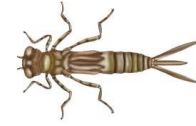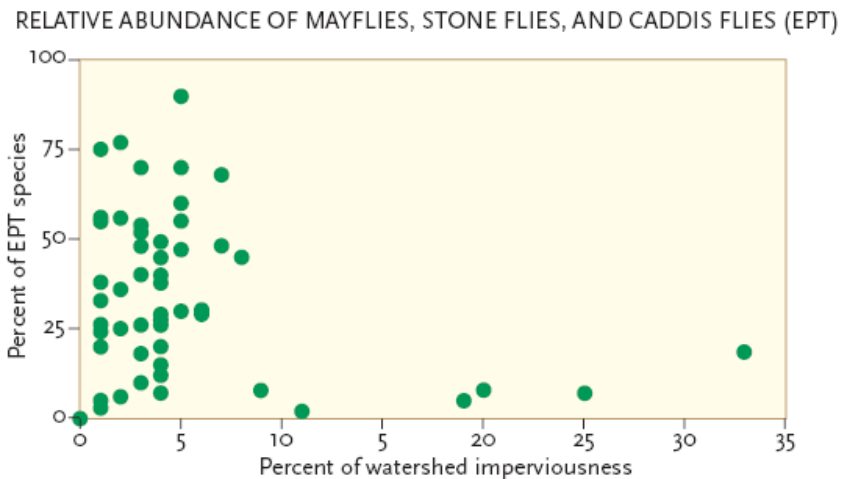# Macroinvertebrates

Invertebrates include all animals without a backbone: worms, insects, and crustaceans. There are a huge number of invertebrates that live in water, providing food for other animals and serving as part of a very important aquatic food web. We call these invertebrates "macro" because we can see them without a microscope.

If you are studying water quality, macroinvertebrates are an important indicator of the health of an aquatic ecosystem. Immature insects such as stoneflies, mayflies, and water pennies (a type of beetle larvae) require a high amount of dissolved oxygen (DO), while aquatic worms, leeches and pond snails can survive in water with low DO. We call oxygen-loving species like mayflies and stoneflies "indicator species" because they provide important clues about the water they are living in. If you only find animals like leeches, snails, and aquatic worms, then you know that there is a problem with water quality, and you should do additional studies to determine the cause.

One of the most useful indicators is the diversity or numbers of kinds of organisms. If you find only one or two kinds of animals, no matter what kind they are, you should perform other water quality tests to determine what might be wrong with your aquatic ecosystem. Sometimes, low diversity can indicate a pollution problem or other habitat change that is affecting the ecosystem.

RELATIVE ABUNDANCE OF MAYFLIES, STONE FLIES, AND CADDIS FLIES (EPT)

The graph shows the relationship between imperviousness and the abundance of three common stream invertebrates, the mayflies (ephemeroptera), the stoneflies (plecoptera), and the caddisflies (trichoptera). This work was done in 39 cold water streams with

different levels of watershed urbanization in Wisconsin and Minnesota (Wang & Kanehl, 2003). Scientists collected all the macroinvertebrates they could in the streams they sampled, and used the EPT organisms because they tend to be sensitive to pollution (with the exception of a few species of caddisflies). EPT richness can be used to compare different test sites, and it is faster than identifying every animal, since you just have to sort the organisms into major groups.

A number of factors besides imperviousness can influence the diversity and density of macroinvertebrates present in an aquatic ecosystem. Seasons, life cycles, types of substrate, food sources, water velocity, and sampling techniques can all affect the diversity in your sample. For example, if you are testing the water in the spring, you might find fewer animals after a flood or heavy rain.

It is also important to know the animals' life cycles. Many larvae emerge as adults in late spring and are present only as eggs during other parts of the year. The substrate on the river bottom can affect your results as well. A rocky bottom provides more habitat than a silty or muddy bottom. You should also take into consideration the surrounding habitat: a forest often provides more food (in the form of plant material) than a meadow. Finally, you need to decide what kind of sampling technique you are going to use. A screen or net that is too large will cause you to miss some animals, while inappropriate equipment use means you won't collect a good sample of all the animals living in the ecosystem.

For instructions on different types of macroinvertebrate collection, go to https://catskillstreams.org/pdfs/guidancedoc.pdf and download Hudson Basin River Watch's Guidance Document.