Exercise: Structured population models

Consider a population suitable for a structured population model. Decide whether you want to make your model age structured or stage structured. In a stage structured model, you have to consider the growth rates between stages.

1. Choose a population to model. What is a suitable number of age or stage structures? What are reasonable parameter values for survival, growth and fertility for each stage?
2. Numerically solve the temporal evolution of the population. Find the long-term growth rate from the dominant eigenvalue and the population structure from the eigenvectors. Compare the result with your simulations (you can find the growth rate as the slope in a plot where you do plot(t, log(y)) in matlab, where "y" is a stage).

Consider an effect that regulates vital rates (survival, growth, and/or mortality). How does the dynamic of the system change? Examples are:

3. Density dependent reproduction. The Beverton-Holt stock recruitment relationship is a classic in fisheries science where the fertility (f) drops as the number of spawning adults (Na) increases: $f = f_0 \frac{1}{1+ aN_a}$. Another such "stock-recruitment" relation is the Ricker: $f = f_0 e^{-a N_a}$ -- you may also invent your own stock-recruitment relation.
4. Density dependent growth or survival. Growth rates or survival decline as the abundance in a stage increases.
5. Temporal changes in fertility or survival rates.
6. Survival influenced by harvesting. What happens if you only target juveniles or only adults?
7. Conservation issues. How would conservation measures be applied to your population? What happens if you target the conservation effort towards eggs, juveniles, adults, or the whole population?
8. Invent your own question…