

## LESSON 3

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# WHY DO WE HAVE SO FEW WHALES AND SO MANY CHICKENS?

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### LESSON DESCRIPTION

The students participate in a classroom simulation that demonstrates the tragedy of the commons. Next, the simulation is altered by an introduction of property rights, and the simulation outcome changes. Then the students solve the mystery of the whales and chickens by comparing their simulation experiences with actual practices regarding whale and chicken management.

### BACKGROUND

Commercial fishing of whales began in the seventeenth century and continued actively until the middle of the twentieth century. By that time, whale populations had dropped to very low levels. The International Whaling Commission was formed in 1946 to provide for conservation of whale stocks. It issued a ban on hunting humpback, fin and minke whales in 1986. Since then, many whale species have increased in numbers. Now whalers in Iceland, Japan and Norway want to resume hunting whales. But opponents fear that resumed whaling, even if it is limited to certain species and the killing of relatively few whales, will put whale populations in jeopardy once again.

Chickens have been raised for slaughter for centuries. Around the world, millions of chickens are killed and eaten every day. Yet despite the daily toll taken on chickens, they are in no danger of becoming extinct. In fact, the chicken population of the world seems to be increasing.

### ECOMYSTERY

Under present regulations, relatively few whales are killed by whalers each year. But millions of chickens are killed and eaten every day. Yet there are too few whales, while chickens are abundant. Why are there so few whales and so many chickens?

### ECONOMIC REASONING

Whaling is an activity conducted by people who do not own whales or provide care for them. The only contact whalers have with whales is to capture and kill them.

This relationship creates what economists call a tragedy of the commons — a situation in which all the incentives at play encourage people to use the resource in question, not to care for it or act to ensure its sustainability (EcoDetection principle 3).

By contrast, chickens are typically raised by owners of chickens. Owners of chickens care for their stock of chickens, managing it so that the stock is not depleted. It is in an owner's best interest to care for the chickens while they are alive and to arrange for an ongoing, fresh supply of chickens. Only by caring for chickens and maintaining a stock of them can the owner receive an adequate return for the costs involved in raising chickens (EcoDetection principle 4). Ownership, in other words, creates an incentive for people to care for what they own (EcoDetection principle 6).

No such incentives influence whalers. They are not rewarded for preserving the whale population. If one whaler, in the interests of conservation, should hold back and not take a whale, another whaler will probably take it. Lack of ownership, in other words, creates incentives that encourage harvesting whales with little or no regard for maintaining the whale population.

### ECONOMIC CONCEPTS

- Choice
- Incentives
- Property rights

### OBJECTIVES

Students will:

1. Participate in or observe a simulation of whaling behavior.
2. Gather data from two different simulation episodes.
3. Use principles of EcoDetection to explain the different outcomes of the simulations.
4. Suggest an appropriate answer to the mystery.

### CONTENT STANDARD

- People respond predictably to positive and negative incentives. (NCEE Content Standard 4.)

### TIME

60 minutes

## MATERIALS

- A transparency of Visuals 3.1, 3.2, 3.3, 3.4 and 3.5
- A box of small crackers — if possible, crackers shaped like fish.

## PROCEDURE

- Explain to the students that they will investigate a controversial issue: Should people be allowed to hunt and kill whales for commercial purposes? They will also investigate a noncontroversial issue: Although millions of chickens are killed each year, no one is trying to Save the Chickens!
  - To introduce the mystery explicitly, **display Visual 3.1** and discuss it briefly with the students.
  - Ask the students to estimate the number of chicken fatalities in the United States each year. This is not as difficult as it may seem. On average, if each person in the United States eats two chickens per year, how many chickens would be killed? The population of the United States in 2000 was about 280 million people. At two chickens per person, that would come to 560 million chickens cooked up annually. And that is an estimate only for one country. China has a population of more than a billion people, and many Chinese people eat chickens, too. Obviously, many, many chickens are killed each year, yet the number of live chickens remains stable or increases.
  - Display Visual 3.2.** Compare the case of the chicken to the case of the whale, as represented by the information on the Visual. Explain that the International Whaling Commission (IWC) recommends that a ban on killing whales of any species should remain in effect until the current population of that species returns to 54 percent of its estimated historical population (prewhale hunting). The context gets more complicated as a result of a new study done by Joe Roman and Stephen R. Palumbi. They used DNA evidence to estimate how many whales were in the historical population. Their study suggests that the IWC's estimate is too low. Both estimates represent efforts to answer an important question: When have whale populations returned to a level at which renewed whale hunting would not threaten the species? As students can see, whale population numbers indicate that whale hunting could resume soon if the IWC's population estimates are used, whereas only minke whale hunting could begin soon if the DNA estimates are used.
- Ask the students to consider this question: Why worry about killing whales? Killing chickens doesn't seem to threaten chicken populations. Why should killing whales threaten whale populations? Record the students' reactions on the chalkboard. Save them for later consideration.
  - Announce that the class will observe a brief activity and that you will then ask them to explain the behavior they observe.
  - Turn on the overhead projector. Scatter six to eight fish crackers on a blank transparency and adjust the projector so that seated students can see the fish. Recruit six volunteers to come to the front of the room and gather around the projector.
  - Explain to the volunteers that the fish crackers are whales, they are whalers and you are a whale buyer. You will give them two 20-second fishing rounds and will purchase any whales they bring to you in good condition. (You will not purchase whales that are crushed or broken.) For each whale caught in the first 20-second round, whalers will receive 25 cents. If any whales remain at the end of the first round, there will be a second 20-second round. If the whalers catch whales in that round and bring them to you, they will receive 50 cents for each whale. In addition, six to eight more whales will be added to the whale pod to reflect the fact that by waiting one round in the simulation, the whale hunters have allowed time for the whales to reproduce.  
  
(Note: Consider in advance how many fish crackers to put on the screen and how much you are willing to pay for them. Generally, the fewer the whales and the older the students, the higher the pay you'll need to offer to provide an effective incentive for participation. With younger students, use individually wrapped treats or quiz points instead of coins for the reward.)
  - Immediately after you give the instructions, say "Go!" and watch the time carefully. Do not give the students time to consider the possibilities or talk over the problem before you say "Go!" (Students tend to grab the fish crackers immediately, although there may be an initial, brief hesitation until one student reaches in. Some fish may

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be destroyed, and typically only a few students earn money. Usually no fish are left for the second episode.)

- J. Pay the students for their catch. Announce that there can be no second round because the whales are all captured or crunched. Ask the six students if they understood that the whales would have been worth more in the second round.

*Usually there is no misunderstanding. If a misunderstanding does occur, run the same experiment again, particularly if no student has tried to organize the others to wait. If you decide to run it again, do so quickly. The result — grabbing, damaged fish and nothing left for the second round — will be the same.*

- K. Ask the whalers why they didn't wait for the second round when the whales would be worth more.

*They may try to blame someone for being greedy, especially the person who grabbed first, but all will probably comment that they couldn't afford to wait for the second fishing round because they were afraid everyone else would take all the whales first.*

- L. **Display Visual 3.3.** Review the principles of EcoDetection briefly; then use the principles in looking back at the whaling simulation.

1. Were resources scarce?

*The whales and the time needed to harvest whales were scarce.*

2. What alternatives were available to the whalers?

*To harvest now, to harvest later or not to harvest at all.*

3. What choice was made among these alternatives?

*The choice to harvest immediately.*

4. Did any whalers set out to destroy the whale population deliberately?

*No. Emphasize that the destruction of the whale population was not a deliberate choice, nor was it something the students considered ahead of time. It was an unintended consequence of their desire to earn income.*

5. Were incentives involved in this experiment?

*Yes. Whalers were rewarded for harvesting whales. They were not rewarded for conserving whales.*

6. Why didn't the whalers wait until the second round to harvest the whales? Waiting for another round would have brought higher prices and increased whale populations.

*The prospect of greater rewards later was offset by the fear that no whales would remain by the second round. No remaining whales, no incentive to wait.*

7. Who owned the whales?

*Most students will respond that no one owned the whales, or everyone did. That observation is true only before the harvesting begins. After harvesting, the whale is owned by the person who grabbed it. This is called the Rule of Capture.*

8. Did rules of ownership affect the incentives?

*Yes. Because ownership was unclear, everyone had an incentive to grab whales before someone else got them.*

9. What caused the over-harvest of the whales?

*The incentives were structured to reward the aggressive harvester; for conservationists, there were no rewards.*

- M. **Place Visual 3.4 on the overhead** and place fish crackers in each property zone. Do not turn on the projector yet. Announce that you are making one change in the game. Otherwise the people and situation will remain the same. You will run the experiment again and see what happens.

- N. Ask the volunteers to gather around the projector; turn on the projector so all the students can see the fish arrangement; then explain the new rule. Assign the whales in each property zone of Visual 3.4 to a student. Explain that she or he owns the whale in that property zone. Also explain that if anyone takes anyone else's whale, the thief will be fined \$1, required to return the whale, and dropped from the experiment.

- O. Make sure that the volunteers understand the new rule. Remind them that there will be two 20-second sessions and that the whales are worth 25 cents in the first session and 50 cents in the second session. Then say "Go!" and start timing. Call "Stop" at the end of the 20-second episode. Pay any student for his or her whale if it has been harvested carefully.

*Usually, the volunteers will not harvest the whales. Some who are confused by the rules may try to harvest the whales, but the others will probably suggest it is not a good idea. If anyone takes someone else's whale, enforce the rule and take away the thief's privilege to harvest whales.*

- P. Start the second round. Call "Stop" at the end of 20 seconds. Pay for the harvested whales; put six more fish on the projector to demonstrate that there was time for the whales to reproduce; thank the volunteers and send them back to their seats.

*Most students will carefully harvest their whales and sell them. Most likely no whales will be damaged. Don't be surprised if some students refuse to harvest their whale. They may have grown attached to it, and the small reward may not suffice as an incentive for harvesting it.*

- Q. **Display Visual 3.3 again.** Use the EcoDetectives principles again to analyze the second simulation activity. Note the differences between the first and second simulation activities as revealed by the analysis.

1. Were resources scarce?

*Yes. The whales and the time needed to harvest whales were scarce.*

2. What alternatives were available to the whalers?

*To harvest now, to harvest later or not to harvest at all.*

3. What choice was made among these alternatives?

*To harvest in the second round — very different from the first simulation.*

4. Did any whalers set out to destroy the whale population deliberately?

*No. In this simulation, in fact, there would probably be an increase in the whale pod by the end of the round. The whalers probably preserved the population while they harvested from it. Emphasize that the restoration of the whale population was not a deliberate choice, nor was it something the students considered ahead of time. It was an unintended consequence of their desire to earn income.*

5. Were incentives involved in this second experiment?

*Yes. Whalers were rewarded for harvesting whales in the second session. They were rewarded for conserving whales during the first round.*

6. Why did the whalers wait until the second round to harvest whales?

*To get a better price. They knew they could wait for the better price because whales would still be available in the second round.*

7. Who owned the whales?

*The whalers owned the whales, both before and after they harvested them.*

8. Did rules of ownership affect the incentives?

*Yes. Whale ownership meant from the beginning that the whalers could wait until the whales were more valuable and had reproduced.*

9. What caused the restoration of the whale population?

*The incentives were structured to reward conservation, not the aggressive harvester. This arrangement allowed the whale population to remain stable.*

- R. **Display Visual 3.1 again.** Ask the students to reconsider their earlier explanations. Why are there so many chickens and so few whales?

*The chickens are raised by people who own them. Chicken owners take care to replenish the stock before selling off chickens for slaughter. Whalers own a whale only after harvesting it. No whaler is rewarded for conserving whales.*

- S. Ask the students to forecast what will happen to whale populations if nations are allowed to hunt whales again.

*Under current ownership rules, the whale populations will decline at a rate depending on how fast they are harvested. No one has an incentive to increase the whale population. Different ownership policies could change that outcome.*

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## CLOSURE

**Display Visual 3.5** and discuss the concept of the tragedy of the commons. Ask:

1. Which of the two simulations illustrates the tragedy of the commons?\*

*The first one. Because ownership was not established until the whales were harvested, no whaler was willing to risk waiting; if anybody did wait, another whaler might take all the whales.*

2. Why was there no tragedy of the commons in the second simulation?

*In the second simulation, ownership was clearly established at the outset, before any whales were harvested. And ownership rights were enforced through rules and penalties. Each owner was secure in knowing the whale would remain his or hers until the owner decided to harvest it.*

\*Footnote for the teacher. Why do people call this phenomenon the “tragedy” as opposed to the “sin” of the commons? It’s called a tragedy rather than a sin because the consequence — the disappearance of the fish — wasn’t the result of any deliberate, sinful action on anyone’s part. People were engaged in pursuing beneficial activities — providing food for others to eat — without any intent to deplete the whale population.

## ASSESSMENT

### Multiple-Choice Questions

1. Which of the following animal populations is most likely to be threatened in a tragedy-of-the-commons slaughter?
  - a. Cattle owned by a rancher in Wyoming
  - b. Chickens raised by a chicken farmer in Minnesota
  - c. Wild African elephants with valuable ivory tusks**
  - d. Dogs owned as pets by families

2. Why do commercial fishers tend to take too many fish in their efforts to harvest fish to sell to the general public?

- a. Commercial fishers are not very smart and will repeatedly act against their own interests by over-fishing.

- b. Commercial fishers are rewarded for catching fish; they are not rewarded for conserving fish.**

- c. Commercial fishers lack knowledge about fish populations.

- d. Commercial fishers do not have to pay property tax on the fish they catch.

### Essay Questions

1. Respond to this argument:

“Fish and whale populations are threatened by the greed of commercial fishers who continue to harvest fish even when those populations are rapidly declining.”

*Commercial fishers are probably no more or less greedy than cattle ranchers or chicken farmers. Yet fish and whale populations are declining while cattle and chicken populations are increasing. The problem seems to be one of incentives. The fishers are rewarded only for harvesting fish or whales. The cattle or chicken owners are rewarded for taking care of their animals and maintaining an ample stock of them.*

2. Many people would prefer to see wildlife remain a resource owned in common. One example has to do with loggerhead turtles that lay their eggs on the sand near beachfront property. The turtles and eggs provide excellent food for animals and humans. How can these turtles remain commonly owned and still be saved from extinction in a tragedy of the commons?

*Rules must be established that provide incentives and penalties, strictly enforced, to protect the wildlife. For example, people who watch over the turtles and eggs until the new turtles are old enough to enter the ocean could be paid. If someone was caught harming the turtles or eggs, it could result in a very steep fine.*

### VISUAL 3.1

#### THE CHICKENS AND WHALES MYSTERY

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A small number of whales are harvested each year, while millions of chickens are killed every day. Yet there are too few whales, and chickens are abundant.

Why are there so few whales and so many chickens?

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## VISUAL 3.2

### WHALE POPULATION ESTIMATES

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<i>TYPE</i>	<i>CURRENT</i>	<i>HISTORIC ESTIMATE*</i>	<i>DNA ESTIMATE**</i>
Humpback	10,000	20,000	240,000
Fin	56,000	30-50,000	360,000
Minke	149,000	100,000	265,000

*Sources:*

*\*The International Whaling Commission*

*\*\*Joe Roman and Stephen R. Palumbi, Science, July 25, 2002*

## VISUAL 3.3

### THE PRINCIPLES OF ECODETECTION

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1. Resources are scarce; therefore, people must choose.
2. People's choices involve cost.
3. People's choices influence environmental quality.
4. People's choices are influenced by incentives.
5. People create rules that influence choices and incentives.
6. People take better care of things they own and value.

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## VISUAL 3.4

### PROPERTY ZONES FOR WHALERS

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## VISUAL 3.5

### THE TRAGEDY OF THE COMMONS

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When property is held in common rather than owned by individuals, it tends to be overused or degraded. Each person who uses it gains the full benefit of use. However, he or she does not bear the full costs of this use. The costs are shared by all the other users — the common owners. Additionally, no one has a strong incentive to conserve resources owned in common because a person who tries to conserve the resource cannot prevent others from using it.

The tragedy of the commons is relevant to many environmental issues including the protection of whales. When whales are owned in common, whalers who kill whales gain all the benefits of their harvest; the more they kill, the more they benefit. But the aggressive whalers will bear only a small portion of the costs of their action. The cost implied by a depleted whale population will be spread out among all the common owners. In the meanwhile, if any whales are left, whalers will have no incentive to hold back. Anybody who holds back on killing whales will find that others will kill the whales instead.

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