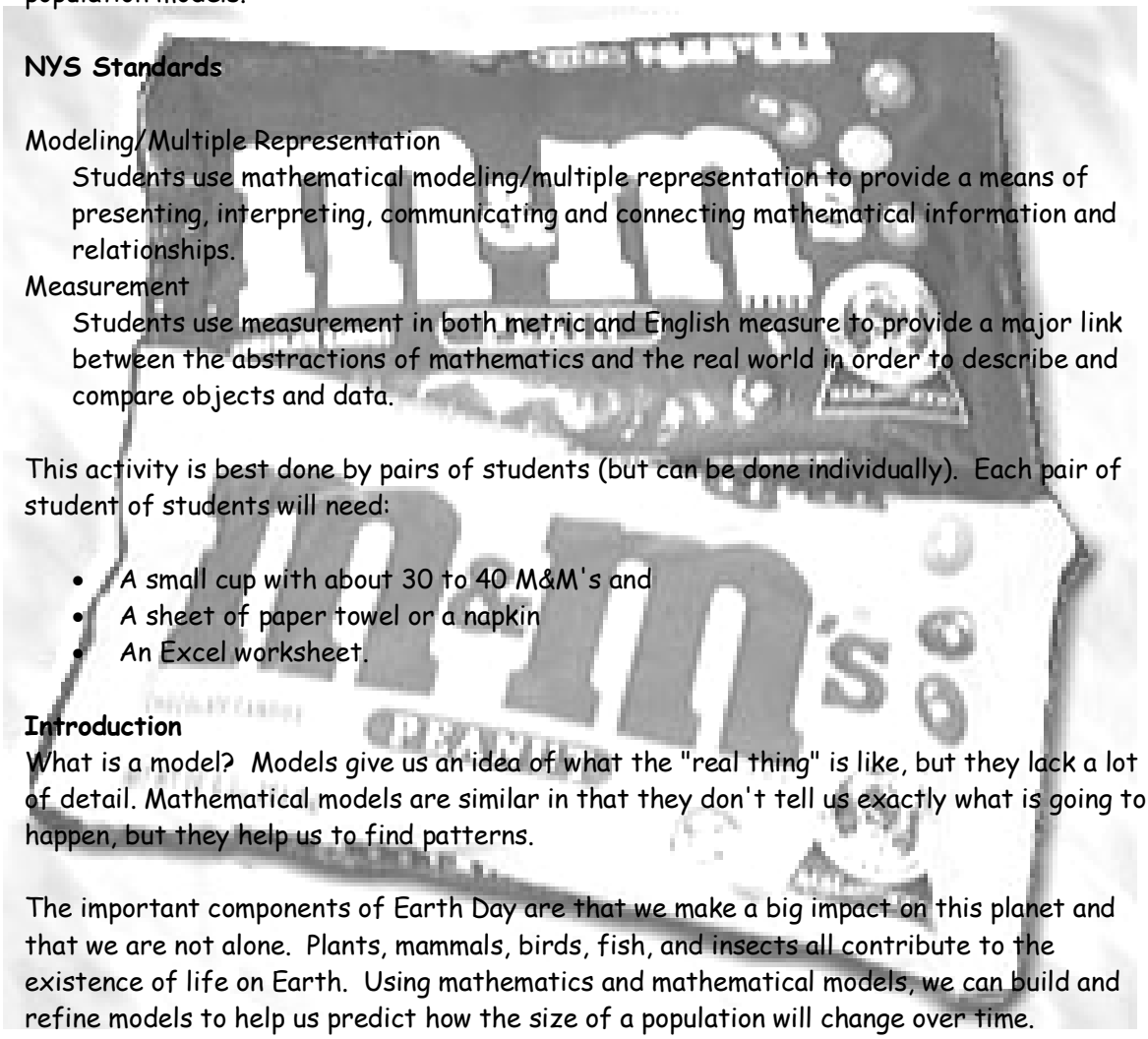
27 July 2003 Michael Baskin
NAS4_501

Population Simulation with M&M's (Grade Levels: 6 - 9)

This activity involves two simulations with M&M's® to explore population growth and decay. The follow-up activity, Population Simulations with Calculators introduces NOW-NEXT or recursive equations as an accessible way to model this behavior and expand to other population models.



NYS Standards

Modeling/Multiple Representation

Students use mathematical modeling/multiple representation to provide a means of presenting, interpreting, communicating and connecting mathematical information and relationships.

Measurement

Students use measurement in both metric and English measure to provide a major link between the abstractions of mathematics and the real world in order to describe and compare objects and data.

This activity is best done by pairs of students (but can be done individually). Each pair of student of students will need:

- A small cup with about 30 to 40 M&M's and
- A sheet of paper towel or a napkin
- An Excel worksheet.

Introduction

What is a model? Models give us an idea of what the "real thing" is like, but they lack a lot of detail. Mathematical models are similar in that they don't tell us exactly what is going to happen, but they help us to find patterns.

The important components of Earth Day are that we make a big impact on this planet and that we are not alone. Plants, mammals, birds, fish, and insects all contribute to the existence of life on Earth. Using mathematics and mathematical models, we can build and refine models to help us predict how the size of a population will change over time. Mathematical models don't produce an exact answer, but they can help us understand either the patterns or the trends that exist.

You are going to use M&M's to simulate and model the population decay and growth in a fishpond. You and your partner will get a cup of M&M's. Do not eat them. The M&M's in your cup represent the fish in a pond.

Simulation for Population Decay

1. Create an Excel worksheet to look like the one below:

Population Decay									
Year	0	1	2	3	4	5	6	7	8
Number of Fish									

2. Count the "fish" in your pond (cup), and record that number under year 0 in the Population Decay chart.

   Have pairs of students gently pour the M&M's, and remind them not to eat the M&M's until you say it is O.K.

3. ***Gently*** pour the fish onto your paper towel. Fish with an "M" face up represent fish that died or were caught during the first year. Place them aside (do not eat them yet), figure out how many fish are left in your pond, and record that population below year 1. Sometimes the "M" is difficult to see on the yellow ones, so look carefully.

4. Place the "live fish" back in the cup, and repeat the experiment for year 2. Record the fish population under year 2 on the chart. Continue the simulation, and record your data for up to 8 years, or until you run out of M&M's.

5. Create a line graph in Excel from the data you collected.
6. Write a sentence or two describing any patterns you see in this fish population.

7. If you started with more fish, do you think you would see the same pattern? Why?

   Collect and display class data (or a subset of class data) to increase the size of your sample and give the entire class one set of data to consider. This can be done with the whole group, or you can have four pairs combine their data and consolidate that for the class.

   With more data, some students will probably recognize that each year you lose about half of your fish. Ask is there any reason why we would be loosing half of the fish? Try to get them to talk about how the M only being printed on one side of the candy relates to this process.

Simulation for Population Growth

8. Somewhere on your current Excel worksheet, create the following labels to track population growth.

Population Growth									
Year	0	1	2	3	4	5	6	7	8
Number of Fish									

9. Now you are going to simulate population growth in the fishpond. Place two M&M's in the cup, and record 2 for your year 0 fish population in the Population Growth chart.

10. Pour the M&M's on your desk. This time, for each fish with an "M" showing, you are to add another fish to the pond. Record your fish population below year 1 in the chart.

    It is a good idea to talk through this step with students and model it with them. That is, start with 2 M&M's in your cup. Suppose when you pour them out, you have 1 M showing (and 1 blank). What do you do? Add 1 more M&M to the cup to make 3, record that number, and start the process over.

11. Put the fish back in the cup, and repeat this process for year 2. Record your population, and continue for up to 8 years or until your run out of fish.

12. Create a line graph in Excel from the data you collected.

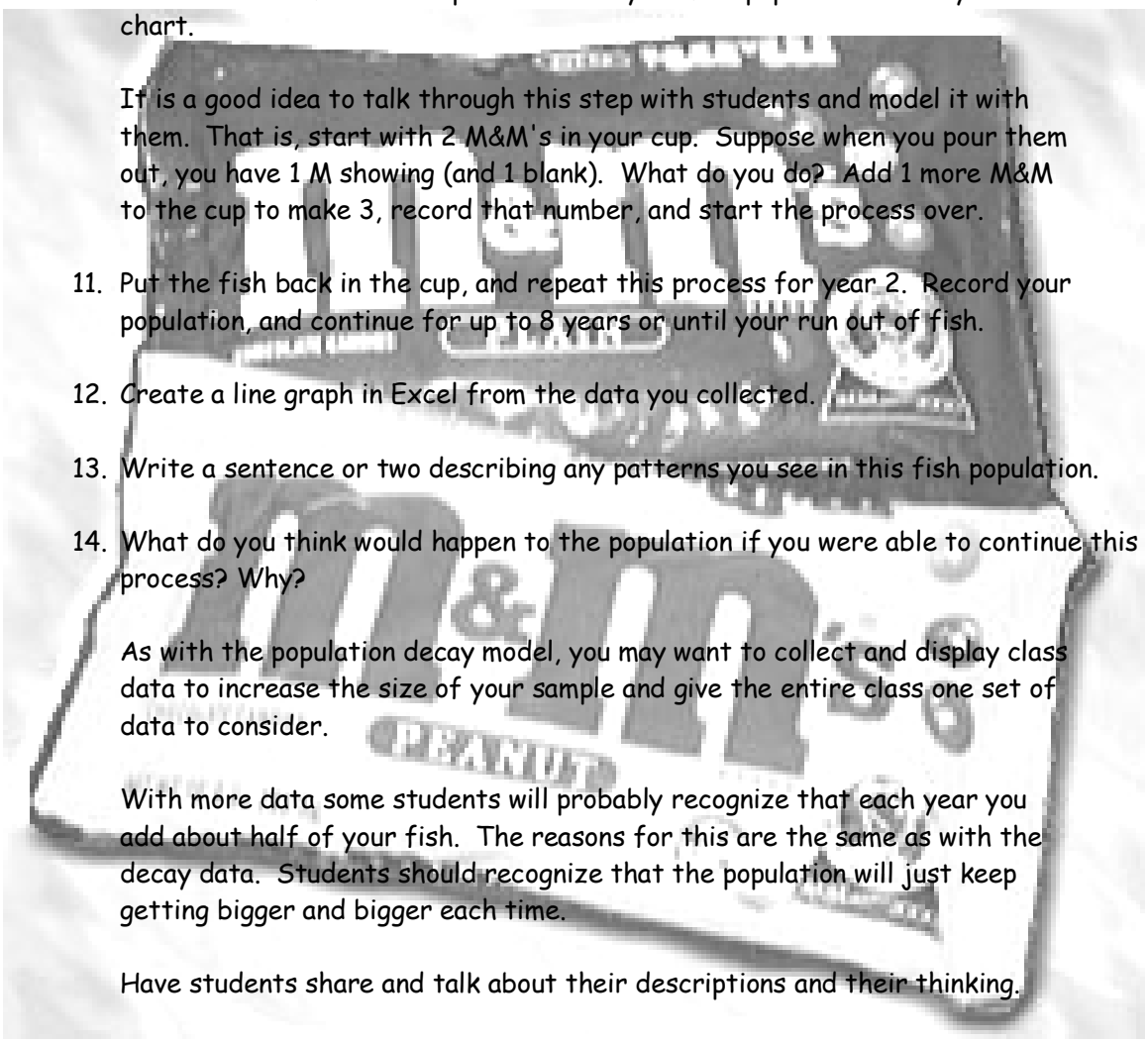
13. Write a sentence or two describing any patterns you see in this fish population.

14. What do you think would happen to the population if you were able to continue this process? Why?

    As with the population decay model, you may want to collect and display class data to increase the size of your sample and give the entire class one set of data to consider.

    With more data some students will probably recognize that each year you add about half of your fish. The reasons for this are the same as with the decay data. Students should recognize that the population will just keep getting bigger and bigger each time.

    Have students share and talk about their descriptions and their thinking.



On a separate sheet of paper to hand in answer the following questions:

- How long does it take the population in the decay model to become half its original size?
- How long does it take the population in the growth model to become twice its original size?
- Why does it take the growth model 2 years?

Dr. Freddie Thomas Learning Center

Population Simulation

Name: _____ Teacher: Mr. Baskin

Date Submitted: _____ Title of Work: _____

	Criteria				Points
	4	**3**	**2**	**1**	
Explanation	A complete response with a detailed explanation.	Good solid response with clear explanation.	Explanation is unclear.	Misses key points.	____
Use Of Visuals	Clear diagram or sketch with some detail.	Clear diagram or sketch.	Inappropriate or unclear diagram.	No diagram or sketch.	____
Mechanics	No math errors.	No major math errors or serious flaws in reasoning.	May be some serious math errors or flaws in reasoning.	Major math errors or serious flaws in reasoning.	____
Demonstrated Knowledge	Shows complete understanding of the questions, mathematical ideas, and processes.	Shows substantial understanding of the problem, ideas, and processes.	Response shows some understanding of the problem.	Response shows a complete lack of understanding for the problem.	____
Requirements	Goes beyond the requirements of the problem.	Meets the requirements of the problem.	Hardly meets the requirements of the problem.	Does not meet the requirements of the problem.	____
				Total---->	____

Teacher Comments: