

Duckweed Population Growth Lab

TEAM ONE: Obtain four test cups in a small tray. Measure 100 ml of spring water in a graduated cylinder and pour into each test cup. Using a toothpick, carefully transfer one colony of three fronds and two colonies of two fronds (total of seven) to each cup. Label each test cup “Spring Water/Control” and number them 1 through 4 using a marker. Place the cups in their holder and then back in the lighted plant grower.

TEAM TWO: Sodium Chloride (table salt)

TEAM THREE: Potassium (K)

TEAM FOUR: Phosphorous (P)

TEAM FIVE: Nitrogen (N)

TEAM SIX: Miracle Gro (fertilizer)

Teams 2, 3, 4, 5, and 6 follow the following instructions:

Obtain four test cups in a small tray. Label the cups with the name of your variable. In addition, label one cup 100 ppm, another one 200 ppm, a third one 400 ppm, and the last one 800 ppm. Measure 10 ml of your variable into the 100 ppm cup and add 80 ml of spring water. Measure 20 ml of your variable into the cup labeled 200 ppm and add 80 ml of pond water. Measure 40 ml of your variable into the cup labeled 400 ppm and add 60 ml of pond water. Finally, measure 80 ml of your variable into the cup labeled 800 ppm and add 20 ml of spring water.

Using a toothpick, carefully transfer one colony of three fronds and two colonies of two fronds (total of seven) to each cup. Place the cups in their holder and then back in the lighted plant grower.

TEAM SEVEN: Obtain four test cups in a small tray. Label them pH 5, pH 6, pH 8 and pH 9 respectively. Add 100 ml of each type of pH to each cup respectively.

Using a toothpick, carefully transfer one colony of three fronds and two colonies of two fronds (total of seven) to each cup. Place the cups back in their small tray and then back in the plant grower.

TEAM EIGHT: Obtain four test cups in a small tray. Measure 100 ml of spring water in a graduated cylinder and pour 100 ml into each test cup. Using a toothpick, carefully transfer one colony of three fronds and two colonies of two fronds (total of seven) to each cup. Label the four cups of spring water, “One Screen,” “Two Screens,” “Three Screens,” and “Four Screens.” Cut pieces of screen that will completely cover the tops of the cups. Over one cup put one screen, over another two screens, a third three screens, and finally, four screens over a fourth. Secure with tape or rubber bands if necessary. Carefully put the cups back in their tray and then into the plant grower.

TEAM NINE: Follow the exact same procedure as team one.

DUCKWEED POPULATION GROWTH WRITE-UP

First, draw a graph that shows your duckweed population growth over the last few weeks. On the x axis should be the dates on which you counted your duckweed. On the y axis should be the number of duckweeds.

Second, answer the following questions concerning the graph.

1. What kind of graph did you get, linear or logarithmic?
2. Use the formula below to determine the growth rate for your four samples.
3. In comparing your graph of duckweed growth to that of world human population growth, how are they similar, how are they different?
4. Why did some teams get such phenomenal growth in their containers while other teams got mediocre growth?
5. Do you think the growth rate of the duckweed will slow down when the entire surface area is covered? Why?
6. What are some of the density-dependent factors that can affect the duckweed population growth?
7. What are some of the density-independent factors that can affect the duckweed population growth?
8. Is duckweed similar to an r-strategist or a k-strategist?
9. What are some of the things that you could do to increase the rate of duckweed growth?
10. Effluent coming out of sewage treatment plants is often directed to ponds covered with duckweed for further cleansing. What do you think duckweed does to help clean the sewage effluent?

How to determine that growth rate (r) of duckweed using the natural growth formula: $N_t = N_0 e^{rt}$

N_0 = the number of duckweed fronds that you have at the **beginning** of the time period in which you are trying to determine the natural growth rate.

N_t = the number of duckweed fronds that you have at the **end** of the time period in which you are trying to determine the natural growth rate.

e = Euler's number for natural decay (the inverse of the natural log (LN))

t = the number of days in the period in which you are trying to determine the natural growth rate.

r = the natural growth rate.

For example, let's say that on Day 16 you have 27 fronds and by Day 19 you have 39 fronds. What is the natural growth rate for this period of 3 days?

$$39 = 27 e^{r3\text{days}}$$

$$0.3677 = r3$$

$$39/27 = e^{r3}$$

$$0.3677/3 = r$$

$$1.44 = e^{r3}$$

$$0.1225 = r$$

$$\text{LN } 1.44 = \text{LN } e^{r3}$$

$$12.25\% = r$$