

MACROINVERTEBRATES

Introduction

Macroinvertebrates are important to the functioning of the ecosystem in which they live for a number of reasons. They serve as food for fish, birds and amphibians and also assist in the breakdown of detritus and other organic material. Because of their relatively extended stay on the benthos, and their inability to move away from pollutants or disturbances in the waterbody in which they live, macroinvertebrates act as an indicator of the condition of the waterbody in which they live. They are also easy to collect and identify.

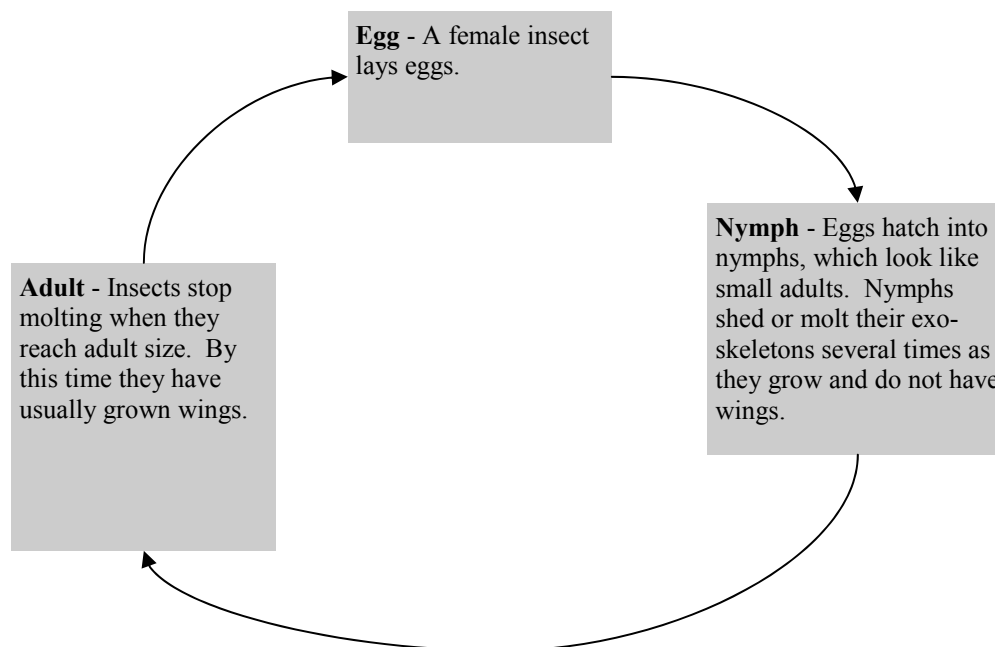
There are three general types of species when performing a bioassessment. Intolerant species are sensitive to pollution and include mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*) and caddisflies (*Trichoptera*). Facultative species such as dragonflies (*Odonata*) and damselflies (*Odonata*) prefer clean waters but can survive in polluted waters. Species such as midges (*Diptera*) and leeches (*Hirudinea*) are considered tolerant because of their ability to survive in polluted waters.

When doing a bioassessment, groups such as the DEC use a diversity index, or proportion of tolerant to intolerant species to evaluate their sample (see page 5). A sample with high diversity and both pollution tolerant and intolerant species shows the researchers that the waterbody that they are evaluating is more stable and less polluted than one that shows only pollution tolerant species and low diversity.

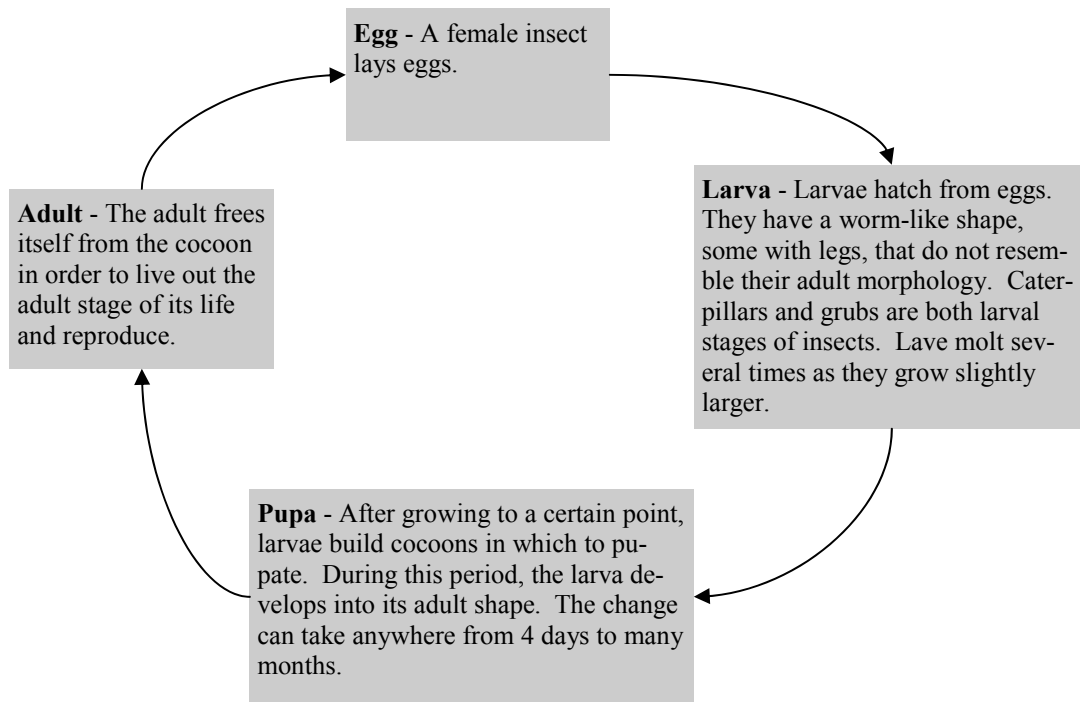
Life Cycles of Insects

Insects go through either complete or incomplete metamorphosis.

Incomplete Metamorphosis



Complete metamorphosis



Breathing Underwater

In order to breathe underwater, aquatic insect nymphs and larvae have developed gills. Gills come in many shapes and sizes, but all gills are characterized by a large surface area. Gills need to have a great deal of surface area available in order to extract the oxygen needed for metabolism. Most bottom dwelling organisms that utilize gills prefer rocky areas to silty areas because the silt can clog their gills, making it difficult to breathe. Gills can be either protected or unprotected.



Platelike



Featherlike



Leaflike

MacroInvertebrate Characterisitcs

The vast majority of invertebrates collected and analyzed in bioassays are freshwater insects. These insects can be sorted and identified and can give insight into the condition of the stream or river where they are found. See the next page for definitions of the body parts of insects and other pertinent terms.

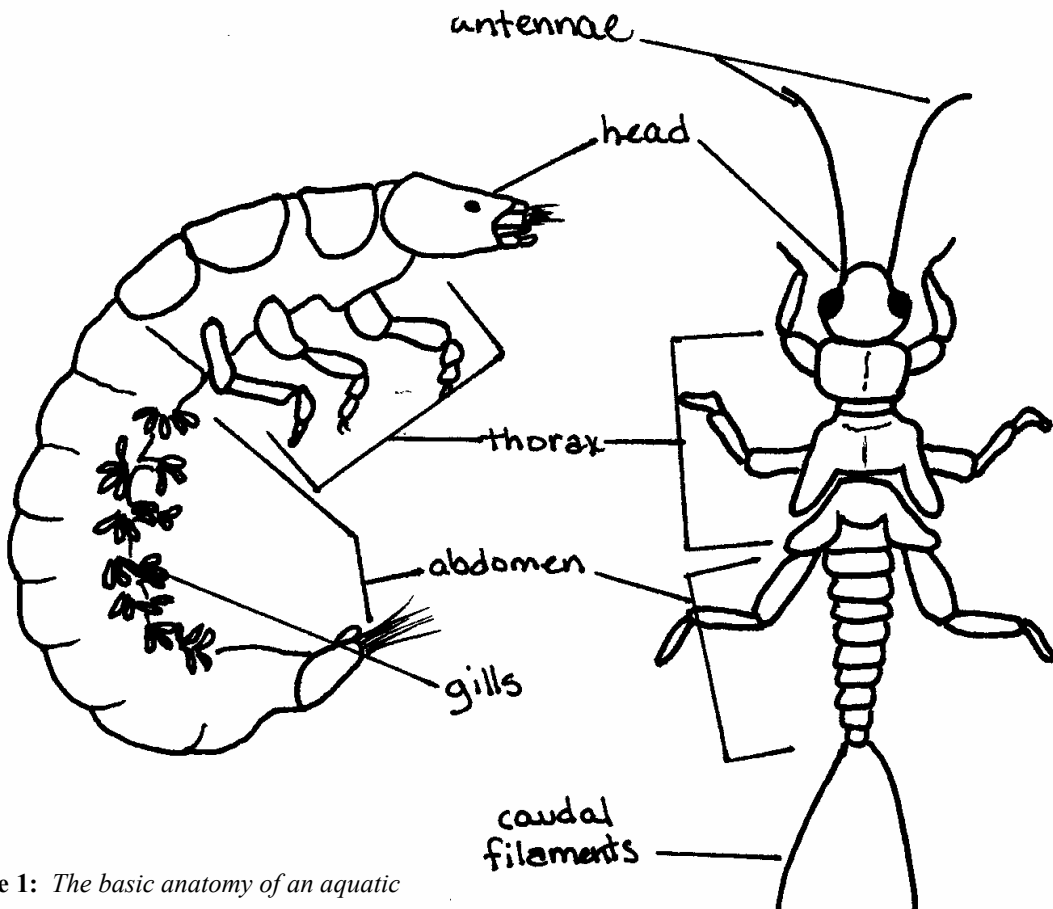


Figure 1: The basic anatomy of an aquatic insect.

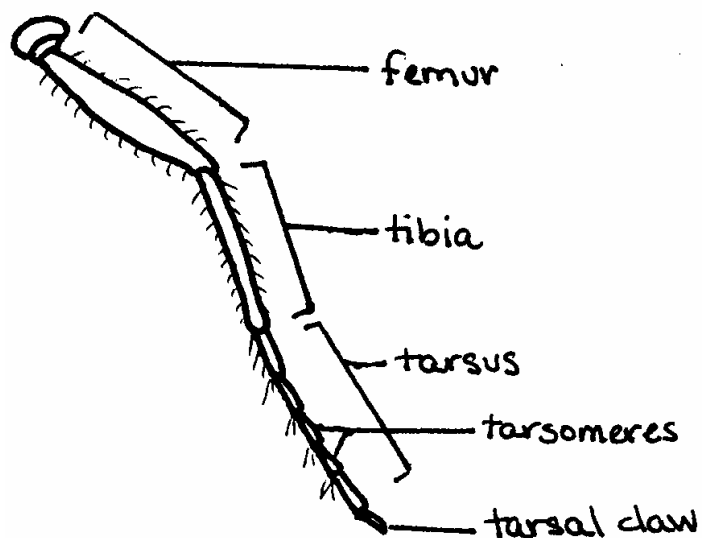


Figure 2: Anatomic detail of an insect leg.

Macroinvertebrate Glossary

- Abdomen** – the most posterior body region, where the appendages do not form legs
- Antenna** – the first pair of appendages in insects, and first two pairs in crustaceans, adapted for feeling and smelling objects in front of the animal
- Anterior** – in the direction of the head; opposite of posterior
- Brachyopterous** – with short or abbreviated wings
- Carapace** – a chitinous or bony shield covering the whole or portions of the head, thorax and abdomen in crustaceans or insects
- Cephalothorax** – the part of the body covered by the carapace; the head and thorax combined
- Cercus** – a paired appendage of the last abdominal segment
- Dorsal** – toward the upper surface when the body is in normal walking position
- Labium** – lower lip; mouthpart lying behind the maxillae
- Meso-** - prefix; pertaining to the middle (e.g., the mesothorax is the middle thoracic segment)
- Meta-** - prefix; pertaining to the last or third in a series (e.g., the metathorax is the last thoracic segment)
- Posterior** – in the direction away from the head; opposite of *anterior*
- Proleg** – any process or appendage that serves for support, locomotion, or attachment; the fleshy, unjointed thoracic or abdominal appendages of larval trichopterans, lepidopterans, and dipterans; may be sclerotized
- Tarsomeres** – segments of the tarsi
- Tarsus** – the fifth (last) segment of an arthropod leg, connected to the tibia (may be composed of several tarsomeres)
- Thorax** – the part of the body between the head and the abdomen
- Tibia** – the fourth segment of an arthropod leg, connected to the femur
- Ventral** - toward the lower surface when the body is in normal walking position: the opposite of dorsal