The Gulf of Maine

Middle Level Lesson Plan

Topic Ecological carrying capacity

Grade Level 7-8

Overview

This QUEST program, *The Gulf of Maine*, includes several segments that discuss the idea of balancing the demands – mostly human – that are placed on resources in the Gulf of Maine. The activities in this teaching unit will help familiarize students with the ecology of the Gulf of Maine and the demands placed on it. They will also research a specific fish species. In addition, students will learn more about carrying capacity, both in an ocean ecosystem and in their own bodies.

Introduction

The Gulf of Maine's unique geographic area allows scientists to identify specific life-supporting factors such as the energy needs, nutrients, and living space within this ecosystem. Such factors are critical in terms of the interaction of organisms, since no organism can exist in any given area without putting specific demands on that area. Students will learn that ecologists use the term *carrying capacity* to define the maximum population of a particular species that a given habitat can support over a given period of time. They will also learn that carrying capacity applies to humans as well. Students will explore the concept that the suitable supply of resources for a particular population is the carrying capacity for that population, and that a habitat's resources – which usually must be shared by many organisms – are not unlimited.

Time Allotment

5-6 class periods of 45 minutes each, or 4 longer class blocks

Accessing Prior Knowledge

Students should be familiar with food webs. They should understand that organisms need certain resources, such as food, in order to survive. In addition, it would be helpful for students to understand the concept of *habitat*, and that organisms within any habitat interact – and sometimes compete – with each other for the available resources.

QUEST: Investigating Our World is a regional public television series seen on Maine Public Broadcasting Network, Vermont Public Television, and New Hampshire Public Television

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Concepts to Clarify

Middle-school students may not believe that food is a scarce resource in most ecosystems; on the contrary, they may think that organisms can change their food sources whenever they choose. Students of all ages also tend to think that some populations of organisms are very large so that they can fulfill the various demands for food by other populations. It would be helpful to emphasize the concept of a *closed system* so that students can more clearly understand the idea of *limited supply*. In addition, students should be introduced to the term *carrying capacity*. This is an abstract concept and will be new vocabulary for most students, but it must be understood before it can be used as a scientific label.

CONNECTIONS TO THE STANDARDS

Maine Learning Results	New Hampshire Curriculum Framework	Vermont Learning Standards	National Science Education Standards	Benchmarks for Science Literacy
B. Ecology Analyze how the finite resources in an ecosystem limit the types and population of organisms within it.	**Life Science** 3b. Curriculum Standard (Grade 6):Identify and describe examples of New Hampshire animals and plants that live together in one ecosystem. (Grade10) Predict, with rationale, the effects of changing one or two factors in an ecosystem.	**The Living World** Organisms, Evolution and Interdependence (5-8) 7.13.ccc. Describe, model and explain the principles of interdependence of all systems that support life.	**Content Standards (5-8)** C. Life Science: Structure and Function in Living Systems The number of organisms an ecosystem can support depends on the resources available and abiotic factors.	**Chapter 5:The Living Environment** 5d. In all environments, organisms with similar needs may compete with one another for resources. In any particular environment, the growth and survival of organisms depend on the physical conditions.

Materials Needed

- TV with VCR
- QUEST: *Gulf of Maine* video
- 8 1/2 x 11-inch scrap sheet of paper (1 per student)
- Graph paper (1 sheet per student)
- Computer(s) with Internet access for classroom use
- A standard food label (optional)
- Chart paper and markers
- Student Handout 1: *Gulf of Maine Attitude Survey*
- Student Handout 2: QUEST: *Gulf of Maine Video Viewing Guide*
- Student Handout 3: *The Haddock*
- Student Handout 4: *The Commons*
- Student Handout 5: *QUEST at Home: The Carrying Capacity of People*

1. Introducing the Concepts

This introductory lesson helps students think about the idea of limiting factors. One way to demonstrate that the rate of use on particular resources can increase exponentially is through a simple paper-folding activity. This demonstrates the abstract concept of exponential growth in a concrete way. Students will also learn how use and rate of consumption can occur faster than anticipated in any given environment, and what the implications can be for that environment.

Step 1

Introduce the activity by challenging students to predict how fast the United States' human population increases each year. (The country's population now is approximately 300 million.) Ask, "Is it a normal linear progression, or does the population grow at some other rate?" (You can draw line graphs if you choose to show the difference between linear and exponential growth.) Ask, "What would a 1 percent increase be each year?" Discuss the differences between these rates of growth with students. Then ask, "What would this population need to live? As the population increases, what would happen to the resources people need?"

These questions introduce students to the idea that living organisms need energy and resources to survive, and that as their numbers increase, so does their need for more energy and resources. The ultimate question that can be explored (depending on your students' ability) is, "What is the *carrying capacity* of the United States?" (**Note:** You will not be able to answer this question specifically, but it will impel students to begin thinking about the concept of carrying capacity.)

Step 2

Now tell students that you want to demonstrate the idea of resource consumption through a simple activity. Hand out a piece of scrap paper to each student. Then ask, "Can you fold your paper in half more than eight times in a row?" Explain that each piece of paper is a resource, and that each fold in the paper represents a demand on that resource. Allow time for students to fold their papers and to experiment with how many folds they can make.

Step 3

Discuss the results. Ask, "Did you think you could make eight folds before you started folding? Why? What is the greatest number of folds you could make? Were you surprised by the result? Why?" (The results usually surprise students, because they most likely have had few experiences with exponential growth.) Now create a table on the board that shows the number of folds students could make versus the thickness of the paper. In setting up the chart, have students figure out that for a single sheet of paper with no folds (0), the thickness would be 1. Folding a single sheet of paper once results in 2 thicknesses, 4 folds would be 16 thicknesses, and so on. Students may have to refold their papers to count the thickness.

Step 4

Review the table on the board with students. Ask if they see any patterns. Then have them predict what the next number after 7 folds would be (i.e., 8 folds would be 256 thicknesses, 9 folds would be 512 thicknesses, and so on). Continue to explore this pattern up to at least 12 folds. Then explain to the class that this is an illustration of exponential growth. The table represents how fast resources are needed as a population exponentially increases.

Step 5 (optional)

Give each student a piece of graph paper. Direct them to graph a line that represents the numbers in the table on the board. Have students choose the scale they wish to use for plotting 10 folds. Their graphs can lead to further discussion of exponential growth. You may also choose to have them graph some other numbers, such as the U.S. population change over time. If you would like to locate other statistics about the U.S., use the Fact Finder Web site at the U. S. Census Bureau's Web site, *http://factfinder.census.gov/home/saff/main.html*. This site includes all kinds of statistics as well as a Kids' Corner with activities.

2. Exploring the Concepts

The following activity is designed to help you elicit your students' ideas about the Gulf of Maine's resources. (You can refer back to this information upon completion of the entire teaching unit to gauge how much students have learned.) Students will take a quick survey to help identify whether they are pessimistic or optimistic about resources in the Gulf of Maine, and what their knowledge levels are regarding the Gulf of Maine's ecology.

Step 1

Introduce the lesson by saying that the class will be examining issues about the Gulf of Maine. Explain that you first want to see what students' ideas and knowledge are about the Gulf now. Distribute copies of Student Handout 1: *Gulf of Maine Attitude Survey*, and have each student take the survey. (If you have good classroom technology, you can choose to have students take the survey electronically, which will enable you to provide the results faster.)

Step 2

Have students tabulate their results (or do it electronically) in groups of four. This will give them an opportunity to see some differences in opinion. Then, with the whole class, create a histogram on the board (or electronically) that shows the results of the survey.

Step 3

Students should look at their class data and make some conjectures about what they see. For example, are most of them pessimistic, optimistic, or somewhere in between regarding the state of the Gulf of Maine's natural resource? Do they seem to understand the issues, or are they mostly guessing? This provides a good opportunity for you to explore students' thinking. (**Note:** As a follow-up assessment, or simply to double-check opinions, you can give the survey again at the end of this teaching unit.)

3. Developing the Concepts

As the first part of this lesson students will watch the *Gulf of Maine* video. One of the key concepts of this QUEST program is the complex issue of carrying capacity. To break up viewing of the *Gulf of Maine* video, students will first watch about half of the film. At that point, check to see how much information they have absorbed. Next, have students watch the second half of the video. To help them understand carrying capacity, it is best to give students an organizer like Student Handout 2 (or another viewing guide of your choice) to use while watching the video.

Step 1

Distribute copies of Student Handout 2: QUEST: *Gulf of Maine* Video Viewing Guide, or hand out another organizer for students to use as they record brief notes about the ideas and issues that are presented in the video. Instruct them to look for information that will help them define both the habitat of the Gulf of Maine and the demands on resources of that habitat. **Play** the first half of the QUEST: *Gulf of Maine* video.

Step 2

Stop the video after showing about half of the program. Elicit students' comments about what they found surprising in the film. Ask what new information they learned. Have students volunteer to read some of their notes to the rest of the class, and direct the others to add these notes (if appropriate) to their own organizers. Answer any questions, and summarize students' general conceptions about carrying capacity thus far.

Step 3

Play the second half of the video. (You may need to do this on another day due to time constraints.) Again, have students record notes in their organizers as they view. When the video is over, have students share their notes with the class. Answer questions as needed.

Step 4

To summarize their learning, have each student draw a Gulf of Maine habitat. This can be assigned as an in-class activity or as homework. Their drawings should represent as many organisms as possible in the Gulf of Maine, as well as the potential demands made on the Gulf. (**Note**: If you like, you can develop a scoring rubric to make this assignment a more formal assessment. The rubric could include items like the following: the number of organisms students include, the accuracy of their depictions of these organisms, the accuracy of their placement of the organisms in the Gulf, examples of food chain interactions, and two to three demands by humans on the habitat.)

4. Synthesizing the Concepts

In this activity, students will look more closely at one species of fish to see how its population has changed as people's demand for it has grown. This fish is *Melanogrammus aeglefinus*, or the haddock. Students will read a brief article about haddock. They will then have an opportunity to ask questions, after which point they will answer some questions. With your prompting, students will then compare haddock with cod, based on information about the plight of these fish that is contained in the QUEST video.

Step 1

Begin by explaining to students that they will be examining one species of fish to learn more about it and its population over time. The fish is the haddock. Inform students that determining how many fish there are of a particular species is usually done by counting the number of fish caught. Since we can't yet see underwater over large distances, counting caught fish is the current method of choice for calculating populations.

Step 2

Distribute copies of Student Handout 3: *The Haddock*. Have students read the brief article on the handout. As they read, they should record any questions they have about this fish and its population. After students have finished reading, elicit their ideas by asking three key questions:

- What do you know about haddock?
- What do you think you know about haddock?
- What do you want to know about haddock and its population?

This is a preassessment technique that allows students to state what they firmly believe they know, right or wrong, and an opportunity to say what they "think" they know. It allows the teacher to make instructional decisions about the depth, direction, and focus for the lessons.

After recording students' responses, separate the ideas from the "What they think they know" and "What they want to know" into similar categories.

Step 3

Divide the class up into groups of three or four. Have each group use the Internet to research the answers to one or more of the questions that still remain about the haddock.

There are numerous in-depth Web sites relating to the haddock. Most of these sites contain much more information than middle-school students usually need, but students may be interested in how much is known about these fish. Some of sources include the following:
http://www.nefsc.noaa.gov/sos/spsyn/pg/haddock/#gbland
http://www.state.ma.us/dfwele/dmf/recreationalFishing/Haddock.htm
http://oregonstate.edu/instruct/fw465/sampson/grndfish/index.htm
http://spo.nwr.noaa.gov/mfr604.htm

Step 4

Have each of the student groups report out to the class about any answers they have found for their assigned questions. Their classmates may want to take notes during this time, as they will later be asked to answer some questions about the haddock.

Step 5

Now direct students to answer a few questions about haddock. If you choose to have them record their answers in journals, these can be used as an assessment of their knowledge about the fish. Write the questions on the board, on chart paper, or on a handout. Some examples of appropriate questions include the following:

1. What seems to be the reason(s) for the decline in the total number of haddock in the Gulf of Maine?
2. What do you think is happening to the food that haddock eat?
3. Is the plight of haddock similar to that of the cod, as described in the QUEST video? How might they be similar or different?

5. Applying the Concepts

By now, students should be forming a clearer understanding of the concept of limited resources. They should also be more familiar with the pressures that exist on the resources in the habitat of the Gulf of Maine, and what can happen to a specific species within that habitat. In addition, students should know that carrying capacity is a concept that applies to all ecosystems. The following activity can be used to solidify this concept.

Step 1

Review with students what they have done so far in this teaching unit: they have explored ideas about carrying capacity within a habitat, examined interactions of organisms in a habitat, and investigated the

pressures on resources that exist for organisms in a habitat (the Gulf of Maine). Explain that now students will be looking at a different habitat and the pressures on it, in the form of a story called "The Commons."

Step 2

Distribute copies of Student Handout 4. Explain that the story on the handout is an adapted version of an original speech that was given in 1967 by Garret Hardin. Have students read the adapted story "The Commons." It is often used as a metaphor for illustrating the concept of limits in a habitat.

Garrett Hardin was an ecologist at the University of California who received many awards for his work in ecology. Trained as an ecologist and microbiologist he is best known for his 1968 essay, The Tragedy of the Commons, Science, 162, now reprinted in over 100 anthologies and widely accepted as a fundamental contribution to ecology, population theory, economics, and political science. The original paper from which this idea was adapted from can be found at *http://www.garretthardinsociety.org/articles/art_tragedy_of_the_commons.html*.

Step 3

Arrange students in small groups of two or three. In their groups, have students discuss what happened in the story and why. Then direct each student to write, either in a journal or on a separate piece of paper, an analysis of what happened and what the causes were.

Step 4

When students have finished writing, invite them to share their thoughts with the class. Lead a discussion about whether this is something that could happen today, and have students back up their opinions. Can they give other examples of similar situations? What seem to be the factors that lead to these situations? Finally, connect these ideas back to the Gulf of Maine (if students have not already done so). Discuss the similarities and differences between the situation in the story and that in the Gulf of Maine. (**Note:** This can also pertain to the situation in Lake Champlain.)

A related resource that you may find useful is an instructional guide from BSCS in Colorado called *The Commons: An Environmental Dilemma*. It was designed for use in high school, but it contains some helpful information for middle-school students as well, including a CD-ROM that simulates the dilemma and uses the Gulf of Maine as one of its examples. To read about the materials at the developer's site, go to *http://www.bscs.org/cp_hs_mod_tc.html*. To obtain the materials from the publisher, go to *http://www.kendallhunt.com/elhi/* under supplemental resources.

6. Extending the Concepts

Quest at Home

Distribute copies of Student Handout 5: *QUEST at Home: Carrying Capacity*. Review the handout with students before they take their copies home. Agree upon a due date for students to return to class with their findings.

Community Connections

The management of limited resources is a concern throughout northern New England. This is the case for fresh-water fisheries as well as for marine fisheries. In Maine, state resources with information about fisheries in the gulf of Maine include the Maine Department of Inland Fisheries and Wildlife and the Department of Marine Fisheries. Their Web sites have specific information about both marine and freshwater organisms: *http://www.state.me.us/ifw/fishing/fishing.htm and*
http://www.state.me.us/dmr/recreational/fishes/know_your_catch.htm

In Vermont, the Vermont Fish and Wildlife Department has a Web site with information about specific fish species, licenses, stocking of fish, and maps for locating fishing areas. This site provides good information about stocks of fish: *http://www.vtfishandwildlife.com/fish_sportfish.cfm*

In New Hampshire, the Department of Fish and Game has a detailed Web site for both marine and freshwater species. There are publications and other resources available at this site:
http://www.wildlife.state.nh.us/Fishing/fishing.htm

Career Opportunties

Discuss some of the following marine-related career categories with students. If possible, invite one or more of these professionals to come to school and speak with the class about their jobs and what they entail.

Fishing: The fishing industry involves several career options, including fishing captain, fishing crew, dockhand, fish processor, fish wholesalers and retailers. Some fishing careers involve different types of fish. The wide variety of species that can be harvested include worms, clams, lobsters, sea urchins, and sea moss.

Marine Science: Marine science offers many options for a career, including researcher and research assistant. In the area of marine biology, professionals can work with a broad range of organisms, from large animals to microscopic plankton. In chemistry, they may study water composition. In physics, they may work on fluid dynamics. In geology, they may study minerals of the oceans as well as large formations such as underwater volcanic vents.

Marine Policy: The area of marine policy is handled by people who are lawyers, government employees, activists, and legislators. Each has had some background in marine work or study of the marine environment.

Resources

This site has information from the **Woods Hole Laboratory** Research Divisions and the **Northeast Fisheries Science Center**. The Center provides overall management and direction for the five laboratories located in the Northeast Region. Data about specific species' sustainability can be found here. *http://www.nefsc.noaa.gov/nefsc/woodshole*

Fisheries statistics and the economic division of **National Marine Fishers Service** can be found here. *http://remora.ssp,nmfs.gov*

The Conservation Law Foundation (CLF) is an advocacy group. Because CLF had filed a suit charging that ground fish catch levels were too low and had to make their case for that claim, they have general fish stock data are available at this site. *http://www.clf.org/advocacy/fisheries_lawsuit.htm*

The phytopia unit is a set of factors about the Gulf of Maine that are visually displayed and that can be manipulated. **Bigelow Laboratories**, the developer of this program, is a research institution dedicated to the study of the ocean. *http://wwwbigelow.org/phytopia*

Greenpeace is an activist group supporting the protection of the ocean and other areas of the earth. *http://www.greenpeace.org*

NOAA Fisheries Headquarters oversees fisheries throughout the country. There is a great deal of data available at this site, as well as many other kinds of information. *http://kingfish.ssp.nmfs.gov*

Northeast Fisheries Science Center is a Web site that include specific data about the projects they are working on. *http://www.nefsc.nmfs.gov*

Woods Hole Oceanographic Institution conducts many kinds of marine research, as well as educational and observational programs. This site offers a wealth of information. *http://www.whoi.edu*

Gulf of Maine Attitude Survey

Directions: For each question, select the answer that most closely matches your opinion.

1. Which statement best represents your opinion about the Gulf of Maine and its supply of natural resources?

- ❑ The supply of natural resources is limited.
- ❑ The supply of natural resources is essentially unlimited.

2. Which statement best represents your opinion about the Gulf of Maine and its food supply?

- ❑ The food supply is decreasing.
- ❑ The food supply is increasing.

3. Which statement best represents your opinion about the water quality of the Gulf of Maine?

- ❑ The water quality is getting worse.
- ❑ The water quality is getting better.

4. Which statement best represents your opinion about the plant life in the Gulf of Maine?

- ❑ The plant life is increasing.
- ❑ The plant life is decreasing.

5. Which statement best represents your opinion about the fishing grounds in the Gulf of Maine?

- ❑ The fishing grounds have plenty of fish.
- ❑ The fishing grounds have less fish now than in previous years.

6. Which statement best represents your opinion about the relationship between the increasing human population and the problems in the Gulf of Maine?

- ❑ The increasing human population has little effect on the problems in the Gulf of Maine.
- ❑ The increasing human population is affecting the problems in the Gulf of Maine.

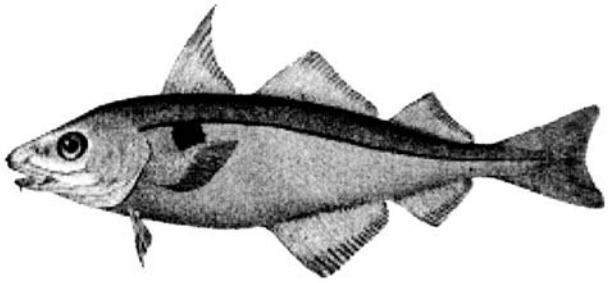
QUEST: *Gulf of Maine* Video Viewing Guide

Directions: Record brief notes in each column when information is presented in the video.

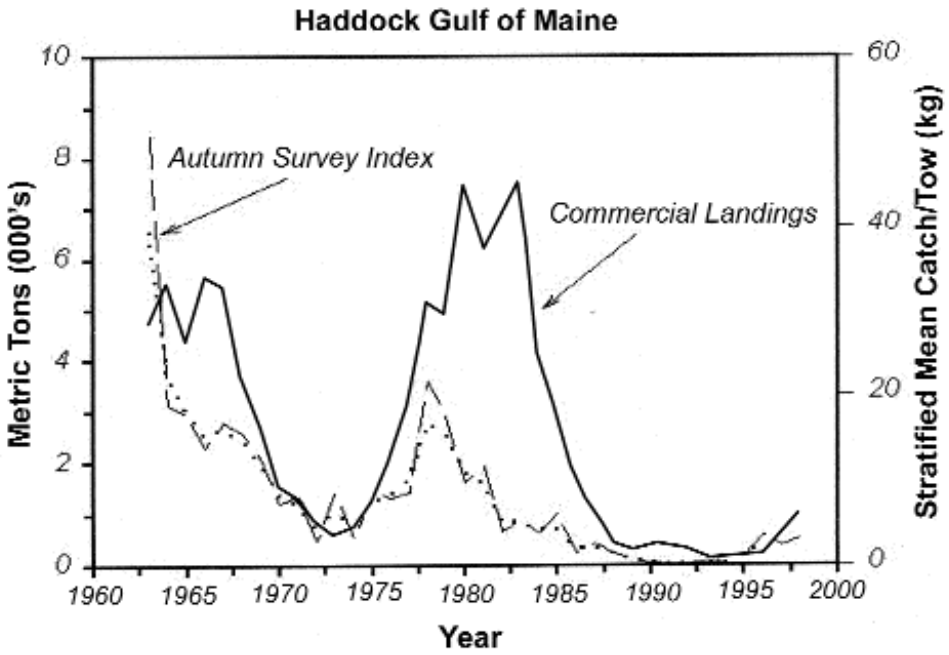
Historical Background	Marine Organisms	Human Interaction	Human Industry Demands

The Haddock

The haddock, or *Melanogrammus aeglefinus*, is found on both sides of the North Atlantic Ocean. In the western North Atlantic, haddock range from Greenland to Cape Hatteras, North Carolina. The highest concentrations are off the East Coast of the United States, with the two major stocks located on Georges Bank and in the southwestern Gulf of Maine. Adult haddock do not undertake long migrations, but seasonal movements occur in the western Gulf of Maine, the Great South Channel, and on the northeast peak of Georges Bank. Haddock prey primarily on small invertebrates, although adult haddock will occasionally consume other fish.



The growth and maturation rates of haddock have changed significantly over the past 30 to 40 years. During the early 1960s, all females age 4 and older were fully mature, and approximately 75% of females were mature at age 3. Spawning occurs between January and June, with peak activity during late March and early April. An average sized (55 cm, 22-in.) female produces approximately 850,000 eggs per year. Larger females are capable of producing up to 3 million eggs annually.



Commercial landings of haddock in the Gulf of Maine declined from about 5,000 metric tons (mt) annually in the mid-1960s to less than 1,000 mt in 1973. Since 1994, commercial landings have increased and were 1,000 mt in 1998. However, commercial landings remain far below both historical landings and the potential yield for this stock. Recreational catches have also declined; since 1981, they have been insignificant. Virtually all landings from this stock in the Gulf of Maine are now taken in the U.S. fishery.

The Commons

(Adapted from *The Tragedy of the Commons* by Garret Hardin, 1967)

In early New England, people were relatively free to use the land as they chose. In those times, many pastures were considered "open to all." No one person owned the pasture land. Cow herders would freely graze their cattle on the pasture shared by all.

Three neighboring cow herders shared a pasture in northern New England. Each owned two cows and grazed them in the pasture. They would meet each other occasionally while they grazed their cows and talk about the news of the day. They would discuss the weather, neighbors, and issues relating to the town. They did this for about two years, and all three profited from the relationship.

The following year, one herder, Alan, was able to buy two more cows. This brought his total number of cows to four. When he grazed his cows in the open pasture that year, the other two men saw that he had increased his number of cows. They wondered why Alan had purchased the new animals. After talking with him, they realized that he was planning on grazing them until they grew bigger. Then he would sell them for a nice profit. The other two herders, Thomas and Gilead, wondered if they, too, could do the same thing. Later that year, Thomas purchased three more cows, which he then grazed in the open pasture. Gilead felt that he was missing out. At the end of that year, he purchased five new cows, bringing his herd to seven.

During the winter, there were several births among the three herds. Their totals for each herder were now: Alan with six; Thomas with seven; and Gilead with nine. During the next grazing season, each herder saw the number of cows the others had. Each man wanted more cows, at least as many as the other herders, and they did what they could to increase their own herds. By now the pasture seemed to be very small because of the number of cows each herder was grazing. The herders found that they had to bring their cows to the pasture more often, because the grass was not as long as it once was when there were fewer cows grazing there.

By the end of that grazing season, and with more winter births, each herder had more animals: Alan with eight, Thomas with eleven, and Gilead with twelve. The animals grazed in the pasture the following season, and the grass began to turn into mud. The herders' animals started to lose weight, and some became sick. Alan started to blame Gilead, and Gilead blamed Thomas. The once-friendly herders became competitive and angry with each other. During the next grazing season, the pasture became mostly mud. The herders could no longer graze their animals there. The pasture was useless for grazing.

Each herder no longer had any pasture to graze his own cows and couldn't understand why the others had continued to graze their increasing herds in the open pasture. The cow herders were not malicious; they had simply been seeking to benefit themselves without thinking about the impact of their actions on the pasture, or on the other people using the pasture. After some of the animals died, the herders were forced to sell their cows at a loss, and the open pasture was no longer a pasture.

The Carrying Capacity of People

You're on a QUEST!

Does the human population have a carrying capacity? To answer this question, you must first be able to calculate your personal energy intake. This activity will help you examine the amount of food (energy) your body takes in every day. Then you may be able to connect your individual intake with the food/energy demands of the general human population.

First, it will help to collect several standard food labels from products that you eat. You should also refer to the United States Department of Agriculture's Recommended Daily Requirements (see below). Then you will record your daily food intake (see the Energy Intake Worksheet at the end of this handout). This activity will help you gain a better understanding of the caloric content of the foods you eat, or the total amount of energy you consume.

Nutrition Facts
Serving Size 15 Crackers (31g)
Servings Per Container About 7

Amount Per Serving
Calories 160 Calories from Fat 70

	% Daily Value*
Total Fat 8g	**12%**
Saturated Fat 1.5g	**7%**
Cholesterol 0mg	**0%**
Sodium 430mg	**18%**
Total Carbohydrate 19g	**6%**
Dietary Fiber Less than 1g	**3%**
Sugars 2g	
Protein 2g	

Vitamin A 0% • Vitamin C 0%
Calcium 0% • Iron 6%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

1. Locate a standard food label for any food that you typically eat (e.g., cereal, soup, prepared food, ice cream, etc.). Read the label carefully, and use the Calorie Counter at the bottom of the USDA Recommended Daily Requirements for a Teenager (below). The Calorie Counter is designed for you to use with one standard food label. Compare this particular food with the daily calorie intake estimate for teenagers in the chart.

2. Take your investigation a step further by calculating your total daily consumption of calories. Using the Energy Intake Worksheet at the end of this handout, keep track of the food you eat in a 24-hour period. Record all of the calories you take in, if possible. Total the numbers, and then see what you daily intake is. If you multiply that number by 365, you will arrive at an estimate of your yearly calorie intake.

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The **United State Department of Agriculture (USDA) Recommended Daily Requirements for Teenagers** varies in terms of type of food, but some specific examples can be found in the following chart. Use this chart for guidance. The USDA recommends a diet of about 2,200 calories for active teenage girls and 2,800 calories for active teenage boys.

Girls	Meal	Boys
1 slice wheat toast, 30 ml peanut butter 240 ml ready-to-eat cereal 240 ml low-fat milk 1 banana	**Breakfast**	2 slices wheat toast, 30 ml peanut butter 480 ml ready-to-eat cereal 240 ml low-fat milk 1 banana
1 slice pepperoni pizza (no extra cheese) 1 apple 180 ml fruit juice	**Lunch**	1 slice pepperoni pizza (no extra cheese) 1 apple 360 ml fruit juice
Chopped raw vegetables or fruit 60 ml pretzels or 2 crackers	**Snack**	Chopped raw vegetables or fruit 120 ml pretzels or 4 crackers
120 ml lean chicken or beef 1 baked potato or 240 ml cooked rice or pasta (with 15 ml of butter) 240 ml cooked vegetables Salad, 30 ml of dressing 240 ml low-fat milk	**Dinner**	180 ml of lean chicken or beef 1 baked potato or 240 ml cooked rice or pasta (with 15ml of butter) 240 ml cooked vegetables Salad, 30 ml of dressing 240 ml low-fat milk

Calorie Counter

Using a food label that shows the nutrition content of that food, use the calorie counter below to calculate the amount of energy you are consuming.

1. Total calories in the container or package: _____

2. Servings per container: _____

3. Calories per serving: _____

4. Number of grams of fat, carbohydrates, and proteins: _____

5. Percentage of calories from fat per serving: _____
(9 cal/g x gram of fat) divided by the number of cal per serving x 100

6. Percentage of calories from carbohydrates per serving: _____
(4 cal/g x gram of carbohydrates) divided by the number of cal per serving x 100

7. Percentage of calories from proteins per serving: _____
(4 cal/g x gram of proteins) divided by the number of cal per serving x 100

Energy Intake Worksheet

FOOD	Breakfast	Lunch	Dinner	Snacks	TOTAL
Bread					
Wheat cereal					
Citrus fruits					
Orange juice					
Coffee					
Tea					
Peanut butter					
Rice of cereal					
Potatoes					
Carrots, other \vegetables					
Apples, other fruits					
Vegetable oil					
Margarine					
Beet sugar					
Cane sugar					
Soft drinks					
Corn cereal					
Sweet corn					
Milk					
Cheese					
Eggs					
Chicken					
Pork					
Beef					
Tuna					
Perch (fish)					
Shrimp (shell fish)					
Other					
TOTALS					

Record calories if possible. Or, record servings or weights and convert to calories. Divide by 1,000 to convert to Kilocalories.

Your 24-hour gross energy intake: _____ cal

Your yearly gross energy intake: _____ cal