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| **iLearn BI 101**  **Procedures** | **Population Ecology Assessment:**  **Survivorship, Dispersion, and Population Growth** |

Now is your opportunity to demonstrate what you have learned about population ecology. After completing this activity and question set you will be submitting a report for grading through the course website. Upon completion of this assignment with the minimum required score, you will have completed the Population Ecology module. The details on the grading and submission process can be found on the course website. You will need two additional documents, both of which can be found in the course module.

* **Survivorship, Dispersion, and Population Growth Report**: Record your answers to the questions below in this document. This report is to be submitted through the submission page on the course’s website.
* **Survivorship, Dispersion, and Population Growth Spreadsheet:** This document has tables and graphs that you will generate as you go through the activities outlined in this document. It is not to be turned in, but you will need it to analyze your data.

**Survivorship**

Within a population, some individuals die very young while others live into old age. Until quite recently for the human population the pattern of mortality has been influenced primarily by disease. When the number of survivors of a population is plotted against time or life span the graph is termed a **survivorship curve**. Three patterns of survivorship are recognized. These three can be displayed by survivorship curves, graphs that indicate the pattern of mortality (death) in a population.

1. What type of survivorship pattern would you predict for humans (Early, late, or constant)? Record your answer in your Report.

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 population data and nonliving objects. In this exercise you will produce survivorship curves using data from obituaries and feathers or soap bubbles.

**Part 1. Obituaries**

1. Obtain obituaries from your local newspaper or website source. You will need about 20-30 for this exercise.
   1. Complete **Table 1** found in your Report by recording the year born, the year died, and age at death for 5 individuals found in your obituaries. Place a “1” **in each cell** if the individual lived to that age interval (AI). For example, if the age at death was 43, then the first 5 age interval columns would be marked with 1's. If the individual did not survive into a particular interval, enter a “0” in the corresponding box. When all rows are complete, total the numbers for each column in the last row of the table. These totals represent the number of individuals that survived through that interval.
   2. Now you will create a graph in your Lab Report to generate a survivorship curve for your sample size of 5 in the spreadsheet. Open the Excel spreadsheet. Click on the first tab titled “Human Survivorship 5”. Enter your totals from **Table 1** of your Report into the yellow highlighted column in the spreadsheet.
   3. After you have created and analyzed your survivorship curve with 5 individuals, you will now use the spreadsheet to create another survivorship curve, but this time using a sample size of 25. Click on the second tab titled “Human Survivorship 25”. (Notice that the type of data being plotted has changed. When reporting data in populations that are very large, it is often easier to report the number of survivors as a percent of the population instead of actual headcounts.) In the yellow highlighted column, enter the year born for 25 individuals you found in your collected obituaries. (It is ok to use the 5 you already used in your first data set.) By entering your data into the spreadsheet, a graph will be automatically generated.
2. Answer the following questions based on the two data sets you just generated. Record your responses in your Report:
   1. What differences do you observe between the two graphs? What type of survivorship curve does each appear to demonstrate? (Remember, your instructor can not see your graph, therefore you must be as descriptive as possible in the differences you observe.)
   2. Does a sample size of 5 seem adequate for assessing human survivorship? Explain your answer.
3. Answer the following questions in your lab report based on the graph that includes 25 individuals. (Be careful to pay close attention to data reported in the graph vs. what the questions below are asking for!)
   1. What is the youngest age of death in your data set?
   2. The oldest age at death?
   3. At what age has **25%** of your sample population **died**?
   4. **50%** died?
   5. **75%** died?
4. Now click on the tab titled “Human Survivorship Historical” and observe the survivorship curves of human populations during different points in history. Discuss some major events in human history can explain the differences in the different curves. Be sure to incorporate terminology learned in the Population Ecology unit (i.e. density dependent factors, growth rate, early/late/constant loss, etc).

**Part 2: Soap Bubble/Feather Survivorship**

If you have some blowing bubbles (the kind you buy for children to play with) these would work very well for this activity and is the way this activity is designed/written. Feathers would be suitable substitution if you prefer to use them or don't have bubbles in a jar at home. If using the feathers, “time to death” is recorded as the moment the feather touches the ground or other surface. Bubbles would be recorded as the moment the bubble bursts.

You might find it helpful to enlist the help of a volunteer to assist you in monitoring time until death. You will carry out repeated trials by monitoring the life of a soap bubble/feather in the following manner. Read through all instructions on this activity BEFORE you begin.

1. Blowing a single bubble, time starts when it leaves the wand.
2. Observe and time how long the bubble lasts until it breaks (in seconds). Hint: you need to do this from a standing position.
3. Record your data in the data table in your lab report.

Practice blowing bubbles for a few minutes until a single bubble can be released from the wand.

Once the bubble is free of the wand, the timer should start the stopwatch. When the bubble bursts record the time of death in **Table 2** of your Report.

**Population 1** – Control Set:

10 Trials is sufficient. Do not give any assistance to the bubble to keep it “alive”, just let it be.

**Population 2** – Parental Care: Once the bubble leaves the wand, you will give your “progeny” assistance to keep alive. You can wave a paper or your hands under it, blow it upward to keep it going, or fan it somehow in an effort to keep the bubble in the air and prevent it from breaking ("dying"). Repeat this for 10 bubbles.

1. Record your data in **Table 2** found in your lab report.
   1. Transfer the time to death data to the **Bubble Survivorship** tab in the Spreadsheet. Once the data is entered a graph will automatically be generated.
   2. Are the two graphs that are generated different? If so how would you describe this difference? (Again, be descriptive as possible). What type of survivorship does each data set represent?
   3. In nature some animals give care to their young and others don’t. Give an example of each.

**Part 3: Dispersion**

Ecologists use the term dispersion to describe the distribution pattern of individuals in a habitat occupied by a population. This pattern may vary from a random, uniformed, or clumped distribution. Dispersion can be an important factor in evaluating the impact a population can have on its habitat or how exploiting a habitat can impact a native population. For example, the action of an equal number of clumped individuals will be different than if the same number had been uniformly distributed.

Print out the image on the last page of this document and use it to determine the pattern of dispersion by following the instructions below:

1. Using a penny, flip the coin onto the page. Where the coin lands, count the total number of algae are touching any part of the coin. Record this number in **Table 3** in your lab report. Repeat this process 20 times.
2. Use **Table 4** to collate your data. Column 1 of the table represents the number of individuals that were touching the coin with each flip (X). Column 2 represents the number of coin flips in your data set that touched the associated number of individuals from column 1 (E). Column 3 is the total number of individuals that were touched with each flip (Column 1 X Column 2). For example: If (X) = 3, and (E) = 6, then 6 of your 20 coin flips resulted in touching 3 algae, then you counted 18 individuals.
3. In the spreadsheet, click on the “Index of Dispersion” tab. Enter your data from column 2 into the cells highlighted in green. Make sure your calculations for number of algae counted and totals, (n) and (N), corresponds with those generated in the spreadsheet. You should see an index (Id) value automatically calculated after you enter your (E) values. Record this index in your lab report.

Use the following information to answer # 10b in Part 4 to determine the distribution pattern of the algae. (Note: Your calculated Id will probably not be exact, but should be much closer to one of the following values than the others.)

If **Id = 1**, then distribution pattern is random

If **Id = n**, then distribution pattern is clumped

If **Id = 0**, then distribution pattern is uniform.

**Part 4: Population Growth Activity**

The last page of this lab represents a **100 square meter (m2) intertidal area** that is the habitat for a variety of marine plants and animals, among them various algae and sea urchins. The date at time of count is December 31st, 2010. Answer the following questions in your lab report about the algae and urchin populations. **Include your calculations in your Report.**

1. Answer the following questions:
   1. What is the density of the algae? Note: Density implies that area has been taken into account **(m2).** Your answer should be expressed as # of algae per square meter (Units must be included!).
   2. What pattern best describes the dispersion of algae based on the index of dispersion you generated in Part 3?
   3. What might this pattern tell us about the lifestyle of the algae?
2. The sea urchin population consists of adults (some of which died during the year) and young (which have been born during the year).
   1. Record your counts for adult, young, and dead sea urchins in your lab report.
   2. What is the total size of the sea urchin population on December 31st, 2010 (live animals only i.e. adults and young)?
   3. What is the density of the population? (Units must be included!)
3. At the beginning of the year (January 1st, 2010) the urchin population consisted of all the adult sea urchins plus those that died during the year. What was the size of the population at the beginning of the year?
4. Determine the birth rate (b) for the sea urchin population in 2010. (use population size calculated for January 1st)
5. What is the sea urchin death rate (d) for the year of 2010?
6. What is the annual growth rate (r) for the sea urchin population?
7. At the current rate of growth,
   1. How many sea urchins will there be in this 100 square meter area in five years?

Hint: **G = (r) x (population size).** Refer to the lecture slides and study guide to see examples of how to determine population size over the course of several years. Start your calculations in 2011. Record the population size for 5 years of growth in **Table 5** of your lab report.

* 1. Do you think this rate of growth is likely? Why? (Keep in mind that an adult sea urchin is approximately the size of a baseball)

