age classes, each of which being weighted by its corresponding contribution to the stable age distribution (i.e. the dominant right eigenvector of the Leslie matrix). Growth rate (λ) is then taken as the dominant right eigenvalue (λ_1) of the matrix.

In a Leslie matrix model with $\alpha - 1$ pre-reproductive stages ($\alpha =$ age at maturity), the probability that a stage one individual reaches reproductive age is a product of $\alpha - 1$ survival probabilities that may or may not differ from one another, depending on the life history strategy approximated by the model (e.g. type I, II or III survivorship; Deevey 1947). In a partial life cycle model, survivorship to reproductive age (l_α) is implicitly a product of $\alpha - 1$ identical probabilities. More formally, the following relationship is assumed:

$$l_\alpha = \prod_{i=1}^{\alpha-1} P_i \approx E(P_J)^{\alpha-1} \quad (1)$$

Eq. 4 for a using a fixed value of l_α and varying values of b:

$$a = \exp\left(\frac{\ln(-\ln l_\alpha)}{b}\right)$$

(Oli and Zinner 2001b). The stochastic simulation was initialized using the stable age distribution of the average projection matrix. We ran the simulation for 50 000 iterations and calculated the stochastic population growth rate using Eq. 7 and constructed 95% confidence intervals according to Caswell (2001, sect. 14.3.6).

R

Deterministic comparisons supported our expectation that growth rates estimated using PLC (λ_{PLC}) would equal

As anticipated due to Jensen's inequality (Ross 1994), for the deterministic and stochastic computations, the PLC approach, in general, consistently overestimated type I life-history and underestimated type III life-history population growth rates. For a type I life-history, the survivorship curve (l_x) is concave down ($b > 1$ in Eq. 4). Therefore, the curve associated with the probability of surviving from age class i to $i + 1$ is concave up. The opposite is true for a type III life-history curve ($b < 1$). Due to Jensen's inequality, the greater the concavity of the curve over which the average is taken, the greater the overestimation or underestimation of population growth. For a type I life-history, Jensen's inequality takes the form of:

$$f(E[X]) \geq E[f(X)] \quad (8)$$

which states that the function of the expectation is greater than the expectation of the function. Thus, growth rate will be consistently overestimated by the PLC model for type I life histories since the product of the probability of survival used in constructing the PLC matrix model will be greater than the product of probability of survival used in constructing a matrix with varying survival probabilities

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