

Lab 3. Predator-Prey Models in Excel.

In this exercise, you will set up an Excel spreadsheet model of a predator prey relationship, and then examine the effects of varying the input parameters. We will assume that the predators are Greater Californian Killer Foxes and the prey are Lesser Fluffy Rabbits.

Set up cells for the rabbit intrinsic rate of increase (r), the fox attack rate (a), the prey-to-predator conversion efficiency (f) and the fox starvation rate (q). Add cells for the initial rabbit population size (N -zero) and the initial fox population size (C -zero)

Enter plausible values into each of these cells (note, you should start with more rabbits than foxes, and use small values in the range of 0.01 – 0.1 for a , f , and q .)

Set up one column labeled “time” and number it 1 through at least 100.

Set up additional columns for rabbit population size (N) and fox population size (C)

The basic equations you need are:

$$\text{Prey growth} = rN - aCN$$

$$\text{Predator growth} = faCN - qC$$

Set the first cell in your Rabbit and Fox columns to copy the respective initial values, as you did for your Exponential and Logistic models.

Use the appropriate formulas for prey growth and predator growth to code the second cell in each column (the attached example may help). Copy these cells down the columns to at least time step 100.

Highlight all three columns (time, rabbits, foxes) and use the graph wizard to create an X-Y scatter plot. Now you can see the behavior of the two populations. It is very unlikely that you will have achieved coupled oscillations with your first attempt.

Now, begin tweaking each of the input parameters, one at a time, and try to find a combination that achieves coupled oscillations or something close to coupled oscillations.

QUESTIONS

1] How is the stability of the predator-prey interaction affected by:

- (a) a larger prey intrinsic rate of increase (r)
- (b) a faster predator starvation rate? (q)
- (c) a higher predator conversion efficiency? (f)
- (d) a higher predator attack rate? (a)

2] What is the ultimate outcome of the predator-prey interaction, regardless of input parameters? How does this compare to the real World? What factors are NOT included in this model that might account for the difference between the model and real World behavior?

Write up due next week. Please include a print-out of an example Excel model run, and your answers to the questions above.

