

## Macroinvertebrate Ecology

Invertebrates are animals that do not have an internal skeleton of cartilage or bone.<sup>1</sup> For the Maryland Envirothon Aquatics Issue, we will concern ourselves with only the aquatic macroinvertebrates (can be seen with the naked eye) that are found in Maryland's freshwater streams. The purpose of this document is to give you a brief overview of macroinvertebrate anatomy, behavior, and ecology. You will also learn how to use macroinvertebrates as an indicator of water quality. It is strongly recommended that you visit a nearby stream, collect some insects, and practice identifying them in the field. You should also know what your samples tell you about the quality of water in your stream.

### Why are they important?

Macroinvertebrates play an important role in the ecosystem of which they are a part. Not only do they serve as food for fish, amphibians, and water birds, they are also involved in the breakdown of organic matter and nutrients.

Freshwater macroinvertebrates are used to assess the "health" of a stream. Taking samples of *all aquatic life stages* of macroinvertebrates can serve as an indicator of the water quality for several reasons:

- Some are sensitive (*intolerant*) to pollution, habitat changes, and severe natural events, while others are more tolerant;
- Many live in the water for over a year;
- They are generally sessile – they cannot escape pollution like fish and birds;
- They are easy to collect.

The biological evaluation of water quality is linked to the number of pollution-tolerant organisms compared to the number of *pollution intolerant* ones. If a survey of the stream yielded a *higher proportion* of pollution tolerant macroinvertebrates and no sensitive ones, that *could* indicate poor water *or habitat* quality index. A more favorable water quality index would be characterized by finding sensitive organisms as well as tolerant organisms. An index such as this is more useful when data is gathered over the long term and trends can be analyzed. The Macroinvertebrate Assessment Form is one sample of how you might assess the water quality of your stream using macroinvertebrates.

Two methods commonly used for evaluating water quality are *indicator organisms* and *diversity indices*. The *indicator organisms* method is based on the fact that every species has a certain range of physical and chemical conditions in which it can survive. Some organisms can survive in a wide range of conditions and can "tolerate" more pollution. Other organisms are very sensitive to changes in water conditions and cannot tolerate pollution. Examples of intolerant organisms are mayflies, stoneflies, and some caddisflies (members of the Ephemeroptera, Plecoptera, and Trichoptera orders, respectively). Examples of some pollution-tolerant organisms

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<sup>1</sup> Voshell, Jr., J. Reese. *A Guide to Freshwater Invertebrates of North America*. Mc Donald & Woodward Publishing Co. Blacksburg, VA. 2002.

include leeches, aquatic worms, and some midge (*Diptera*) larva. Water quality is evaluated by comparing the number of tolerant organisms to the number of intolerant organisms. A large number of pollution-tolerant organisms and few intolerant organisms may indicate poor water and/or habitat quality. However, remember that pollution-tolerant organisms can also be found in a wide range of conditions, including pollution-free environments.

Diversity refers to the number of different kinds of organisms found in a biological community. In general, communities with a high diversity are more stable. Pollution and/or frequent habitat disturbance can eliminate intolerant species, and therefore reduce diversity. So if an area becomes polluted, the total number of organisms may stay the same, but diversity may decrease.