$$\boldsymbol{N_k} = \boldsymbol{LN_{k-1}}$$

$$\begin{bmatrix} n_0 \\ n_1 \\ \vdots \\ n_k \end{bmatrix}_{t+1} = \begin{bmatrix} F_0 & F_1 & \ldots & F_k \\ S_0 & 0 & \ldots & 0 \\ 0 & \ddots & \ldots & 0 \\ 0 & 0 & S_{k-1} & 0 \end{bmatrix} \begin{bmatrix} n_0 \\ n_1 \\ \vdots \\ n_k \end{bmatrix}_t$$

where:

$n_{k,t+1}$ = number of organisms in age class k at time t+1

F_k = fecundity, the per capita average number of female offspring born from mother of the age class k

S_k = the fraction of individuals that survives from age class t to age class t+1

$n_{k,t+1}$ = number of organisms in age class k at time t+1

F_k = fecundity, the per capita average number of female offspring born from mother of the age class k

S_k = the fraction of individuals that survives from age class t to age class t+1

$$F_k = S_k B_{k+1}$$

$$n_{0,t+1} = F_0 n_{0,t} + F_1 n_{1,t} + \cdots + F_k n_{k,t} \tag{1}$$
$$n_{k,t+1} = S_{k-1} n_{k-1,t} \tag{2}$$

$$\begin{bmatrix} n_0 \\ n_1 \\ \vdots \\ n_k \end{bmatrix}_{t+1} = \begin{bmatrix} F_0 & F_1 & \ldots & F_k \\ S_0 & 0 & \ldots & 0 \\ 0 & \ddots & \ldots & 0 \\ 0 & 0 & S_{k-1} & 0 \end{bmatrix} \begin{bmatrix} n_0 \\ n_1 \\ \vdots \\ n_k \end{bmatrix}_t$$

$$\boldsymbol{N_k} = \boldsymbol{LN_{k-1}}$$
$$= \boldsymbol{L^k N_0} \tag{3}$$