Name_____ Period _____Date_____

Grow GloFish® Grow!
# Graphing GloFish® Population Growth

Objective

The learner will calculate the potential rate of increase in the size of a population of GloFish® fluorescent fish.

The learner will draw and label a graph showing the S-shaped population growth curve for a population of GloFish.

Introduction

A population or group of organisms of the same species living in the same geographical area has the potential to produce offspring at an exponential rate. Even though the capacity for exponential growth exists, such a population increase seldom exists in nature. Predictably, population size is limited by external factors. The size of a population is affected by many factors such as birth rate (natality), death rate (mortality), availability of resources, and the movement of members into or out of the population. The number of individuals that can be supported by the resources in a specific environment is referred to as carrying capacity of that environment. Graphs of changes that occur in the size of specific populations over time will typically demonstrate a sigmoid (S-shaped) curve. See Fig. 1 below. In this activity you will predict growth rates and prepare a growth curve for a population of GloFish.

Fig. 1 Population Growth Curve
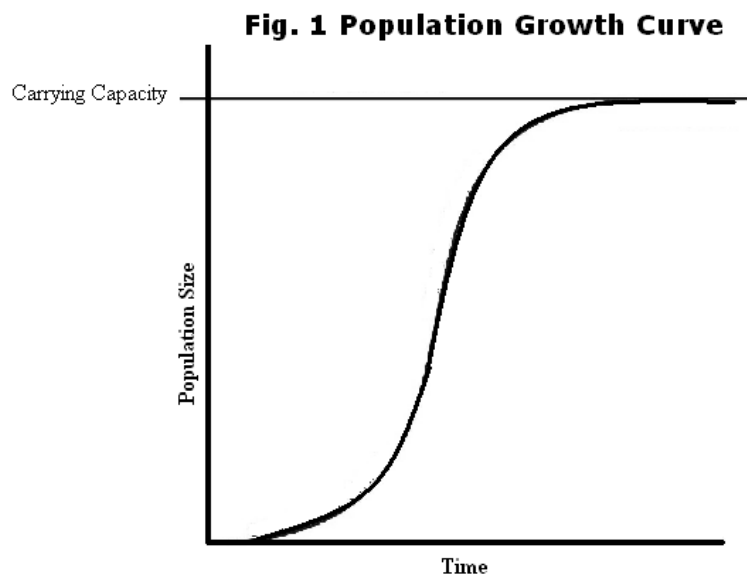
National Standards Addressed
Life Science C—Interdependence of organisms

Materials Per Group
Meter stick
Graph paper
Pencil

Materials for Classroom
Rectangular aquarium containing 6 or more GloFish®

Safety Precautions
No significant safety precautions exist with this activity, however, care should be taken to guard the safety of living organisms in the laboratory.

Procedures
Part A: Calculating Population Size

1. Count the number of female GloFish present in the aquarium. The males are typically slimmer than the females. The females tend to have a thicker body and more rounded under side. Record your original population data in *Data Table 20.1*.

2. Calculate the change in size of the female population that could occur if each female produces 100 eggs per spawning, half of which are females and spawns once every four weeks for 16 weeks. Show your work in the space provided.

3. Prepare a graph of the exponential growth of the population. Be sure to label the *x* and *y* axes on your graph.

Part B: Determining Carrying Capacity

1. The maximum size of populations, such as the GloFish in the aquarium is determined by the available resources. Your GloFish population growth will be limited by the size of your aquarium. Using the meter stick, calculate the volume of water that is available as living space for fish in your aquarium. Show your work in the space provided.

2. Determine the carrying capacity of the aquarium if each GloFish requires 5 cm³ of water to survive? (In this case assume water is the limiting resource.) Show your work in the space provided.

3. Add a second line to your graph from Part A to indicate your predictions for the size of the population during weeks 4 through 16 given the carrying capacity you have calculated.

Part A - Data

Work Space

Data Table 20.1: Exponential Population Growth

Original Population	4 Weeks	8 Weeks	12 Weeks	16 Weeks

Exponential Growth

Part B - Data
Volume of water available: _____
Show your work below:

Carrying capacity of aquarium:_____
Show your work below:

Discussion Questions:

1. Indicate if the following would increase or decrease the rate of growth in your GloFish® population.

    a. Higher levels of natality - (increase or decrease)

    b. Lower levels of mortality - (increase or decrease)

    c. Increased immigration - (increase or decrease)

2. Explain the relationship that exists between an environment's carrying capacity and the size of a population?

3. In this activity, it was assumed that the amount of living space (water) would limit the size of the population. Name two other resources that could prevent a population of GloFish from growing exponentially.

4. How would the carrying capacity be affected if you moved your GloFish population into an aquarium that contains 15 more liters of water?

5. Which of the following graph represents a population that is experiencing the impact of a new viral disease?
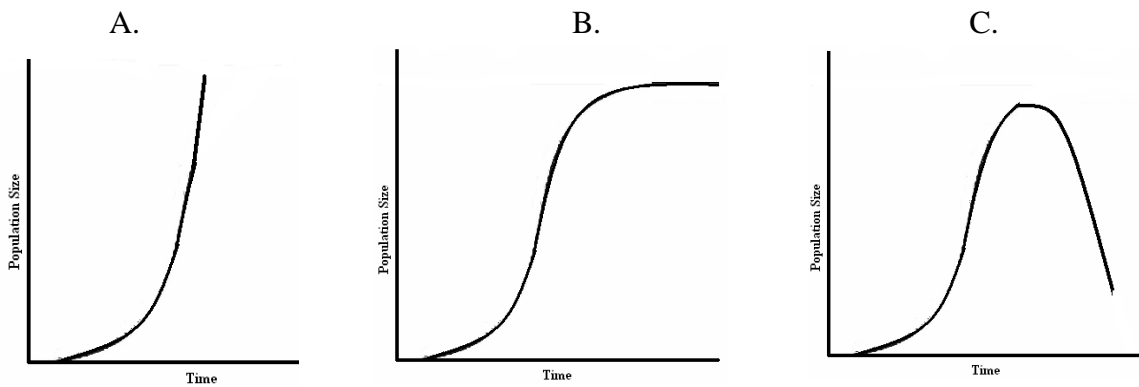
Elaborations or Extensions

Provide students with human population data and have them determine how the data compares to a typical population growth curve.

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Answer Sheet

Intended Grade Level
9th, 10th, 11th

Teacher Information
The number of fish in your original population of GloFish is not significant. Six or more fish in the original population allow the calculations in part A to clearly demonstrate the significant increase in population size.

The calculations are intended to show the estimated possible change in population size. Students may find it more logical to subtract the males from each population which will result in slightly smaller numbers in the estimated population sizes.

Original Population	4 Weeks	8 Weeks	12 Weeks	16 Weeks
8	400	20,000	1,000,000	50,000,000

Discussion Questions and Possible Answers

1. Indicate if the following would increase or decrease the rate of growth in your GloFish population.

   a. *Higher levels of natality - (increase)*

   b. *Lower levels of mortality - (increase)*

   c. *Increased immigration - (increase)*

2. Explain the relationship that exists between an environment's carrying capacity and the size of a population?

   Carrying capacity limits the size of the population

3. In this activity, it was assumed that the amount of living space (water) would limit the size of the population. Name two other resources that could prevent a population of GloFish from growing exponentially.
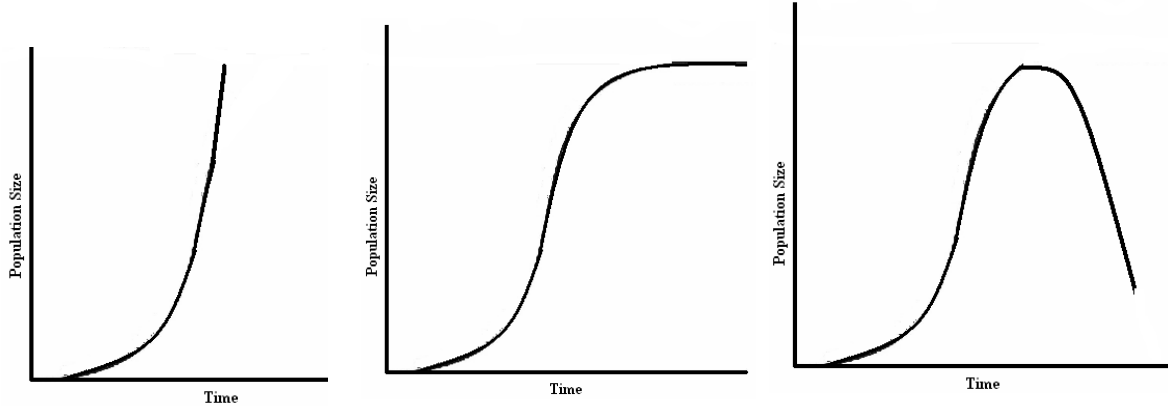
   Amount of available food, number of predators and, increase in disease

4. How would the carrying capacity be affected if you moved your GloFish population into an aquarium that contains 15 more liters of water?

   The carrying capacity would be increased by the additional water.

5. Which of the following graph represents a population that is experiencing the impact of a new viral disease?

   Graph C

A.	B.	C.