Population ecology assignment: Life history

1. (6 points in total) Scientists investigate an annual plant species for three years. The adults produce 150 seeds per year, on average. In the first year of the study, 2% of the seeds survive to become adults. In the second year of the study, 1% survive to become adults in the second year. In the third year of the study, 0.2% survive to become adults.

a. (3 points) What is the finite growth rate λ for this population in each of the three years?

It is 150*0.02 = 3 the first year, 150*0.01 = 1.5 the second year, 150*0.002 = 0.3 the third year.

b. (1 point) What is the ratio of the population at the end of the study to that at the beginning?

The population increases by a factor of 3, then 1.5, then 0.3. Thus it is multiplied by these three numbers in turn, which is the same as multiplying by their product: 3*1.5*0.3 = 1.35.

c. (2 points) What is the "correct" average value of λ – ie., the constant value which would give the same total growth of the population over three years?

The average λ will have $\lambda * \lambda * \lambda = 1.35$, so $\lambda = \sqrt[3]{1.35} = 1.11$.

2. (4 points in total) Scientists investigate another annual plant species for one year. The adults produce 150 seeds, on average. 1/3 of the seeds go to a place where 2% survive, 1/3 go to a place where 1% survive, and 1/3 go to a place where 0.2% survive.

a. (3 points) What is the overall proportion of seeds that survive?

The number that survive for each adult will be 50*0.02 = 1 the first place, 50*0.01 = 0.5 the second place, and 50*0.002 = 0.1 the third place. The total is 1.6. The proportion is thus 1.6/150 = 1.07% This can also be simply calculated as the arithmetic mean of the three survival probabilities.

b. (1 points) What is the value of λ for this population?

1.07% * 150 seeds/adult = 1.6 offspring per adult. We get a higher value of λ averaging within a generation than we did when we averaged between.