Virginia Save Our Streams
Eastern Biomonitoring Method for Muddy Bottom Streams
Stream Quality Survey Instructions
Standard Operating Procedures for Macroinvertebrate Population Surveys

Background

The stream quality survey, originally designed by the Izaak Walton League of America and revised and updated by the Virginia Save Our Streams Program (VA SOS), allows volunteer monitors to collect data on the health of their local streams. These data, if collected and recorded properly, assist state agencies, local governments, and concerned citizens in improving local environmental conditions related to water quality. This document is a comprehensive guide to doing a stream survey that contributes to the state effort to manage and protect Virginia's waterways.

Conducting a survey of the macroinvertebrates, organisms large enough to be seen by the unaided eye, allows you to assess the health of your stream. Many stream-dwelling organisms are sensitive to changes in water quality. Their presence, absence, or population changes through time serves as an indicator of environmental conditions. Macroinvertebrates are easy to find, collect, and identify. By following the instructions below (a summary of the VA SOS Training Session) and filling out the VA SOS Stream Survey, you can diagnose your stream's water quality. Remember, your data are most useful when you have become a certified VA SOS monitor. As outlined in our quality assurance plan, to become a certified monitor you must first attend a Virginia Save Our Streams training session and complete the subsequent certification test. To find out more about attending a training session and becoming certified contact VA SOS at 888-656-6664 or vasosoffice@vasos.org.

Site Selection

Monitoring should be done at one station, defined as a single stretch of stream not more than 100 meters long. If you wish to assess a longer section of a stream, select two monitoring stations at the top and bottom of the stretch, or multiple sites along the length of the stretch at quarter-mile or greater intervals. Be sure to revisit the same station each time so that your results will be comparable. Carefully record the location of your monitoring station on your VA SOS Stream Survey form. If you do not know the latitude and longitude coordinates when you monitor, use an accurate description of the site (i.e. Site located on north side of route 660, 1 mile east of route 607) that enables you or another monitor to return to the same location. The regional coordinator or VA SOS staff will help you identify the coordinates at a later date.

Monitoring should be conducted four times a year for each station you monitor. We suggest a schedule of January, April, July, and October, though consistency is more important that a specific month. In addition, you may choose to monitor after a significant event that may have a significant impact on the stream, such as a chemical or oil spill, a heavy rain following the spreading of manure or fertilizer on lands nearby, or a flood. Do this no more than twice, for an annual maximum of six surveys. The survey

itself is a stream disturbance and too heavy a monitoring cycle can negatively impact macroinvertebrate populations.

If you are monitoring more than one station on a stream, you should begin monitoring at the station furthest downstream and work upstream. This will prevent macroinvertebrates disturbed from your first test from washing downstream and getting caught in your net a second time. Each station should include only the organisms present at that location and not those disturbed from previous tests.

Catching the Macroinvertebrates – Virginia Save Our Streams Eastern Method

The equipment required includes a d-frame net with a mesh size of 500-650 microns, a wash bucket or other seining device (mesh size must be no larger than the d-frame net mesh size), plastic containers (such as ice cube trays) tweezers, a magnifying glass or magnifying cubes, pencils, rubber boots or other stream shoes, and rubber gloves (required for impaired streams). Contact VA SOS for information on locating a d-frame net and wash bucket.

We will use our d-frame net to jab a total of 20 times in several habitat areas in the stream. After each jab and sweep, the net should be rinsed into the sieve bucket to collect all the macroinvertebrates and the debris from the net (leaves, sticks, etc). The entire sample in the sieve bucket will be identified streamside and used to fill in the data sheets.

Selecting the Assessment Area for your Site

1. The stream to be evaluated by this method should be wadable and have a defined channel. The stream may have extensive wetland areas associated with the stream as long as there is one major channel in which there is always water. Your monitoring will be conducted in the major channel.
2. The stream should be a perennial stream; water flows in the stream throughout the year to support aquatic organisms.
3. The assessment area will be approximately 100 meters in length (downstream to upstream). Macroinvertebrates will be collected in habitats throughout the assessment area.
4. The assessment area should contain no major tributaries and should be homogeneous with regard to habitat conditions.
5. Using the front page of your field sheet, visually examine your site and the three habitat areas present (woody snags, banks, submerged aquatic vegetation). Identify the percentage of each of the habitats present in your assessment area (the percentages must add up to 100%).
6. Determine the number of jabs in each habitat present in your assessment area. Multiply 20 (the total number of jabs) by the habitat percent to get the number of jabs that should be taken in that particular habitat. For example, if 40% of the habitat areas in your assessment area is woody snags, multiply 20 by 40% (or 0.40). The calculation reveals that 8 jabs should be taken in woody snag habitat areas. Record the number of jabs to be taken in each habitat on your data sheet.
7. Riffles may be found in the assessment area but are not sampled.

Collecting the Macroinvertebrates

1. Start your collection at the downstream limit of your 100-meter sampling area. Move upstream as your collect your sample to avoid low visibility caused by sediment resuspension.
2. Collections are made in all velocity regimes and all available habitats in the assessment area. Sampling of the channel bottom should be avoided as much as possible.
3. A single sample of macroinvertebrates consists of collecting 20 jabs in productive habitats. A single sample is what is recorded on the data sheets.
4. 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 three major productive habitats in coastal plain streams.
    a) 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.
    b) 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.
    c) 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.
5. The jab 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.
6. Attempt to minimize the amount of mud and vegetation in the net. If the net gets clogged during the jab and sweep, the contents of the net should be discarded and the jab for that habitat is redone. Do not hesitate to discard a jab that has too much sediment – you will be happy you did when you are sorting the sample!
7. Do NOT attempt to capture organisms swimming on the surface (but retain them in the sample if you happen to get a few).

Stream Side Identification

Once you have collected 20 jabs (an entire sample) throughout your monitoring site, it is time to pick, identify, and count the organisms in your 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.

3. Using tweezers or your fingers, gently pick all the macroinvertebrates from selected grid and place them in your collecting container. 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. 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.
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. **COUNT THE SCUDS 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.** 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. Again, we are looking for 100 organisms. 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.
7. Only include macroinvertebrates on the Tally Sheet – in other words , don't put fish, salamanders, or other organisms on the Tally Sheet.
8. If you have an organism that you cannot identify, tally it in the box labeled "other subsurface macroinvertebrates" and send it to VA SOS to be identified.
9. Include the total number of organisms in the sample on the lower right corner of the tally sheet.
10. Follow the tables attached to the tally sheet to calculate the individual metrics and the final ecological condition score.

Studying the Find

There are two important pieces of information you are recording in your survey; the diversity of orders or families of macroinvertebrates, and the population within each of these. Diversity is a strong sign of health, especially if the orders are diverse in those families that are pollution sensitive. Populations tell us something about the trend in stream health. Increases in numbers of sensitive species may indicate an improved food supply or better water quality. Decreases could be due to seasonal variations or lowering water quality. In tolerant species a population increase could indicate poor water quality or a change in stream bottom conditions due to sediments. Table 1: Assessing Impairment, will clarify these distinctions.

Streams can suffer from a variety of problems that may be discovered by consistent stream quality surveys through time. These usually fall into three categories given below:

1. **Physical Problems** – These may include excessive sedimentation from erosion, street runoff, or a discharge pipe. Sediment may: contribute to excessive flooding; reduce flow rates; change temperature of the water (which decreases oxygen levels); and smother aquatic life. The result is usually a reduction in the number of all animals in the study area.

   Sometimes the physical problems are not in the stream itself, but due to changes in the structure of the stream bank. Reduced shading from the riverine vegetation increases water temperature and lowers oxygen levels in the stream. This has an adverse effect on fish populations and sensitive macroinvertebrates. Any substantive change to the stream bank can have an effect on stream health.

2. **Organic Pollution** – This is normally from excessive human or livestock wastes or high alga populations due to an increased nutrient load in the stream. The result is usually a reduction in the number of different kinds of macroinvertebrates in the stream; commonly shredders like stoneflies or some mayflies, leaving more collectors/scrappers such as netspinning caddisflies, scuds, or lunged snails.

   Sources of organic pollution include runoff from farms, treated sludge from sewage treatment plants, runoff from impervious surfaces like streets, parking lots, and roofs, leaking septic systems, and excessive fertilizer from lawns or golf courses.

3. **Toxicity** – This includes chemical pollutants such as chlorine, acids, metals, pesticides, herbicides, and oil. One of the most serious examples is acid mine drainage from old coalmines in southwestern Virginia. This leaves the stream clear, clean, and dead. A low level of toxicity general lowers the variety and numbers of all macroinvertebrates.