

Aquatic Macroinvertebrates

Macroinvertebrates as Water Quality Indicators

(From “Aquatic Macroinvertebrates” – published by Oregon Trout

<http://www.ortrout.org/images/4education/images/volpacketforms/aquatic%20macroinvertebrates.pdf>)

Macroinvertebrates can be described as spineless animals that can be seen with the naked eye (without magnification), or any aquatic invertebrate collected with a standard mesh collecting net (mesh size 500 microns or 0.5 millimeters). Macroinvertebrates in streams are biological communities that integrate the effects of many different factors over time. Macroinvertebrate populations are more sensitive indicators of habitat disturbance or infrequent chemical contamination than standard chemical monitoring. Aquatic insects such as mayflies, on average, spend about a year in the aquatic larval stage before beginning their brief lives as adults. Consequently they require good stream flow and a healthy temperature range throughout the year. You would not expect to find a healthy mayfly population in a seasonal stream that dries up or gets too warm during the summer months. Macroinvertebrate populations will also respond over time to pollution, whether it is from chemical or thermal sources, habitat disturbance such as erosion due to land use practices, and/or changes in stream structure as a result of flood events.

Macroinvertebrates and the Aquatic Food Web

Fish populations depend on healthy macroinvertebrate populations to survive. The availability of macroinvertebrates as food is determined by both the physical and biological condition of the stream. Food for macroinvertebrates includes organic materials, like algae that grow on rocks or leaves and other material that fall into the stream and decompose. Benthic or bottom dwelling insects are adapted for attachment in fast-moving water.

They obtain food by grasping or collecting, grazing or scraping. Aquatic insects that drift are most vulnerable to being eaten. Drifting can be described as leaving their positions among boulders and gravel in riffles to be carried downstream short distances before reattaching to the stream bottom.

Functional Feeding Groups

Dividing stream invertebrates into shredders, collectors, scrapers, and predators is somewhat artificial because some of these immature forms fit into more than one category. For example, scrapers may eat a lot of detritus or debris while they graze algae. These distinctions are valuable. By looking at the feeding habits of these young invertebrates, you can begin to sort out different roles these animals play in the ecology of watersheds.

Shredders - usually in headwaters area, and in areas that have a high percentage of canopy cover.

Examples: organic case caddis, crane flies, stoneflies

Found in: leaf packs, water-logged wood, headwater streams

Scrapers/ Grazers - need sunlight penetration for algae growth

Examples: mineral case caddis, snails, mayflies,

Found in: rocks, open-canopied areas, mid-stream reaches

Collectors - filtering collectors, gathering collectors - common in all reaches, make up larger proportion in lower reaches where sediment collects.

Examples: Net-spinning caddis, Midge larva, Blackfly larvae, mayflies

Found in: rocks and mud

Predators - found in all habitat types, in smaller proportion relative to other feeding types

Examples: Mottled stoneflies, beetle larvae, dragonfly larvae, free living caddis, crane fly larva

Found: throughout the stream

Insect Groups Arranged by Tolerance to Pollution

Group 1: Intolerant

These organisms are sensitive to pollution.

Their dominance generally suggests good water quality.

Group 2: Somewhat Tolerant

These organisms can tolerate a wider range of water quality conditions.

Group 3: Tolerant

These organisms are generally tolerant of pollution. Their dominance suggests poor water quality.

Water What-ifs

Water Quality and Aquatic Macroinvertebrates

(From "Science Junction – What If's" – North Carolina State University -

<http://www.ncsu.edu/sciencejunction/depot/experiments/water/lessons/macro/index.html>)

Aquatic macroinvertebrates are found in lakes, streams, ponds, marshes and puddles and help maintain the health of the water ecosystem by eating bacteria and dead, decaying plants and animals. Overall water quality affects which types of organisms can survive in a body of water. "Water quality" may include the amounts of dissolved oxygen and the levels of algal growth, pollutants which may be present and the pH level. Some macroinvertebrates such as stoneflies, mayflies and water pennies require a high level of dissolved oxygen and their abundance is an indication of good water quality.

Other macroinvertebrates can survive at a lower dissolved oxygen level because they can come to the surface to get oxygen through a breathing or "snorkel" tube or carry a bubble of air with them around their bodies or under their wings. Several species of macroinvertebrates are indicative of water systems with lower dissolved oxygen levels and include aquatic worms and leeches. Lower dissolved oxygen levels are often associated with polluted waters while higher levels indicate good quality water.

There are several reasons why macroinvertebrates are used as water quality indicators:

- They are sensitive to changes in the ecosystem.
- Many live in an aquatic ecosystem for over a year.
- They cannot easily escape changes in the water quality.

- They can be collected very easily from most aquatic systems with inexpensive or homemade equipment.

The life cycle of a macroinvertebrate goes from egg to adult form and they can undergo either complete or incomplete metamorphosis. Complete metamorphosis has 4 stages, egg, larvae, pupa and adult. Organisms which undergo complete metamorphosis include true flies, beetles and caddis flies. Many of these organisms are aquatic for the egg and larval stages, but not in the adult stage. Incomplete metamorphosis has 3 stages, egg, nymph and adult. Organisms which undergo incomplete metamorphosis include stoneflies, mayflies, dragonflies and true bugs.

Many of these organisms, such as dragonflies, do not live in an aquatic ecosystem as adults. Other species such as true bugs which include the backswimmers, water scorpions and the water striders, are examples of macroinvertebrates which spend their entire lives in the water. The length of the life cycle of a macroinvertebrate can vary from less than 2 weeks for some midges and mosquitoes and two years or longer for some stoneflies, dragonflies and dobsonflies.