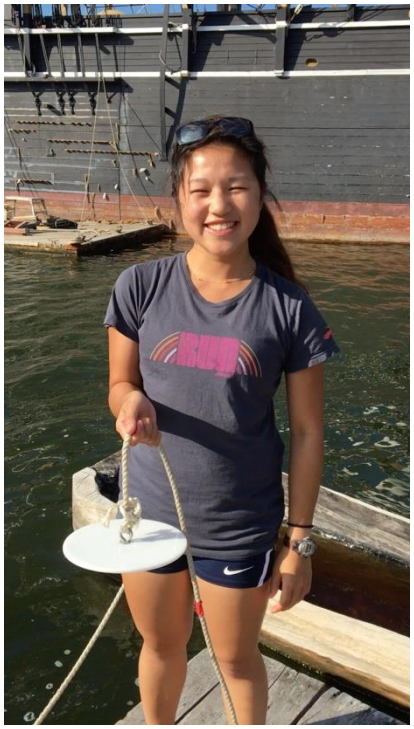
MYSTIC SEAPORT THE MUSEUM OF AMERICA AND THE SEA TM

Mystic Seaport for Educators
Science on the 38th Voyage of the *Charles W. Morgan*
Lesson 1 of 6: Water Transparency and Whales
Student Reading

Introduction:

At first glance, the open ocean seems to be a vast blue desert, inhabited only by the large fish or mammals that pass through. If we were to use a microscope, however, we would see that every drop of ocean water contains hundreds of tiny plants and animals. These organisms can be divided into two categories: phytoplankton (plants) and zooplankton (animals).

Phytoplankton harness energy from the sun using the process of photosynthesis, which means that they absorb light energy and carbon dioxide in order to produce oxygen. It is estimated that 40% of the oxygen on earth is produced by phytoplankton, and every other species in the ocean depends on them for this reason. Among zooplankton, some are juveniles of large, strong-swimming marine organisms. Others will remain plankton for their entire lives. Zooplankton feed on phytoplankton directly, and both types live near the top layer of the ocean. This is where sunlight can be found for phytoplankton to use in photosynthesis.



In spite of their size, plankton are not just a food source of other small organisms. There are many large species, known as "planktivores," that constantly feed on this population, including baleen whales. Baleen whales have no teeth. Instead, their mouths contain a material known as baleen that acts as a filter system. The baleen allows them to feed on massive amounts of small fish and microscopic zooplankton, like krill, as they swim.

In general, small fish species are attracted to areas with large amounts of phytoplankton, because these waters contain high levels of oxygen produced by photosynthesis. Larger species, such as whales, often follow these fish species as a source of prey. In these areas, however, light is blocked by the millions of tiny phytoplankton and doesn't travel through the water as well. Lower light transmission might therefore suggest that whales may be attracted to these waters. We measure light transmission using a tool known as a Secchi disk.

Though it appears simple, the Secchi disk is a great way to figure out how much of the water column (that is, how deep) light penetrates for photosynthesis. We lower a Secchi disk by hand until we cannot see it anymore. After sunlight hits the surface of the ocean, the light may be deflected or absorbed by underwater particles or organisms until it reaches only part of its original strength. The Secchi depth is the first depth at which the disk cannot be seen anymore. This corresponds to the 18% light level. For plants, there's nothing special about 18% light, but below 1%, plants don't have enough light for photosynthesis. A simple equation allows us to use the Secchi depth, or 18% light level, to calculate the 1% light level.

Key Words:

Secchi Disk: A disk that is lowered into the water to measure how well the light is transmitted, or travels, through the water column.

Secchi Depth: The depth at which the Secchi disk can no longer be seen from the surface. We can use this information to determine the depth where the water doesn't contain enough light for photosynthesis. The Secchi depth shows us the 18% light level, and we can use an equation to determine the 1% light level, where photosynthesis will not occur.

Light Transmission: A term used to describe how well light travels through water.