Assignment #3: Predator-Prey Model

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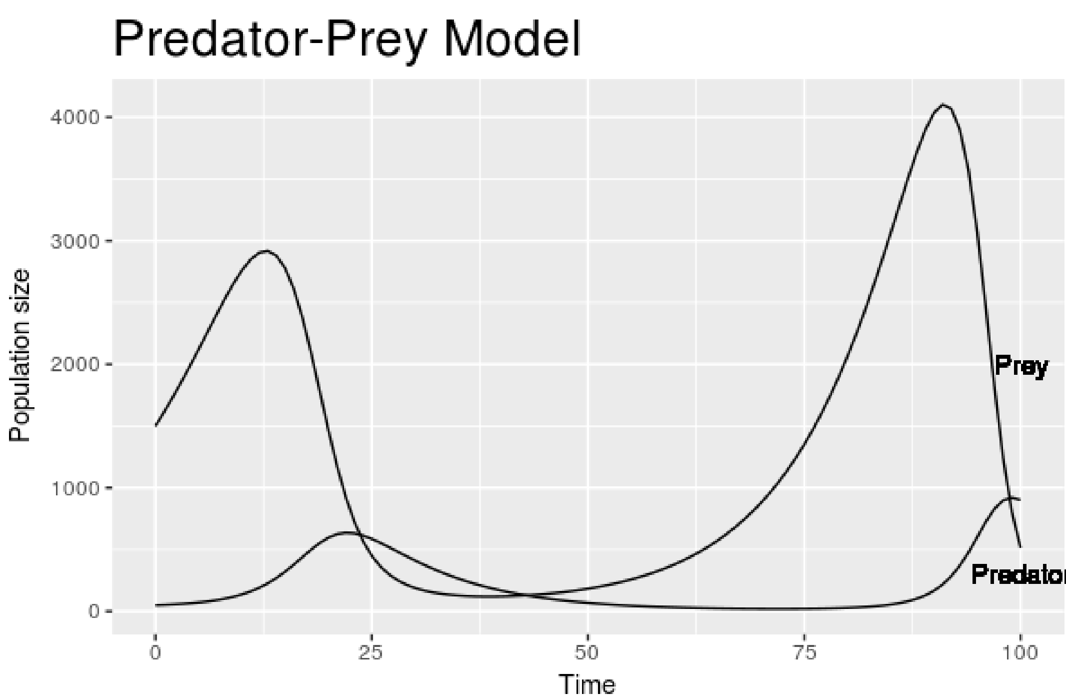
1 A Brief Introduction

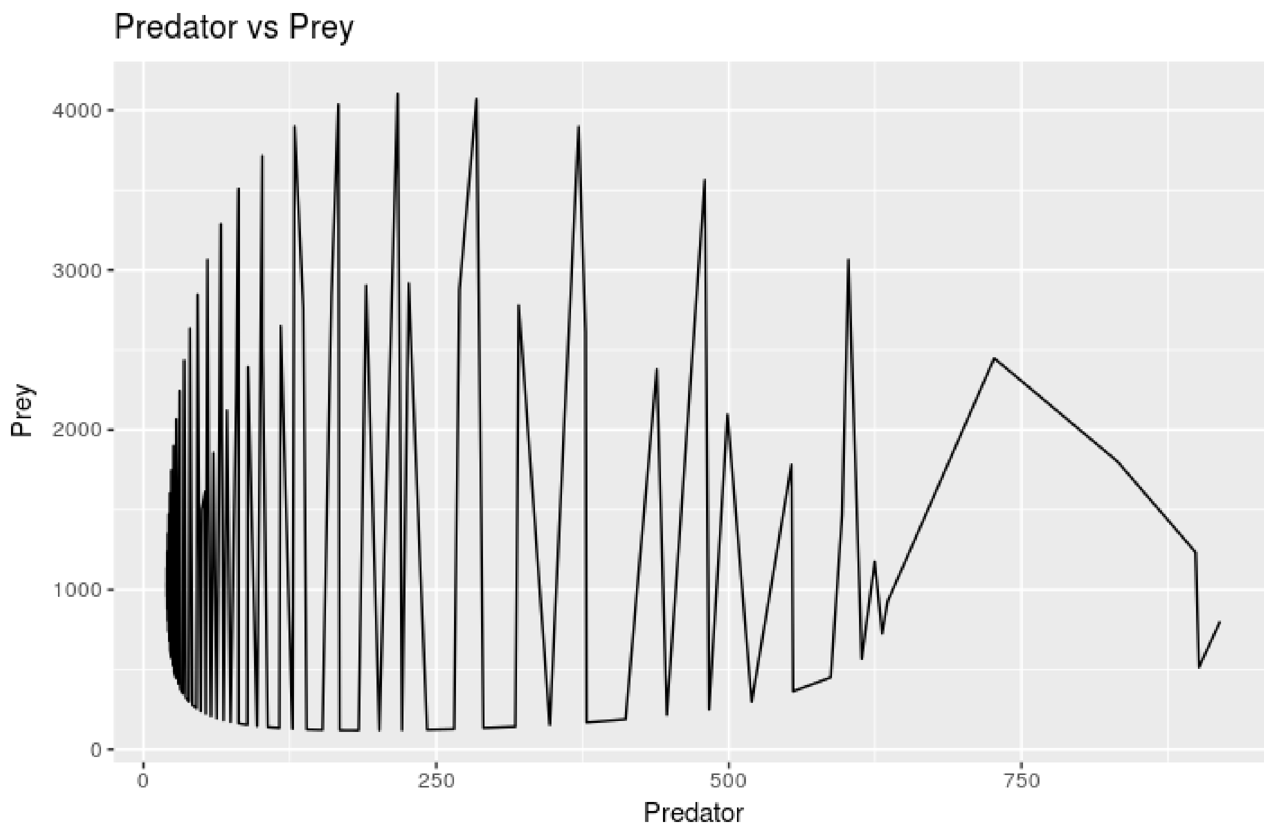
In this lab, I am observing the relationship between the prey and the predator and to create a model illustrating the results from the relationship. The prey model is represented by the equation, $V_{t+1} = V_t + rV - aV_tP_t$. Whie the predator model is represented by the model, $P_{t+1} = P_t + abV_tP_t - dP_t$.

2 Results

2.0.1 Prey and Predator Population Size Over Time



2.1 Predator vs. Prey Population Size



3 Conclusion

By analyzing the results from the graph, I concluded that the rise of the prey population is due to a lower population size of the predator. When the prey population decreases, then the graph shows an increase in the predator's population.

4 Appendix

4.0.1 C/C++ Code for Exponential Growth Model

```
#include <iostream>
#include <stdio.h>
#include <fstream>
#include <string>
#include <string.h>



using namespace std;

int main()
{
  int n; // size of array


  // Initializing model parameters
  double r = 0.1;
  double a = 0.0005;
  double d = 0.1;
  double b = 0.2;


  cout << "Enter time(months): " << endl;
  cin >> n;

  double V[n]; // V_t is the prey model
  double P[n]; // Predator model

  V[0] = 1500; // initialize the prey to 1500 starting size
  P[0] = 50;



  for (int t = 0; t < n; ++t)
  {
    V[t + 1] = V[t] + (r * V[t]) - (a * V[t] * P[t]);

    P[t + 1] = P[t] + ( a * b * V[t] * P[t]) - (d * P[t]);
  }

/*  ofstream outFile;
```

```
  outFile.open("input.txt");

  for (int i = 0; i < n; ++i)
  {
    string data;
    outFile <<  printf("%7.1d\t%7.2f\t%7.2f\n", i ,V[i], P[i] );

  }

  outFile.close();*/

  char text[100];
  char filename[100];
  FILE *outfile;

  printf( "Save data to disk file ? (y/n) : " );
  scanf( "%s", text );
  if ( strcmp( text, "y" ) == 0 )
  {
    printf( "Enter filename for first dataset : " );
    scanf( "%s", filename );
    outfile = fopen( filename, "w" );
    for ( int i = 0; i <= n; i++ )
    {
      fprintf( outfile, "%7.1d\t%7.2f\t%7.2f\n", i ,V[i], P[i] );
    }
    fclose( outfile );


  }
}
```

4.0.2 R Code for Generating Predator and Prey Population Size Over Time

```

library(ggplot2)
library(directlabels)
my_data <- read.csv(file.choose(), sep = '\t', header=FALSE)
names(my_data)
names(my_data) <- c("Time","Prey","Predator")

head(my_data)
```

```

graph <- ggplot(my_data, aes(x= Time)) + ggtitle("Predator-Prey Model") + geom_line(aes(y=Prey)) + geom_line(aes(y=Predator)) +ylab(label="Population size") + geom_text(aes(x= 100, y = 2000, label= "Prey")) + geom_text(x = 100, y = 300, label ="Predator" )
graph + theme(plot.title = element_text(size=21))
```

4.1 R code for Generating Predator vs Prey Population Size

```
library(ggplot2)
library(directlabels)
my_data <- read.csv(file.choose(), sep = '\t', header=FALSE)
names(my_data)
names(my_data) <- c("Time","Prey","Predator")

head(my_data)
ggplot(my_data, aes(x = Predator , y = Prey)) + geom_line() + ggtitle("Predator vs Prey")
```