Project 8: Lotka-Volterra predator-prey equations

Let the prey-predator satisfy the Lotka-Volterra equations, but with a refuse for the prey, the

model will be changed to be (equation).

1. Explain the new model

The new model, represented by the equations above, is very similar to the original Lotka-Volterra model in its simplified form. There is the addition of a new parameter “k” that describes the effectiveness of the refuge, which the prey will use as shelter from the predators, aiding prey population and decreasing predator population. U-k prey is the only prey that is available to predators due to the refuge.

1. Find the steady states or equilibrium

(0,0) and (k+1, k+1)

1. Whether the steady states are stable? Please do the analysis (u>k)

The trivial steady state can be considered unstable assuming a>1

The nontrivial steady state is a stable node since the determinant of the Jacobian is positive and the trace is negative.

4) Assume the parameters k=10, a=1, find the numerical solution of (u,v) with Matlab and

plot the solution of u and v at time [10, 30], for example.

At time 10,30 we saw both the predator and the prey gradually drift towards the equilibrium value. However, for higher values of u(0) we saw the prey rapidly jump down towards the k value (signifying k prey taking refuge) while the predators increased rapidly accordingly with the loss of prey. The populations then again drifted towards the steady state. For values of u(0) and v(0) both below the steady state, we saw that this was advantageous towards the prey at first (since refuge is more widely available) but the results again drifted towards the steady state.