Gooey Ducks?

Key Concepts

1. The harvesting of geoducks is the largest clam fishery on the Pacific Coast.
2. The harvesting of geoducks from coastal waters can impact marine habitats.

Background

Geoducks (pronounced "gooey ducks") are the world's largest clam found in temperate waters. They are found in sand or mud in intertidal areas below the zero tide level. Most geoducks are found below the tidal zone in Puget Sound.

The Washington State Department of Natural Resources manages the somewhat controversial geoduck fishery. Prior to 1969, the geoduck was a sport clam only. The controversy pits commercial interests against sport clammers. Other groups worry about over-harvesting by either group. Geoducks are harvested by teams of divers using hand-held water jets which temporarily liquefy the sand or mud bottom. The divers then can pull the geoducks out of the sand by the neck.

Opponents claim these high pressure water jets leave the bottom a virtual "biological desert". Proponents, on the other hand, claim, "Harvesting causes little disturbance on the sea floor. Only a small hole is left where the geoduck was removed."

As the human population increases, the controversy is likely to increase. When it comes to eating, geoducks are considered a delicacy by many. Most geoduck necks, comprising 50 percent of the weight of the clam, are sent to Japan. The remainder is used by the domestic market in clam steaks and chowder. In either market, geoducks fetch a high price per pound.

Materials

For the class:

- copies of student pages, "Gooey Ducks?"
- calculators

Teaching Hints

"Gooey Ducks?" highlights an unusual clam, the giant geoduck. This activity is designed to get students thinking about the numbers involved in harvesting marine animals to supply food and the impact that harvesting can have on the animal population.

The mathematics required to solve the word problems may be challenging for some students. Challenge questions require division. Depending on the math skills of your class, you may wish to ignore the "challenge" questions, determine the answers as a group, or team students and provide calculators.

Key Words

geoduck - a large edible clam found on the the Pacific Coast

manage - to control and regulate the harvest of a resource (as in geoducks)

Answer Key

1. A geoduck is a large clam. Geoducks are the world's largest non-tropical clams.

2. Geoducks thrive in the sandy bottoms found in much of Washington's Puget Sound.

3. a. 165 million pounds of geoducks can be managed for harvesting.

   b. 5 million pounds of geoducks can be harvested per year.

   c. At the rate of 5 million pounds of geoducks per year, it would take 33 years for all of the geoducks to be harvested. i.e.:

$$\frac{\text{165 million pounds of Geoduck available to harvest}}{\text{5 million pounds of Geoduck harvested per year}} = 33 \text{ years}$$

It is worth discussing the assumptions made in these questions, namely that the geoducks stop reproducing and none die. Neither assumption makes much sense in the natural world. For this problem, one assumption stops the population from increasing while the other stops it from decreasing except through harvesting. Perhaps, we can consider the assumptions to balance each other out. Assumptions such as these are what scientists and planners use to make a **model**. A model represents a real situation and can be used to study the effect of changes.

4. a. One diver can harvest up to 2,000 pounds of geoduck a day.

   b. One diver can harvest up to 10,000 pounds of geoduck in a 5 day work week (i.e.. 2000 pounds/day x 5 days = 10,000 pounds).

   c. One diver can harvest up to 500,000 pounds of geoducks in a 50 week year (i.e. 10,000 pounds/week x 50 weeks = 500,000 pounds).

   d. At the rate found in (c) it would take 10 divers to harvest the 5 million pounds of geoduck allowed by the State of Washington (i.e. 5,000,000 pounds of geoduck/500,000 pounds of geoduck per diver = 10 divers).

5. a. It takes about 6 years for a geoduck to reach 2 pounds.

   b. Geoducks can live to be 130 years old.

   c. If the geoduck grew at a rate of 2 pounds per 5 years, it would weigh 40 pounds at 100 years (i.e. 100 years/5 years x 2 pounds per 5 years = 40 pounds).

   d. Since the largest geoducks known weigh about 13 pounds, it does not seem likely that geoducks grow the same amount each year of their lives.

Gooey Ducks?

Gooey Ducks? Actually, it is spelled "geoducks" and they are **not** birds at all. Geoducks are the world's largest non-tropical clams. These giant clams usually weigh 2-5 pounds. The heaviest geoducks can weigh up to 13 pounds!

Geoduck harvesting has become a large fishery. It is the largest clam fishery on the Pacific Coast. These giant clams thrive in sandy bottoms. These bottoms are found under much of Washington's largest estuary, Puget Sound.

1. What is a geoduck?

2. Where is one place where geoducks thrive?

Here are some geoduck facts:

- 165 million pounds of geoduck can be managed for harvesting in Puget Sound.
- 5 million pounds of geoduck per year can be harvested.
- Geoduck divers can dig a geoduck every 15 to 30 seconds. They can harvest up to 2,000 pounds a day.
- It takes about 6 years for a geoduck to reach 2 pounds.
- Geoducks can live to be 130 years old.

3. Let's assume all the geoducks alive now in Puget Sound, stay alive. Also assume that no new geoducks are added to the population. The population of geoducks will then remain the same size.

   a. How many pounds of geoducks can be managed for harvesting?

   _____million pounds

   b. How many pounds of geoducks can be harvested per year?

   _____million pounds

   c. Challenge: In how many years could all the pounds of geoducks be harvested?

   _____years

   Hint: Assume we have ten pounds of geoduck available to harvest. We harvested 2 pounds per year. At this rate, it would take 5 years to harvest all of the geoducks. In other words:

$$\frac{\text{10 pounds of geoduck available to harvest}}{\text{2 pounds of geoduck harvested per year}} = \text{5 years to harvest all geoducks}$$

   Set your problem up the same way:

   _____years to harvest all the geoducks

4. a. How many pounds of geoducks can one diver harvest a day?

   _____pounds a day

   b. How many pounds can one diver harvest in a 5 day work week?

   _____pounds in a week

   c. How many pounds can one diver harvest in a 50 week work year?

   _____pounds in a year

d. Challenge: Assume the yearly rate of harvest you found in (c). How many divers would it take to harvest 5 million pounds of geoduck?

_____divers

5. a. How many years does it take for a geoduck to reach two pounds?

_____ years

b. How long can geoducks live?

_____years

c. Challenge: A particularly quick growing geoduck reached two pounds in 5 years. This geoduck grew at the same rate to an age of 100 years. How much did it weigh?

_____pounds at 100 years

d. Think about your answer in (c). Do you think geoducks grow the same amount each year of their lives?

yes / no (circle your answer)

How did you reach your conclusion?