Goals: 1) Familiarize students with the graphical method for solving the Lotka-Volterra model of species competition.
   2) Determine which Pokemon © is the best.

Each of you has received a Pokemon slip with a picture and statistical description of your species. Three characteristics are important.
- **K** - the carrying capacity (N/ha) determined allometrically from the listed weight of the Pokemon
- **a** - the antagonistic effect of the Pokemon
- **d** - the defensive tolerance of the Pokemon

Data were modified from the Psypokes.com “Pokedex” statistics for each Pokemon species. Attack and defense values were assumed to be measured on a per-unit mass basis and we are experimenting with only “electric” Pokemon species to insure that they compete for the same resources.

Game rules: Your job is to compete your Pokemon with at least three other Pokemon species held by your classmates.

In order to solve the graphical Lotka - Volterra model, you need to have four numbers: the carrying capacity for each species ($K_1$ and $K_2$), and the competition coefficients (their effects on one another, $\alpha_{21}$ and $\alpha_{12}$). The first two are written on the slips. In order to calculate the competition coefficients, use the following formula.

$$\alpha_{21} = \frac{a_1}{d_2} \text{ for the effect of 1 on 2}$$

or

$$\alpha_{12} = \frac{a_2}{d_1} \text{ for the effect of 2 on 1}$$

Next, you need to draw the zero net growth isocline (ZNGI) for each competing species. Remember, the ZNGI (say, for species 1) is the line that connects $K_1$ on its own population axis to $K_1/\alpha_{12}$ on the population 2 axis.

Finally, examine the isoclines, and draw vectors representing the trajectories in each section of the phase space. When a species population is above its isocline, it decreases; when it is below the isocline, it decreases. Record whether the outcome is exclusive (1 or 2 wins deterministically), stable (1 or 2 coexist), or unstable (either 1 or 2 may win).
Use the graph paper to record your three “bouts.” To summarize the steps.

1) Label your axes with the competitors’ names
2) Calculate $\alpha_{21}$ and $\alpha_{12}$, then $K_1/\alpha_{12}$ and $K_2/\alpha_{21}$.
3) Draw the ZNGI for species 1, then for species 2. Scale the axes as you have to.
4) Draw the vectors in each section of the phase space.
5) Record the result (exclusive (and who wins), stable, or unstable).
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