

Lesson Plan

Part 1: Go Fish! *Exploring The Tragedy of the Commons*

Lesson Submitted by: Claire Barnett

Time: 1 class period

Aim: This is a hands-on lesson adapted from one written by Jeremy Szerlip (Scarsdale High School, Scarsdale, NY). The purpose of the activity is to introduce the concept of “The Tragedy of the Commons.” It is presented in guided inquiry fashion so that students are able to come up with a solution to the problem themselves: the only way to harvest a population for human use indefinitely is by means of a Sustainable Harvest.

Background: The Tragedy of the Commons is an environmental concept that dates back to a 1968 paper written by Garrett Hardin. The Commons dates back even further, the term often used in Colonial times to denote certain lands held “in common” by everyone in a village upon which they could graze their livestock. Since the land belonged to no one and everyone, an individual could benefit in the short-term by putting too many animals on the land, thus resulting in overgrazing and deterioration of the resource. Unfortunately, human nature coupled with the long-held belief that the earth’s resources are virtually inexhaustible has led to a world-wide deterioration of “common” resources, such as oceans, the air, wildlife populations, etc. Exacerbating this is the fact that humans frequently look to short-term benefits without a view of the long-term consequences.

Teacher Notes:

1. Make sure you double-check for food allergies before undertaking this lesson.
2. Reproduction: Double the number of fish remaining in the lake.
3. Make sure the kids do not talk or communicate while fishing.
4. Time the rounds, telling them when to start and stop fishing.
5. Follow-up: class discussion
6. Evaluation: Have them write a summary of what they have learned.
7. Post-lesson activities: Introduce terms;
 - a. Tragedy of the Commons
 - b. Sustainable Harvest
 - c. Look at stories of Fishery Collapses

National Science Education Standards:

Content Standard A (Science as Inquiry): all students should develop --

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Content Standard C (Life Science): all students should develop understanding of --

- Structure and function in living systems
- Reproduction and heredity
- Regulation and behavior
- Populations and ecosystems
- Diversity and adaptations of organisms

Content Standard F (Science in Personal and Social Perspectives): all students should develop understanding of --

- Personal health (bioaccumulation)
- Populations, resources, and environments
- Science and technology in society (fisheries, fishing technology)

Content Standard G (History and Nature of Science): all students should develop understanding of --

- Science as a human endeavor
- Nature of science
- History of science



Go Fish!

Introduction: In colonial days, there was usually an area of land set aside in each town called a “commons,” upon which all townspeople could graze their livestock. In Ecology, this concept is employed to understand the use of resources that are shared, or held in “common.” In this activity, you will learn what often happens to such commonly-held resources.

Materials:

- 1 pair of chopsticks for each student
- 16 Goldfish crackers for each group of four
- 1 dish for each group of four (“lake”)

Procedure:

1. Each one of you represents the head of a hungry family. In order for your family to survive, you must catch enough fish for them to eat. The only food source is a small local lake which can hold up to 16 fish.
2. Once a year you will get a chance to fish and each time you fish you may take 0, 1, 2, 3, or 4 fish from the lake. It is your choice how many fish you take!

One fish: Your family starves.

Two fish: Your family survives.

More than 2 fish: You can sell them for a profit.

3. You will fish for 5 years. After each “year” of fishing, fill in the Data Table for Game #1.
4. The fish in your lake will reproduce once a year. Keep the fish that you “catch” in front of you. (You will be able to eat them later!)
4. At the end of each “year,” your teacher will add more fish to the lake to simulate reproduction.

5. If any family has starved then you cannot fish the next year!
6. **You are not allowed to talk or communicate while fishing!**
7. Do not begin until the teacher says to start fishing.
8. After the first game, answer discussion questions 1 -- 6. You may discuss the questions with your group, but you should each write your answer in your own words. Remember to always answer your questions in complete sentences so that a reader would understand your answers even if he or she did not know the questions!!
9. After you have answered discussion questions 1 through 6, begin Game #2. Fill in the Data Table after each round. Remember, you MAY NOT communicate with each other while fishing!
10. When you have completed Game 2, answer the rest of the discussion questions.

Go Fish! Discussion Questions

1. Did anyone in your group take too many fish? What was the consequence?
2. How did it make you feel if anyone did take too many fish?
3. Did everyone in your group try to take as many as possible? Why or Why not?
4. Does our society reward those with the "most"?
5. Did anyone sacrifice the number of fish they caught for the good of the community? Why or why not?
6. Does society ever reward that type of person?
7. In Game 2, did you change your strategy? If so, what did you do differently and why?
8. Is it possible to maximize the number of fish caught per person **AND** the number of fish remaining in the lake? Explain.
9. Think of a **local "commons"** that you are familiar with. (e.g. parking lots, public bathrooms, parks, the school cafeteria, the hallway, etc.) Do similar situations arise? Explain.
10. How might those problems be solved? Be specific!
11. What are some **natural resources** that are **common** resources?
12. What are the **global commons**? Are these being used wisely? Explain.
13. What can people do to use these resources more wisely?



GO FISH!
DATA TABLE
Game #1

PERIOD _____

NAMES OF FISHERMEN/WOMEN: _____

	Number of fish in the lake [after reproduction]	Number of fish caught per person	Number of fish caught per year [by everyone]
YEAR ONE			
YEAR TWO			
YEAR THREE			
YEAR FOUR			
YEAR FIVE			
TOTAL			

GO FISH!
DATA TABLE
Game #2

PERIOD: _____

NAME OF FISHERMEN/WOMEN: _____

	Number of fish in the lake [after reproduction]	Number of fish caught per person	Number of fish caught per year [by everyone]
YEAR ONE			
YEAR TWO			
YEAR THREE			
YEAR FOUR			
YEAR FIVE			
TOTAL			

LESSON PLAN

I teach an entire unit on ecology, therefore my Lesson Plan will extend across a three-week period. It is still a work-in-progress, but since my post-fielding materials are already quite late, I will send what I have so far and when it is complete I will submit the final version. (If you want, I can include pictures of my students doing the various activities.)

Prior to these lessons, students will have learned some basic ecological concepts, including:

- Population
- Community
- Habitat
- Ecosystem
- Food chains & webs
- Predator/prey relationships
- Competition

Day 1: Tragedy of Commons hands-on, inquiry-based activity during which students discover the concept of sustainability (in particular, the sustainable harvest of a fishery) – 1 class period

Day 2: The Game of Life from NOAA and the National Marine Sanctuaries – a game intended to reinforce the concepts of overfishing, fishery collapse, and sustainable harvest – 1 class period

Days 3 & 4: Empty Oceans from NOAA, the National Marine Sanctuaries, and the Monterey Bay Aquarium -- This activity continues the concept of sustainability and also introduces an action component: Seafood Watch -- 2 class periods

Day 5: Introduction to our Research Site, the Elkhorn Slough

- Review food webs using the Elkhorn Slough Community as an example. Given cards with pictures of each species and its diet, students construct a food web. Explain that these species freely go in and out of the Slough into Monterey Bay; add Monterey Bay species cards; web becomes more complicated.

This information is from the Earthwatch pre-fielding materials for our expedition:

“Elkhorn Slough, Monterey Bay, California -- When the oyster fishery off Moss Landing, California was facing collapse, local fishermen reasoned that if they got rid of the oyster-eating sharks and rays in Elkhorn Slough, the oysters would bounce back. Armed with pitchforks, shotguns, and dynamite, an enthusiastic citizenry descended upon this rich estuary off Monterey Bay in 1946, and killed hundreds of sharks and rays. The oyster population collapsed anyway. However, the shark and ray hunt continued. In 1988, collaborating organizations put an end to the hunt and initiated a tag-and-release program. Since 1991, researcher Sean Van Sommeran and colleagues at the Pelagic Shark Research Foundation have worked with local anglers and numerous local and national organizations to protect and preserve the elasmobranchs (sharks and rays) of Elkhorn Slough and the Monterey Bay Marine Canyon.”

Day 6: Present Shark Derby of Elkhorn Slough via Powerpoint presentation and/or archival newspaper article

- Provide elasmobranch population data to students from before shark derby and during shark derby years.. Students graph data and analyze it to determine if the shark derby was a sustainable harvest

- Provide oyster population data; students infer whether sharks and rays caused decline.
- Students read article explaining how shark derby was stopped partly due to efforts of Sean Van Sommeran, who now researched these animals in the Slough.

Day 7: Introduce our Principal Investigator, Sean Van Sommeran and learn about his pelagic shark research

- show video http://www.youtube.com/watch?v=a_KQT-MBvsg
- read about his research on Great White migration – http://www.pelagic.org/overview/1111_021111_TVShark.html
- Read about other radio tracking shark research data <http://www.sciencedaily.com/releases/2005/10/051007095128.htm>

Day 8: Hands-on Activity: Students use actual radiotracking data at <http://topp.org/> to plot the points on a map

Day 9: Population Studies

- View Powerpoint of Sean’s Elkhorn Slough research and Earthwatch’s part in it – and mine! (i.e. catching, measuring and tagging)
- Hands-on activity of a “Mark and Recapture” population study (I have been using one with turtles, which I will change to thornback rays.)

Day 10: Smartboard interactive lesson illustrating the effect of removing a species or pollution on an entire web using the ecosystem/food web of Elkhorn Slough. (Will address bioaccumulation here as well.) Students will be able to define an estuary and explain its importance (marine organisms begin their life cycle in estuaries and the Slough is an important “nursery.” Biggest concept : Everything is connected!)

Days 11 -- 15: “Shark Week”

Students will each choose a particular species of shark to research and present their findings to the class.

Monday – Wednesday: At the beginning of each class I will present a “Shark Bite” – a bit of shark trivia. Then we’ll watch a short video (different one each day), then they will use the remainder of the class for research.

Thursday & Friday: We will still start with a “Shark Bite,” then student presentations

