EEB 5301 Homework 3

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Problem 1

Part a

Figure 1 shows that interspecific competition dominates the interaction, the cotinga population will go extinct and the fruit dove population is safe.

The y-intercept of the purple dove line is defined by $\frac{k}{\alpha_{dc}}$ and the x-intercept of the orange cotinga line is defined by $\frac{k}{\alpha_{cd}}$. Since $k_c = k_d$, we assume k=1 for graphical simplicity.

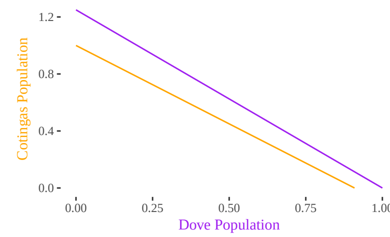

Figure 1: Fruit Dove and Spangled Cotingas Phase Diagram

Part b

In Figure 1, the conclusions based on the intercepts of the axes are constrained by the following be true: $\frac{k_c}{\alpha_{cd}} < k_d$ (x-axis) and $k_c < \frac{k_d}{\alpha_{dc}}$ (yaxis). If the carrying capacity of the Cotingas violates these constraints then the conclusions in Part a would change.

Problem 2

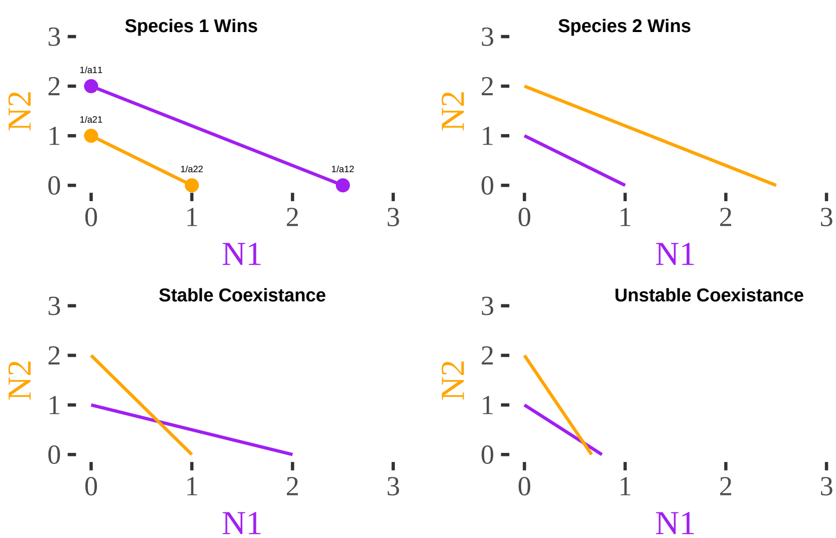

Figure 2: Four Competition Scenarios from absolute Lotka-Volterra Equations

The zero growth isocline is found by setting each population growth rate to zero, $\frac{dN_1}{dt} = 0$. The intercepts for the absolute case can be found as:

$$0 = r_1 N_1 (1 - \alpha_{11} N_1 - \alpha_{12} N_2)$$

$$0 = 1 - \alpha_{11} N_1 - \alpha_{12} N_2$$

Putting the equation in a linear mx+b format:

$$N_1 = \frac{1}{\alpha_{11}} - \frac{\alpha_{12}}{\alpha_{11}} N_2$$

The intercepts for the N_1 zero growth line are $\frac{1}{\alpha_{11}}$ and $\frac{1}{\alpha_{12}}$. The N_2 zero growth line intercepts can easily be shown to be $\frac{1}{\alpha_{22}}$ and $\frac{1}{\alpha_{21}}$

Problem 3

Part a

The lowest resource concentrations for each species to maintain populations at equilibrium when growing on their own are:

Astrionella

- Phosphate: .01μmol^{-1}
- Silicate: .02μmol^{-1}

Synedra

- Phosphate: .02μmol^{-1}
- Silicate: .01μmol^{-1}

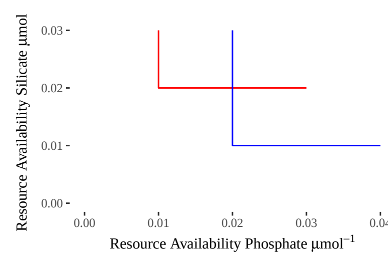

Figure 3: Resource availability phase diagram for *Astrionella* (red) and *Synedra* (blue)

Part b

Yes, there is the potential for these species to coexist on these two resources stably. Since the zero net growth isoclines (ZNGI's) cross, competitive exclusion will not occur in all scenarios. Coexistance is therefore possible.

Part ci

- Phosphate = .03μmol^{-1}
- Silicate = .015μmol^{-1}

Part cii

- Phosphate = .03μmol^{-1}
- Silicate = .03μmol^{-1}

Part ciii

- Phosphate = .01μmol^{-1}
- Silicate = .01μmol^{-1}