Andrew Lipton

Simulations And Predictions

I found this colloquium interesting when comparing it to the work I'm doing for my final project (predator-prey modeling) and how to run a good simulation. The simulations that Stephanie Dobson ran, simulated all of the individual whales with unique attributes. Some of these attributes were individual foraging behaviors, prey intake, and social communications. Using these, and information about foraging locations throughout the season she was able to predict very accurately where whales would be throughout the season without having to track them individually. However, for a predator-prey simulation, you want to track two species and the interactions between the two, such as the predator eating the prey, the predator and prey reproducing and predators dying from lack of prey. I decided that I wanted to figure out the ideal conditions to create a realistic predator/prey simulation using code.

To create my simulation I used python and took many elements from Conway's Game of Life (what I'm writing about in my other essay). The basics that I took from Conway's Game of Life were: for every "cell" (predator, prey, or empty) check its neighbors and change its state based on what neighbors the cell. So for example, if an empty cell has at least two prey around it, it will have a chance to turn into prey. I incorporated 5 variables that can change for my simulation: PRED_DIE (the chance that a predator dies if there is no prey around it), PRED_REP(the chance for a predator to reproduce when eating a prey), PRED_REP_2(the chance for 2 predators to reproduce when neighboring), PREY_REP(the chance for 2 prey to reproduce when neighboring), and PREY_SPAWN(the chance for an empty cell to turn into a prey). I then ran simulations with 200 generations and random starting conditions. Using the data from that, I graphed the # of predators and # of prey for each generation and looked for graphs that modeled real predator-prey models. The main thing I was looking for in a graph was the cyclic nature of: an increase in predators decreases the number of prey and a decrease in predators increases the number of prey.

Going over the graphs of my data, I think the best starting conditions to model real life were: PRED_DIE = 100%, PRED_REP = 50%, PRED_REP_2 = 20%, PREY_REP = 40%, PREY_SPAWN = 0.1%. These conditions created **Image 1.** where you can see that as # of predators is low, the number of prey is high and vice versa. Because the simulations are random, this isn't always the result with these starting conditions, however, these starting conditions created the most realistic graphs. Because I used randomness to determine the initial variables during testing, I got some interesting results other results (see **Image 2. and Image 3.**)

Overall, I think my simulation was successful and was able to simulate a predator vs. prey model. I think, similarly to Professor Dobson's simulation, certain starting conditions could be used to model predator-prey in the real world. This could model things that would be hard to accurately track in real life because of time difficulties.

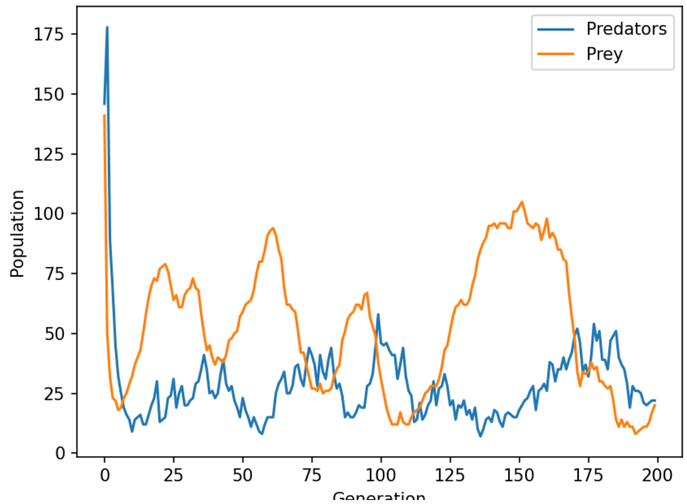

Image 1. The prey peaks at 25, 60, 80, and 150 correspond to dips in predators at those points.

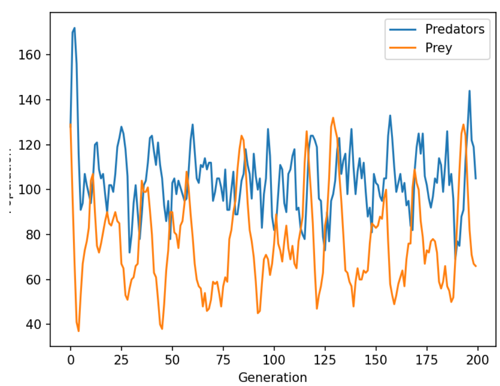

Image 2. Insanity

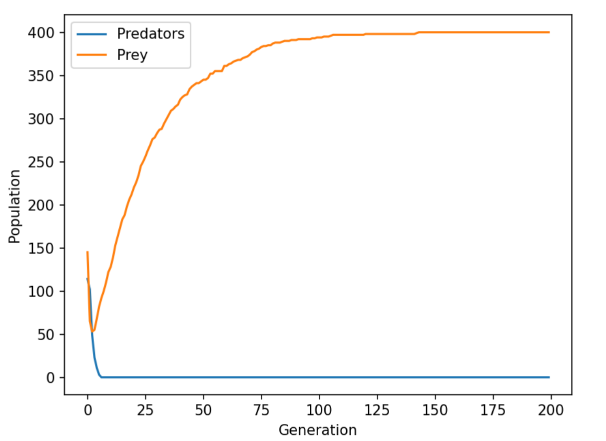

Image 3. A Rare Prey Domination