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Appendix G. Comparing ecological and evolutionary dynamics in the bistability 3b.

By the chain rule, ecological and evolutionary rates are divided as

$$\frac{dX}{dt}=\frac{\partial X}{\partial k}\frac{dk}{dt}+\frac{\partial X}{\partial z}\frac{dz}{dt}, \tag{G.1}$$

where X is the response variable, k is the ecological variable, and z is the evolving trait (Hairston et al. 2005). We choose the per capita growth rate of predator as the response variable as Hairston et al. (2005),

$$X=\frac{1}{P}\frac{dP}{dt}=\frac{\sum_{j=1}^{2}s_jN_j}{1+h_2\sum_{j=1}^{2}s_jN_j}-(\delta+m). \tag{G.2}$$

The ecological variable k is the prey abundance $N = N_1 + N_2$, and the evolving trait z is prey vulnerability $p = (s_1N_1 + s_2N_2)/(N_1 + N_2)$. Therefore,

$$\frac{1}{P}\frac{dP}{dt}=\frac{pN}{1+h_2pN}-(\delta+m), \tag{G.3}$$

and

$$\begin{aligned}
&\frac{\partial X}{\partial k}=\frac{s_1N_1+s_2N_2}{\left[1+h_2\left(s_1N_1+s_2N_2\right)\right]^2\left(N_1+N_2\right)},\\
&\frac{dk}{dt}=\frac{dN_1}{dt}+\frac{dN_2}{dt},\\
&\frac{\partial X}{\partial z}=\frac{N_1+N_2}{\left[1+h_2\left(s_1N_1+s_2N_2\right)\right]^2},\\
&\frac{dz}{dt}=\frac{\left(s_2-s_1\right)}{\left(N_1+N_2\right)^2}\left(N_1\frac{dN_2}{dt}-N_2\frac{dN_1}{dt}\right).
\end{aligned} \tag{G.4}$$

To compare the overall importance of the ecological and evolutionary terms in equation (G.1), we averaged their absolute values over a long simulation. Omitting the initial transient, the values are 0.037 (ecological) and 0.055 (evolutionary) for the antiphase cycle (Fig. 6A, 6C) and 0.31 (ecological) and 0.015 (evolutionary) for the non-antiphase cycle (Fig. 6B, 6D). Therefore, measured by the impact on predator per capita growth, evolutionary effects/ecological effects are 1.5 and 0.048.

LITERATURE CITED

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