

Lab 7: Predation

Basic instructions:

For today's lab, the 'Continuous predator prey models' module will be used. To get to this module, click on 'Multi species dynamics' then on 'Continuous predator prey models'. For all questions, set 'Model type' to θ logistic, 'functional response' to Type II, 'Plot type' to P, N vs. t, and 'termination conditions' to run to 200. Make sure that θ is set to equal 1.

Mathematical background:

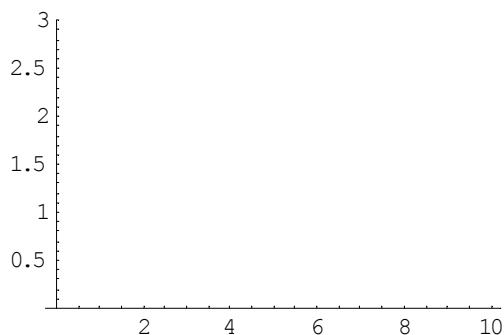
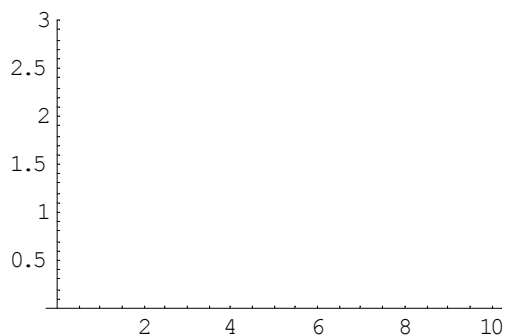
The mathematical background for today's lab was covered in the lecture 'concepts of predation'. It would be very helpful to review that material and to bring a copy of it with you. In addition to the material covered in lecture, understanding these simulations will require an additional bit of mathematical background; you will need to understand the mathematical formulation for the Type II functional response. Specifically, Populus assumes that the number of prey eaten per predator is given by:

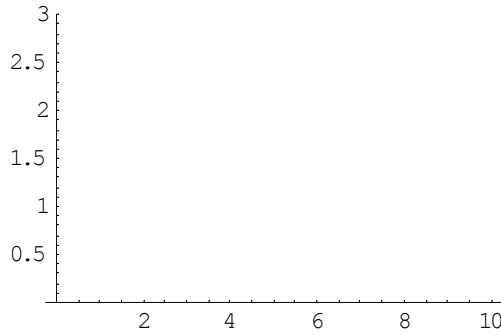
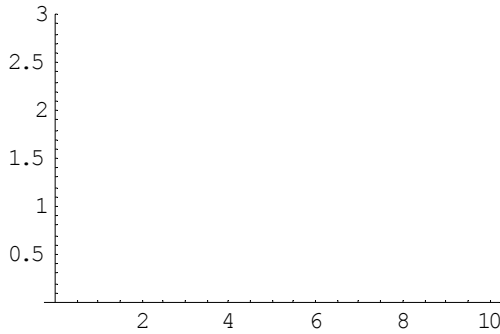
$$F = \frac{CN}{1 + hCN}$$

where N is the size or density of the prey population, and C and h are parameters that determine the shape of the Type II functional response.

Questions:

1. Draw a graph of F as a function of prey population size, N , for each of the following values of h : 0, 1/3, 2/3, and 1, assuming that $C = 1$. Based upon these graphs, what (in biological terms) does the parameter h determine? Which value of h corresponds to a Type I functional response?





2. Set $K=100$ and $h=0$. Make sure that θ is set equal to 1. Do not adjust the other parameters.

A. Do the population densities of predator and prey appear to be produced by a Type I or Type II functional response? Why is this the case?

B. Now set $h = \frac{1}{2}$ and observe the resulting population dynamics of predator and prey. Do these dynamics now appear to be produced by a Type I or Type II functional response? Why is this the case?

C. Are the population dynamics of predator and prey more stable with $h = 0$, $h = \frac{1}{2}$, or $h = 1$? Why?

3. Set $K=200$ and $h = 0$. Make sure that θ is set equal to 1. Do not adjust the other parameters.

A. Slowly increase the value of h . At what value of h (to the nearest .01) to the population density cycles switch from being stable to being unstable?

B. Change the carrying capacity to $K = 100$ and reset h to 0. Slowly increase the value of h . At what value of h (to the nearest .01) to the population density cycles switch from being stable to being unstable?

C. Why do your answers to A and B differ?