



**MISSOURI STREAM TEAM
VOLUNTEER WATER QUALITY MONITORING PROGRAM
Standard Operating Procedure**

ORIGINAL EFFECTIVE DATE: July 3, 2024

RECERTIFICATION DATE:

SOP TITLE: MoST-VWQM-SOP: Wadeable Streams Macroinvertebrate Sampling

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APPLICABILITY:

Applies to all Level 1, Level 2, Level 3 and CSI trained Missouri Stream Team, Volunteer Water Quality Monitoring Program Participants

1.0 SCOPE AND APPLICABILITY

A good way to monitor the water quality of a stream is to closely examine its biological diversity. Aquatic macroinvertebrates are an important component to the resident biological community; typically requiring months to years to complete their life cycle. Pollution or habitat disruption of the stream system can cause mortality or disrupt the life cycle of the biological community. Examining diversity of the community, combined with pollution tolerance rankings, are considered to be good ways to evaluate if the biological community has diverged from natural conditions.

This SOP will detail the MoST, VWQM sampling methods for stream macroinvertebrates. Macroinvertebrates collected through this sampling method are intended to be identified to standard taxonomic levels, followed by the calculation of a macroinvertebrate pollution tolerance index. Calculation of the pollution tolerance index is not addressed in this SOP.

2.0 DEFINITIONS AND ABBREVIATIONS

CSI – Cooperative Stream Investigation
MDC – Missouri Department of Conservation
MoDNR – Missouri Department of Natural Resources
MoST – Missouri Stream Team
SOP – Standard Operating Procedure
VWQM – Volunteer Water Quality Monitoring
QAPP – Quality Assurance Project Plan
QA/QC – Quality Assurance/Quality Control

3.0 SUMMARY OF METHOD

The wadeable stream macroinvertebrate sampling method described in this SOP is used by MoST, VWQM Program participants that have received Level 1, Level 2, Level 3 or CSI Program training.

4.0 HEALTH AND SAFETY REQUIREMENTS

Appropriate protective gear, such as water-proof boots, should be worn to protect against potential water-borne illnesses during monitoring. It is also advisable to wash your hands with soap and water after monitoring, especially before eating or drinking.

Those participants that monitor near wastewater should be vaccinated for Hepatitis A. Please contact your county health department or your personal physician for this vaccination.

Do not attempt to sample macroinvertebrates if you cannot safely wade across the stream (e.g., not higher than hip level if wearing chest waders). If chest waders are worn while wading, a safety belt should be worn on the outside to prevent filling the waders if accidentally submerged.

5.0 PERSONNEL QUALIFICATIONS

Participants will be knowledgeable of this SOP and will have, at a minimum, attended a Level 1 VWQM workshop.

6.0 SUPPLIES AND EQUIPMENT

The following equipment is needed to collect and process a macroinvertebrate sample:

- Program provided 500 µm mesh kick net
- Program provided forceps
- Program provided magnifying lens
- Program provided macroinvertebrate identification guides
- Volunteer provided poles for the kick net
- Volunteer provided white ice cube trays
- Volunteer provided water squirt bottle
- Volunteer provided scrub brush (for large woody debris)

7.0 PROCEDURES

The accuracy of macroinvertebrate sampling is dependent on following this method and by selecting a suitable stream reach. In streams with recurring riffles (hereafter known as riffle/run streams) a suitable stream reach is determined by wadeable depths, the presence of flowing water, and at least two riffles in a 300-foot sampling reach. In streams without riffles (hereafter known as glide/pool streams) a suitable stream reach is determined by 300-foot sampling reach with wadeable depths, the presence of flowing water, and rootmat or woody debris habitats.

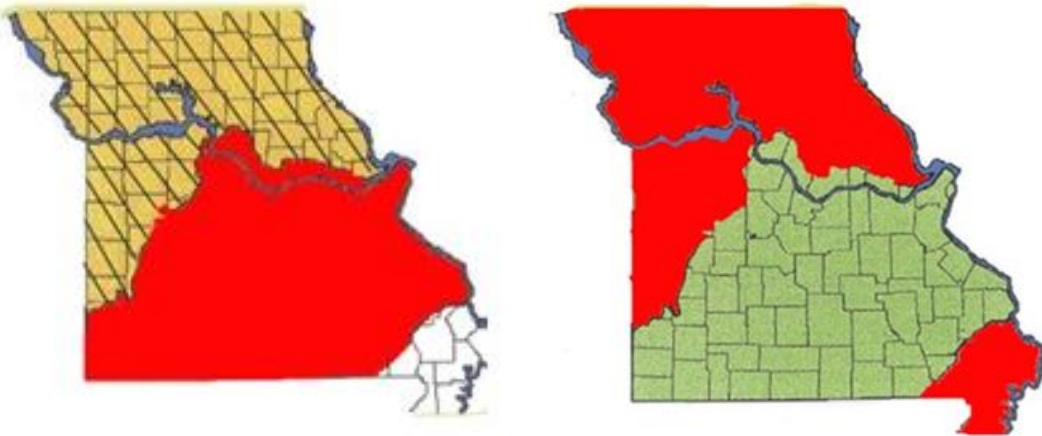
Streams with riffle/run predominance are found primarily in the Ozark ecological region (see Figure 1), however they may be found in some parts of the Prairie region. A typical and characteristic feature of a riffle/run stream type is a repeated and regular frequency of riffles. Riffles typically form every 7-10 stream widths.

Streams with glide/pool predominance are found primarily in the Prairie and Lowland ecological regions of Missouri (see Figure 1). Glide/pool stream types generally have a repeated and predictable meander sequence. Pools typically form immediately after a bend. The preferred habitats to sample in glide/pool streams are rootmat and woody debris. The least desirable habitat to sample are pools. Pools will not be covered under this SOP since the net type needed is a specially issued item by the VWQM program and special training is needed on sampling pools.

Whichever stream type and habitat is sampled, the goal of sampling is to maximize the diversity of the macroinvertebrate community collected. To do so, good sampling technique is required, as well as selection of different flow, depth, and substrate sizes within the major habitat. The preferred habitat to sample in riffle/run streams are riffles and runs; with rootmat as the alternative preferred habitat. The preferred habitat to sample in glide/pool streams is rootmat; with large woody debris as the alternative preferred habitat.

To collect representative diversity of organisms from a stream reach, each kicknet (regardless of habitat) should be collected from different microhabitats in a variety of flow, depth, substrate size, and substrate condition.

Figure 1 – Ecological Regions (highlighted in red)
Ozark Ecoregion Prairie and Lowlands Ecoregion



7.1 SAMPLING RIFFLE/RUN STREAMS

When selecting the 300-foot sampling reach in a riffle/run stream, ensure that there is adequate riffle habitat within the assessment reach. Habitat types can “move” or change over time depending on high water events and water levels. Riffles at your site may become runs if water level is elevated.

7.1.1 RIFFLE SAMPLING METHOD

Riffles and runs have a coarse bottom substrate mixture of cobble and gravel. Riffles are shallow, turbulent stream segments with higher gradient than runs. Runs are moderately shallow stream segments with laminar flow and lacking turbulence.

1. Identify (3) microhabitat sampling areas from riffles located in the sampling reach; each microhabitat riffle area should have different water depth, velocity, and substrate size.
2. Approach the first microhabitat sampling area from downstream.
3. Facing upstream, spread a kick net perpendicular to the current in the riffle (it is recommended to have an additional person to assist with the net).
4. Ensure the bottom of the net follows the contour of the stream bottom.
5. Slope the kicknet approximately 45 degrees in a downstream direction.
6. Rub organisms off all large stones within 3x3 foot area immediately upstream of the net, the current should transport all organisms into the net.
7. Weigh down the bottom of net with a few large stones that have been cleared of organisms.

8. Thoroughly agitate the substrate 3-6" deep in the upstream 3x3 foot area by using a shuffling kick method with your feet.
9. Rub large stones weighing down the net and set aside.
10. Slowly lift the net from stream, ensuring water does not pour out the front or back.
11. Move to land to pick and sort invertebrates from the net (see Section 7.3).
12. Repeat net sampling at the other (2) microhabitats.

7.1.2 ROOTMAT SAMPLING METHOD

Rootmats are submerged roots from terrestrial vegetation, which are important habitat and sources of refuge for aquatic organisms. Rootmat is best defined as the immersed portion of fine fibrous roots of woody vegetation that are found along the bank.

1. Identify (3) microhabitat areas of rootmats located in the sampling reach; each microhabitat rootmat area should have different water depth, velocity, and substrate quality and should total approximately 3-feet total length.
2. Approach the first microhabitat sampling area from downstream.
3. Facing upstream, place the bottom side of the kick net against the bank and immediately downstream from the rootmat.
4. Ensure the handles of the net are at a ninety-degree angle to the bank.
5. If current is present, disturb the rootmat by gently stirring it with your feet or hands; the current will move organisms downstream into the net.
6. If no current is present, kick the rootmat in a downstream direction to create a current while dislodging organisms and moving them into the net.
7. When finished, rotate the bottom of the net upward in an upstream direction.
8. Move to land to pick, sort, identify, and record invertebrates from the net (see Section 7.3).
9. Repeat net sampling at the other (2) microhabitats.

7.2 SAMPLING GLIDE/POOL STREAMS

When selecting the 300 foot sampling reach in a glide/pool stream, insure that there is adequate rootmat or woody debris habitat within the assessment reach. Habitat types can "move" or change depending on water levels. Access to rootmat and woody debris can become non-wadeable if the water level is elevated.

7.2.1 ROOTMAT SAMPLING METHOD

See Section 7.1.2

7.2.2 LARGE WOODY DEBRIS SAMPLING

Large woody debris is defined as submerged portions of large logs (also known as snags) and tree branches greater than one inch in diameter. The woody debris selected should represent a variety of conditioned wood types, sizes, water depths, and velocities.

1. Approach woody debris from a downstream to upstream direction. Approximately 4-5 woody debris samples will equal one net set. Therefore a complete set of 3 nets is equal to sampling a total of approximately 12-15 pieces of woody debris.
2. Select the first piece of woody debris.
3. If the woody debris is an independent tree branch, gently lift the branch towards the water surface and place the net below the branch. Try and use any current to help move dislodged organisms into the net. Scrub a 6 x 6 inch area with a scrub brush.
4. If the woody debris is a larger log, position the net bottom to conform to the curvature of the log. Try and position the net so that any current will help move dislodged organisms into the net.
5. Use a scrub brush to clear an area of approximately 6 x 6 inches. If there is no current, create a current toward the net with the brush when scrubbing the 6 x 6 inch area.
6. After each piece of woody debris is scrubbed, raise the net from the water and move to land to pick and sort the organisms (see Section 7.3).
7. After 4-5 pieces of woody debris have been picked, sorted, identified, and recorded continue with the other (2) microhabitats.

7.3 FIELD PROCESSING MACROINVERTEBRATES FROM THE NET

After each net set has been collected, the organisms caught in the net should be removed for identification. Due to the difference in organic and inorganic material also collected in the net, there is no standard amount of time required for sorting macroinvertebrates. Rather, thorough processing should be the goal, with organisms pulled from the net in numbers that are representative of their abundance in the net.

1. Spread out the net set flat on the ground, or on a net stand.
2. Fill the water squirt bottle with stream water.
3. Before beginning to pick out organisms, use the squirt bottle to rinse organisms from large debris and leaves into the net. Set aside the debris.
4. Fill the white ice cube trays or other sorting trays with stream water.
5. Record the number of people that are picking organisms.
6. Begin recording the picking time.
7. Begin picking organisms into the sorting trays. Try to sort them into separate areas of the sorting trays by types that look alike.
8. Normally, the first organisms picked will be larger and more active.
9. Spend an adequate amount of time picking a representative amount of large, active organisms.
10. Keep the net moist by using the water squirt bottle.
11. Shift search patterns to smaller, active and less active organisms.
12. Spend an adequate amount of time picking a representative amount of smaller, active and less active organisms.

13. Record the end picking time.
14. Thoroughly rinse the net in the stream.
15. Identify and enumerate invertebrates in the sorting trays.
16. Record enumeration on the macroinvertebrate data sheet.
17. Repeat steps 1-16 after collecting the 2nd and 3rd net sets.

7.4 MACROINVERTEBRATE IDENTIFICATION

The identification of macroinvertebrates is based on taxonomy and the taxonomic levels preferred by the VWQM Program. Taxonomic levels refer to the organization of macroinvertebrate based on the Linnaeus taxonomic classification system. This naming system is hierarchical, with the broadest grouping starting at “Kingdom” and the narrowest grouping ending at “Species.” The complete system in descending order is: Kingdom, Phylum, Class, Order, Family, Genus, Species.

Listed below are the classification groups and common names that the VWQM Program uses for macroinvertebrate identification.

- Class = gilled snail, mussel, aquatic worm, leech, and other snail
- Order = caddisfly, mayfly, stonefly, crayfish, scud, sowbug, and other beetle larvae
- Sub-order = dragonfly and damselfly
- Family = riffle beetle, water penny, crane fly, alderfly, watersnipe, fly midge, and pouch snail
- Genus = dobsonfly and fishfly

These various levels of taxonomic identification are based on the ability to observe distinguishing taxonomic characteristics in the field with hand held magnification of 10-20x. There are various taxonomic keys that can be utilized to assist in identification and that are provided at Level 1 VWQM workshops (some examples are listed below):

- Izaak Walton League of America – Stream Insects & Crustaceans
- University of Wisconsin Extension – Key to Macroinvertebrate Life in the River
- The Adopt-A-Stream Foundation – Streamkeeper’s Field Guide
- Missouri Stream Team – VWQM Level 1 Training Notebook
- Missouri Stream Team – Guide to Aquatic Macroinvertebrates

Once identification to the appropriate level has been determined, data is entered onto the Stream Team, VWQM Macroinvertebrate Data Sheet and/or entered into the VWQM Database (not covered under this SOP).

8.0 SPECIAL CONSIDERATIONS

Sampling Reminders

- Always collect samples in an upstream direction
- Do not sample in areas that you have previously disturbed
- Be consistent with methods, time of year, and habitats sampled

Be mindful of nuisance species spread by disinfecting nets and boots if more than one site is sampled per day (see below).

Technique	Duration	Concentration	Solution	Comments
Vinegar	20 min.	100%	1 gallon, no water	Corrosive to metal and toxic to fish
Household Bleach (Chlorine)	10 min.	3%	4 oz. bleach/1 gallon water	Corrosive to metal and toxic to fish
Air Drying	3-5 days	NA	NA	Must completely dry
Freezing (<32°F)	24 hours	NA	NA	Must be below freezing for the entire time
Salt Bath	24 hours	1%	1/8 cup/1 gallon water	Equipment must be completely submerged

9.0 QUALITY ASSURANCE/QUALITY CONTROL

As part of attending Level 2 Workshops, macroinvertebrate identification testing is required. Level 2 workshops are covered under a MoDNR QAPP (see Section 10.0).

As part of attending a Level 3 QA/QC audit, macroinvertebrate sampling technique will be observed and identifications will be tested. Level 3 audits are covered under a MoDNR QAPP (see Section 10.0).

10.0 REFERENCES

Missouri Department of Natural Resources, Quality Assurance Project Plan for Level 2 and Level 3 Volunteer Water Quality Monitoring.

Missouri Stream Team – Volunteer Water Quality Monitoring Program; Introductory Volunteer Water Quality Monitoring Training Notebook, Chapter 5, Biological Monitoring
https://mostreamteam.org/assets/chapter5_biologicalmonitoring.pdf