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Part I: Brine Shrimp Life Cycle

Abstract:
In this lesson, students will have the opportunity to observe brine shrimp cysts, newly hatched brine shrimp, and adult brine shrimp with a dissecting microscope. Students will record their observations through drawings and writing.

Grade level: 3rd

Utah Elementary Core Curriculum Standards:

STANDARD 3030-01: Students will explore ecosystems and discover relationships among living organisms and the nonliving world.

- *Objective 3030-0101: compare and contrast similarities and differences of similar habitats.*
- *Objective 3030-0102: Identify relationship between living and nonliving organisms in a habitat.*

In-class instructional time: 30-45 minutes

Terminology:
Brine shrimp (*Artemia salina*): tiny aquatic animals that live in Great Salt Lake and other hypersaline environments.
Ecosystem: a unit made up of the interacting living and non-living components of a community.
Cysts: dormant brine shrimp babies
Nauplii: the first stage in the life cycle of brine shrimp after they have hatched from the cysts.

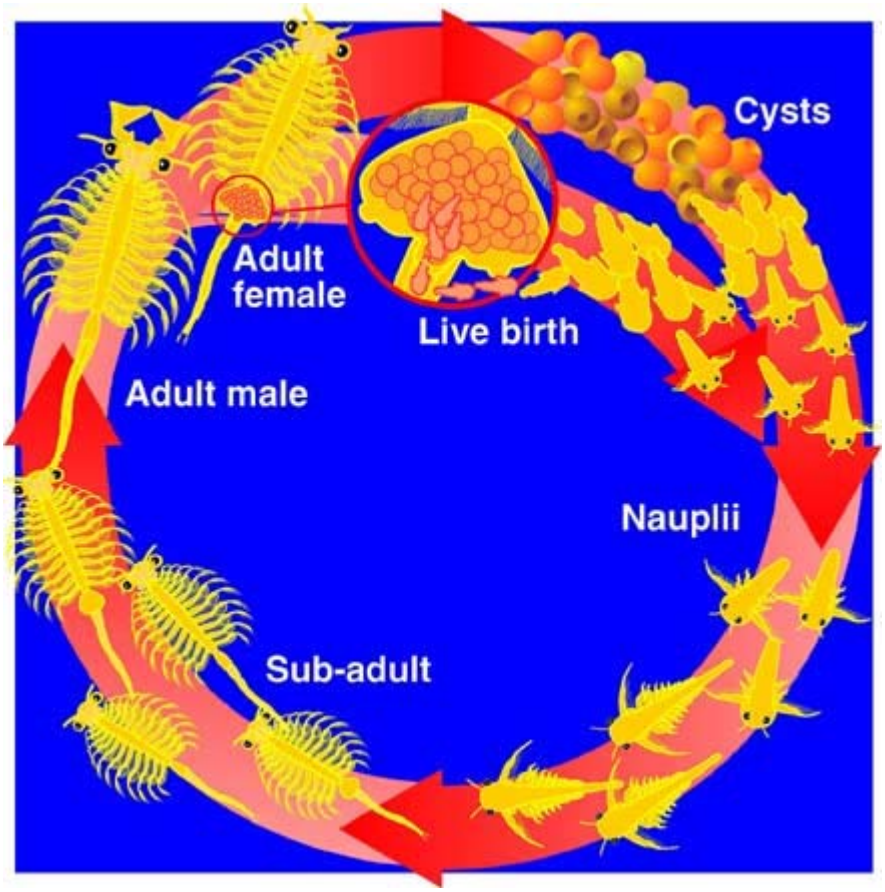
Intended Learning Outcomes:

- Students will observe different stages of the brine shrimp's life cycle
- Students will identify stages of the brine shrimp's life cycle through drawings.

Background:

Brine shrimp are one of the few organisms that can live in the Great Salt Lake under normal conditions. They are well adapted to living in the salty water and feed on the algae and bacteria in the lake. Brine shrimp hatch from tiny cysts containing fully formed baby shrimp that float on the surface of the lake. Cysts laid in the fall can survive the winter, remaining dormant until the weather is right for hatching. Although the adult shrimp cannot survive cold temperatures, these over wintering cysts have been known to remain viable for up to 25 years! During warmer months, cysts are hatched within the females, who carry "egg sacs" on their abdomens. Newly hatched brine shrimp are called *nauplii*. Nauplii look like tiny white dots to the naked eye and are very active. They molt several times before reaching adulthood. Adult brine shrimp are small—about ¼" long—and may be slightly pink in color.

Brine shrimp play an important role in the Great Salt Lake ecosystem. They provide food for many birds of the Great Salt Lake, such as gulls and grebes. Brine shrimp also play a role in Utah's economy. Every year, millions of pounds of brine shrimp cysts are harvested and sold to pet stores or prawn farmers in Asia, for use as fish or prawn food.



Materials:

- Brine shrimp cysts*
- Oolitic sand (not necessary, but great if you can find it)
- Ziploc bags and clear cups or glass mason jars with lids (do not use pickle jars)
- De-ionized or distilled water
- Sodium chloride (table salt with no added iodine)
- Nauplii (newly-hatched brine shrimp) (see **Advance Preparation**)
- Adult brine shrimp (see **Advance Preparation**)
- Dissecting microscopes or hand lenses
- Plastic pipettes
- Plastic petri dishes

**Brine shrimp cysts can be purchased online from the following locations:*
http://www.brineshrimpdirect.com
http://www.pondsolutions.com/brineshrimp.htm

Advance Preparation:

- Two to three weeks prior to lesson, set up a brine shrimp ecosystem to begin hatching so you will have adult brine shrimp to observe. Also, two days prior to the lesson, begin hatching another group of brine shrimp so you will have nauplii to observe.
- See Lesson II for instructions on setting up brine shrimp ecosystems.

Prior Knowledge Assessment:

- Ask students what they know about Great Salt Lake. What lives near Great Salt Lake? Does anything live in Great Salt Lake? Ask students if they know what a brine shrimp is. Have students write or draw pictures of what they think a brine shrimp looks like.

Procedure:

- Sprinkle a few cysts on white paper and have students brainstorm a list of what the "brown stuff" might be. Have students observe the cysts through microscopes/hand lenses and record their observations through writing and drawing in their science journal.
- Tell students that those brown things are actually cysts from an animal in Great Salt Lake. Explain how cysts contain fully formed baby brine shrimp and can remain dormant during the cold winter, waiting for better hatching conditions.
- Show students the nauplii, explaining that they are newly hatched brine shrimp. Show students how to use the pipette to pick up nauplii and place them in a dish or on a slide for observation. Have students record their observations by drawing and writing about what they see.
- Show students the adult brine shrimp and have them observe them underneath a dissecting microscope. Have students record their observations by drawing and writing about what they see. Students can compare their drawings of actual brine shrimp to the drawings they created during the pre-assessment.

Procedure adapted from

- http://www.teachers.net/lessons/posts//659.html
- The Great Salt Lake Story: An Interdisciplinary Activity Guide
    - available from: The Utah Museum of Natural History.
      215 South 1350 East
      University of Utah
      Salt Lake City, UT 84112
      Phone number: (801) 581-4887

Closure:

Have students draw a diagram showing the life cycle of a brine shrimp. Discuss how the life cycle is similar to and different than their own life cycle and the life cycles of other animals. Explain to students the role that brine shrimp play in Great Salt Lake's ecosystem and in Utah's economy. (See **Background** for more information.)

Assessment strategies:

Have students record their observations and drawings in their science journal. Students are graded according to the detail and accuracy of the drawings and written responses.

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Light Conditions for Brine Shrimp Hatching in a Micro-Ecosystem

Abstract: Students will create an ecosystem and determine the amount of light that will allow shrimp cysts to hatch more quickly. They will conduct an experiment and collect and record the data found.

Grade Level: 3rd

Utah Elementary Core Curriculum Standards:

STANDARD 3030-01: Students will explore ecosystems and discover relationships among living organisms and the nonliving world.

- *Objective 3030-0101: compare and contrast similarities and differences of similar habitats.*
- *Objective 3030-0102: Identify relationship between living and nonliving organisms in a habitat.*

In-class instructional time: 45 minutes first day, 20-30 minutes for at least 2 consecutive days.

Terminology:

- Brine shrimp (*Artemia salina*): tiny aquatic animals that live in Great Salt Lake and other hypersaline environments.
- Ecosystem: a unit made up of the interacting living and non-living components of a community.
- Cysts: dormant brine shrimp babies
- Nauplii: the first stage in the life cycle of brine shrimp after they have hatched from the cysts.
- Oolitic sand: sand composed of oolites
- Oolite: a particle with a shell of concentric layers of calcium carbonate deposited around a central core--usually a tiny piece of brine shrimp "poop" or a mineral fragment.

Intended Learning Outcomes:

- Students will create an ecosystem of their own containing elements needed to hatch and grow brine shrimp.
- Students will decide how the ecosystem of the brine shrimp fits into the larger ecosystem.

Background:

Brine shrimp are well adapted to the high salinity of Great Salt Lake and play an important role in its ecosystem. They provide food for many birds of Great Salt Lake, such as gulls and grebes. Brine shrimp feed on microorganisms such as algae and bacteria and help rid the lake water of contaminants such as phosphorus and nitrogen. Under optimal conditions, brine shrimp can live up to three months or more. However, due to changes such as temperature and food supply in the lake, the average life cycle is closer to 1½ months. Other variables that can affect a brine shrimp's growth and survival include light, pH oxygen, and salinity of the water. This lesson will focus on the role light plays in Brine Shrimp hatching. (You could investigate some of these other variables in further experiments!)

Materials:

- Ziploc bags and clear cups or glass mason jars with lids (do not use pickle jars)
- Brine shrimp cysts
- Oolitic sand (not necessary but great if you can find it.)
- De-ionized or distilled water.
- Sodium chloride (table salt with no added iodine)
- Microscope

Brine shrimp cysts can be purchased online from the following locations:
http://www.brineshrimpdirect.com
http://www.pondsolutions.com/brineshrimp.htm

Prior Knowledge Assessment:

- Ask the students if they know anything about brine shrimp. Discuss the conditions necessary for normal organisms to live. Ask students to decide under what light conditions they think the brine shrimp will hatch the fastest—would they hatch faster with no light, constant light, or a few hours each day of light? Have them write down a prediction and why they think it will happen that way.

Procedure:

You should divide class into thirds. Each group will prepare three jars for one of the three different light levels.

- Measure 1 cup of distilled or de-ionized water to 1 teaspoon of sodium chloride. Mix well and pour into jars.
- Add enough oolitic sand to cover the bottom of the jar. Also, you can have students examine the oolitic sand underneath a microscope. It looks different than regular sand in that the particles (oolites) are quite round and smooth. You can explain to students how the sand is formed from particles of brine shrimp "poop" getting coated with calcium carbonate as they are rolled around the bottom of the lake.
- Add a small amount of brine shrimp cysts to the jar. (Enough to cover the flat end of a toothpick.)

- Place one group of jars underneath a sun lamp. These jars will remain under the lamp 24 hours a day.
- Place one group of jars in a dark closet or cupboard. These will remain in the dark 24 hours a day.
- Place one group of jars in a dark closet or cupboard. These jars will need to be placed under a sunlamp for 2 hours each day.

Brine shrimp should be hatched in a semi warm environment, although they do hatch at room temperature within 24-48 hours.

- Students should check the brine shrimp every 8-12 hours. (Once at the beginning of the day and once before they go home will work also.)
- Have students create a classroom chart to record the results of their observations. Be sure to include headings for each type of light, with as many spaces as there are jars, a space for room temperature and for the time the samples are taken. You should also have a space for what time the samples were started.
- Students can take samples from their jars and look at them under the microscope to count the number of cysts that have hatched. Demonstrate how to estimate the total number of nauplii in the jar: Use a plastic pipette to remove 1 mL of water from the jar and place it on a petri dish. Put the dish over the light of the dissecting microscope and count the number of nauplii. Multiply this number by 250 to get the estimate of how many nauplii are in the 250 mL of water in the jar.
- Have students record the number of hatched brine shrimp in their samples on a chart under the appropriate heading for amount of light. Also record the time the sample was taken.

Procedure adapted from

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- The Great Salt Lake Story: An Interdisciplinary Activity Guide
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Closure:

After two or three days of collecting data, have students examine the results. What does the data indicate about what kind of light conditions brine shrimp need to hatch? Does the data support their original hypothesis?

Assessment strategies:

Have students write their predictions, observations and results in their science journal. Students are graded on a rubric for the completeness of their write up of the experiment, neatness, and for well thought out hypotheses.

Students may also prepare a short report on what is needed in the ecosystem of a brine shrimp for it to survive, as well as what part the brine shrimp play in the larger ecosystem they are a part of. Reports will be assessed on accuracy of information and creativity. Possible resources for student reports include websites such as the following:

- http://people.wcslc.edu/faculty/t-harris/gslfood/index.html
- http://wwwdutslc.wr.usgs.gov/shrimp/index.html