NONTIDAL BENTHIC MACROINVERTEBRATE METHODS MANUAL

LOWER WATERSHED

CMC
Chesapeake Monitoring Cooperative

ALLIANCE for the Chesapeake Bay

Defenders of Soil, Air, Woods, Waters and Wildlife – The Izaak Walton League of America

Alliance for Aquatic Resource Monitoring – ALLARM – est. 1986

University of Maryland Center for Environmental Science

Produced by the Chesapeake Monitoring Cooperative

Working together to understand the health of our waters

September 30, 2016

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Contributors

This document was created through a collaborative effort of three organizations: The Alliance for the Chesapeake Bay, Alliance for Aquatic Resource Monitoring, and the University of Maryland Center for Environmental Science. The authors want to thank Dan Boward for his expert review of these protocols.

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Acknowledgments

Much of this manual was adapted with permission from the following sources:

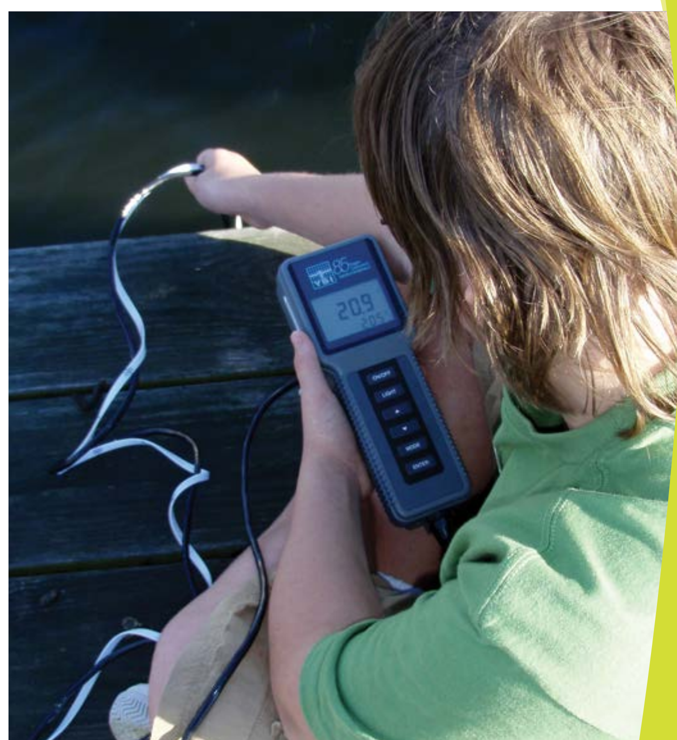
Virginia Save Our Streams: Monitor's Checklist for the Modified Method. (2007). Izaak Walton League of America

Volunteer Biological Monitoring Manual. (2009). The Alliance for Aquatic Resource Monitoring

Introduction

We rely heavily on the Chesapeake Bay and all its tributaries for our drinking water, food sources, recreation, and navigation. Since the initiation of the Chesapeake Bay Program in 1983 the communities in the watershed have been working towards improving the health of these waters. A significant portion of that work is tracking our progress through water quality monitoring. There are many sources of water quality data – including data collected by volunteers, local governments, conservations districts, and nongovernmental groups such as academia and watershed organizations that are not currently being used by the Chesapeake Bay Program to track Bay health and determine success of restoration efforts.

The Alliance for the Chesapeake Bay (ACB), Izaak Walton League of America (IWLA), Dickinson College's Alliance for Aquatic Resource Monitoring (ALLARM), and the University of Maryland Center for Environmental Science Integration and Application Network (IAN), have partnered to create the Chesapeake Monitoring Cooperative (CMC). The CMC will provide technical, logistical, and outreach support for the integration of citizen-based and non-traditional water quality and macroinvertebrate monitoring data into the Chesapeake Bay Program (CBP) partnership.



This is the first effort to integrate citizen science water quality data, to inform policy management and water quality assessments, into a federal program. Not only will these data be available to the CBP through the development of a Chesapeake Monitoring Cooperative database, but will be accessible to the public, local governments, universities, and others. The contributions of data by volunteer and non-traditional monitoring groups to the CMC and CBP monitoring network will provide valuable information that supports shared decision-making, adaptive management, and measuring progress towards the 2014 Chesapeake Bay Watershed Agreement.

Goals of the Chesapeake Monitoring Cooperative

- To build a cooperative network of volunteer and non-traditional monitoring groups that shares their water quality data with their local communities, the public, and the Chesapeake Bay Program.
- Provide technical assistance and support to monitoring groups and individuals to collect, analyze, and communicate about water quality data.
- Build relationships between the Chesapeake Bay Program Partnership and the non-traditional and volunteer water quality monitoring community.
- Provide the infrastructure and support to make all water quality data of known quality available to the Chesapeake Watershed community and integrate data into the CBP partnership's monitoring database.
- Develop consistent monitoring and training protocols, technical guidance, data gathering tools, quality assurance mechanisms, and data analysis and communication tools.
- Provide training and technical support to monitoring groups in order to ensure provision of consistent, high quality data to the Chesapeake Bay Program.

Purpose of this manual

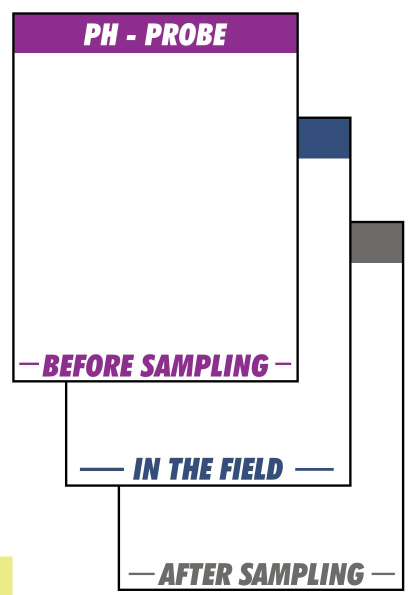
This Manual outlines the Chesapeake Monitoring Cooperative's (CMC) Macroinvertebrate Monitoring Program and contains information specific to the program and to Izaak Walton League's Save Our Streams. The details of the CMC Macroinvertebrate Monitoring Program can be found in the Quality Assurance Project Plan, developed in May 2016, by the Chesapeake Monitoring Cooperative.

The purpose of this manual is to ensure that the methods used to collect and identify macroinvertebrates are consistent among CMC monitors throughout the lower Chesapeake Bay Watershed. The procedures written in this manual serve a quality control mechanism for collecting data of known, documented quality.

The CMC project is currently funded by EPA through December 2021.

How this manual is organized

This manual is designed to be modular; this means that you can pull it apart into only the pieces that you need and it should still function as helpful step-by-step directions to successfully collect sound biological data. Sections are numbered on the bottom to help you keep the pieces assembled in order.



The manual is broken into two main sections: introductory materials that help you understand what you need and how to prep before getting out into the field, and the methods themselves. The methoda are broken into three sections: before sampling, at the stream, and after sampling. The method sections are marked by purple, navy, and gray footers, respectively. If you want to narrow down the amount of paper that you take with you in the field, you can pull out all the sheets that have a navy header and footer labeled "at the stream."

NOTE

There are notes highlighted in yellow (like this one) to remind you of important things such as safety, quality control, and best practices. Be sure to read these and take note of their contents.

Collecting and Using Stream Data to Answer Questions

The goals, questions, and potential data uses of the Benthic Macroinvertebrate Monitoring Program are summarized in the table below.

GOALS	QUESTIONS	RESULTS
• Identify local hotspots • Identify sites suitable for restoration projects • Measure stream health	• What is the overall health of the stream? • Is the stream meeting or exceeding water quality standards? • Are there areas that need additional assessment?	Data can be analyzed and used by monitors, groups, communities, stakeholders, government, and the CPB to: • answer program questions • create a baseline of current watershed conditions to compare to if/when changes in the watershed occur • inform watershed management strategies at a local and regional level • increase awareness of stream health issues

Study Design

The Chesapeake Monitoring Cooperative works with all CMC monitoring groups to develop a monitoring study design that addresses the questions and concerns of the group. The study design process ensures that a monitoring program is designed with clear research questions and ways to answer those questions, based on how the data will be used. The decisions made during the study process include choosing:

What to monitor – macroinvertebrates and/or water quality parameters

How to monitor – methods, equipment, etc.

Where to monitor – identify and prioritize monitoring sites

When to monitor – timeframe and frequency

How to use and communicate the results

Macroinvertebrate Monitoring Program

MACROINVERTEBRATES ARE…

animals that are large enough to see without magnification and do not have a backbone, such as crustaceans, insect larvae, and worms. They are monitored to assess the water quality conditions in a stream. Macroinvertebrates spend much or all of their life in a stream, and the number and diversity of organisms living in the stream are influenced by 1) the quality of the water, and 2) the availability and condition of in-stream habitat. Macroinvertebrate populations are threatened by chemical and thermal pollution, sedimentation, and habitat loss. Different types of macroinvertebrates tolerate different levels of pollution and stream conditions – healthy streams have an abundant and diverse macroinvertebrate population, which contribute to a healthy ecosystem. Macroinvertebrates are most abundant in riffles (areas of fast moving water), where oxygen is more plentiful or in areas around banks or in-stream structures that provide more protection. The protocol outlined below focuses on collecting macroinvertebrates from these two areas.

CMC MEMBER REQUIREMENTS

The minimum requirements to participate in the CMC Macroinvertebrate Monitoring Program include:

- Create a written study design.
- Attend CMC training workshops and follow-up meetings.
- Become certified and maintain biennial certification.
- Document your site location(s) using GPS and confirm that the site(s) is easy to access.
- Follow the procedures included in this CMC Macroinvertebrate Monitoring Methods Manual as it applies to your study design – sample collection, identification, equipment maintenance, quality assurance & quality control, and data management.

CMC groups residing in the lower part of the Chesapeake Bay Watershed (MD, VA, DC, WV, and DE) are trained by the Izaak Walton League of America and follow the Save Our Streams Macroinvertebrate Monitoring Protocol. Monitors in the upper watershed are trained by ALLARM and follow the Environmental Alliance for Senior Involvement (EASI) Macroinvertebrate Monitoring Protocol.

Save Our Streams Monitoring Protocol

The Izaak Walton League of America trains monitors to follow the Virginia Save Our Streams (VA SOS) Macroinvertebrate Monitoring Protocol, a volunteer-friendly protocol developed in 2002, by scientists Sarah Engel and Reese Voshell adapted from the traditional SOS method (the National IWLA method). The research study was published in American Entomologist. This protocol is used throughout the lower Chesapeake Bay Watershed by volunteers looking to learn more about the health of their local streams. VA SOS has a network of regional trainers and coordinators who can help provide training for individuals and groups within these regions. Macroinvertebrates are collected and identified to the Order level, then scored based on the Save Our Streams Multimeric Index. The number and diversity of organisms found in the stream help to classify a stream reach as having an acceptable or unacceptable ecological condition. It is suggested that macroinvertebrates be monitored four times a year (every 3 months). If that is not possible, please focus on a spring and a fall collection at a minimum, in order to account for seasonal changes within the stream and the lifecycle of some organisms.

The VA SOS Protocol contains two different sampling methods, and you will need to choose which method (rocky bottom streams vs. muddy bottom streams) is suitable for your monitoring site, based on the stream's hydrology and streambed:

Stream Reach Charecteristics	Rocky Bottom Stream	Muddy Bottom Stream
Hydrology		
Riffles (area of fast moving water)	✓	
Streambed		
Boulders (> 10" in diameter)	✓	
Cobbles (2.6 – 10" in diameter)	✓	
Gravel (~0.2 – 2.5" in diameter)	✓	
Sand, Silt, or Mud (< 0.2" in diameter)		✓

Best practices for monitoring

BEFORE GOING OUT INTO THE FIELD

a. Choose a regular sampling day: Macroinvertebrate samples should be taken four times a year (every 3 months). If that is not possible, please focus on a spring and a fall collection at a minimum.

b. Always check your equipment before heading out into the field. Look for wear and tear that might affect the quality of your sample.

c. When able, use rubber bottom boots instead of felt bottom boots.

d. Get landowner permission: If you are not accessing a site that is public be sure to get a signed landowner permission form and mail a copy to your monitoring coordinator. See page 12 for a copy of a blank landowner permission form.

IN THE FIELD

a. Sample with a buddy. It's always better to have an extra pair of hands and another person to help out in a hard or dangerous situation.

b. Follow the safety guidelines outlined on page 11.

c. Always sample from the same location. If you do move your site please let your monitoring coordinator know so that the site information can be updated.

d. Always approach your sampling location from downstream. Try your best to not disturb the sediment on the stream bottom as this can affect your sampling results.

e. Be sure to select the correct method (rocky vs. muddy bottom) based on the stream's hydrology and streambed. Use the same method of sample collection each time you visit your site.

f. During sampling, make sure the kick net lays snug against the streambed.

g. Do not allow water to wash over the top or bottom of the kick net when removing it from the stream.

h. A white sheet underneath your sample makes it easier to sort bugs.

Best practices for monitoring

IN THE FIELD CONTINUED…

i. Use your Identification key in the field. It's not cheating! If you can't ID the bug send a picture, that's what we're here for.

j. Provide comments on your data sheet: The "Comments" section can be used to record general observations about the site especially changes due to erosion, recent notable weather, and any problems you had with the sampling procedures or equipment. The comments are very helpful to your monitoring coordinator when trouble shooting data anomalies.

k. To increase the chance of survival, return the macroinvertebrates to the stream as soon as possible after identification.

OVERALL

a. Stay certified. Keep your monitoring certification up to date.

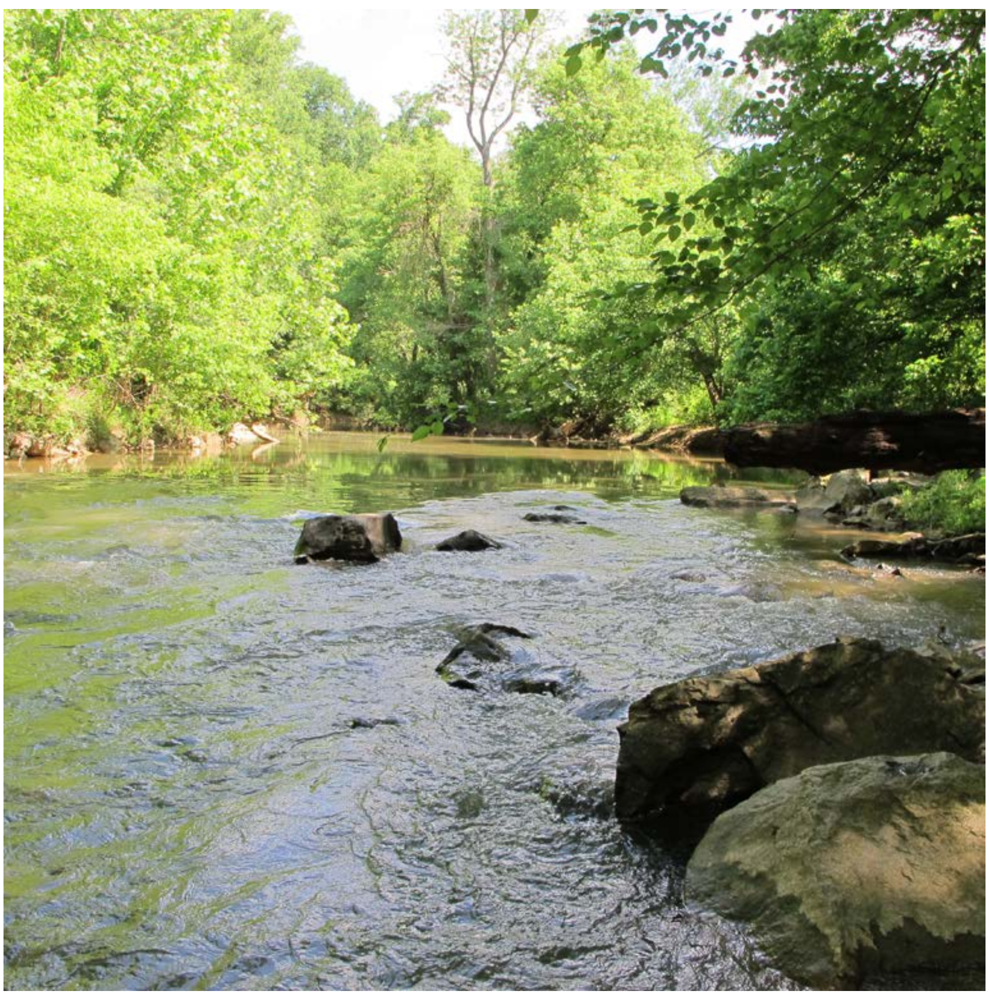
b. Have fun!

Field safety tips

SAFETY CONSIDERATIONS WHEN VISITING YOUR MONITORING SITE

CMC recommends that you visit your monitoring site(s) with a partner, or at a minimum, notify someone when you leave your house (and return) from monitoring. You should always put safety considerations first, and should never monitor when you feel ill, during inclement weather (especially snowy/icy conditions), or under high-flow conditions. Do not sample a stream if water is above your knees or if water is flowing extremely fast. This can be dangerous. Take caution when entering and exiting the stream and wear waders or close-toed shoes. Glass may be hidden in the bottom of the stream - watch out for it!

It is good practice to have a first aid kit available to attend to cuts and scrapes. If you do get a cut or scrape while in the stream, use peroxide to clean the wound. This sampling method cannot detect bacteriological pollution. Always remember to wash your hands after sampling in any stream, this can help protect you against bacteriological pollution.



PROPERTY OWNER PERMISSION AND LIABILITY RELEASE AGREEMENT

_______________________________is participating in a program to monitor the condition of local rivers and streams, to collect baseline data and ensure that water quality is properly maintained. As part of the survey, trained local volunteers collect water samples and scientific baseline data on a weekly basis at consistent specific sites. This monthly monitoring will last approximately 30 minutes to an hour per site. This agreement is intended to grant permission to volunteers to access private property for site-specific data collection in the watershed, as well as to release and hold harmless the property owner from liability arising from that access.

I, _______________________________ the property owner, hereby grant permission to ________________________________(name of organization), its volunteers, and necessary project partners, to enter my property located at __________________________________ ____, beginning on _________________(date) until_______________________(date or until program completion), for the sole purpose of site-access and water monitoring that takes place on or near my property to accomplish weekly baseline data collection.

I agree that my permission is granted on a voluntary basis and I have neither received or expect to receive any form of compensation in exchange for my permission.

I agree to hold the organization listed above, its volunteers, and necessary project partners, harmless from and forever discharge them from any and all liability for damages, injury, or loss which may be sustained as a result of their entry into the private property described in this agreement.

In addition, the organization listed above hold harmless and forever discharge me, the property owner, from any and all liability for any damage, injury, or loss which may be sustained as a result of their entry into the private property described in this agreement.

Property Owner____ Date: ________________

Organization ____ Date: ________________

VOLUNTEER LIABILITY WAIVER

LIABILITY

The Alliance for the Chesapeake Bay, hereafter ACB, intends that volunteers participating in this program are not acting on behalf of the ACB Board of Directors or any ACB partner in any official capacity. As such, it is the intent of ACB that volunteers are not authorized to be considered agents, employees, or authorized representatives of the ACB or any partner for any purpose, and that volunteers are not entitled to the same benefits received by employees of the ACB.

Volunteers must recognize the potential for injury to themselves and their real and personal property which may result from volunteer activities conducted with the ACB's volunteer monitoring program. The ACB and all ACB partners intend that volunteers expressly assume all risks and liability for any injuries to, or caused by, volunteers under this program.

LIABILITY RELEASE

In consideration of the foregoing, I, for myself, my heirs, and executors, do hereby release and discharge all Alliance for the Chesapeake and supporting organizations for all claims, damages, demands, actions and whatever in any manner arising or growing out of my participation in said monitoring program.

Signed:____
Date:_____________________

First and last name : ____
Phone:__________________________

Address: ____
____

Data entry and management

As a CMC monitor you are required to electronically enter the biological data that you collect to the CMC database. If you do not have access to a computer or the Internet and are unable to submit your data electronically, you may mail your data sheets to your monitoring coordinator for them to submit on your behalf.

Your monitoring coordinator needs to double check the data entered for any errors. We are all human and we make mistakes, so a strong part of the CMC is that we have incorporated a system of checks to make sure that the data made available on the CMC database is of the highest possible quality. By mailing your data sheets to your monitoring coordinator the CMC is able to check for data entry and potential equipment errors, as well as archive the sheets in a secure location.

Follow these steps to make sure your data are entered and checked so that you can share your data with the larger Chesapeake community:

1. Collect your biological data and record it on your field data sheet. Be sure to fill out your field sheet in its entirety.
2. Enter your data to the CMC database (available Fall 2017).
3. Upload a scanned .jpg or .pdf of your field sheet.
4. Review your entered data to make sure it matches your field data sheet.
5. Submit your electronic data.
6. Mail your field data sheet to your monitoring coordinator for review and quality control check. If you uploaded an image of your field sheet to the database you can bundle your field sheets and mail them to your monitoring coordinator each quarter. If you didn't upload your data sheet, mail it in as soon as you can so your data can be checked out by your monitoring coordinator.

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Dickinson College/ALLARM
C/O CMC Coordinator
P.O. Box 1773
Carlisle, PA 17013

Izaak Walton League of America
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707 Conservation Lane
Gaithersburg, MD 20878

7. After your data has been quality checked it will be made available on the database to the larger Chesapeake community.
8. Explore your data!

GATHERING MATERIALS AND EQUIPMENT LIST

For Both Rocky and Muddy Bottom Streams:

- Tape measure
- Waders or close-toed shoes
- Wash bottle
- First aid kit
- Wet bucket (for carrying wet items)
- Aquatic thermometer
- Table (foldable)
- Table Cover – White cloth works best
- Sorting tray –White ice cube trays work best
- Sorting utensils – spoons, tweezers, paint brushes, spray bottle
- Magnification – hand lens, microscope, etc.
- Preservation materials – camera, glass vials, ethanol
- Pencils (2)
- Pencil sharpener
- Calculator
- Neoprene Gloves

For Rocky Bottom Streams:

- Net (3×3 foot Kick-seine with 1/16 inch mesh)
- Net poles (2) (Wood dowels; 1" x 48")

For Muddy Bottom Streams:

- D net (1 ft)

Materials:

- SOS Identification Key and Data Sheets
- Unknown Specimen Form
- Clip Board
- Reference book (i.e. Voshell: A guide to Freshwater Invertebrates of North America, Guide to Aquatic Insects and Crustaceans) or quick reference field guide (i.e. IWLA's Bug App)
- Landowner permission forms if applicable
- State specific Collection License (requirements differ per state)

CHECKING YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

Once you have collected all of your equipment, check to make sure all of the materials are clean and in good condition. If you would like to purchase these items, you can get more information about cost and where to purchase at the following link:

http://www.vasos.org/monitors-page/equipment-list/.

ROCKY BOTTOM METHOD

Benthic Macroinvertebrate Sampling

1. Choose a site (riffle) that is accessible (public property or with landowner permission) and that has the stream water bubbling over cobblestone sized rocks (3”-10” at the widest part of the particle). We strongly encourage monitors to avoid the mixing zone of permitted wastewater discharges.

2. Use a VA SOS seine net. This mesh size is important for quality assurance purposes.

3. Approach the riffle from downstream and position the net just below a spot with maximum bubbling action and a predominant number of cobbles. (approx. 45 degree angle) The net should be spread as widely as possible and set to allow a direct flow of water into the center of the net.

4. The sampling area is 1 square foot in front of the net. The net is 3 square feet, so you can use the size of the net to approximate your 1 square foot area. The monitor that will do the rubbing should take some cobbles from OUTSIDE the area to be sampled and rub them underwater (and outside of the “net zone”) before gently laying them on the bottom of the net to anchor the net to the stream bottom.

ROCKY BOTTOM METHOD

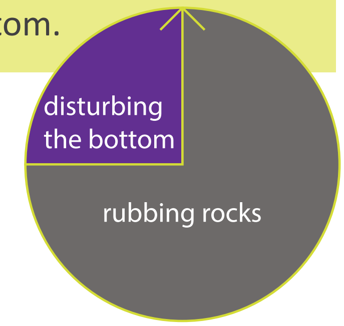
5. The person holding the net will then time the other monitor to allow the rubbing of rocks for twenty seconds immediately upstream of the net. The final five seconds will be announced and for that time the "rubber" will scratch the stream bottom with their fingers, a garden cultivator type tool, or agitate the stream bottom with thier boots to collect any organism that live in the substrate.

6. Rub the "anchor" stones to remove any critters that may have attached themselves and with a forward and scooping motion remove the net from the stream. Examine the net for any organisms that are not macroinvertebrates (minnows or salamanders) and return them to the stream.

7. Take the net to the streamside and place it on a sheet that will allow for identification of any organisms that may pass through the mesh. Use ice cube trays and dishes to pick ALL organisms. Examine both sides of the net and the sheet beneath to obtain a rigorous count of all aquatic macroinvertebrates that were caught.

NOTE

20 seconds is ideal for the first time monitoring a new station, as you may end up with a lot of bugs to sort through. If you know the site and know that it does not yield many bugs in 20 seconds, you can increase the collection time up to 90 seconds. Always spend ¾ of the sampling time rubbing rocks and ¼ disturbing the bottom.



8. Repeat this procedure until a composite of all nets yields a total of organisms in excess of 200. Remember to thoroughly pick each net and add the total to the previous total.

9. See the section on "Macroinvertebrate Identification" to divide the macroinvertebrates into groups of organisms and calculate ecological condition of the stream.

NOTE

The time devoted to rubbing can be modified according to the judgment of the monitors but cannot exceed 90 seconds per "dip". Also, no more than 4 "dips" can be made in pursuit of exceeding 200 organisms. If the monitors fail to find 200 organisms in 4 "dips" the calculation shall be made with the total that is obtained. Special note of this fact should be made in reporting the data.

MUDDY BOTTOM METHOD

Choosing where to sample within the stream

Volunteers identify habitat areas within the stream. The habitat areas are: woody snags, banks, submerged aquatic vegetation, and riffle areas (cobble-stone sized rocks). These habitat areas will be sampled in proportion to their abundance in the stream segment sampled.

woody snags

banks

submerged aquatic vegetation

riffle areas

Benthic Macroinvertebrate Sampling

A single sample of macroinvertebrates consists of collecting 20 jabs in productive habitats. A single sample is what is recorded on the data sheets.

A single jab consists of aggressively thrusting the net into the target habitat for a distance of approximately 1 meter; i.e. the distance the net can be swept while standing in one place. This initial "jab" is followed by 2-3 sweeps of the same area to collect the dislodged organisms.

MUDDY BOTTOM METHOD

The following techniques are recommended for sampling the four major productive habitats in coastal plain streams.

Woody snags – snags or submerged woody debris, are sampled by jabbing in medium sized snag material (sticks and branches). Large material (e.g., logs) may be sampling by scraping the net along the surface. Woody debris may be picked up, held in the net, and rubbed by hand.

Banks – stream banks with roots and snag material are sampled similar to snags. Vegetated banks are preferred over unvegetated banks. If the bank is undercut, be sure to jab back under the bank, drawing the net from the stream bottom to the top of the undercut bank.

Submerged aquatic vegetation – submerged macrophytes are sampled in deep water by drawing the net through the vegetation from the bottom to the surface of the water. Macrophytes in shallow water are sampled by bumping the net along the bottom in the macrophyte bed.

Riffle areas – riffles should be sampled by placing the net firmly along the bottom of the stream and using your hand or foot to “rub” around the cobbles in the riffle.

The sample is transferred to the sieve bucket (or other seining device) by banging the net over the bucket opening or by inverting the net into a partially submerged bucket. Contents of the net are transferred into the sieve bucket after each jab.

Processing the Sample

1. Thoroughly mix the sample in the sieve bucket by swishing it around in shallow water. Be sure to keep the entire sample in the bucket!
2. Empty the contents of your sieve bucket onto a flat, light colored surface, such as a white sheet, or table. This makes the organisms easier to see. Spread the sample across a square portion of your surface (as large an area as needed so that the material is not clumped into piles). Using a stick as a guide, divide your sample into 4 grids to make 4 squares of the same size. Randomly select one of these squares to start your picking and identification. You may want to decide which square you will use before you start sampling, to avoid bias.
3. Using tweezers or your fingers to gently pick all the macroinvertebrates from selected grid and place them in your collecting container. Any moving creature is considered a part of the sample. Look closely for very small organisms and take your time. It is important to thoroughly pick all the organisms from the grid.

NOTE

Carefully look on both sides of any debris in the grid, as many insects will cling to any available litter. You may want to use a squirt bottle filled with water from the stream to wash away some of the mud that might hide organisms.

Processing the Sample Continued...

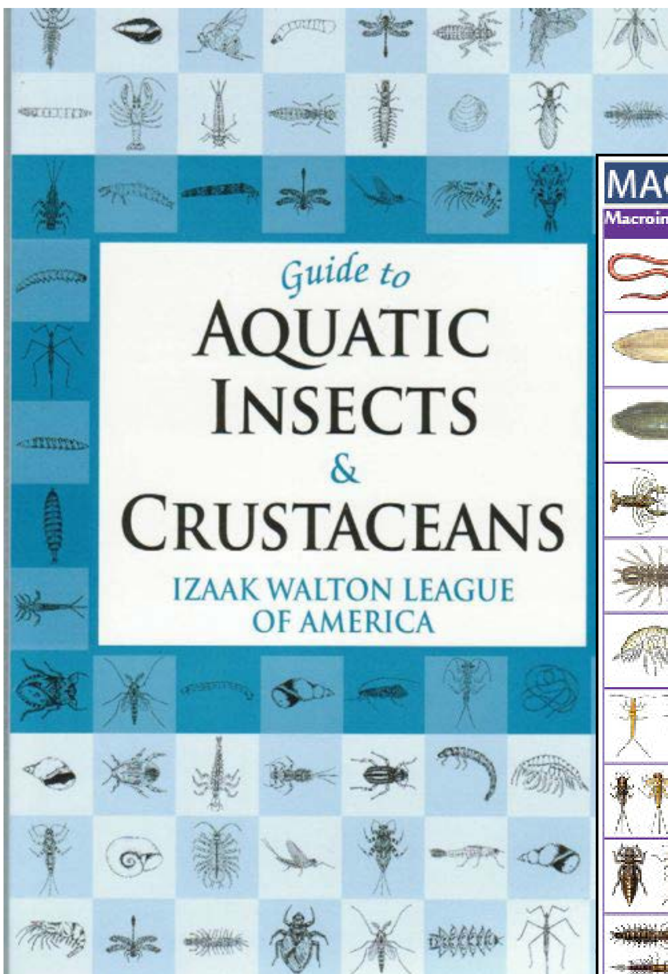
4. As you are picking the grid, separate the organisms into look-alike groups. Use primarily body shape and number of legs and tails, since the same family or order can vary considerably in size and color. Use the tally sheet and macroinvertebrate key to aid in the identification process.
5. Record the number of individuals you find in each taxonomic group on the tally sheet. Our tally sheet and metric calculations should be based on a sample size of at least 100 organisms. If you did not pick 100 organisms from the grid, you must select another grid to pick. The second grid must be picked in its entirety.
6. Record the number of individuals in each taxonomic group on the tally sheet for the second grid. If you do not have 100 organisms after you have picked the second grid, continue onto the 3rd and pick that grid in its entirety. Continue picking grids in their entirety until you have at least 100 organisms OR you have picked the entire sample.

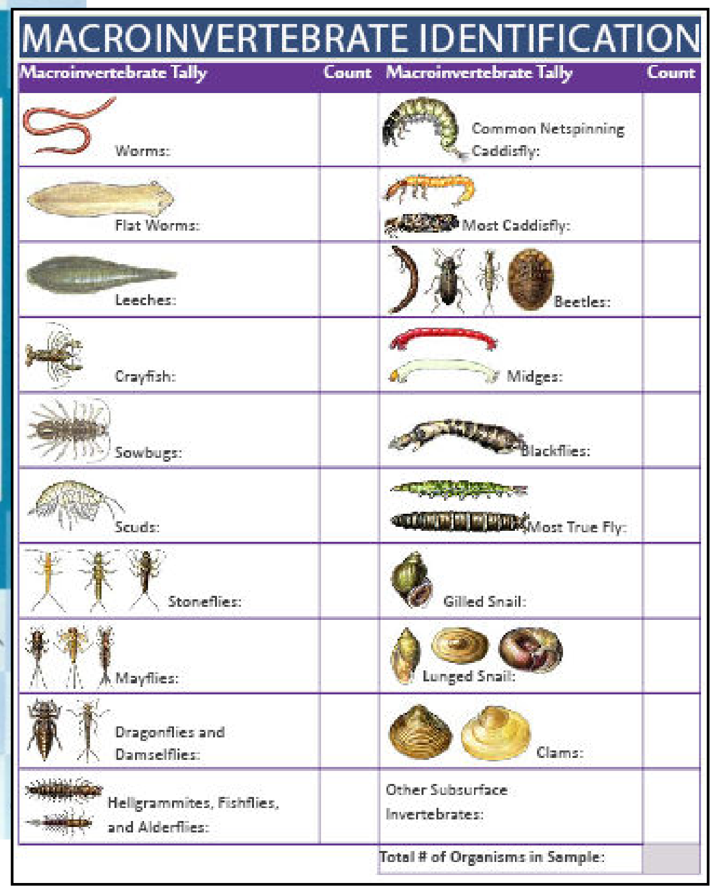
NOTE

Count the Suds found in your sample, but do not count them towards the 100 organisms required! In other words you need at least 100 non-scud organisms for your sample.

MACROINVERTEBRATE IDENTIFICATION

Use the sorting supplies to divide the macroinvertebrates into groups of organisms – each group should have similar characteristics and appearance. Use a hand lens (if needed), the VA SOS Identification and Data Sheet, and any other resources to identify the organisms to the Order level. Tally the number of organisms in each Order on the Data Sheet.





MACROINVERTEBRATE IDENTIFICATION

Macroinvertebrate Tally	Count	Macroinvertebrate Tally	Count
Worms:		Common Netspinning Caddisfly:	
Flat Worms:		Most Caddisfly:	
Leeches:		Beetles:	
Crayfish:		Midges:	
Sowbugs:		Blackflies:	
Scuds:		Most True Fly:	
Stoneflies:		Gilled Snail:	
Mayflies:		Lunged Snail:	
Dragonflies and Damselflies:		Clams:	
Hellgrammites, Fishflies, and Alderflies:		Other Subsurface Invertebrates:	
		Total # of Organisms in Sample:	

AT THE STREAM

Virginia Save Our Streams Data Sheets

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can document changes in ecological condition. Please note, this method was designed and tested for conditions in the state of Virginia and may not be appropriate in other areas.

Date: ______________________ Number of participants: ______________

Stream: ______________________ Station: ______________________

Group or individual: ______________________________________

Name of certified monitor: ______________________________________

County: ______________________ Latitude: __________ Longitude: __________

Location (please be specific): ______________________________________

Average stream width: ______________ Average stream depth: ______________

Flow rate: ☐ High ☐ Normal ☐ Low ☐ Negligible

Weather last 72 hours: ______________________________________

Water Temperature: ______________ ºF (Please specify if reporting in Celsius)

Collection Time:

Net 1: __________ sec

Net 2: __________ sec

Net 3 __________ sec

Net 4: __________ sec

Other Comments: ______________________________________

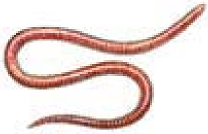
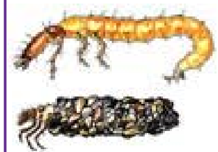
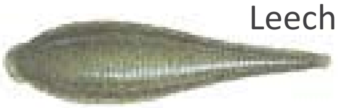
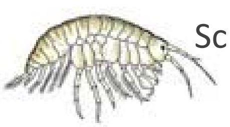
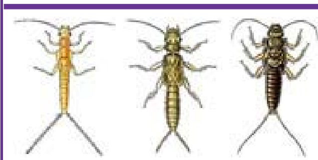
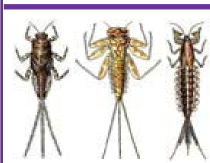
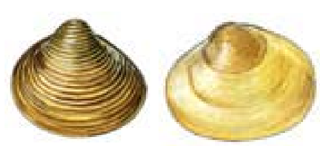
____

____

____

____

MACROINVERTEBRATE IDENTIFICATION

Macroinvertebrate Tally	Count	Macroinvertebrate Tally	Count
 Worms:		 Common Netspinning Caddisfly:	
 Flat Worms:		 Most Caddisfly:	
 Leeches:		 Beetles:	
 Crayfish:		 Midges:	
 Sowbugs:		 Blackflies:	
 Scuds:		 Most True Fly:	
 Stoneflies:		 Gilled Snail:	
 Mayflies:		 Lunged Snail:	
 Dragonflies and Damselflies:		 Clams:	
 Hellgrammites, Fishflies, and Alderflies:		Other Subsurface Invertebrates:	
		Total # of Organisms in Sample:	

MACROINVERTEBRATE IDENTIFICATION

Handeling Unknown Specimen

If you find that you or anyone else in your group cannot identify an organism, you will need to:

1. Photograph and/or preserve the organism with ethanol in a glass vial
2. Fill out the Unknown Specimen Form (page 27)
3. Send the information to Izaak Walton League staff or certified taxonomist for identification

Photos and forms can be e-mailed to your regional coordinator or to:
vasos@iwla.org

If you have any questions, you can call Lea Rubin at (301) 548-0150.

Specimens and forms can be mailed to:
VA SOS, Izaak Watlon League of America
707 Conservation Lane
Gaithersburg, MD 20878

REMEMBER

To increase the chance of survival, return the macroinvertebrates to the stream as soon as possible after identification.

Return the macroinvertebrates to the stream and rinse all of your supplies to be sure all organisms are returned. You are now ready to begin calculating the stream water quality using the VA SOS Multimetric Index.

Unknown Sample Submittal Form - Virginia Save Our Streams

Date: ______________________________ Name and Address of submitting volunteers:

Sample Information:

Stream: ______________________________ Station: ______________________________

County: ______________________________ Latitude: __________ Longitude: __________

Location (please be specific): ____

____

Do you have any thoughts about what this organism might be? ____________________

____

Please fill out completely, preserve your specimen - don't forget your label, and send your unknown and this form to VA SOS program mailing address (on previous page).

For office use:

Identification of organism: ____

Who identified it: ____

Please fill out in pencil and include in your unknown preservation jar or vial:

Date: __________________ Name of submitter: ______________________________

Stream: ______________________________ Station: ______________________________

County: ______________________________ Latitude: __________ Longitude: __________

Location (please be specific): ____

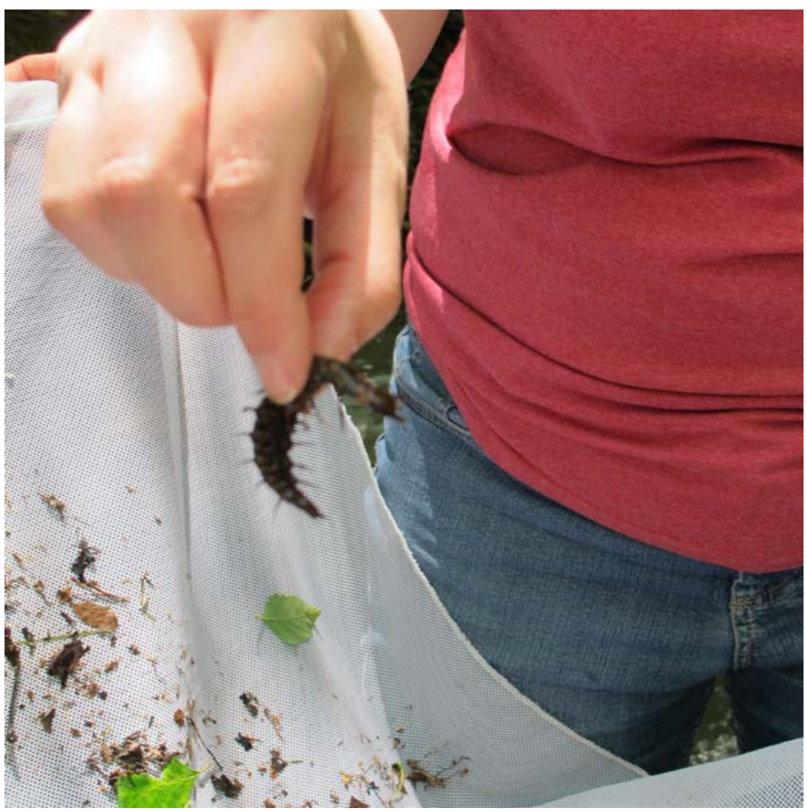
MULTIMETRIC INDEX

What is the Multimetric Index?

The data sheet divides the organisms by their Order. Six individual metrics are calculated based on tolerance levels of organism groupings. Then, the individual scores are combined to calculate the multimetric index score to determine whether the site has acceptable or unacceptable ecological condition.

IMPORTANT!

If after 4 nettings there are 0 macroinvertebrates, the multimetric score for the sample will be 0. If this occurs, please contact VA SOS or VA DEQ immediately.



MULTIMETRIC INDEX

Metrics 1 - 4 - % Presence

Metric Number	Metric Organism Group	# of Metric Organisms		Total # of Organisms in the sample		Percent (This is your value for the metric)
1	Mayflies + Stoneflies + Most Caddisflies		/		X 100	%
2	Common Netspinners		/		X 100	%
3	Lunged Snails		/		X 100	%
4	Beetles		/		X 100	%

Metric 5 - % Tolerant

Taxon	Number
Worms	
Flatworms	
Leeches	
Sowbugs	
Scuds	
Dragonflies and Damselflies	
Midges	
Black Flies	
Lunged Snails	
Clams	
Total Tolerant	
Total # of Organisms in Sample	
Total Tolerant/Total # of Organisms	
X 100 (This is your value for Metric 5)	

Metric 6 - % Non-Insects

Taxon	Number
Worms	
Flatworms	
Leeches	
Crayfish	
Sowbugs	
Scuds	
Gilled Snails	
Lunged Snails	
Clams	
Total Non-Insect	
Total # of Organisms in Sample	
Total Non-Insects/Total # of Organisms	
X 100 (This is your value for Metric 6)	

Multimetric Index Calculation

Write your metric value from the previous pages in the 3rd column (Your Metric Value). Determine whether each metric should get a score of 2,1, or 0 – depending upon the range of your metric value. Put a check in the appropriate box for your metric value under 2,1, or 0. Count the total number of 2's, 1's, and 0's. Follow the multiplication at the bottom of the chart to determine your Save Our Streams Multimetric Index score and determine whether the site has acceptable or unacceptable ecological condition.

Metric Number	Metric Organism	Your Metric Value	2	1	0
1	% Mayflies + Stoneflies + Most Caddisflies		Greater than 32.2	16.1 - 32.2	Less than 16.1
2	% Common Netspinners		Less than 19.7	19.7 - 34.5	Greater than 34.5
3	% Lunged Snails		Less than 0.3	0.3 - 1.5	Greater than 1.5
4	% Beetles		Greater than 6.4	3.2 - 6.4	Less than 3.2
5	% Tolerant		Less than 46.7	46.7 - 61.5	Greater than 61.5
6	% Non-Insects		Less than 5.4	5.4 - 20.8	Greater than 20.8
			Total # of 2s:	Total # of 1s:	Total # of 0s:
		Subtotals:	Multiply by 2:	Multiply by 1:	Multiply by 0:

Now add the 3 subtotals to get the Virginia Save Our Streams Multimetric Index Score: ____________

If you scored 9 - 12, you have ACCEPTABLE ecological condition
If you scored 8, ecological condition cannot be determined at this time
If you scored 0 - 7, you have UNACCEPTABLE ecological condition

Equipment Cleaning and Storage

1. Clean waders or boots with a dilution of ethanol alcohol. It is easiest to keep the dilluted ethanol in a spray bottle for easy use when you are finished at a monitoring site. This will keep you from spreading any invasive species from one stream to another.
2. Rinse and dry off all equipment.
3. Store equipment in a cool dry place.