

Life at the Surface

Adapted from: “Life at the Surface” and “A Tense Place to Live?” in Living in Water. National Aquarium in Baltimore, 1997.

Grade Level: all

Duration: 1 class period

Setting: classroom

Summary: Students make models of surface dwelling organisms that use surface tension.

Objectives: Students will recognize how organisms are adapted to living at the surface, while learning about surface tension.

Related Module Resources:

- Books: macroinvertebrates
- Macroinvertebrate fact sheets [folder]

Vocabulary: cohesive property, surface tension

Materials (Included in Module):

IN ENVELOPE:

- Forks, paper clips
- Reference Collections that include aquatic insects that live on water surface.

Additional Materials (NOT Included in Module):

ACADEMIC STANDARDS (ENVIRONMENT AND ECOLOGY)

7th Grade

4.1.C Explain the effects of water on the life of organisms in a watershed.

- explain how the physical components of aquatic systems influence the organisms that live there in terms of size, shape and physical adaptations

4.6.A Explain the flows of energy and matter from organism to organism within an ecosystem.

- describe and explain the adaptations of plants and animals to their environment
- demonstrate the dependency of living components in the ecosystem on the nonliving components

4.7.A Describe diversity of plants and animals in ecosystems.

- identify adaptations in plants and animals

10th Grade

4.1.C Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments

- describe and explain the physical factors that affect a stream and the organisms living there

4.7.B Explain how structure, function and behavior of plants and animals affect their ability to survive.

- describe an organism’s adaptations for survival in its habitat

12th Grade

4.6.A Analyze the interdependence of an ecosystem.

- analyze the relationships among components of an ecosystem

BACKGROUND:

Most aquatic insects that we collect are found on the stream substrate (bottom), but there are a number of insects that reside on or near the water’s surface.

Water has a tendency to stick to itself. This **cohesive property** of water is perhaps most obvious at the surface. The top layer of water molecules forms a film or “skin” which is relatively strong caused by **surface tension**. A number of animals and plants live directly on the surface of bodies of water. Even though many of these creatures are heavier than water and cannot float, they stay at the surface by “riding” on the surface film created by surface tension.

Some aquatic insects reside on the surface of the slow moving sections of a stream, creek, river, or on ponds and lakes. Some live on the surface because of a readily available supply of food. Another reason to live on the surface or near the surface is to have plenty of oxygen available. It doesn't matter to them whether or not the water contains enough dissolved oxygen because they breathe from the air without having gills or they have special breathing apparatus or habits to obtain oxygen from the air.

The most familiar aquatic insect that dwells on the surface is the water strider, also called pond skaters or Jesus bugs because they “walk on water.” These insects have feathery leg tips to skate along the water with the second pair of legs actually penetrating the surface and working like oars to propel the insect. These insects prowl for insects that have fallen into the water. These fallen insects cause a vibration on the water surface film that helps the water strider find it and capture it. The strider then uses piercing-sucking mouthparts to eat the prey.

Another common surface dweller is the whirligig beetle, often found scurrying around living in colonies. These insects have some incredible adaptations to live on the surface. Whirligigs have two sets of eyes – a pair above the surface and a pair for below the water. Even if it did not spot a predatory fish approaching, the whirligig is usually safe from harm because it has a strong distasteful secretion (creating a unique odor when caught) that makes it unpalatable to fish. The hind legs have swimming hairs to help it swim on the surface and dive into the water. Like many other aquatic beetles, when they dive underwater, they carry with them an air bubble on their underside and breathe from this bubble.

Other kinds of insects, like mosquito larvae, hang upside down from the surface film and poke a breathing tube up through it. A water scorpion and a giant water bug also have breathing tubes. These creatures can use their tubes to take in oxygen while remaining safely below the water's surface. A pond insect called a springtail has a spring-like appendage with which it jumps around on the surface of ponds and temporary water holes.

One thing that could destroy the surface tension of water is detergent. Soapy industrial pollutants can cause problems for surface dwelling insects. Interestingly enough, some insects that might otherwise be preyed upon by water striders are able to spit small amounts of “detergent” into the water and cause the strider to go under before grabbing its meal!

NOTE: Be careful not to refer to things that are supported by surface tension as floating. They are heavier than water and do NOT float. Try using the concept of riding or resting on surface tension.

OVERVIEW: Students can do a few different things to learn more about surface dwelling aquatic insects: catch them at the stream, keep and observe some water striders in an aquarium, conduct a demonstration of surface tension using paperclips, and review these creatures under a microscope.

PROCEDURE: WATER SURFACE TENSION DEMONSTRATION

1. Discuss surface tension. Explain that the students will observe this water property in a short activity.
2. Provide the students with some metal and/or plastic coated paperclips and a fork. Fill up a large beaker, butter dishes, Tupperware container, or some other container with water. Instruct the students that they are to try to place as many paper clips on the water surface as possible. Even though the paperclip is heavy enough to sink, surface tension can allow the paperclip to ride on top of the water.
3. Hold a contest to see who can get the most paperclips to ride on the surface.

PROCEDURE: CATCH AND OBSERVE WATER SURFACE DWELLERS

1. Once you are sure the students understand the concept of surface tension, discuss organisms that use surface tension using the background information.
2. Once at a creek or pond, it is best to catch surface dwelling aquatic insects using a d-frame net. Swoop this net along the surface or dip it into a colony of whirligig beetles or a group of water striders.
3. Students can observe these aquatic insects under a microscope or with magnifying glasses. A petri dish with both a bottom and lid might be helpful in order to keep these creatures from crawling out from under the microscope. Student can also observe the preserved specimens from the reference collection of these surface creatures.
4. Encourage students to make observations of the creatures and to search for all the body adaptations discussed in the background section.
5. Students can bring water striders back to the classroom and place them into an aquarium to observe. Use the information at the end of this activity on how to care for water striders.

DISCUSSION:

What are the benefits to living on the surface for aquatic insects? *See background information.*

What body adaptations do some surface dwelling insects have? Did students find these adaptations when observing the insects? *See background information.*

EVALUATION:

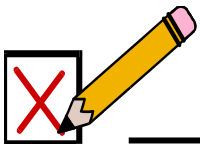
- Explain surface tension.
- Describe how organisms use surface tension.
- Identify adaptations that allow organisms to rest on surface tension.

EXTENSIONS AND MODIFICATIONS:

- Have the students draw a picture of an aquatic insect that dwells on the surface, pointing out the adaptations.
- Allow the students to make models out of craft supplies of some of these aquatic creatures. They can make the models as elaborate as they wish, including adaptations for eating, avoiding predators, etc.

NOTES (TEACHERS, PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):

Activity Version: May 2003



INFORMATION: CARING FOR LIVE WATER STRIDERS

SOURCE OF INFORMATION: *Rivers and Streams (Exploring Ecosystems)*. Patricia A. Fink Martin. Franklin Watts, Grolier Publishing, Inc., New York, 1999.