Myocaster Multiplier

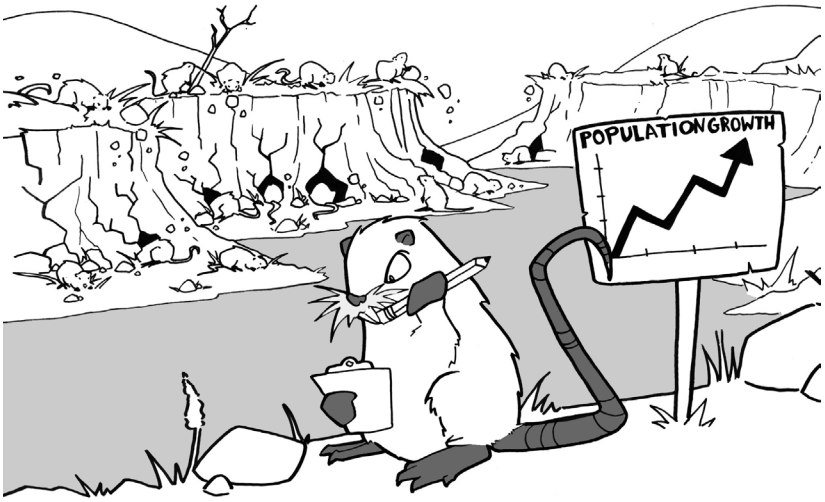
Name _____ Date _____

INSTRUCTIONS

In this activity you will calculate the nutria (*Myocastor coypus*) population growth in an isolated wetland in western Oregon and plot the population growth over a five-year period. Use a piece of graph paper to make your plot.

Make the following assumptions for your model, rather than using the information in the background section:

1. A failed fur farmer released a one-year-old male and female into the wetland at the same time.
2. None of the nutria left or entered the wetland during the five years.
3. No diseases or shortage of habitat limited the population.
4. All sexually mature females successfully bred and gave birth to a litter of four young, two times a year, each year.
5. There were an equal number of males and females in each litter.
6. The nutria died of old age when they reached five years of age.

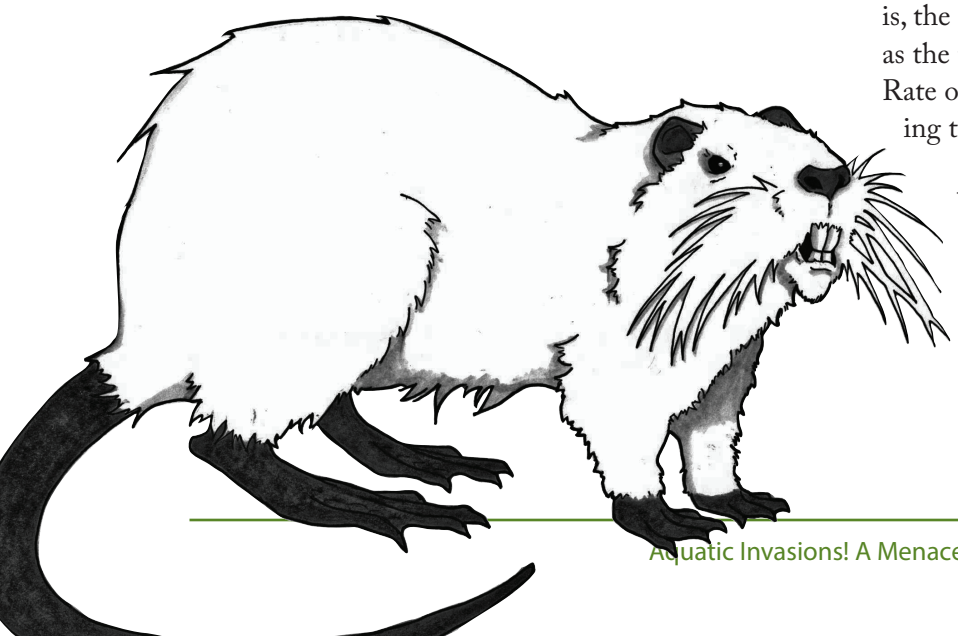


ADDITIONAL EXERCISE

After calculating and plotting the total population over a five-year period, calculate and plot the total population again, but assume that all sexually mature females produce only one litter each year and experience 20 percent predation. Compare the plots.

With nothing to keep the nutria numbers in check, their population will undergo **exponential growth**. That is, the rate at which the population grows will increase as the total number of reproducing females increases. Rate of change can be calculated using a graph by finding the slope between any two points.

After plotting the graphs, check the slope between Years 3 and 4, and compare this with the slope between Years 4 and 5. Is this an example of an exponential function?



Nutria

Myocastor coypus population after five years, with two litters per year and 20 percent predation.

Year	Initial Females	Total Births	Female Births	Total Females	Total Nutria	Total Surviving Nutria	Total Surviving Females
1							
2							
3							
4							
5							

Myocastor coypus population after five years, with one litter per year and 20 percent predation.

Year	Initial Females	Total Births	Female Births	Total Females	Total Nutria	Total Surviving Nutria	Total Surviving Females
1							
2							
3							
4							
5							

EXERCISE GUIDING QUESTIONS

1 **In completing this exercise, you have created a "scientific model" for nutria population growth. Based on the information in the species guide and the background information in this activity, how realistic are the assumptions in this model?**

2 **How likely is it that the population will remain isolated, with no immigration or emigration of nutria?**

3 **What factors could limit an increase in the population?**

4 **What impacts will an increase in the population have on the wetland?**

5 **Compare the two curves. How are they similar or different?**

QUESTIONS

1 **The change that the nutria population experienced could be described as _____ growth.**

2 **Nutrias always have an equal number of male and female young in a litter: TRUE FALSE**

3 **Assumptions . . .**

a are used by scientists to simplify how things work.

b are always true and make models 100 percent correct.

c don't need to be tested.

d don't have to be realistic to make a model correct.

4 **The model created eventually would have shown that the nutria population would reach infinite numbers. Would the nutria population in the wetlands have continued to grow to infinite numbers in real life?**

a Yes, the model showed exponential growth, which can be used to show real-life population numbers exactly.

b Yes, nutrias reproduce really fast and would have overcome any setbacks, such as disease and lack of resources, until there would be an infinite number of nutria.

c No, the model created used assumptions that didn't include concepts such as limited resources, predation, loss of habitat, genetic variability, or disease.

d No, because nutria don't like being crowded and would have started to move away from the wetlands when population levels got to around 1 trillion nutria.

5 **Some people think that nutrias are cute and feed them.**

a I think this is a bad idea. Feeding them helps them survive and reproduce in areas where they are hazardous to the environment.

b I think this is a good idea. If I feed them now, they won't eat the roots of plants later and help cause erosion of river banks.

c I think this is a good idea. I can't get sick from them, so what's it hurting if I give them a little snack?

6 **Because limitations were not considered, the nutria population grew exponentially. An equation can be used to predict exponential population growth over time:**

$$N_t = N_0 e^{rt}$$

where N_t = population size at time t; N_0 = original population size, r = intrinsic rate of increase, and t = time. Use the following values: N_0 = 2 nutria and r = 1.38629 to find the nutria population at t = 10 years.

7 **Some models consider limitations. This growth model is typically called logarithmic. The formula that calculates a logarithmic growth curve is:**

$$N_t = N_0 e^{kt}$$

where N_t = population size at time t; N_0 = original population size, k = carrying capacity, and t = time. Use the following values to find the nutria population at t = 10 years: N_0 = 2 nutria and r = 0.5.

MATH GUIDANCE AND FORMULAS

Start with Year 1

1 **Initial females. Since there was initially only one female released, there is one female.**

2 **Now that the number of initial females is known, calculate the total number of births that year.**

total births = (initial females) × (number of litters per year) × (number of nutria per litter)

3 **How many of those total births were female nutria?**

female births = total births ÷ 2

4 **Calculate the total number of female nutria in the wetlands; keep the initial females in mind.**

total females = (female births) + (initial females)

5 **If females make up half of the nutria population, how many total nutrias are there in the wetlands?**

total nutria = total females × 2

6 **Now, taking into account predation, how many nutrias survived this year?**

total surviving nutria = total nutria × predation in decimal form

7 **Once the total number of surviving nutria is known, how many female nutria survived the year? The number of female nutria that survived will make up the next year's initial female population.**

total surviving females = total surviving nutria ÷ 2 = Year 2's initial females

8 **Repeat these calculations for Years 2 through 5.**