DEMOGRAPHIC STOCHASTICITY PROGRAM - NOTES

You can choose from three different discrete population growth models:

(1) Beverton-Holt model: $N_{t+1} = \left[\frac{a}{1+bN_t}\right]N_t$

(2) Ricker model: $N_{t+1} = \left[e^{r\left(1-\frac{N_t}{K}\right)}\right]N_t$

(3) Discrete logistic model: $N_{t+1} = \left[r\left(1-\frac{N_t}{K}\right)+1\right]N_t$

In each case, the program asks three input parameters:

- Growth rate at low density: This is the annual growth rate (the expressions in the brackets in the above formulas) evaluated at N=0. In the Beverton-Holt model, this is a; in the Ricker model, this is e^r; in the logistic model, this is r+1.

- Carrying capacity: This is the equilibrium density. In the Beverton-Holt model, this is (a-1)/b; in the Ricker model and in the logistic model, this is K.

- Initial population number: An arbitrary positive integer (but beware of overshoots in the Ricker and in the logistic models, since these are overcompensating).

The program iterates population dynamics assuming non-overlapping generations (annuals), and that the number of offspring is Poisson distributed (the expectation equals the annual growth rate evaluated at the current population size).

Note that in deterministic models, the carrying capacity only scales density and has no effect on the qualitative behaviour of the model. In finite populations, however, the carrying capacity is important since it influences the strength of demographic stochasticity. For experimenting with the programs, recall that the deterministic Beverton-Holt model is undercompensating and hence cannot produce oscillations or chaos. In the Richer model, limit cycles appear at r=2, e^r=7.389; in the logistic model, limit cycles appear at r=2, r+1=3.