Department of Pesticide Regulation
Environmental Monitoring Branch
1001 I Street
Sacramento, CA 95812
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STUDY #233: Benthic macroinvertebrate comparison study using Hester-Dendy samplers

I. INTRODUCTION

Biological monitoring (bioassessment) is becoming a widely used and accepted method for evaluating water quality throughout the United States (SWRCB, 2003). Periphyton, aquatic vertebrate and benthic macroinvertebrates (BMIs) are commonly monitored aquatic assemblages in bioassessment monitoring (U.S. EPA, 1999). In order to conduct a cost-effective, scientifically valid rapid biological assessment, monitoring may be reduced to one aquatic assemblage (U.S. EPA, 1999). BMIs are the common aquatic assemblages measured in rapid monitoring protocols. They are useful in evaluating the overall health of flowing water systems, and are affected by changes in a stream's chemical and or physical structure (Karr and Kerans, 1991). Their sensitivity to stresses (temperature, dissolved oxygen, chemical and organic pollution) allows them to be effective indicators of specific anthropogenic disturbances (House et al., 1993).

Lotic waters within the California central valley have been greatly altered to accommodate for urban and agricultural development. Physical habitat (vegetation and substrate) is often times reduced or removed completely, greatly impacting aquatic organisms within the stream. One method of examining a BMI community in an impaired watershed is to create an artificial substrate for BMIs to colonize on, hence substituting for the loss of natural substrate, vegetation and other organic matter used to colonize on. Artificial substrates can be used to measure possible historical BMI conditions prior to anthropogenic disturbances. They can also be used to measure the effect of water quality on BMI populations, without the added impact from the surrounding impaired physical habitat.

In order to determine maximum diversity and population size obtainable using artificial substrate samplers, proper placement and length of time within a stream system should be examined first.

II. OBJECTIVE

The objective of this study is to compare taxa variation and population size from Hester-Dendy (H-D) artificial substrate samplers placed at various locations within a stream. Additionally, we will compare taxa variation and population size from samplers placed in a stream for various lengths of time.

III. PERSONEL

This study will be conducted by staff from the Environmental Monitoring Branch, Surface Water Protection Program under the general direction of Kean S. Goh, Agricultural Program Supervisor IV. Key personnel are listed below:

Project Leader:	Juanita Bacey
Field Coordinator:	Michael Mamola
Senior Scientist/Statistician:	Terri Barry
Taxonomists:	Bidwell Institute, University of California, Chico

Questions concerning this monitoring study should be directed to Juanita Bacey, Environmental Research Scientist, at (916) 445-3759.

IV. STUDY PLAN

EPA recommended Hester-Dendy (HD) artificial substrate samplers will be used. These samplers consist of 14 round plates of natural, water-resistant masonite spaced on an 8 inch eyebolt (Mamola, 2005). HDs will be deployed in three separate streams for a total of 54 units (Figure 1).

At each stream, three replicate H-D samplers will be deployed in three locations and for two time periods:
Site 1: 6 HDs placed in the water near the bank/vegetation (3 deployed for 4 weeks and 3 deployed for 6 weeks)
Site 2: 6 HDs placed in center stream, hung 1ft. below the surface of the water from a buoy (attached to cement block to prevent floating downstream; 3 deployed for 4 weeks and 3 deployed for 6 weeks)
Site 3: 6 HDs placed in center stream, on the substrate or floor of the creek, placed just above any mud (3 deployed for 4 weeks and 3 deployed for 6 weeks)

V. BENTHIC MACROINVERTEBRATE SAMPLING METHOD

Sampling will be conducted per DPR SOP EQWA006 (Mamola, 2005): "Procedure for Collecting Benthic Macroinvertebrates using a Hester-Dendy Sampler".

VI. MACROINVERTEBRATE ANALYSIS

Bidwell Institute at the University of California, Chico, will perform macroinvertebrate identification. Quality control will be conducted in accordance with previously established California Department of Fish and Game procedures (DFG QC, 2000). A sub-sample of 500 macroinvertebrates will be identified to genera and, when possible, to species.

VII. DATA ANALYSIS

Macroinvertebrate analysis procedures are based on the U.S. EPA's multi-metric approach to bioassessment data analysis. A taxonomic list of the BMIs identified in each sample will be generated along with a summary consisting of BMI metrics.

A nested analysis of variance statistical method will be used to compare significant differences between the various locations and lengths of time deployed in the water (Zar, J.H. 1996).

VIII. TIMETABLE

Field Sampling: November 14 through December 28, 2005
Final Report: December 30, 2006

XII. BUDGET

Bioassessment Analysis	Cost at $567/sample			
BMI identification	3 streams x 18 samples	54 samples	=	$ 30,618
Total				**$30,618**

IX. REFERENCES

DFG QC. 2000. California Department of Fish and Game, Aquatic Bioassessment Laboratory QAPP. See attachment A.

House, M.A., J.B. Ellis, E.E. Herricks, T. Hvitved-Jacobsen, J. Seager, L. Lijklema, H. Aalderink, I.T. Clifforde. 1993. Urban Drainage-Impacts on Receiving Water Quality. Wat. Sci. Tech. 27(12), 117-158.

Karr, J.R. and Kerans, B.L. 1991. Components of Biological Integrity: Their Definition and Use in Development of an Invertebrate IBI. U.S. EPA Report 905-R-92-003, Environmental Sciences Div., Chicago, IL, 16 p.

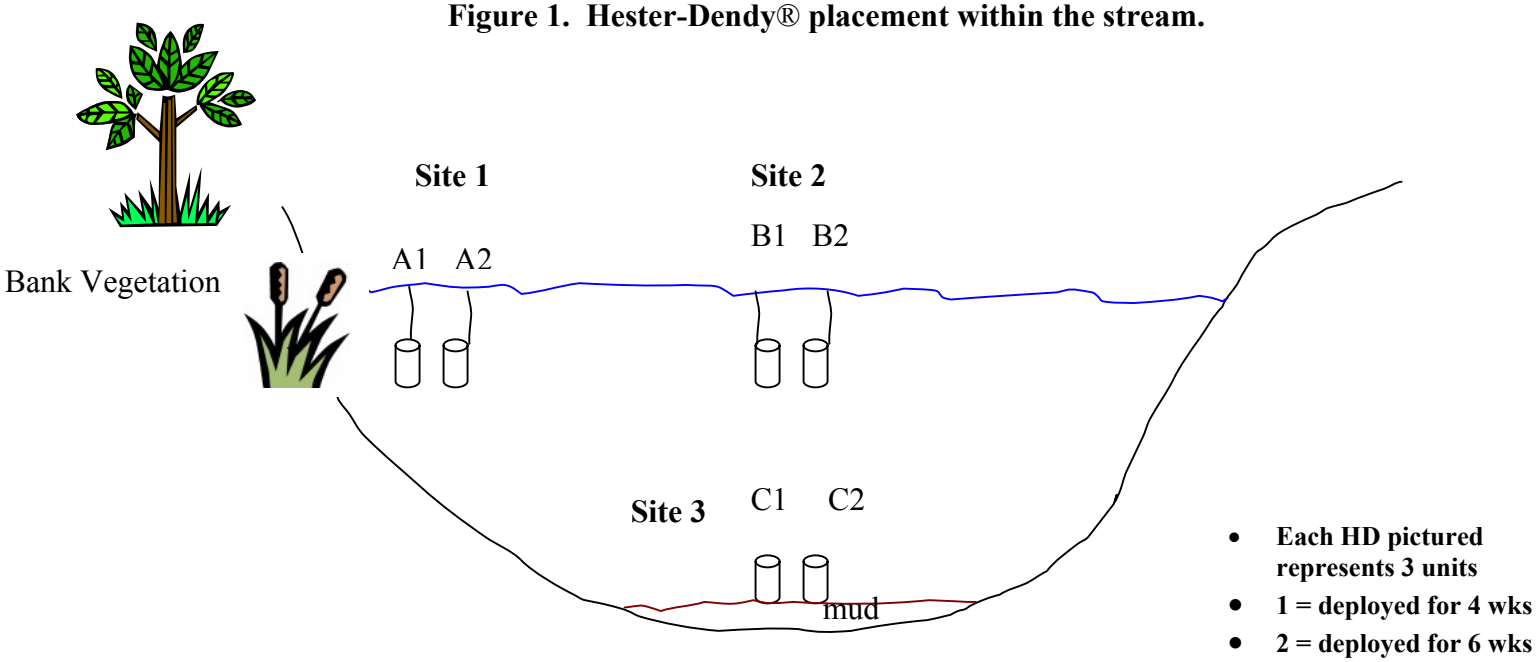
Mamola, Michael. 2005. Procedure for collecting benthic macroinvertebrates using a Hester-Dendy sampler. Department of Pesticide Regulation. Environmental Monitoring Program. Sacramento, California. SOP #EQWA006.

State Water Resources Control Board. 2003. The status and future of biological assessment in California streams. [Online]. Available at http://www.swrcb.ca.gov/swamp/docs/bioassess_chapt1.pdf

U.S. EPA 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. EPA; Office of Water: Washington D.C.

Zar, J.H. 1996. Biostatistical analysis. Prentice Hall, N.J.

Figure 1. Hester-Dendy® placement within the stream.



Attachment A.

Excerpt from California Department of Fish and Game, Aquatic Bioassessment Laboratory QAPP (Full QAPP currently under revision).

Internal Taxonomic Identification QA:

Taxonomic identifications are evaluated by the ABL's QC taxonomist with the goal of checking the accuracy and consistency of individual taxonomists. Ten percent of the samples from any given project are randomly selected and then checked for taxonomic accuracy. All taxa from each of the randomly selected samples are re-identified by the QC taxonomist, and the number of specimens in each vial is re-checked. Any errors in taxonomy, including misidentification, multiple taxa per vial, counting error and deviation from standard taxonomic effort are recorded in spreadsheet form, and then are analyzed with QC MANAGER, an ACCESS© program that summarizes the types of discrepancy and their frequencies. If a taxonomist is discovered to consistently misidentify a particular taxon, that person will receive instruction from the QC taxonomist about how to properly identify specimens in that group, and all future ID's involving that taxon will be checked until the problem is resolved.