



**Title:** Fish Food

**Subject:** Science

**Grades:** 3 – 5

**Concept:** Students learn about the role plants play in aquatic food webs.

**Learning Objectives:**

- Compare the effects of changing light conditions on a plant's ability to carry out photosynthesis.
- Relate reduced light exposure effects on plants to the effects of some pollutants on plants.
- Demonstrate an understanding of the concept that living organisms depend on one another for survival.

**Teacher Background:**

Food chains are visual representations of the eating relationships between organisms in an ecosystem. Food webs combine individual food chains from the same ecosystem into a single, interrelated web of organisms that rely on each other for sustenance. At the base of every food web are photosynthetic organisms, like plants and photosynthetic bacteria. These photosynthetic organisms play two major roles in the aquatic food web. First, they provide food for primary consumers, including some species of fish. Second, they remove carbon dioxide from water and release oxygen into the water, increasing the amount of dissolved oxygen available to fish and other aquatic organisms that rely on dissolved gases to survive. This activity explores the relationship between aquatic plants and their role at the base of an aquatic food chain.

**Materials:**

- For each group:
  - Elodea sprig
  - Test tube
  - Test tube rack
  - Water
  - Lamp
  - Stopwatch
  - Hand lens
  - Blue cellophane

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- Individual pictures of organisms from the same aquatic food chain

**Vocabulary:**

- Photosynthesis
- Food chain

**Timing:**

- Approximately two 45-minute class periods
  - Lesson: 45 minutes
  - Activity: 30 minutes
  - Wrap-up: 15 minutes

**Lesson:**

1. Post the parts of the aquatic food chain on the board or on a piece of chart paper. Ask students to identify the type of environment most of the organisms belong in. Most students will recognize that the organisms come from an aquatic environment.
2. Explain to students that the organisms on the board are all part of the same aquatic **food chain**. Explain that a food chain connects organisms that eat each other. Work as a class to organize the organisms on the board in the appropriate food chain. The plant organism should be at the bottom of the food chain.
3. Ask students how the plant obtains food from its environment. Some students may be able to explain that plants need the sun to grow. Discuss the process of **photosynthesis**. Explain that plants use energy from the sun along with water and carbon dioxide to make their own food. Plants also produce oxygen during photosynthesis, which they release into the atmosphere. Photosynthesis takes place in the plant's green leaves. This is why plants do not need an external source of food.
4. Ask students what the fish needs from its environment. Students should be able to identify water and food as necessary to fish survival. Some students may be able to identify oxygen as necessary for fish survival. Ensure that students make the connection between the oxygen released by underwater plants and the oxygen fish need to obtain from their environment.
5. Show students a picture of an underwater plant. Ask students what this plant needs to make its own food. Students should be able to identify the requirements for photosynthesis: sunlight, carbon dioxide, and water. Students should also be able to describe the products of photosynthesis: food and oxygen.
6. Have students draw the underwater plant in their notes. Discuss how the plant gets what it requires from its environment. Students should add a representation of sunlight passing through the water to the plant leaves and a representation of the leaves absorbing dissolved carbon dioxide

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- from the water. Students should also include oxygen being released from plant leaves and food being made in the plant leaves in their diagrams.
7. Ask students what would happen to the plant if the water became polluted. Students should be able to explain that pollutants are substances that harm plants. Some pollutants limit the amount of light available to the plant. Other pollutants damage the plant's leaves, which it needs to carry out photosynthesis.
  8. Have students work in pairs to predict what would happen to the rest of the food chain if the water becomes polluted. When students are ready, encourage them to share their ideas with the class. Students should be able to explain that water pollution will damage the plants. If the plants are damaged, the fish will have less to eat, and so on through the highest levels of the food chain.

**Activity:**

1. Divide the class into groups of three. Distribute the activity materials to each group.
2. Students should use the following procedure to investigate the relationship between a light source and photosynthesis. A similar activity has been described at the web site <http://www.mysciencebox.org/bubblingplants>.
  - a. Arrange the test tube rack and the lamp so that the bottom of the light bulb is six inches from the bottom of the test tube when it is resting in the rack.
  - b. Fill the test tube with water equilibrated to room temperature and place it in the rack. Turn on the lamp.
  - c. Place the Elodea sprig in the water with its stem pointing up.
  - d. Start the stopwatch.
  - e. Count the number of bubbles produced by the Elodea sprig for a five-minute period. Record this number in your notes.
  - f. Repeat steps b-e, this time with the lamp 12 inches from the Elodea sprig. Record the number of bubbles produced during five minutes of light exposure.
  - g. Repeat steps b-e, this time with blue cellophane covering the top and sides of the test tube and the lamp six inches from the Elodea sprig. Record the number of bubbles produced during five minutes of light exposure.
3. When students are finished with their experiments, have them summarize their results in a data table. Have students write a one-sentence summary describing the results of each trial.

**Wrap-up:**

1. Using the data from their experiment, have each student prepare written answers to the following questions to demonstrate achievement of learning objectives.

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- a. What do the bubbles in this experiment represent? (The bubbles represent O<sub>2</sub> gas produced as a result of photosynthesis.)
  - b. Under what conditions did the Elodea produce the most bubbles? (The most bubbles are produced when photosynthesis occurs at the highest rate, i.e., when the light intensity is highest.)
  - c. Which conditions best simulate the effects of pollution on photosynthesis in Elodea? Why? (Reduction of light intensity by moving the light source away from the plant or by limiting the spectrum of light to fewer wavelengths using colored cellophane both reduce the rate of photosynthesis. Both mimic the effects of some pollutants that block light from reaching aquatic plants.)
  - d. How would the health of local fish populations be affected by the conditions that produced the fewest bubbles? Why? (If photosynthesis is reduced, plants will not grow as well, which in turn limits both food and oxygen available for fish. Therefore fish will not fare as well in conditions that threaten plant survival.)
2. When students are finished, discuss their answers to the questions. Make sure that students understand the relationship between plant health and fish health in aquatic ecosystems.

**Standards:**

Life Science

- **Organisms and Environments:** All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants.
- **The Characteristics of Organisms:** Organisms have basic needs. For example, animals need air, water, and food; plants require air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met. The world has many different environments, and distinct environments support the life of different types of organisms.
- **Organisms and their Environments:** An organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce and others die or move to new locations.

Association of Fish and Wildlife Agencies (AFWA)

- The health and well-being of fish, wildlife, and humans depend on the quality of their environment.
- All living things depend on habitat that includes adequate and suitably arranged food, water, shelter, and space.

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