ADDING ARMADILLOS

METHOD

Students discuss the concept of biotic potential and use equations to determine how a family of armadillos grows over four generations.

MATERIALS

- Student Worksheet
- Reference material on armadillos (optional)

INTRODUCTION

When investigating the population growth of wildlife species, it's important to consider **biotic potential**, the ability of an organism to reproduce given ideal environmental conditions. Animals with high biotic potential are generally able to start breeding at a young age, produce many offspring during one reproductive cycle, and reproduce frequently. Many small animals, like mice, rabbits and insects, have high biotic potential; many large animals, like humans, whales and horses, have low biotic potential. However, organisms tend not to fulfill their biotic potential because most species do not live under ideal environmental conditions and growth is usually impeded by predators, disease, lack of food, or changes in habitat.

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

CONCEPT

All species have the ability to reproduce and a species' biotic potential determines how quickly its population is able to grow.

GRADE LEVEL

Upper elementary

SUBJECTS

Math, Science

OBJECTIVES

Students will be able to:

- Calculate the population of armadillos over four generations using addition and multiplication (by 4s).
- Define biotic potential and give examples of species with high and low biotic potential.
- Name two factors that impact the biotic potential of a species.

SKILLS

Adding, multiplying within 100, critical thinking

PROCEDURE

1. Distribute the Student Worksheet to each student.

2. Read the following paragraph aloud to students. If you've collected reference materials on armadillos, like books or images, you may want to share those as well.

   "The nine-banded armadillo of North and South America is a peculiar mammal. Their bodies are covered in armor (a hard, shell-like skin used for protection) and they have some rather unusual habits. Their favorite foods are insects – almost all of their diet is bugs and their larvae. They mate after their first year of life and produce one litter a year. In each litter, four ***offspring*** *(babies) are born.*

   In this activity, we're going to see how a family of armadillos, the Dillo family, grows over several generations in an ideal environment. Right now, the Dillo family is made up of two individuals – Mamadillo and Papadillo."

3. Ask students to hypothesize how many armadillos they think will be in the Dillo family after four years. Record ideas on the board.

4. Students complete the Worksheet in pairs.

5. Go over the Worksheet answers as a class and compare the total with students' hypotheses.

STUDENT WORKSHEET ANSWERS

Task 1:

4 + 4 + 4 = 12

Task 2:

Year 0: 2 + 0 + 0 = 2
Year 1: 4 + 2 = 6
Year 2: (4 x 4 = 16) + 4 = 20 + 6 = 26
Year 3: (20 x 4 = 80) + (4 x 4 = 16) + 4 = 100 + 26 = 126

DISCUSSION QUESTIONS

1. Were you surprised by the total number of armadillos after four years? If your hypothesis was off, why do you think this was the case?

   Answers will vary. Students may not have accounted for the offspring of all of the previous armadillo generations.

2. Biotic potential is the ability of an organism to increase in numbers under ideal environmental conditions, such as no predators, injuries, or diseases. Do you think the biotic potential of armadillos is high or low? Why?

   The biotic potential of armadillos is fairly high, given that they produce four offspring each year.

3. Can you think of an animal that might have higher biotic potential than our armadillo family? Lower? Explain your thinking.

   Higher: Rabbits, mice, lemmings, insects, frogs, etc. Lower: Whales, elephants, humans, horses, etc.

4. What are characteristics of species with high biotic potential? What about those with low biotic potential?

   Animals with high biotic potential are typically smaller and have shorter lifespans. Their families grow very quickly. These animals spend a short period of time with their mothers after they are born. For example, rabbits have around six babies per litter, and each baby will only spend around eight weeks with its mother.

   Animals with low biotic potential are typically larger and have longer life spans. Their families grow slowly in comparison to animals with a high biotic potential. These animals spend a long period of time with their mothers after they are born. For example, whales usually only have one baby at a time and that baby will stay with its mother for 1-2 years.

5. Why might some animals have more babies than others?

   Smaller animals have more predators, so it's less likely that all their young will survive into adulthood.

6. If armadillos multiply so rapidly, why isn't the world overrun with armadillos? What might stand in the way of the armadillo population growing as it does in the simulation?

   The Dillo family had the perfect environment for their family. But in the real world, there are things which keep a population from growing forever. Many animals are eaten by other animals or die from diseases or lack of food. Others die because of changes in the weather or local environment, like the destruction of their habitat.

7. Although humans have a much lower biotic potential than armadillos, our population continues to grow steadily. Why do you think humans survive at a higher rate than armadillos?

   Humans are the most sophisticated animal species. We don't have natural predators and we have found many ways to fight common diseases, grow food, and survive in different climates.

8. In order for the human population to be stable and not grow or decline, what would be the average number of children each couple could have during their lifetimes?

   Two. This would mean that while some couples have many children and some would have none, the average per couple would be two. A two-child average means that, on a population level, each couple would replace themselves.

MEASURING LEARNING

Students come up with a fictitious animal that has high biotic potential. They must decide how frequently their animal species reproduces and how many offspring are in each litter. Then they determine how many individuals there would be after three generations. Students can record their work and final answers in a math journal or on a sheet of paper. Students should be sure to give their animal a name and, if time allows, draw a picture of the animal.

FOLLOW-UP ACTIVITY

Teach students the Fibonacci Sequence. Fibonacci was a mathematician who lived 800 years ago. He wrote a book in which he includes the following math problem:

A man put a pair of rabbits in a place surrounded by a wall. How many pairs of rabbits can be produced from that pair in a year if every month each pair gives birth to a new pair and that new pair begins to reproduce during their second month of life?

This led Fibonacci to the following sequence of numbers: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144.

Challenge students to figure out the next number in the sequence. (Hint: Each subsequent number is the sum of the previous two numbers. *Answer: The next number is 233.*)

You can find lessons using the Fibonacci Sequence at **Mensa For Kids**, including where you can find this sequence in nature. There are also a number of children's books that illustrate this number sequence, such as *The Rabbit Problem* by Emily Gravett (2010).

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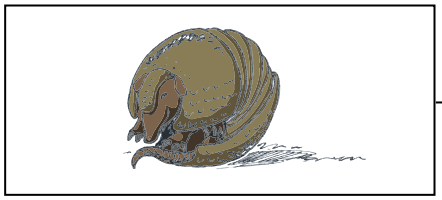
STUDENT WORKSHEET

Name: _____ Date: _____

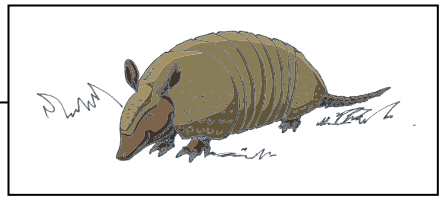
1. A male and female armadillo (Mamadillo and Papadillo) mate one time each year. Each time, Mamadillo gives birth to four babies. At the end of three generations, how many armadillos will Mamadillo herself have given birth to?

   Fill in the blanks with a drawing or numbers. Then add to find the total number of offspring.

Mamadillo



Papadillo



(Number of babies in 1st litter)

(Number of babies in 2nd litter)

(Number of babies in 3rd litter)

Total number of armadillos

2. Let's say that all of the offspring of the first two generations lived. Each of them found mates and produced litters, and all of those offspring lived too. What is the total population of armadillos after three generations?

   Fill in the blanks and add all members of the armadillo family to get the total population at the end of three generations. This total number will be all the offspring born during Mamadillo's and Papadillo's lifetimes, plus Mamadillo and Papadillo themselves. Remember, each litter has four armadillos.

	NEW OFFSPRING	**+ TOTAL ALIVE FROM LAST YEAR**	**TOTAL ALIVE**	**YEAR**
Originally, there are _____ armadillos, Mamadillo and Papadillo.	0	0	2	Year 0
Mamadillo gives birth to _____ offspring.				Year 1
Last year's offspring each have 4 offspring for a total of _____. And Mamadillo and Papadillo have another _____.				Year 2
Last year's offspring each have 4 offspring for a total of _____. And Year 1's offspring each have 4 offspring for a total of _____. And Mamadillo and Papadillo have their litter of _____.				Year 3