BENTHIC MACRO INVERTEBRATE SAMPLING IN THE YUBA RIVER WATERSHED USING THE CALIFORNIA STREAM BIOASSESSMENT PROCEDURE

2006 Protocol Brief for SYRCL River Monitors

The South Yuba River Citizens League (SYRCL) follows the California Stream Bioassessment Procedure (CSBP) -- a standardized protocol for assessing biological and physical/habitat conditions of wadeable (< 1.5 m) streams in California – when conducting benthic macroinvertebrate (BMI) sampling. The CSBP is a regional adaptation of the US EPA Rapid Bioassessment Protocols. Bioassessment using BMIs is a cost-effective tool because aquatic insects have a diverse community structure with individual species residing within the stream for a period of months to several years. BMIs are sensitive, in varying degrees, to temperature, dissolved oxygen, scouring, sedimentation, nutrient enrichment and chemical and organic pollution. Assessment measures integrate the effects of water quality over time and provide citizens with an understanding of ecological health of the river system.

The purpose of this Protocol Brief is to introduce the techniques of bioassessment to citizen monitors and to ensure that the data that is generated can be used by state regulatory agencies and will be compatible with a statewide bioassessment effort. Additional information can be obtained at the CSBP web site at www.dfg.ca.gov/cabw/cabwhome.html. We have obtained a DFG Scientific Collecting Permit; a copy of it will accompany each sampling team.

Equipment needed per team:

Equipment List for Check in-
Data sheet-
Clipboard-
California Bioassessment Protocol: Bug Collecting and Pebble Counts
Measuring tape 150 meter, 150 M. cord or Rangefinder
Random Number Table on card, or Wrist Watch
GPS unit-
pH/water Temp meter-
Alkalinity Kit-
Conductivity Meter-
D-shaped kick net (500 microns or 0.5 mm mesh)
Brass or plastic Sieve -
3 Toed Garden Tool for rock rubbing
White sampling tray-
Waste bottles-
Sampling Jars, 1-2 per site, to hold samples

Squeeze bottle to wash net-
Forceps, for cleaning net, 2 per site
Magnifying glasses for viewing bugs, 2 per site
95% ethanol in jug, for preserving BMIs
Rite-in-Rain paper labels for inside jars, write with pencil
Labels for outside jar, write in pencil
Ski Pole - Metric Ruler, 1000 mm
Orange for Discharge Measurement
Diving or gardening gloves are optional, recommended
2 buckets for elutriation of bug sample and carrying gear
Felt Wading Boots and river walking, layered clothing
Digital Camera - Densitometer - Clinometer or Auto Level
Flags labeled A-K and 8 additional flags for bug riffles

SYRCL Standard Operating Procedures

Arrival

1. Begin at predetermined site near the SYRCL monthly monitoring site
2. Record on datasheet Site Name, date, time, GPS cords at bottom of reach, team members.
3. Complete both sets of labels in pencil with Site Location, Transect #, Date, Time. Store safely until after sample is collected.
4. Take Alkalinity, pH and Water Temp, Conductivity. We will use D.O. from monthly monitoring.
5. Take photos of river and shore at Transects A, F and K (up and down).
6. Record any comments throughout the day in comments section.

Locate Reach and Transects

1. Measure entire reach: if wetted width ≤ 10 =150 m reach; if >10m = 250m, then mark off 11 equidistant transects moving upstream.
2. Walk reach and note areas of reach inappropriate for transects due to non-riffle habitat, uneatable depth, or other unsafe areas. Record sections of reach not available for sampling by noting tape locations (for example, “0 to 95 m and 110 to 150 m”).
3. Select eight transect locations by drawing three-digit random numbers between 000 and 150 excluding the nonviable areas using a random number table.
4. Measure and record the river wetted width. This and next step should be done after sampling BMIs.
5. Measure and record depth along each transect at 5 places across the river: One meter in from each edge and three across the middle. You can leave The average line blank.

Discharge - Neutrally Buoyant Object Method for rough estimations

Ideally, the float should move with the same velocity as the water, just below the stream surface. An orange, orange peel or ice cubes are appropriate. Find a straight reach with minimum turbulence and an interval selected and marked. Allow a float time of at least 20 seconds. The interval should overlap one or more surveyed cross sections (cross section where there are known

depth and width measurements). The float is introduced upstream of the reach so it reaches the speed of the water before timing starts. In larger streams (>10m width) cross sections should be divided into three or more sub-sections. Floats are introduced at the midpoint of each section. Several runs should be made to obtain an average.

Notable Field Conditions - complete on data sheet

Bug Collecting

1. Carry kick net, jars, ethanol, labels, gloves (opt), white tray and sieve, magnifiers, forceps, bucket and densiometer to the first transect, A.

2. Determine net placement within each habitat unit by generating a pair of random numbers between 0 and 9. Examples of convenient random number generators include the hundredths place on the stopwatch feature of a digital watch or a random number chart. The first number in each pair (multiplied by 10) represents the percent upstream along the habitat unit's length. The second number in each pair represents the percent of the riffle width from right bank. For example, if the two generated random numbers are 4 and 7, you will walk upstream 40% of the distance of the riffle and then go 70% of the distance across the riffle. This position is the center of the 1 ft2 (0.09 m2) sampling quadrate for that riffle. If you are unable to sample this location because it is too deep or it is occupied by a large boulder, select a new pair of random numbers and pick a new spot.

3. At the first of these sites, one person places the net firmly in the gravel or cobble substrate, holding the handle firmly, standing downstream of net. Another person **GENTLY** disturbs a 1 square-foot section upstream of the net, rubbing with a gloved hand, kicking rocks and/or using clawed garden tool to an approximate depth of 6 inches to loosen substrate for 2-3 minutes, allowing it to flow into net. Attempt to pull out rocks and large leaves from net though checking to keep the bugs inside. Cast clean rocks to the side or downstream to avoid altering pebble count transects. Finally, splash water on outside of net, knocking bugs to bottom of net. Please work gently to keep the bugs as intact as possible!

4. Move upstream to the next randomly selected habitat unit and repeat steps, taking care to keep the net wet but uncontaminated by foreign material when moving the net from riffle to riffle. Sometimes, the net will become so full of material from the streambed that it is no longer effective at capturing BMIs. In these cases, the net should be emptied into sample jars. Use the bucket and sieve in using the elutriation technique to remove large debris, sticks, gravel and rocks, after ensuring no bugs are attached. After inverting the net, remove clinging insects from net with forceps. After inverting the net, remove clinging insects from net with forceps.

5. Continue until you have sampled eight 1ft² (0.09 m²) of benthos, holding net so no tiny bugs escape. Transfer bugs carefully to white tray for observation and casual ID (optional).

6. Combine all samples within the net to make one composite sample using preferably one jar, two if necessary.

7. Place completed waterproof paper label inside jar. Be sure inside and outside labels match with sample collected. Cover in ethanol. Gently agitate contents if there is sand or mud present to help mix the alcohol, taking care to not damage any organisms inside. Seal jar with saran wrap tightly. Keep jars upright in bottom of bucket to prevent agitation or spillage.

Transect Dimensions- Start with the downstream transect

Wetted Width: The wetted channel is the zone that is inundated with water and the wetted width is the distance between the sides of the channel at the point where substrates are no longer surrounded by surface water. Measure the wetted stream width and record this in the box at the top of the transect form.

Bankful Width and Depth**:** The bankful channel is the zone of maximum water inundation in a normal flow year (one to two year flood events).

Densiometer (Canopy Cover) – done at each transect

1. Take four Densiometer readings to get % Canopy Cover from the center of each Transect. Take two readings while standing at each river edge facing the shore (RR & RL); then standing in the center of the river: one facing downstream CD, one upstream CU. Holding the densiometer one foot above the water, keeping it level, see your face in the mirror, then move your face towards your body, just out of view of the mirror.

2. Count how many intersections of the lines and corners 0-17 above the black tape contain canopy and then shout numbers for each direction to recorder or writes them on the front of the data sheet.

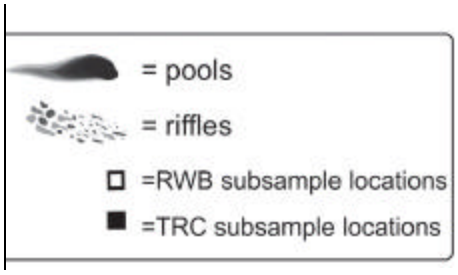
Reach Slope

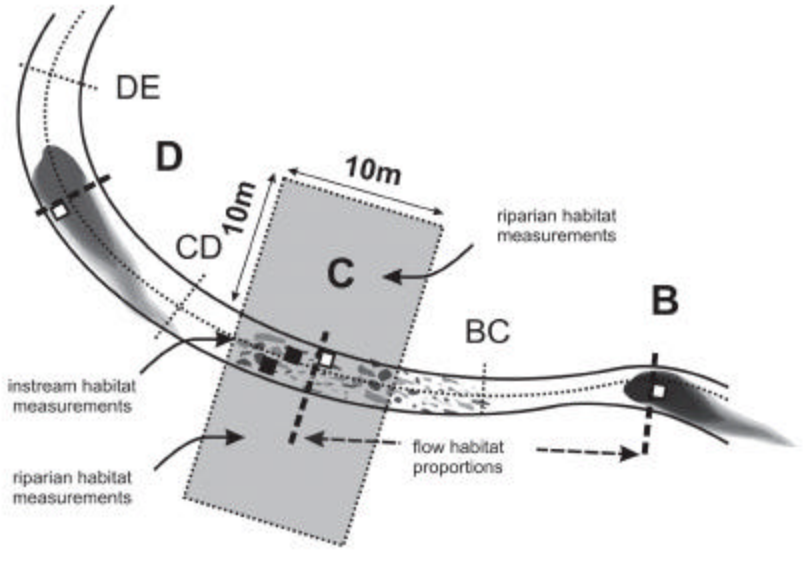
Slope measurements work best with two people, one taking the readings at the upstream transect and the other holding a stadia rod at the downstream transect. Divide the reach into multiple segments such that stadia rod markings can be easily read with the measuring device to be employed. An auto level should be used for reaches with a percent slope of less than or equal to 1%. All methods (clinometer, hand level, or auto level) may be used for reaches with a percent slope of greater than 1% to measure the percent slope of the water surface (not the streambed) between the top and bottom of each segment. Be sure to adjust for water depth by measuring from the same height above the water surface at both transects. Record percent slope, not degrees slope. Record the segment length for each of these sections in the appropriate boxes.

Additional Habitat Characterization – Complete for three parameters

Visual Estimates of Instream Habitat - (5m upstream and 5m downstream)

Riparian Vegetation, Bank Stability and Flow Habitats - (for left and right banks, in estimated 10 X 10m riparian area centered on the edges of the transect). Record for each Transect.





Pebble Count Procedure – done two feet upstream of bug sampled sites, following invertebrate collecting

Once bugs have been collected from the first riffle, the pebble count may be started in that same riffle by another team, staying downstream of all sampling.

Pebble Count Equipment:

- Meter Stick marked with relevant size-class distinctions
- Ski-pole
- Data sheet for particle sizes, clipboard and pencil

In this procedure, you will measure the particle size distribution of the streambed from which the BMI samples are taken. It is best for two people to perform this procedure: one to pick up and measure rocks exclusively and the other to record. A second pebble counter can reduce the time

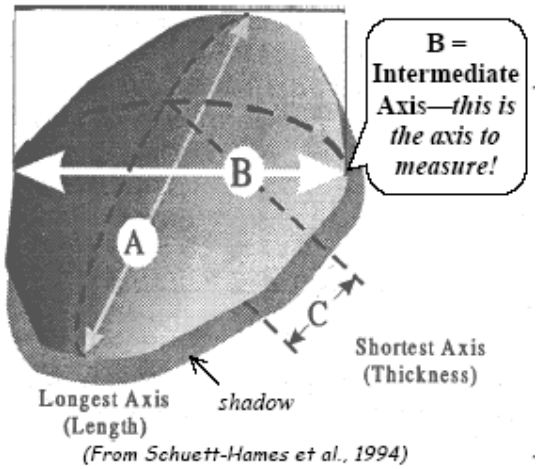
required. Each should start on opposite sides of the river and meet in the middle and both counters must be carefully coordinated by the recorder.

1. The location of the pebble counts should represent the location of the BMI sampling, as closely as possible. Sample along the same three cross-section transects from which BMI samples are taken.

2. The counter(s) will walk back and forth, at least once, for each of the eight transects. A total of 100 minimum particles must be measured, so each back and forth crossing must have at least 12-15 particles measured or additional complete crossings until that number for that transect is obtained. Each crossing is a trip from wetted edge to wetted edge. Do not stop midway; continue walking and counting for full crossings.

3. Walk straight across this channel, heel-to-toe or with a natural sized step without looking down to avoid biasing foot placement. With each step, insert the ski-pole or rod straight down to the stream-bottom along the line drawn at the tip of your boots. Measure whatever you first touch with the rod, be it silt, gravel, or a boulder.

4. Pick up the particle and measure its diameter along its intermediate axis, which is perpendicular to the other two. To find this, first find the longest axis; then find the smallest axis that is perpendicular to the longest axis. There is now one more axis that is perpendicular to both the longest and shortest axes--that is the intermediate axis. See diagram below. Shout the size and whether it is Loose or Embedded to the recorder. If you can pick up the particle, it is recorded as a tally in the "Loose" column on your data sheet.



(From Schuett-Hames et al., 1994)

5. If you've hit fine sediment, you don't need to pick it up. Just call out "fines," and the recorder will enter a tally in the "<4 mm" row (see data sheet). If you hit fine sediment that covers a rock completely (not sporadically), count the fines, not the rock. You can tell if you've hit fines, because the rod will make a "thud" (rock covered by algae). You can confirm this fact in a couple of ways: "scrunch" (sand/silt) or "squish" (mud") sound rather than a "thunk" (rock) or:

a) Look for a plume of dirt that flows downstream after you lift up the rod.
b) If you're not sure whether what covers the rock is silt or algae, jiggle the rock, and if the covering easily washes away, it is fine sediment, not algae.

6. Don't count bedrock, trash, or vegetative debris. If the rod hits loose leaves or garbage, attempt to clear the material away in order to identify a single substrate particle. If the material can not be cleared away easily, take another step.

7. If you can't easily remove the rock from the bed, excavate around it and measure it in place. The intermediate axis will be the smaller of the two exposed axes. You will tally these pieces in the "Embedded" column on your data sheet.

8. Record each particle as a length within the following classes: < 4 mm; 4-8 mm; 8-16 mm; 16-32 mm; 32-64 mm; 64-128 mm; 128-256 mm; 256-512 mm; 512-1024 mm; >1024 mm. These geometric increments facilitate calculation of particle size statistics.

9. For <u>each particle</u> measured, make <u>two tallies</u> on your data sheet:

a. One in the appropriate row for size class, in either the "Loose" or "Embedded" column (not both!). Embedded particles are resistant to removal due to adherence of mud and sand.

b. And one in the "Total" column, to keep track of how many total particles you've counted. Draw labeled lines (e.g. "end T1") across the Total column indicating moves between transects.

10. The recorder should verbally repeat each measurement and column back to the counter for error checking before placing the tally mark.

11. If you are on a big boulder and the next step is still on the same rock, tally that rock again. If your foot falls on a rock that you can't stand on, put your foot on top of it and keep your weight on the other foot while you reach down with the rod. If you have to move your forward foot for whatever reason, try to make your next step start from wherever your forward foot would have been.

12. Even when 100 tallies are obtained, all counters must continue their counting to the other side of the channel to get even distribution. If you have two pebble counters and need only one more crossing, one can start on each side, and they should meet in the middle.

This protocol borrows from the Clallam County Streamkeepers Field Procedures (<u>http://www.clallam.net/streamkeepers/assets/applets/PebbleCt.pdf</u>).