

Title

Sustainable Resource Use

Overview

Students play the role as captains of commercial fishing boats and compete with their classmates for a share of the “catch.” Students see firsthand the effects of overharvesting a renewable resource as their fishery dwindles with each fishing season. This thought-provoking, hands-on exercise teaches the importance of using natural resources sustainably.

Objectives

Students will:

- Understand renewable vs. non-renewable resources
- Understand the importance of and interconnectedness of sustainability in relation to economics, population growth, and ecology
- Understand the concept of tragedy of the commons and how it relates to sustainability
- Learn how their own food and other consumer choices relate to the economic model of price determination, supply and demand
- Analyze changes in population and biodiversity in an ecosystem from result of exploitation

NGSS

- HS-ESS3-2: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems
- HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity

Key Terms

- Sustainability- To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations
- Carrying Capacity- The maximum population size of the species that the environment can sustain indefinitely
- Tragedy of the Commons- An economic and environmental example that occurs when the natural resources of an area that is owned by the commons (such as rivers, lakes, ponds, streams, and public land) is exploited over time due to lack of rules and regulations

Materials

- Using Common Resources activity sheet-one per group
- Sustainable Resource Use Data Table-one per group
- Soup bowl sized bowls (one for each group of 4 players)
- Paper straws (one for each player)
- M&Ms
- Goldfish crackers
- Writing utensils to record data-one per group

Overview

- Each student will be a “fisher” whose livelihood depends on catching fish.
- Each M&M and Goldfish represents a fish.
- Each bowl represents a fishery in the open ocean.
- Each fisher must catch at least one fish in each round to survive to the next fishing season.
- When the fishing season begins, students must hold their hands behind their backs and use the “fishing rod” (paper straw) to suck “fish” (M&Ms and Goldfish crackers from the “ocean” and deposit them in front of them.
- The fish remaining in the ocean after each fishing season represent the reproductive population, and thus for every two fish of the same species, one fish of that same species is added. For example, if there are three Goldfish and two M&Ms in the bowl, add one Goldfish and one M&M.
- After each round, fishers must record their catch in their Fishing Log. Students may eat their catch after they record their data.
- Students are to record their results and communicate them to the instructor, who will write them out on a display board.

Procedure

Students will sit at groups of four per table, two on each side, facing one another.

Begin by introducing the activity as a competitive game in which students will compete with their table mates for chances to catch fish in a fishery in the open ocean. Explain that a fishery is a place where fish or other aquatic animals are caught. In this case, the fish are M&Ms and Goldfish crackers and the open ocean is represented by a bowl in the center of the table. Introduce the concept of carrying capacity, and explain that each bowl starts the game with a carrying capacity of 20 fish (10 M&Ms and 10 Goldfish). Proceed to read the directions aloud to the whole class, while having each group follow along with a set of directions. Pass out straws after directions are read.

After each season, have each group bring up their bowl to the instructor to receive replacement fish. These fish represent offspring from the last season. Remember, each bowl can only hold 20 fish total. For the fish to “reproduce” (add one fish to the bowl) you need two of the same species represented by either Goldfish or M&Ms. It’s also important to remind students that if a fisherperson does not catch anything in a season, then they are out for the remaining seasons. After the 5th round, have students calculate each fisher’s profit, their totals, and the grand total for the group.

On a large board, visible for all students to see, create a graph with the first column header entitled, “Group Total.” The second one should write, “winner’s total” and includes the winning score from each group. In the third column header write, “Seasons.” Lastly, the fourth column header should read, “Fish left? (Yes or No)” Ask each group what their group total was, the winning person at their group was, how many seasons there was fish in the bowl for, and if there were fish leftover in the bowl after round 5.

This game was designed to have the most sustainable fishery (i.e. the fishery that had fish for all five seasons, and potentially had some remaining) make the most money. Ideally, the winning fisherperson at the most sustainable fishery also made the most money individually.

Discussion

After the instructor has compiled the class’s data, have students analyze as a class. Questions to facilitate discussion are:

- What group was the most successful?
- Compare and contrast the most successful groups with the least successful groups. Do you notice any pattern in the data?
- What group’s fisheries have the potential to allow future generations to fish it?

Conduct a discussion about the concept of sustainability. If any group did not completely deplete their fish discuss why this happened (less people fishing, created regulations etc.) Ask why sustainability might be an important goal for a community and why it might be difficult to achieve that goal.

Have each group of student brainstorm ways that they might have made the fisheries more sustainable. Some possible ways are catch limits (a certain number of M&Ms and Goldfish crackers), marine reserves (an area of the plate where fishing is not allowed), and harvesting only certain species per season. Ask students to come up with a regulation that they can make at their fishery that would allow them to still have fish left after all five rounds.

Extensions

- Have students come up with a rule that would allow their fishery to never be depleted

*This lesson was Adapted from Massachusetts Marine Educators and modified for Living Lands & Waters

http://ma-marine-ed.org/wp-content/uploads/2014/10/sustainability_activity.pdf

Using Common Resources

Purpose:

You are the captain of a commercial fishing company, competing with other companies like yourself, who are fishing in the same **fishery**. Your goal is to be the most successful fishing captain you can be.

Directions:

1. Students work in groups of four. Each student in the group plays the role of a captain of a different fishing company and competes with the other three captains at his/her table for a share of the fish.
2. Members of the same group share a body of water, represented by a bowl of 20 fish.
3. “Fish” in the experiment are M&M candies and goldfish crackers with a current market value:

M&M candies = \$10.00 each
Goldfish crackers = \$5.00 each
4. The fishery has a **carrying capacity** of 20 fish, so there will never be more than 20 fish in the bowl at the beginning of a season.
5. Each captain uses a paper straw as the fishing tool. Fishing tools must be held in the mouth while fishing. Fish can only be removed by applying suction through the fishing tool.
6. Hands cannot be used during fishing time. It is recommended that captains place their hands behind their backs.
7. Captains fish one season at a time, which represents one generation of fish. Each captain may catch as many fish as he/she wants each season.
8. Each captain needs to earn at least \$5 per fishing season in order to stay in business. Captains whose company goes out of business must sit out for the remaining seasons until the end of the activity.
9. Each fishing season will last 10 seconds, with start and end times announced by the teacher.
10. At the end of each season, each captain records his/her profit based on the number of fish he/she catches. After recording, a captain may eat all the fish he/she catches.
11. Before the beginning of each new season, the surviving fish (i.e. those left in the bowl) reproduce one offspring for every two fish of that species surviving in the bowl.
12. After reproduction, if the new total amount of fish exceeds 20, fish must be removed so that the total returns to 20 before the next season starts. These fish are set aside and do not count as anyone’s catch.
13. At the end of five fishing seasons, the most productive fishery in the entire room will be determined.
14. _____

Fishing Log					Grand Total
Student Names					
	Profit (\$)				
Season 1					
Season 2					
Season 3					
Season 4					
Season 5					
Total					

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Student Names					
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