

# Standard Operating Procedure 11: Habitat Sampling, version 1.0

## Overview

A crew of three people, including a data recorder and two measurers, is optimal for habitat sampling in smaller streams but four are definitely needed for safety and speed on the lower sections of the Rose, Rapidan, Hawksbill, and Hughes rivers. A fourth person increases efficiency (but is not necessary) on the lower Hazel, North Fork Moormans, and Piney Rivers. The steps below will assume three individuals are involved. Required equipment includes two spooled measuring tapes (30 m and 100 m), a cobble stick, a clinometer, a clipboard, D-net with marked handle, and a habitat data sheet (data sheet in SOP 16).

Habitat measurements start at the downstream start point of the sample reach as determined by the site location directions. Measurements are taken at 10 m intervals along each 100 m stream site after the insects have been collected. The 100 m measuring tape should be extended longitudinally between the upper and lower boundaries of the site. The tape should be placed along the middle of the stream. A large loop of parachute cord facilitates anchoring the tape to boulders, logs or debris at the start of the reach.

Measurements are to be made by proceeding upstream. All habitat measurements are recorded on a separate field sheet. A 30 meter tape is used to mark each transect in succession for the habitat measurements. The tape can be secured on the stream banks with stones, a large stick, or held once the third person is available. The overall scheme for habitat measurements is illustrated for a representative stream site in Figure 1. Note that transects T0 through T10 demarcate segments S1 through S10, respectively. Width, depth, riparian vegetation, and substratum are measured at each transect. Debris retention, fish cover, pool-riffle ratio, and % slope (gradient) are measured through each segment.

## Collecting Data

- 1) **Picture.** Before establishing the first transect, take a picture. See SOP 10 for details.
- 2) **Establishing the first transect.** Tie off the 100 meter (m) tape at the proper start location (i.e. directly adjacent to the tag tree, or based on description in site directions). To begin habitat data collection, stretch the 30 m tape from left to right across the stream channel and perpendicular to the direction of flow. Pull any slack out of the tape and take depth and substrate measurements from waterline to waterline width (wetted width). **Wetted width will always define the left and right bounds of a transect.** The width of the stream at each transect is recorded to the nearest 0.1m. So, when you get to the right hand bank, cross out the prerecorded distance on the field sheet and write in the actual width. (Note: When proceeding upstream past an island, the 100 m tape should always be extended up the center of the island).

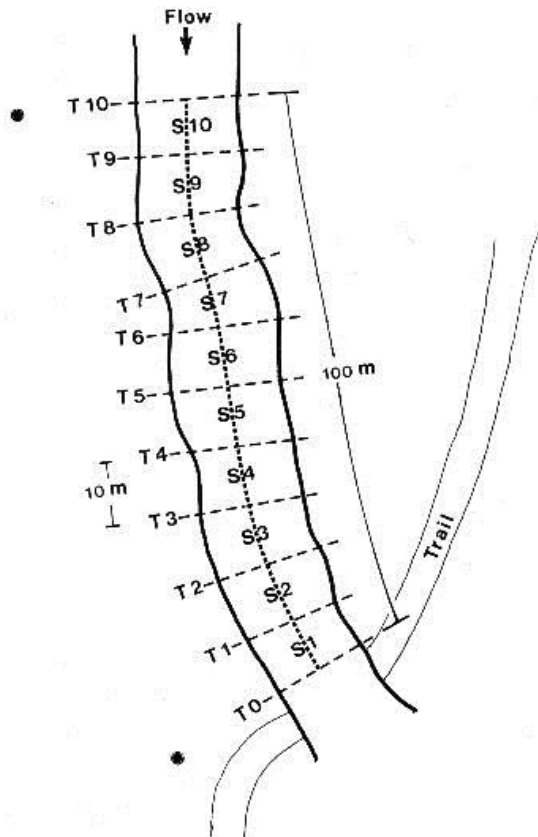


**Figure 1.** Diagram of stream reach. Depth, percent riparian vegetation, riparian vegetation type, and substratum are measured at each transect. Percent fish cover, Pool-riffle ratio, and % slope (gradient) are measured through each segment.

- 3) **Recording water depth and substrate.** Using the tape as a guide, water depths are measured and substrate types are estimated every 0.3m across the channel **from left to right (as you look upstream)**. At each 0.3m interval, water depth is measured to the nearest 0.01 m directly below the transect (i.e. tape) using the depth staff or “cobblestick” and recorded in the “depth” box for that point in the transect on the datasheet. At each point, categorize the dominant substrate material that is found within a visually estimated 15 cm diameter circle surrounding where the depth staff contacts the substrate. A length of PVC pipe with the substrate sizes delineated (“cobblestick”) is very useful for making rapid and accurate decisions on substrate size. Substrates size is estimated along the intermediate axis.

The table below notes substrate sizes and data abbreviations:

| Substrate Type | Data Sheet Abbreviation | Particle Size    |
|----------------|-------------------------|------------------|
| Bedrock        | “R”                     | Large, immobile  |
| Boulder        | “B”                     | >25 cm, mobile   |
| Cobble         | “C”                     | 6.0 cm – 25.0 cm |
| Pebble/Gravel  | “P”                     | 2.0 mm -6.0 cm   |
| Sand           | “S”                     | 0.2 mm - 2 mm    |

|         |     |                                                                |
|---------|-----|----------------------------------------------------------------|
| Silt    | "L" | <0.2 mm                                                        |
| Organic | "O" | Logs/moss/detritus/other vegetation                            |
| Island  | "I" | Rock or land structures greater than 30 cm high and 30 cm wide |

Substrate abbreviations are recorded in the "Substr" box for that point on the transect. Surface substrates, not underlying substrates, are recorded (e.g. if the streambed and associated cobble (C), boulder (B), or bedrock (R) substrates are covered with a layer of silt then silt or "L" is entered as the substrate value for that point. If a layer of moss, leaf debris, sticks or woody debris, or a thick layer of algae exists, then organic or "O" is entered as the substrate value for that point. In this manner, mid-stream wood jams would be recorded as having a zero depth and a substrate of organics. If there is an even mix of substrates, the recorded substrate will be determined based on the particle that the depth staff is contacting. By definition, the start and end points for a transect occur at the wetted edges of the channel and therefore, depths in these locations will always be zero (dry land). The last recorded point on a transect may not fall on the 0.3 meter mark, so cross that distance out on the data sheet and write in the proper distance, a zero for depth and the appropriate substrate observed at the endpoint. Stream depths and substrates are recorded at 0.3m intervals across every transect in the reach.

- 4) Recording percent riparian vegetation (Rip. Cov.).** From the center of the transect, the data recorder should estimate the percent of vegetative cover directly over the transect. The estimate includes all vegetation that extends over the wetted width of the stream above the transect. This measurement should be estimated ***as if the leaves of deciduous trees would be expected to be present.*** At each transect, look directly up and rank the amount of cover over the stream channel into one of four categories: 3 = 67-100% covered; 2 = 34-66% covered; 1 = 1-33% covered; and 0=None. This qualitative estimate is recorded on the habitat field sheet above the depth and substrate measurements for each transect in the section labeled "riparian cover". When the percent riparian vegetation is recorded as "0" (i.e. none), riparian type (see below) should always be recorded as "N" (i.e. none).

In Category 0 or 1 the stream is exposed to the sun almost the entire day. Categories 0 or 1 are not likely to occur in Shenandoah National Park unless there has been extensive perturbation of the surrounding forest. Category 1 is the situation that would normally be expected for a small stream located in a forest during the early stages of succession, or for a river which is too large for the trees to fully extend over the channel to provide shade. Most of the streams in Shenandoah, particularly the smaller ones at higher elevations, are likely to have riparian cover that fits Category 3. This is the condition when the limbs of most of the trees on both banks meet over the stream channel, thereby shading most of the water. In Category 2, the limbs of the trees do not meet over the water, but the trees are tall enough and the stream narrow enough that the water is shaded except during the middle of the day. Riparian cover will be recorded for each 10 m segment for the entire reach.

- 5) **Recording riparian vegetation type.** From the center of the transect, the data recorder should determine the dominant type of vegetative cover directly over the transect. The estimate includes all vegetation that extends over the wetted width of the stream above the transect. The goal is to determine the major vegetation input that would fall or blow into the stream. Vegetation is differentiated between trees (T), shrubs (S) (less than 5 m in height), grasses/forbs (G), or none (N). When vegetation type is recorded as “none” (N), it should always be accompanied by a 0% (0) determination for percent riparian cover. This qualitative estimate is recorded on the habitat field sheet above the depth and substrate measurements for each transect in the section labeled “Type”. Riparian vegetation will be recorded for each 10 m segment for the entire reach.
- 6) **Recording gradient (%Grad; see SOP 12 for additional details).** After substrate, depth, and riparian vegetation have been recorded for the transect, the 100 m tape should be secured at the site start point in the center of the channel. With the endpoint securely anchored, the 100 m tape should now be extended upstream at mid-channel. Each 10 m interval on the tape is marked with a strip of colored electrical tape so that it can be readily distinguished at a distance. At 10 m, any slack should be pulled out of the tape from the upstream end. When multiple channels are encountered, run the tape up the center of the “island” (for discussion of islands, see step #11). Using a clinometer, gradient should be measured (in %) between the 0 and 10 m transect. Gradients are shot from an individual standing in the water in the center of the channel at the 0m transect to an individual standing in the water at the center of the 10 m transect. In most cases, gradient will be a positive number but it can be negative (e.g. the person at the 10 m point is standing in a deep pool.) **It is important to note that the gradient value estimated from the 0 meter transect of the monitoring site must be recorded in the 10 m distance row on the data sheet.** The space for gradient on the “0” distance row is crossed out for this purpose. Gradient measurements will be recorded at each 10 m interval up to the upstream end of the monitoring site (100 m for all sites excluding 1F308 and 2F303, which end at 60m and 50m respectively). The 10 m offset on the data sheet will provide a gradient value that corresponds to the last recorded distance measured at the upstream end of the monitoring site. See SOP 12 for clinometer use.
- 7) **Recording pool habitat.** Following gradient determination, the data recorder walks upstream through the first 10 m section and conducts a visual estimate of the relative amount of pool versus riffle habitat. Pool habitat is defined as wetted habitat with an apparent water velocity of zero (0). Riffle habitat would constitute all other portions of the channel. Current must be estimated visually. It should be kept in mind that pool-riffle ratios refers only to major differences along the length of a segment and that minor differences across the width of a segment are disregarded. Pocket water in the channel during low flow can be considered as a pool; glides and runs (smooth, slow-flowing water) are considered to be riffles.

Pool and riffle habitat are estimated as a percent of the total wetted channel, but are recorded as integers between 0-10. As such, the relative amounts of pools versus riffles for each 10 m section should always be two numbers that add up to ten. The 100 m tape that is stretched longitudinally along the channel is helpful, but pool-riffle is still largely a

qualitative estimate. Pool habitat will be recorded for each 10 m segment for the entire reach.

**Note that pool and riffle habitat data also have a 10 m offset on the data sheet.** The first recorded values for these habitats must be recorded in the “10” distance row on the data sheet. The spaces for “pool” and “riffle” on the “0” distance row are crossed out for this purpose. As for gradient, the 10 m offset on the data sheet will provide a set of habitat values that corresponds to each 10 m section including the last measured section at the upstream end of the monitoring site.

- 8) Debris Retention.** Examine each segment between adjacent transects and categorize them according to the percentage of cover of retention structures: 3 = 67-100%; 2 = 34-66% and 1 = 1-33%. For example, when visualizing a segment from above, a “3” would have debris retention structures distributed across 67-100% of the wetted segment. Debris retention structures include rock outcrops, boulders, trees rooted in the channel, and fallen logs. The amount of debris accumulated on the structures does not enter into the decision. The estimate should include structures that would function at low and high levels of flow. This qualitative estimate is recorded on the habitat field sheet above the depth and substrate measurements for each transect in the section labeled "Debris Retention". Debris Retention will be recorded for each 10 m segment for the entire reach.
- 9) Fish Cover.** Examine each segment between two adjacent transects and categorize them according to the abundance of fish cover. Fish cover is considered to be places where a 150 to 200 mm (6 to 8-inch) brook trout could hide without being visible from above. Structures that provide cover are large rocks, logs, undercut banks, turbulence/whitewater, and terrestrial vegetation that bends over into the water. In order to be usable cover, the water must be at least 15 cm deep and the current should be less than 15 cm/s. In addition, depth and velocity alone can define fish cover, and any water >25 cm in depth and < 15 cm/s in velocity should be considered fish cover. Depths and velocities must be estimated visually when categorizing fish cover. These qualitative estimates should be made according to the existing water level: 3 abundant = 67-100% (more than 67% of segment has cover); 2 intermediate = 34-66% (34-66% of segment has cover); and 1 exposed = 1-33% (less than 33% of segment has cover). This estimate is recorded on the habitat data sheet above the depth and substrate measurements for each transect in the section labeled "Fish Cover". Fish cover will be recorded at each 10 m transect for the entire reach.
- 10) Establishing the next transect.** At this point, the entire habitat crew should be assembled at the 10 m distance point along the monitoring site. Begin another transect by stretching the 30 m tape across the stream channel, making sure it intersects the 100 m tape at the appropriate 10 m interval. Again, all transects are perpendicular to stream flow. The same sequence for measuring or estimating stream channel width, depths, substrates, riparian cover, gradient and habitats must be followed at each subsequent 10 m distance interval as described above.

**11) Islands.** Islands are rock or land structures greater than 30 cm high and 30 cm wide that support perennial vegetation. It is nearly impossible to eliminate all braided channels. An original attempt was made to reduce long sections of braids (entire transects and braids over 30 m long) during the site selection process – but, streams change. The 100 m tape should be run through the center of the island. If a transect falls within the island the following factors need to be addressed: A) slope – slope should be taken standing in the largest channel. B) The 30 m transect tape should cross the island just like it would cross the rest of the channels. Take habitat data or the wetted width of the first channel, use “0” depth and whatever the substrate is until the land is 30 cm above the water’s edge and then “0” depth “I” for substrate. Close to the second channel beware of the 30 cm height point and resume normal measurements.

**12) Ending the Sample Reach.** With the exclusion of 1F308 and 2F303, all sample sites should end at 100 m (1F308 and 2F303 end at 60m and 50m respectively as is documented in those specific site directions). Gradient and habitat measurements are continued up to the endpoint (i.e. through the final segment) with depths, substrates and riparian cover are measured at the endpoint transect as described above.

## SOP Revision History

All protocols, regardless of how sound they are originally, require modification as new and different information becomes available. SOP version numbers increase incrementally by tenths (e.g. version 1.1, version 1.2...etc.) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0 ...). Small changes or additions to existing methods will be reviewed in-house by Shenandoah or Mid-Atlantic Network staff. However, if a complete change in methods is sought, an outside review is required.

### Revision History Log:

| Prev. Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
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