APES PREDATION LAB: PREDATOR-PREY INTERACTIONS

WHAT TO TURN IN:	Hypothesis	Data Table	Graph	Error Analysis	Conclusion	Questions

OBJECTIVES

- To model interactions between populations of owls and mice.
- To measure the sizes of the populations as they change over several generations.
- To graph the data obtained.

BACKGROUND INFORMATION

Predator organisms feed upon other organisms, called prey. The predators depend on the populations of these prey organisms. The number of predator organisms depends on the numbers of the prey. The number of prey is limited by the number of predators that feed on them. In other words, the size of predator and prey populations is dependent on each other. Owls are predators. They feed on smaller organisms such as mice. As predators, owls occur high in a food chain of forest organisms. Mice occur lower on the food chain.

In this model of predator/prey interactions, one must make simplifying assumptions:

- Assume owls feed only on mice.
- Assume that all owls that can catch and eat a certain number of mice will survive and reproduce.

These assumptions are like patterns that exist in nature, but they do not mirror them exactly. Assumptions are useful, however, in simplifying the model so that population patterns emerge and can be analyzed.

MATERIALS: cardboard, paper, masking tape, metric ruler, graph paper, scissors

HYPOTHESIS TOPIC: How do you think the numbers of owls and mice will change?

PROCEDURE, DAY 1:

If applicable, complete steps 1-2.

1. Obtain or print graph paper and cut out *200 squares*. OR Use the metric ruler and a sheet of paper to create a grid of squares that are each *1 cm* on a side. Draw enough lines to make *200 squares*, each of which will represent a mouse. Use scissors to carefully cut out the squares.

2. Draw and cut out a cardboard square that is *6 cm* on a side. This larger square will represent an owl.

If you are given materials, begin here.

3. You will simulate *25 generations* of mice and owls that live within a habitat. For this simulation, assume that each mouse not eaten by an owl survives and produces one offspring. To avoid starvation, each owl must catch at least three mice. Assume that each surviving owl produces one offspring for every three mice it has caught. To represent the habitat, place masking tape on a counter or table top to make a square *30 cm* on a side.

4. Place 100 of the mouse squares randomly within the habitat square. Do not allow any to overlap. This set of 100 squares represents the *first generation* of the mouse population. Set aside the 100 remaining mouse squares in a pile for later use.

5. Hold the owl square above the habitat square and drop it onto the habitat. Assume that any mouse square that is at least partially covered by the owl square is a catch. Catch as many of the mice as you can with one drop. Remove and count the captured mice. Assume that there are two owls in the first generation,

and drop the owl square a second time to represent the feeding attempt of this second owl. Again, remove and count any mice that have been caught.

6. In column D of the Data Table, record the *total number of mice caught by both owls*. Note that columns B and C have already been filled in with the original numbers of mice and owls in the first generation.

7. Each mouse that has not been caught is assumed to produce one offspring. Add to the habitat one offspring for each mouse that has not been caught. Use the pile of mouse squares that you reserved earlier as offspring. In column F, record the *total number of surviving mice and offspring*.

8. Determine whether each of the owls survives and reproduces. (Remember that an owl must catch at least three mice to survive, and that it produces one offspring for every three mice it has caught.) Note and record in column F of the Data Table the *number of owls that have starved*. Record in column G the *total number of surviving owls and their offspring*. This number will equal the number of drops to be made by owls in the next generation.

9. Copy the numbers from columns F and G of generation 1 to columns B and C, respectively, of generation 2. These numbers represent the population sizes of mice and owls present at the start of the second generation.

SUMMARY OF HELPFUL HINTS:

Minimum owl population = 1
Minimum mouse population = 3
Maximum mouse population = 200
Column F = [(# mice not caught) x 2], not to exceed 200
Column G = (Column D / 3) + (# owls which did not starve)

PROCEDURE, DAY 2:

10. Repeat steps 5 through 9 until you have simulated 25 generations. Stop after the owls from the 24th generation feed. Make certain that at the beginning of each generation there are at least three mice and one owl in the habitat. If the populations fall too low, bring the numbers up to these minimum values by adding mouse squares or allowing one owl drop. Also note that the mouse population cannot exceed 200.

11. On a sheet of graph paper, use your data to make a line graph of the numbers of mice and owls at the beginning of each generation versus the generation number. Plot the *generation number* (1-25) along the *x*-axis. Plot the *numbers of mice and owls* (columns B and C) along the *y*-axis. Use dots to mark the numbers of mice and Xs to mark the numbers of owls. Connect the dots to form a curve for mice. Connect the Xs to form a curve for owls. Using different colors is optional.

QUESTIONS (to be done after the data table and graph are completed)

1) What happened to the mouse population during the first few generations? What happened to the owls during this period?
2) What happened to the mouse population after many more generations? What happened to the owl population?
3) Based on your graph, relate the trends in population sizes of the mice and owls.
4) Suppose you were given an unlabeled graph of owl and mice populations. Given what you observed on the graph you made, how could you infer which curve represented the owls and which represented the mice?
5) Compare your model of interactions between the owl and mouse populations with what might actually occur in a community that includes owls and mice. How do you account for the difference?