Volunteer Biological Monitoring Program

Data Collection Protocol

ARLINGTON
VIRGINIA

March 2022

Arlington County Government provides accommodations for qualified individuals with disabilities as described in the Americans with Disabilities Act. To arrange for accommodation, please call 703-228-4488, TTY 703-228-4611, or e-mail lwhitesell@arlingtonva.us.

1. Sampling Reach Selection

Nine pre-determined stations have been selected by Arlington County staff for long term monitoring. At each of these locations, volunteers select a representative sampling reach for data collection. A standard reach is 100 meters (300 feet). All of Arlington's monitoring teams should include riffles within their reach. Riffles are the shallowest, steepest areas of the reach, often turbulent-looking in comparison to a smooth preceding pool/glide and successive run. Riffle substrate should be dominated by cobble and/or stable course particle materials (2" – 10" particle size). Ideal riffle water depths should not exceed one foot, and flow should be observable. Preferred pool habitats should have stable, structural habitat, such as submerged woody debris, and available edge habitat, such as submerged hanging roots and overhanging or submerged aquatic vegetation. Pools deeper than one foot may be sampled.

So it is clear to all of the team members which areas will be included in the assessment, use the County-provided tape measure and measure out the 300 foot reach when you arrive at your site.

2. Reach Photographs

Once the sampling reach has been identified, take at least three photographs of the reach. One from the lower end of the reach facing upstream, one from the top of the reach facing downstream, and one at mid-reach. The water and the stream banks should be visible in each picture. There should be a point of reference in each photograph that will allow us to compare the photographs through the years. Upload the photographs to the Arlington Volunteer Monitoring Flickr site - https://www.flickr.com/photos/arlmonitoring/. The photographs are taken in lieu of completing a habitat assessment field data sheet.

3. Temperature and Water Chemistry Measurements

After completing the habitat assessment, enter the stream channel at the downstream extent of the study reach. Be careful not to disturb substrate or habitat that will be sampled. All water measurements should be taken near the channel thalweg and in direct flow. Avoid backwater, stagnant areas and approach measurement sites from downstream. Follow the steps below to measure temperature, pH, dissolved oxygen, phosphate, and nitrate.

Temperature

Ambient Air Temperature

1. Hold or hang the thermometer in a shaded area approximately 3 feet above the ground.
2. Wait at least 3 minutes before reading.
3. Record time of day and air temperature in Celcius degrees on the data sheet.

Water Temperature

1. Place a thermometer in a clear container, and completely submerge it in the stream. Place a rock, from in the stream, in the bottom of the container to keep it in place.
2. After a minimum of three minutes, record the temperature in Celsius degrees on the data sheet.

pH

1. Test strips have been provided with the monitoring gear.
2. Submerge a single strip until it stops changing color.
3. Hold the strip against the color chart for comparison.
4. Record the pH number associated with the matching color on the chart.
5. Dispose of the test strip in either sharps container.

Dissolved Oxygen and Phosphate Tests

1. Follow the directions in the individual test kits (small black boxes).
2. Dispose of sharps and wastewater in the appropriate, provided sharps container. **Double check that the wastewater and sharps are placed in the correct waste container. Read the waste container label before disposing of the wastewater and sharps.**

Nitrate

1. The nitrate test is conducted with a test strip, similar to the pH test.
2. Follow the directions printed on the bottle.
3. Dispose of the test strip in either sharps container.

4. Benthic Macroinvertebrate Collecting Methods

You will need the following equipment for collection and sample processing.

Equipment	Quantity
Aquatic dipnet	2
Field table	2
Sampling gloves (pairs)	2
Large, white basins	3
Ice cube trays	Several
Petri dishes	Several
Needlepoint forceps	Several
Plastic spoons and pipettes	Several
Field microscope/hand lens	1
2-Dram vial with ethyl alcohol	1
Field guides to include Voshell's Guide to Freshwater Inverts.	1
Macroinvertebrate ID keys	Several

Benthic macroinvertebrates are collected using a "multi-habitat approach" adapted from the EPA's *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (EPA, 1999). Each selected 300 foot sampling reach should exemplify the best possible habitat conditions characteristic of the greater system (EPA, 1999). All of Arlington's monitoring teams should include riffles within their reach. Riffles are the shallowest, steepest areas of the reach, often turbulent-looking in comparison to a smooth preceding pool/glide and

successive run. If available, riffle substrate should be dominated by cobble and/or stable course particle materials (2" – 10" particle size). Ideal riffle water depths should not exceed one foot, and flow should be observable.

Ten samples are collected with a D-frame or rectangular dipnet from areas representative of the different productive habitat types (pools, riffles, undercut banks, submerged aquatic vegetation, woody debris, leaf packs, etc.). The habitats are sampled in rough proportion to their occurrence within the sampling reach. The rock rubbing method is to be used with all bottom substrate habitats. Productive edge habitat should be sampled using 'jab' techniques. Conversely, pools should be sampled solely using jabs with collection primarily along the banks and focusing on submerged hanging root mats, wetted overhanging vegetation, undercut banks, and submerged woody debris.

Always begin sampling furthest downstream in the reach and work upstream. Evaluate the reach as a whole, before entering the water so you can determine the proportion of habitats and the sampling technique that will be used in each section. One riffle may provide more favorable habitat characteristics than another. Remember that you are trying to sample the best available habitat conditions, and more sampling effort will be given to more favorable areas. A pool's community of macroinvertebrates is typically different from a riffle's community. Sample all available habitat types within the pool (roots, vegetation, banks, woody debris, etc). Based on the professional sampling that was conducted during 2012 and 2013, **teams should not take more than two (2) edge habitat samples.**

In order to make the most efficient use of time and volunteers, two teams may collect samples at one time. The first team will enter the stream at the bottom of the reach and take a total of five (5) samples while working their way upstream. The second team will start at the middle of the reach (roughly 150 feet away from the other team) and will take a total of five (5) samples while working their way upstream. This option is possible because:

- All of Arlington's sites have multiple access points. Volunteers do not need to walk through the sampling area to reach the mid and downstream reach sections.
- The rock rubbing method keeps the disturbed sediment from the upstream site to a minimum. Sediment from the upstream team should not impact the downstream team.
- The distance between the two teams minimizes the amount of the disturbed sediment from the upstream site reaching the downstream team.

The following steps summarize collection techniques:

Rock-rubbing Sampling Technique – used in riffles

1. In a team of two or three, approach from the downstream extent of the reach. Slowly walking upstream, identify areas within the riffle that appear to have stable, mid-sized substrate particles and faster-flowing water.

2. Once you have selected your first sampling location, place the dipnet against the bottom of the channel, perpendicular to the direction of flow. You may need to clear an area immediately downstream of the net to allow the base of the frame to rest flush with the streambed. Water should pass easily through the back of the net. Ensure that the net can lay flat against the bottom of the

channel. If there are rocks that do not allow the net to lay flat with an even, uninterrupted water flow, clear the rocks in the area of the net.

3. Select one team member to hold the dipnet in place, standing downstream and to the side of the net so not to impede flow. Select one or two other team members to perform the 'rub' within a 1 square foot area immediately upstream of the net.

4. Positioned to the sides of the net (not in front), pick up each rock and (still submerged) run hands gently over every surface. Allow the flow of water to wash dislodged particles/organisms into the net. If a rock is too large to lift, brush the surface in place. As each rock is brushed, place it outside the 1-foot sampling area. You may also wish to stack the rocks at the edges of the frame to improve flow into the net.

5. After all of the larger rocks have been cleared, carefully use your hands or a small 3-tine cultivator (see image to the right. Photo credit: http://www.gardentoolcompany.com) to fluff the substrate. "Fluffing" is a light disturbance of the top 1-3 inches of the stream bed sand and gravel. Again, allow the flow of the stream to carry dislodged particles into the net. Do not push sediment into it. Gloves and the 3-tine cultivator will help protect hands from glass or other sharp objects that are underwater hazards.

6. After 1 minute, tilt the dipnet back as you lift it out of the water so as not to lose the collected organisms in the net. **Return all of the rocks to their 1 foot square sampling area after you have removed the net.**

7. Holding the dipnet's handle parallel to the stream, and keeping the net and its contents above the water, rinse the net using a cup and stream water. This will help to remove fine materials from the net. Rinsing may require several cupfuls to do an adequate job of removing the sediment from the net. Check the outside of the net to see if any organisms may be clinging to the net. You don't want to wash them away while rinsing!

8. Rinse all of the collected material into one corner of the net while in the stream. Then transfer the net contents to a white basin by rinsing out the net and its contents with stream water. Turn your net inside out and carefully inspect the net to ensure that all of the organisms have made it into the white basin. All ten samples will be composited into one white basin.

Jab Sampling Technique – use in pools and edge habitat

1. With the jab method, one person maneuvers the net. An additional team member may help shake the hanging roots. After selecting an area to jab, approach from downstream.

2. With the dipnet mostly underwater, allow the back of the frame to stay above the surface. With your hand, place hanging roots and/or submerged vegetation directly into the net. Thrash the roots back and forth with your hand to dislodge any clinging organisms. Be careful to lift the roots and vegetation back out of the net before attempting to remove the net from the water. If the net is pulled downward and fully submerged, a portion of the sample may be lost.

An alternative to the "hand shake" option described in the two steps above is the "pop-jab" option. For more skilled practitioners, a pop-jab may be more efficient. This technique is accomplished by hooking the submerged roots/vegetation from below with the net. Then a quick tossing motion is used – similar to how you would flip pancakes in a skillet. A video demonstration of this technique is available at: http://www.youtube.com/watch?v=tbA1yzYDBDM&feature=youtu.be.

3. Submerged logs may also represent productive habitat. Sample by rubbing the surface with a flat palm and following your hand with the dipnet. Logs close to the surface may also be sampled with a pop-jab technique.

4. After each jab, rinse large items (leaves, sticks, rocks) in the net individually. Inspect the items for macroinvertebrates that may be attached. If there aren't any macroinvertebrates attached to the items, remove them from the net. Wash all of the collected material into one corner of the net and transfer it to a white wash basin by rinsing the net with stream water. All of the jabs will be composited into the basin.

Note: Shorter duration jabs are more efficient than longer ones. Take several shorter jabs in a localized area to maximize the ratio of organisms to non-biotic materials.

5. Macroinvertebrate Sample Processing

The ten samples are deposited into a single white tub. Sorting cannot begin until all of the samples are in the same basin. Move the wash basin containing the composited sample to a level, shaded area on the bank for sample processing. Fill the ice cube trays with stream water.

1. Using a white bowl, take a small random scoop of the sample from the large white basin. Scoop at random, without trying to select visible organisms.

2. Use forceps to methodically sort through all of the material. As you encounter organisms, use forceps, a pipette or spoon to place them in the ice cube tray compartments filled with stream water. Do not bias your sample by only selecting larger organisms. Be sure to look closely for smaller ones, as well, and sort the entire scoop completely before getting a new scoop. As you transfer organisms to the ice cube trays, place one organism per tray compartment.

3. When the entire scoop has been sorted, discard the water and debris (rocks, leaves, etc) back into a "sorted" container that will later be returned to the stream. *Someone should periodically check the "sorted" container to ensure that there are not any missed organisms.* Sort subsequent scoops completely until 100 organisms (±10%) have been collected or until the entire composited sample has been processed. If 100 organisms are not present in the entire sample, re-sort the "sorted" container. If necessary, go back to the stream and take additional samples using the dipnet. Note that additional samples were required on the data sheet.

4. Identify organisms using provided pictorial keys. Record tallies and totals on the Macroinvertebrate Tally sheet. If you cannot identify an individual, place it in a vial of ethyl alcohol and return it with the data sheet.

5. If there is remaining water and unsorted debris after 100 organisms (±10%) have been sorted using the method described in steps 1-3, look through the sample bucket for any undocumented families. If you find a "new" family, note it on the data sheet. Do not provide a count for the "new" family, just note that the additional families were also in the sample. *For example, the team has documented black flies, caddisflies, and lunged snails through the unbiased sorting method in steps 1-3 and you have counted 100 organisms. You know that there are crane flies and damselflies in the unsorted sample. Make a note on the data sheet that crane flies and damselflies were also found.*

6. After sorting is complete, return everything to the stream including leaves, rocks, water and organisms.

Questions?
Contact Lily Whitesell at lwhitesell@arlingtonva.us, 703-228-3042 (work) or 703-201-3763 (cell).

Glossary

- Embeddedness:
  - The degree to which an object is buried in stream sediment. (NRCS)
  - The extent to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom. (US EPA)

- Reach: 100 meters long (300 feet), this area is representative of the stream and is the location where monitoring will take place. (EPA)

- Riffle: Where the depth decreases due to the accumulation of large pebbles and stones or even an outcrop of rock. (www.lifeinfreshwater.org.uk/Web%20pages/Rivers/Channels.htm)

- Thalweg: The line followed by most of the streamflow. The line that connects the lowest and deepest points along the streambed. (NRCS)

Sources:

- Audubon Naturalist Society. Stream Quality Assessment Survey.

- U.S. EPA. 1999. Rapid Bioassessment Protocol for Use in Streams and Wadeable Rivers. EPA 841-B-99-002. http://water.epa.gov/scitech/monitoring/rsl/bioassessment/index.cfm

  - Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

- U.S. Department of Agriculture, Natural Resources Conservation Service. December 2009. National Biology Handbook, Subpart B-Conservation Planning. Part 614 Stream Visual Assessment Protocol Version 2.