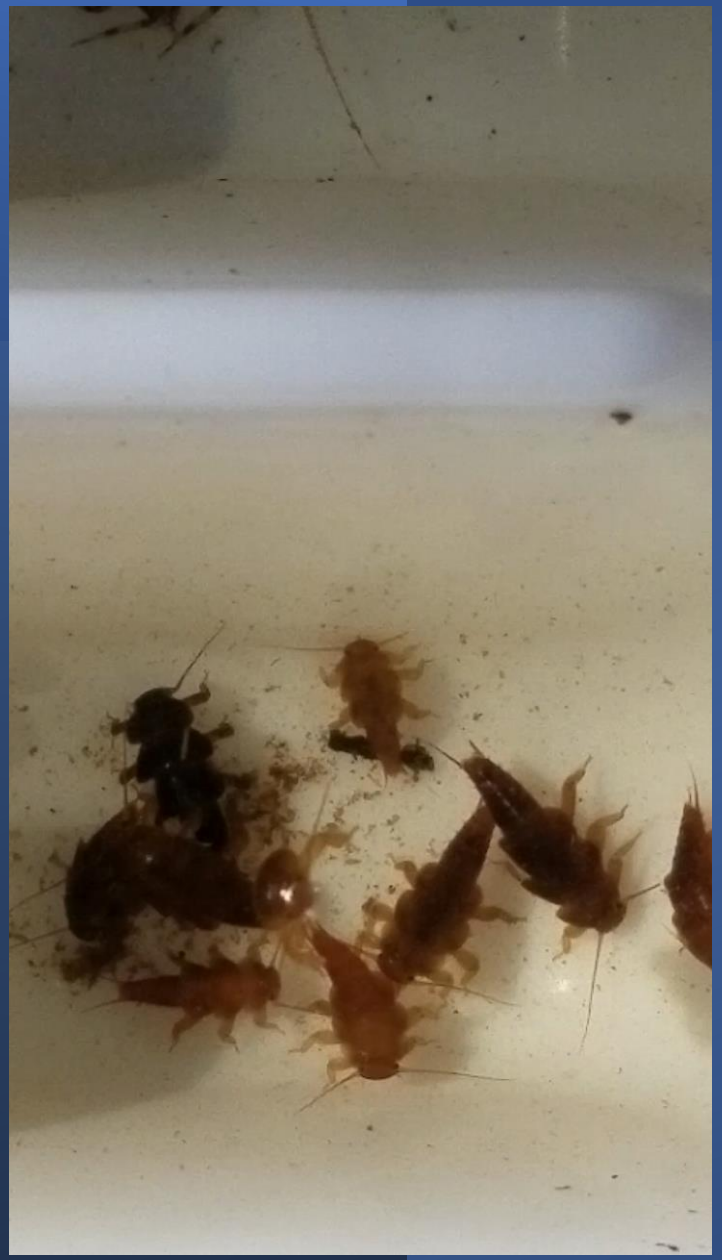
Location: 50

Town: Andover

Date: 10/15/15

And now, name that bug!

Use the Macroinvertebrate Sorting Guide to Find the Answer



Answer:

Roach-like stone fly

Tolerance value = 0

Feeding Group = Shredder

Answer:

Humpless Case Maker Caddisfly

Tolerance Value = 1

Feeding Group = Shredder

Answer:

Cornucopia-case Caddisfly

Tolerance = 3

Feeding group = scraper

Answer:

Free-living Caddisfly

Tolerance Value = 0

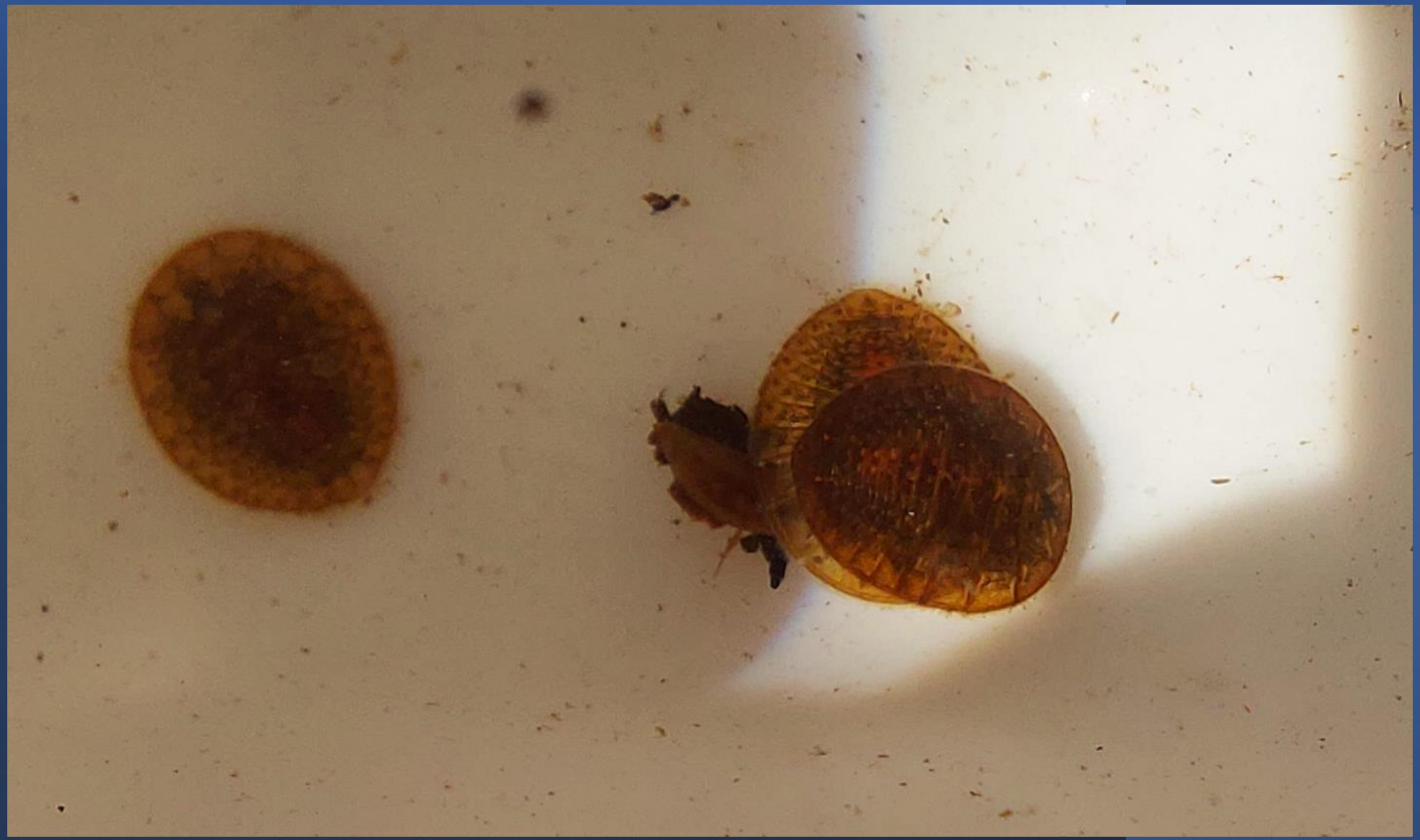
Feeding Group = Preditor

Answer

Miscellaneous Small Stonefly (Small Winter Stonefly)

Tolerance value = 1

Feeding group = Shredder



Answer:

Water Penny Beetle

Tolerance Value = 4

Feeding Group = Scraper

Answer:

Brush-legged Mayfly

Tolerance Value = 2

Feeding Group = Collector-filterer

Answer

Fingernet Caddisfly

Tolerance Value = 4

Feeding Group = Collector-filterer

Answer:

Saddlecase Maker Caddisfly

Tolerance Value = 0

Feeding Group = Scraper

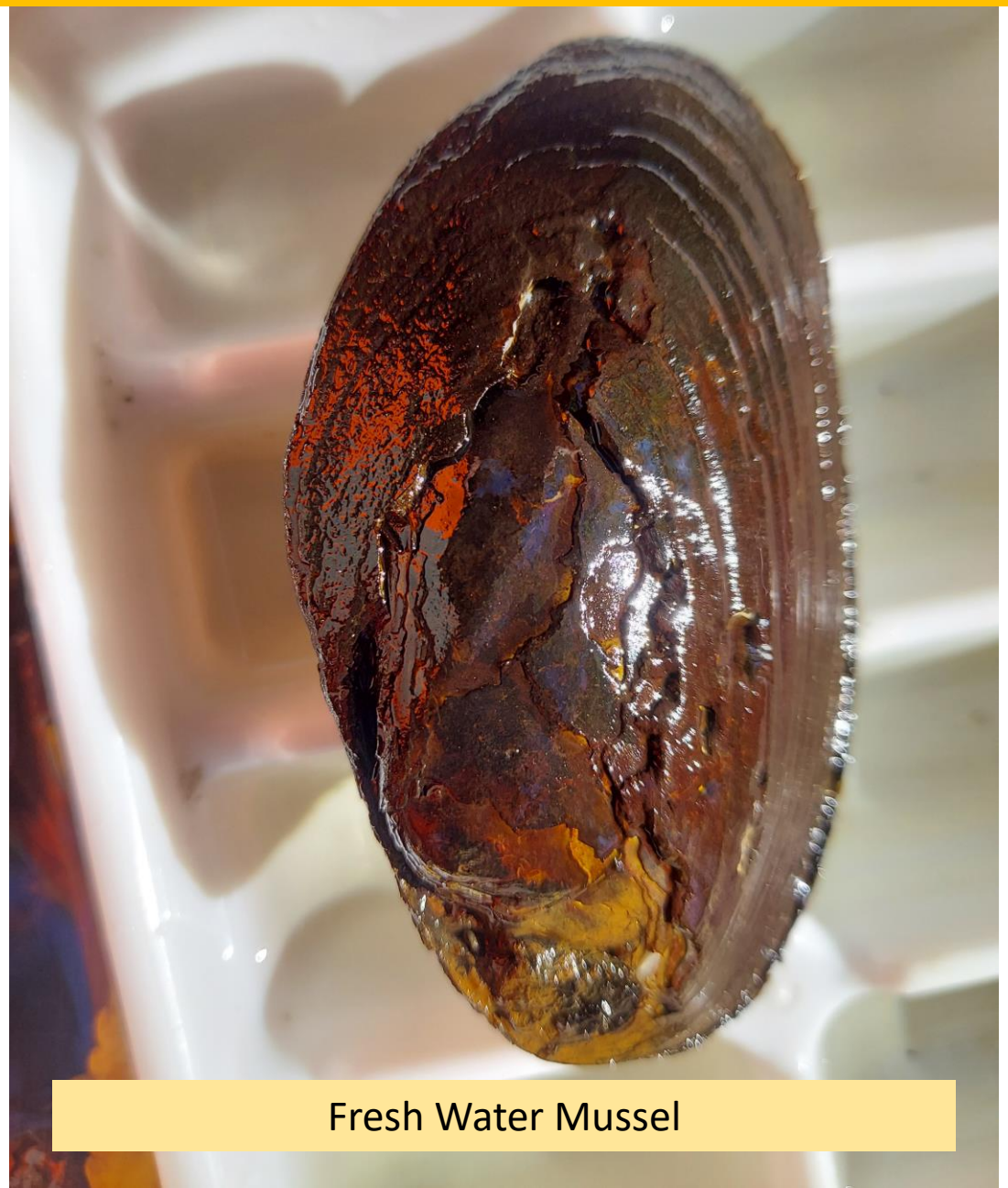
Answer:

Two-tailed Flathead Mayfly

Tolerance Value = 0

Feeding group = scraper

Other common stream macroinvertebrates



Fresh Water Mussel

Crayfish

Questions?

Jean.Pillo@comcast.net