BACK BAY SCIENCE CENTER

Plankton Identification and Sampling Methods

ACTIVITY: TINY BUT MIGHTY!

TIME: 40-50 minutes
GRADE LEVEL: 7th-12th
GROUP SIZE: 8-10 students

Activity at a Glance: Students will collect and identify plankton and learn about the important ecological functions plankton supply to the food web and our oceans.

NEXT GENERATION SCIENCE STANDARDS

PERFORMANCE EXPECTATIONS

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models • Develop a model to generate data to test ideas about designed systems, including those presenting inputs and outputs (MS-ETS1-4) **Using Mathematics and Computational Thinking** • Use mathematical and/or computational representations of phenomena or design solutions to support explanations (HS-LS2-1) **Constructing Explanations and Designing Solutions** • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-6) • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (…)	**ETS1.B: Developing Possible Solutions** • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it (MS-ETS1-4) • Models of all kinds are important for testing solutions (MS-ETS1-4) **ETS1.C: Optimizing the Design Solution** • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution (MS-ETS1-4) **LS2.A: Interdependent Relationships in Ecosystems** • Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and non-living resources and from such challenges as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem (HS-LS2-1) **LS1.C: Organization for Matter and Energy Flow in Organisms** • Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars	**Scale, Proportion, and Quantity** • The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs (HS-LS2-1) **Energy and Matter** • Energy drives the cycling of matter within and between systems (HS-LS2-3)

and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future (HS-LS2-3) **Scientific Knowledge is Based on Empirical Evidence** • Scientific knowledge is based on logical connections between evidence and explanations (MS-LS1-6) **Scientific Knowledge is Open to Revision in Light of New Evidence** • Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence (HS-LS2-3)	(food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use (MS-LS1-6) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** • Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes (HS-LS2-3) **PS3.D: Energy in Chemical Processes and Everyday Life** • The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e. from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen (secondary to MS-LS1-6)	

Ocean Literacy 5: The ocean supports a great diversity of life and ecosystems

A- Ocean life ranges in size from the smallest living things, microbes, to the largest animal on Earth, blue whales.

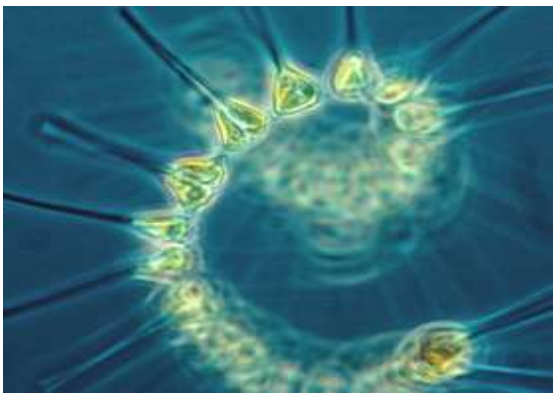
B- Most of the organisms and biomass in the ocean are microbes, which are the basis of all ocean food webs. Microbes are the most important primary producers in the ocean. They have extremely fast growth rates and life cycles, and produce a huge amount of the carbon and oxygen on Earth.

Ocean Literacy 6: The ocean and humans are inextricably interconnected

A- The ocean affects every human life. It supplies freshwater (most rain comes from the ocean) and nearly all Earth's oxygen. The ocean moderates the Earth's climate, influences our weather, and affects human health.

BACKGROUND INFORMATION

The term plankton is derived from the Greek word planktos, meaning "wanderer" or "drifter" and is used to describe any organism that drifts on the ocean's currents and whose position in the water column is determined by wind and its effects on the thermocline. They essentially are not capable of independent locomotion. Some types can produce lipids to keep them afloat while others rely on whipping tail-like projections known as flagella to keep them in the upper layer of the thermocline. Plankton come in many different varieties and forms and are uniquely important to the environment.



Plant plankton, known as phytoplankton, form the base of the food chain through their cellular respiration. They are responsible for a supreme amount of the atmospheric oxygen with estimates as high as 80%. This is due to the presence of chloroplasts in their cells that allow them to be photosynthetic. Unlike other types of plankton all phytoplankton are holoplankton – they remain plankton through their whole life cycle.

Animal plankton, known as zooplankton, are the next level up on the food chain. They are the primary consumers of phytoplankton and bacteria and varied in morphology and characteristics. It is in this group that you start to see species of meroplankton – the type of animals that are only plankton at various stages in their life cycle.

As a whole, plankton are ecologically important and dangerous. They produce most of the atmospheric oxygen and serve as an important carbon sink trapping dangerous carbon emissions. They are also the base of the food chain so disruptions at that trophic level have far reaching implications further up. They can also be hazardous during algal blooms. During these times of population explosions they not only consume all of the oxygen in the water creating anoxic conditions but some species release toxins into the water that are bio-magnified up the food chain.

TEACHER GUIDE – Plankton

ACTIVITY: Plankton Identification and Sampling Methods

OBJECTIVES:

Students will be able to:

1. Develop a model that will be the most optimal design for sampling plankton to be able to generate data on counting and identifying plankton.
2. Use mathematical representations to explain how the presence and abundance of plankton can affect entire ecosystems.
3. Construct a scientific explanation based on evidence for how photosynthesis, particularly in plankton, drives the cycling of matter and flow of energy.
4. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions in Upper Newport Bay

MATERIALS:

Plankton net with detachable containers
Sample jar/container to transfer sample into
Microscope slides and covers
Pipette
Compound microscopes
Plankton ID sheets
Plankton Sampling Observation Sheets
Plankton Sampling Analysis Question Sheets
Pencils
Habitat Board
Board Magnets
Plankton Samples
Stage Microscopes
Calculators

KEY TERMS:

Algal Bloom Anoxic Biomagnify Cellular Respiration Chloroplast Flagella Holoplankton Meroplankton Morphology Organism Phytoplankton Photosynthetic Plankton Primary Producer Thermocline Toxin Trophic Level Water Column Zooplankton Productivity