

Freshwater Classification Background

Introduction

Aquatic invertebrates are small organisms without backbones that are found in freshwater and saltwater. There are two types of invertebrates: micro and macro. Macro-invertebrates are those organisms that are able to be seen with the naked eye. Micro-invertebrates are those that require a microscope to be seen. Both types of aquatic invertebrates are found in many different habitats, e.g., under stones, and buried in sediment, woody debris, hot springs, shallow ponds, and deep lakes. Some more tolerant, less-sensitive invertebrates can even be found in salty or polluted waters. As for diet, aquatic invertebrates are a type of heterotroph known as omnivores; they eat plants, other insects, and, in some cases, small fish.

Life Cycle

Most aquatic insects, such as dragonflies or damselflies, begin their lives living directly in the water. These organisms may spend over a year in the water, encompassing most of their lives. For example, an adult dragonfly spends only 1-3 months on land! Aquatic insects move through two different types of growth, incomplete or complete metamorphosis.

Metamorphosis is the change that occurs during the organism's development from egg to adult.¹ Incomplete metamorphosis involves three stages of growth: egg → nymph → adult. The nymph is a small replica of the adult. These invertebrates go through a series of molt or skin sheds until they reach adult size. In complete metamorphosis, larvae do not look like adults and there are four stages of growth: egg → larva → pupa → adult. During the pupa stage the organism is wrapped in a cocoon where it undergoes its transformation from larva to adult. A dragonfly is a good example of an animal that performs incomplete metamorphosis, while a butterfly is a good example of an animal that performs complete metamorphosis.

Examples and Fun Facts

Aquatic invertebrates are quite diverse. Hailing from the arthropod, annelid, and mollusk phyla, macro-invertebrates come in all shapes and sizes. Leeches, snails, clams, water penny beetles, may flies, black flies, and crayfish are just a few examples of different types of species. Each macro-invertebrate species is unique. Did you know that:

- some dragonflies can fly up to 30 mph
- crayfish can swim forwards, backwards, and sideways
- a digestive system runs through the tail of both the dragon and the damselfly
- there are more than 700 different types of mayflies in North America
- dragonflies have been around for over 300 million years
- mayflies have gills along the sides of their body
- snails can live from 9-15 years?

Indicator Species

Although small, aquatic invertebrates are very important to an ecosystem not only with respect to the food web but they also help assess environmental conditions of an area. Specifically, they serve as an indicator of watershed health. Aquatic invertebrates are good indicators because they: live in the water for all or most of their life, stay in areas suitable for their survival, are easy to collect, differ in their tolerance to amount and types of pollution, are easy to identify

in a laboratory, often live for more than one year, have limited mobility, and are integrators of environmental condition.ⁱⁱ For example, mayflies and stoneflies, if found, are indicators of good water quality. In contrast, leeches and worms are indicators of poor water conditions.

Additional Resources

Pennsylvania Fish and Boat Commission:

<http://www.fish.state.pa.us/education/catalog/cat5cri.htm>

University of Wisconsin-Extension

{When online, enter pdf as a web address}

Vocabulary

- Aquatic Macro-Invertebrate: small freshwater organism, visible to the naked eye; most aquatic insects start off as
- Bioindicator: organism that assess environmental conditions of an area
- Caudal/Tail Fin: Fin on end of fish; used to propel the fish
- Classification: A systematic arrangement in groups or categories according to established criteria
- Complete Metamorphosis: four stages of development; involves pupa stage where larva wraps self in cocoon; where the change to adult occurs
- Dorsal Fin: Top or backside fin on a fish; used for balance and protection
- Ecosystem: Community of organisms and their environment; working together
- Gills: Organ a fish uses to obtain oxygen from the water
- Incomplete Metamorphosis: three stages of development; larva looks like adult
- Invertebrate: Organism without a backbone
- Lateral Line: Organ a fish uses to “feel” low vibrations; tiny microscopic pores
- Nares: Organ a fish uses to smell; similar to nostrils
- Predator: Organism that preys upon or eats another organism
- Prey: Organism that predator is targeting or organism that is being eaten
- Vertebrate: Organism with a backbone
- Heterotroph: Organism that can't make its own food
- Omnivore: Organism that eats both plants and animals

ⁱ US EPA. Life Cycle of Aquatic Insects. 3 December 2008
<<http://www.epa.gov/bioiweb1/html/lifecycle.html>>.

ⁱⁱ U.S. EPA. Invertebrates as Indicators. 3 December 2008.
<<http://www.epa.gov/bioiweb1/html/invertebrate.html>>.