

Survivorship Lab

Within a population, some individuals die very young while others live into old age. To a large extent, the *pattern* of survivorship is species-dependent. Generally, three patterns of survivorship have been identified. These three have been summarized by *survivorship curves*, graphs that indicate the pattern of mortality (death) in a population.

Humans in highly-developed countries with good health-care services are characterized by a Type I curve, where there is high survivorship until some age, then high mortality. The insurance industry has generated information to determine "risk groups." The premiums they charge are based upon the risk group to which an individual belongs.

While survivorship curves for humans are relatively easy to generate, information about other species is more difficult to determine. It can be quite a trick to simply determine the age of an individual plant or animal, not to mention watching an entire population over a period of years. However, the principle of determining survivorship can be demonstrated in the laboratory using nonliving objects.

In this exercise, we will study the populations of soap bubbles, using them as models of real populations to construct survivorship curves. We will subject these populations to different kinds of stress to determine the effects upon survivorship curves.

Materials

- bubbles
- stopwatch
- rulers
- calculator
- graph paper - logarithmic
- and arithmetic scale

Procedure:

Soap Bubble Survivorship

Work in groups of four for this experiment. One person will blow bubbles, a second member will serve as the timer, a third observes survivorship, and the fourth records data in your data tables. Three different populations of soap bubbles will be formed based upon actions of group member:

Population 1 - once the bubble leaves the wand, group members wave, blow, or fan in an effort to keep the bubble in the air and prevent it from breaking ("dying").

Population 2 - group members do nothing to interfere with the bubbles or keep them in the air.

Population 3 - this group requires a line one meter from the bubble blower. The group member blowing the bubbles tries to blow the bubbles through the opening in the frame. Bubbles that don't cross the line "die" at 1 second. Bubbles that cross the line are timed until they pop/die. Group members cannot do anything to influence the bubbles survival.

Fill out the three data tables, one for each population

1. Practice blowing bubbles for a few minutes until they can be generated with the single end of the wand.
2. Once the bubble is free of the wand, the timer should start the watch. When the bubble bursts, the timer should note the time and puts a check mark next to the appropriate "age at death" in the data table for the appropriate population.
3. Obtain data on approximately 50 bubbles
4. Summarize your data as follows:
 - a) Count the number of checks at each age. Record the number in the column headed "Total Number Dying at This Age."
 - b) By subtracting the number dying at each age from the total number of bubbles blown (approximately 50). Determine and record the surviving at each age. For example, if 5 bubbles died at age 1 second, then $50-5=45$ survived at least one second.
 - c) Calculate the percentage surviving at each age. Since at "birth" (moment the bubble left the wand) all bubbles were "alive", 100% were alive at age 0. Use the following formula to calculate the percentages for the rest of the ages:

Percentage surviving to this age = (number surviving)/(total bubbles blown, approx. 50) x 100%

Repeat the entire procedure above for each of the three soap bubble populations, making the modifications necessary that are described earlier.

C. Plotting Survivorship Curves

Logarithmic Plot

Use the logarithmic grid to plot your data again. NOTE- this is a **semi-log** grid, meaning the horizontal lines become closer together toward the top of the grid. Notice that the scale on the vertical axis runs from 1 at the bottom to 9 near the middle, then from 1 to 9 near the top; there is a 1 at the topmost line. The lines are spaced according to the **logarithms** of the numbers.

The 1 at the top represents 100%, the 9 below it 90%, and so on. this means that the 1 in the middle of the page is 10%, while the 9 below it represents 9%; the 8, 8%; and so forth until the 1 at the bottom represents 1%.

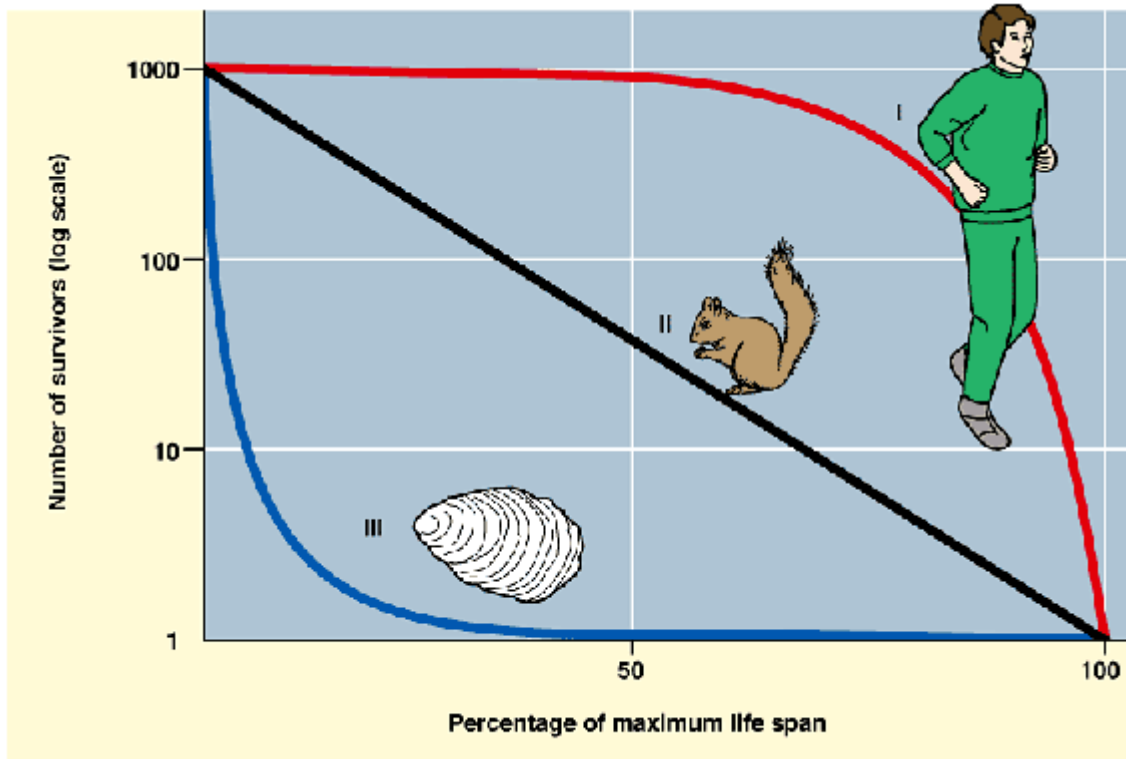
Using a semi-log grid, the spacing automatically takes into account the effect of a log on the graph and "calculates" the logarithm of the percentage surviving for you.

Plot the survivorship of the two dice and three bubble populations as you did before, but this time of the semi-log grid.

D. Interpretation of the Survivorship Curves

A straight line on the logarithmic plot indicates the death rate is constant. In the arithmetic plot it is easier to see that more individuals die at a young age than at older ages. In natural populations, three basic trends of survivorship affecting population size have been identified. These are represented in the table and semi-log graph below. NOTE- In analyzing a population survivorship trend, the semi-log plot must be used.

Survivorship Curves

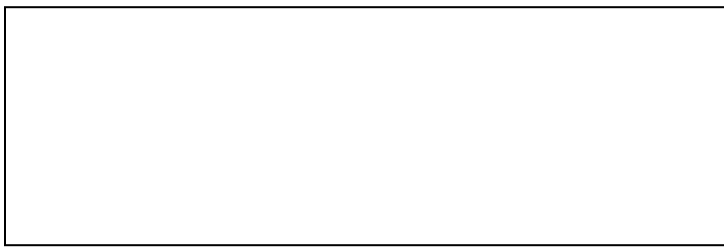


Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

I Low mortality early in life, most deaths occurring in a narrow time span at maturity

II Rate of mortality fairly constant at all ages

III High mortality early in life



Directions for Writing the lab Report

- (5 pts) **MLA Heading:** Apply the skills from your English classes and include the proper MLS heading—LEFT side of the page.
- (5 pts) **Neatness:** Your lab report **MUST** be written in BLUE or BLACK pen, or you may type it. If you type it, use Times New Roman (12 pt font) or Arial (11 pt font).
- (5 pts) **Title for Lab Report:** Write a scientific, descriptive title for the lab report. Good lab titles summarize the lab.
- (5 pts) **Purpose:** What is the purpose for doing this lab?
- (5 pts) **Section Headings:** The Following Section Headings must be included in the left margin of the lab report: Purpose (restated in your own words), Data Table, Survivorship Graph and Analysis Questions. You **MUST** have the 4 section headings for all 5 points.
- (15 pts) **Data Table** Record each data point for the lab in the data tables provided.
- (5 pts) **Data Table TITLE** Write a scientific title for your data table. A good title summarizes the information recorded in the data table.
- (25 pts) **Graph of Data** Graph your results on the graph paper provided. You may **NOT** turn in a computer generated graph. Include the following on your graph:
Equal increments for each axis
Label both axes
Graph the data points for each material (yes, this graph has 3 lines)
Label each line or include a legend
Title – yes, that good, scientific title again.

Analysis Questions

1. What is the independent variable for this experiment? What is the dependent variable for this experiment? Explain.
2. Examine the survivorship curves for the three soap bubble populations. How do they correlate with the Type I, II, and III survivorship trends? Explain.
3. Do any of the bubble populations show constant death rate for at least part of their lifespan? If so, which?
4. How did the treatments that bubble populations 1, 2, and 3 were subjected to affect the shape of their curves?
5. Which type of survivorship curve describes a population of organisms that produces a very large number of offspring, most of which die at a very early age, only a few surviving to old age? Give an example of a population of this type.
6. Would you expect a population in which most members survive for a long time to produce few or many offspring? Which would be most advantageous to the population as a whole? Explain.
7. Suppose a human population exhibits a Type III survival curve. What would you expect to happen to the curve over time if a dramatic improvement in medical technology takes place? Explain.

Soap Bubble Population Data Population #:

Soap Bubble Population Data: Population One					
Age at Death (seconds)	Percent of maximum life span (X axis)	Tally each Bubble that Dies	Total Number Dying at this Age	Total Number Surviving at this Age	Percent Surviving to this Age (Y axis)
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30+					

X axis: Percent of maximum life span = (age at death) / (maximum age at death) X 100%

Y axis: Percentage surviving to this age = (number surviving)/(total bubbles blown, approx. 50) x 100%

Soap Bubble Population Data: Population Two					
Age at Death (seconds)	Percent of maximum life span (X axis)	Tally each Bubble that Dies	Total Number Dying at this Age	Total Number Surviving at this Age	Percent Surviving to this Age (Y axis)
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30+					

X axis: Percent of maximum life span = (age at death) / (maximum age at death) X 100%

Y axis: Percentage surviving to this age = (number surviving)/(total bubbles blown, approx. 50) x 100%

Soap Bubble Population Data: Population Three					
Age at Death (seconds)	Percent of maximum life span (X axis)	Tally each Bubble that Dies	Total Number Dying at this Age	Total Number Surviving at this Age	Percent Surviving to this Age (Y axis)
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30+					

X axis: Percent of maximum life span = (age at death) / (maximum age at death) X 100%

Y axis: Percentage surviving to this age = (number surviving)/(total bubbles blown, approx. 50) x 100%