CURRICULUM SUPPLEMENT

A Big Package of Small Things!

A Zooplankton rearing and collection activity

For use with the **Drivers** section of **Gulf Watch**

Overview: Students will get a close up look at live plankton by hatching their own colony of zooplankton. During the first of two multi-part activities, students will collect and clean the materials needed to build a brine shrimp hatchery in the classroom. Once hatched students will observe these tiny arthropods under magnification and make population estimates from their measurements. Finally the students will construct their own plankton net that is suitable to be used to collect wild specimens of plankton from local fresh or salt water bodies of water.

Learning Objectives:

The student will:

- *Understand and be able to explain the **construction of a rearing habitat** necessary for the hatching and development of a zooplankton species (*Artemia franciscana*).*
- *Understand thru observation the **motility and morphology of a species of zooplankton.***
- ***Estimate population density** of their zooplankton colony.*
- ***Construct and employ a proven scientific instrument** used to capture samples of plankton from the wild. Understand how this instrument is used by researchers in the field to track the density and type of plankton in the study area.*

Standards Addressed:

Alaska Science GLES :
https://education.alaska.gov/akstandards/standards/standards.pdf
6th: SA1.1, SA1.2, SA3.1, SE2.2
7th: SA1.1, SA1.2, SA3.1, SE1.1, SE2.2
8th: SA1.1, SA1.2, SA3.1, SE1.1, SE2.2, SE3.1

Next Generation Science Standards:
http://www.nextgenscience.org/search-performance-expectations
MS-LS1-4, 5, 7
MS-LS2-1, 2, 4, 5

Ocean Literacy Principles:
http://oceanliteracy.wp2.coexploration.org/ocean-literacy-framework/principles-and-concepts/
OLP #5 The ocean supports a great diversity of life and ecosystems.

Materials/Location Needed:

- *This lesson encompasses two, multi-part activities; both can be completed in the classroom setting with an extra credit activity students can accomplish outside of school. These activities do require the purchase of some materials not normally found in classroom or school supplies. However every*

effort has been made to keep the costs as low as possible using materials which are readily available in most communities.

- *Two clear one-liter soda bottles with caps*
- *Non-iodized salt*
- *Baking soda*
- *Reading lamp*
- *Aquarium materials: Many schools and perhaps even some of your students will have the following equipment that they are no longer using. Be sure to ask around before you make the following purchases:*
    - *3/16" rigid aquarium air-line tubing – at least 12" long (3' sections sell for apx. $2.00)*
    - *4' of flexible air-line aquarium tubing (8' packages sell for apx. $3.00)*
    - *Aquarium air pump (smallest you can find – 10 gal. tank pumps sell for apx. $8.00)*
- *Vial of brine shrimp eggs (6 gm vials sell for apx. $7.00)*
- *Several eye-droppers*
- *1 mm graph paper found on page 9 of this lesson.*
- *One page of overhead transparency film*
- *Microscope or hand lens with 20x power*
- *9" wooden embroidery hoop – one for each student (ea. sells for apx. $1.50)*
- *5 gal. paint strainer bag – one for each student (ea. sells for apx. $1.50)*
- *3, 15" pieces of nylon string – one set for each student (1000' sells for apx. $5.00)*
- *1, 3/8" stainless steel washer per student (100 pack sells for apx. $10.00)*
- *1, 12" cable tie per student (100 pack sells for apx. $7.00)*
- *1, wide mouth clear plastic drink bottle per student from recycling bin (washed clean!)*
- *30' of nylon parachute cord per student (100' sells for apx. $5.00)*
- *Student worksheet found on pages 7-8 of this lesson plan.*

Teaching Time: 120 minutes over two days – 24 hours apart

Preparation Time: 60 minutes

Background:

Activity 1: Named after the Greek word for 'drifter' plankton are vital to marine food webs all around the world. In fact it is plankton in the form of photosynthesizing plants called phytoplankton, that allowed the Earth to become habitable in the way we know and enjoy it today. Phytoplankton are responsible for 3 of every 5 breaths of oxygen we take! While many phytoplankton are so small extreme magnification is required to view them. Some species of zooplankton can be seen easily with the naked eye and in greater detail with only minimum ocular enhancement.

Activity 2: To catch and sample these tiny critters, scientists employ a relatively simple device called, conveniently enough, a plankton net. The very fine mesh at the capture end (called the 'cod end') of the net allows the water to escape while collecting a universe of tiny plankton. By varying the size of this mesh, the depth and duration of deployment, and the location of the sample, researchers can obtain a 'snapshot' of the planktonic life in their area of study.

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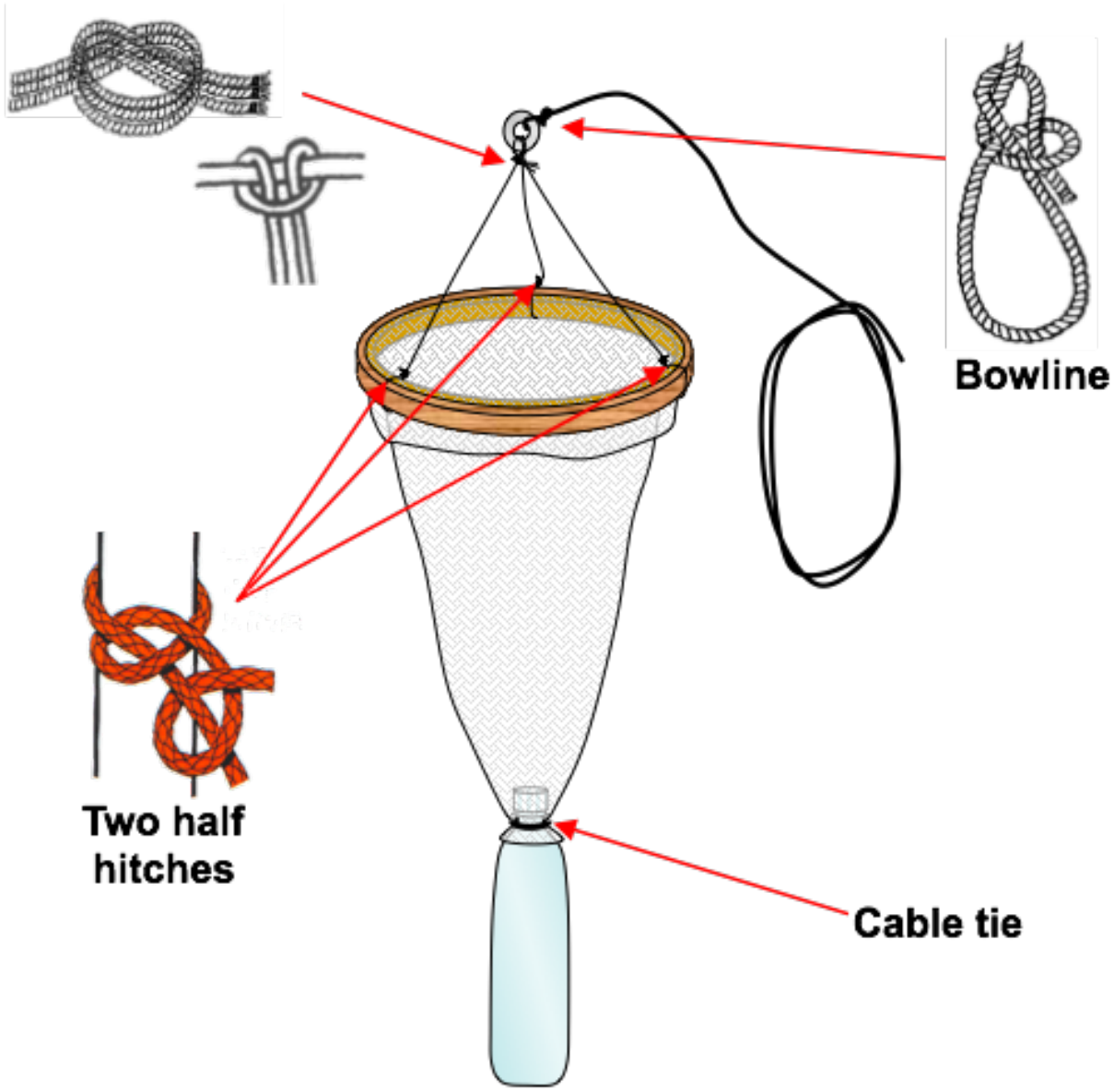
Directions:

1. **Activity 1: Plankton planet!** After completing the **Drivers** section of *Gulf Watch*, explain to your class that they are going to dive deeper into the world of plankton. As a class you will be constructing a zooplankton rearing tank. Once the plankton hatch, students will sample and observe their specimens under magnification and make estimates of the population density of their colony.
2. Prior to the lesson watch the following YouTube video on the construction of your hatchery. Either instruct the students yourself or have them watch the video as well prior to assigning them jobs for construction. *https://www.youtube.com/watch?v=vc9ZuzCSepQ*
3. Division of labor will depend upon your situation but giving each task to a different team can be an effective way to teach project management. Once complete the zooplankton hatch can take 24 to 36 hours depending on the variables in your zooplankton eggs and environmental conditions.
4. First group your students into pairs and provide each with a ½ sheet of 1mm graph paper, two small squares (the first 6 cm^2, the second 4 cm^2) of transparency film, and a magnifying device.
5. Explain that they will be observing a sample of zooplankton and attempting to measure the length of an individual brine shrimp. Ask them to place the larger of their transparency film on top of their graph paper.
6. Determine the most efficient way of distributing the samples to your class with the end goal for each group being a small, single drop of water with zooplankton on one half of the larger square of transparency film.
7. Under magnification each group should observe their specimens. Ask them to make notes and a drawing on their worksheets of what they see in their water drop.
8. Next have them use the grid lines on their graph paper to make an estimation of how long a single specimen in their water drop is. If the students are struggling to make measurements because of the zooplanktons movements have them create a simple slide by laying the other, smaller half of their transparency film on top of the sample drop. This will flatten the water droplet and trap the specimens preventing them from moving.
9. Finally ask them to determine population density of their entire colony. How many individual plankton are in their drop of water? What is the class average in a single drop of water? The average small drop of water is equal to approximately 0.1 ml. Using these numbers have your students do the math to make an estimated population count for their entire bottle colony of brine shrimp. Lead a discussion about the amount of biomass in just plankton that must be in the ocean! No wonder so many animals use this as a primary food source.

10. **Activity 2**: **Corralling Copepods!** Ask your students to take a few minutes and research the different ways animals catch and eat plankton in the ocean. After allowing a few to report their findings announce that they will be creating their own plankton catchers in the form of a plankton net.
11. Pass out the following materials to each student:
    a. One embroidery hoop
    b. One, 5 gallon paint strainer bag
    c. Three, 15" sections of nylon string
    d. One, 3/8" steel washer
    e. One, 12" cable tie
    f. One, wide mouth plastic drink bottle
    g. One, 30' length of para cord
12. Either by demonstrating or passing out the directions for individual work have the students construct their own plankton net using the following directions and illustration:
    a. Loosen the embroidery hoop screw and separate the hoops. Feed the large open end of the strainer bag up through the inside hoop, then fold the top 2 inches down on the outside of this hoop (so it will be sandwiched between the two hoops). Bring the two hoops back together and re-tighten the screw to secure the net.
    b. Using a pencil or other sharp device, poke three *evenly spaced* holes through the top of the net just below the hoop (the holes go through both layers of the fabric).
    c. Tie the three small pieces of string together at one end using an overhand knot with all three strands.
    d. Using a two-half-hitches or similar knot, tie the loose end of each small piece of string through one of the holes in the net & around the hoop – this secures the net to the hoop as well as creating the tow harness for the net. *Tighten these knots very securely, or the net will come loose when it gets wet!*
    e. Thread the three pieces of string (now tied together) up through the washer, then loop them back over the other side of the washer to tie a girth hitch.
    f. Using a sharp pair of scissors, cut a hole in the bottom end of the strainer bag. The hole should be just large enough to fit over the top of the plastic bottle.
    g. Use the cable tie to secure the small opening of the net around the top of the drink bottle.
    h. Tie the long cord to the washer using a bowline (or similar strong knot), and you're finished!



13. For extra credit students can make plankton "tows" at a local body of water. Ask them to report back their discoveries using the space provided on their worksheets.

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Note:

This activity does result in the hatching of live animals. Please be sure to check with your school administration for any restrictions prior to beginning that portion of this lesson. You may also want to consider what to do with your zooplankton once your students have finished their observations and measurements. Luckily these brine shrimp make excellent goldfish food, so they can be used without waste to feed a classroom or student's pet!

Assessment:

Students can be assessed on participation in many aspects of the activity and/or their success at completion of the worksheet.

Name _____ Date_____Class_____

Activity #1: Plankton Planet!

1. Take a look into the bottle housing your class' plankton colony. Record your observations below. What color are your plankton? Can you make out individual organisms? Take a guess at how many plankton are in the colony!

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2. Once you have observed your plankton under magnification record your observations below. How do the zooplankton move about? Are they all active? Do you notice any distinguishing marks?

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3. Use the graph paper under your drop of water to measure the specimens swimming around in it. Each square is 1 mm. How long is an individual zooplankton? Can you measure more than one? If so what is the average length of all the specimens? Do you see variations in size amongst the organisms in your droplet?

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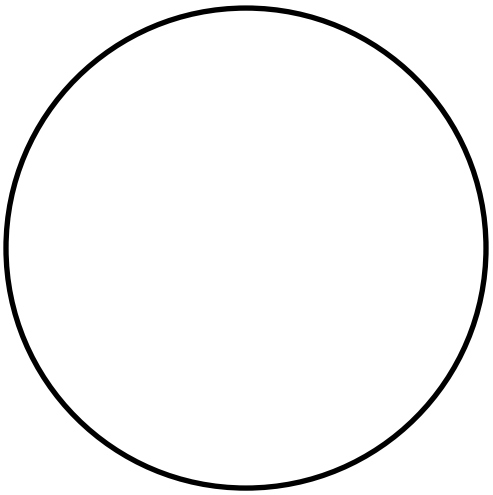
4. Use the circle to the right to make a drawing of the specimens in your droplet of water. Try and add as much detail as you can see!



5. If each droplet of water measures 0.1ml. Use the class average number of copepods in each droplet of water to determine an estimation of population density in your colony of zooplankton. About how many brine shrimp live in your bottle?

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Activity #2: Corralling Copepods!

5. EXTRA CREDIT!
   Using your newly built plankton net head out to your favorite local body of water. It doesn't matter if it is a pond, lake or the ocean, zooplankton live almost everywhere! Try and find a place where the water is calm and toss or drop your net into the water. You are performing what researchers call a plankton tow. What comes up?

Record your findings below. Do you see lots of different organisms in your sample? What happens when you repeat the plankton tow? How about when you change up the variables? New depth, longer time below the surface, new location?

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Research some of the more interesting specimens you find. You can keep your plankton for closer review later either alive and in a bucket of water or preserve them by trapping them between two pieces of clear packing tape. What kinds of plankton did you find? Record your discoveries and observations below.

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6. Use the circle to the right to make a drawing of the most interesting specimen in you plankton tow!