Generic Population Model for Roe Deer

Isao Kawaguchi

Assumptions

- I focused only female dynamics.
- Sex ratio is assumed as 1:1.
- Age specific survival rate was obtained from Fig 2 of McElligott et al. (by manual measuring).
- Each female (>2 age) reproduce 0.8 female offsprings per year.
- I couldn’t find appropriate dose rate -response data for Roe deer, thus I used acute LD_{50}=8.7Gy value from ICRP Pub. 108 and omitted radiation effect to reproduction.

Parameters for Roe deer

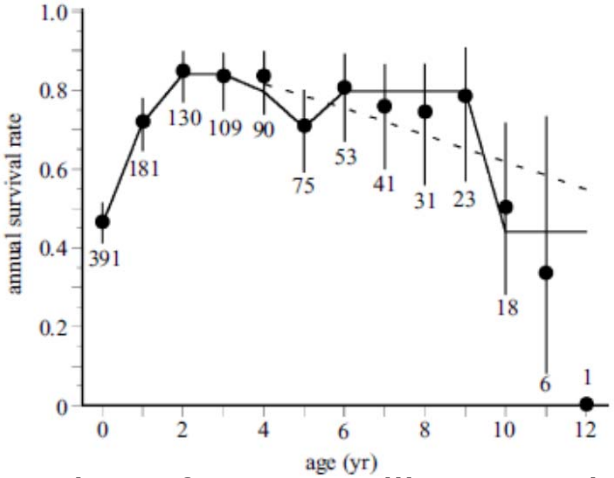

Fig. 2 from McElligott et al.

Maximum age=12

survival rate = {0.4732060,.7084470,.8537690,.8365120,.8365120,.7084470,.7992730,.7638510,.7447770,.7820160,.5095370,.3269750,0}

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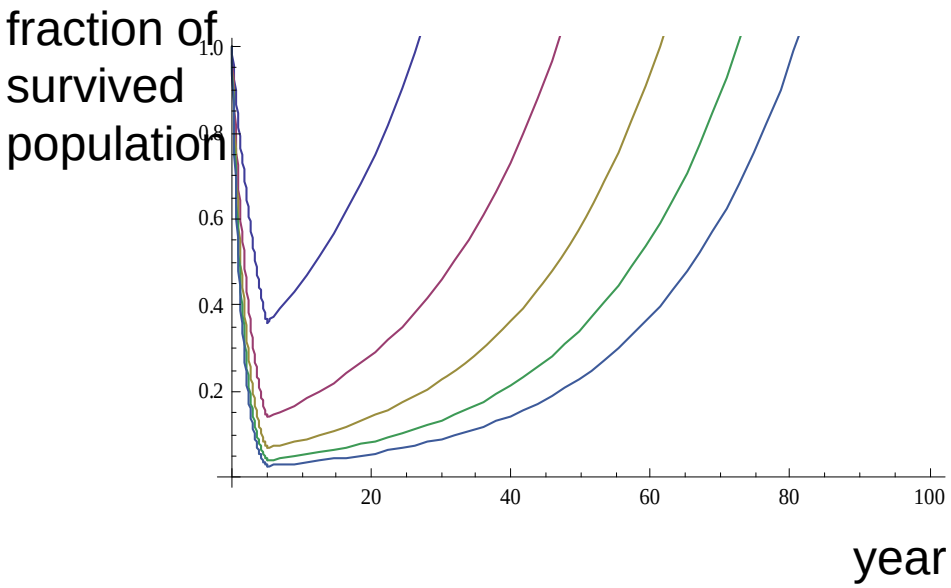
    0     0.378565 0.378565 0.378565 0.378565 0.378565 0.378565 0.378565 0.378565 0.378565 0.378565 0.378565
0.708447     0        0        0        0        0        0        0        0        0        0        0
    0     0.853769     0        0        0        0        0        0        0        0        0        0
    0        0     0.836512     0        0        0        0        0        0        0        0        0
    0        0        0     0.836512     0        0        0        0        0        0        0        0
    0        0        0        0     0.708447     0        0        0        0        0        0        0
    0        0        0        0        0     0.799273     0        0        0        0        0        0
    0        0        0        0        0        0     0.763851     0        0        0        0        0
    0        0        0        0        0        0        0     0.744777     0        0        0        0
    0        0        0        0        0        0        0        0     0.782016     0        0        0
    0        0        0        0        0        0        0        0        0     0.509537     0        0
    0        0        0        0        0        0        0        0        0        0     0.326975     0
```

⟶ intrinsic growth rate= 0.0474502/year

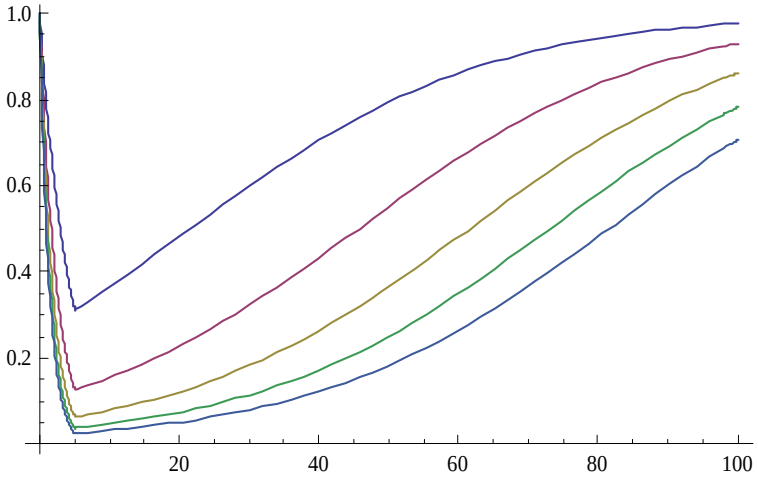
Malthus growth model

$$X(t) = X_0 e^{-(r-\alpha)t}$$
$$X(t) = X_0 e^{-r(t-5)+5\alpha}$$



Logistic model

$$\frac{dx}{dt} = rx\left(1 - \frac{x}{K}\right)$$



Age structured population (Discrete time model)

$$\begin{pmatrix} x_1(t+1) \\ x_2(t+1) \\ \vdots \\ x_n(t+1) \end{pmatrix} = \begin{pmatrix} p_1 f_0 & p_1 f_1 & \cdots & p_1 f_n \\ p_2 & 0 & \cdots & 0 \\ \vdots & \ddots & 0 & 0 \\ 0 & \cdots & p_n & 0 \end{pmatrix} \begin{pmatrix} x_1(t) \\ x_2(t) \\ \vdots \\ x_n(t) \end{pmatrix}$$