Aquaculture

*Lesson Plan for Grade 5, Science*

*Prepared by Agriculture In The Classroom*

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

*for Mississippi Farm Bureau Federation - AITC*

# OVERVIEW & PURPOSE

Students discover the sources of various fish and seafood, compare wild-caught and farm-raised aquaculture systems, and use a simulation to determine how overfishing can damage the ocean ecosystem.

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# EDUCATION STANDARDS

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

SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others’ ideas and expressing their own clearly.

E.5.10 Students will demonstrate an understanding of the effects of human interaction with Earth and how Earth’s natural resources can be protected and conserved.

ELA-W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work and provide a list of sources.

**NALOs:**

# T1.3-5.a Describe similarities and differences between managed and natural systems (e.g., wild forest and tree plantation; natural lake/ocean and fish farm)

# T1.3-5.d Identify the major ecosystems and agro-ecosystems in their community or region (e.g., hardwood forests, conifers, grasslands, deserts) with agro-ecosystems (e.g., grazing areas and crop growing regions)

T5.3-5.e Provide examples of agricultural products available, but not produced in their local area and state

T2.3-5.e Understand the concept of land stewardship and identify ways farmers care for land, plants, and animals

# OBJECTIVES

* Students will understand sustainability
* Students will compare aquaculture
* Students will understand the lifespan of overfishing

# MATERIALS NEEDED

* [Harvesting Knowledge Fish Farming](https://www.americasheartland.org/watch/season-7/?episode=americas-heartland-701&start=483&end=615)
* [Comparing Aquaculture handout (1 for each student)](https://drive.google.com/file/d/1OSP2QPGkynrIa4mCq3yKt_uMGZRIeAYE/view?usp=drive_link)
* [Wild-caught Fishing : Working the Water (lobster fishing) video](https://www.youtube.com/watch?v=L4Ni0cV_qvA)
* [Fish Farming:Acres and Acres of Catfish video](https://www.pbs.org/video/americas-heartland-311/)
* [Cage Fish Farming: Oyster Farming video](https://www.youtube.com/watch?v=Ku8KiUXrzV4)
* Colored goldfish
* 4 Plates (1 for each group)
* Spoons (1 for each student)
* Straws (1 for each student)
* Napkins (1 for each student)
* Pieces of sting (1 for each student)
* 1 roll of tape

# Lesson Set Up:

1. Pull up the following videos in preparation for the lesson
   1. [Harvesting Knowledge Fish Farming video](https://www.americasheartland.org/watch/season-7/?episode=americas-heartland-701&start=483&end=615)
   2. [Wild-caught Fishing : Working the Water (lobster fishing) video](https://www.youtube.com/watch?v=L4Ni0cV_qvA)
   3. [Fish Farming:Acres and Acres of Catfish video](https://www.pbs.org/video/americas-heartland-311/)
   4. [Cage Fish Farming: Oyster Farming video](https://www.youtube.com/watch?v=Ku8KiUXrzV4)
2. Give each student the [Comparing Aquaculture handout](https://drive.google.com/file/d/1OSP2QPGkynrIa4mCq3yKt_uMGZRIeAYE/view?usp=drive_link)
3. Organize students into groups of 4
4. Collect supplies into piles
   1. 1 Plate
   2. 4 Spoons
   3. 4 Straws
   4. 4 Napkins
   5. 4 pieces of string
   6. 1 roll of tape
5. 8-10 Goldfish on each paper plate

# Vocabulary

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

**bivalve mollusk:** aquatic mollusk whose body is enclosed in a hinged shell such as oysters, clams, mussels, and scallops

**crustacean:** a type of animal (such as a crab or lobster) that has several pairs of legs and a body made up of sections that are covered in a hard, outer shell

**fish farm:** a place where fish are artificially bred or cultivated for food, restocking lakes for angling, or to supply aquariums

**mollusk:** a type of invertebrate animal (such as snails, clams, or squids) that has a soft body, does not have a backbone, and usually lives in a shell

**overfishing:** to fish to the detriment of a fishing ground or to the depletion of a kind of organism

**seafood:** shellfish and sea fish served as food

**sustainability:** a method of harvesting or using resources so that they are not depleted and/or permanently damaged

**wild-caught:** taken from the wild rather than being bred from domestic stock

Ag Facts:

* Mississippi **aquaculture** has risen to the top within the U.S. with **205 catfish farms**.
* Mississippi produces 65% of the nation's **farm-raised catfish.**
* Mississippi ranks #1 in the U.S. for farm raised **catfish**.
* The typical production of **shrimp** per acre ranges from 500 to 1,000 pounds.
* There are 20 **game fish** producers in Mississippi.

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# Background Information for Teacher:

# **Seafood** (fish and shellfish) are a nutrient-dense source of dietary protein. Compared to other sources of protein, seafood is low in calories and saturated fat and rich in key nutrients including zinc, magnesium, phosphorous, potassium, and vitamins A, B12, and D. Seafood is also a primary food source of omega-3 fatty acids, EPA, and DHA.3 The American Heart Association and the Dietary Guidelines for Americans recommends eating two, 3.5 ounce servings of fish per week.4

# The seafood we purchase at retail markets can come from a variety of sources. **Aquaculture** is the farming of aquatic organisms such as fish, **crustaceans**, **mollusks**, and aquatic plants. **Fish-farming** can involve raising fish commercially in tanks or other man-made enclosures such as ponds or concrete fish runs. These farms manage their water (flow, oxygen levels, etc.) and the growth of fish from the fertilization of eggs until harvest. Other fish farms follow similar principles, but use a cage system in a natural water source such as a lake or ocean. These farms use the same water and habitat as wild fish, but keep their fish in separate enclosures. Regardless of the type of system, it is considered a *farm* if humans manage the breeding, feeding, and growth of the fish. In the United States, trout and catfish are the most commonly farmed fish species. World-wide, the seafood most commonly farmed are shrimp and salmon.5

# Some of the seafood we eat is supplied through fishing. This seafood is usually labeled as **wild-caught** and is harvested using nets, trawls, or other devices. Wild harvest commercial fishermen work closely with government agencies to help ensure that wild stocks are not **overfished** in US waters. The National Marine Fisheries Service identifies areas considered essential to living marine resources and regulates the use of these areas so that the habitats remain healthy, sustainable, and productive. Although many waters are managed through quotas on the number of fish that can be caught and restrictions on the size of fish that can be harvested, the breeding, feeding, and growth of the fish are not managed by humans in any way.

# Many species of fish and shellfish can be raised on farms or caught from the wild. The dietary value of fish resulting from both (farmed or wild-caught) production methods is equal. In addition to a dietary comparison, a look at the environmental impacts of each system is critical to maintaining the long-term **sustainability** of fish farming and wild-caught fisheries. It is estimated that wild-caught fisheries have reached their maximum sustainable yield, while the world's appetite for seafood is growing.6

# One solution to this challenge is the aquaculture industry, which can satisfy the growing demand for seafood in an environmentally friendly and sustainable manner. US aquaculture operations raise fish such as trout, tilapia, barramundi, and cobia that can replace more familiar species on menus yet still meet customers' wants and needs. Other farms are raising traditional marine species such as cod, flounder, and halibut. The availability of these species from farms allows consumers to access their favorite seafood while wild fish stocks recover.

# Another example of aquaculture providing positive environmental impacts is the production of **bivalve mollusks**, such as clams, oysters, and mollusks. These shellfish remove nutrients from the water by feeding on algae and particulate matter. This helps maintain good water quality and minimizes the loss of critical oxygen. While farmed shellfish are growing, they spawn and help to reseed wild shellfish beds. Due to their unique structure, bivalve mollusks provide habitats and hiding places for other organisms, adding to the biodiversity of the marine ecosystem. These impacts are so important that, in some areas, community volunteers are restoring oyster and clam populations.

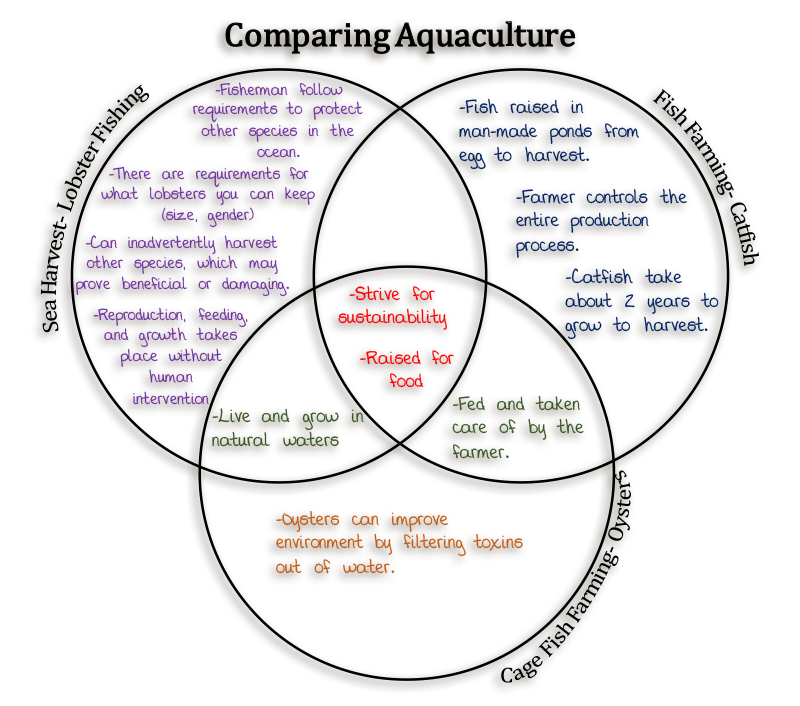
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# LEARNING PROCEDURES

Interest Approach:

1. Ask the students to name different types of seafood they eat. List the seafood they name on the board.
2. Ask the students to pretend the classroom is an ocean, and that they are the fish. Encourage the students to "swim" around the room and spread out across the whole ocean. Ask the students to identify seafood from the list on the board that are caught from an ocean.
3. Mark off a smaller area in the room. Explain to the students that this area represents a fish farm. Allow students to "swim" around in the fish farm. Ask the students to identify seafood from the class list that are harvested from fish farms.
4. Facilitate a discussion to compare and contrast the ocean and the fish farm. Ask the following questions:
   * Would it be easier to catch fish in the ocean or the fish farm?
   * How easy would it be to manage the fish in the ocean as compared to the fish farm?
   * What are some reasons why people would choose to farm fish instead of catch them in the wild?

**Activity 1: Sourcing Fish and Seafood**

1. Ask students if they can guess how long fish has been part of our diets in human history. Show the [Harvesting Knowledge - Fish Farming](https://www.americasheartland.org/watch/season-7/?episode=americas-heartland-701&start=483&end=615) video clip to answer the question. After the video, ask students, "How do we get these fish from the water to our plates?"
2. Give each student a copy of the [Comparing Aquaculturehandout](https://drive.google.com/file/d/1OSP2QPGkynrIa4mCq3yKt_uMGZRIeAYE/view?usp=drive_link). Using the back side of the handout as a guide, discuss the three different methods of harvesting fish and seafood.
3. Inform students that they will be taking a video tour of these three different methods. As they watch each video clip, they should fill out the Venn diagram noting the differences and similarities found while comparing each method.
   * **Note:** If students are not familiar with Venn diagrams, give additional instructions describing what each portion of the circles represent.
4. Show the following video clips:
   * Wild-caught Fishing: [Working the Water (lobster fishing)](https://www.youtube.com/watch?v=L4Ni0cV_qvA)
   * Fish Farming: [Acres and Acres of Catfish](https://www.pbs.org/video/americas-heartland-311/)
   * Cage Fish Farming: [Oyster Farming](https://www.youtube.com/watch?v=Ku8KiUXrzV4)
5. After watching the videos, have a class discussion to summarize what students learned. Point out to students that not all the lobsters we eat are wild-caught and not all oysters and catfish are farmed. Lobsters can be farm-raised and oysters and catfish can be wild-caught. Use the following questions to help guide their comparisons and complete their Venn diagrams:
   * Where do the fish/seafood shown in the videos live? (*The lobsters and oysters live in natural waters. The catfish live in man-made waters.*)
   * Where do the fish/seafood shown in the videos get their food? (*The lobsters eat from the ocean. The oysters and catfish are fed by farmers*.)
   * Which method is regulated by the type of animals that can be harvested? (*Wild-caught fishing. In order to manage the populations of wild lobsters, fishermen must follow specific requirements to maintain healthy populations of lobsters and protect other species.*)
   * Which method has the potential for harming other populations of animals? (*Wild-caught fishing. The fishing process could inadvertently harvest or harm other species. You can also note that in some cases invasive species can be better managed to improve the ecosystem through fishing* practices.)
   * Which fish/seafood shown in the videos were completely reliant upon farmers to manage their breeding, feeding, and growth? (o*ysters and catfish)*
   * Which method has the goal of producing a food product for human consumption? (*all three*)
   * Which method strives for sustainability? (*all three)*

**Activity 2: The Lifespan of Overfishing**

1. Explain to the students that a food web is a way to show the feeding relationships among species within a community. Inform the students that they will be simulating an ocean food web using colored goldfish crackers to better understand an ecological issue associated with commercial fishing.
2. Explain that in this ocean's food web the yellow goldfish eat seaweed of which there is always plenty. The green and red goldfish eat the yellow goldfish, and the dark orange goldfish eat both green goldfish and red goldfish.
   * Note that there must be at least two goldfish of each species in the ocean for these fish to survive. However, you may or may not want to share this with the students immediately.
3. Inform the students that in addition to its place in the food web, each fish also has a dollar value, and the purpose is to earn money. If the fish are harvested, each yellow goldfish will make a profit of $2, red goldfish will make a profit of $5 each, and dark orange goldfish will make a profit of $10 each.
4. Organize students into groups of four. Give each student one copy of [The Lifespan of Overfishing Student Data Table](https://drive.google.com/file/d/1IFY6ubmnbc4tPRkGU_H9yl6DKbOvdI9D/view?usp=drive_link). Have one person from each group collect the following supplies:
   * 1 plate
   * 4 spoons
   * 4 straws
   * 4 napkins
   * 4 pieces of string
   * 1 roll of tape
5. Students may use the spoons, straws, strings, and/or tape to create any fishing pole they would like. The key is to get fish out of the ocean and onto their napkin (aka boat).
6. At the start of the activity, put 8-10 of each color of goldfish into each group's ocean (paper plate). (Numbers can be adjusted as the teacher sees fit.) Have the students record the number of each fish in the "Year 1 Start" column of their data table.
7. When all the oceans are stocked and fishing poles are made, give the students 30 seconds to fish. At the stopping signal, all fishing poles must be put down.
8. Tell the students to fill in their data tables for "Year 1 End" with the number of each species of fish that remains in their ocean. Record the value of their catch in the "Year 1 Income" column. Any fish remaining on the table, still attached to the fishing pole, or destroyed during fishing do not count. Once their tables are filled out, the students can eat the goldfish they caught.
9. Adjust the number of fish in each ocean to account for reproduction by adding one new fish of each species for each two that remain. Keep in mind that there must be a food source for each species to allow for survival. If no food source remains, remove that species from the ocean.
10. Repeat steps 6-8 three more times until there have been four years of fishing.
11. Instruct the students to use their data to create a line graph showing the changes in their fish population over time.
12. Have each group report to the class the final number of fish remaining in their oceans after year four. Some oceans may be completely empty of fish. Others may have established a way to fish sustainably so that there are more fish than when they started. Discuss the various strategies the different groups used (or didn't use) to manage their oceans.
13. As a class, discuss the following questions:
    * What is overfishing?
    * Why does overfishing happen?
    * What are the effects of overfishing?
    * What is stewardship and why is it important?
    * How can the world continue to fish in a sustainable manner?

**Concept Elaboration and Evaluation**

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

* Fish and seafood provide a healthy source of proteins and vitamins. USDA dietary recommendations encourage eating fish and seafood twice per week.
* Overfishing occurs when more fish are caught than can be replaced through natural reproduction.
* Overfishing is a problem because it depletes the fish stock which, in turn, negatively affects the ecosystem of a fishing ground.
* Aquaculture is the cultivation of aquatic organisms such as fish or shellfish. It is considered a sustainable practice of food production because it does not deplete the resource.

Elaborate

* Have students create a digital PSA from the poster via prezi or video by using editing tools like Movie Maker, iMovie, Explain Everything, Vimeo, or Spark Video. Assign roles such as producer, actor/narrator, set designer/graphics designer, etc. Here is an example: Overfishing PSA
* Have students visit a fish research facility and/or interview local fishers, fish biologists, or other people involved with local fisheries.
* Have students research oysters and how oyster farming can produce a positive impact on water quality.
* Assign students to research common fish and seafood dishes in the United States and discover if they are typically farm-raised, wild-caught, or both.
* Discuss how culture and geography impact dietary choices. Have students research countries who consume high quantities of fish and seafood. Discuss geography and see if students can identify a correlation between cultural diets and proximity to source. Do locations closest to the sea typically consume more seafood? Students can also learn more about catfish and its cultural roots in the Southern United States.
* Explore careers in the aquaculture industry. Learn what a Fish Biologist does to research and educate the public about fish issues.

Source: <https://agclassroom.org/matrix/lesson/626/>

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/1uscM3AvNJtAhVdoBz14onSUxY2QRFvgM/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)



*For more information and additional lessons visit*

*https://msfb.org/ag-in-the-classroom/lesson-plans/.*