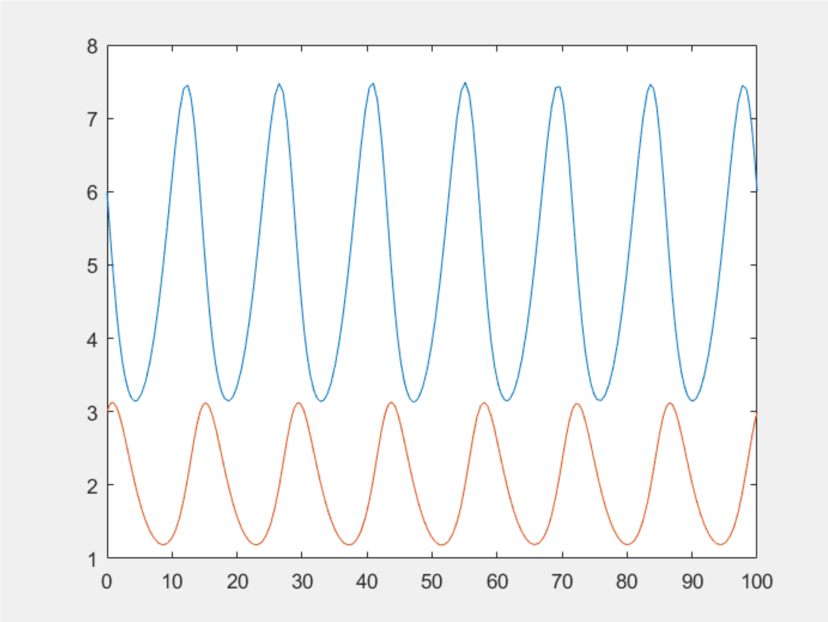
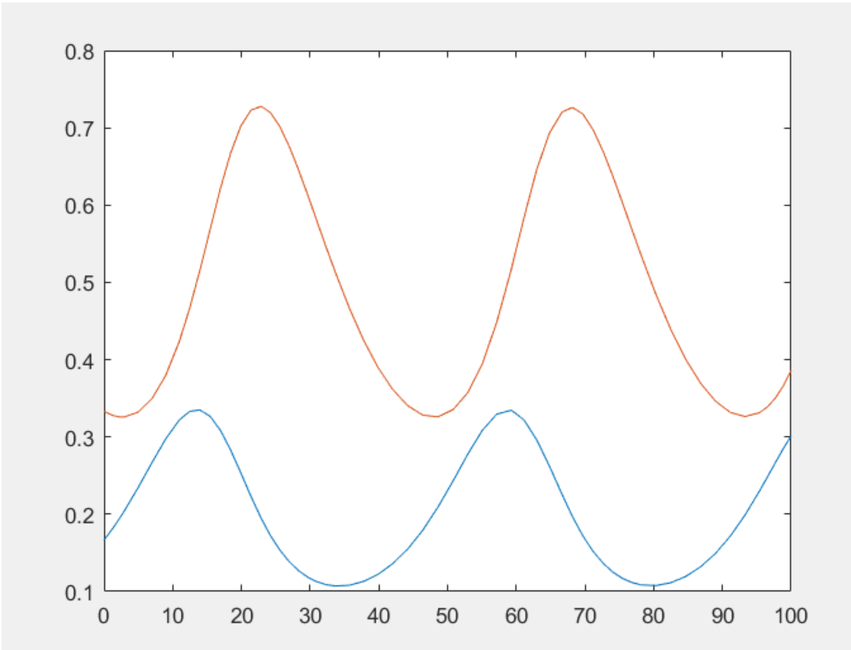
Mathematical Analysis:



The population of the prey and predator fluctuate around the equilibrium point x(t)=5 and y(t)=2.

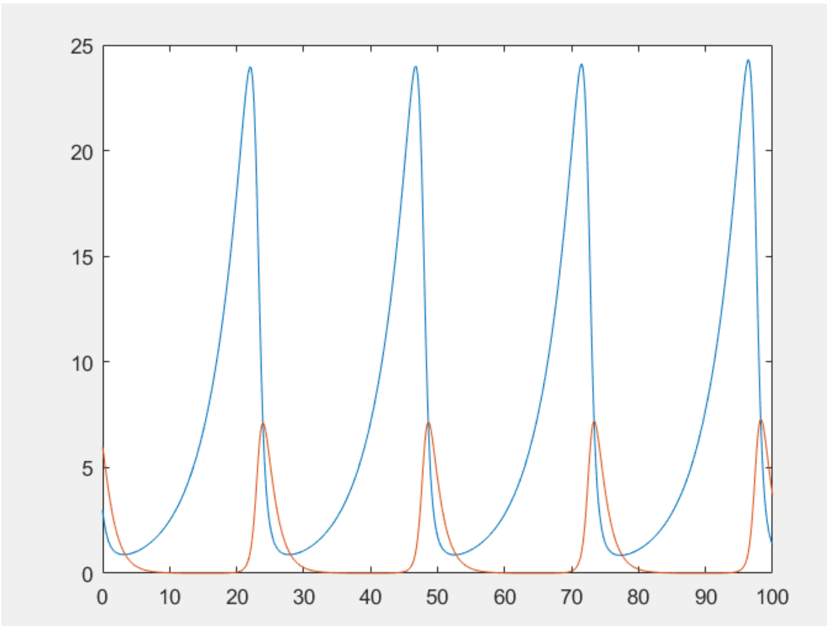
Interpretation of the result: For the prey population, if the interaction of predator on prey is less than the increase in the population of prey, we have coefficient of gamma=.5 and delta=.1. For the predator population, so we have the coefficient alpha=.4 and beta=.2. For such a case, the population of both fluctuate around their stable population which x(t)=5 and y(t)=2. There is more prey population than predator.



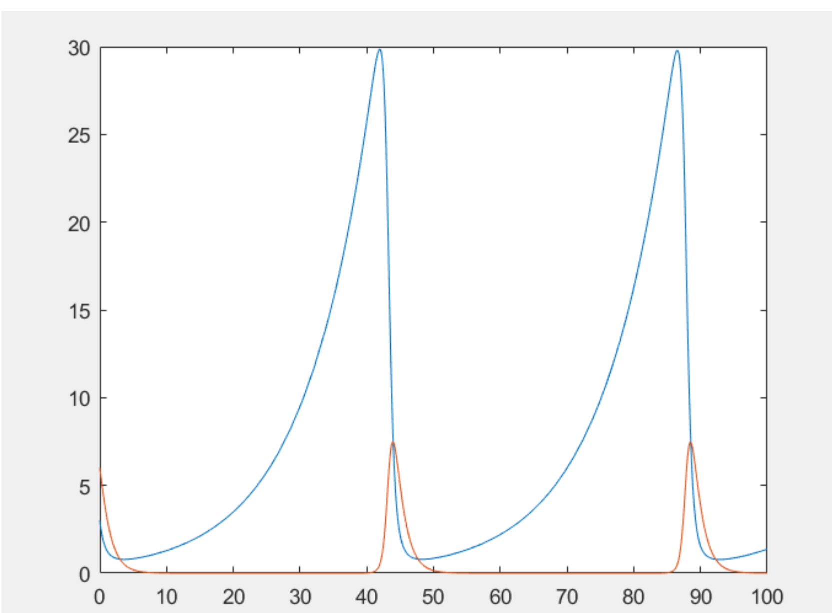
For the prey population, if the interaction of the predator is more than the rate of increase of the population prey then we have the coefficients of gamma=.1 and delta=.5. For the predator population, so we have the coefficient alpha=.2 and beta=.4. For such a case, the population of both fluctuate around their stable population which x(t)=1/5 and y(t)=1/2.But there is more predator population than prey.

From this, we can see that initially the population of the prey is increasing and predation is also increasing but a bit lagging behind. So when the predator population increases and is more than the prey, the predator population catches up and but because of lack of prey, the predator population start to decline and the prey population starts to rise again. This cycle continues.

Model 2:



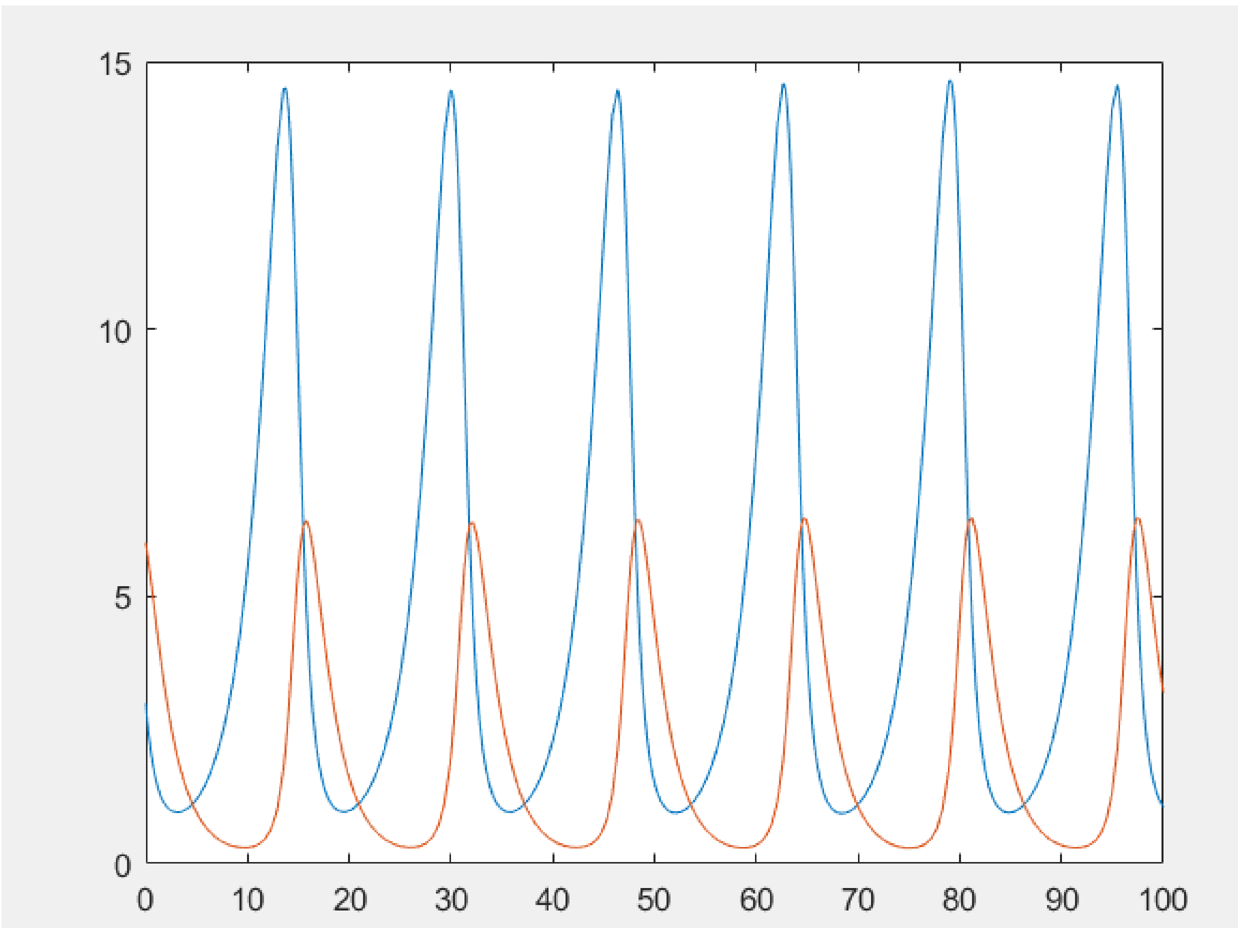
25
20
15
10
5
0
0 10 20 30 40 50 60 70 80 90 100

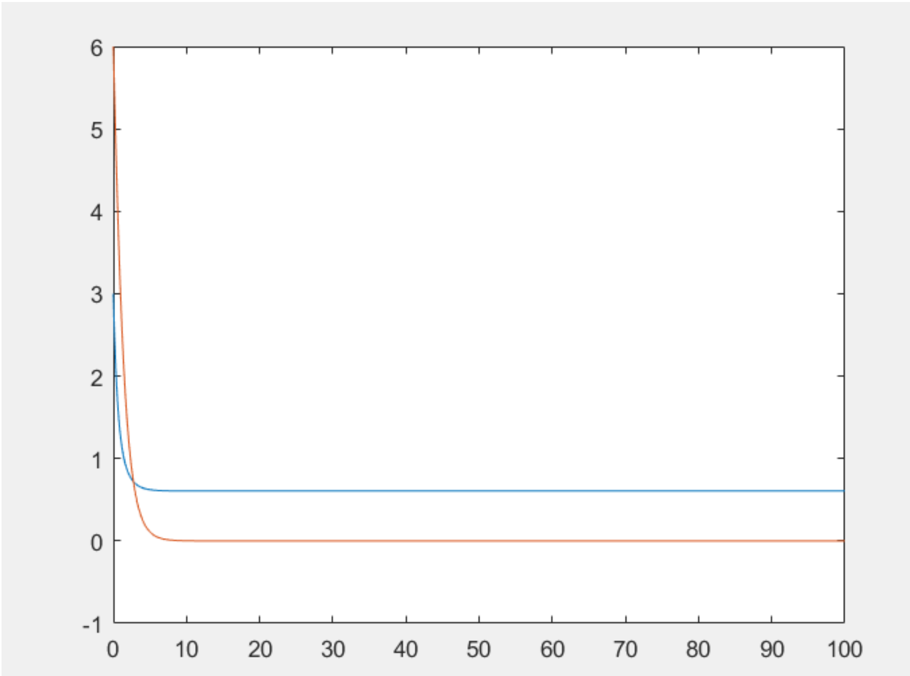


30
25
20
15
10
5
0
0 10 20 30 40 50 60 70 80 90 100

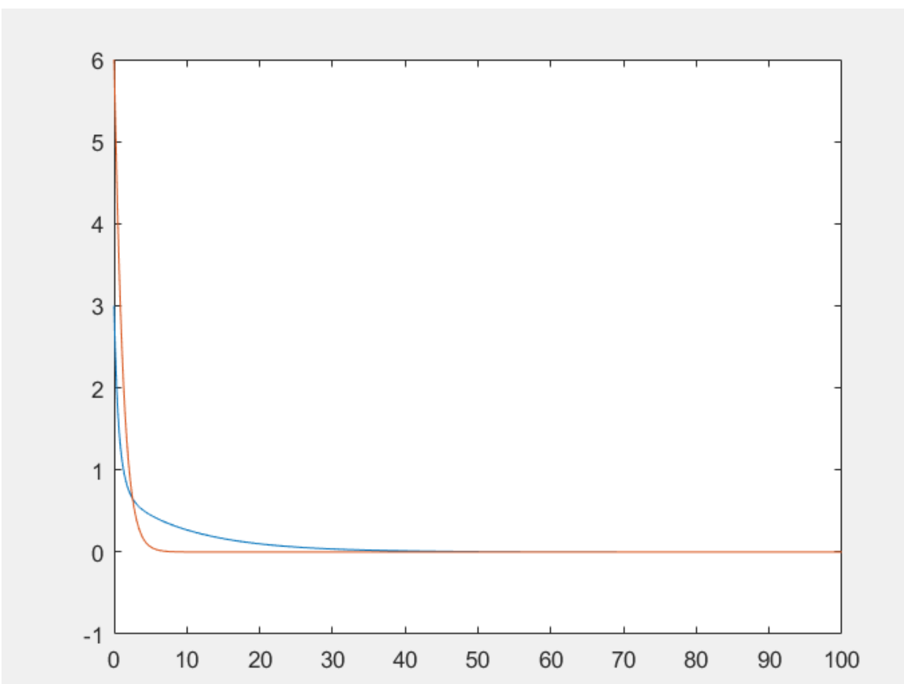
Fishing reduces the rate of increase of the prey, so say,alpha-E and increases the rate of decrease of the predator, so gamma +m but does not affect the interaction coefficients. So y(t)=(alpha-E)/beta , the average number of predator is decreased by fishing and the average number of prey is increased.

Stopping fishing, increases the average number of predators to increase and the decrease in the average number of prey. Illutration:

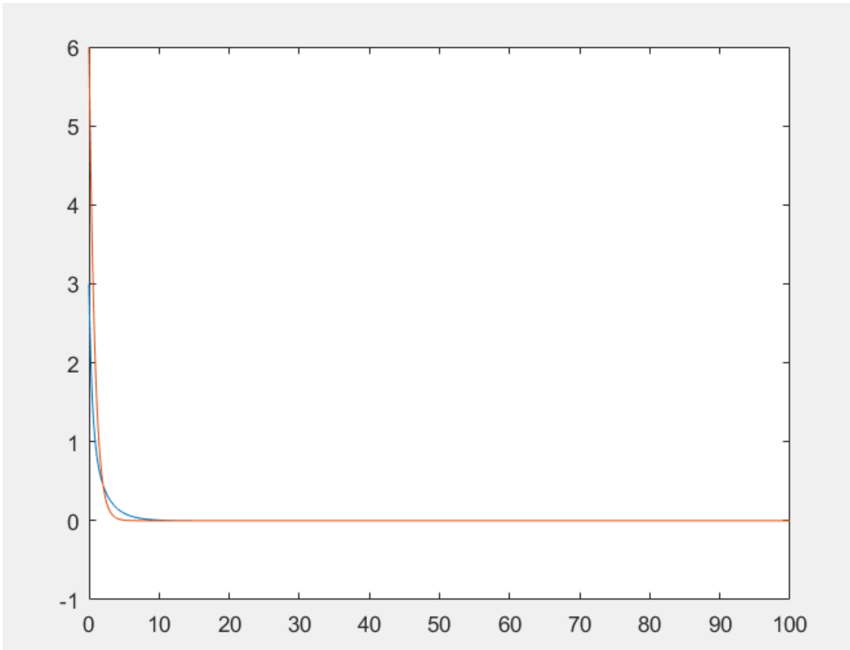


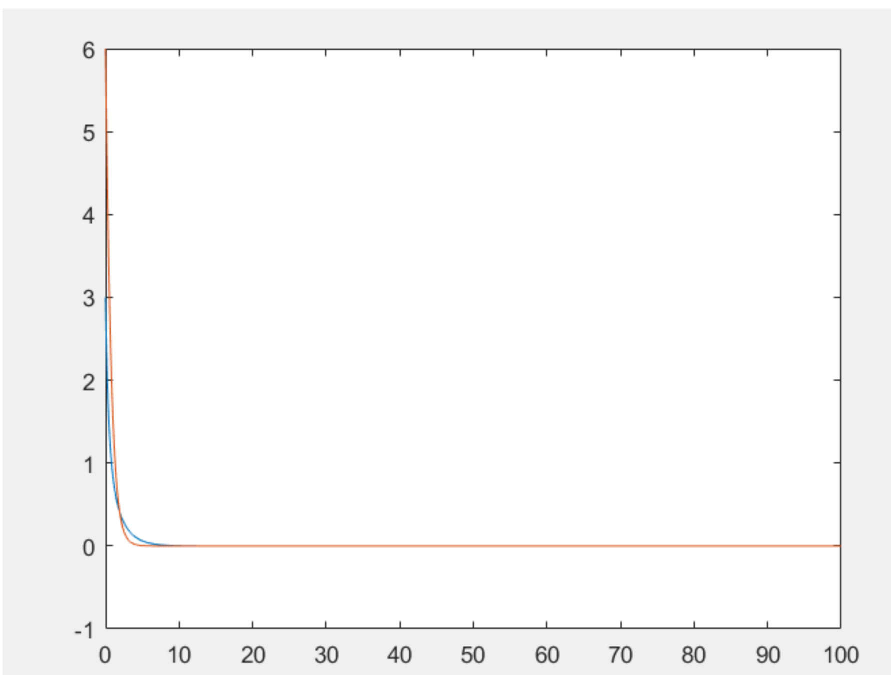


When alpha and E are equal, we have y(t)=0 as (alpha-E)/beta=0. But there is a constant population of prey as there is no predator to feed on them.



When there is overfishing, E is greater than alpha, then the population of the prey decreases.





Eventually, both the prey and predator become extinct for E big enough.

Interpretation: When there is moderate fishing, the rate of increase of the prey decreases so the average population of the predator decreases while the average population of the prey increases. When fishing is stopped, then the rate of the increase of the prey increases and so the predator average population increases. Other than that, overfishing causes, the predator population to die out first followed by the prey.

For the insecticide treatment, the prey average population will increase according to the model as firstly, the predator might also be a victim of the insecticide and also because the rate of increase of the prey will decrease so the average population of the predator will fall drastically. This creates a paradox where the insecticide which was supposed to decrease the average population of the prey in return increases the average population of the prey in the long run.