A Piece of the Action: Macroinvertebrate Aquarium

Overview

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Title
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Investigative Question
How do aquatic macroinvertebrates live in and move about their environment?

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Objective
Students observe and analyze macroinvertebrates in aquarium habitats.

Materials
For the introductory activity: petri dish, overhead projector and screen, low-powered dissection microscope, several aquatic macroinvertebrates.

Ten-gallon or larger aquarium; pond water or tap water and dechlorination chemical (available from pet stores); aquarium air pump or laboratory air jet; air stone; air line tubing and air line valve for pressure control (available from pet stores); rocks, gravel, sand, mud, plants and invertebrates collected from a pond or stream; full-page magnifer (available at bookstores) to attach to the side of the aquarium; dissection needle; screen top for the aquarium to prevent invertebrates from escaping. A screen top can be made by folding windowscreen over the top of the tank.

Time
One or two 50-minute class periods followed by periodic observations.

Advance Preparation
1. Select a cool, bright location for the aquarium. Make sure that the stand or shelf can support the weight of the aquarium plus gravel and water. Ten gallons of water weighs about 80 pounds.
2. If tap water is used, fill buckets or barrels with enough water to fill the aquarium half full. Treat the water with chlorine remover and allow it to sit for at least a day.
3. Collect rocks, gravel, sand, mud, plants and invertebrates from a pond or stream. If tap water is not to be used, collect pond or stream water. If a safe pond or stream is nearby, students may collect this material by themselves (See "Get Your Hands and Feet Wet" activity). If possible, store the invertebrates in a refrigerator until the aquarium is ready to receive them.

4. Assemble the air line tubing and pressure control valve.

Introducing the Activity
Carefully place an invertebrate in a petri dish half filled with pond or stream water. Place the petri dish on an overhead projector and view the invertebrate on a screen. A highly mobile creature works best (e.g., whirligig beetle). Students can also observe other aquatic macroinvertebrates with a low-power dissection microscope. Students should note the insect parts and how the animals move.

Procedure
1. Set the aquarium tank in its final location. Do not move it after it is filled with water! Place coarse sand, gravel, and a few larger stones in the bottom of the tank. Slowly fill the tank half full with water. Try not to stir up the substrate. Hint: place a plate or pan on top of the substrate and pour the water on it instead of directly on the substrate. Connect one end of a length of airline tubing to an air stone and the other end to an aquarium air pump or a laboratory air jet.
2. Plant rooted plants in theSand in the aquarium. Make sure some of the plants stick up out of the water to allow insects to crawl out of the water to molt and emerge as adults (dragonflies, stoneflies). Release a variety of invertebrates into the aquarium and install the screen cover.

3. Observe the invertebrates daily. Attach the full-page magnifer to the side of the aquarium to help students observe small invertebrates. Without disturbing the aquarium, look for them hiding in the plants and around the rocks. Is there evidence of burrowing? Note the activity of the invertebrates. Are they swimming? Crawling? Do some have a favorite place in the aquarium?

4. Some of the invertebrates will be predators, and they will need to be fed or they will eat some of their tank mates. Try offering them tiny bits of chopped shrimp or beef or chicken heart. Stick a piece of meat on the end of a dissection needle and hold it in front of the predator. Wiggle the needle slightly so that the meat looks alive.

5. How many of the macroinvertebrates can you identify? Does the library have books that will help you to make identifications?

Assessing the Activity

Assign a written report on observations of macroin vertebrates in an aquarium. This may be done in the form of a journal in which observations are recorded on a daily basis. Alternatively, students could elect to report on a given macroinvertebrate:

food habits, locomotion, habitat preference, adaptations—in so far as these can be determined by observing an organism in an artificial habitat. Library research would be helpful in writing this report and might also give clues on what behaviors organisms in the aquarium might be expected to exhibit.

Extending the Activity

1. Use a larger aquarium (20-, 30-, or 40-gallon tank). Set up several habitat types within that aquarium. Different substrates and plants can be used in various sections of the aquarium. After a couple of weeks, observe how the critters are arranged about the aquarium. What conclusions can be drawn?

2. Collect substrate (bottom materials) and plants from a stream along with their accompanying invertebrates. Do not add additional invertebrates. Observe what critters appear in the aquarium.

3. Try to establish a balanced aquarium. In a balanced aquarium, no outside input should be necessary. There should be enough plants to feed the herbivores and enough herbivores to feed the predators. Divide the class into groups with each group setting up its own potentially balanced aquarium. Each group selects the plants and invertebrates for its aquarium. Students should keep a record of what they included and why. They should keep weekly records of what is happening in their aquarium. After two months, compare the aquaria. What differences can be observed? What happened in each and why? Were there significant failures or successes? Can these be accounted for? What would students do differently if they were to set up their aquaria again?

4. Put one aquarium in a sunny place and one in a dark place. After two weeks observe the differences in plants, animals, substrate, water color, and odor.

5. Set up an aquarium in a dark room or in an area not reached by sunlight. Place a light near one end. Observe how the invertebrates distribute themselves about the tank. Is there an effect on plant growth ?

6. Set up two aquaria that are as identical as possible. Place one in a sunny locaton and allow it to experience a natural light regime. Light the other aquarium at night (in effect, reversing its daylight hours). During the day, cover it with one or more layers of red cellophane to simulate night. More than one layer of cellophane should be added if the contents of the aquarium can be easlily seen without the use of a flashlight. Observe the activity in the dark aquarium by shining a flashlight through the red cellophane. Compare the activity in the two tanks. Differences may not be immediately apparent.

7. Set up a stream aquarium by providing a current using a submersible undergravel filter head available at pet stores. Position the filter head along the length of the tank to create a current along the bottom. Use sand, gravel, and a couple of piles of rocks as substrate. Add invertebrates and plants collected from a flowing stream. Observe changes in substrate depositions and how the invertebrates distribute themselves about the aquarium. To what conclusions do your observatons lead?
8. Collect macroinvertebrates from different areas of a stream: pool, riffle, muddy bottom, rocky bottom, still water, fast flowing water, varying water depths. Record as much information as you can about each collection site. Identify the macroinvertebrates by site. What correlations can you make between a site and its resident macroinvertebrates? Return the organisms to the stream or bring them back to the classroom for the aquarium.

State Goals
11,12

Concept

Although aquatic organisms live in water, they do not necessarily live in the same types of habitats. They partition the available space based on their preferences for the various conditions that occur in flowing waters.

Safety and Waste Disposal If an aquarium stand is used, it must be strong enough to support the weight of an aquarium filled with water.