

2. Keep a journal of the types of insects you find and try to identify them. What adaptations do these animals have to aquatic life (gills, fringed legs for swimming, camouflage, streamlined shapes)? Try to discern which are predators (dragonfly nymphs, backswimmers, water striders) and which are usually prey (fly larvae, mosquito larvae and water boatmen).

Extensions

Investigate streamlining, gills, fins and other aquatic adaptations of fish and mammals that live in water. Get a whole fish from the market, or set up a small aquatic tank in your classroom. What parts of their bodies are similar to insects? Which are different?

Vocabulary

- abdomen
- antennae
- complete metamorphosis
- exoskeleton
- gills
- incomplete metamorphosis
- larva, larvae
- nymphs
- pupa, pupae
- setae
- surface tension
- thorax
- tracheal tubes

Resources on the Internet

www.entsoc.org — This site includes links to just about any bug-related site on the Web.

www.sasionline.org — The Sonoran Arthropod Studies Institute is a non-profit organization dedicated to arthropod research and education projects.

www.nhm.org — The Natural History Museum of Los Angeles County's web site includes pages devoted to the Insect Zoo.

www.dragonflies.org — Called "Digital Dragonflies," this site has beautiful images of dragonflies. While it is not geared for children, the site provides vibrant images nonetheless.

Suggested Reading for Students and Educators

McClung, Robert, 1970. *Aquatic Insects and How They Live*. Morrow Publishing, New York, NY.

Johnson, Sylvia A., 1989. *Water Insects*. Lerner Publications, Minneapolis, MN.



AQUATIC INSECTS

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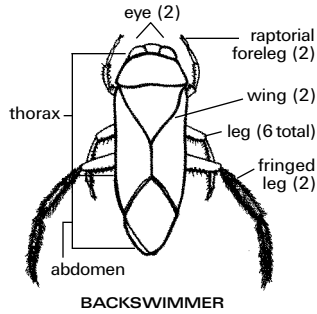
Imagine a watery world where the inhabitants must carry air bubbles to breathe and communicate through ripples on the surface of the water. They may have oar-shaped legs to swim, and some have needle-shaped beaks to pierce their prey and suck bodily fluids. There are some that live on the surface of the water, feeding on drowning insects. These are just some of the survival strategies of aquatic insects.

Insects

Many animals that live in fresh water are insects, with a hardened shell that protects their bodies called an exoskeleton. All insects have six legs as adults, one pair of antennae and three body sections. The head contains the mouth parts and the sensory organs; the thorax contains muscles needed to move the legs and wings; and the abdomen is the location of the internal organs needed for respiration, digestion and circulation. Some aquatic insects, such as dragonflies and damselflies, grow in a gradual manner called incomplete metamorphosis; like all insects, they must shed their exoskeleton several times to grow larger. Others such as beetles and mosquitoes (and their terrestrial counterparts, butterflies and moths) undergo complete metamorphosis, which includes four separate stages: egg, larva, pupa and adult. These aquatic insects spend their egg and larval stages underwater and crawl onto dry land to form their pupae and become adults. The adults may remain in the water to feed and mate, or they may leave the water forever.

Aquatic Adaptations

Aquatic insects were once terrestrial insects that gradually moved into aquatic habitats because there was less competition for food and living space. They continue to breathe air, and some have evolved ways to carry air bubbles with them as they swim after prey. Insects do not breathe with lungs; instead they have trachea, tubes that deliver oxygen directly to the internal organs. Some aquatic insects breathe through tracheal gills (they resemble fins at the end of the insect's abdomen) that enable the insect to absorb oxygen directly from the water. Some insects are so tiny that the oxygen diffuses directly through their thin exoskeletons and they don't need trachea.



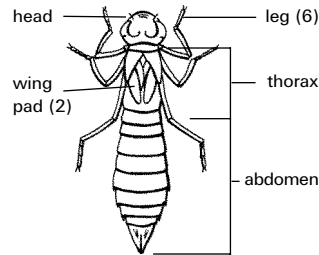
BACKSWIMMER

Many types of aquatic insects use the hairy surface of their bodies to carry an air supply with them as they swim. Predaceous diving beetles trap an air bubble under their wings; not only does the beetle breathe the oxygen in the bubble, but the bubble itself acts as a physical gill and draws even more dissolved oxygen out of the water. The backswimmer also uses a trapped air bubble; however, it draws the bubble over its wings. Giant water bugs break the surface of the water with the tip of their abdomens and draw air into a cavity under their wings. They can breathe with this air supply underwater for as long as 10 minutes.

Because aquatic insects have to move rapidly through water, their bodies are streamlined to facilitate their movement. They do not have prominent antennae, and their legs are often fringed to function as paddles. Backswimmers "row" with their long, oar-shaped back legs.

Underwater Life Cycles

Most aquatic insects live in the water during their immature stages and can or must leave the water as adults. Dragonflies and damselflies begin their lives as nymphs (larva is also an accepted term) in ponds and streams. These nymphs are predators and have a long, hinged lower lip that functions as an arm to grab prey swimming by. Unlike other aquatic insects, dragonfly and damselfly nymphs can breathe underwater with gills at the ends of their abdomens. As they grow, they develop structures on their backs called wing pads, where flying wings will develop later. After several weeks they climb out of the water and their larval (or nymphal) exoskeleton splits down the back. An adult dragonfly emerges, ready to hunt on the wing.



DRAGONFLY NYMPH

Predaceous diving beetles are excellent swimmers, pursuing smaller insects through the water. Females lay their eggs on underwater plant stems, and the larvae, sometimes called "water tigers" for their carnivorous ways, begin to hunt soon after they hatch out. However, the larvae must crawl up onto dry land to pupate, returning to the water as adults. Adults can fly and can be found on summer nights near bright lights.

Female mosquitoes lay their eggs in groups called "egg rafts" that float on the surface of the water. Mosquito larvae hatch out and hang upside down with a tube at the tip of their abdomens for breathing at the water's surface. Mosquitoes lay hundreds of eggs in their brief lives but, luckily for us, few of these larvae will live to pupate and leave the water. They are an important food source for many aquatic insects and fish.

Life on Top of the Water

Water striders, the long-legged insects that skate on the water's surface, have many adaptations that enable them to take advantage of surface tension on top of the water. Their long legs spread their body weight over a larger distance, and setae, fine oil-covered hairs on their feet, dent the water's surface without breaking the surface tension. Water striders have piercing mouth parts that drain the fluids from insects that fall into the water. They use their front legs to grasp prey, their middle legs to move quickly across the surface, and their hind legs to steer.

Build an Aqua-scope

An aqua-scope is an easy way to stay dry while peering into a watery world. Visit a local pond and scoop all sorts of bottom material (leaves, plants, mud and invertebrates) into a plastic bin. After the water settles, students can use their water scopes to observe aquatic insects as they swim around the bin.

Materials

- A can opener
- A clean frozen juice can for each student
- A roll of packing tape
- A 4" square of clear plastic wrap for each can
- Thick elastic band
- Scissors

What To Do:

1. An adult should remove both ends of the juice cans. Stretch the plastic wrap tightly around the end of the can, secure with the rubber band. Use the packing tape to tape down the edges of the plastic wrap. Put one end of the aqua-scope in the water to view aquatic insects.

(Continued)