Elisabeth Kerns

Timothy Graven

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Modeling Project: Rosenzweig-MacArthur Report

In order to study the relationship between population dynamics, the interactions between the lynx and snowshoe hare were studied. The Rosenzweig-MacArthur Model represents an extension of the Lotka-Volterra Model. The

The variables are defined as followed. Several of the parameters were carried over from the Lotka-Volterra model. H represents the herbivore predator, while P represents the predator. The variable b indicates the prey birth rate, and the variable a represents the predator attack rate. The variable e indicates the conversion efficiency of prey to predators. (how many prey eaten per new predator) The parameter s represents the predator death rate. In order to develop the Rosenzweig-MacArthur model, two additional parameters were added. The parameter d indicates ____. Max time spent per prey → related to max number of prey can catch. In addition, the parameter was added to represent

Here, the dynamics of the Rosenzweig-MacArthur Model were studied in comparison to the Lotka-Volterra results. The plots below represent the results of those simulations. In each simulation, the population of prey is indicated by the black line. The predator colors were changed for each simulation in order to distinguish which parameter was being changed.

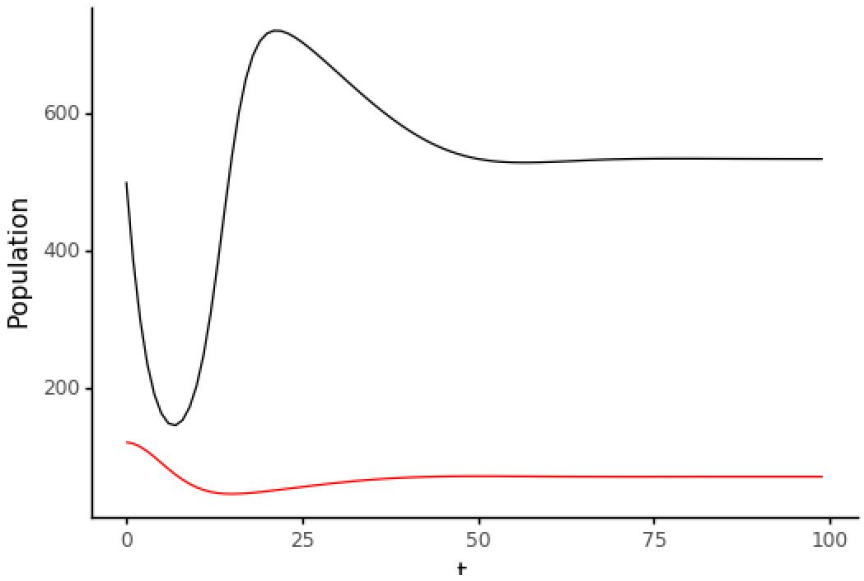

Figure 1. Simulation 1 with standard parameters

When the simulation was ran with the starting parameters, the population of prey significantly outnumbered the population of predators. In this standard model, the prey experiences a dip in population at earlier times, as the predators consume significant prey. Then, the prey population booms based on overconsumption by the predators. After some time, both the predator and prey populations reach an asymptote, as the system reaches an equilibrium. At this point, the rate at which predators consume prey equals the rate at which prey are born.

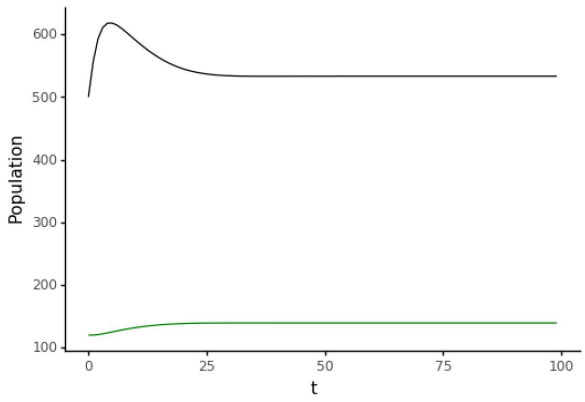

Figure 2. Simulation 2 using a doubled prey birth rate, b.

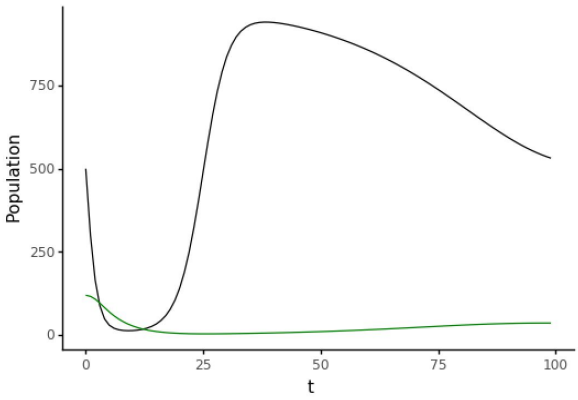

Figure 3. Simulation 3 using a halved prey birth rate, b.

In Simulation 2, the prey birth rate was doubled from the standard parameters. Figure 2 shows that the prey population experiences an initial increase which contrasts the initial decrease in the standard simulation. Both the predator and prey population levels eventually reach equilibrium.

In Simulation 2, the initial prey birth rate was halved from

Figures

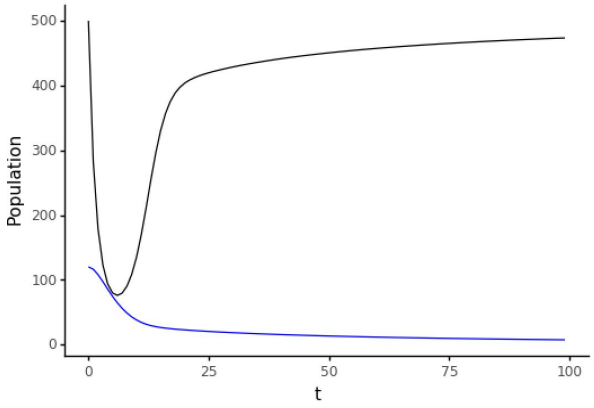

Figure 4. Simulation 4 using a triple predator attack rate, a.

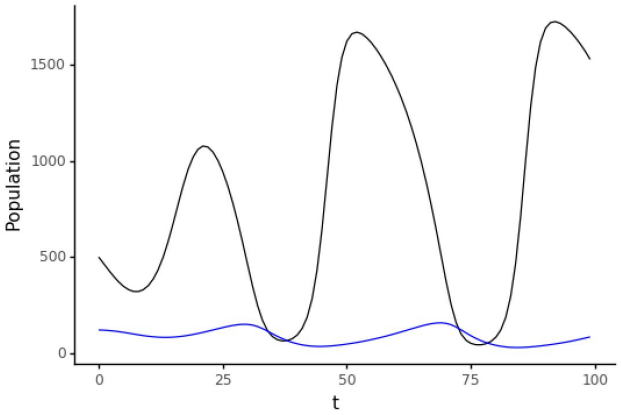

Figure 5. Simulation 5 using a halved predator attack rate, a.

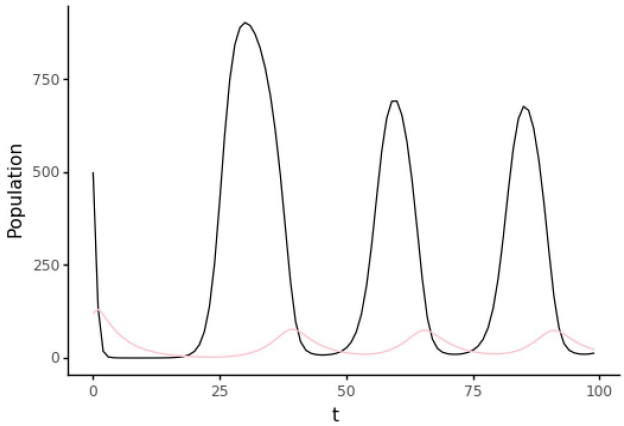

Figure 6. Simulation 6 using doubled w.

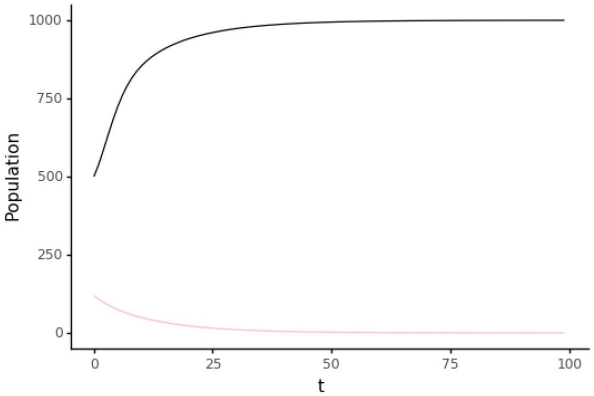

Figure 7. Simulation 7 using a halved w.

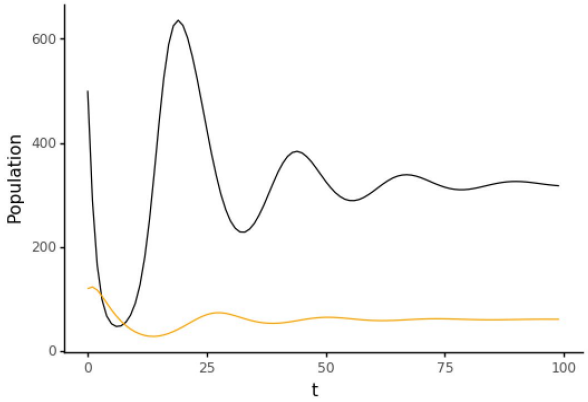

Figure 9. Simulation 9 using tripled d.

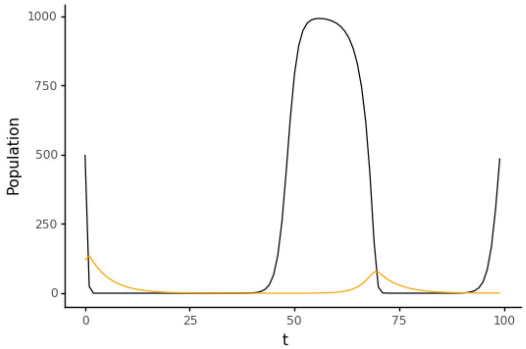

Figure 10. Simulation 10 using halved d.

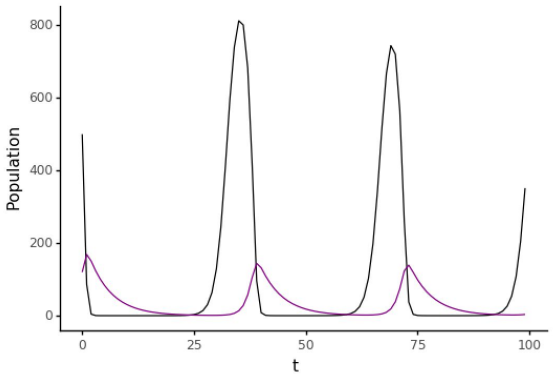

Figure 11. Simulation 11 using doubled e.

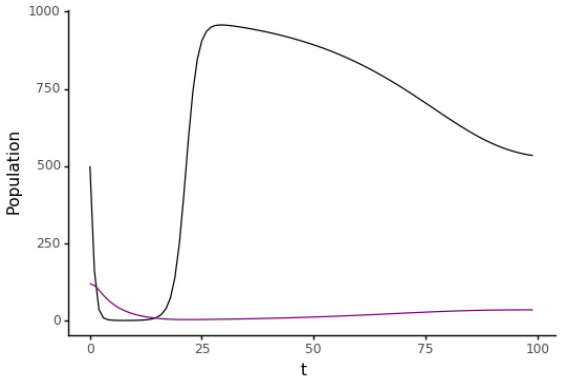

Figure 12. Simulation 12 using halved e.

Parameter	Effect on Predator Abuandance	Evidence for Effect
H		
P		
b		
a		
e		
s		
d		

d		

Table 1.

Further, the Paradox of Enrichment was simulated