



## **TVWA Bio-assessment Program**

(This information is adapted from: *M. T. Barbour, J. Gerritsen, and B. D. Snyder, eds. Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish. Second Edition. EPA 841-B-99-002 United States Environmental Protection Agency, Washington.*)

Bioassessment is an evaluation of the condition of a waterbody using biological surveys and other direct measurements of the resident biota in surface waters. Biological communities reflect overall ecological integrity of systems and integrate the effects of different stressors. Monitoring of biological communities is also relatively inexpensive, especially when compared to the costs of assessing toxic pollutants, and the status of biological communities is of direct interest to the public as a measure of environmental health of a system.

### Periphyton (Benthic Algae) Collection - General

Periphyton is composed of primary producers and is an important foundation of many stream food webs. These organisms also stabilize the substrata that serves as habitat for many other organisms. Diatoms, a type of algae and part of the periphyton community, are particularly useful ecological indicators because they are found in abundance in most stream ecosystems. The great numbers of species provide multiple, sensitive indicators of environmental change and the specific conditions of their habitat. Algae also have very short life cycles, making them valuable indicators of short term impacts. As primary producers, algae are most directly affected by physical and chemical factors. Algal assemblages are sensitive to some pollutants that may not visibly affect other aquatic assemblages or may only affect them at higher concentrations. Sampling periphyton is also easy, inexpensive, and requires few people.

### Periphyton Sampling Methods

Due to the restrictions imposed on our project by limited budget and time and the depth, velocity, and sediment characteristics of the Yukon River, we will be sampling periphyton (benthic algae) with a focus on diatoms using artificial substrates for colonization. Plexiglass plates fitted with plexiglass shields will be used for colonization substrates. Plates will be cleaned with acetone and wiped with Kimwipes prior to being deployed at sites and in between sampling periods. Periphyton sampling will be conducted at all sites chosen for macroinvertebrate sampling (described below). Shade will be recorded at each site by estimating the percent overstory cover within 5 square meters of the sampling site. Periphyton sampling plates will be attached to the line of the

macroinvertebrate sampler (see below) at three places along the line. One plate will be placed near the surface of the river, one half way down the line, and one just above the wire envelope used for macroinvertebrate sampling. Plates will be free swinging on the line so that the shields will be facing upstream to protect the plate from sediment scouring. The plates will be checked three times during the open water period (June – August) at three week incubation intervals. The plates will be deployed during the first week of June after the initial snow melt and high water system has subsided and the water level has dropped. Algae will be removed from the plates at these times using toothbrushes and razor blades. Algae will be removed from slides and rinsed into a white plastic or enamel pan or directly into a water-tight, unbreakable, wide mouth 1000 ml container using a wash bottle and distilled water. If washing samples into white pan first, pour combined samples into 1000 ml container and use wash bottle to rinse pan into bottle. The samples will be thoroughly mixed in the 1000 ml container and then a 125 ml subsample will be transferred to a 125 ml bottle using a turkey baster. For the 125 ml sample, 375 micro liters of Lugol's solution or some other iodine based solution will be added for sample preservation (0.3 ml for every 100 ml of sample). A permanent label will be placed on the outside of the 125 ml sample container with the following information: water body name, location, station ID #, date, name of collectors, initial sample volume, type of preservative. Make sure the information on the data sheet and sample label are the same. Caution! Lugol's solution will turn paper black.

Examine all brushes and scraping tools for residues, rub them clean and rinse them in distilled water before sampling the next site or putting them away. All other equipment that came into contact with samples should also be rubbed clean and rinsed with distilled water between sampling sites and before being put away. All equipment should also be examined and cleaned when necessary prior to use at the next sampling site. After sampling, review the recorded information on all labels and forms for accuracy and completeness.

Transport samples back to laboratory in cooler with ice (keep them cold and dark). And store preserved samples in dark place until they are processed. Be sure to stow samples in a way so that transport and shifting does not cause samples to leak. Samples will be sent to a qualified periphyton taxonomist for identification.

#### Equipment List - Periphyton

Plexiglass plates with shields

Toothbrush, razors

Wash bottle with distilled water

White plastic pan

Sample containers

Field notebook/data forms

Preservative (Lugol's solution)

Cooler with ice

#### Macroinvertebrate Sampling - General

Macroinvertebrate assemblages are good indicators of localized conditions. Because aquatic macroinvertebrates generally have somewhat limited migration and dispersal patterns, they are well-suited for assessing site-specific impacts. They integrate the effects of short-term environmental variation, and sensitive life stages will respond more quickly to stress than the overall community. Macroinvertebrates are also important prey species for a number of fish, making them ecologically important.

#### Macroinvertebrate Sampling Methods

Due to the restrictions imposed on our project by limited budget and time and the depth, velocity, and sediment characteristics of the Yukon River, we will be sampling macroinvertebrates using artificial substrates for colonization. Artificial sampling will also allow us to sample widely within the Yukon River watershed while controlling for the confounding effects of habitat differences among sites. Macroinvertebrates will be sampled near stations already designated by TVWA for water quality monitoring.

Artificial substrates for macroinvertebrate colonization will consist of an 8 x 8 inch envelope made out of 0.5 inch chicken wire and filled with a consistent amount of natural rocky substrate and woody debris. The substrate will be collected at one site along the Yukon River and will be of consistent quality and quantity within all envelopes. Envelopes will be attached to a length of leadline that will be long enough to reach from shore to the bottom of the river. The line will be firmly attached to trees or shrubs along shore and at the end of the line will be an anchor to keep the line submerged. In the first sampling season, there will be two sets of lines with envelopes at each sampling site to determine the best collection method to avoid sedimentation of the envelopes. On one line, the envelope will be placed 1 meter above the anchor, while on the second line, the envelope will be placed just above the anchor. Both lines will be located within an eddy or slower moving water along the river and will be as close as possible to each other without tangling. Envelopes will be checked and macroinvertebrates collected 3 times per open water season at three week intervals. Lines will be pulled up, taking care to disrupt or scrape the envelope as little as possible. The contents of the envelope, as well as the empty envelope itself, will be placed in a white plastic bucket and washed with distilled water. Substrate and envelope will also be inspected by hand to remove any invertebrates still remaining. Forceps may be needed to remove organisms from substrate. Water in bucket will then be poured through a 250 micron sieve. Invertebrates collected on sieve will then be placed in a plastic bottle or whirl pack for preservation with  $\geq 75\%$  isopropyl alcohol or 95% ethanol. The volume of preservative added will be at least two times that of the sample volume, to avoid sample decomposition. A permanent label will be placed on the outside of the sample container with the following information: water body name, location, station ID #, date, name of collectors, initial sample volume, type of preservative. A label with the same information should be placed inside the container. Make sure the information on the data sheet and sample label are the same.

After sampling is complete at a given site, all sampling equipment will be rinsed thoroughly, examined closely and cleaned of any remaining organisms or debris; this includes substrate and envelopes. Any additional organisms should be placed into the

sample containers. Substrate will be placed back into envelopes and redeployed at sampling site.

Equipment List- Macroinvertebrates

Wash bottle with distilled water

Extra distilled water for washing substrate

Forceps

White bucket

250 micron sieve

Sample containers

Preservative (>75% isopropyl alcohol, 95% ethanol)

Field notebook/data forms