Predator Prey Lab Exercise L3

Name _____ Date_____

Objective: To compare predator and prey populations over time in a small ecosystem.

Introduction: In 1970 the deer population of a small island forest preserve was about 2000 animals. Although the island had excellent vegetation for feeding, the food supply obviously had limits. Therefore the wildlife service rangers feared that overgrazing might lead to mass starvation. Since the area was too remote for hunters, the wildlife service decided to bring in natural predators to control the deer population. It was hoped that natural predation would keep the deer population from becoming too large and also increase the deer quality (or health) since predators often pick the weaker members of the herd. In 1971, ten wolves were flown into the island.

Procedures:

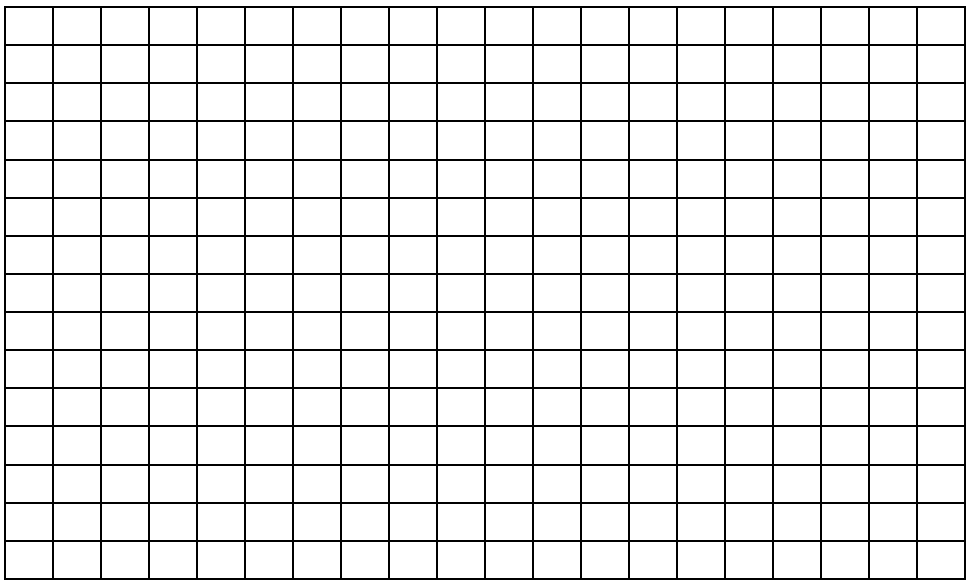
1. The results of this program are shown in the following table. The Population Change is the number of deer born minus the number of deer that died during that year. Fill out the last column for each year (the first has been calculated for you).

	Year	Wolf Population	Deer Population	Deer Born	Deer Predation	Deer Starvation	Deer Population Change
1971	0	10	2,000	800	400	100	+300
1972	1	12	2,300	920	480	240	
1973	2	16	2,500	1,000	639	498	
1974	3	22	2.363	944	891	191	
1975	4	28	2,225	996	1,114	20	
1976	5	24	2,087	836	953	2	
1977	6	21	1,968	788	840	0	
1978	7	18	1,916	766	720	0	
1979	8	19	1,962	780	760	0	
1980	9	19	1,982	790	760	0	

2. Graph the deer and wolf populations on the graph below. This information is in grey in the data table. Use different scales for the wolf population and the deer population on the y axis. For the deer population, use one box/200 deer; use one box/2 wolves for the wolf population. Use one color to show deer populations and another color to show wolf populations.
3. Connect the data points.
4. Add a title and key to your graph.

Title:_____

Deer Population



Wolf Population

Years

Key:

Questions:

1. Look at your graph. Describe the changes to the deer and wolf populations between 1971 and 1980 (years 0 and 9).

   Deer population: _____

   _____

   Wolf population: _____

   _____

2. Between what years did

   - the deer population have the greatest increase? _____
   - the deer population have the greatest decrease? _____
   - the wolf population have the greatest increase? _____
   - the wolf population have the greatest decrease? _____

3. What do you think would have happened to the deer population on the island between 1971 and 1980 (years 0 and 9) if wolves had NOT been introduced?

   _____

   _____

   _____

   _____

   _____

4. Predict what happened to the size of the deer population after 1980 (year 9). Explain your prediction.

   _____

   _____

5. Predict what your graph would look like when the ecosystem reached carrying capacity. Recall that carrying capacity is the maximum population of a given species that can survive indefinitely in a given environment.

_____

_____

_____

6. Use the information from the graph to calculate the unit rates of change for the deer and wolf populations. Use the formula to complete the chart below.

$$\text{Unit Rate of Change} = \frac{\Delta \text{ Number of deer (or wolves)}}{\Delta \text{ Years}} = \frac{\Delta y}{\Delta x} = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

Graph segment Ordered Pairs	**Δ Number of deer Δy**	**Δ Years Δx**	**Unit Rate of Change Δy/Δx**
Deer population from 1971-1972 (years 0-1) (_____, _____) (_____, _____)			
Deer population from 1973-1976 (years 2-5) (_____, _____) (_____, _____)			
Graph segment	**Δ Number of wolves Δy**	**Δ Years Δx**	**Unit Rate of Change Δy/Δx**
Wolf population from 1973- 1975 (years 2-4) (_____, _____) (_____, _____)			
Wolf population from 1976- 1978 (years 5-7) (_____, _____) (_____, _____)			

7. What does a positive (+) unit rate of change tell you about a population? What does a negative (-) unit rate of change tell you about a population?

_____

_____

_____

8. We are going to focus on two lines on the wolf graph: 1973-1975 AND 1976-1978. Using the unit rate of change that you already calculated in #6, and one of the ordered pairs, determine the y-intercept for both lines. The equation for a line is

   y = mx + b
   where m is the unit rate of change (slope) and
   b is the y-intercept

Y Intercept – Wolf graph line from 1973-1975 (years 2-4)	Y Intercept – Wolf graph line from 1976-1978 (years 5-7)
m = Ordered pair (x, y) = (___ , ___) y = mx +b Solve for b:	m = Ordered pair (x, y) = (___ , ___) y = mx +b Solve for b:

9. Based on the unit rates of change you calculated above and the y intercepts, write an equations for the lines on the wolf curve from 1973-1975 and 1976-1978.

Equation - Wolf graph line from 1973-1975 (years 2-4)	Equation - Wolf graph line from 1976-1978 (years 5-7)

10. Using the equations above, calculate:
    a) what the wolf population would be in 1985 (year 14) if the population in 1975 continued to grow.

    b) which year the wolf population would be zero if the population continued to decline after 1978 (year 7).

11. Why would a scientist be incorrect to use Equation #1 or Equation #2 to predict a future wolf population?

_____

_____

_____

Final thoughts:

Most biology textbooks describe that predators and prey exist in a balance. This "balance of nature" hypothesis has been criticized by some scientists because it suggests a relationship between predators and prey that is good and necessary. Opponents of this hypothesis propose the following questions:
Why is death by predators more natural or "right" then death by starvation?
How does one determine when an ecosystem is in "balance"?
Do predators really kill only the old and sick prey? What evidence is there for this statement?
What is your opinion of the balance of nature hypothesis? Would the deer on the island be better off, worse off, or about the same without the wolves? Defend your position.