Brine Shrimp: Getting to Know a Salt Water Arthropod

Horseshoe crabs are arthropods that have changed little since their initial appearance on earth over 450 million years ago. Raising horseshoe crabs in a home aquarium is possible, but requires a great deal of work, money, and experience in maintaining saltwater animals. Raising brine shrimp, however, offers an easy and relatively inexpensive alternative. Brine shrimp (scientifically known as Artemia) are arthropods that, like their relatives the horseshoe crabs, thrive in saline waters. Brine shrimp, however, are not marine, but are found in inland saltwater lakes.

In this activity, students will assemble a small saltwater aquarium to raise and observe brine shrimp. Then students will observe and record the growth of brine shrimp through various stages of their life cycle, and examine their various anatomical features.

Grade Level: 6th -8th Grade
Subject Matter: Life Sciences
National Standards: NS.5-8.1, NS.5-8.3

Beach Season for Horseshoe Crabs, http://www.sciencefriday.com/videos/watch/10312

Each summer, horseshoe crabs (*Limulus polyphemus*) from the Yucatan to Maine crawl up on beaches to mate and lay eggs. That makes June and July a good time of year for marine scientists like John Tanacredi, of Dowling College, to monitor horseshoe crabs' numbers. Dr. Tanacredi been tracking horseshoe crabs on Long Island, N.Y. for 10 years and has recently started a breeding program, with the aim of increasing the crabs' population size in the wild.

Activity Materials
Brine Shrimp Hatchery Kit – available for $36.00 each from www.carolina.com
One carton of sea salt or kosher salt
Empty and clean one-liter bottles – one for each student or group of students
Teaspoons – one for each student or group of students
Yeast – a couple of packets
Magnifying lens – one for each student or group of students

Vocabulary
Arthropod: an invertebrate having jointed appendages, an exoskeleton, and a segmented body.
Invertebrate: an animal without a backbone.
Cyst: protective sac enclosing an organism such as brine shrimp eggs.
Nauplius (Plural = Naplii): brine shrimp larva (plural = larvae).
Molting: the shedding of an exoskeleton as an organism grows a larger exoskeleton.

What to Do
Note: In order to conserve materials, this lesson can be modified as a classroom or group activity. To allow students to compare and contrast, you will need to set up at least two aquariums. Read and follow the care and maintenance instructions included in the Brine Shrimp Hatchery Kit.

1. Begin the lesson by having students watch the Science Friday video, "Beach Season for Horseshoe Crabs." Ask students if they were surprised to learn that horseshoe crabs are related to scorpions or spiders. Inform students that they are going to observe the growth of another type of arthopod.

2. Without telling students what the specimens are, place a pinch of brine shrimp eggs on a piece of white paper in front of each student. Have them examine the eggs with a magnifying lens and discuss their observations with each other. What do the specimens look like? What do the students think the specimens are?

3. Inform students that these are brine shrimp eggs and that brine shrimp are another type of arthopod, just like horseshoe crabs. Have students follow the instructions below to prep their aquarium:

a. Fill the empty liter bottle with lukewarm water and pour two teaspoons of sea salt or kosher salt inside.

b. Close the bottle and shake until the salt has completely dissolved. Pour the salt water into the plastic aquarium. Repeat making saltwater and pouring it into the aquarium until the aquarium is almost full.

c. Set up the air pump, assuring that one end of the tubing is attached to the air pump, and the other end is attached to the air stone. Place the end with the air stone into the water.

d. Once the air stone is inside the aquarium, turn on the air pump and add the brine shrimp eggs to the water (half a teaspoon to one teaspoon of brine shrimp eggs per aquarium).

e. Place the container in a warm place, but out of direct sunlight. Eggs will begin to hatch in about 24 hours.

4. Have students use their magnifying lenses to observe and record the following over the next three weeks:

a. Life cycle stages – Sketch and record measurements from each stage. What are the different body parts that develop for each stage? When do they molt, and why?

b. Feeding – After the first 24 hours, students can feed brine shrimp a small pinch of yeast once a week. Inform students that they should not overfeed the brine shrimp, to avoid polluting the water. During each feeding, record brine shrimp reaction to food placed in the aquarium.

c. Movement – How do brine shrimp move through water? Are they constantly moving or do they prefer a certain area of the aquarium?

d. Gender – What are the physical differences between male and females?

e. Light stimulus – Place the aquarium so that one part of the aquarium receives direct light. How do the brine shrimp react?

5. Compare and contrast the results from all aquariums. Discuss why the results were different or similar. Did all the eggs hatch at the same time? Were all the aquariums placed in the same environment? Were salinity or temperature levels the same in each aquarium? What other variables could account for the differences?

What's Happening?
Brine shrimp commonly are found in inland saltwater lakes such as the Great Salt Lake in Utah. The life

cycle of a brine shrimp begins as an egg (cyst) that can remain dormant for as long as a few years. Once exposed to favorable conditions, the brine shrimp will hatch form its cyst as a larva (nauplius). Nauplii can molt about 15 times before reaching adult size, which can be as long as a centimeter. They can live up to a year.

In the late nauplius stage, a brine shrimp will develop 11 appendages that help it feed, swim, and eat. Males will have distinctive antennae on top of their heads and females will develop visible egg pouches. Ideal conditions, such as warm temperatures, accessible food, and plenty of oxygen, will cause brine shrimp to reach maturity at a faster rate (three to six weeks) than less favorable conditions will (eight weeks). Brine shrimp are raised and sold as a food source for other aquarium fish and crustaceans, used in science research experiments, and advertised as fun household pets.

Topics for Classroom Discussion

- What are some characteristics that make horseshoe crabs and brine shrimp similar or different from each other?
- What are some possible reasons that brine shrimp can be found only in saline inland lakes?
- Why would brine shrimp cysts need to remain dormant for long periods of time?

Extended Activities and Links

Extend this activity by having students create experiments that test favorable physical conditions for hatching and growing brine shrimp. Variables can include different salinities, temperatures, and pH levels. For a closer look at brine shrimp, use a turkey baster to gently extract a few brine shrimp from the aquarium, and place them on a Petri dish to view under a microscope. Observe and compare brine shrimp development for each life cycle stage.

Have students research and collect images of various types of arthropods, and create photo journals with descriptions of each type.

Go on a horseshoe crab expedition, searching for live horseshoe crabs at a local beach or aquarium. If possible, visit a beach or marshlands during the full moon in the spring, when students may be able to see horseshoe crabs mating.

Explore brine shrimp life cycle through this online interactive:
http://learn.genetics.utah.edu/content/gsl/artemia/

Learn interesting facts about horseshoe crabs, teacher resources, and how to help conservation efforts:
http://horseshoecrab.org/