Predator Prey Population Oscillation Lab

Background

In ecosystems of the world today there are many different relationships present between organisms. Within those relationships, the organisms involved may be benefited, harmed, or neither. We can classify these relationships based on the impact of the relationship on the organism. One type of relationship that exists between certain organisms is a predator prey relationship. This lab looks at how that type of relationship impacts the populations of both species.

Pre-lab Questions

1. Define the following terms:
   a. Predator -

   b. Prey -

   c. Population -

2. Give an example of a predator prey relationship from your own experience. Be sure to identify which organism is the prey species and which one is the predator species.

3. List at least 3 abiotic factors AND explain how they can each impact the populations of different species in an ecosystem.

4. List at least 3 biotic factors AND explain how they can impact the populations of different species in the same ecosystem as question 3.

Materials

prey species	predator species	pen or pencil
paper box lid	plastic spoon	plastic cup
orange and blue colored pencils		plastic bag
2 inch radius transparency circle		calculator (opt)

Procedure

1. Start by adding 4 predators to your plastic cup. Next add 40 prey to the cup.
2. If using edible species, **DO NOT EAT ANY OF YOUR CRITTERS UNTIL YOU ARE DONE WITH THE LAB.**
3. One member of the team will shake the cup and then gently shake the contents into the paper box lid. Use a side- to- side motion when shaking the organisms out of the cup.
4. The second team member will evaluate which of the organisms "survived" the round. In order for a predator to survive they must "eat" 6 prey. Lay the transparency circle on one of the predators, placing the dot of the circle on the center of the predator. Any of the prey that are

either completely or partially under the circle are close enough that the predator can capture and eat them. If they are eaten they must be removed from the box for the next round. If the predator does not have at least 6 prey close enough to capture, it too will die and need to be removed from the box lid. If two predators are close enough that they both fit under the circle then 12 prey must be close enough for them to capture or they will both starve to death.
5. Once you have determined which ones need to be removed from the box, count the number of each species eaten and those that survived and record this information in the data table.
6. Each remaining predator produces one offspring and each remaining prey produces two offspring. Calculate the population changes for the next round and enter that data into the table. If all of your predators starve to death you must run through the next round without predators unless you have 40 prey remaining. Once the prey population is back up to at least 40 then reintroduce 4 predators for the following round.
7. Put the correct number of prey and predator species in the cup and repeat steps 3-6 for a total of 20 rounds.
8. If the number of predators becomes large enough that placing them in the cup is not practical, place them in the box and shake it 4-5 times before adding the prey using the same technique that you used before.
9. When you have completed all trials, check with your teacher to make sure that you have all of the data you need before becoming the ultimate predator and consuming all of the organisms involved (if you used the edible species).
10. Once the class is finished, the data will be compiled into a class data sheet using Excel. A series of graphs will be made to show the relationship between the predators and prey over time. When plotting the individual team graphs, use orange for the predator data and blue for the prey data.

Data and Graphs
See the data table at the end of the lab.

Graphs needed for this lab will include:

Graph 1 will be a line graph showing your population of the prey species for all trials.

Graph 2 will be a line graph showing your population of the predator species for all trials.

Graph 3 will be a triple axes line graph with the data for both predator and prey for all trials. The predator data will be plotted on the left hand y axis and the prey data will be plotted on the right hand y axis. Use the same scale that you used on graphs 1 and 2.

Graph 4 will be a bar graph showing the number of deaths for each round or trial. Each trial will have two bars, one for predators and one for prey.

A set of four additional graphs will be plotted using class data and Excel. You will produce the same type of graphs as you did for your individual team data. Instructions on entering data into Excel and making graphs are included at the end of this lab.

Post Lab Conclusions
1. What type of relationship is presented by the graphed data, both yours and the class's?

2. What happens to the prey species when the predator species population increases? Why?

3. What happens to the predator species when the prey species population increases? Why?

4. Describe at least three other limiting factors (other than the number of predators or prey) that can affect population sizes. What effect does each of these limiting factors have on the populations?

5. Describe at least three behaviors that either predators or prey use to increase their chances of survival. Explain how these behaviors help the organism to survive.

6. What was the purpose of graphing the data individually for the predator and the prey and then again with both species on the same graph?

7. What was the purpose of graphing the class data?

8. Describe what would happen if either your predator or prey species died out before the end of the 20 trials.

a. Construct a hypothesis of what would happen in a real ecosystem if this were to occur.

b. What is an example from our area that correlates to this situation?

c. What steps could be taken to correct this situation?

Instructions for using Excel for class data

1. Open your browser and go to Microsoft Live. Click on SkyDrive. If necessary, sign in as jraish@avocacsd.org, password 224tigers.
2. Once in SkyDrive, go to Predator prey data table and open it. You should see a data table that looks exactly like the one you used for your team data.
3. Click on the first box or cell (B3) and go up to the function line just below the word clipboard. Type in +4, then move to the second cell and type in +40, etc. for each cell. Be sure to enter a + sign each time.
4. Continue this for each round until you have added in all of your data from the 20 rounds.
5. When the class has finished entering all of the data you can create scatter graphs and print them off for your report.

Teacher Notes

- To decrease student frustration with the counting aspect of this lab I would suggest counting out prey species into groups of 100 and placing them in a snack bag marked 100. If you would like to do this by mass, 100 mini M&Ms have an average mass of 3.05 g.
- If the predator species dies out in the first few rounds, have the students run the next round without predators or until the number of prey is at least 40. At that point, have them reintroduce 4 predators into the environment and continue as before.
- If either the predator or prey species dies out in the last 3 or 4 rounds of the total of 20 rounds, have the students continue to calculate what the remaining population numbers will be at the end of the 20 trials. You may want to introduce the concept of survivorship and give them a survivorship percentage to factor into their calculations.
- Although this lab works well using Swedish fish as the predator and mini M & M's for the prey species, for those teachers who may not want to use edible species I have found that 2 cm wooden cubes and pony beads also work well.
- The dots in the middle of the transparency circles tend to wear off over time and will need to be periodically refreshed.
- Calculators are highly recommended for this lab.
- In order to set up a live editable spreadsheet on Microsoft Live or Google Docs you may need to update your software.