Benthic Macroinvertebrate Studies and Services

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Why Study Benthic Macroinvertebrates?

The benthic macroinvertebrate community is an assemblage of numerous taxa of organisms, large enough to be seen by the unaided eye, that inhabit the sediment or bottom substrates in an aquatic environment for at least part of their life cycle. Macroinvertebrates are involved in the recycling of nutrients and the decomposition of organic materials, and thus transfer that energy flow from organic matter resources to vertebrate populations in the form of fish food.

These significant functional roles that macroinvertebrates play in the freshwater ecosystem stress the importance of the community in the study of stream ecology. It has been suggested that no aquatic ecosystem can be maintained long without a healthy benthic macroinvertebrate community, and an increase in the knowledge of the community's state is crucial in the assessment of ecosystem health.

> "***A sound understanding of macroinvertebrate ecology is a prerequisite to the implementation of a biological approach to ecosystem management.***"
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> - R.K. Johnson, T. Wiederholm, and D.M. Rosenberg *from:* Freshwater Biomonitoring and Benthic Macroinvertebrates (1993)

Benthic macroinvertebrates are included in the biological monitoring programs of many state and federal agencies largely due to the numerous advantages that macroinvertebrates offer in detecting disturbance or environmental stress in rivers and streams. Macroinvertebrates are also commonly studied as part of baseline investigations related to hydropower relicensing, watershed analysis, and other land-use development projects, and have become one of several biological indicators that have been used for assessing habitat enhancement projects, such as gravel and large wood supplementation.

About R2's Expertise

R2 Resource Consultants, Inc. (R2) is an environmental and engineering consulting firm specializing in fishery and water resources. In our work, we implement a variety of biological, ecological, and engineering disciplines. Among these disciplines are specialties in aquatic entomology and aquatic ecology, which are used for studies involving benthic macroinvertebrates.

R2 aquatic entomologists/ecologists have studied aquatic invertebrate communities in rivers, streams, and lakes throughout the continental United States. They have extensive knowledge of all aspects of benthic macroinvertebrate studies, including the development of detailed study designs, sample collection, laboratory analysis, taxonomic identification, data analysis, and report preparation.

The R2 team has conducted numerous invertebrate monitoring studies designed to detect changes in water quality, sediment quantity, as well as monitor

the restoration/recovery of previously perturbed systems. We have applied or are familiar with a number of federal (EPA) and state agency required sampling and laboratory protocols and corresponding metrics in conducting aquatic invertebrate studies, including those in Oregon, Washington, Montana, and California.

A primary advantage of R2 is our multidisciplinary staff. Using the expertise of our hydrologists, fluvial geomorphologists, hydraulic and sediment transport engineers, and water resource engineers, we can link physical and hydrologic processes to biological responses, allowing us to describe potential causes as well as the effects, and to develop appropriate mitigation strategies.

Benthic Macroinvertebrate Services and Capabilities:

- **Bioassessment Studies using:**
  - EPA Rapid Bioassessment Protocol
  - State-specific Protocols
  - Multimetric, B-IBI assessments
- **Biomonitoring Studies involving:**
  - Water quality and water pollution impacts
  - River regulation (e.g., the effects of power peaking, ramping rates, pulse flows)
  - Stream restorations
  - Dam removals
  - Gravel augmentation
- **Quantitative and qualitative surveys of macroinvertebrates in streams, rivers, lakes, ponds**
- **Food habits studies/ linkage to bioenergetics (fish stomach content analysis)**
- **Trophic relationship studies**
- **Hyporheos studies**

- **Expertise in a variety of benthic macroinvertebrate sampling methods**:
  - Surber, Hess, Ellis-Rutter samplers
  - Artificial substrate samplers
  - Kick-net samplers (D-net, Slack)
  - Invertebrate drift sampling
  - Hyporheic sampling
- **In-house capability to process samples and identify specimens to the standard effort taxonomic level**

Recent and Ongoing Benthic Macroinvertebrate Projects:

- *Effects of Pulse Type Flows on Benthic Macroinvertebrates and Fish: A Review and Synthesis of Information* for Pacific Gas and Electric Company.
- *Comparison of Benthic Macroinvertebrates in Spring-Versus-Run-Off Dominated Streams, Upper Klamath Basin, Oregon* for the Bureau of Indian Affairs, Portland, Oregon.
- *Kerr Dam Ramping Rate Biological Studies, Flathead River, Montana* for Confederated Salish and Kootenai Tribes of the Flathead Nation.
- *Lower Deschutes River Macroinvertebrate Monitoring, Deschutes River Basin, Central Oregon* for Portland General Electric.
- *Aquatic Resource Studies for Baker River Project Relicensing, Baker and Skagit Rivers, Washington* for Puget Sound Energy.
- *Missouri-Madison Rivers Project Operation Studies, Madison and Missouri Rivers, Montana* for PPL Montana.
- *Whatcom Creek Restoration and Biological Monitoring Whatcom Creek, Washington* for Equilon Enterprises, LLC.

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