

Discussion question

Age-specific mortality rates are often modelled using a Siler function:

$$\mu(x) = a_1 e^{-b_1 x} + a_2 + a_3 e^{b_3 x},$$

where x is the age of the individual.

Explain it is reasonable for the mortality function to have this shape?

For chimpanzees, some estimated Siler parameters are $a_1 = 0.248$, $b_1 = 0.608$, $a_2 = 0.028$, $a_3 = 7.53 \times 10^{-3}$, $b_3 = 0.063$. How would you calculate the average life expectancy of a chimp with these Siler parameters from age 0? How about from age 15, i.e. how many more years is a 15-year-old chimp expected to live? You don't actually have to calculate this, just discuss how one would calculate it.

For chimps, the average age of first birth is around 15 and age of last birth is around 45. Assuming that the birth (conception) rate β is constant during this fertile period, how would we determine the minimum birth rate β to ensure that the population maintains itself or grows?