

Lesson Title: Photosynthesis in the Ocean

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Topic: Photosynthesis & Food Webs

Targeted Grade Level: Grade 6

Time Needed: 10 days

Subject Integration: Science, Technology, Literacy

Standards: 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.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

NGSS Performance Expectations 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

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Developing and Using Models Analyzing and Interpreting Data Constructing Explanations and	LS1.C: Organization for Matter and Energy Flow in Organisms Plants, algae (including phytoplankton), and many	Cause and Effect Energy and Matter

<p>Designing Solutions</p>	<p>microorganisms use the energy from light to make sugars (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)</p> <p>LS2.A: Interdependent Relationships in Ecosystems</p> <p>Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)</p> <p>LS2.B: Cycle of Matter and Energy Transfer in Ecosystems</p> <p>Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment</p>	
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	occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)	
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Measurable Student Learning Objectives: Students will be able to use microscopic images to identify various species of common phytoplankton. Students will be able to describe how photosynthetic organisms meet their needs in the ocean. Students will be able to identify phytoplankton as a major source of oxygen in Earth's atmosphere. Students will be able to construct a sample marine food web. Students will be able to explain the importance of phytoplankton in the food web. Students will be able to make predictions about changes to a food web.

Engaging Context/Phenomena: Students will watch a Ted-Ed video introducing phytoplankton, and observe microscopic images of phytoplankton.

Data Integration: Students make qualitative observations of phytoplankton concentrations when completing the ACES activities on Photosynthesis in the Ocean and Food Webs in Action.

Differentiation of Instruction: This lesson can be differentiated in a number of ways. There will be handouts and written instructions for students in order to provide further scaffolding for those who may need it. There will also be different goals that students will be expected to achieve based on their ability. For example, students may not be expected to use every

marine animal in their food web, but will be given less cards. Students will also be given models throughout the unit, such as a diagram of the photosynthesis equation to refer to, and a model of food webs as reference.

Real-life Connection: Students learn about photosynthesis often, and know it happens around them, but are not entirely aware that it happens in oceans as well. This lesson shows students where they get their energy from, and how that energy travels through different organisms to eventually get to them. Students also interact with oceans when traveling, and many live near the ocean in my school (located right near the Long Island Sound), so this lesson is relevant to their environment.

Possible Misconceptions: Many students do not expect photosynthesis to happen under water, and are used to photosynthesis occurring in plants that they see every day, such as trees, grass and flowers.

Lesson Procedure:

5E Model	5E Objectives
<p>Engage</p> <p>Phytoplankton Microscopy Lab</p>	<p>Procedure: Students are watching a video introducing them to phytoplankton. They continue to complete a lab where they are identifying common species of Phytoplankton in different microscope slides.</p> <p>Modifications Handout of slideshow to students, guided notes for those who need them</p> <p>Standards Addressed 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 (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)</p> <p>Formative/Summative Assessments: Student worksheets</p> <p>Resources</p>

	<p>https://www.ted.com/talks/tierney_thys_and_plankton_chronicles_project_the_secret_life_of_plankton</p> <p>https://myasadata.larc.nasa.gov/sites/default/files/2019-08/SLIDES%20Phytoplankton%20Microscopy%20Lab.pdf</p> <p>https://myasadata.larc.nasa.gov/lesson-plans/introduction-phytoplankton</p>
<p><u>Explore</u></p> <p>Signals of Spring Phytoplankton Photosynthesis in the Ocean</p>	<p>Procedure: Students will use the ACES platform to complete an investigation on phytoplankton populations and chlorophyll concentration during seasonal changes.</p> <p>Modifications Some students will need larger images of the chlorophyll concentrations. They will also have access to the phytoplankton maps on the ACES website.</p> <p>Standards Addressed 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</p> <p>Formative/Summative Assessments Student questions will be collected and graded as a summative assessment</p> <p>Resources</p> <p>https://signalsofspring.net/aces/ssheets/08photosynthesis.pdf</p>
<p><u>Explain</u></p> <p>Photosynthesis & Food Web Notes</p>	<p>Procedure: Teacher and students will go through guided notes on Photosynthesis and Food webs.</p> <p>Modifications Copy of class notes will be available for students</p> <p>Standards Addressed 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</p> <p>Formative/Summative Assessments Student notes will be checked for completion, students will</p>

	<p>complete CER paragraph on what phytoplankton need to perform photosynthesis</p> <p>Resources <u>Photosynthesis & Food Web Guided Notes</u></p>
<p><u>Elaborate</u></p> <p>Food Web in Action - Creating the Food Webs</p>	<p>Procedure: Students will work in small groups to create a food web of marine animals from the cards provided to them. They will mount these cards to a poster/paper and show the direction of energy flow from producer to each level of consumer.</p> <p>Modifications Students will be given less food web cards, and a model food web for reference.</p> <p>Standards Addressed MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.</p> <p>Formative/Summative Assessments Evaluate food webs for completion</p> <p>Resources Food Web cards: https://signalsofspring.net/aces/foodwebcards.pdf</p>
<p><u>Evaluate</u></p> <p>Food Web in Action Questions</p>	<p>Procedure: Students will work together in groups to answer the questions on “Food Web in Action.” They will use their food webs, the analysis questions, and any attached images to summarize their knowledge on photosynthesis and the cycling of energy in the ocean.</p> <p>Standards Addressed MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.</p> <p>Formative/Summative Assessments Students will answer questions pertaining to their food webs and phytoplankton.</p>

	<p>Resources Food web cards, pasted to poster/paper</p> <p>https://signalsofspring.net/aces/ssheets/10FoodWebInActionG.pdf</p>
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Teacher Background: Teacher needs to have some background knowledge of phytoplankton species. They should also have background knowledge of the process of photosynthesis, producers, consumers, autotrophs, and heterotrophs. They should also have background knowledge of food webs, and how energy is transferred through food webs.