

## **MACROINVERTEBRATE NOTES**

**Assembled by Sharon J. Collman**

### **WHAT ARE MACROINVERTEBRATES? WHY NOT JUST CALL THEM INSECTS?**

The term macroinvertebrates includes all the insects (six legs, adults with 2 pair of wings and antennae) along with other invertebrates (animals without backbones such as clams, snails, flatworms) and arthropods (jointed legged animals like mites, crustaceans, isopods and amphipods, etc.). The macroinvertebrates are large enough to be seen without the aid of a dissecting scope or handlens (though these tools aid in seeing details used in identification).

### **WHY STUDY MACROINVERTEBRATES?**

Invertebrates can be abundant in rivers, streams and ponds. They are easier to locate and study than the more mobile organisms like fish. Many invertebrates have specific requirements in terms of water quality. When only pollution tolerant species are present, they provide an indication of how fit the water is for other organisms that are harder to study (like fish). Abundant pollution sensitive species indicates good water quality and a healthy habitat for salmonid fish. <http://www.delawarenaturesociety.org/nrc/SW/macroinvertebrates.htm>

### **WHAT HABITATS SUPPORT MACROINVERTEBRATES?**

- Wetlands
- Streams and Rivers
- Lakes, Ponds and Reservoirs
- Estuaries and near coastal areas

### **WHERE IN THE WATER DO THE INVERTEBRATES LIVE?**

- Water surface (in quiet back pools – whirligig beetles, water striders, springtails)
- Under grasses and undercut stream banks (Haliplid beetles, dragonfly larvae)
- River bottom under and among rocks (out of the swift current and tumbling debris – caddis flies, stoneflies, mayflies, damselflies, etc.)
- On or among vegetation in the water (floating, submerged, emergent, etc.)
- Riffles or water tumbling over rocks, (high in oxygen and especially rich in insect diversity)
- Glides (smooth flowing water)
- Pools (slow moving water at the edges or behind logs or rocks)
- Hyporheic zone (in the watery spaces in gravel bars and along shores – even several hundred yards away from the water). This is a relatively new area of study and can be an important area the inverts.
- Sediment (some organisms are adapted to living in the mud at the bottom of water bodies)
- Riparian vegetation above the water (stream, river, pond, etc.) – Insects can fall into water from foliage above and provide substantial contribution to the food chain.

### **HOW ARE MACROINVERTEBRATES CLASSIFIED?**

- By taxonomic group (order, family, genus and species): such as the beetles (Coleoptera), caddisflies (Trichoptera), stoneflies (Plecoptera), damselflies (Odonata), etc.
- By feeding group: collectors, shredders, raspsers, predators

- By role: predator (consumes prey), parasite (lives in or on a host without killing it), saprophyte (feeds on dead plants and animals), herbivore (plant feeder), etc.
- By pollution tolerance or sensitivity (bio-indicators).

## HOW DOES ONE SAMPLE FOR (CATCH) MACROINVERTEBRATES?

- Kitchen strainer – useful for creating an awareness of insects in various habitats without great expense. Good for catch and release observations.
- White pan, shallow dishpan or white paint tray liners
- For a descriptions and photos of common sampling equipment see:  
<http://www.epa.gov/owow/monitoring/rbp/ch07main.html>

## MONITORING PROTOCOLS FOR MACROINVERTEBRATES?

Your best guide is to talk with others in your area about what protocols and guidelines they are using. It is important to have some consistency so that comparisons can be made between now and the future, or between sites. There are many protocols, sometimes even within, or among, agencies in the same state. There are also differences on how the data will be used: general awareness, water quality assessment, or research for example

There is an EPA Website map to assist you in finding state protocols for your state (WA, OR, ID, AK or nationwide). On the map, click on the state you are interested in. The specific sites below will save you some floundering, through agency listings but you might still want to explore the information at your state ecology or Department of Environmental Quality website. Check also under forestry, Departments of Natural Resources, or Departments of Agriculture. Check also with them to insure you have their most recent version. Many documents on the web were placed there years ago and were not removed when new or revised websites were developed.

<http://www.epa.gov/bioindicators/html/stateprgs.html>

### WASHINGTON

- Stream Biological Monitoring (Dept of Ecology)  
[http://www.ecy.wa.gov/programs/eap/fw\\_benth/index.html](http://www.ecy.wa.gov/programs/eap/fw_benth/index.html)
- Using Invertebrates to Assess the Quality of Washington Streams and to Describe Biological Expectations (1997; 85 pages) <http://www.ecy.wa.gov/pubs/97332.pdf>
- Benthic Macroinvertebrate Biological Monitoring Protocols for Rivers and Streams (2001 Revision, Washington Department of Ecology) <http://www.ecy.wa.gov/pubs/0103028.pdf>

### OREGON

- Oregon Watershed Enhancement Board (OWEB) <http://www.oweb.state.or.us>
- Xerces Society's list of and links to various resources (suppliers, books, labs, funding, etc.) for identifying and learning about insects <http://www.xerces.org/aquatic/books.htm#id>
- Stream Macroinvertebrate Protocol: Oregon Plan for Salmon and Watersheds by the Water Quality Interagency Workgroup for the Oregon Plan  
<http://www.cbr.washington.edu/salmonweb/oregon/Macro.html>

### IDAHO

- Idaho State University Stream Ecology Center--Dedicated to the study of the ecology of all flowing bodies of water...most concentrated in the Northern Basin and Range and Snake River Plains Ecoregions. [http://www.isu.edu/departments/bios/Professors\\_Staff/Minshall/homepage.htm](http://www.isu.edu/departments/bios/Professors_Staff/Minshall/homepage.htm)

- Module 12: Biological Habitat Assessment – Streams  
[http://www.pnwwaterweb.com/Vol\\_Mon\\_mod12.pdf](http://www.pnwwaterweb.com/Vol_Mon_mod12.pdf)

#### ALASKA

- Master Watershed Steward Program (Alaska) homepage (curricula, publications, education programs)  
<http://www.uaf.edu/coop-ext/landresources/watershed/wer.html>
- University of Alaska Cooperative Extension Water Quality Website <http://www.uaf.edu/coop-ext/water/index.html>
- 1999 Alaska Biological Monitoring and Water Quality Assessment  
[http://enri.uaa.alaska.edu/bmap/pdfs/Rpt\\_Final\\_9\\_00.pdf](http://enri.uaa.alaska.edu/bmap/pdfs/Rpt_Final_9_00.pdf)
- Biological Monitoring and Assessment Program for Alaska (technical level rapid bioassessment protocols, Education level guide to water quality monitoring and data sheet and volunteer program collection procedures, plus “Guide to Macroinvertebrates of Alaska”  
<http://enri.uaa.alaska.edu/bmap/Procedures.html>

#### SOME OTHER WEBSITES

- An example: simple sampling guideline for volunteers from the Maryland Stream Program  
<http://www.dnr.state.md.us/education/teamdnr/dnettask.pdf>
- Macroinvertebrate monitoring sampling procedures  
<http://www.fish.washington.edu/naturemapping/water/3dcolmac.html>
- Macroinvertebrate Water Quality Rating --The Water Quality Rating is initiated by identifying and then categorizing each of the macroinvertebrates collected into one of three groups, according to their known response to pollution: sensitive, somewhat sensitive or tolerant. The number of each organism is converted to one of these letter codes: A =1-9; B = 10-99; C = >100. This data is transferred to a form outlining the three aforementioned groups. The number of letters in each group is added and multiplied by the appropriate index number: sensitive = 3; somewhat sensitive = 2; tolerant = 1. The three products are added to determine the Macroinvertebrate Water Quality Rating: excellent (>22); good (17-22); fair (11-16); poor <11). The perceived diversity of the macroinvertebrate sample, not so much their numbers in each group, is the important indicator of water quality at the stream site. <http://www.projectwatershed.org/quality.html>
- Water quality “what if’s. Lesson plans and activities for teachers.  
<http://www.ncsu.edu/sciencejunction/depot/experiments/water/lessons/macro/>
- Line drawing of pollution tolerant, somewhat tolerant and sensitive macroinvertebrates.
- from <http://www.amrclearinghouse.org/Sub/WATERmonitoring/ZZMacroGuide.htm>
- Resource lists, equipment catalogues, identification guides, survey  
<http://www.amrclearinghouse.org/Sub/WATERmonitoring/ZZResources.htm>
- What are Macroinvertebrates--Brief definition, life cycles, where they live, anatomy, resources  
<http://www.amrclearinghouse.org/Sub/WATERmonitoring/MacrosBack.pdf>

EPA’s Bioassessment and Biocriteria

<http://www.epa.gov/ost/biocriteria/index.html>

Invertebrates as biological indicators - EPA

<http://www.epa.gov/bioindicators/html/invertebrate.html>

North American Benthological Society list of useful links, very comprehensive and useful

<http://www.benthos.org/links/index.cfm?task=Display&URLtopic=Aquatic%20insects>