Minimarvels

Overview

Students are introduced to some of the adaptations that have evolved in aquatic insects including changes in locomotion, breathing reproduction and feeding.

Title
Minimarvels

Investigative Question
What are some of the adaptations that aquatic insects have developed to facilitate life in aquatic environments?

Overview
Students are introduced to some of the adaptations that have evolved in aquatic insects including changes in locomotion, breathing reproduction and feeding.

Objective
Students learn some of the remarkable adaptations that insects have made to aquatic environments

Materials
five wide-mouth glasses or jars, five needles, five forks, copies of **Minimarvel Insect Drawings**

Time
One 50-minute class period

Advance Preparation
Photocopy materials and student pages.

Introducing the Activity
Ask students what their first reaction is when they see an insect. Is it to swat at it or smash it?

Present materials below as background information:

The immediate reaction of most of us to a crawling or flying insect is to stomp or swat. Even the smallest of these creatures that we so often kill are remarkably designed and intricately structured animals. Down to the tiniest detail, their bodies are perfectly adapted for success within their complex ecosystems.

An insect's body is composed of three main parts: head, thorax, and abdomen. The head contains most of the sensory equipment such as eyes, antennae, and mouthparts. Mouthparts differ considerably in size and shape depending upon their functions. Some insects, for example, have piercing and sucking mouthparts for getting fluids out of plants or animals; other insects have chewing mouthparts for devouring prey or leaves; still others have sponging mouthparts for picking up fluids. The middle part of the body is the thorax. It houses the locomotor apparatus—three pairs of legs and in many insects one or two pairs of wings. The abdomen contains the sexual organs used in mating and egg laying and the organs for digestion and breathing.

How many insects are there? The exact number of species is unknown because many areas of the world remain to be studied by entomologists. Estimates vary considerably, but a guess of over one million living species is probably quite conservative. We do know, for example, that a quarter of a million species of beetles have been described and that 28,600 of them are found in the United States! In contrast, only 5,000 species of mammals are found on our planet. These numbers mean that there are at least 200 insect species for every species of mammal. A British entomologist once estimated that 1,000,000,000,000,000,000 (a billion billion) insects are alive at every instant. Insects outnumber people by at least 1,000,000 to 1, and the insect population outweighs the human population by at least 20 to 1.

Why have insects proved so successful? One reason is their small size, which lets them occupy habitats too small for other animals. In addition, their diminutive size allows them to survive and reproduce on small amounts of food. Another reason for their success is their short life cycle. An insect can utilize habitats or food resources that are available for only a short time. The success of insects also depends upon their ability to move from unfavorable sites to more favorable sites, often by flying. In addition, insects have an amazing potential for reproduction: a mayfly, for example, lays thousands of eggs during its brief adult life.

Where do insects fit into food webs? They are found almost everywhere above the level of primary producer, and the roles they play are crucial to the functioning of food webs. Insects feed on a wide variety of plants, aid in their pollination, and decompose dead organisms. In turn, insects are a major food resource for other organisms, including birds, amphibians, mammals, and other insects.

Entomologists study insects for many reasons, but the incredible number of species and their wide variety of colors, shapes, life histories, and sizes (from about 1/100 of an inch to 13 inches in length and from 1/50 of an inch to nearly 1 foot in wingspread!) interest us all.

You may want to review insect metamorphosis briefly if that is a subject with which your students are familiar.

Procedure

1. Distribute the Student Page 1 Background information sheets for students to read.
2. Introduce the water strider: “The water strider, sometimes called a pond skater, does not float on water like a piece of wood. Instead, it skates on the surface. Its body is so light that its six legs do not break through the water’s thin surface.”
3. Demonstrate how the water strider manages to walk on the surface of water with the following simple experiment.
   a. Divide the class into five groups, providing each group with a glass of water, a needle, and a fork.
   b. Ask a member of each group to follow these instructions: Place the needle on the fork, hold the fork near the surface of the water, and let the needle gently roll into the water. The needle floats because the surface of the water is like a skin that supports the needle.
   c. Push on the needle with the fork, and the needle sinks because the water’s “skin” has been broken.
   d. Allow a few minutes so that each student can perform the needle “trick.” Some failures can be anticipated if students break the surface of the water with the fork.

4. Have students discuss the wetland minimarvels described in the background information

5. Distribute a copy of **Minimarvel Insect Drawings** to each student.

6. At the chalkboard list the aquatic insects you have introduced. Ask students to help you compile this list: water strider, dragonfly nymph, diving beetle, caddisfly, water scorpion, damselfly, and water bug.

7. With no hints from you, ask students to label each drawing. By a process of elimination, they should be able to identify most of the pictures. The answers are provided below.

8. Review the adaptations of these wetland insects by asking individual students to choose one of the drawings and describe the adaptation that insect has made.

ANSWERS

1. water strider
2. dragonfly nymph breathing
3. dragonfly nymph expelling water to move
4. dragonfly nymph catching prey
5. caddisfly
6. diving beetle
7. damselflies mating
8. water scorpion
9. male giant water bug

Assessing the Activity

Ask students to write a paragraph on one of the following topics. This assignment is especially appropriate if you have introduced comparison as a writing device. Encourage students to come up with other topics in which they compare the adaptation of a wetland insect to another, quite different application of the same principle.

1. Compare the locomotion of the dragonfly nymph to the forward thrust of a jet plane.

2. If you blow up a balloon and then release it into the air, the balloon takes off. How is the movement of the balloon like the underwater locomotion of the dragonfly nymph?

3. Why is a canoe paddle or an oar shaped the way it is? How does this relate to the hairy rear legs of the diving beetle?

4. Compare the apparatus of a deep-sea diver to the breathing adaptations of the water scorpion and the diving beetle.

State Goals

11, 12 (Objective 12.7.31)

Concept

Insects are an extremely diverse group of organisms which have become specialized to the environments they inhabit.

Safety and Waste Disposal

Needle demonstration should be monitored or removed depending on students.

Student Page 1 – Background Information

Locomotion. The water strider, sometimes called a pond skater, does not float on water like a piece of wood. Instead, it skates on the surface. Its body is so light that its six legs do not break through the water's thin surface.

Another remarkable form of water locomotion is used by the immature dragonfly or nymph. Although the adult dragonfly relies on its wings to get about, the nymph lives underwater and depends on a form of jet propulsion. It sucks water through the rear of its body into a chamber in its abdomen and then squirts it out with enough force to propel itself forward through the water.

Diving beetles swim underwater searching for aquatic insects and tiny fish to eat. Their hairy rear legs act like paddles to move them through the water.

Feeding. The adult dragonfly catches mosquitoes and other small insects while in flight, but the wingless immature nymph develops entirely underwater and must find another method of feeding. Nymphal mouthparts are hinged underneath the head and swing out like a retractable lower "lip" to snatch prey such as an aquatic insect, a small fish, or even a tiny tadpole.

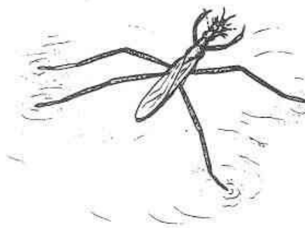
The slender water scorpion uses its front legs to capture prey—just about any small underwater creature. Its needlelike mouthparts pierce its prey, and the water scorpion then sucks the juices from inside.

The water strider searches for insect prey on the surface of water and finds a menu suited to its ability to "skate" on the surface. Tiny waterproof hairs on its feet help to prevent it from sinking.

Breathing. Many water insects, such as the caddisfly, rely on gills for breathing. The water scorpion, however, has no gills and must poke its breathing tube up through the surface film of the water to get air. The gill-less diving beetle must go to the surface to get a bubble of air, which it holds under its wing as it re-enters the water. Other diving beetles rely on waxy hairs to trap air next to their bodies. The dragonfly nymph gets oxygen by pumping water into a chamber in its abdomen; expelling this water also provides locomotion.

Reproduction. The female of some species of water bugs takes care of her eggs by gluing them to the back of a male, which carries them until they hatch. Damselflies and dragonflies mate while in flight. The male grasps the female behind her head with the tip of his abdomen. The female collects sperm by placing the tip of her abdomen near the male's sex organs on the anterior (front) end of his abdomen.

Minimarvel Insect Drawings



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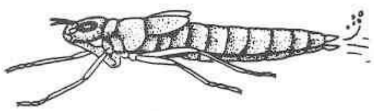

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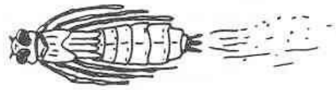

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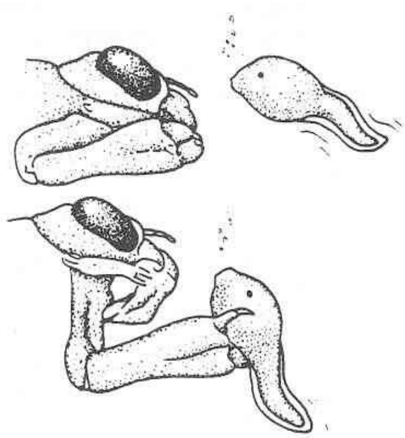

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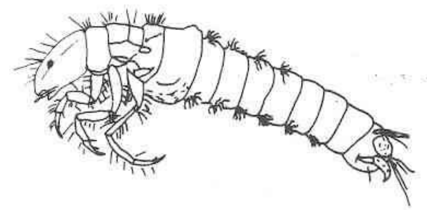

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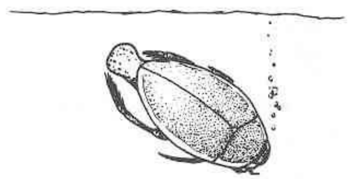

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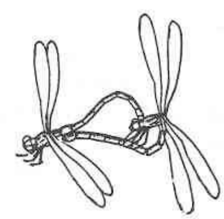

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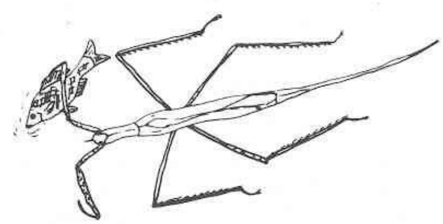

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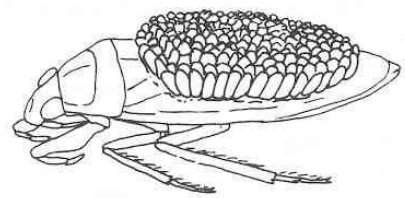

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