Citizen Science Fact Sheet W-8

Stream Biology

Purpose

Many people are not aware of the diversity of small organisms that live in a stream, yet these organisms play a vital role in its ecosystem. Studying macroinvertebrates – organisms that lack a backbone yet are large enough to see without a microscope – reveals important clues about a stream's health.

One reason is that macroinvertebrates are sensitive to low levels of dissolved oxygen in the water. Organisms that depend solely on dissolved oxygen will not survive without it, while those organisms that breathe air are better able to survive in low-oxygen waters. Some species are simply more tolerant of these conditions than others. Low levels of dissolved oxygen in a stream indicate that the stream is in poor health. This could be due to high levels of pollutants, increased organic matter, or physical aspects such as lack of shade.

Sediment from bank erosion and runoff is another factor affecting the number and type of macroinvertebrates in the stream. When rocky areas of the streambed, such as riffles, become covered in too much silt, life cycles of macroinvertebrates that normally live there may be disrupted. Silt eliminates the stone and gravel habitats needed for reproduction and protection from predators.

Keep in mind that macroinvertebrate life cycles consist of stages such as egg, larvae, and adult. Certain species will be more prevalent than others during different seasons, and sometimes it will be very difficult to find macroinvertebrates because they exist as eggs or other forms too small to see. Do not assume that just because a species was not present when you sampled, it is never present in the stream.

Mid-spring (early to mid-May) is a good time to sample because many types of larvae usually are present. Many of the macroinvertebrates to look for are the larval stages of organisms like flies and beetles, which will leave the site when mature. Just like the chemical assessment, macroinvertebrate assessments give a snapshot of the stream at a particular time. Even though you can gain valuable information about the stream from a single visit, it is important to do multiple samplings at different times for a more complete picture of the stream's health.

Tools

You will need the following tools to conduct a macroinvertebrate assessment:

- A macroinvertebrate identification guide. We recommend *A Field Guide to Macroinvertebrates* from the Isaac Walton League. See page 4 for ordering information.
- A white, wide-bottomed pan for sorting.
- Sturdy wading shoes.
- A net. While any net can be used, a kick net (Figure 8.1, below) or some other type of net with a wire rim to place flat against the streambed works best.

It is often helpful to work with someone with experience identifying macroinvertebrates because it can be difficult to distinguish among them at first. See page 4 for contact information.

Figure 8.1. Kick nets and other equipment are available locally or through classroom science or forestry supply catalogs.

WATER

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Stream Biology and Macroinvertebrate Sampling

Procedure

If you are also doing chemical analysis of the water, be sure to collect water samples and run the turbidity test before you step into the stream. Wading stirs up sediment which can affect the results of the tests.

1. Determine the area you are going to sample (1 ft x 1 ft, 2 ft x 3 ft, etc.) and the time you are going to spend stirring up the bottom (30 seconds, 1 minute, etc.). Consistently using the same size area and time when sampling enables you to more accurately compare your results from different streams and different sampling dates.
2. Making sure that you are upstream of the net, so that any creatures you disturb will be swept into the net, and start stirring up the bottom with your feet. Do this for the amount of time you decided on in Step 1.
3. Empty everything from your net into the white sorting pan. Carefully sort through the contents for macroinvertebrates, making sure that you check leaf clusters and sticks for anything that may be attached to them.
4. Identify the macroinvertebrates you found using the Isaac Walton League guide, and record how many of each kind you found on the data sheet on page 3.
5. Take the number of sensitive macroinvertebrate species present and multiply by 3. Take the number of somewhat sensitive macroinvertebrate species present and multiply by 2. Take the number of tolerant macroinvertebrate species present and multiply by 1. Add these results together.

Figure 8.2. Sampling macroinvertebrates requires close observation.

Interpretation

To determine your score, complete the data sheet on page 3.

Action Steps

A one-time low score on stream biology assessment may not mean a stream is necessarily bad. As discussed earlier, the time of year, recent weather, and other factors can make a difference in the abundance of the various species in your stream. Next steps after sampling and collecting data include comparing your data to other groups in your area at a similar time of the year; re-sampling in a few weeks or at different times throughout the year to determine how seasonal cycles affect samples; and completing the stream site assessment included in Citizen Science water quality fact sheet W-9, *Stream Site Assessment*, to determine if there are physical factors that might be affecting stream biology.

Finally, you could sample a reference stream in your area that is known to be more natural or pristine than your sample stream. Compare the results collected under similar conditions. You will also gain information from completing the chemical tests described in fact sheets W-2 through W-7. If your stream is in good shape, that's good news. Now as a good steward, your mission is to keep it that way.

Macroinvertebrate Rating[1]			
4 – Best	3 – Good	2 – Fair	1 – Poor
Score of more than 22.	Score between 17 and 22.	Score between 11 and 16.	Score less than 11.

[1]Total of three index values from data sheet table (page 3) equal macroinvertebrate score.

Macroinvertebrate Sampling Data Sheet

(Make copies as needed)

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Stream Biology and Macroinvertebrate Sampling

Participant names: _____ Date: _____

Stream name and reach: _____

Location description: _____

No. of kick net samples: _____Approx. area/sample: _____Minutes/sample:_____

Weather conditions (last three days) _____

Average water depth at site: _____ Average water surface width at site: _____

Stream water temperature at sampling: °F _____ °C _____

Stream flow rate: ___very high ___somewhat high ___normal ___low ___very low

Stream appears: ___clear ___cloudy ___muddy

Characteristic of stream in sample area is best described as:

___a pool ___slow moving, deep ___fast but not shallow ___fast and shallow ___riffle

Amount of substrate in the stream (rocks, logs, leaves) for macroinvertabrates is:

___high, diverse ___high but not diverse ___medium ___low ___not present

Sensitive			**Somewhat Sensitive**			**Tolerant**		
Name	**Number**	**Present (check)**	**Name**	**Number**	**Present (check)**	**Name**	**Number**	**Present (check)**
Caddisfly larvae			Alderfly larvae			Aquatic worms		
Gilled snail			Beetle larvae			Blackfly larvae		
Hellgram-mite			Clams			Leeches		
Mayfly larvae			Crane fly larvae			Lunged snails		
Riffle beetle adult			Crayfish			Midge larvae		
Stonefly larvae			Damselfly larvae					
Water penny larvae			Dragonfly larvae					
			Fishfly larvae					
			Scuds					
			Sowbugs					
			Watersnipe larvae					
*Number of boxes checked _____ × **3** = _____ index value*			*Number of boxes checked _____ × **2** = _____ index value*			*Number of boxes checked _____ × **1** = _____ index value*		
Column 1 index value + column 2 index value + column 3 index value = macroinvertebrate score.								

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Stream Biology and Macroinvertebrate Sampling

Where to order supplies

Isaac Walton League

707 Conservation Lane
Gaithersburg, MD 20878
Phone 301-548-0150
www.iwla.org
Web site includes supplies and training materials for macroinvertebrate sampling.

A Field Guide to Macroinvertebrates
Published by the Izaak Walton League of America. This handy, laminated reference is designed to help volunteer monitors identify aquatic macroinvertebrates when conducting water surveys. Diagrams of the macroinvertebrate larvae and adults are grouped by biological type and display common features that characterize each organism. Cost is $4.95.

Order from:
McDonald and Woodward Publishing Co.
431-B East, College Street
Granville, OH 43023
Phone 1-800-233-8787
Fax 1-740-321-1141
mwpubco@mwpubco.com
www.mwpubco.com/IWLAinverts.htm

Online key to macroinvertebrates
http://wsrv.clas.virginia.edu/~sos-iwla

Other resources

See Citizen Science fact sheet W-10, *Starting a Water Monitoring Team*, for other sources related to macroinvertebrate assessment. Kick nets and other equipment are available locally or through classroom science or forestry supply catalogs.

Kansas Biological Survey – Central Plains Center for Bio-Assessment (CPCB)

CPCB's mission is to provide biological expertise for the Central Plains Region by facilitating the exchange of information between scientists, government officials, and the public on issues of water quality; providing scientific expertise on such issues as taxonomy, aquatic ecology, data storage, data analysis, and study design; collaborating on scientific studies of nutrients, bio-criteria, and bioassessments of regional water bodies; and maintaining open communications within the region via a Web page. *www.cpcb.ku.edu*

Streamlink

Streamlink is a project of the Kaw Valley Heritage Alliance. Streamlink provides stream assessment experiences for school-age children and conducts stream monitoring training during the year. *www.streamlink.org/programs/sa.htm*

Alabama Water Watch (AWW)

A nonprofit affiliation of citizen monitoring groups. They have developed and distribute the "Bio-assess Game," to simulate stream biological assessment in the classroom. Plastic cards with drawings, sample data sheets, and actual aquatic invertebrate samples provide good practice before going to the field with your team.

AWW Program Office, 203 Swingle Hall
Department of Fisheries, Auburn University
Auburn, AL 36849
Phone 334-844-4785
Toll free 888-844-4785
Fax 334-844-9208
www.alabamawaterwatch.org/
www.aces.edu/waterquality/

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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