

Context of lesson:

When students visit the *Sea World UCLA* they will participate in a station focused on the study of plankton. This lesson is designed to reinforce the scientific process of collection for later analysis.

Pre-requisites:

None

Target Audience:

This lesson is designed for use with middle school and secondary level students. The lesson can easily be adapted for younger or more advanced students. Be sure to look at modifications listed to meet these and other special needs.

Introduction:

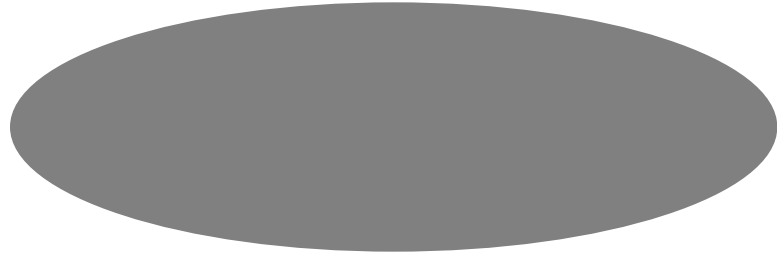
Scientists, with the use of the plankton net, obtain mid-sized plankton. This net made from silk gauze mesh is towed through the water vertically, horizontally or obliquely to obtain the sample. Nets might be conical, conical-cylindrical or rectangular in shape. The basic configuration of a plankton net is a net attached to a wire bridle at one end and a collection bucket (cod end) at the other. In net sampling, a comparatively large amount of water is filtered, and as a result, a representative sample of organisms in a given volume of water is obtained.

Student learning outcomes:

- Students will construct plankton nets of various size mesh.
- Students will use their plankton net to collect plankton samples.
- Students will identify the plankton they collect.
- Students will determine the volume of water that originally contained the plankton sample.

Standards Addressed:

	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9-12
California Science Content Standards	2a, 6a, 6b, 6d, 6e, 6f, 6g, 6h	5a, 5c, 5d, 7b, 7c, 7e	3d, 6b, 7a, 7c	1a, 1b, 1c, 1d, 9b, 9c, 9f	Physics 1a, 1b, Biology 6a, 6e, I&E 1a, 1b, 1c, 1e
National Science Content Standards	Design and conduct a science investigation; use appropriate models; understanding scientific inquiry; motion can be measured; an organism's behavior; population within a given ecosystem; diversity of organisms; history of science			Use technology and mathematics to improve investigations; calculate motion; diversity of organisms; behavioral biology; environmental quality	



Materials: (per team)

- Coat hanger
- String
- Nylon stocking
- Needle
- Strong thread
- Pliers
- Small jar (no lid)
- Larger jar (with lid)
- Sticker
- Permanent marker

Procedures:

- Bend the coat hanger into a 5” circle and loop handle (see figure 1)
- Use one leg of a nylon stocking and wrap the open piece of stocking over the wire circle, folding the nylon over the wire approximately 5” (see figure 2)
- Sew the folded section so it is securely fastened to the wire circle
- Tie a knot at the toe of the stocking.
- Place an open jar inside the stocking with the bottom of the jar against the knot.
- Tie a string around the stocking at the top of the jar

Variation:

- Give each team a net mesh of a different size or material. Some suggestions are (cheese cloth, window screen material, gauze, lace)

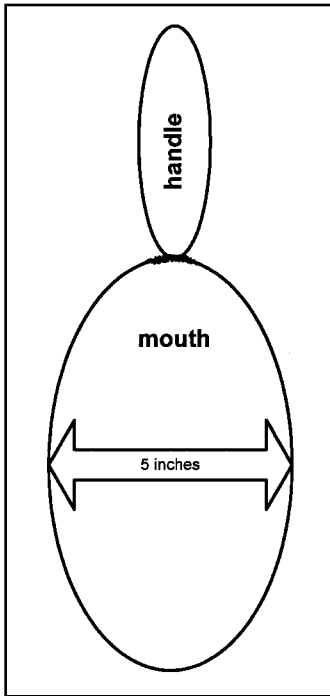


Figure 1

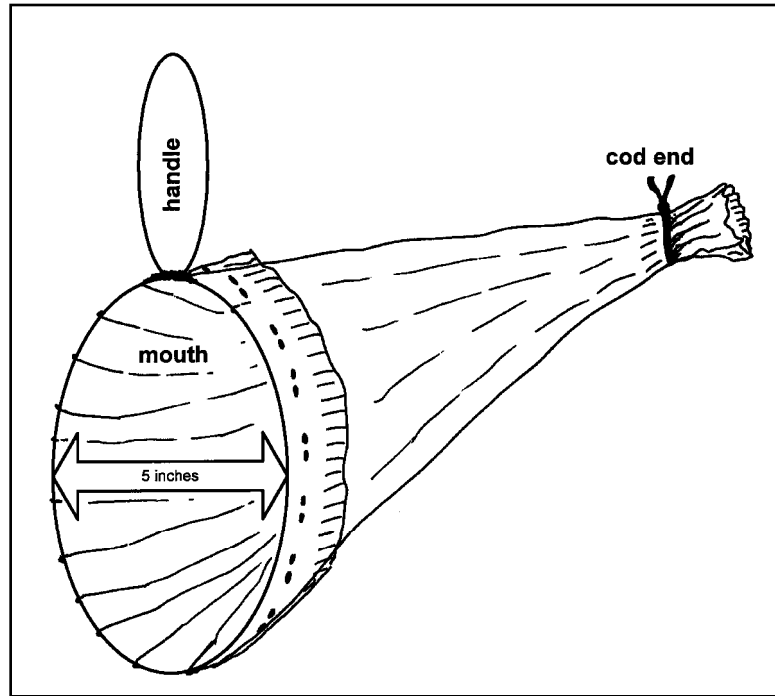
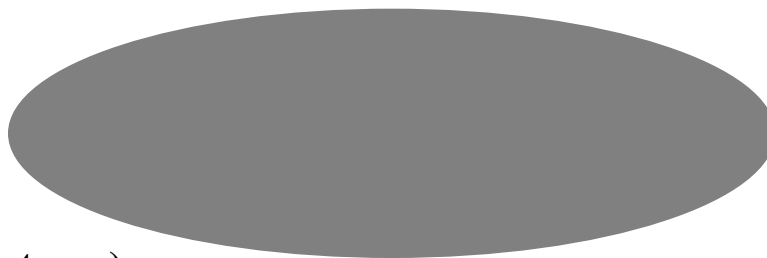


Figure 2

Example Plankton Nets



Materials: (per team)

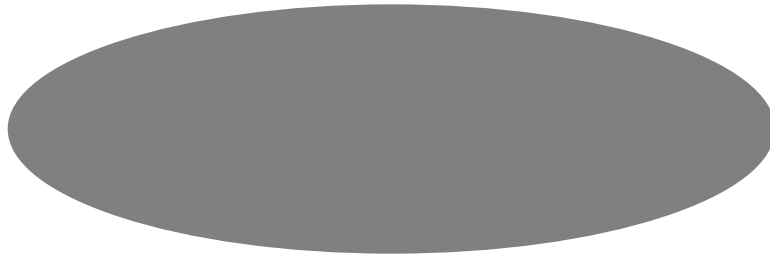
- Your plankton net from Part 1
- Source of plankton
 - Natural water source like a pond, lake, ocean

Procedures:

- Water enters the open circle of the net. You can use a number of methods to do this (pouring buckets of water into the net, or dragging the net through the water source)
- When you've collected your sample, pour the sample into the larger jar. Rinse the net with more water to get any plankton off your net and into the larger jar.
- Secure the lid on the larger jar for transport.
- Label your sample by attaching a sticker and using a permanent marker to note the date, time and location of your sample.

Variation:

- Fill a large bucket or aquarium with water and add each of the following:
 - Confetti (< 2mm in width)
 - Poppy seeds (about 1.4 mm in width)
 - Large glitter (1.1mm in width)
 - Fine ground pepper or cinnamon (< 1mm in width)
- Circle the bucket/aquarium with your net. After filtering out the contents of the net onto a coffee filter, use a squirt bottle to rinse the net.



Materials: (per team)

- Microscope
- Depression slides
- Eyedropper
- Phytoplankton and Zooplankton Identification guides

Procedures:

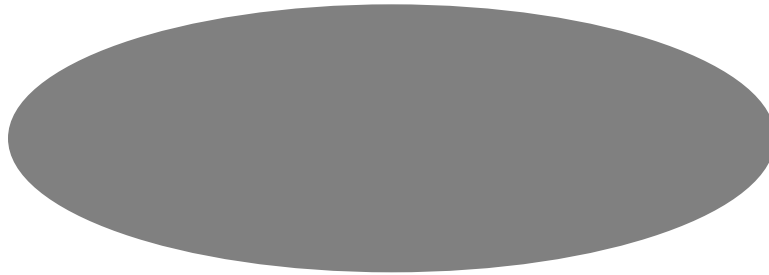
- Use an eye dropper to transfer your plankton sample onto your depression slide.
- Look at the slide under the microscope
- Identify your plankton
- Record your results
 - Fill in phylum, subphylum and class
 - Tally the number of each type of organism in the space provided

Type of Plankton	Phylum:	Phylum:	Phylum:	Phylum:
Subphylum				
Class				
Sample #1				
Sample #2				

Variation:

- Count the number of each type of particle collected from your bucket/aquaria and record your data.

Type of “Plankton”	Number of Confetti	Number of Poppy Seeds	Number of Glitter	Number of Pepper
Size of “Plankton”	>2mm	1.4mm	1.1mm	<1mm
Aquarium Net				
Mesh #1 (fill in type)				
Mesh #2 (fill in type)				



Materials: (per team)

- Your plankton net
- Coarse ground pepper (brine shrimp eggs or glitter to mimic plankton)
- Calculator
- Tape measure
- 2 Buckets or aquaria the same size labeled A and B
- coffee filters
- squirt bottle for rinsing plankton net
- funnel

Procedures (A):

- Add about twice as much of your plankton mimic to bucket A than to bucket B and agitate the water a bit
- For bucket A, move your plankton net around the bucket one time only. Rinse out the contents in the net using the squirt bottle into a coffee filter-lined funnel and count the number of particles collected by the net
- While some of the team counts particles, others begin with bucket B
- For bucket B, move the net around the bucket twice. Again, rinse out the contents into a new coffee filter and count the number of particles

Points for discussion:

- How much 'plankton' was in each sample that your team collected?
- Was there anything different in your team's methods of plankton collection between the two buckets? If so, how could this affect your results?
- What is an important parameter that must be determined before you can estimate actual plankton concentrations in the ocean?
- You know that scientists use a plankton net to catch and count plankton. However, there are problems associated with using plankton nets. What do you think the problems are?

- One problem with collecting plankton is that the amount of water filtered by the net depends on how much water has flowed through the net. So, what determines how much water has flowed through the plankton net?

Procedures (B):

Scientists measure the volume of water that passed through the plankton net by attaching a flow meter inside the mouth of the net. Before flow meters were invented, scientists calculated the amount of water by hand.

- How big is the mouth of your plankton net?
 - Find the radius of the mouth of your net.
 - To calculate how much water will pass through your net, calculate the area of the mouth of your net (hint: $\text{area} = \pi * r^2$ where $\pi = 3.14$ and $r = \text{radius}$)
- How do we get the volume?
 - Since we want to calculate how much water goes through a plankton net, we are interested in getting a volume that has the units of m^3 . This means that we need to take the area of the mouth of the net and multiply it by something to get the volume. If area has the units of m^2 and we want to get m^3 , we must multiply by some distance in meters (m). The distance comes from how far the plankton net traveled through the water.
- How far did the plankton net travel?
 - If the research vessel you are using to take plankton samples is moving at a rate of 1 nautical mile/hour, how far will the plankton net be towed through the water if you tow it for 15 minutes? (hint: Convert nautical miles into meters. 1 nautical mile = 1,853 meters)
 - For this experiment, your net followed the circumference of the bucket/ aquarium. Find the circumference of your bucket/ aquarium. (Remember you traveled around the bucket A once and bucket B twice)
- So, how much water passed through your net?
 - Calculate the volume of water filtered by multiplying your answer from the two steps above
- Calculate the concentration of 'plankton' in each bucket using the following equation:

$$\text{CONCENTRATION} = \frac{\text{\# OF INDIVIDUALS}}{\text{VOLUME}}$$
- How might the size of the plankton net mesh effect your calculations?

Example Assessment:

Give students materials to make a plankton net to a set of specifications. Specifications may include the size of organisms to be collected, time limitation for pulling the net through the water source, and identifying the organisms once collected.

Student Objectives:

Student will build a plankton net following the specifications given, calculate the amount of water flowing through the net based on the time allowable for collection, collect and identify the plankton collected using appropriate technology and present plankton diversity and density using graphs and text analysis.

Evidence:

Student will have the plankton net built to specifications, calculations on volume of water through the net, and data on plankton collected.

Rubric:

Rubric Score	Explanation of Rubric Score
4	completes all components of the task or activity thoroughly and accurately; uses scientific method fully and accurately; demonstrates accurate use of scientific processes (such as repetition of experiments, accurate observations); collects, organizes, and displays data accurately; interprets and explains information or data in a logical, accurate and clearly stated manner; uses appropriate tools and technology in an accurate, efficient, and productive manner
3	completes most components of the task or activity with possibly some minor errors; uses scientific method ; demonstrates use of scientific processes (such as repetition of experiments, accurate observations); collects, organizes, and displays data with possibly one or two minor errors; interprets and explains information or data, but with minor faults; uses appropriate tools and technology with reasonable accuracy
2	completes some components of the task or activity with possibly significant errors; uses at least parts of the scientific method; demonstrates little use of scientific processes (such as repetition of experiments, accurate observations); collects, organizes, or displays data that contains errors; interprets or explains information or data with significant errors; uses some appropriate tools or technology, but perhaps ineffectively or incorrectly
1	completes no components of the task; uses the scientific method with significant errors or not at all; demonstrates no use of scientific processes (such as repetition of experiments, accurate observations); collects, organizes, or displays flawed or incomplete data; does not interpret or explain information or data; uses inappropriate tools or technology or uses them to produce incorrect results; uses oral, written, or symbolic language that interferes with meaning

Note: You can purchase fish netting from Memphis Net and Twine Co., Inc. Visit their website (www.netten.net/memnet) and go to “close out nets” and then to “discounted bulk netting”. There you will find affordable bulk nylon netting. You can also call toll free at 1-800-238-6380