Aquaculture

*Lesson Plan for Grade 1, Science*

*Prepared by National Agriculture In The Classroom*

*Modified by Mississippi State University, School of Human Science*

*for Mississippi Farm Bureau Federation - AITC*

# OVERVIEW & PURPOSE

Students identify the basic needs of plants and fish and engineer, assemble, maintain, and observe a small-scale aquaponics system that meets plant and fish needs.

# EDUCATION STANDARDS

**Mississippi College-and-Career Readiness Standards:**

L.K.2.3 With teacher guidance , conduct a structured investigation to observe and measure (comparison of lengths) the changes in various individuals of a single plant species from seed germination to adult plant. Record observations using drawing or writing.

ELA-SL.1.1 Participate in collaborative conversations with diverse partners about grade 1 topics and text with peers and adults in small and larger groups.

S.L.1.2: Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

**NALOs:**

T2.K-2.c Identify examples of feed/food products eaten by animals and people

T2.K-2.e Identify the importance of natural resources (e.g., sun, soil, water, minerals) in farming

# OBJECTIVES

* Students will learn where food is grown
* Students will understand and observe fish
* Students will make other connections within agriculture

# MATERIALS NEEDED

* 5 potted plants (choose 5 of the same plant)
* [Plant Observation Sheet](https://drive.google.com/file/d/17JDdTn27tzDDHZj7ngpw_fMzoMg9288j/view?usp=drive_link)
* [Aquaponics- Pass the Plate video](https://video.disney.com/watch/aquaponics-pass-the-plate-4ece977e6d34cbb50e43bf04)
* [Plant PowerPoint Slides](https://docs.google.com/presentation/d/1k-Powv-wiUvHonXxvozEC6cwhpk3xY8A/edit?usp=drive_link&ouid=109918902593538910659&rtpof=true&sd=true)
* [Ocean Live Cam](https://explore.org/livecams/oceans/cayman-reef-cam)
* [Fish Needs Cards](https://drive.google.com/file/d/1R1qU3p25iJQi3C4v5zLrnCK0pnpD_SLv/view?usp=drive_link)
* 4 Hula hoops

# Lesson Set Up:

1. Open up [Aquaponics- Pass the Plate](https://video.disney.com/watch/aquaponics-pass-the-plate-4ece977e6d34cbb50e43bf04) video as a way to engage students.
2. Divide students into four groups.
3. Prepare each group with a potted plant.

# Vocabulary

**aquaculture:** the cultivation of aquatic organisms (such as fish or shellfish) especially for food

**aquaponics:** a system of aquaculture in which the waste produced by farmed fish or other aquatic animals supplies nutrients for plants grown hydroponically, which in turn purify the water

**decomposition:** the process of breaking down or being broken down into simpler parts or substances especially by the action of living things (as bacteria or fungi)

**fertilizer:** any material of natural or synthetic origin that is applied to soils or plant tissues to supply one or more nutrients essential to plant growth

**gills:** the paired respiratory organ found in many aquatic organisms that extracts dissolved oxygen from water and excretes carbon dioxide

**hydroponics:** the method of cultivating plants using a mineral nutrient solution in a water solvent without the use of soil

**nutrient:** a substance that provides nourishment essential for growth and the maintenance of life

**photosynthesis:** the process by which plants convert carbon dioxide, water, and light energy into sugars and oxygen in order to store energy; the opposite of cell respiration

**respiration:** the process through which a plant exchanges oxygen and carbon dioxide with its environment

**spawn:** release or deposit eggs

**stomata:** small openings in the leaves and stems of plants which can open and close to exchange oxygen and water vapor for carbon dioxide

**symbiotic relationship:** close, prolonged association between two or more different organisms of different species that may, but does not necessarily, benefit each member

# Ag Facts:

* **Catfish** are named for their cat-like whiskers that protrude from their snouts.
* 89,400 acres of ponds were used for **farm**-raised **catfish** production in the United States.
* **Farm**-raised **catfish** tend to be more consistent because of their scientifically formulated diets and constant care.
* Mississippi produced 350 million pounds, or 55 percent, of all U. S. catfish production in 2005.

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# Background Information for Teacher:

# **Aquaponics** is the combination of **aquaculture** (farming fish and other aquatic organisms) and **hydroponics** (growing plants in water without soil). Fish and plants are simultaneously grown in an enclosed, recirculating system. A small-scale aquaponics system has ten basic components—a fish tank, a grow bed, a growing medium, a water pump, tubing, a grow light, a fish cave, water, fish, and plants. Water from the fish tank is pumped to the plants, removing the waste from the fish and keeping the fish tank clean. The fish waste is converted by bacteria into a natural **fertilizer** that is absorbed by the plants. The water is filtered through the plant roots and returned back to the fish tank, providing the fish with a fresh source of water. The fish and plants interact in a mutually beneficial **symbiotic relationship** within a single system. The waste produced by one is used by the other. With the exception of the fish food, all fish and plant needs are provided within the aquaponics system.

# Plants require **nutrients**, water, air, and light to survive and grow. Nutrients, sometimes referred to as fertilizers, are the vitamins and minerals plants need for healthy growth. They come from the **decomposition** of rocks, dead plants, and animals and are absorbed through the roots of the plant. Water is also absorbed through the roots and transported to the rest of the plant through the stem. Water helps keep plants rigid and transports nutrients throughout the plant. Air enters the plant through tiny holes in the leaves called **stomata**. The roots absorb oxygen to convert food into energy, a process called **respiration**. Plants use energy from light to make food. In the **photosynthesis** process, the plants use energy from light, carbon dioxide from the air, and water to make sugars and starches that are used as food for the plant. In nature, plants typically get nutrients from soil, water from rain, carbon dioxide and oxygen from the air surrounding them and from air pockets in the soil, and light from the sun. In an aquaponics system, nutrients come from the fish waste, water comes from the fish tank, air is present in the classroom, and light comes from the grow light.

# Like humans, fish have four basic needs—nutrients, water, air, and shelter. Different types of fish eat different types of food. Fish feed on microorganisms, smaller fish, worms, plankton, sponges, algae, aquatic plants, or commercial fish food. Freshwater fish do not actively drink water. The water they need flows into them through their gills and skin. Saltwater fish actively drink water through their mouths. Their bodies process the water to filter out the salt. Fish need oxygen from the air present in water to breathe. A fish breathes by taking water into its mouth and forcing it through its **gill** passages. As water passes over the thin walls of the gills, dissolved oxygen moves into the blood and travels to the cells of the fish. Fish need shelter for protection from predators. Some fish also eat, sleep, and **spawn** under the cover of shelters. In an aquaponics system, clean water comes from the water that is filtered by the plants and drained into the fish tank, air is present in the water, and shelter is provided by the rock cave in the fish tank. Nutrients are the only fish need that is not provided within the aquaponics system. Nutrients for the fish are added to the system, most often in the form of commercial fish food appropriate to the species of fish being raised.

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# LEARNING PROCEDURES

Interest Approach:

1. Ask the students, "Where is the food you eat grown?" After discussing the student responses, ask them if they think food can be grown in the middle of a big city.
2. View the video [Aquaponics – Pass the Plate.](https://video.disney.com/watch/aquaponics-pass-the-plate-4ece977e6d34cbb50e43bf04)
3. Ask the students why it might be beneficial to raise fish and plants together in one system. Use the following points to guide the discussion:
   1. The fish waste is not released into the environment.
   2. The waste produced by the fish is used as fertilizer for the plants.
   3. The plants purify the water for the fish.
   4. Food can be produced using less water than traditional growing methods. This allows food to be produced during droughts or in areas with little water.

**Activity 1: Needs of a Plant**

1. Ask the students if they have ever taken care of a plant. If they have, ask them to describe what they did to care for their plant.
2. Ask the students, "What are the basic needs of plants?" (*nutrients, water, air, and light)* Use the [Needs of a PlantPowerPoint Slides](https://docs.google.com/presentation/d/1k-Powv-wiUvHonXxvozEC6cwhpk3xY8A/edit?usp=drive_link&ouid=109918902593538910659&rtpof=true&sd=true) to introduce the four basic needs of a plant.
3. Divide the class into four groups. Assign each group one of the needs of a plant.
4. Provide each group with a potted plant. The fifth plant is the "control" plant. Show the students the control plant and explain that this plant will receive everything it needs to live and grow—nutrients, water, air, and light.
5. Each group will design an investigation to find out if their plant can survive without their assigned need. For example, if a group was assigned "light," they will design an investigation to determine if their plant can survive without light.
6. Allow each group time to brainstorm ideas about how to design their investigation. Tell students to keep in mind that they are limited to easily available materials that can be found either in the classroom or at home. Be sure to visit with each group during the brainstorming process to give guidance and feedback.
7. After the necessary materials are gathered, have each group set up their investigation. Provide each student with a [Plant Observation Sheet](https://drive.google.com/file/d/17JDdTn27tzDDHZj7ngpw_fMzoMg9288j/view?usp=drive_link)and give students time to record their observations each day for two weeks.
8. After the two-week observation period, have each group meet together to summarize their observations and interpret their findings. Provide time for each group to share their findings with the class.

**Activity 2: Needs of a Fish**

1. Ask the students, "What do you need to survive?" (*food, water, air, and shelter*) Ask the students if they think fish have the same or different needs. Discuss their responses and guide them to the understanding that fish have the same basic needs as humans.
2. View an [Ocean Live Cam.](https://explore.org/livecams/oceans/cayman-reef-cam) Using the information from the *Background – Agricultural Connections* to discuss how the needs of the fish seen in the live cam are being met.
3. Choose a large outdoor area or gymnasium to represent the ocean. Tell the students that they are going to play "Fish Tag" and they are all fish. Assign 5-10 students to be predators. Use sports pinnies or headbands to identify the predators. Spread all of the [Fish Needs Cards](https://drive.google.com/file/d/1R1qU3p25iJQi3C4v5zLrnCK0pnpD_SLv/view?usp=drive_link)and the four hula hoops around the ocean. Explain to the class that the fish will have two minutes to "swim" around the ocean collecting cards while trying to avoid being caught by the predators. If a predator tags a fish, the fish has been caught and is out of the game. Eaten fish will move to the edge of the ocean and participate in an activity such as jump rope, hula hoop, jog around the ocean, etc. Each fish is trying to collect one food card, one water card, and one air card before time is up. The hula hoops represent shelter. When a fish is standing inside a hula hoop, they are safe from predators and cannot be caught. Only three fish can stand in a hula hoop at a time, and they may only stay there for ten seconds.
4. After one round is complete, choose new predators and play again. Repeat the game until every child has had an opportunity to be a predator.
5. Review with the students the importance of food, water, air, and shelter to the survival of a fish.

Evaluate:

After conducting these activities, review and summarize the following key concepts:

* Nutrients, water, air, and light are the basic needs of plants.
* Food, water, air, and shelter are the basic needs of fish.
* Aquaponics is the combination of aquaculture and hydroponics. The waste produced by fish provides nutrients for the plants, which in turn purify the water.
* An aquaponics system meets all the needs of fish and plants with the exception of food for the fish.

Source: <https://agclassroom.org/matrix/lesson/633/>

# Additional Learning Procedures

To help students review and elaborate more about aquaculture, complete a [“I used to think… now I think…”](https://drive.google.com/file/d/1mDmIYCYOkZJaRGObq4-TC60PluvSIMuM/view?usp=drive_link) chart and share with other students.

Going further, try reading new texts related to aquaculture such as [“Carl’s Fish Farm: An Introduction to Aquaculture: A children’s educational, rhyming picture book” by: K. Michelle Edge.](https://www.amazon.com/Carls-Fish-Farm-Introduction-Aquaculture/dp/1639443215/ref=sr_1_3?crid=2RPJB1Q4G6FZR&keywords=kids+aquaculture+book&qid=1692975596&sprefix=kids+aquaculture+book%2Caps%2C151&sr=8-3)



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