MODELLING ENVIRONMENTAL UNCERTAINTY IN BIRTH-DEATH AND BRANCHING PROCESSES:

SOME COMMENTS

General birth & death processes appear to be the most favoured family of models for theoretical investigations in conservation biology. A compelling reason for is the immediate biological interpretation of D. Goodman's parametrization in terms of the per-capita growth rate $r(i)$ and the corresponding 'variance' $V(i)$. Their connection with the usual birth and death rates $\lambda(i)$ and $\mu(i)$ is $r(i) = (\lambda(i) - \mu(i))/i$and $V(i) = (\lambda(i) + \mu(i))/i^2$.

One has $V(i) = V_1/i$, V_1 a positive constant, for the linear birth-death process, with or without a finite carrying capacity. This underlines the diminishing effect of demographic uncertainty as population size increases. Goodman suggests modelling environmental uncertainty by adding a constant term, $V(i) = V_1/i + V_2$.

He does not give, as I see it, a compelling reason for this modification. I will explain how it does arise from the context of his discussion, why I think it is not appropriate for temporal environmental uncertainty, and how it may be harmonised with some of the model catastrophe effects found in the branching process literature.