

BIO 480/680 Lab Exercise 3
Predator - Prey Model
Due date: 21 February 2025

This exercise investigates a model for two species of organisms that interact as predator and prey (see Haefner Ch 3, Exercise 7). Your job is to write a computer program to solve the set of equations describing these two species:

$$V_{t+1} = V_t + rV_t - aV_tP_t$$

$$P_{t+1} = P_t + abV_tP_t - dP_t$$

For these equations, V is the prey organism and P is the predator organism, r is the prey reproductive coefficient, d is the predator death coefficient, a is the prey consumption rate coefficient, and b is the conversion of prey to new predators (how many predators can be made per prey consumed).

Try the following values for the model parameters:

$$\begin{aligned}r &= 0.01 \\a &= 0.0005 \\d &= 0.1 \\b &= 0.1\end{aligned}$$

For the initial population sizes (at $t = 0$), use:

$$\begin{aligned}V_0 &= 1500 \\P_0 &= 50\end{aligned}$$

You should run the model for as many time steps as needed to see how the populations will vary in the future - probably at least 400 time steps or even more.

Present your results in two forms: (1) as a graph of prey and predator population size versus time and (2) as a graph showing predator *versus* prey population size (one population on the x-axis, one population on the y-axis). We will see later that this second graph is sometimes called a phase-space diagram.

Discuss the behavior of these two populations. How do they vary over time? Do you think they will continue with the same pattern of variation?