

# A Race to the Bottom

## Educator Lesson Plan

*Original activity adapted from Newfound Harbor Marine Institute's "Plankton Races."*

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## About This Activity

**Target Grade Levels:** 3 – 6; 9 – 12

**South Carolina State Science Standards:** 3.L.5; 4.L.5; 5.E.3; 5.L.4; 6.L.5; H.B.2; H.E.6

## Ocean Literacy Essential Principle

#4: The Ocean makes Earth habitable.

## Focus Questions

- Why is it important for phytoplankton to float in the upper-water column?
- What types of adaptations do species of phytoplankton have that enable them to float?

## Objectives

- Students will understand that phytoplankton are autotrophic and carry out the process of photosynthesis.
- Students will understand the importance of body form and function in keeping phytoplankton floating in the upper levels of the water column.

# Activity Details

**Group Size:** A minimum of two people is recommended

**Time:** 15 – 20 minutes

## Materials

- Two, tall graduated cylinders or mason jars of the same size
- Enough putty to give a palm-sized portion to each group
- Water (to fill graduated cylinders or jars)
- Timekeeping device
- Pictures of phytoplankton (a recommended resource can be found on the National Oceanic and Atmospheric Administration (NOAA) site: [www.coastalscience.noaa.gov/research/stressor-impacts-mitigation/pmn/image-gallery/](http://www.coastalscience.noaa.gov/research/stressor-impacts-mitigation/pmn/image-gallery/))

## Background Information

**Phytoplankton** are **autotrophic** microscopic organisms found in both fresh and salt water. “**Phyto**” means “**plant**” and “**plankton**” comes from the Greek word that means “**wanderer**.” Phytoplankton, in general, flow with the horizontal movements of currents and waves. They have some control over their vertical movement up and down the water column. This **vertical migration** allows phytoplankton to stay in the upper-water column during the day so that they can carry out photosynthesis and descend to lower levels of the water column at night to absorb necessary nutrients.

Several factors are responsible for the upward and downward movement of phytoplankton species and one of the main features of phytoplankton that allows them to stay “afloat” in the upper-water column has to do with their body structure. Floating in the upper-water column is imperative for the species to acquire sunlight for photosynthesis. If they didn’t float, they would die! Characteristics that enable phytoplankton to float include the presence of air sacks and spines for increased surface area.

## Procedure

- Divide the class into groups of approximately the same size. If you have a small group and

enough putty, you can have individuals do this activity.

- Give each group a piece of putty and instruct them to create a species of phytoplankton – it can be a true species or a “newly discovered” species of their own creation. Instruct the groups that the purpose of the “race” is for their phytoplankton to fall to the bottom of the jar LAST. The jar/cylinder represents the water column of the ocean and the phytoplankton needs to stay in the upper levels in order to photosynthesize. Be sure that their creation fits into the mouth of the mason jar or graduated cylinder.
- Give the groups 10 minutes to develop their phytoplankton species. They cannot test it in water prior to the race, but can measure their creation to be sure it will fit inside the mason jar or graduated cylinder.
- While students are constructing their phytoplankton, fill the graduated cylinders or mason jars with the same volume of water.
- After 10 minutes, have each group nominate one person who will “race” their species of phytoplankton. Select two groups to have their people come race their phytoplankton.
- Have each group discuss the rationale behind their phytoplankton structure.
- Counting down “Ready-Set-Go!” each person will drop their phytoplankton in at the same time into separate jars or cylinders. The teacher begins the stopwatch at the time of deployment. Typically, the phytoplankton will eventually drop to the bottom of the jar or cylinder. The time needs to be recorded when the phytoplankton reaches the bottom. The winner is the phytoplankton that reached the bottom LAST.
- If you have more than two groups, have the winner of the first group race another phytoplankton from another group until an overall winner is determined based on the length of time before hitting the bottom of the jar or cylinder.

## Extensions

- Allow students to modify their design and do a rematch. Prior to “racing”, have the students explain why they made the changes.
- Provide students with handouts of real phytoplankton species. Discuss the adaptations that each species has to allow it to float effectively in the water column. A recommended resource is the image gallery on NOAA’s Phytoplankton Monitoring Network website: [www.coastalscience.noaa.gov/research/stressor-impacts-mitigation/pmnm/image-gallery/](http://www.coastalscience.noaa.gov/research/stressor-impacts-mitigation/pmnm/image-gallery/).
- Consider becoming involved in the Phytoplankton Monitoring Network – a citizen-science

program that involves collecting water samples, identifying species of phytoplankton, and reporting your findings to scientists. More information can be found at [www.coastalscience.noaa.gov/research/stressor-impacts-mitigation/pmnl/](http://www.coastalscience.noaa.gov/research/stressor-impacts-mitigation/pmnl/).

