

Benthic Macroinvertebrates

Biology II
Mrs. Michaelsen

I. What are Benthic Macroinvertebrates?



mk29.image.pbase.com/.../2185658.chetekriver.jpg

A. Animals without backbones that can be seen with the naked eye that spend at least part of their life cycles on the bottom of a water body.

Macroinvertebrates as Indicators

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

Benthic Macroinvertebrates - Examples



Mayflies

(Ephemeroptera)



Stoneflies

(Plecoptera)



Caddisflies

(Trichoptera)



Crane Flies



Black Flies



Snipe Flies

True Flies

(Diptera)



Midges

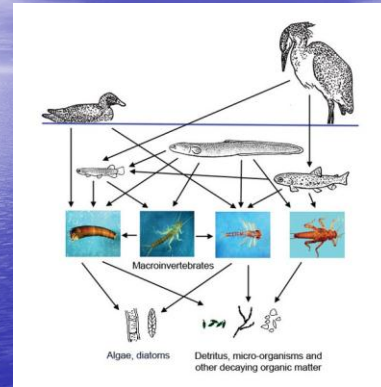


Deer Flies

II. Food Web

- A. Macroinvertebrates are an important part of the food chain, especially for fish.
- B. Many feed on algae and bacteria.
- C. Some shred and eat leaves and other organic matter.
- D. "Middleman" in the aquatic food chain, and play a critical role in the flow of energy and nutrients.
- E. As benthos die, they decay, leaving behind nutrients that are reused by aquatic plants and other animals.

Food Web



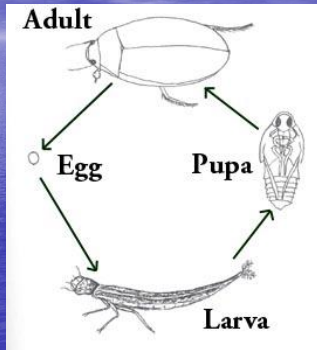
III. Insect Life Cycles

- A. Approximately 5% of insects spend all or part of their life cycle in water.
- B. The immature stages of these aquatic insects often have streamlined bodies and they breathe with gills.
- C. There are two types of insect life cycles.
 1. Complete metamorphosis includes a larvae and pupa stage.
 2. Incomplete metamorphosis includes only a nymph stage.

D. Complete Metamorphosis

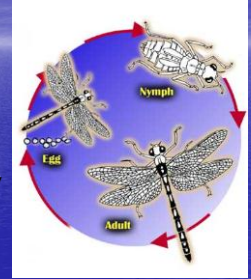
1. True flies, dobson flies, alder flies, beetles, caddisflies.
2. Egg, larva, pupa, adult.
3. The larva that hatches looks completely different from an adult. After the larva has completed its growth, it turns into a pupa. The insect is re-formed in the pupal stage, emerging as an adult.

Complete Metamorphosis Waterboatman

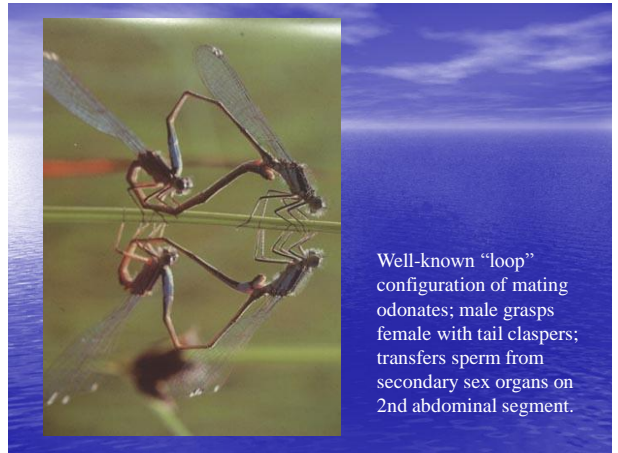


E. Incomplete Metamorphosis

1. Mayflies, stoneflies, damselflies, dragonflies, and true bugs.
2. Egg, nymph, adult.
3. The nymph that hatches from the egg is wingless, unlike an adult. The insect comes out of its last molt as a fully winged adult.



Dragonfly

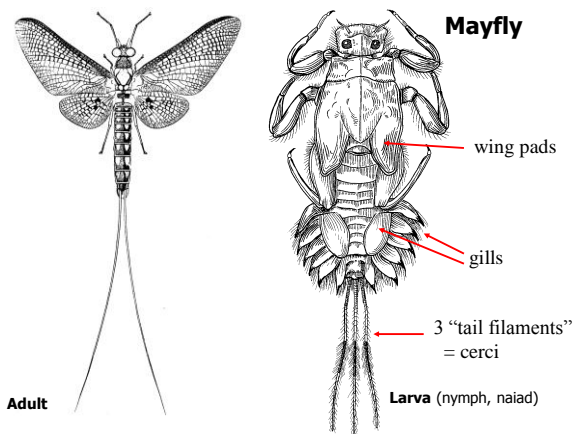


Well-known "loop" configuration of mating odonates; male grasps female with tail claspers; transfers sperm from secondary sex organs on 2nd abdominal segment.

4. Mayflies are unusual in the insect world because they are the only group of insect which molts after the wings are fully developed. The adult stage of the mayfly only lives for about 24 hours in some cases. The nymph of the mayfly, however, takes two years to grow and develop in the streams where it lives.



EPHEMEROPTERA, mayflies



IV. Functional Feeding Groups

A. Aquatic invertebrates can be grouped into four functional feeding groups according to how and what they eat:

1. Scrapers:

- a. Mainly herbivores (plant-eaters).
- b. They remove algae, bacteria and fungus growing on the surface of rocks, twigs and leaf debris.
- c. Many of these organisms are flattened to better hang onto rocks while they feed in a current.
- d. They feed somewhat like a child licking the icing from the top of a cookie.

Mayfly nymph feeding under water



2. Shredders:

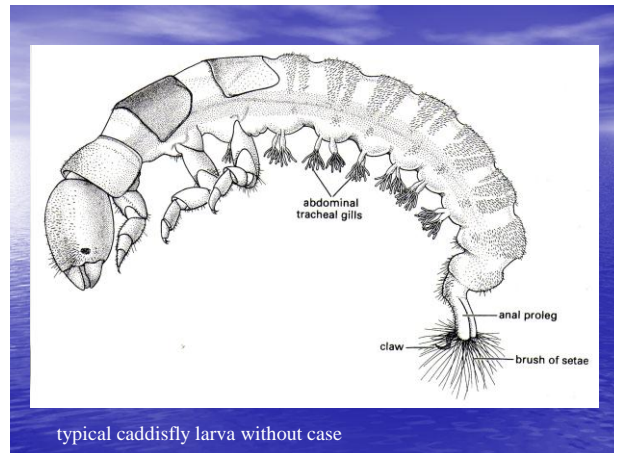
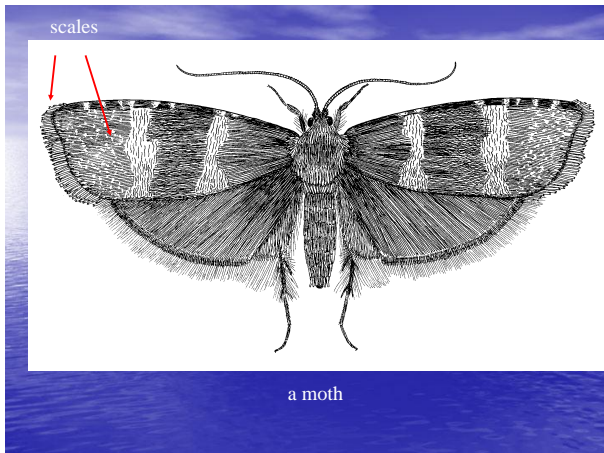
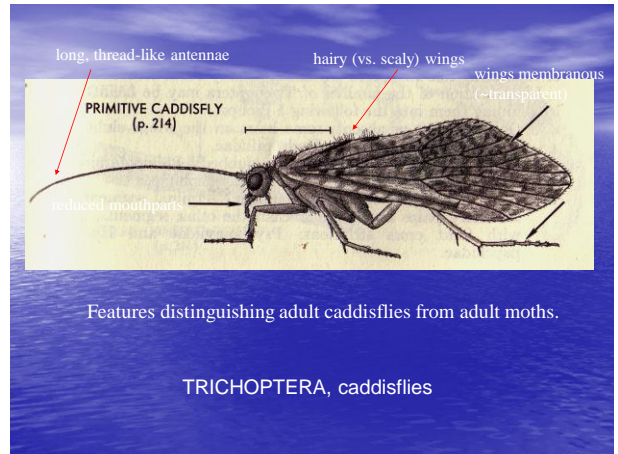
- a. Herbivores that chew on coarse leaves and twigs that have started to decay.
- b. This group plays an important role in breaking things down to a size that can be handled by other macroinvertebrates.
- c. Because these herbivores also consume the nutritious decomposer bacteria and fungi present on the decaying leaves, they are really omnivores.

Stonefly nymph



3. Collectors:

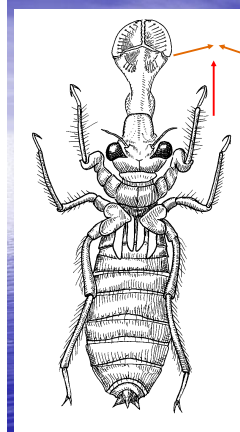
- a. Collectors are omnivores that feed on whatever is easiest to find.
- b. They gather fine particles that pass by in flowing water (feces, algae, plant and animal fragments) as well as any bacteria attached to this material.
- c. **Filtering collectors** strain particles out of the flowing water with brushes or nets.
- d. **Gathering collectors** obtain dead organic material from the river bottom sediments.





caddis fly larval cases

TRICHOPTERA



4. Predators:
2. grab
 1. lunge
- a. Predators are carnivores that eat small insects, leeches and fish.
 - b. In turn, these invertebrate predators are often a major food source for other predators such as fish.

dragonfly larva hydraulic labial mask feeding mechanism

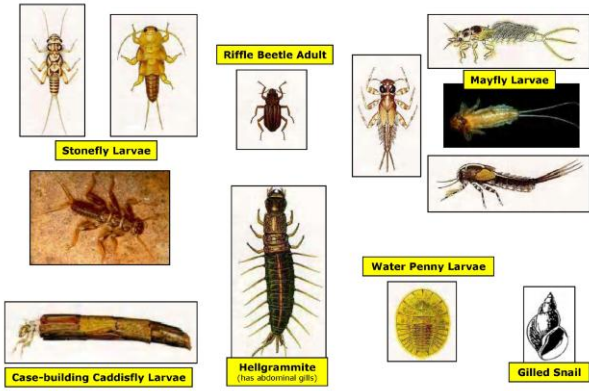
Dragonfly nymph



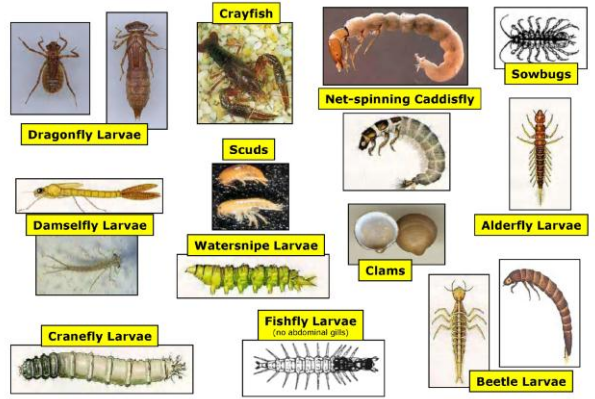
V. Why Sample Invertebrates?

- A. Benthic macroinvertebrates are a very diverse group of organisms.
 1. Display a wide range of sizes
 2. Habitat requirements
 3. Life histories
 4. Sensitivities to water quality impairment.
- B. Some are sensitive to changes in substrate composition, others are sensitive to fluctuations in dissolved oxygen.
 1. Some require cold water temperatures, while others can tolerate a wide range of temperatures.
- C. This wide range of living requirements makes them excellent indicators of anthropogenic stress on aquatic systems.

Macroinvertebrates Sensitive to Pollution



Macroinvertebrates Somewhat Sensitive to Pollution



Macroinvertebrates Tolerant to Pollution

