EPA United States Environmental Protection Agency

US Army Corps of Engineers

ERDC

Northeast and Southeast Streamflow Duration Assessment Methods: Aquatic macroinvertebrate indicators

Video Training

2025

The SDAMs are based on 12 indicators:

Nine (9) indicators are measured in the **field,** three (3) are **desktop-based**

Five (5) are shared by both SDAMs, plus:

- Two only used in NE SDAM
- Five only used in SE SDAM

*In recommended order of data collection**

1. Bankfull channel width
2. Entrenchment ratio (NE only)
3. Aquatic macroinvertebrate indicators
   - Benthic Macroinvertebrate Index (BMI) score
   - Total aquatic macroinvertebrate abundance (SE only)
5. Slope (NE only)
6. Shading
7. Prevalence of rooted upland plants in the streambed (SE only)
8. Particle size of stream substrate (SE only)
9. Prevalence of fibrous roots in the streambed (SE only)
10. Drainage area
11. Elevation
12. Average precipitation (May-July) (SE only)

*Note: there is no #4 (1, 2, 3, 5) to account for the two different aquatic macroinvertebrate indicators.

Aquatic macroinvertebrate indicators

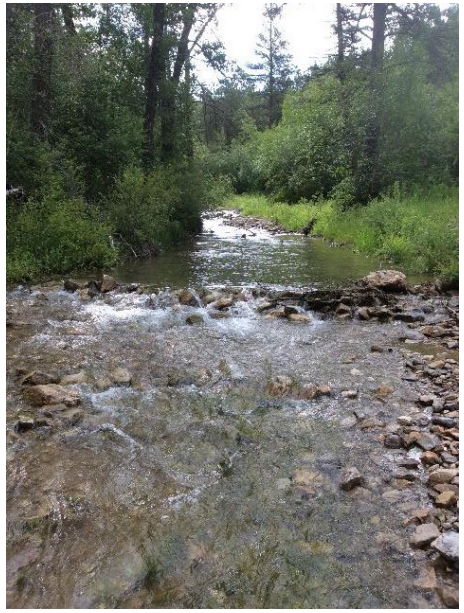
- Both NE and SE SDAMs use aquatic macroinvertebrate indicators, with one common between the two methods. Both are **responses** to flow duration.
  - Benthic Macroinvertebrate Index (BMI) (both)
  - Total abundance of aquatic macroinvertebrates (SE only)
- Higher abundance is associated with **longer** streamflow duration. BMI also measures richness, higher levels of which are also associated with longer flow durations.
- BMI requires some level of taxonomic identification to determine richness, though specific taxon identification is not required.
- Sampling methods for the SDAMs are the same.

Macroinvertebrates.org

Collecting aquatic macroinvertebrates

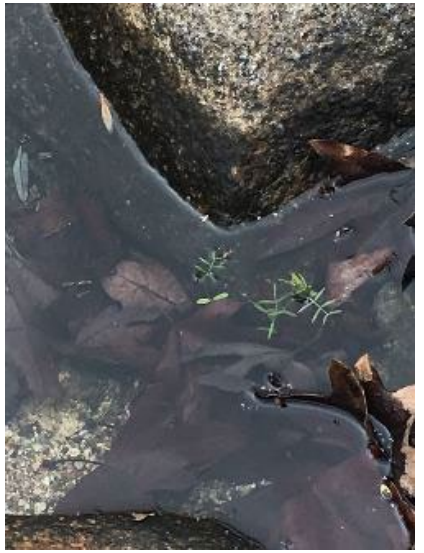
- Measured with a 15-minute search in at least 6 locations that represent all habitat types.
- In crews of two or more, one person can collect, sort, and identify aquatic macroinvertebrates while another evaluates other indicators after reach boundaries are determined.
- Do not differentiate between live organisms and non-living material (cases, shed skins, etc.). All are counted for both indicators.
- Ignore terrestrial life-stages or species.

Target all habitat types



Riffles

Pools



Leaf packs

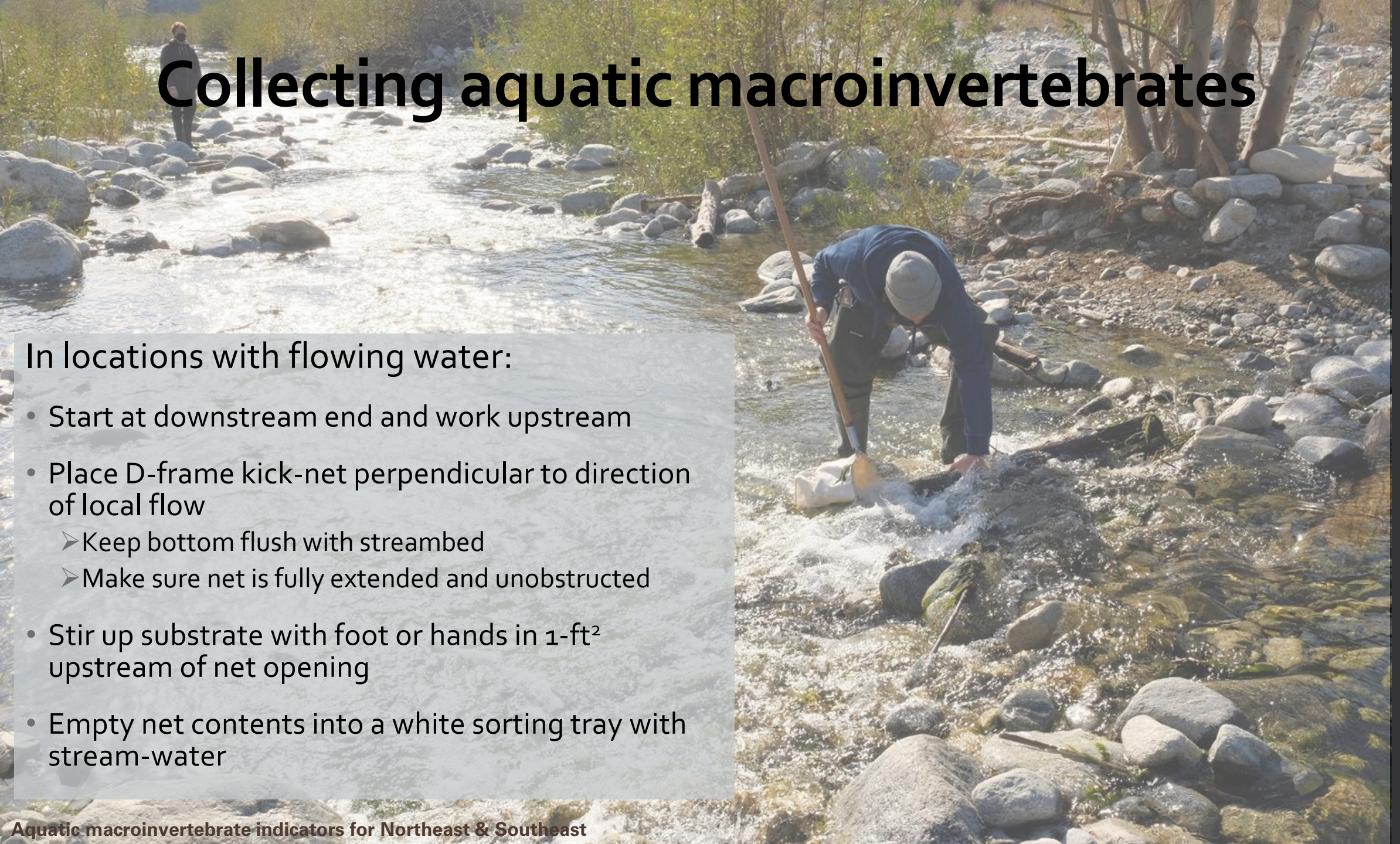
Tree roots

Woody jams

Undercut banks

Use the appropriate method for the conditions

Collecting aquatic macroinvertebrates



In locations with flowing water:

- Start at downstream end and work upstream
- Place D-frame kick-net perpendicular to direction of local flow
  - Keep bottom flush with streambed
  - Make sure net is fully extended and unobstructed
- Stir up substrate with foot or hands in 1-ft^2 upstream of net opening
- Empty net contents into a white sorting tray with stream-water

Collecting aquatic macroinvertebrates

In locations with still water:

- Place net in water
- Kick up substrate
- Rapidly move net through water, sweeping up suspended invertebrates

Collecting aquatic macroinvertebrates

In woody jams, root mats, and undercut banks:

- Jab with a D-frame net to dislodge & capture any clinging invertebrates

Collecting aquatic macroinvertebrates

- Pick up and examine large cobbles or other substrate.
- "Clingers" will be evident; for example, heptageniid mayflies are flattened and will often be found clinging to rocks.

In partially dry and dry streams

- Look for areas where water may have persisted; focus on remaining wetted habitats, if they exist
- Turn over cobbles and boulders in areas where water likely persisted longer (dry streams)
- Look at streamside vegetation or large boulders for shed skins or cases

Shed larval skins (exuviae)

Caddisfly cases

Field versus lab processing of invertebrate samples

- Both are acceptable; however, identification of specific taxa is not required for either aquatic macroinvertebrate indicator.
- When relying on field identifications:
  - Ensure at least one crew member is adequately trained
  - Voucher specimens can be used to confirm identifications
  - Use hand lenses or field scope, if available
- Lab processing is sometimes a better option
  - Field crews may not have necessary expertise
  - Higher confidence in identifications
  - Samples may be re-evaluated by expert taxonomists
  - Save time in the field

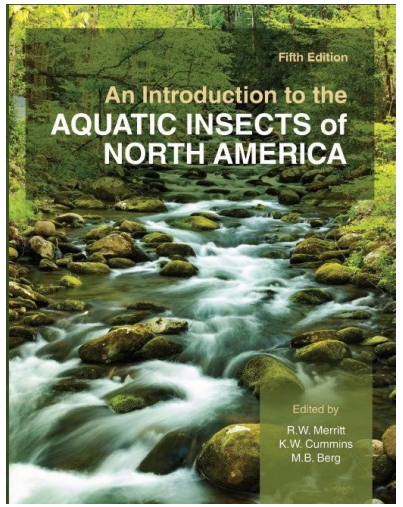
Pick the approach that best suits the skills and capacity of your field crew!

Field sorting and identification

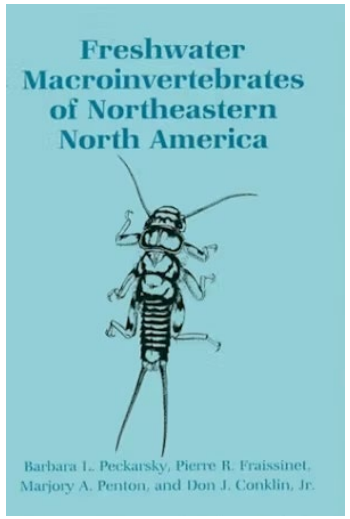
- For richness: identify aquatic macroinvertebrates (up to **5** taxa).
  - Family level for insects and mollusks
  - Order level for crustaceans and mites
  - Class or phylum for all others
- For abundance, individuals can be the same taxon or different taxa.
  - Tally up to **11** in NE, up to **41** in SE.
- A white-backed tray makes it easier to see and feather-weight forceps, eye-droppers can help with sorting.
- Be patient: some invertebrates will start moving and become noticeable.
- Search for invertebrates clinging to the net.
- Specimens can be collected to confirm identifications, if needed.

Books to help learn identifications

Keys for lab identification



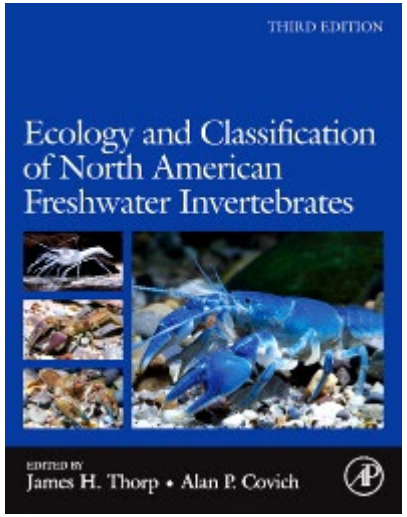
- Merritt, Cummins and Berg's *An introduction to Aquatic Insects of North America*



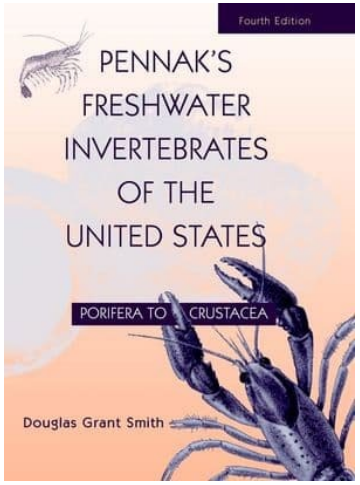
- Peckarsky et al.'s *Freshwater Macroinvertebrates of Northeastern North America*

Field guides

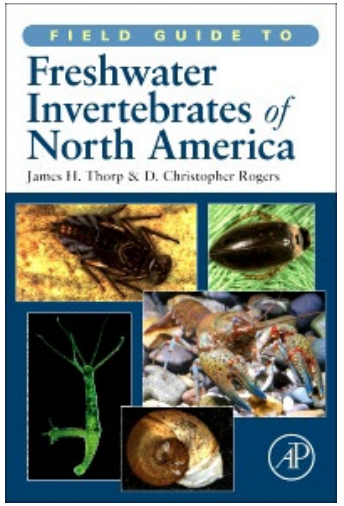
- Voshell's *A Guide to Common Freshwater Invertebrates of North America*



- Thorp and Covich's *Ecology and Classification of North American Freshwater Invertebrates*



- Smith/Pennak's *Freshwater Invertebrates of the United States*

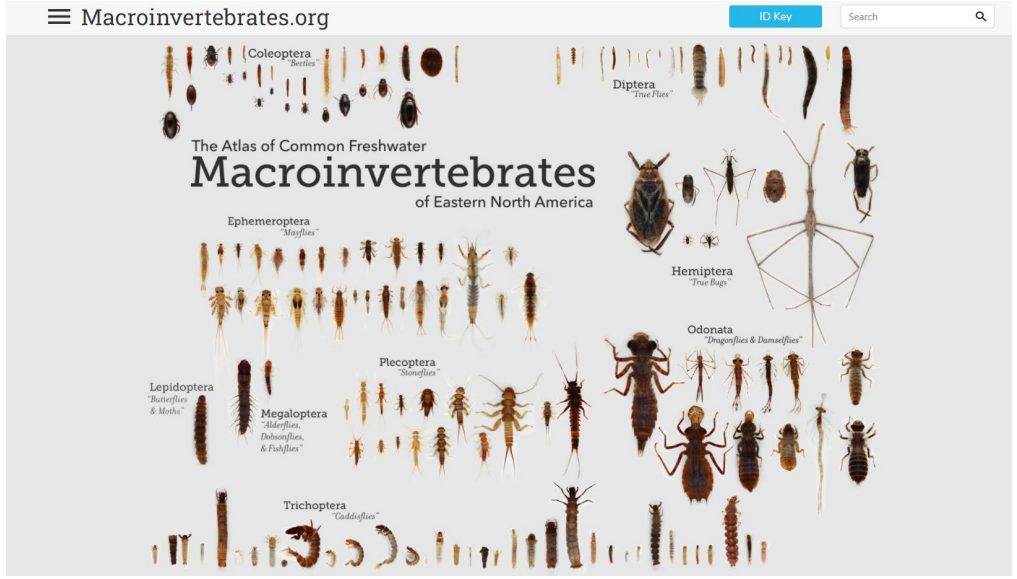


- Thorp and Rogers' *Field Guide to Freshwater Invertebrates of North America*

Plus several more!

Other identification resources

Online resources



- Atlas of Common Freshwater Macroinvertebrates of Eastern North America
- Maryland Dept. of Natural Resources Family Level Key to Stream Invertebrates of MD
- USGS North American Aquatic Macroinvertebrate Digital Reference Collection; current focus is on states west of Mississippi; some taxa only have adult photos

Professional societies offer workshops:

- The Xerces Society
- The Society for Freshwater Science
- SWPBA
- AMAAB
- NEIWPCC

Aquatic macroinvertebrate indicators for Northeast & Southeast

Be aware of common terrestrial taxa you might encounter

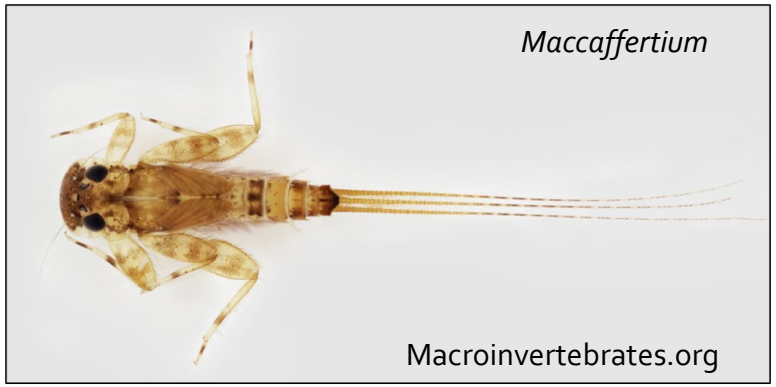
- If not familiar with common types of aquatic macroinvertebrates, use of field guides is recommended, especially to discern aquatic vs. terrestrial taxa or life stages.

Soldier fly larva

Common mayfly families

(Order Ephemeroptera)

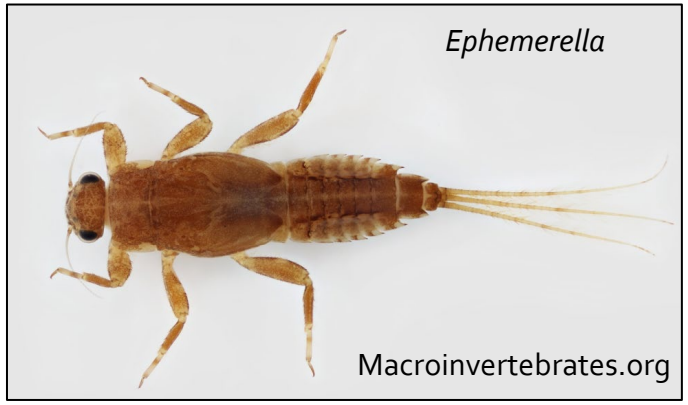
Flat-headed mayflies (Heptageniidae): one of the most common and abundant taxons collected overall



Small minnow mayflies (Baetidae): generally, 2nd most common mayfly family collected in the NE/SE

Prong-gilled mayflies (Leptophlebiidae)

Spiny crawler mayflies (Ephemerellidae)



Combmouthed minnow mayflies (Ameletidae)

Common mayfly families

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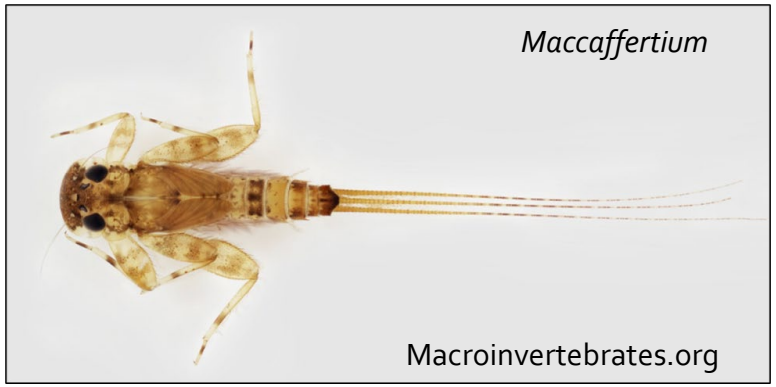

Sn
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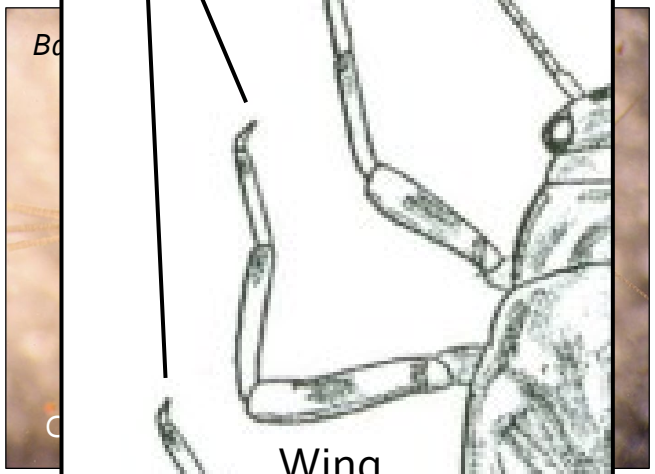
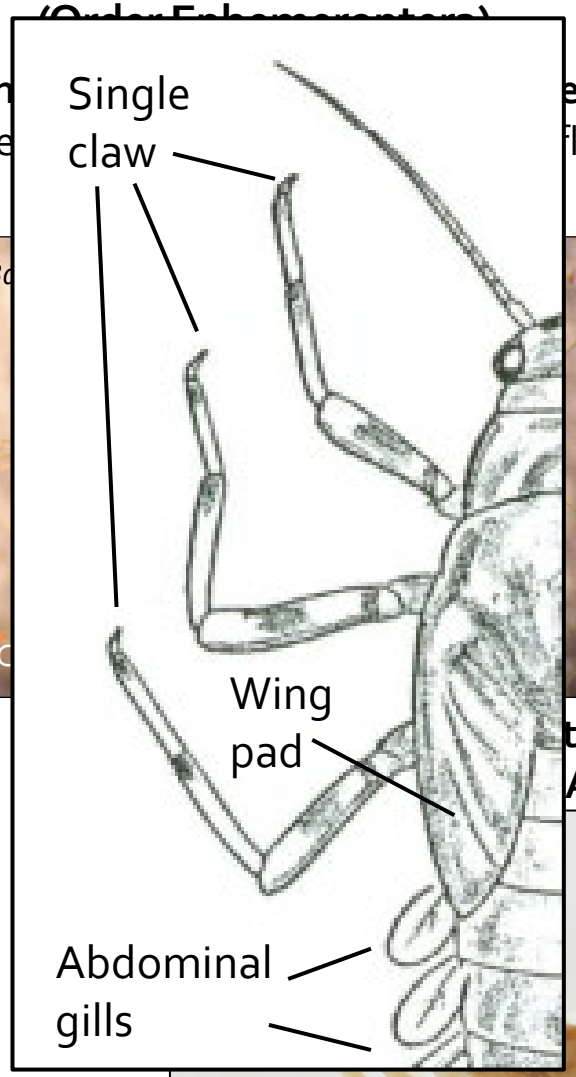
fly





Prong-gilled mayflies (Leptophlebiidae)

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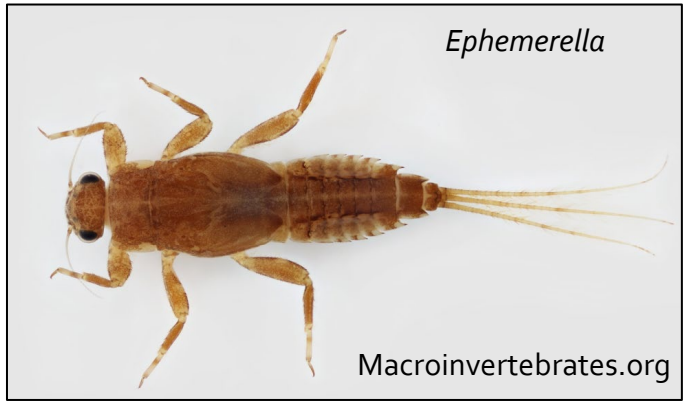

thed minnow mayflies
Ameletidae)

Common stonefly families

(Order Plecoptera)

Common stoneflies (Perlidae): most common and abundant stonefly family collected, depending on season

Small "winter" stoneflies (Capniidae): most common and abundant stonefly family collected, depending on season

Rolled-winged stoneflies (Leuctridae)

"Spring" stoneflies (Nemouridae)

Stripetails (Perlodidae)

All images: Macroinvertebrates.org

Common stonefly families

(Order Plecoptera)

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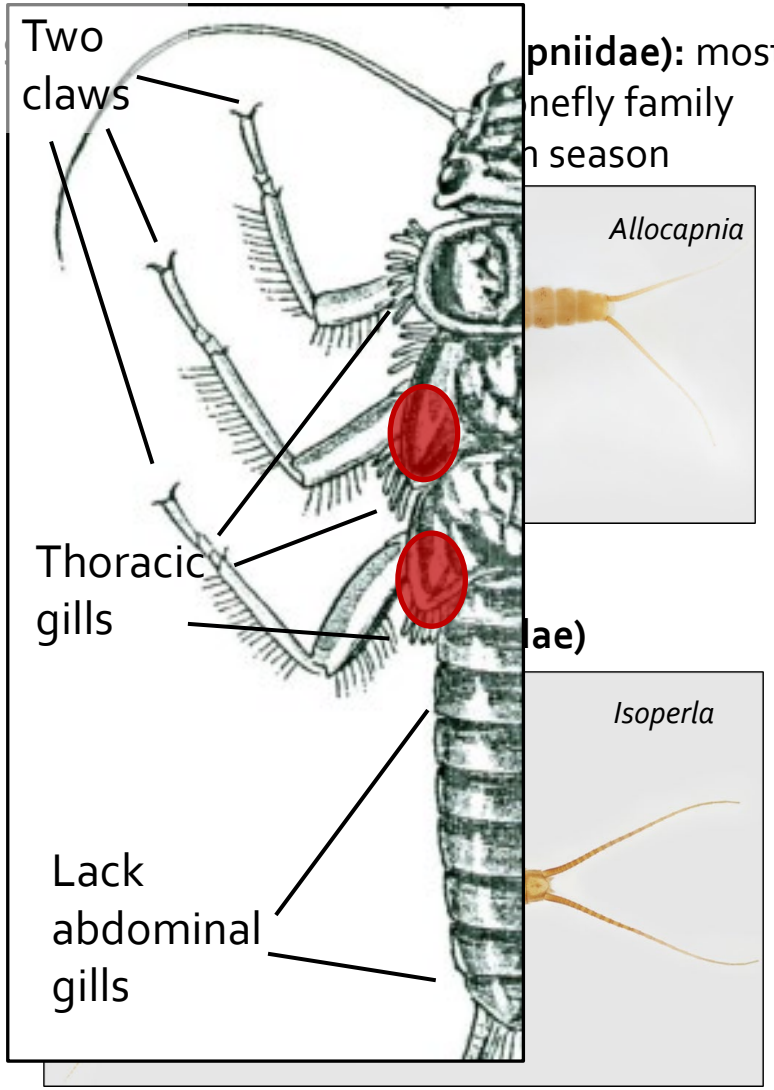
"Spring" stoneflies (Nemouridae)



pniidae): most
nefly family
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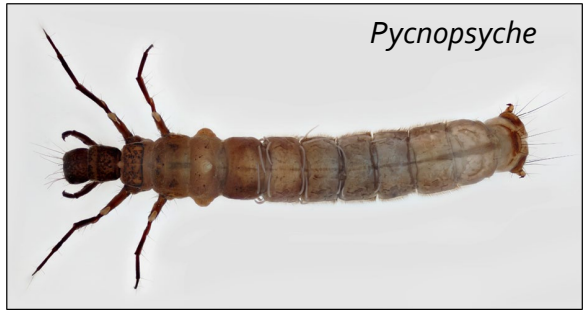
Rolled-winged stoneflies (Leuctridae)

All images: Macroinvertebrates.org

Common caddisfly families (Order Trichoptera)

Net-spinners (Hydropsychidae): Most common caddisfly family collected

Northern casemakers (Limnephilidae)



Scaly mouth caddisflies (Lepidostomatidae)

Fingernet caddisflies (Philopotamidae)

Free-living caddisflies (Rhyacophlidae)

Trumpet net caddisflies (Polycentropodidae)

All other images: Macroinvertebrates.org

Common aquatic beetle families (Coleoptera)

Diving beetles (Dytiscidae): most common and abundant beetle collected

Riffle beetles (Elmidae)

Water pennies (Psephenidae)

Toe-winged beetles (Ptilodactylidae)

Water scavenger beetles (Hydrophilidae)

Whirligig beetles (Gyrinidae)

Long-toed water beetles (Dryopidae)

All images: Macroinvertebrates.org

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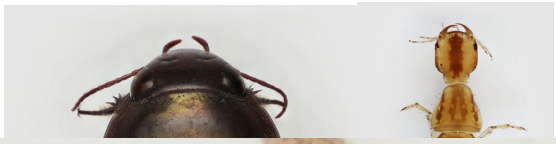
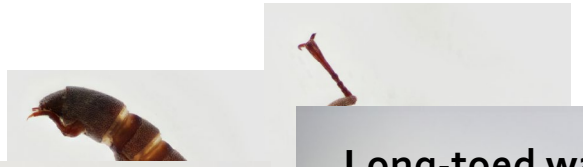
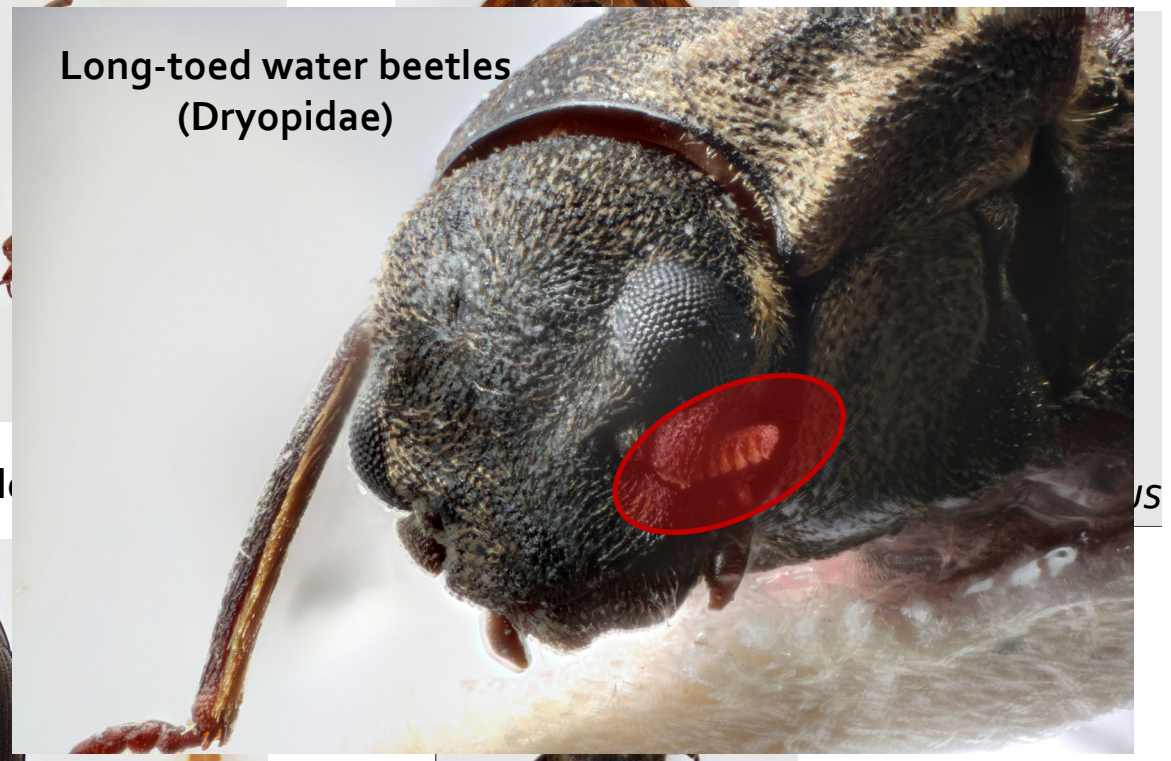


Riffle beetles (Elmidae)



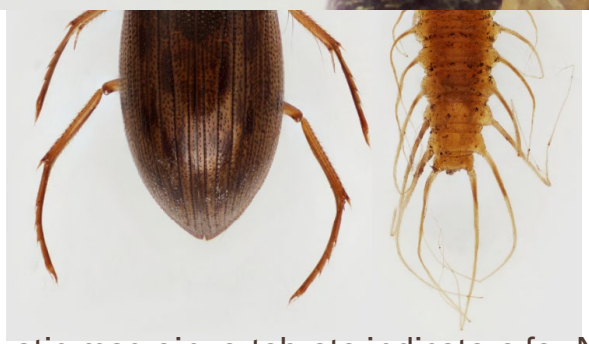
Water pennies (Psephenidae)

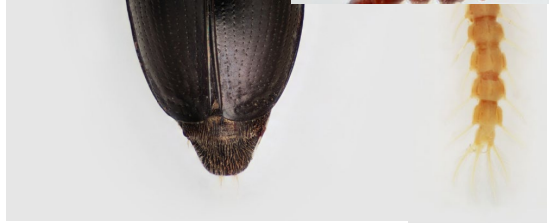
Toe-winged beetles (Ptilodactylidae)

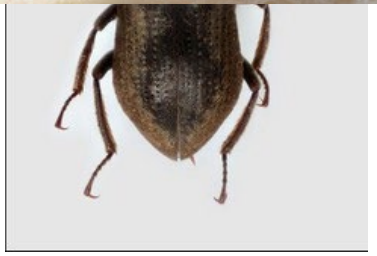


Long-toed water beetles (Dryopidae)

Riffle beetles (Elmidae)



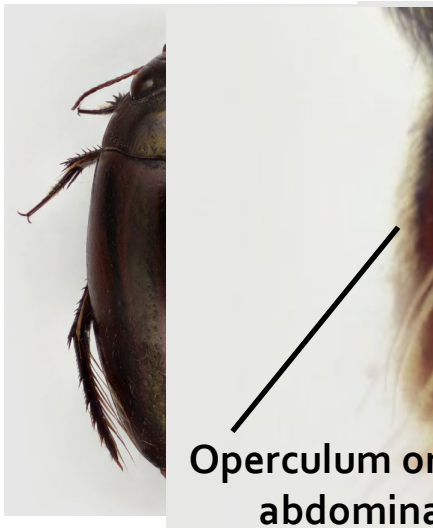




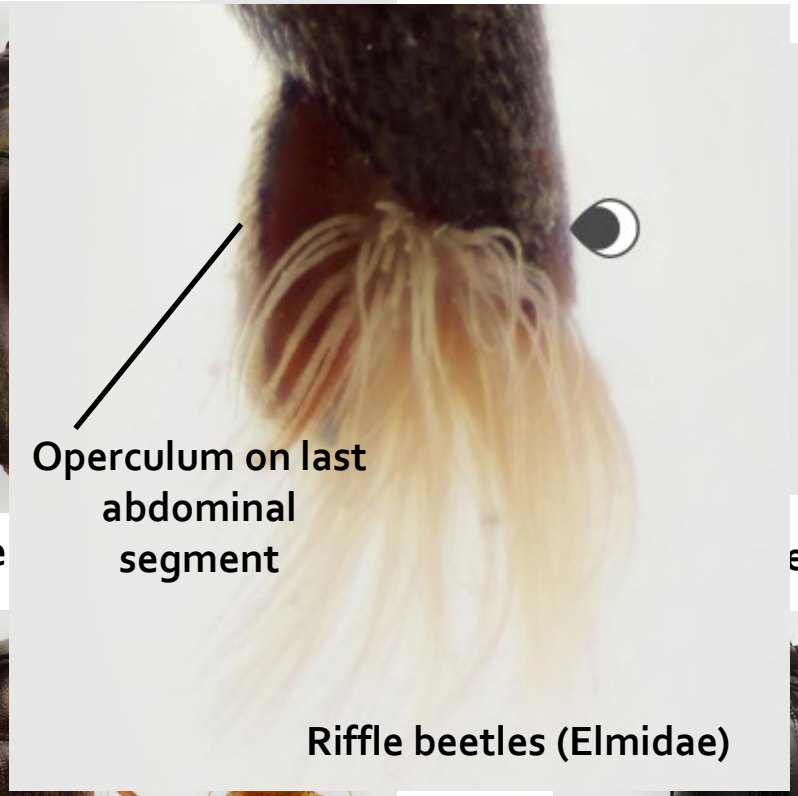
All images: Macroinvertebrates.org

Common aquatic beetle families (Coleoptera)

Diving beetles (Dytiscidae): most common and abundant beetle collected



Water scave



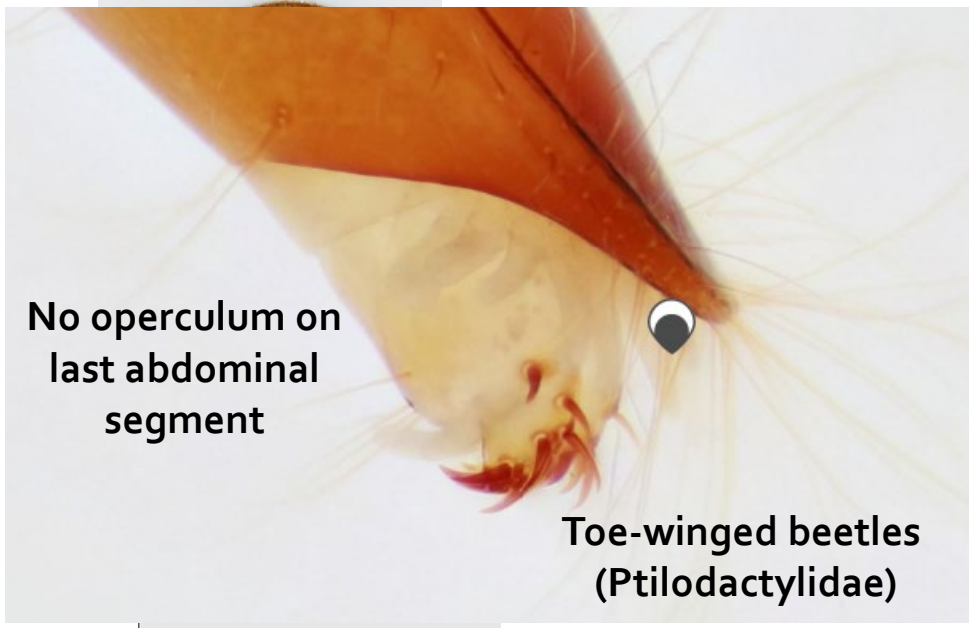
Riffle beetles (Elmidae)

Riffle beetles (Elmidae)

etles (Gyrinidae)

Water pennies (Psephenidae)

Toe-winged beetles



Toe-winged beetles (Ptilodactylidae)

All images: Macroinvertebrates.org

Common Odonata and Megaloptera families

Clubtail dragonflies (Gomphidae)

Broad-wing damselflies (Calopterygidae)

Spiketail dragonflies (Cordulegastridae)

Narrow-wing damselflies (Coenagrionidae)

Dobsonflies (Corydalidae)

Alderflies (Sialidae)

All other images: Macroinvertebrates.org

Common Diptera and Hemiptera families

Non-biting midges (Chironomidae): most common and abundant of all taxa collected

Black flies (Simuliidae)

Meniscus midges (Dixidae)

Mosquitoes (Culicidae)

Water striders (Gerridae)

Crane flies (Tipulidae)

Riffle bugs (Veliidae)

Water boatmen (Corixidae)

All other images: Macroinvertebrates.org

Common mollusk families & crustacean orders

Asian clams (Corbiculidae)

Bladder snails (Physidae)

Crayfish (Order Decapoda)

Isopods (Order Isopoda)

Ramshorn snails Planorbidae

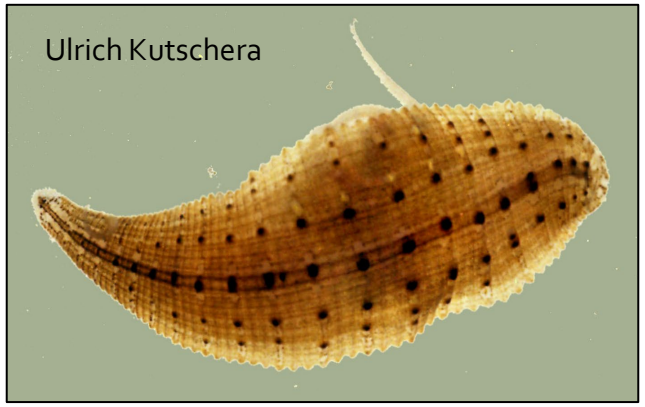
Amphipods (Order Amphipoda)

All other images: Macroinvertebrates.org

Other aquatic macroinvertebrates

Segmented worms (Phylum Annelida)

Leeches (Hirudinea)



Worms (Oligochaeta)

Flat worms (Phylum Platyhelminthes)

Aquatic mites (Superorder Acariformes)

Record on the field form (BMI score)

- BMI score used in NE and SE SDAM (appears on all field forms).
- Identify up to 5 taxa and tally up to 11 individuals

3. BMI Score (NE and SE)

____ (0-3)	0 (Absent) No aquatic macroinvertebrates observed. 1 (Weak) Total abundance is 1 to 3. 2 (Moderate) Total abundance is ≥4. 3 (Strong) Total abundance is ≥10 and richness ≥3, OR Richness is ≥5. *Note: Richness is based on family-level identification for aquatic insects and mollusks, order-level for crustaceans and mites, and class or phylum for all other aquatic macroinvertebrates.*

Taxa / Notes on BMI score:

Record on the field form (Total abundance)

- Total abundance of aquatic macroinvertebrates is an SE indicator; will be on combined and SE field forms only.
- Tally up to 41 individuals.

4. Total aquatic macroinvertebrate abundance (SE only)

Mark the appropriate box for the total number of aquatic macroinvertebrates observed.

- ☐ No aquatic macroinvertebrates observed.
- ☐ Total abundance is 1 or 2.
- ☐ Total abundance is 3 to 40.
- ☐ Total abundance is 41 or more.

Notes on total aquatic macroinvertebrate abundance:

Knowledge check!

True or false: No aquatic macroinvertebrates will be found in a dry reach.

A. TRUE

B. FALSE

False: Count individuals or evidence of aquatic macroinvertebrates you observe in a dry reach, whether living or dead. The most common non-living evidence may be caddisfly cases, insect exuviae or mollusk shells.

Knowledge check!

When is sampling for aquatic macroinvertebrates complete?

A. When you've collected at least 100 individuals

B. After you've collected from the richest habitats

C. After you've collected from 6 locations over 15 minutes

D. Immediately, in a dry reach

Sampling is complete after at least 6 locations have been sampled over 15 minutes of searching.

Knowledge check!

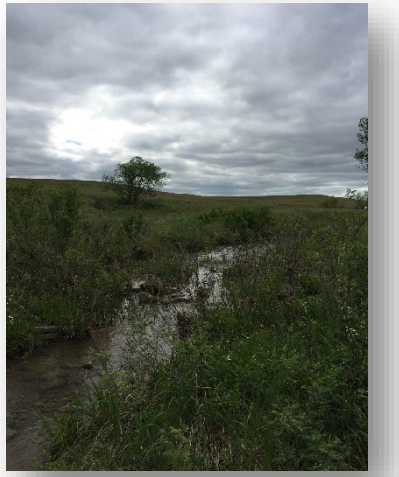
True or false: Lab identifications of aquatic macroinvertebrates are preferred over field identifications.

A. TRUE

B. FALSE

False: Identifications are not required for the aquatic macroinvertebrate indicators; however, both field and lab identifications are acceptable if identifications are made. Practitioners should select the approach that best suits their field crew's skills and capacity.

For more information about SDAMs visit



https://www.epa.gov/streamflow-duration-assessment