Lab 1: Cemetery demography & life history strategies *

BIO 3103 *Baylor University*

Background information

Organisms have evolved different **life history strategies** which differ in their methods of reproduction, number and size of offspring, timing of growth, means of resource acquisition, and prey avoidance. Life history strategies are evolved traits that maximize reproductive success in some way. However, resources are finite and for every benefit a trait conveys to the organism it is normally associated with a trade-off in the fitness of another trait. While these factors and how they interact can be highly complex, **survivorship** offers a simple means to quantify how a particular population ensures their reproductive success.

For example, humans devote an enormous amount of energy and resources to offspring care, which results in low mortality rates among their young. On the other hand, most insects produce a massive number of offspring that have extremely high rates of mortality, but due to the abundant offspring some still survive to reproduce. Plotting the number of surviving organisms against age yields what is called a **survivorship curve** (Fig. 1), which is a visual way to assess how various organisms differ in their life history strategies. Scientists can use these plots to examine differences in organisms, or assess changes within subsets of a population.

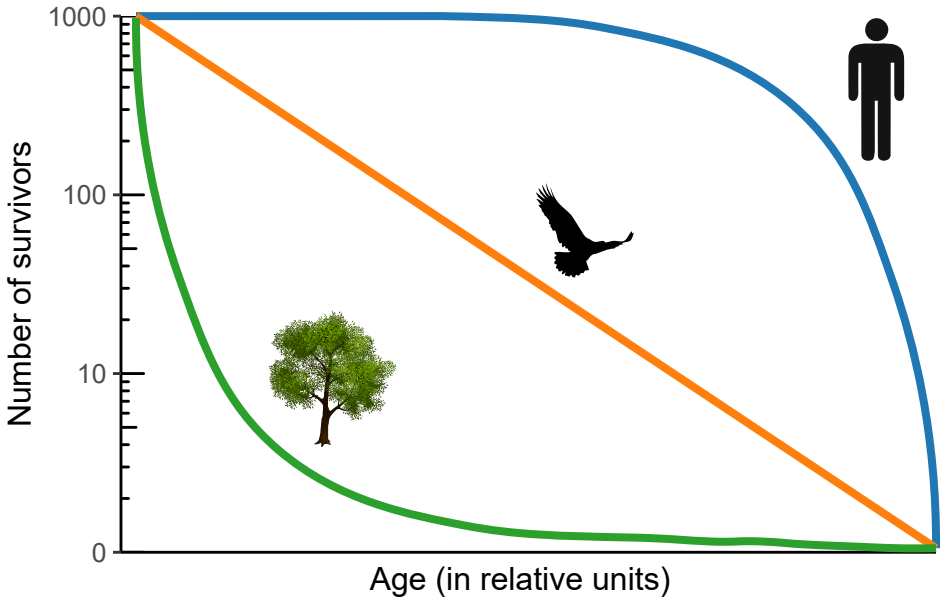

Figure 1: Idealized examples of Types I, II, and III survivorship curves overlaid with example organisms. Type I survivorship is characterized by high probability of survival early in life, followed by a rapid decline as individuals reach older age. Type II survivorship displays roughly constant mortality throughout the lifespan of the organism, and Type III exhibits high mortality among young offspring.

*__Current version__: January , 2019

Objectives

For this analysis you will use what you know about humans (*Homo sapiens*) and a common bird of prey (*Aquila chrysaetos*, the Golden Eagle) to form hypotheses about their life history strategies. You will use demographic data collected from a local cemetery, as well as data generated by the U.S. Fish & Wildlife Service to address your hypotheses about these two populations. We also have some ancillary data collected from each individual (**ancillary data** is data collected other than our primary variable of interest), which we can use to divide the populations into two groups to see how different forces influence survivorship *within* a population.

Figure 2: Migratory Golden eagle in Denali National Park and Preserve. Mating pairs return each year to northern nesting territory in the spring, and most new fledglings leave the nest by mid-August. During winter their range extends from southern Canada to south of the Rocky Mountains.

- We can use birth and death years on gravestones, as well as names (to infer gender) to collect simple but useful information about the local human population. You helped collect this data, and should be able to tell the reader how and why you did this.
- Additionally, survey data collected by state and federal agencies provide valuable information about golden eagles. Golden eagles are federally protected in the United States, and Fish & Wildlife collects detailed information from tagged individuals (Fig. 2). Every tagged individual is monitored till death, and afterwards detailed information about mortality is recorded along with the eagle's age. In this dataset, eagles are broadly divided into a group that died of natural causes and those that died from anthropogenic sources (power-lines, vehicle/boat hits, illegal hunting, etc.). This data was pulled from a report published by the U.S. Fish & Wildlife Service (Milsap et al. 2016).

We will use this data to test hypotheses addressing the following questions:

1. Does gender affect survivorship in human populations?
    - And if so, how?
2. Does human impact affect survivorship in eagle populations?
    - And if so, how?
3. Do humans and eagles display different life history strategies?

Please form testable null hypotheses to address these questions. If you want, you may also substitute question 1 for another within-population comparison for humans. To evaluate your hypotheses, you will…

1. Questions 1 and 2: statistically address differences in survivorship between groups using a **t-test**, and display the data using a **bar-graph**
2. Question 3: **compute** and **display survivorship** (no statistical test needed for this part, assessing differences in those curves statistically is beyond the scope of this lab).

Lab report specifics

Below are some specific guidelines for this lab report, but you should also utilize the general grading rubric in the Syllabus!

- **Participation** (1 pts)
- **Introduction** (2 pts)
  - General information about population ecology / life history strategies
  - How are survivorship curves used in population ecology?
  - Build up rationale to lead into your objectives/hypotheses statements
- **Methods** (2 pts)
  - Explanation of data collection and analysis
- **Results** (5 pts)
  - Text section (overview of results, summary statistics, etc.)
  - Bar-plots and associated t-tests for Q1 and Q2
  - Survivorship curve for Q3
- **Discussion** (2 pts)
  - Clearly address your null hypotheses
  - What are some plausible explanations for differences (or lack thereof) between groups?
  - What are some plausible explanations for differences between humans and golden eagles?
  - Place your results in an evolutionary context.

Literature cited

Ecologists frequently use publicly available data in their analyses. While you do not need to cite the data-source, you do need to tell the reader in your **Methods** section who generated the data, as well as what parts of the dataset you used.

Milsap, B. A., Bjerre, E. R., Otto, M. C., Zimmerman, G. S., & Zimpfer, N. L. (2016). Bald and Golden Eagles: Population demographics and estimation of sustainable take in the United States, 2016 update (p. 115). Division of Migratory Bird Management, Washington D.C., USA: U.S. Fish and Wildlife Service.