Name: _____

Student Exploration: Rabbit Population by Season

Vocabulary: carrying capacity, density-dependent limiting factor, density-independent limiting factor, limiting factor, population, population density

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. Suppose you had a pet rabbit. What would the rabbit need to stay alive and healthy? (list at least 3 things)

   _____

2. A female rabbit can give birth to over 40 baby rabbits a year. Suppose all of her offspring survived and reproduced, all of their offspring survived and reproduced, and so on. If that happened, in only eight years the mass of rabbits would exceed the mass of Earth!

   So, why aren't we overrun with rabbits? What keeps the rabbit population in down?

   _____

   _____

Gizmo Warm-up

A **population** is a group of individuals of the same species that live in the same area. The size of a population is determined by many factors. In the Gizmo™, you will see how different factors influence how a rabbit population grows and changes.

1. Select the **BAR CHART** tab. What is the initial rabbit population?

   _____

2. Select the **TABLE** tab. Click **Play** ( ), and allow the simulation to run for **one year**.

   A. In which season did the rabbit population increase the most? _____

   B. In which season did the rabbit population increase the least? _____

Activity A: **Carrying capacity**	Get the Gizmo ready: • Click **Reset** ( ).	

Question: What determines how large a population can grow?

A **limiting factor** is any factor that controls the growth of a population. What do you think are some of the limiting factors for the rabbit population? _____

1. Run Gizmo:
   Select the **DESCRIPTION** tab.
   Set the **Simulation speed** to **Fast**.
   Select the **GRAPH** tab. Click **Play**, and allow the simulation to run for at least **10 years**.

A. Describe how the rabbit population changed over the course of 10 years.

_____

B. What pattern did you see repeated every year? _____

_____

C. How could you explain this pattern? _____

_____

2. Analyze: The **carrying capacity** is the maximum number of individuals of a particular species that an environment can support. All environments have carrying capacities.

   A. Find the environment's approximate carrying capacity for rabbits

   Population in the summer? _____ Population in the winter? _____

   Average of populations = carrying capacity _____

   B. When did the rabbit population reach carrying capacity? Explain how you know.

   _____

Activity B: **Density-dependent limiting factors**	Get the Gizmo ready: • Click **Reset**. • On the SIMULATION pane, make sure **Ample** is selected for the amount of **LAND** available.	

Introduction: **Population density** is the number of individuals in a population per unit of area. Some limiting factors only affect a population when its density reaches a certain level. These limiting factors are known as **density-dependent limiting factors**.

Question: How does a density-dependent limiting factor affect carrying capacity?

1. Think about it: What do you think some density-dependent limiting factors might be?

   _____

2. Predict: Suppose a shopping mall is built near a rabbit warren (home), leaving less land available for rabbits. How will this affect the environment's carrying capacity?

   _____

3. Experiment: Use the Gizmo to find the carrying capacity with **Ample**, **Moderate**, and **Little** land. List the carrying capacities below.

   Ample: _____ Moderate: _____ Little: _____

4. Analyze: How did the amount of space available to the rabbits affect how many individuals the environment could support? _____

5. Infer: Why do you think limiting a population's space decreases the carrying capacity?

_____

Activity C: **Density-independent limiting factors**	Get the Gizmo ready: • Click **Reset**. • On the SIMULATION pane, select **Ample** for the amount of **LAND** available.	

Introduction: Not all limiting factors are related to a population's density.
Density-independent limiting factors affect a population regardless of its size and density.

Question: How do density-independent limiting factors affect how a population grows?

1. Gather data: Click **Play**.
   Allow the population to reach **carrying capacity**.
   Click **Pause** ( ).
   Select the GRAPH tab and click the camera ( ) to take a snapshot of the graph.
   Paste the snapshot into the Explain Everything app. Label the graph "**Normal Weather**."

2. Investigate: Click **Reset**.
   Select **Harsh winter** from the **CONDITIONS** listed on the SIMULATION pane.
   Click **Play**, and observe the how the population changes over **five years**.
   Paste a snapshot of the graph into the Explain Everything app. Label the graph "**Harsh Winter**."
   A. How does the Harsh Winter graph differ from the Normal Weather graph?

   _____

   B. What do you think most likely caused the differences seen in the two graphs?

   _____

3. Investigate: Deselect **Harsh winter**.
   Select **Cold spring**. Click **Play**, and observe the how the population changes over a period of **five years**.
   Paste a snapshot of the graph into the Explain Everything app and label the graph "**Cold Spring**."
   A. How does the Cold Spring graph differ from the Normal Weather graph?

   _____

   B. What do you think most likely caused the differences seen in the two graphs?

   _____

4. Investigate: Deselect **Cold spring**.
   Select **Hot summer**.
   Click **Play**, and observe the how the population changes over a period of **five years**.
   Paste a snapshot of the graph into the Explain Everything app. Label the graph "**Hot Summer**."

   A. How does the Hot Summer graph differ from the Normal Weather graph?

   _____

   B. What do you think most likely caused the differences seen in the two graphs?

   _____