Classical models in biology (exercises) BL.6003
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Series 3: Lotka-Volterra model

1. Phase space and vector field of the Lotka-Volterra model

As for the SI model in series 2, draw the phase space, the non-trivial zero growth isoclines, and the vector field of the Lotka-Volterra. Use the following sets of parameters and initial conditions:

$r = 1, \gamma = 2, \beta = 1$, and $m = 1$

$(N(0), P(0)) = (0.2, 0.2), (1, 0.5), (0.1, 0)$, and $(0, 2)$

2. Lotka-Volterra model with a logistic growth for the prey

Here we will study a first modification of the original Lotka-Volterra model. Instead of assuming an exponential growth for the prey, we will assume a logistic growth. This new model is then given by:

$$\begin{cases} \dfrac{dN}{dt} = r \cdot N - \alpha \cdot N^2 - \gamma \cdot N \cdot P \\ \dfrac{dP}{dt} = -m \cdot P + \beta \cdot N \cdot P \end{cases}$$

As previously, you will have to draw the phase space, the non-trivial zero growth isoclines, and the vector field of this new model. Use the following sets of parameters and initial conditions:

$r = 1, \gamma = 2, \beta = 1, m = 1$, and $\alpha = 1/3$

$(N(0), P(0)) = (0.2, 0.2), (1, 0.5), (0.1, 0)$, and $(0, 2)$