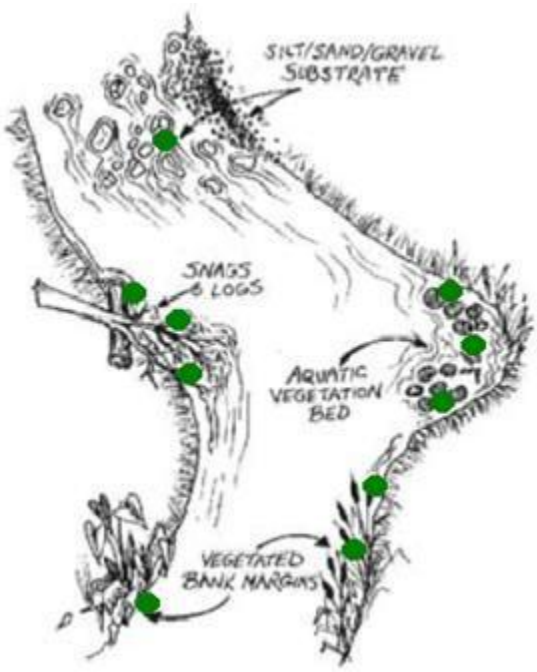
Collecting macroinvertebrates from low-gradient streams

The vast majority of stream-dwelling benthic macroinvertebrates live in the riffle areas formed when the water flows over irregularities in the stream bottom such as uneven bedrock layers, and aggregations of pebbles, cobbles and large boulders. The optimum habitat for macroinvertebrates is a riffle composed of moderately sized particles ranging in size from ten-inch cobbles down to one-inch gravel. However, streams and rivers in many states vary from high gradient, cobble dominated to low gradient with sand or silt sediments. Therefore, a method suitable to sampling a variety of habitat types is desired in these cases. Benthic macroinvertebrates are collected systematically from all available in-stream habitats by jabbing with a D-frame dip net or a small rectangular kick-net. A total of 10 jabs (or kicks) are taken from all major habitats. For example, if the habitat in the sampling reach is 50% snags, then 50% or 5 jabs should be taken that habitat. The **common habitats** of many low-gradient streams are described below:



1. **Cobble and gravel** are usually prevalent in the **riffles and runs**, which are a common feature throughout most mountain and piedmont streams. In many high-gradient streams, this habitat type will be dominant. However, riffles are not a common feature of most coastal or other low-gradient streams. Sample shallow areas with coarse (mixed gravel, cobble or larger) substrates by holding the bottom of the dip net against the substrate and dislodging organisms by kicking the substrate for 0.5 m upstream of the net.

2. **Snags and other woody debris** that have been submerged for a relatively long period (not recent deadfall) provide excellent colonization habitat. Sample submerged woody debris by jabbing in medium-sized snag material (sticks and branches). The snag habitat may be kicked first to help dislodge organisms, but only after placing the net downstream of the snag. Accumulated woody material in pool areas are considered snag habitat. Large logs should be avoided because they are generally difficult to sample adequately.

3. When lower banks are submerged and have **roots and emergent plants** associated with them, they are sampled in a fashion similar to snags. Submerged areas of undercut banks are good habitats to sample. Sample banks with protruding roots and plants by jabbing into the habitat. Bank habitat can be kicked first to help dislodge organisms, but only after placing the net downstream.

4. **Submerged macrophytes** are seasonal in their occurrence and may not be a common feature of many streams, particularly those that are high-gradient. Sample aquatic plants that are rooted on the bottom of the stream in deep water by drawing the net through the vegetation from the bottom to the surface of the water (maximum of 0.5m each jab). In shallow water, sample by bumping or jabbing the net along the bottom in the rooted area, avoiding sediments where possible.

5. The least productive habitats are **muddy and sandy substrates**; however, these may be prevalent in some streams. Sample banks of un-vegetated or soft soil by bumping the net along the surface of the substrate rather than dragging the net through soft substrates; this reduces the amount of debris in the sample.

Equipment:

1. Standard D-frame net or modified rectangular net;
2. Sample containers and labels;
3. 90-95% ethanol or rubbing alcohol;
4. Forceps;
5. Clipboard;
6. Data sheets and identification guides (if necessary); and
7. Buckets, strainers and collection trays.

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Collection and evaluation procedures

1. A 100-meter reach that is representative of the characteristics of the stream should be selected. Whenever possible, the area should be at least 100 m upstream from any road or bridge crossing to minimize its effect on stream velocity, depth and overall habitat quality. There should be no major tributaries discharging to the stream in the study area.

2. Before sampling, complete the physical/chemical field sheet to document site description, weather conditions and land use. After sampling, review this information for accuracy and completeness.

3. Draw a map of the sampling reach. This map should include in-stream attributes (e.g., riffles, falls, fallen trees, pools, bends, etc.) and important structures, plants, and attributes of the bank and near stream areas. Use an arrow to indicate the direction of flow. Indicate the areas that were sampled for macroinvertebrates on the map. Approximate "river mile" to sampling reach for probable use in data management of the water re-source agency. If available, use hand-held GPS for latitude and longitude determination taken at the furthest downstream point of the sampling reach.

4. Sampling **always** begins at the downstream end of the reach and proceeds upstream. A total of 10 jabs or kicks will be taken over the length of the reach; a single jab consists of forcefully thrusting the net into a productive habitat for a linear distance of 0.5 m. A kick is a stationary sampling accomplished by positioning the net and disturbing the substrate for a distance of 0.5 m upstream of the net.

5. Place the netted material into the first collection pan. Using forceps transfer any collected organisms to the second collection pan. Complete your streamside (qualitative) biological assessment form from the organisms collected, or preserve the sample for later identification and analysis. Document observations of aquatic flora and fauna. it is often a good idea regardless of the method chosen to make qualitative estimates of macroinvertebrate composition and relative abundance as a cursory estimate of ecosystem health and to check adequacy of sampling.

6. Record the percentage of each habitat type in the reach. Note the sampling gear used, and comment on conditions of the sampling, e.g., high flows, treacherous rocks, difficult access to stream, or anything that would indicate adverse sampling conditions. Perform habitat assessment after sampling has been completed. Having sampled the various microhabitats and walked the reach helps ensure a more accurate assessment. Conduct the habitat assessment with another team member, if possible.

Note: If your organization decides to complete independent surveys that include aquatic collections, you must apply for and receive a Scientific Collection Permit from the WVDNR. **CLICK-HERE** to view the program's 2011 permit.

References and additional resources

1. Field and laboratory methods for macroinvertebrate and habitat assessment of low-gradient streams (Mid-Atlantic Coastal Streams Workgroup)
2. Comparison of single and multi-habitat protocols for collecting macroinvertebrates from wadeable streams (Journal of American Water Research)
3. Protocols for sampling aquatic invertebrates in freshwater wetlands (Maine)
4. Macroinvertebrate sampling basics (Stroud water research center)
5. Rapid bioassessment protocols for use in wadeable streams and rivers (USEPA)
6. Multi-habitat macroinvertebrate sampling from wadeable streams (Georgia)
7. Waterwatch biological stream assessment procedures (Kentucky)
8. Protocols for sampling macroinvertebrates from wadeable streams (New Zealand)