

Let's Go Fishing

An Ecosystem Resource Game

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Let's Go Fishin'

An Ecosystem Resource Game

Skill Level

Beginner (4th/5th graders)

Intermediate (6th-8th Graders)

Learner Outcomes

The learner will be able to recognize scarcity of resources. Understand resource planning on common resources.

Impact:

Students are successful if they can:

- Demonstrate motor skills by removing fish from the plate by sucking through a plastic straw.
- Understand the concept of fish reproduction.
- Successfully calculate fish added to each generation.
- Hypothesize successful resource management.
- Work as a group to develop a management plan.
- Implement a plan to test experiment.

Tag(s)

4-H Citizenship

4-H Communication

4-H Science

4-H Environmental Science

4-H forestry, Wildlife and Fisheries

Time Needed: 35-120 minutes

Materials Needed:

- Goldfish crackers (1 bag /30 students)
- Plastic drinking straws (1/student)
- Paper plates or bowls (8-9 inches) (1 for each set of 3-4 students)
- Timer
- Student Worksheets (optional)

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Introduction to Content

This lesson demonstrates scarcity of resources, allows students to collaborate and create a plan to manage scarce resources, and experiment by implementing their plan.

Introduction to Methodology

Students will have the opportunity to experiment in managing scarce common resources by “fishing” in a common pond, collaborating with their “community” to develop guidelines for resource management and implement those management practices.

Terminology

- **Common Resources** – Scarce resource that provides benefits to users but is not owned or claimed exclusively by anyone.
- **Stocking Rate** - The number of animals (fish) inhabiting a body of water.
- **Overfishing** - Catching too many fish such that a breeding population becomes too depleted to recover and/or to sustain a population.
- **Tragedy of the Commons** - Concept which states that if many people enjoy unrestricted access to a common resource, it will become overused since there is no incentive to conserve the resource for the future.
- **Carrying Capacity** - The population size of a particular species that an ecosystem can support.
- **Ecosystem Balance** - Balanced ecosystem signifies a habitat which is sustainable. It consists of animals, plants, microorganisms and more which depend on each other and their surroundings. These ecosystems exhibit resourceful energy and material cycling. It also displays interconnectedness amid primary producers and predators.
- **Hypoxia (in water)** - Hypoxia, or low levels of dissolved oxygen (less than 2-3 milligrams of oxygen per liter of water), can result in fish kill due to lack of oxygen.



Teacher Talk

When setting the stage for this activity, DO NOT explain the goal or objectives of the activity prior to the first round of fishing. Students should be allowed to fish “as they wish” for the first round to properly demonstrate the tragedy of the commons.

Setting the Stage/Opening Question

Ask, “How many of you like to fish? Today we are going to go fishing.”

Allow students to share their experiences with fishing.

Ask the essential question, “Do people need a plan when fishing? Does fishing have any responsibilities?”

Ask, “If we are going fishing, what will we need to be successful?” (Students should answer, “fish, fishing pole, pond, etc.”)

Say, “Obviously we cannot go to a real pond with real fish while we are here in the classroom, so we are going to use our imagination. This is your pond (hold up a plate/bowl), these will be your fish (show the goldfish crackers), and these will be your fishing poles (show the straws).”

Lay the groundwork for the fishing activity. Explain:

1. Each fishing period is a period of 30 seconds and will represent one year in our pond.
2. To catch a fish, students must suck on one end of the straw to pick up the fish on the other end. Students will remove the fish from the pond and place it in a pile in front of their pond.
3. Once a fish is removed (fished) from the pond it is dead. This fish CANNOT go back in the pond and CANNOT reproduce.
4. Each person must catch at least one fish each year to survive.
5. At the end of each year, for every two fish that remain in the pond one baby fish is added to the pond.

Strategies to Engage Students

It is important to collect and dispose of straws at the end of the activity! Students should not take their straw to their next class.

Spoons can be substituted for straws as the “fishing pole.”

Experience

Notes

Game 1

1. Divide students into groups of three to four. Each group should sit in a circle around the “pond” (plate or bowl). Ensure each student has equal access to the pond.
2. Place 20 fish (Goldfish crackers) in each pond.
3. Set the timer for 30 seconds- Say, “Let’s go fishin’” to begin.
4. At the end of 30 seconds, say “Stop.” Walk around to each group and have them report the number of remaining fish. Inquire how many “baby fish” they need. Help them understand this calculation (two adult fish produce one baby fish. One adult left in the “pond” means they should get no baby fish). Most groups will have completely depleted their fish.
5. Stop the group and hold a discussion. Ask students:
 - a. At the end of the year, what happened with your fish population?
 - b. How many people are fishing at your ponds? How many fish are in your pond now? How many fish were needed for people? Why are there no more fish?
 - c. How many people are going to survive in the next year (remember you must catch at least one fish/person each year)?
 - d. What could we do differently knowing this common resource is finite? Remind students of the essential question, “Did you decide you need a plan when fishing? Does fishing come with responsibilities?”

Game 2

1. Direct groups to work together to create a resource plan (fishing guidelines) to ensure survivability of fish and human populations. Students should have conclusions such as:
 - a. Each year we can remove X number of fish per person.
 - b. Each year we should ensure that X number of fish remain in the pond.

Allow groups to make all their own decisions. It is fine if some develop unsustainable regulations.

2. Reset each pond to 20 fish and repeat 30 seconds of “fishing” periods as before. At the end of each round, allow groups to calculate reproduction rates and add necessary fish to the pond. (Allow three or more additional rounds).
3. Collect the materials and lead a discussion on the activity. Use the following guidelines:

- c. Compare the first round (without rules) and the following rounds with rules.
- d. What strategies did you use? Did they work? Why or why not? What evidence demonstrates that your plan did or did not work?
- e. What if people didn't follow the plan? If not, how did that affect your group?
- f. Again ask, "Do people need to have a plan when fishing?"
- g. What can we learn from this as it pertains to our own pond-stocking rates?
- h. Wildlife management agencies, such as Tennessee Wildlife Resources Agency or TWRA, set rules for fishing in the state of Tennessee. Can we use this information to help us understand how they manage common fisheries?

For middle school students:

Analyze the Findings

1. Give each group a student worksheet to collect data for each "fisherman" as well as a number of fish in each round.
2. Direct each group to calculate the total number of fish in game 1 and game 2.
3. Direct each group to calculate the average number of fish caught for each "fisherman" in game 1 and game 2.
4. Have students create a graph with this data.

Explore the Findings and Go Further

Ask the students:

Compare games 1 and 2. What changed? How did that affect the fish population and fisherman's survivability? Did developing a plan change the outcome (affect your pond ecosystem)?

Variations:

- **Introducing predator-prey relationships:**
 1. Explain to students that the goldfish represent bass in their pond. Introduce a new species of fish in the pond (they can be represented by another type of food, such as M&Ms). These would be bluegill fish.
 2. In this round, whenever a bass is removed, it is replaced by two bluegills.
 - a. Ask, "What will happen to the ponds after several generations? Does the relationship between bass and bluegill change?" **ANSWER: Unbalanced populations are less productive. Reproduction destabilizes or decreases, and growth is limited.**
 - b. Ask, "If my population of bass exceeds my bluegill population, what can I expect to see in my pond? What management tools can we employ to achieve ecosystem balance?" **ANSWER: Excessive bass populations could result in exceeding pond carrying capacity (bass consume a lot of resources). Can limit reproductive rates of bass as well as individual growth. Manage by decreasing bass populations (fish and remove). NOT by increasing bluegill!**
 - c. Ask, "If my population of bluegill exceeds my bass population, what can I expect to see in my pond? What management tools can we employ to achieve ecosystem

balance?" **ANSWER: Excessive bluegill populations could disrupt bass reproduction rates as they consume bass eggs. Individual bluegill sizes can increase such that young bass are no longer able to consume. This results in a bass population that consists of only a few very large individuals. Manage by decreasing bluegill populations (fish and remove). NOT by increasing bass!**

Introducing Carrying Capacity:

Allow the population of one of the ponds to increase where there is no more plate showing (pond has exceeded carrying capacity).

At this point, remove all fish from the pond. Discuss this with students:

- a. Ask, "The carrying capacity of the pond was exceeded. What is carrying capacity? What happens if we exceed an ecosystem carrying capacity?" **ANSWER: Carrying capacity is the number of a given species that a habitat can sustainably support. When exceeded, resources are depleted and populations naturally correct (die off).**
- b. Ask, "What is hypoxia? How would this result from exceeding a pond carrying capacity?" **ANSWER - Lacks dissolved oxygen in water. Fish obtain their oxygen directly from the water. If there are too many fish, there is not enough oxygen. If fish die, the decomposition robs the water of additional oxygen further exacerbating the hypoxic conditions**
- c. Ask, "Could temperature affect the carrying capacity of the pond?" Point out that temperature affects dissolved oxygen. **ANSWER: Increased water temperatures decrease solubility rates for oxygen. As water temperatures rise, the pond can sustain less fish due to decreased dissolved oxygen.**

Harvest Regulations

1. After game 1, have students brainstorm harvest regulations that would sustain both human and fish populations.
2. Have each group write down their harvest regulation. Check with each group to ensure the regulations are different for each group.
3. Proceed with game 2.
4. After game 2, compare results between groups. Have each group report:
 - a. What were the harvest regulations?
 - b. What was the outcome?
 - c. Did it work? Why or why not?
5. Prior to game 2, pull a child aside from one or more groups and ask them to "ignore" the groups harvest regulations and take as many fish as they can. Observe the results in these groups.
6. Ask:
 - a. What happened in this group? What was the result?

- b. How does this reflect society? What do we do as a society when someone disregards those regulations (laws)?

Share/Process

Say: "What did you learn today about fish populations in a pond?"

Generalize

Say: "Do our local TWRA or pond owners managers use these strategies in their management of these waters?"

Apply

Say: "How could we use this information to manage the fish resources in our commons such as local lakes?"

Science

4.LS2: Ecosystems: Interactions, Energy, and Dynamics

- 3) Using information about the roles of organisms (producers, consumers, decomposers), evaluate how those roles in food chains are interconnected in a food web, and communicate how the organisms are continuously able to meet their needs in a stable food web.
- 4) Develop and use models to determine the effects of introducing a species to, or removing a species from, an ecosystem and how either one can damage the balance of an ecosystem.

5.LS4: Biological Change: Unity and Diversity

- 2) Use evidence to construct an explanation for how variations in characteristics among individuals within the same species may provide advantages to these individuals in their survival and reproduction.

6.LS2: Ecosystems: Interactions, Energy, and Dynamics

- 1) Evaluate and communicate the impact of environmental variables on population size.
- 6) Research the ways in which an ecosystem has changed over time in response to changes in physical conditions, population balances, human interactions, and natural catastrophes.

Math

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real world contexts, explaining the meaning of 0 in each situation.

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another. For example, Susan is putting money in her savings account by depositing a set amount each week (50). Represent her savings account balance with respect to the number of weekly deposits ($s = 50w$, illustrating the relationship between balance amount s and number of weeks w).

6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center (mean, median, mode), spread (range), and overall shape.

6-12 LANGUAGE STANDARDS: Knowledge of Language – Standard 3 L.KL.3 Cornerstone: Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

8.L.KL.3 When writing and speaking, adjust style and tone to a variety of contexts; when reading or listening, analyze stylistic choices to determine context. 7

7.L.KL.3 When writing and speaking, choose precise language to express ideas concisely.

6.L.KL.3 When writing and speaking, vary sentence patterns for meaning, reader/listener interest, and style; maintain consistency in style and tone.

6-12 LANGUAGE STANDARDS: Vocabulary Acquisition and Use –

Standard 6 L.VAU.6 Cornerstone: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the post-secondary and workforce level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

8.L.VAU.6 Acquire and accurately use grade-appropriate general academic and domain specific words and phrases; develop vocabulary knowledge when considering a word or phrase important to comprehension or expression.

7.L.VAU.6 Acquire and accurately use grade-appropriate general academic and domain specific words and phrases; develop vocabulary knowledge when considering a word or phrase important to comprehension or expression.

6.L.VAU.6 Acquire and accurately use grade-appropriate general academic and domain specific words and phrases; develop vocabulary knowledge when considering a word or phrase important to comprehension or expression.

SPEAKING AND LISTENING STANDARDS: Comprehension and Collaboration –

Standard 1 SL.CC.1 Cornerstone: Prepare for and participate effectively in a range of conversations and collaborations with varied partners, building on others' ideas and expressing one's own ideas clearly and persuasively.

8.SL.CC.1 Prepare for collaborative discussions on 8th grade level topics and texts; engage effectively with varied partners, building on others' ideas and expressing one's own ideas clearly.

7.SL.CC.1 Prepare for collaborative discussions on 7th grade level topics and texts; engage effectively with varied partners, building on others' ideas and expressing one's own ideas clearly.

6.SL.CC.1 Prepare for collaborative discussions on 6th grade level topics and texts; engage effectively with varied partners, building on others' ideas and expressing one's own ideas clearly.

5.SL.CC.1 Prepare for collaborative discussions on 5th grade level topics and texts; engage effectively with varied partners, building on others' ideas and expressing one's own ideas clearly.

FL.F.5 RL.1-7, 9, 10RI.1-10 W.5-6 4 4. SL.CC.1 Prepare for collaborative discussions on 4th grade level topics and texts; engage effectively with varied partners, building on others' ideas and expressing one's own ideas clearly.

Student Worksheet

Name: _____ Date: _____

Game 1

		# Fish caught			
Year	# of Fish in pond	Fisherman 1	Fisherman 2	Fisherman 3	Fisherman 4
1	20				
2					
3					
4					
Total end of year 4		Avg # caught	Avg # caught	Avg # caught	Avg # caught

Game 2

		# Fish caught			
Year	# of Fish in pond	Fisherman 1	Fisherman 2	Fisherman 3	Fisherman 4
1	20				
2					
3					
4					
Total end of year 4		Avg # caught	Avg # caught	Avg # caught	Avg # caught



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