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Appendix E. Comparison of true and approximate coexistence regions.

The figures in the text show coexistence regions defined by simulation. However, analytical approximations are used to obtain theoretical insight. Below, we compare the coexistence regions that are implied by the analytical approximations with those found by simulation. For the analytic regions, we use the two-species invasion rate combining (D.13) and (D.18) for $n = 2$, to obtain

$$\bar{r}_i / \beta = \eta_i - \eta_r + s\left[\text{cov}\left(E_r, C^{\{-i\}}\right) - \text{cov}\left(E_i, C^{\{-i\}}\right)\right].$$

Now $\text{cov}(E_j, C^{\{-i\}}) = \text{cov}(E_j, G_r)\bar{N}_r$, which in (D.21) is approximated by $\sigma^2 \bar{G}\bar{N}_r$ for $j = r$, and $\rho\sigma^2 \bar{G}\bar{N}_r$ for $j = i$, when σ^2 is small. Qualitatively, these two formulae are the same. As we have large σ^2, in the graphs below, we use the formula $\text{cov}(E_j, C^{\{-i\}}) = \text{cov}(E_j, G_r)\bar{N}_r$.

Note that the true and approximate coexistence regions give essentially the same message, although quantitative differences are present.

Figure E1: Comparison of true and approximate coexistence region.

On the left is the comparison between true (between the two solid lines) and approximate (between the two dashed lines) coexistence regions without predation. On the right is this comparison with predation. Parameters: $s_1 = s_2 = 0.8$, $a_1 = a_2 = 0.05$, $s_p = 0.8$, G is beta random variable with parameters (0.5,0.5).