

1. For a population of seals the survival rate of females in their first and second years is 35% and 25%. Each female in the second age class produces 3 female offspring, and each female in the third age class produces 3 female offspring.
  - a. Find the Leslie matrix for this population.
  - b. If there are 10 females in each of the three age classes, find the initial age distribution vector.
  - c. Iterate the Leslie equation 5, 10, 15 and 20 times. What is the eventual fate of this population?
  - d. Investigate the effect of changing the 2<sup>nd</sup> age class birth rate to 2 or 1.
  - e. Investigate the effect of changing the 3<sup>rd</sup> age class birth rate to 2 or 1
  
2. Suppose the survival rate of females in their first and second years is revised to 20% and 25%. Each female in the second age class produces 4 female offspring, and each female in the third age class produces 3 female offspring.
  - a. Find the Leslie matrix for this population.
  - b. If there are 10 females in each of the three age classes, find the initial age distribution vector.
  - c. Iterate the Leslie equation 5, 10, 15 and 20 times. What is the eventual fate of this population (try 100 years)?
  - d. Investigate the effect of changing the 2<sup>nd</sup> age class birth rate to 5.
  
3. Suppose a particular species of salmon lives to four years of age. In addition, suppose that the survival rate of salmon in their first, second, and third years is 0.5%, 7%, and 15%, respectively. You also know that each female in the fourth age class produces 5,000 female offspring. The other age classes produce no offspring.
  - a. Find the Leslie matrix for this population.
  - b. If 1,000 female salmon in each of the four age classes are introduced into the system, find the initial age distribution vector.
  - c. Iterate the Leslie equation 5, 10, 15 and 20 times. What is the eventual fate of this salmon population?

4. Suppose another species of salmon lives to four years of age. In addition, the survival rate of salmon in their first, second, and third years is 2%, 15%, and 25%, respectively. You also know that each female in the fourth age class produces 5,000 female offspring. The other age classes produce no offspring.
  - a. Find the Leslie matrix for this population.
  - b. If 1,000 female salmon in each of the four age classes are introduced into the system, find the initial age distribution vector.
  - c. Iterate the Leslie equation 5, 10, 15 and 20 times. What is the eventual fate of this salmon population?
  - d. Calculate the exponential growth rate over the course of 20 years.  

$$[final\ pop = (initial\ pop)(rate)^{20}]$$
  
5. Suppose a third species of salmon lives to four years of age. In addition, the survival rate of salmon in their first, second, and third years is 1%, 10%, and 20%, respectively. You also know that each female in the fourth age class produces 5,000 female offspring. The other age classes produce no offspring.
  - a. Find the Leslie matrix for this population.
  - b. If 1,000 female salmon in each of the four age classes are introduced into the system, find the initial age distribution vector.
  - c. Iterate the Leslie equation 5, 10, 15 and 20 times. What is the eventual fate of this salmon population?