Friday-Monday: Review & Prep! Read through the packet and gather your materials.

Tuesday: Tune in! Watch our educators lead a live demonstration at 2pm.

Wednesday: Experiment & Play! Follow the activity instructions in your packet.

Thursday: Share Your Results! Submit a photo of your results to education@hrpt.ny.gov to be featured on our website. Then, download next week's packet!

HUDSON RIVER PK
RIVER PROJECT

Virtual Summer Camp: STEM Explorers

Week 2—Plankton Discoveries

Materials Check List

Build Your Own Plankton

- ☐ Build Your Own Plankton Worksheet
- ☐ Build Your Own Plankton Worksheet Key
- ☐ Plankton ID Guide
- ☐ Pencil
- ☐ Medium bowl of water
- ☐ Penny
- ☐ Aluminum foil
- ☐ Timer
- ☐ Suggested building materials
    - Foil
    - Paper clips
    - Toothpicks
    - Pipe cleaners
    - Bubble wrap
    - Beads
    - Rubber bands
    - Tape
    - String
    - Plastic fragments
    - Pebbles

Plankton Charades

- ☐ Plankton Charades Cards
- ☐ Scissors

HUDSON RIVER PK
RIVER PROJECT

STEM Explorers Week 2

Build Your Own Plankton

Theme: Plankton; Phytoplankton and Zooplankton; Buoyancy; Food Web; Water Quality
Ages: 8-14 years old
Prep Time: 5 minutes
Activity Time: 30-40 minutes

Activity Summary:
Did you know that the greenish hue of the Hudson River Estuary is an indicator of health rather than toxicity? Microscopic plants and animals, called plankton, give the River this color. Plankton are the foundation of the Hudson River food web; they provide food and oxygen to a variety of organisms.

In this lesson, students will learn about two categories of plankton–– phytoplankton and zooplankton–– and discover where in the Hudson River these tiny organisms are most abundant, and build their own plankton using common household items.

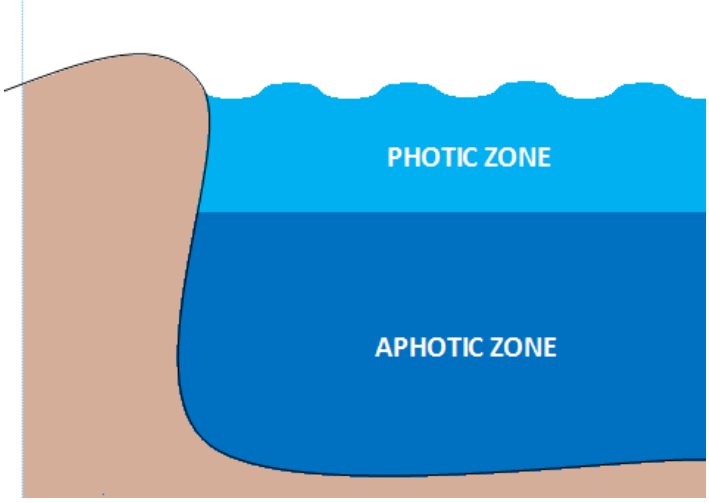
Objectives:
- Students will identify the difference between phytoplankton and zooplankton
- Students will identify the photic and aphotic zones in the water column
- Students will learn the key term "neutral buoyancy"
- Students will build a model plankton that is neutrally buoyant

Lesson Materials:
- Build Your Own Plankton Worksheet
- Build Your Own Plankton Worksheet Answer Key
- Plankton Identification Guide
- Pencil
- Medium bowl filled with water
- Aluminum foil
- Penny
- Timer
- Suggested Plankton Build materials
  - Foil
  - Paper clips
  - Toothpicks
  - Pipe cleaners
  - Bubble wrap
  - Beads
  - Rubber bands
  - Tape
  - String
  - Plastic fragments
  - Coins
  - Pebbles

Background:
Where in the water do most plankton live?
You can divide an aquatic system into two zones, based on the amount of sunlight that penetrates through the water. The topmost zone is the **Photic Zone**. This is the depth at which sunlight can still penetrate the water and allow photosynthesis to occur. The deeper zone is called the **Aphotic Zone** receives practically no sunlight during the daytime and is nearly dark. No plants can survive in this zone because they cannot access sunlight to perform photosynthesis. Interestingly, phytoplankton and zooplankton both possess a range of physical characteristics that help them stay in the River's **photic zone**. Phytoplankton must stay in this zone to benefit from the sun energy and zooplankton frequent this zone to eat phytoplankton. This is important to know for the main activity in this lesson.

HUDSON RIVER PK
RIVER PROJECT

STEM Explorers Week 2



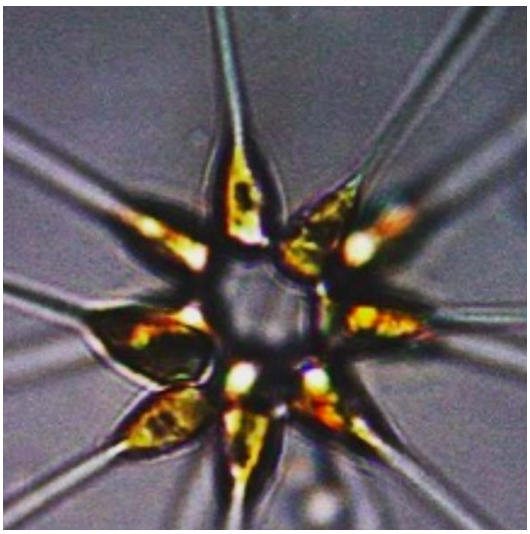
Both phytoplankton and zooplankton have developed numerous adaptations to help them stay in the Photic Zone. These adaptations influence the plankton's ability to float or its **buoyancy**: the force applied by the water in an upward direction. The thing about plankton is that they must be **neutrally buoyant**, this means that they are fully submerged in the water, because in nature plankton that only float on the surface dry up in the sun and die.

Lesson Procedure
Gather all the materials listed at the first page of this lesson plan, and follow the steps in the Build Your Own Plankton worksheet. Answer the guiding questions on the worksheet to learn the concepts presented in the background section above and apply them while constructing your own plankton.

Build Your Own Plankton Worksheet

Part 1: Learning about plankton
Below are two photographs of plankton found in the Hudson River. These photos had to be taken with a special microscope camera, because the actual size of these plankton is about as small as the period at the end of this sentence. Plankton are microscopic organisms that drift through the River.

A



This plankton is called a **diatom**.

B

This plankton is called a **copepod**.

HUDSON RIVER PK
RIVER PROJECT

STEM Explorers Week 2

1. Take a few minutes to observe plankton in the photographs above. What are 2 similarities between Photo A and Photo B? What are 2 differences?

---

2. Plankton can be categorized into two types: phytoplankton and zooplankton. **Phytoplankton** are **plants**, and **zooplankton** are **animals**. Identify each photo above as phytoplankton or zooplankton based on the observations you made in Question 1. Fill in the blanks and circle whether your identification is a plant or an animal.

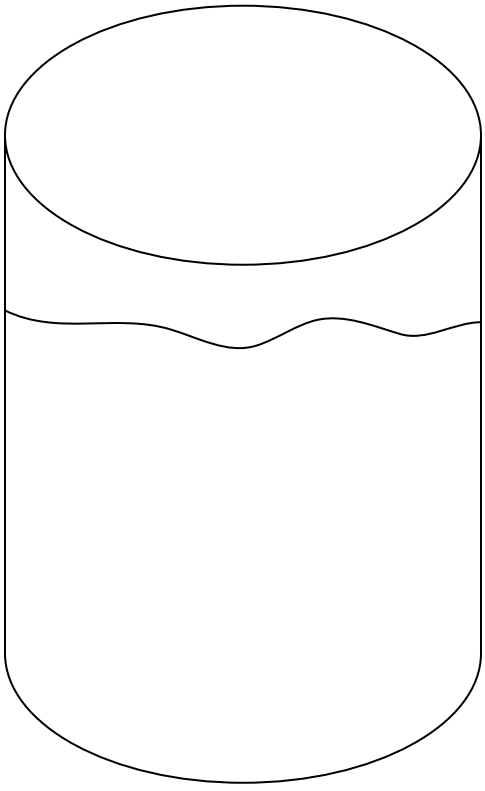
   Photo _____ is a **phytoplankton**. This means that it is a(n) plant / animal.

   Photo _____ is a **zooplankton**. This means that it is a(n) plant / animal.
3. Plants and animals on land and underwater get their energy in similar ways to those in the Hudson River. Identify the energy sources for each in the lines below.
   a. What do plants need to grow? _____
   b. What do animals need to grow?_____

Part 2: Learning where plankton live

Let's do a little experiment to explore **buoyancy**, which means an object's ability to float. This will help us understand where plankton live in the water.

1. Fill a medium sized mixing bowl with water.
2. Gently drop a small ball of aluminum foil into the bowl. Draw where it lands in the water on the image to the right.
3. Gently drop a penny into the bowl. Draw where it lands in the water on the image to the right.



Something that floats at the very surface of water is **Positively Buoyant.** Something that sinks in water is **Negatively Buoyant.**

4. Label your drawings to indicate which item is positively buoyant and which is negatively buoyant.

Something that floats somewhere just under the surface of water is **Neutrally Buoyant**. That's what plankton are! Plankton must stay fully submerged in the water, but not sink too deep where there is no sunlight. If plankton float on the water's surface, the sunlight is too hot and they cannot survive.

STEM Explorers Week 2

5. Draw a little plankton in the image above, and label it neutrally buoyant. You can use the photos from Page 1 of this worksheet as a guide, or invent your own plankton. Feel free to also reference the Plankton Identification Guide.

The sweet spot where plankton float is called the **photic zone** (pronounced FOE-tick), which refers to the zone where sunlight can shine through. Just like plants on land, phytoplankton need sunlight to survive. Zooplankton can be found in the photic zone because they eat phytoplankton (and sometimes other zooplankton, too).

Part 3: Build your own plankton

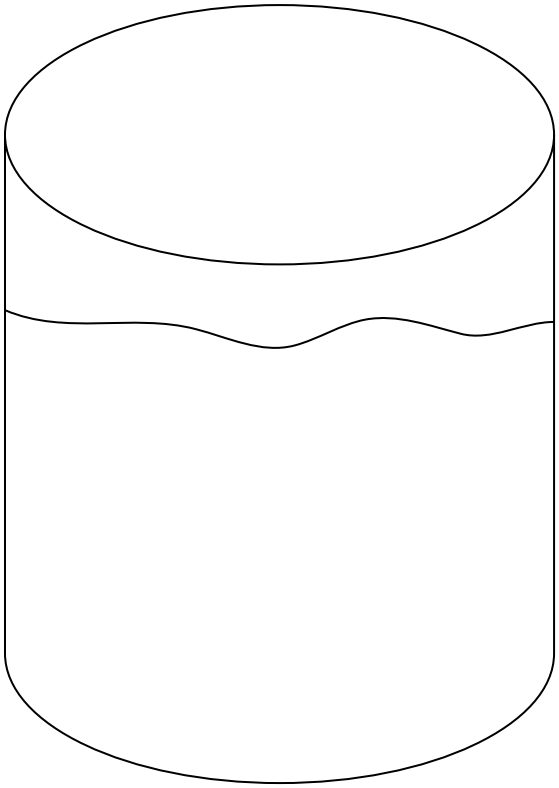
Your challenge is to create a plankton that is **neutrally buoyant**. It should float just under the surface of the water, without any bits popping out of the water, or sinking all the way to the bottom.

1. Build: gather your Plankton Build materials and bundle them together however you would like, using tape, foil, string, or whatever else you have handy. Think about your design as a phytoplankton or zooplankton. How will it resemble a plant or animal? Use the Plankton Identification Guide as a reference.

2. Predict: what do you think will happen when you place your plankton in your bowl of water? Why?

---

3. Test: place your plankton in your bowl of water and observe what happens. Use the timer to record how long it floats in the photic zone.
4. Record: draw your results in the image below, and label it with “Trial 1” and the time.



STEM Explorers Week 2

5. Redesign: make any changes you think your plankton needs to stay floating in the photic zone longer and test again.

6. Record: draw your results in the image above, and label it with “Trial 2” and the time.

7. Repeat step 5.

8. Record: draw your results in the image above, and label it with “Trial 3” and the time.

Part 3: Reflect on your experiment

1. Which trial of your plankton design succeeded in buoyancy the longest? Explain.

2. What features helped your design stay in the Photic zone?

3. What features caused your design to sink?

4. What new changes would you make to help your design stay in the Photic zone longer?

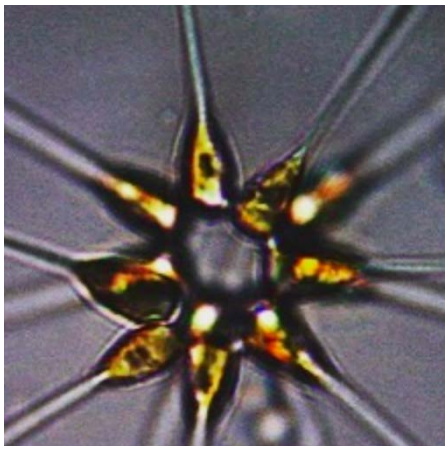
Build Your Own Plankton Answer Key

Part 1: Learning about Plankton

Below are two photographs taken of plankton found in the Hudson River. These photos had to be taken with a special microscope camera, because the actual size of these plankton is about as small as the period at the end of this sentence. Plankton are microscopic organisms that drift through the River.

STEM Explorers Week 2

A



This plankton is called a **diatom**.

B

This plankton is called a **copepod**.

1. Take a few minutes to observe plankton in the photographs above. What are 2 similarities between Photo A and Photo B? What are 2 differences?

Both of the plankton in the photos above have skinny long things coming out of them. This helps to increase their **surface area**, which allows them to float in the water. Both plankton also have parts that look see-through.

The plankton in Photo A looks like a star, or a flower, but the plankton in Photo B looks like a bug. The plankton in Photo A looks like the things coming out of it are sticks, but the things coming out of the plankton in Photo B look like antennae and legs.

2. Plankton can be categorized into two types: phytoplankton and zooplankton. **Phytoplankton** are **plants**, and **zooplankton** are **animals**. Identify each photo above as phytoplankton or zooplankton based on the observations you made in Question 1. Fill in the blanks and circle whether your identification is a plant or an animal.

   Photo A is a **phytoplankton**. This means that it is a(n) **plant**.

   Photo B is a **zooplankton**. This means that it is a(n) **animal**.

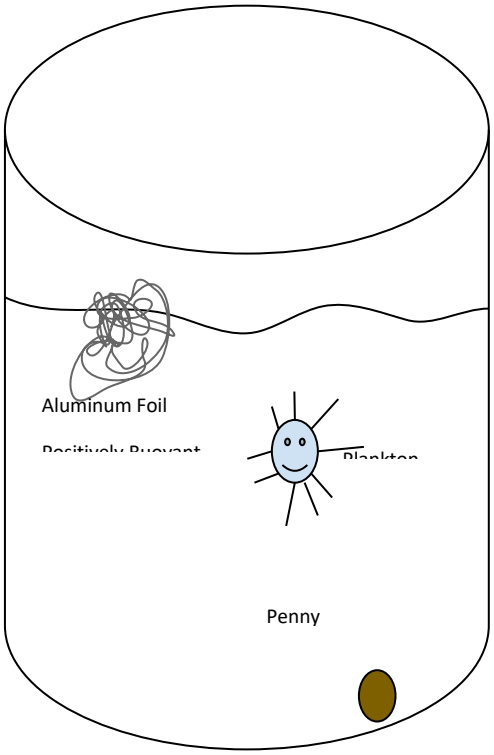
3. Plants and animals on land and underwater get their energy in similar ways to those in the Hudson River. Identify the energy sources for each in the lines below.
   a. What do plants need to grow? Sunlight, water, carbon dioxide
   b. What do animals need to grow? Food, water, oxygen

Part 2: Learning Where Plankton Live

STEM Explorers Week 2

Let's do a little experiment to explore **buoyancy**, which means an object's ability to float. This will help us understand where plankton live in the water.

1. Fill a medium sized mixing bowl with water.
2. Gently drop a small ball of aluminum foil into the bowl. Draw where it lands in the water on the image to the right.
3. Gently drop a penny into the bowl. Draw where it lands in the water on the image to the right.



Something that floats at the very surface of water is **Positively Buoyant.** Something that sinks in water is **Negatively Buoyant.**

4. Label your drawings to indicate which item is positively buoyant and which is negatively buoyant.

Something that floats somewhere just under the surface of water is **Neutrally Buoyant**. That's what plankton are! Plankton must stay fully submerged in the water, but not sink too deep where there is no sunlight. If plankton float on the water's surface, the sunlight is too hot and they cannot survive.

5. Draw a little plankton in the image above, and label it neutrally buoyant. You can use the photos from Page 1 of this worksheet as a guide, or invent your own plankton.Feel free to also reference the Plankton Identification Guide.

The sweet spot where plankton float is called the **photic zone** (pronounced FOE-tick), which refers to the zone where sunlight can shine through. Just like plants on land, phytoplankton need sunlight to survive. Zooplankton can be found in the photic zone because they eat phytoplankton (and sometimes other zooplankton, too).

Part 3: Build Your Own Plankton

Your challenge is to create a plankton that is **neutrally buoyant**. It should float just under the surface of the water, without any bits popping out of the water, or sinking all the way to the bottom.

1. Build: gather your Plankton Build materials and bundle them together however you would like, using tape, foil, string, or whatever else you have handy. Think about your design as a phytoplankton or zooplankton. How will it resemble a plant or animal? Use the Plankton Identification Guide as a reference.

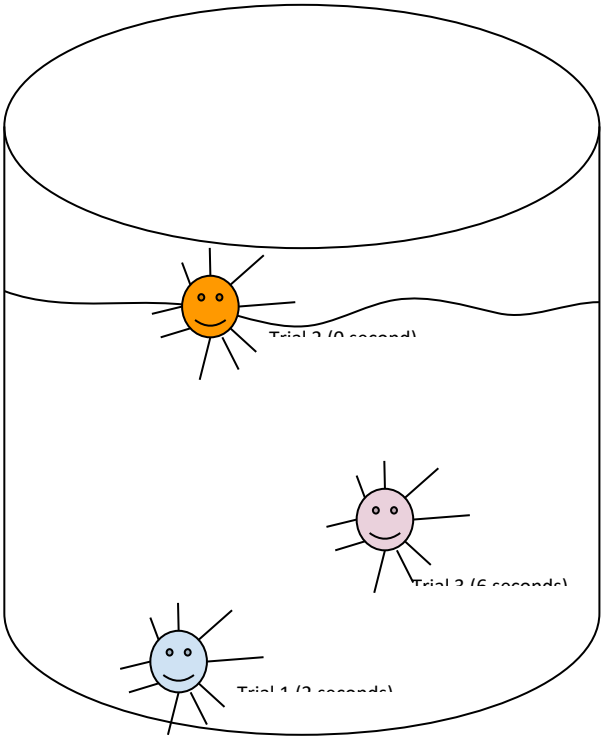
2. Predict: what do you think will happen when you place your plankton in your bowl of water? Why?

I predict that when I place my plankton in my bowl of water it will float right under the surface of the water because I combined the aluminum foil and the penny with a rubber band. The foil floats and the penny sinks, so together I think they will be somewhere in the middle.

3. Test: place your plankton in your bowl of water and observe what happens. Use the timer to record how long it floats in the photic zone.

4. Record: draw your results in the image below, and label it with "Trial 1" and the time.

STEM Explorers Week 2



5. Redesign: make any changes you think your plankton needs to stay floating in the photic zone longer and test again.

6. Record: draw your results in the image above, and label it with “Trial 2” and the time.

7. Repeat step 5.

8. Record: draw your results in the image above, and label it with “Trial 3” and the time.

Part 4: Reflect on Your Experiment

1. Which trial of your plankton design succeeded in buoyancy the longest? Explain.

My 3rd trial plankton design succeeded in maintaining neutral buoyancy for the longest. It still sunk to the bottom after 10 seconds, but it stayed in the middle for the most time. I think this was because after trying to make my plankton lighter in Trial 2, I only had to make a small change by taking off a little aluminum foil to make it sink down.

2. What features helped your design stay in the Photic zone?

Some things that helped my design stay in the photic zone, just under the surface of the water, were aluminum foil and toothpicks. Too much of these things made my plankton too light, but they were good for keeping my plankton floating because they are very light materials.

3. What features caused your design to sink?

Some things that helped my plankton design sink were pennies and pipe cleaners. The pennies were very heavy metal and the fuzzy part of the pipe cleaners absorbed water to help my plankton sink down.

4. What changes would you make to help your design stay in the Photic zone longer?

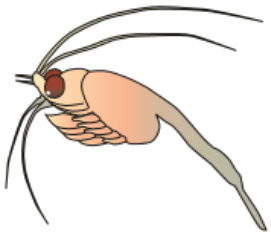
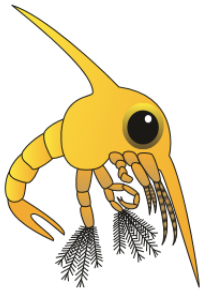
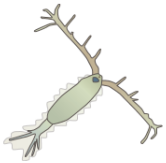
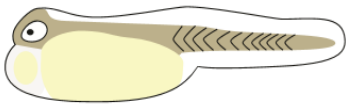
To help my plankton design stay in the photic zone longer, I would like to space out my pipe cleaners more and add one or two small paper clips to the ends. Spacing out my pipe cleaners can help increase the surface area of my plankton, which means there is more space for the water to push my plankton upward. The small paper clips could help balance out the weight of the water that gets absorbed into the pipe cleaners.

HUDSON RIVER PARK RIVER PROJECT

STEM Explorers Week 2

Plankton Charades

Print two copies of the plankton charades page. Keep one copy for guessing and then cut out the other cards. As a group, review the name of each plankton, and discuss some of the key features that might indicate whether it is phytoplankton or zooplankton. Players from each team take turns picking up a card and miming the plankton while their teammates guess the name within an allotted time to win a point. Once you have gone through the entire deck, the team with the most points wins!

 Diatom *Pseudo-nitzschia*	 Copepod nauplii
 Dinoflagellate *Certaium*	 Diatom *Chaetoceros*
 Mysid shrimp	 Crab zoea
 Copepod *Acartia*	 Fish Larvae

HUDSON RIVER PK
RIVER PROJECT

PLANKTON IDENTIFICATION GUIDE

Diatom
Pseudo-nitzschia

Copepod nauplii

Coccolithophore

Diatom
Chaetoceros

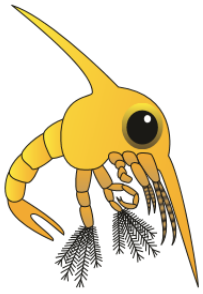
Amoeba

Dinoflagellate
Amphidinium

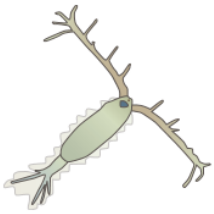
Diatom
Cyclotella

Dinoflagellate
Certaium

Cyanobacteria

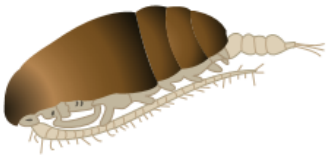


Crab zoea



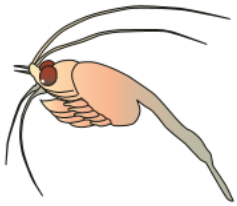
Copepod
Acartia

Ciliate
Didinium



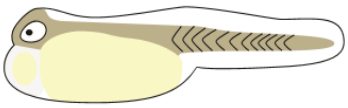
Copepod
Paracalanus

Dinoflagellate
Dinophysis



Mysid shrimp

Crab eggs



Fish Larvae