Name: _____ Date: _____

Student Exploration: Food Chain

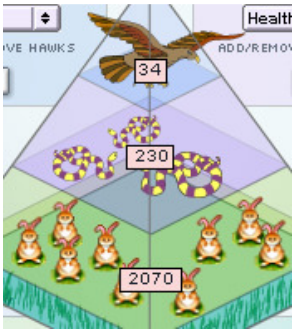
Vocabulary: consumer, ecosystem, equilibrium, food chain, population, predator, prey, producer

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
The *Food Chain* Gizmo™ shows a **food chain** with hawks, snakes, rabbits, and grass. In this simulation, the hawks eat snakes, the snakes eat rabbits, and the rabbits eat grass.

1. **Producers** are organisms that do not need to eat other organisms to obtain energy.
   A. Which organism is a producer in this food chain? _____
   B. Where does the producer get its energy? _____

2. **Consumers** must eat other organisms for energy. Which organisms are consumers in this food chain? _____

Gizmo Warm-up
The SIMULATION pane of the Gizmo shows the current **population**, or number, of each organism in the food chain.



1. What are the current populations of each organism?
   Hawks: _____ Snakes: _____ Rabbits: _____ Grass: _____

2. Select the BAR CHART tab, and click **Play** ( ). What do you notice about each population as time goes by?
   _____
   If populations don't change very much over time, the ecosystem is in **equilibrium**.

3. Compare the equilibrium populations of the four organisms. Why do you think populations decrease at higher levels of the food chain? _____
   _____
   _____

Activity A: **Predator-prey relationships**	Get the Gizmo ready: • Click **Reset** ( ). • Check that the BAR CHART tab is selected.	

Question: Predators are animals that hunt other animals, called prey. How do predator and prey populations affect one another?

1. Observe: Run the Gizmo with several different starting conditions. You can use the **+** or **–** buttons to add or remove organisms, or you can choose **Diseased** from the dropdown lists.

2. Form hypothesis: How do you think predator and prey populations affect one another?

   _____

   _____

3. Predict: Based on your hypothesis, predict how changing the rabbit population will affect the other organisms at first. Write "Increase" or "Decrease" next to each "Prediction" in the table.

Change	Grass	Snakes	Hawks
Doubling rabbit population	Prediction: Result:	Prediction: Result:	Prediction: Result:
Halving rabbit population	Prediction: Result:	Prediction: Result:	Prediction: Result:

4. Test: Add rabbits until the population is about twice as large as it was (200% of balance). Click **Play**, and then **Pause** ( ) after approximately ONE month. Next to each "Result" line in the table, write "Increase" or "Decrease." Click **Reset** and then halve the rabbit population (50% of balance). Record the results for this experiment in the table as well.

   A. How did doubling the rabbit population affect the grass, snakes, and hawks at first?

      _____

      _____

   B. How did halving the rabbit population affect the grass, snakes, and hawks at first?

      _____

      _____

(Activity A continued on next page)

Activity A (continued from previous page)

5. Predict: Predict how changing the snake and hawk populations will affect the other organisms within the first month. In the tables below, write your predictions.

Change	Grass	Rabbits	Hawks
Doubling snake population	Prediction: Result:	Prediction: Result:	Prediction: Result:
Halving snake population	Prediction: Result:	Prediction: Result:	Prediction: Result:

Change	Grass	Rabbits	Snakes
Doubling hawk population	Prediction: Result:	Prediction: Result:	Prediction: Result:
Halving hawk population	Prediction: Result:	Prediction: Result:	Prediction: Result:

6. Test: Click **Reset**. Try each experiment with the Gizmo. Record each result after one month.

   A. How did increasing the snakes affect the grass? _____

   Explain why: _____

   _____

   B. How did increasing the hawks affect the rabbits? _____

   Explain why: _____

   _____

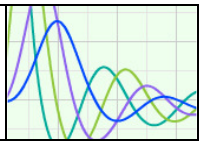
7. Draw conclusions: In general, what effect did removing prey have on predators? _____

   _____

   What effect did removing predators have on prey? _____

   _____

Extend your thinking: In North America, many top predators, such as wolves, have been driven nearly to extinction. What effect do you think this has on their main prey, deer? Write your answer on a separate sheet, and/or discuss with your classmates and teacher.

Activity B: **Long-term changes**	Get the Gizmo ready: • Click **Reset**. • Select the GRAPH tab.	

Question: An ecosystem is a group of living things and their physical environment. How do ecosystems react to major disturbances?

1. Observe: Kill off most of the hawks using the **–** button, and then click **Play**. Observe the GRAPH for about 12 months, and then click **Pause**. What happens?

   _____

   _____

2. Analyze: Explain why you think the population of each organism changed the way it did. (Use extra paper if necessary.)

   _____

   _____

   _____

3. Experiment: Click **Reset**. Try making other changes to the ecosystem. Use the **+** or **–** buttons, or choose **Diseased** from the dropdown lists. Click **Play** and observe for at least 12 months. Record what happens on another sheet of paper or in your notes.

4. Summarize: Give at least one example of each of the following:

   A. A major disturbance that the ecosystem was able to recover completely from.

      _____

   B. A major disturbance that caused the ecosystem to stabilize at a new equilibrium.

      _____

   C. A major disturbance that caused the ecosystem to completely collapse.

      _____

   D. (Challenge) A major disturbance that *almost* caused a total collapse, but that the ecosystem was able to recover from eventually.

      _____