



VOLUNTEER WATER QUALITY MONITOR MANUAL

CHESAPEAKE MONITORING COOPERATIVE

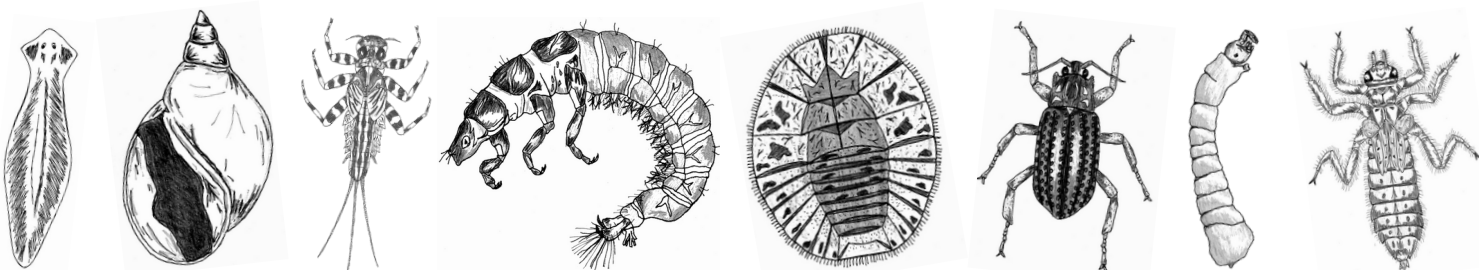
ChesapeakeMonitoringCoop.org

IZAAK WALTON LEAGUE OF AMERICA

IWLA.org/water

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Who We Are



[The Izaak Walton League](#) is one of America's oldest and most successful conservation organizations. The Izaak Walton League has been at the forefront of every major clean water battle in the United States, from a decades-long push for federal water pollution control in the 1940s to efforts today to restore Clean Water Act protections for critical streams and wetlands. League leaders helped conceive the Wild and Scenic Rivers Act of 1968 and broke the political ground necessary for passage of the landmark 1972 Clean Water Act. Community members around the country use our pioneering Save Our Streams program to monitor local waterways, plan restoration projects, and report water quality problems. Today, our clean water priorities include engaging youth in the outdoors, cleaning up nonpoint source pollution, and halting the spread of invasive species.



The Izaak Walton League's [Save Our Streams program](#) is the only nationwide program training volunteers to protect waterways from pollution and bring information about water quality to their communities. The program began in 1969 when water pollution problems were easy to see – like massive oil spills and burning rivers. Early Save Our Streams volunteers cleaned up trash from their local waterways and reported problems like streams becoming clogged with silt. In the 1980s, the League recognized that with the right training, volunteers could collect scientifically valid data to assess water quality in local streams – a conviction that has proven true. Ever since, the League has been teaching volunteers to study stream health and report their findings to decision-makers. Today, trained volunteer stream monitors across the country are uncovering pollution problems and urging their local leaders to take action on water quality. The work of these volunteers also creates a critical record of water quality over time, making it possible to quickly identify pollution problems that develop in the future.

Chesapeake Monitoring Cooperative (CMC)

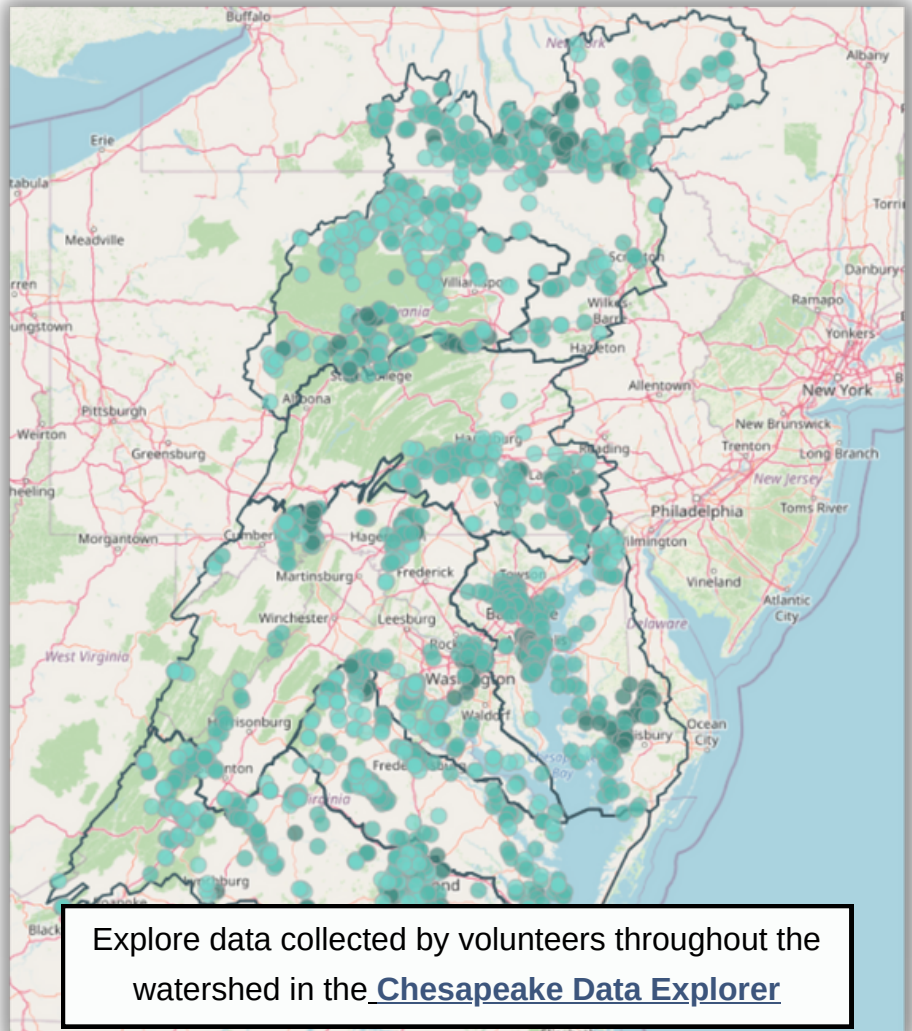
The **CMC** connects water quality monitoring initiatives across the region in order to amplify voices and enhance our understanding of the Chesapeake Bay Watershed. To accomplish this, we provide technical, programmatic, and outreach support in order to integrate volunteer-based water quality and macroinvertebrate monitoring data into a centralized data hub, the Chesapeake Data Explorer. These data are publicly available and used by the Chesapeake Bay Program to assess the health of the Chesapeake Bay and watershed. Through the CMC, SOS data collected within the Chesapeake Bay watershed will also be sent to the Chesapeake Bay Program.



Chesapeake Bay Program
Science. Restoration. Partnership.

CMC
Chesapeake Monitoring Cooperative

CMC Partners



SOS Program Overview

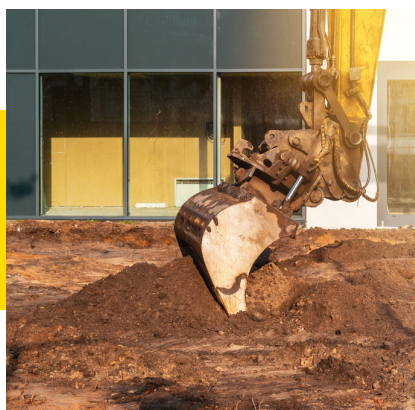
What pollutes the Chesapeake Bay Watershed?

Trash, oil spills, runoff – we know there are many different toxins that can pollute our water. But where does this pollution come from, and how can we stop it? Pollution enters our freshwater from either point or nonpoint-sources. Point source pollution has a clear cause you can point to, like a broken pipe. Nonpoint source pollution is harder to identify, and doesn't have a clear single source. Nonpoint source pollution is the most prevalent threat to water quality today.



Point Sources versus Nonpoint Sources from Indiana County Conservation District

How does nonpoint source pollution get into our water? Every time it rains or snows, natural and man-made pollutants on the land are washed into streams and wetlands. These pollutants include pesticides, fertilizers, metals, plastics, manure, road salt and motor oil from farms, lawns, roads, and landfills. Eroded soil from construction zones, logging operations, and land disturbances clogs streams, and bacteria from septic tanks and animal waste runoff can make wildlife and humans sick.



Volunteer Water Quality Monitoring

Every state in the US is required under the federal Clean Water Act to report on water quality to Congress in a 305(b) report. If a state reports that a waterway is impaired or polluted, the federal government can provide funding and other resources to help restore and protect it.

Unfortunately, less than 30% of waterways in the US are monitored professionally, leaving a huge gap in knowledge of our water quality status. This is where volunteer water quality monitors come in. Because they regularly visit and monitor the same sites year after year, SOS volunteers are often the first ones to discover and report at-risk streams and creeks – ensuring that their site becomes a state priority.

Americans have the right to know whether or not streams are safe for swimming, fishing, playing, and drinking. Save Our Streams monitors help achieve that goal by collecting water quality data in streams throughout the watershed and educating the public about importance of clean water.



Benthic Macroinvertebrate Monitoring

Hundreds of SOS volunteers collect stream quality data from over 300 stream sites across the watershed. Monitors collect, identify, and sort benthic macroinvertebrates from the stream. By identifying which macroinvertebrates live in a local stream stream, volunteers can calculate a stream health score.

Aquatic Benthic Macroinvertebrates

The macroinvertebrates we collect in the SOS program are animals that are:

- **AQUATIC** - live in water
- **BENTHIC** - are bottom dwelling
- **MACRO** - are large enough to see without magnification
- **INVERTEBRATES** - do not have a backbone, such as crustaceans, insect larvae, and worms



Macroinvertebrates 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
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 – some are tolerant to poor conditions and others are highly sensitive. 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.

**By collecting, counting, and identifying macroinvertebrates
we can calculate a stream health score.**

Quality Assurance Project Plan (QAPP)

SOS has QAPP's with the Virginia Department of Environmental Quality and the Chesapeake Bay Program that establishes the quality of our methods and data. By certifying in and following SOS protocols, the data you collect is considered reliable and useful to these agencies. The SOS program utilizes two different benthic macroinvertebrate collection protocols depending on stream type:

- **Rocky Bottom**
- **Muddy Bottom**



Data Use



Chesapeake Bay Program
Science. Restoration. Partnership.

Data collected by certified Save Our Streams monitors are accepted at the Tier 1 level by the Chesapeake Bay Program. This means that they will use your findings to:

- Conduct an environmental health screening
- Target management actions needed throughout the watershed
- Establish a baseline stream health assessment
- Educate the public on the water quality impacts of land use activities



SOS Certification

By successfully completing all requirements of the Save Our Streams Quality Assurance and Quality Control Program, we are able to ensure that the data you collect are reliable and meet the standards of the Izaak Walton League of America, the Virginia Department of Environmental Quality, and the Chesapeake Bay Program.



- 1 Complete Macroinvertebrate and Water Quality Training
- 2 Attend a Field Protocol Training
- 3 Pass Protocol Exams
- 4 Receive Certificate and Start Monitoring!

Maintaining SOS Monitor Certification

Monitors must submit data at least **once every 2 years** in order to maintain active certification. To ensure monitors get credit for monitoring, be sure to list all certified monitors on your data submissions. If your certification lapses, you will need to recertify.

Volunteer Pledge

As a Save Our Streams monitor, I pledge to:

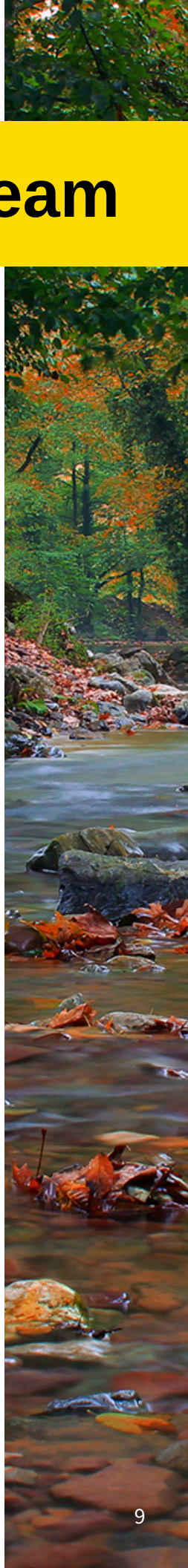
- Collect and submit stream health data so that it may be shared with my community, government officials and agencies, and stakeholders.
- Monitor consistently to establish a reliable timeline of my stream's health.
- Follow sampling and identification protocol to produce the highest quality data possible.
- Ensure the safety of myself and my team whenever sampling in the field.
- Respect landowners and always ask for permission before accessing private land for monitoring.
- Respect sampling sites by minimizing physical impact on wildlife habitat.
- Carry a copy of a state permit for monitoring during every monitoring event.
- Behave respectfully and cordially whenever interacting with the public.
- Represent Save Our Streams and the Izaak Walton League of America in a professional manner, and...

Serve as a voice for my local streams and waterways.



10 Reasons to Monitor a Stream

- 1** To help the state assess the health of the many miles of streams in the Chesapeake Bay Watershed.
- 2** To establish baseline stream health data. This is helpful when discussing whether land-use changes have impacted your streams.
- 3** To evaluate impacts of up-stream land use practices on your stream.
- 4** To keep track of changes in your stream – seasonally and over a period of time.
- 5** To assist local agencies in determining the effectiveness of Best Management Practices (BMPs) and where more BMPs are needed.
- 6** To observe and record changes at your site - erosion, loss of trees, increased litter, etc.
- 7** To identify and report significant pollution events like oil or sewage spills - you are the eyes and ears of your site!
- 8** To build community pride or community concern for a local streams' condition.
- 9** To raise awareness about potential health and safety concerns in streams where children and pets may play.
- 10** To connect your friends, family, or community members to their local natural spaces.



Monitoring Car Sign

Place this sign on your car dashboard or window to let curious people passing by know that you are parked there in order to conduct stream monitoring.



Stream Water Quality Monitoring in Progress



Certified volunteer monitors are sampling the health of this local waterway. Please contact the Save Our Streams coordinator with any questions or concerns: sos@iwla.org

What's Save Our Streams? Find out at **SOS.org**

Monitoring Equipment

You can find a [list of recommended equipment on our website](#) with suggested links to purchase.

For Both Rocky and Muddy Bottom Streams

- Tape measure
- Non-felt bottomed waders or close-toed shoes
- First aid kit
- Aquatic thermometer
- Folding Table
- Table Cloth – White plastic works best
- Sorting tray – White ice cube trays work best
- Sorting utensils – spoons, tweezers, pipettes, spray bottle
- Magnification – hand lens, microscope, etc.
- Neoprene Gloves
- SOS Identification Key and datasheets
- Pencils/pens
- Clip Board
- Identification materials
 - Voshell: A guide to Common Freshwater Invertebrates of North America
 - IWLA: Guide to Aquatic Insects and Crustaceans
 - Creek Critters App
- Scientific Collection Permit
- Unknown Specimen Form
- Landowner permission forms if applicable



For Rocky Streams

- 3x3 Kick Net (1/32 or 500 micron mesh)
- 2 Net poles (Wood dowels; 1.25" x 48")

For Muddy Streams

- D-net
- Sieve bucket



Check Your Equipment Before Going Out in the Field

Before each monitoring session, check to make sure all of the materials are clean and in good condition.

Help Stop Aquatic Hitchhikers!

Stopping the spread of invasive species and bacteria is critical to protecting our stream habitats. It is important to clean and disinfect your boots and equipment before moving from one stream site to another. You can do any of the following to prep your equipment between sites:

- Wash with biodegradable soap or 10% bleach solution
- Leave in full sun for several days
- Let equipment dry completely before sampling another site

****Please note that felt bottomed waders/boots are banned in Maryland, as they can easily carry invasive species from site to site.***

Storing Equipment

Once equipment is fully dry, store in a cool dry space. If possible, store waders laying flat or hanging to avoid weakening the material.



Establishing a New Site

Permission

When finding a new site to monitor, ensure that you have all of the needed permissions to use that property. If it is county/city/state/federal land be sure to have the proper additional permits. If it is private property, be sure to have written permission from the landowner (permission and liability release form on page 15).

Site Requirements

Monitoring sites should meet the following requirements for use in the SOS program:

- At least 1/4 mile from another site
- Easy and safe access into the stream site
- Has the necessary habitat to sample within a 100 meter span

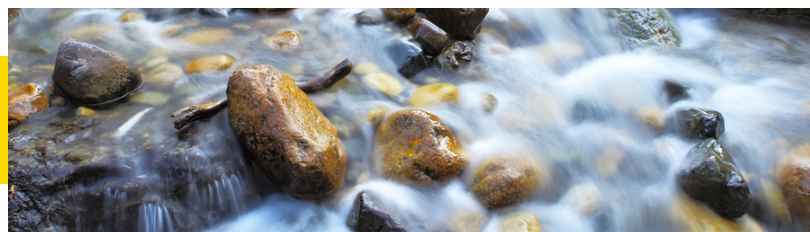


Rocky Habitat - 4 riffles within 100 meters

- A riffle: a shallow, fast-moving area of water with a depth of 3 to 12 inches and cobble-sized stones (2 to 10 inches) or larger

Muddy Habitats - at least one of the below within 100 meters

- Woody snags: areas where tree trunks or limbs have fallen into the stream.
- Stream banks: the edge of the stream - may be vegetated, bare soil, undercut, or eroded.
- Riffles: shallow, fast-moving areas of water flowing over cobble-sized stones and rocks.
- Submerged aquatic vegetation: any plant growing under or out of the water of the stream.



Naming Your Site

Once you have secured a new monitoring site, you will need to assign it a Site ID. This ID should be unique to your site and offer some descriptions to where it is. For example, avoid Site ID's like "1" and instead use something like "Muddy Branch 1" or "Muddy Branch Bridge Site".

Recording Your Site

- Once you have named your site, you will need to create your site in the [Clean Water Hub](#) (further instructions on page 26).
- If your stream or creek is unnamed, record the stream name as "Unnamed Tributary to (insert body of water the stream empties into)".

NOTE: Enter your latitude and longitude coordinates in decimal format.

For example, IWLA headquarters lat/long in decimal format is:
39.121004, -77.220614

**Do not use minutes/seconds format:
39° 7' 15.6138" N, -77° 13' 14.2098" W**



MAPS MY SITES ABOUT  HELP



Search Sites

[MY ORGANIZATIONS](#)

[MY SITES](#) [CREATE A NEW SITE](#) [SEARCH](#)

Property Owner Permission and Liability Release Agreement

_____ (organization/monitor) is participating in the Save Our Streams 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 biological samples to assess stream health conditions on a biannual basis at consistent specific sites. This monitoring will last approximately 1-4 hours 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/monitor), its volunteers, and necessary project partners, to enter my property for the sole purpose of site-access and water monitoring that takes place on or near my property to accomplish regular baseline data collection.

Address: _____

Monitoring Dates: (or until program completion) _____

I agree that my permission is granted on a voluntary basis, can be revoked at any time, 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: _____

Stream Monitor _____ Date: _____

When to Sample

Frequency: Your site should be monitored 2 times a year: spring and fall. You may also choose to monitor your site at other times during the year to measure impacts of a significant event in your watershed, or to host a community outreach event. It is very important you do not monitor your site too often – we don't want to impact the macroinvertebrate community in your stream. Your state may also have specific recommended monitoring windows.

Conditions: Volunteers are not to conduct their normal sampling within one week of heavy rainfall if possible (approximately more than 1 inch of rainfall in rural areas or ½ inch of rainfall in urban areas). Rather, monitors should sample the stream during its average conditions for that season.



Do not monitor:

- Alone
- During thunderstorms or heavy rain
- If banks are too steep or slippery
- During posted health warnings
- If a sewage or oil spill is apparent

It is recommended that all monitors display at least 100 square inches of solid blaze orange material at shoulder level within body reach and visible from 360 degrees, especially during hunting season.

Scientific Collection Permit

Maryland Department of Natural Resources



A MD DNR permit covers scientific research or educational projects, collections of display animals, ecological monitoring or in-stream surveys, but may not be used to collect animals for sale or personal use. Permits are issued annually, for a \$10 fee payable by check or money order, or electronically through our online payment system. A summary report of activities is required annually in addition to any other information required under the permit.

Virginia Department of Wildlife Resources

The Izaak Walton League of America holds a DWR Scientific Collection permit that covers all certified monitors in Virginia. Visit VASOS.org for the Virginia SOS Manual and for more information about monitoring in VA.

West Virginia, Delaware, DC, Pennsylvania, and New York

Please check with your state agencies to ensure that you have the proper permits to conduct benthic macroinvertebrate stream sampling.

**Monitors should have their scientific collection permit
with them at every sampling event.**



SOS Datasheets



Biological Monitoring Data Form for Rocky Bottom Method

Name of Stream: _____ Station ID: _____

Name of Certified Monitor(s): _____

Group/Organization: _____ Number of Participants: _____

Latitude: _____ Longitude: _____

County/State: _____

Survey Date: _____ Start Time: _____ End Time: _____

Description of Site Location: _____

Record stream site information here. Be sure to list ALL certified monitors present at each collection.

Record Net Times for Rocky Bottom Protocol

ROCKY BOTTOM SAMPLING

Using a kick-siene net, take up to four samples in the riffle area of 20 to 90 seconds each (75% of the time rubbing rocks, 25% of the time disturbing the streambed). Adjust the length of the sampling period to ensure you collect at least 200 macroinvertebrates. Write the length of each sampling period in seconds and place a check mark next to the net mesh size used (Note: If sample does not reach 200 organisms, three nets must be 90 seconds for approval).

_____ Net 1 _____ Net 2 _____ Net 3 _____ Net 4 Net Mesh Size: 1/32" 1/50"

Record Habitat Jabs for Muddy Bottom Protocol

MUDDY BOTTOM SAMPLING

Record the number of jabs taken from each habitat type (20 jabs total). Total jabs taken from a particular habitat type should be proportionate to the overall percentage of the habitat type in the sample area.

Banks _____ Woody Snags _____

Riffles (Cobble Areas) _____ Submerged Aquatic Vegetation _____

PHYSICAL CONDITIONS (check all that apply)

Today: Sunny Overcast Intermittent Rain Steady Rain Heavy Rain Snow

Yesterday: Sunny Overcast Intermittent Rain Steady Rain Heavy Rain Snow

Day Before Yesterday: Sunny Overcast Intermittent Rain Steady Rain Heavy Rain Snow

Water Temperature: _____ C° Avg. Stream Width _____ ft.



















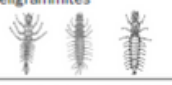
Flow Rate: _____ (high, normal, low) Avg. Stream Depth _____ in.

OTHER COMMENTS

Recent weather and additional comments provide extra context for your results!

Tallying Your Sample

Tally and count all of your macroinvertebrates on your VA SOS datasheet.

Macroinvertebrate	Tally	Count	Macroinvertebrate	Tally	Count
Worms 			Common Netspinning Caddisflies 		
Flat Worms 			Most Caddisflies (not Common Netspinning) 		
Leeches 			Beetles 		
Crayfish 			Midges 		
Sowbugs 			Black Flies 		
Scuds 			True Flies 		
Stoneflies 			Gilled Snails 		
Mayflies 			Lunged Snails 		
Dragonflies and Damselflies 			Clams 		
Alderflies, Fishflies, and Hellgrammites 			Other benthic macroinvertebrates		
			Total number of organisms in the sample (include "other" category)		
















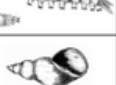





BIOLOGICAL MONITORING DATA FORM FOR ROCKY BOTTOM STREAMS

Other Benthic Macroinvertebrates

In both the Rocky and Muddy Bottom protocols, there is a section called “Other Benthic Macroinvertebrates.” This is where you can tally benthic macroinvertebrates that are not part of the SOS count, like aquatic caterpillars. You can also use this section to tally macros that you cannot identify in the field. Take detailed notes and photos to assist you later. Be sure to identify all unknown macros and adjust your tallies before submitting your data (refer to page 25 for instructions on unknown specimens). **You will include the number of "Other Benthic Macroinvertebrates" in the “Total Number of Organisms”.**

You may find organisms in your net that should not be tallied in the VA SOS protocol. Organisms like water striders, whirligig beetles, water boatmen, and predaceous diving beetles are surface breathers and do not provide any indication of water quality with the VA SOS protocol. If a critter wants to stay above water and moves across the water’s surface, do not count it. Mosquitos also breathe from the surface in both their larvae and adult stages, and should not be counted.

MUDDY BOTTOM MACROINVERTEBRATE COUNT

Macroinvertebrate	Tally	Count	Macroinvertebrate	Tally	Count
Worms 			Alderflies, Fishflies, and Hellgrammites 		
Flat Worms 			Common Netspinning Caddisflies 		
Leeches 			Most Caddisflies (not Netspinning) 		
Crayfish 			Beetles 		
Sowbugs 			Midges 		
Scuds 			Black Flies 		
Shrimp (Freshwater) 			True Bugs 		
Stoneflies 			Gilled Snails 		
Mayflies 			Lunged Snails 		
Dragonflies (not Gomphidae) and Damselflies 			Clams 		
Gomphidae (clubtail) Dragonfly 			Other benthic macroinvertebrates		
			Total number of organisms in the sample (include "other" category)		

2

NOTE:

- In the Muddy Bottom Protocol you will count True Bugs (i.e. backswimmers, water scorpions, etc.). These are more prevalent in muddy bottom streams and are not counted in the Rocky Bottom Protocol.
- In the Muddy Bottom Protocol you will count the Gomphidae "Clubtail" Dragonfly separately from the other dragonflies and damselflies due to their differing pollution tolerance. You can distinguish them by their paddle shaped antennae, as opposed to the thin antennae of other dragonflies.

Most dragonflies:
thin antennae



Gomphidae dragonflies:
paddle-shaped antennae



Photos by: Macroinvertebrates.org

Multimetric Index Calculation

In both the Rocky and Muddy Bottom protocols, you will calculate a stream health score using the Multimetric Index. To calculate, you will tally the total number of organisms in each metric listed on your datasheet. Divide the total number of organisms in each metric by the total number of organisms overall. Then, multiply by 100 to find the percent of each. This percentage is your Metric Value.

Once you have your Metric Values for each metric, you will go to the next page and determine if your percentage for that metric is worth 2, 1, or 0 "points." A high percentage of pollution sensitive macros or a low percentage of pollution tolerant macros are worth more "points" because they are indicators of good water quality. You will use the chart to check the boxes for each metric value and its coinciding "point" amount. Follow the multiplication steps at the bottom of the chart to determine the Save Our Streams Multimetric Index Score and determine whether the site has Acceptable, Grayzone, or Unacceptable ecological conditions.

INDIVIDUAL METRICS

	Organism Groups	Number of Organisms	Total Number of Organisms in the Sample	Percent <i>(This is your value for this metric)</i>
Metric 1	Mayflies + Stoneflies + Most Caddisflies (not Common Netspinning)		÷	Multiply by 100 %
Metric 2	Common Netspinning Caddisflies		÷	Multiply by 100 %
Metric 3	Lunged Snails		÷	Multiply by 100 %
Metric 4	Beetles		÷	Multiply by 100 %

Metric 5: Tolerant		Metric 6: Non-Insect	
Organism Groups	Number of Organisms	Organism Groups	Number of Organisms
Black Flies		Clams	
Clams		Crayfish	
Dragonflies and Damselflies		Flatworms	
Flatworms		Gilled Snails	
Leeches		Leeches	
Lunged Snails		Lunged Snails	
Midges		Scuds	
Scuds		Sowbugs	
Sowbugs		Worms	
Worms		--	--
Total Tolerant		Total Non-Insect	
÷		÷	
Total number of organisms in sample		Total number of organisms in sample	
Multiply by 100		Multiply by 100	
Percent <i>(This is your value for Metric 5)</i>	%	Percent <i>(This is your value for Metric 6)</i>	%

BIOLOGICAL MONITORING DATA FORM FOR ROCKY BOTTOM STREAMS 3

MULTIMETRIC INDEX (STREAM HEALTH SCORE)

	Metric Organism	Your Metric Value	2	1	0
Metric 1	Mayflies + Stoneflies + Most Caddisflies (not Common Netspinning)		Greater than 32.2	16.1 - 32.2	Less than 16.1
Metric 2	Common Netspinning Caddisflies		Less than 19.7	19.7 - 34.5	Greater than 34.5
Metric 3	Lunged Snails		Less than 0.3	0.3 - 1.5	Greater than 1.5
Metric 4	Beetles		Greater than 6.4	3.2 - 6.4	Less than 3.2
Metric 5	Tolerant		Less than 46.7	46.7 - 61.5	Greater than 61.5
Metric 6	Non-Insects		Less than 5.4	5.4 - 20.8	Greater than 20.8
			Total # of 2s:	Total # of 1s:	Total # of 0s:
			Multiply by 2:	Multiply by 1:	Multiply by 0:
			SUBTOTALS		

Add the three subtotals to get the Save Our Streams Multimetric Index Score: _____

Acceptable Ecological Condition (9 - 12)

Ecological conditions cannot be determined at this time/Grayzone (8)

Unacceptable Ecological Condition (0 - 7)

BIOLOGICAL MONITORING DATA FORM FOR ROCKY BOTTOM STREAMS 4

Stream Conditions

Volunteers should complete a qualitative streamside visual analysis that assesses the general conditions in the stream every time they conduct a biomonitoring session. The assessment can help identify sources of stress to the macroinvertebrate community in your stream and is an important water quality assessment tool. These data serve as a monitor's record of physical conditions and can be used to identify observable changes over time. [Find a detailed habitat assessment manual online.](#)

STREAM CONDITIONS

Fish water quality indicators: <input type="checkbox"/> scattered individuals <input type="checkbox"/> scattered schools <input type="checkbox"/> trout (pollution sensitive) <input type="checkbox"/> bass (somewhat sensitive) <input type="checkbox"/> catfish (pollution tolerant) <input type="checkbox"/> carp (pollution tolerant)	Barriers to fish movement: <input type="checkbox"/> beaver dams <input type="checkbox"/> man-made dams <input type="checkbox"/> waterfalls (> 1 ft.) <input type="checkbox"/> none <input type="checkbox"/> other _____	Surface water appearance: <input type="checkbox"/> clear <input type="checkbox"/> clear, but tea colored <input type="checkbox"/> colored sheen (oily) <input type="checkbox"/> foamy <input type="checkbox"/> milky <input type="checkbox"/> muddy <input type="checkbox"/> black <input type="checkbox"/> grey <input type="checkbox"/> other _____	Streambed deposit (bottom): <input type="checkbox"/> grey <input type="checkbox"/> orange/red <input type="checkbox"/> yellow <input type="checkbox"/> black <input type="checkbox"/> brown <input type="checkbox"/> silt <input type="checkbox"/> sand <input type="checkbox"/> other _____
Odor: <input type="checkbox"/> musky <input type="checkbox"/> oil <input type="checkbox"/> sewage <input type="checkbox"/> other _____ <input type="checkbox"/> none	Stability of streambed (bed sinks beneath your feet in): <input type="checkbox"/> no spots <input type="checkbox"/> a few spots <input type="checkbox"/> many spots	Algae color: <input type="checkbox"/> light green <input type="checkbox"/> dark green <input type="checkbox"/> brown coated <input type="checkbox"/> matted on stream bed <input type="checkbox"/> hairy	Algae located: <input type="checkbox"/> everywhere <input type="checkbox"/> in spots <input type="checkbox"/> % covered _____
Stream channel shade: <input type="checkbox"/> full (more than 75%) <input type="checkbox"/> high (50% - 74%) <input type="checkbox"/> moderate (25% - 49%) <input type="checkbox"/> slight (1% - 24%) <input type="checkbox"/> none	Streambank composition (=100%): _____ % trees _____ % shrubs _____ % grass _____ % bare soil _____ % rocks _____ % other	Streambank erosion: <input type="checkbox"/> severe (more than 75%) <input type="checkbox"/> high (50% - 74%) <input type="checkbox"/> moderate (25% - 49%) <input type="checkbox"/> slight (1% - 24%) <input type="checkbox"/> none	Riffle composition (=100%): _____ % silt (mud) _____ % sand (1/16" - 1/4" grains) _____ % gravel (1/4" - 2" stones) _____ % cobbles (2" - 10" stones) _____ % boulders (> 10" stones) (Not applicable to Muddy Bottom Streams)

Record observations of various physical characteristics of stream. These conditions provide extra context to your macro data.

NOTE: For categories asking for percentage values, work with your team to come to a reasonable estimate. You are not expected to calculate precise percentages.

LAND USES IN THE WATERSHED (UPSTREAM AND SURROUNDING SAMPLING SITE)

Indicate whether the following land uses within a one-mile radius of your sampling site have a high (H), moderate (M), slight (S), or no (N) potential impact to the quality of your stream.

<input type="checkbox"/> Oil & gas drilling	<input type="checkbox"/> Urban uses (parking lots, highways, etc.)	<input type="checkbox"/> Agriculture (type: _____)
<input type="checkbox"/> Housing developments	<input type="checkbox"/> Sanitary landfill	<input type="checkbox"/> Trash dump
<input type="checkbox"/> Forestry	<input type="checkbox"/> Active construction	<input type="checkbox"/> Fields
<input type="checkbox"/> Logging	<input type="checkbox"/> Mining (type: _____)	<input type="checkbox"/> Livestock pasture
		<input type="checkbox"/> Other _____

Rate level of potential impact from specific land uses within ONE MILE RADIUS of site.

COMMENTS: Describe the amount and type of litter in and around the stream and indicate the current and potential future threats to the stream's health.

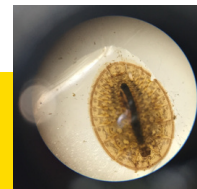
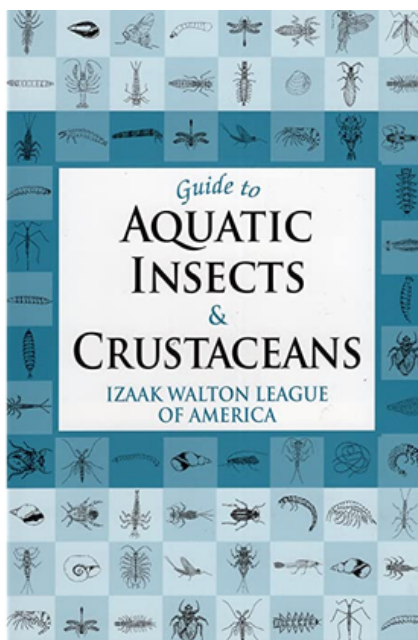
Please send your datasheets to your regional coordinator or submit them online at www.vasos.org. If you have any questions about this protocol, please contact the VA SOS Coordinator at vasos@iwla.org. Data sheets must be stored for five years after sampling. If you are unable to keep your datasheets, please contact the VA SOS Coordinator.

Macroinvertebrate Identification

Sorting Your Sample

When you first get started monitoring, it may be easiest to start by simply sorting critters by similar appearances. Place organisms that share similar characteristics in the ice cube tray together. After picking your sample, go through the ice cube tray and spend more time magnifying, identifying, and recording your organisms.

As you get more practice and your macroinvertebrate identification skills improve, you can potentially identify as you pick them off of the net and call your organisms out to another monitor as they record your findings.



Identifying Macroinvertebrates

We identify to the Order level in the SOS program. The accuracy of SOS stream health score data relies on the accuracy of macroinvertebrate identification. Monitors should take care to identify all macroinvertebrates correctly. Utilize identification resources and magnification tools to ensure that your identifications are correct. When in doubt, put the critter under the microscope to be sure! **Many macroinvertebrates share similar characteristics to others, so monitors should take the time to identify multiple characteristics on each bug that confirm your identification.**

Returning Your Sample

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 health score using the SOS Multimetric Index.

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



Handling Unknown Specimens

If you find that you and your monitoring group cannot identify an organism, you will need to do the following to secure an accurate identification;

1. Photograph and write down a detailed description of the organism
2. Fill out the Unknown Specimen Form (page 25)
3. Send the information to SOS Staff at SOS@iwla.org

You may also choose to preserve the organism in a jar or vial of ethanol and mail the sample and form to the SOS office for identification.

Izaak Walton League of America
ATTN: SOS Coordinator
707 Conservation Lane
Gaithersburg, MD 20878



Unknown Specimen Submittal Form

Name and Email Address of submitting volunteer(s) _____

Sample Information:

Survey Date: _____ Station ID: _____

County/State: _____

Latitude: _____ Longitude: _____

Location (be specific): _____

Please describe the physical characteristics of this organism (including any identifiable movements):

Do you have any thoughts on what this organism might be? _____

If you would like to send the SOS office this organism to assist with identification, please fill out the information below in pencil and include in your preservation jar or vial.



Date Collected: _____ Submitter Name: _____

County/State: _____ Station ID: _____

Latitude: _____ Longitude: _____

Location (please be specific): _____

Clean Water Hub

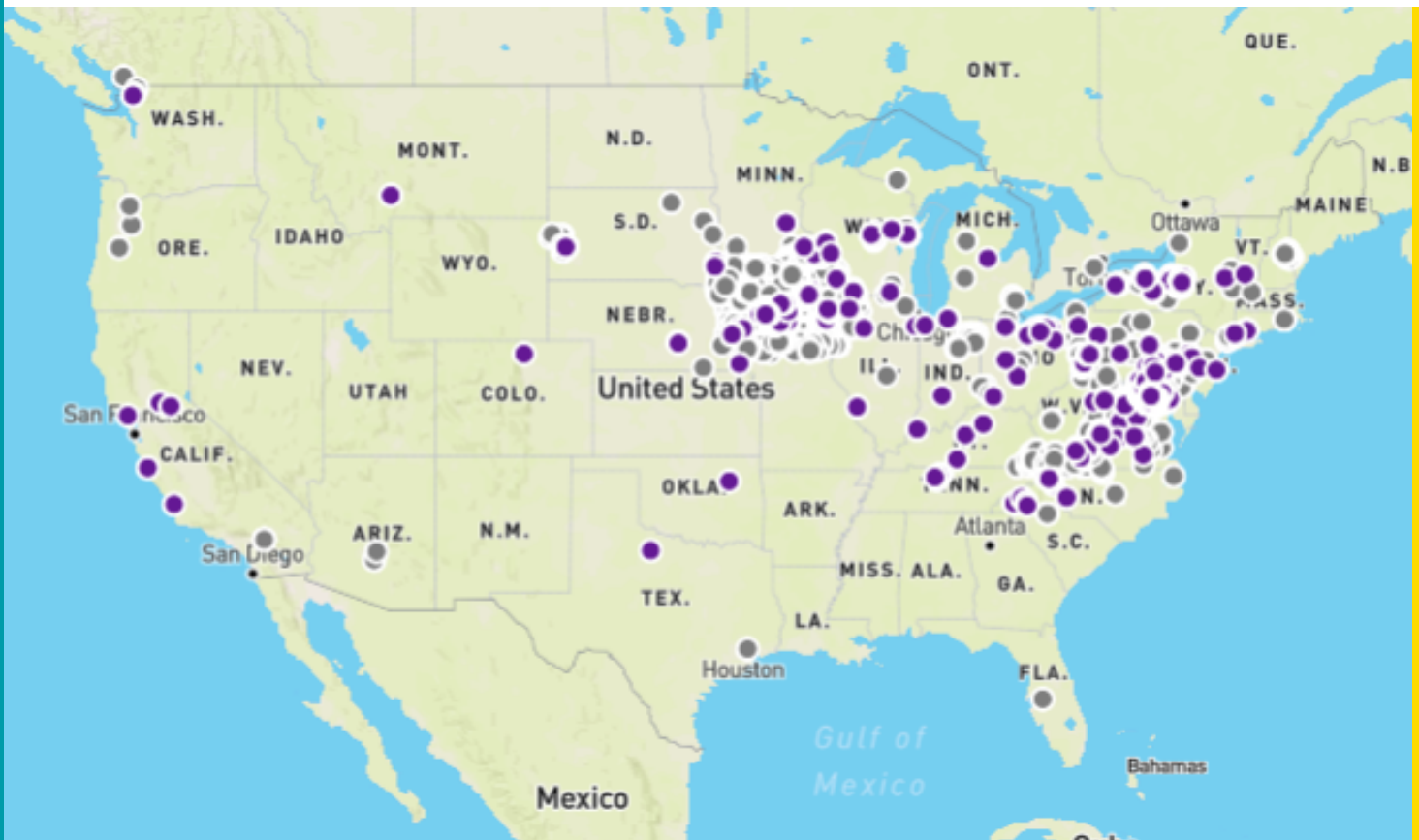
What is the Clean Water Hub?

The Clean Water Hub is collaborative data visualization tool to help water quality monitors and communities track water quality in local creeks and streams.



The Clean Water Hub currently hosts the following types of water quality data;

- VA SOS & Chesapeake Bay SOS benthic macroinvertebrate data
- National SOS benthic macroinvertebrate data
- Chemical water quality data
- Salt Watch & Nitrate Watch results
- Macroinvertebrate data collected by the Creek Critters app



Create Your Clean Water Hub Account

- Visit CleanWaterHub.org and create a free account.
- In the "Organization Name" field, search for the [Chesapeake Monitoring Cooperative organization page](#). Open the page and click "Join Organization".

JOIN ORGANIZATION



Request a Clean Water Hub Group/Organization Profile

If you are part of a monitoring group or organization, we recommend you create an organization page where all of your sites can be associated with your group. This will allow you to see all of your sites in one place and access downloads of your data. This profile is a great way to manage data for multiple sites, and can serve as a communication tool for you to share your results with your community.

[Request an organizational profile using this online form](#), or by emailing SOS@iwla.org.

Create a New Site in the Hub

- Log in to the Clean Water Hub
- Click "My Sites" at the top of the page
- Click "Create A New Site"
- Input all relevant site information
- Input "Chesapeake Monitoring Cooperative" into the organizations field

MAPS

MY SITES

ABOUT



HELP

CREATE A NEW SITE



Organizations

Chesapeake

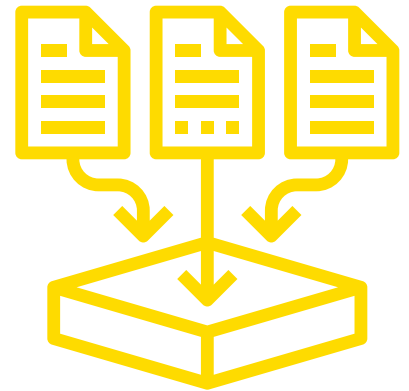
Chesapeake Monitoring Cooperative

NOTE: You will not be able to submit any data until you have both joined the Chesapeake Monitoring Cooperative organization and added the organization to each site.

Submitting SOS Data

Submitting Data to the Clean Water Hub*

1. Log in to the [Clean Water Hub](#).
2. Go to "My Sites" and use the "Search Sites" search bar to locate your site. Click on the site ID to open it.
3. Click "Create a Reading" and select either the VASOS/CMC Muddy Bottom or VASOS/CMC Rocky Bottom protocol.
4. Enter information from your datasheet into the online submission form.
5. Click "Save Changes."



**Check with your program coordinator for your group's specific submission protocol.*

NOTE: Be sure to list every certified monitor that was present at the sampling on your data form. This is how they will receive credit to maintain active certification.

Viewing Data in the Clean Water Hub

1. Go to "My Sites" and use the "Search Sites" search bar to locate your site. Click on the site ID to open it.
2. Select the protocol that you would like to view (Rocky or Muddy Bottom) to generate a graph of your multimetric scores over time.
3. Scroll below the graph to view a sequential list of your data submissions. Click "View" to see the full datasheet and click "Edit" to make any changes.



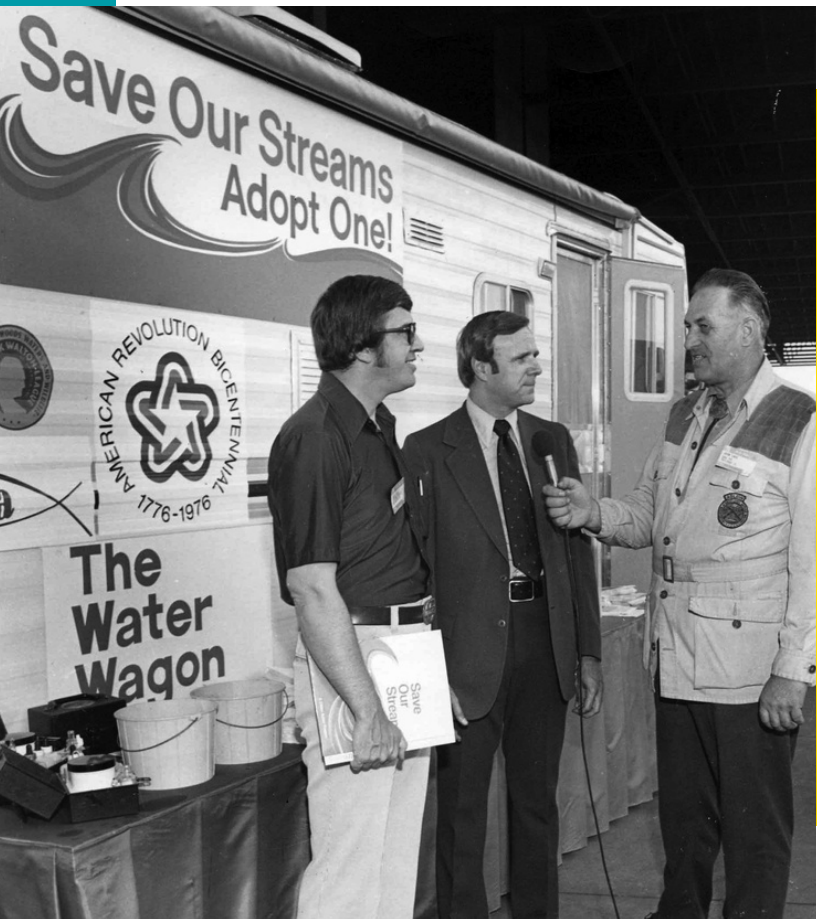
Data are quality assured and sent to the Chesapeake Bay Program at the start of every calendar year.

NOTE: You must keep a physical or digital copy of your datasheet for at least 5 years after your sample is taken. This protects our data from being lost to any potential database malfunctions.

Advocacy Guide

Use Your Data!

Stream monitoring is one step of many that you can take to protect your waterways. The [Save Our Streams Advocacy Guide](#) shows you how to take action at the local, state or federal level to protect the waterways you monitor. You'll find valuable tips and advice on how to organize your community, influence policymakers, and create positive change for your streams. Plus, read inspiring success stories from fellow monitors and other League members.



Other Monitoring Opportunities

Salt Watch

IWLA sends **free kits** to volunteers to track levels of road salt (chloride) in their local streams throughout the year and submit their data to a national database. Volunteers can share and use these data with their local watershed groups, neighbors, and local government. Interested in partnering? We can send you bulk kits for your monitoring or education groups.



Creek Critters

Perfect for classes, families, public programs, and even as a solo activity, Creek Critters is easy and fun. Collect bugs by following simple step-by-step instructions, and identify your bugs with an interactive identification key. The app automatically calculates your Stream Health Score based on your findings. The score tells you how healthy your stream is – plus your results are added to the Clean Water Hub, our public database of water quality in America.



Chemical Monitoring

In addition to benthic data, measuring dissolved oxygen, phosphate, pH, nitrate, chloride, and clarity can create a more complete picture of stream health. IWLA offers datasheets, [manuals](#), and instructional videos to get you started. If you are based within the Chesapeake Bay Watershed, you can also become a certified monitor through the Alliance for the Chesapeake Bay's [RiverTrends program](#).



Nitrate Watch

Nitrate Watch is the newest community science program from the IWLA Clean Water team. It mobilizes volunteers across the country to track nitrate levels in surface water and drinking water. Request your Nitrate Watch kit and find educational resources and advocacy actions at www.NitrateWatch.org.



Become an IWLA Member

National Membership

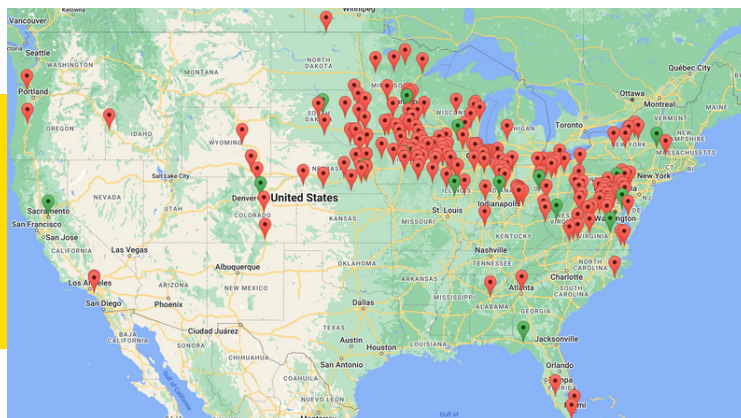
The Izaak Walton League doesn't take a "doom and gloom" approach to conservation. We work for practical solutions that balance conservation with sustainable use of natural resources. Want to help find common-sense solutions to today's environmental problems? Join the League as a national member to support our conservation and advocacy work.

[Become a National Member](#) and receive:

- Outdoor America magazine, the League's award-winning quarterly magazine
- E-news you can use each month to defend America's outdoors
- Advocacy on your behalf to protect clean water, fish and wildlife, and outdoor recreation
- Networking with League members
- Scholarships that are only open to League members and their families
- Supporting the only organization training volunteers to protect clean water nationwide

Join a Local Chapter

Volunteers are the heart and soul of the League's brand of community-based conservation. Much of that volunteer work happens at our more than 200 chapters, where you can find opportunities to enjoy outdoor America – and protect it for the enjoyment of others. Some chapters offer hiking trails, fishing ponds, and shooting sports facilities. Many chapters organize stream clean-ups, youth programs, and conservation education events.



[Find a Chapter](#)
[Near You](#)

APPENDIX A

Protocol Manuals

Rocky Bottom Protocol

Objective:

Sampling up to four riffles, use kick net to collect 200+ macroinvertebrates to identify and tally. Use the SOS metrics datasheet to calculate a stream health score.

Step 1: Identify Riffles

Identify which four riffles you will sample during your collection. Look for riffles where maximum bubbling action occurs and there are plenty of cobble sized rocks. Riffles can be aligned vertically moving upstream, horizontally across a wide stream, or both!

Step 2: Decide First Net Time

Net times should be anywhere between 20-90 seconds. The first net at a new site should be 20 seconds. Adjust net times as needed during protocol to best reach 200 bugs collected. No more than 4 nets can be taken.

Step 3: Approach From Downstream

Start with the most downstream riffle and approach from downstream. Avoid disturbing riffle areas before your sample collection begins to avoid disrupting or double counting bugs.



Step 4: Place Kick Net Below Riffle

Place your kick net downstream of the riffle you aim to sample. Kick net should be placed perpendicular to water flow and held at approximately a 45 degree angle. Be sure that water is flowing *through* the net, and not over the top. Spread net as widely as possible and allow direct flow of water into the center of the net.



Step 5: Line Net Edge with Rocks

To avoid losing any macroinvertebrates beneath the net, place anchor rocks along the bottom edge of the net. Anchor rocks should be taken from OUTSIDE of the sample area and cleaned off of any bugs before placing.



NOTE: Though the kick net is 3 feet wide, your sample area is only 1 square foot in front of the net. Use the net to approximate one foot width.

Step 6: Rub Stream Rocks

Spend 75% of your chosen net time rubbing rocks. Pick up cobbles in your sample area and rub them quickly and thoroughly underwater. Get to as many rocks as possible during your allotted time. The aim is to dislodge any macros that are clinging to the rocks and capture them in the net.

75%



Step 7: Disturb the Substrate

Spend 25% of your chosen net time disturbing the substrate of the stream within your 1 sq/ft sampling area. Use a clean rock, hand rake, or trowel to rigorously stir up stream bottom.

**Using your hand is not recommended to avoid injury. Using your feet is also not recommended.*

Step 8: Clean and Remove Anchor Rocks

Your macros have evolved to cling to rocks as if their life depends on it - because it does. They may have grabbed onto your anchor rocks during your collection, so you must clean those rocks off into your net before removing.

Step 9: Take Net to Table to Process

Take net back to your table to pick your macroinvertebrates. Be sure not to lose any of your sample on your way.

NOTE: You may catch vertebrates like minnows and salamanders in your net. You can make a note of their presence on your datasheet, but you will not count them as part of the SOS calculation. Return them to the stream promptly.



Step 10: Processing Your Sample

Using forceps, spoons, or pipettes, pick ALL macroinvertebrates off of the net and place into ice cube trays. Swap positions around the table to double check for bugs not picked yet.

When picking your net, start by completely picking bugs off of the top. Then roll the net away and pick any bugs stuck on the underside of the net. Once all bugs are off of the net, examine the table cloth for any bugs that crawled through.

TIP: Use the 5 minute rule! If 5 minutes pass without finding a bug, the net is fully picked.

NOTE: You must FULLY pick every net. Do not stop picking when you reach 200 organisms if there are still bugs on net. Picking every bug ensures that the composition of the stream is accurately reflected when calculating a stream health score.

Step 11: Count and Identify Macroinvertebrates

If your first net yields 200 or more bugs, you are done! If not, bring your net to your second riffle and take a second net. Repeat this process until you have reached 200+ bugs OR completed 4 nets.

***If 4 nets fail to collect 200 organisms the metric calculation should still be made with the total that is obtained. If 4 nets do not collect 200 bugs, 3 out of 4 nets must be 90 seconds for data to be approved and sent to the CBP.**

NOTE: To avoid capturing an excessive number of bugs, 20 seconds is ideal for the first time monitoring a new station. Net times should be adjusted to ensure capturing 200+ organisms, but cannot exceed 90 seconds. No more than 4 nets can be taken.



Muddy Bottom Protocol

Objective:

Use D-Net to take 20 jabs in the muddy bottom habitats available at the site, collect 100+ macroinvertebrates to identify and tally. Use the SOS metrics datasheet to calculate a stream health score.

Step 1: Identify Habitat Composition

Identify which of the four Muddy Bottom habitats are available within the 100 meter site you have selected. The habitat areas are: woody snags, banks, submerged aquatic vegetation, and riffle areas (cobble-stone sized rocks).

Plan to divide your 20 jabs among the habitats available in proportion to their abundance at the site. For example, if 50% of your site is bank, 25% is woody snag, and 25% is submerged aquatic vegetation (SAV) - do 10 jabs in bank, 5 jabs in woody snag, 5 jabs in SAV.

Not all four habitats will always be present at every Muddy Bottom site.



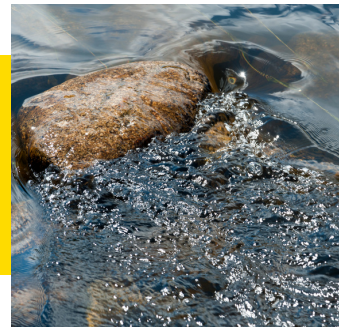
Woody Snag



Stream Bank



**Submerged Aquatic
Vegetation**



Riffle Areas

NOTE: Riffle areas are the areas of highest oxygenation in a stream. When riffles are present, the highest concentration of macroinvertebrates will be found there. If you have four riffles at a site, you should use the Rocky Bottom protocol to get the most accurate and representative score. Use the Muddy Bottom protocol when less than 4 riffles are available.

Step 2: Perform 20 Jabs Along Site

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.

The following techniques are recommended for sampling the four major productive habitats in muddy bottom 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 sampled 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 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. Mark on your datasheet how many jabs were done in each habitat.



Step 3: Processing Your Sample

- 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!
- Empty the contents of your sieve bucket onto a flat, light colored surface, such as a white sheet, or table. Use a spray bottle to remove all organisms from the bucket. Examine bucket to ensure all bugs have been removed.
- 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.



- Using forceps, spoons, or pipettes, pick ALL macroinvertebrates from the first grid square and place into ice cube trays. Count the bugs collected from the grid. If you have collected 100+ organisms (not including scuds), you are done and do not need to pick the other grids. If you have not reached 100 organisms, proceed to the second grid. Repeat process until you have reached 100 non-scud organisms OR have fully picked all four grids.

NOTE: You must **FULLY** pick each grid before continuing to the next. Do not stop at 100 non-scud organisms if there are more left in the grid. Picking every bug ensures that the composition of the stream is accurately reflected when calculating a stream health score.

NOTE: Because scuds can be so abundant in a muddy bottom stream, do not count them towards your 100 organism minimum. Collect at least 100 non-scud organisms from your grids to ensure a representative sample is being counted. When doing your metric calculations, you **WILL** include scuds in the total count.

Contact Us



Email us at SOS@iwla.org



Find us online at

ChesapeakeMonitoringCoop.org and
IWLA.org/Water



Call us at 301-548-0150



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