**Name: Period:**

**Duck, Duck, Growth Instructions**

**Limiting Factors and Carrying Capacity Lab**

**Purpose:**

In this lab students will explore the effects of limiting factors on a pair of ducks. Students will then examine why the limiting factors influences the carrying capacity of a population. Students will collect data and analyze it before drawing a conclusion about limiting factors and carrying capacity.



**Materials:**

* 200 black beans
* 1 4x4 cm piece blue paper
* 1 4x4 cm piece pink paper
* 15 4x4 cm grey/black paper
* 1 piece of printer paper (lake)

**Directions:**

1. Within your group verify that your bag has 200 black beans.
	1. *The printer paper represents the ecosystem (lake) while the black beans represent the fish (prey) within a lake.*
	2. *The squares of paper represent ducks (predators) each piece of paper is a duck*.
2. **Read each scenario. Add or remove fish from the lake as needed for each scenario.**
3. After the lake is filled with the needed fish take turns being the duck.
4. Drop each duck on the printer paper. Remove and record and fish that the duck lands on.
5. Each duck must catch at least four fish every 2 days, or it will die. Once a duck dies it will not be able to hunt any more.
6. ***At the conclusion of the activity please replace all items in the gallon size bag to ensure the next group has the needed materials.***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Day 0 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
| # fish caught  | x | 20 | 10 | 10 | 5 | 3 | 4 | 3 | 2 | 1 | 1 |
| # of ducks hunting  | x | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| # of ducks that survived 2 days | 2 |  | 2 |  | 2 |  | 1 |  | 1 |  | 0 |

**Example** of how to fill out the chart: In each scenario you will be told how many fish have to be captured for each duck to survive. In this example we will say that **each duck requires 4 fish every 2 days to survive. If you only catch 7 fish, only one duck survives. If you only catch 3 fish neither of your ducks survive.**

**To determine the # of ducks that survived 2 days add up the number of fish for those two days. If the number is 8 or more both ducks survive. If the number is 4-7 only 1 duck survives. If the number is less than 4 zero ducks survive.**

**Duck, Duck, Growth**

**Limiting Factors and Carrying Capacity Lab**

**Name: Period:**

**Think about it and predict:**

1. **What factors may affect the duck population?**

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1. **How will those factors affect the duck population?**

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**Data Collection**

**Scenario One: Control** Run

Place 50 “fish” in the “lake”. Take turns dropping the two “ducks” into the lake. Each drop of the pair of ducks counts as one day. (For example: drop blue duck once and pink duck once equals one day). Record fish caught for each day. **Each duck requires 4 fish every 2 days to survive. If you only catch 7 fish, only one duck survives. If you only catch 3 fish neither of your ducks survive.**

**Hypothesis**: I believe the duck population will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Day 0 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
| # fish caught  | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks hunting  | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks that survived 2 days | 2 |  |  |  |  |  |  |  |  |  |  |

**Scenario Two: Fish Spawning (having baby fish)**

The fish are spawning; place 100 “fish” in the “lake”. Take turns dropping the two “ducks” into the lake. Each drop of the pair of ducks counts as one day. (For example: drop blue duck once and pink duck once equals one day). Record fish caught for each day. **Each duck requires 4 fish every 2 days to survive. If you only catch 7 fish, only one duck survives. If you only catch 3 fish neither of your ducks survive.**

**Hypothesis**: I believe the duck population will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Day 0 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
| # fish caught  | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks hunting | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks that survived 2 days | 2 |  |  |  |  |  |  |  |  |  |  |

**Scenario Three: Pollution Run Off**

A local farm just fertilized their land. Shortly after the fertilizer was laid it rained. The rain caused the fertilizer to run off into the lake causing an algae bloom. The algae bloom killed half of the fish in the pond. Place 25 “fish” in the “lake”. Take turns dropping the two “ducks” into the lake. Each drop of the pair of ducks counts as one day. (For example: drop blue duck once and pink duck once equals one day). Record fish caught for each day **Each duck requires 4 fish every 2 days to survive. If you only catch 7 fish, only one duck survives. If you only catch 3 fish neither of your ducks survive.**

**Hypothesis**: I believe the duck population will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Day 0 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
| # fish caught  | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks hunting | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks that survived 2 days | 2 |  |  |  |  |  |  |  |  |  |  |

**Scenario Four: Drought!**

There is a drought and the lake begins to dry up and killing many fish! Place 10 “fish” in the “lake”. Take turns dropping the two “ducks” into the lake. Each drop of the pair of ducks counts as one day. (For example: drop blue duck once and pink duck once equals one day). Record fish caught for each day. **Each duck requires 4 fish every 2 days to survive. If you only catch 7 fish, only one duck survives. If you only catch 3 fish neither of your ducks survive.**

**Hypothesis**: I believe the duck population will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Day 0 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
| # fish caught  | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks hunting | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks that survived 2 days | 2 |  |  |  |  |  |  |  |  |  |  |

**Scenario Five: Ducklings (Ducks need more food to survive)**

It is the springtime and the ducks have a clutch of eggs that are hatching! There are now two ducklings and the ducks need to catch more fish to feed them! The ducks now have to catch six fish every 2 days to feed themselves and their young. Return to the original 50 “fish” within the “lake”. Take turns dropping the two “ducks” into the lake. Each drop of the pair of ducks counts as one day. (For example: drop blue duck once and pink duck once equals one day). Record fish caught for each day. **Each duck requires 6 fish every 2 days to survive. If you only catch 11 fish, only one duck survives. If you only catch 5 fish neither of your ducks survive.**

**Hypothesis**: I believe the duck population will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Day 0 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
| # fish caught  | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks hunting | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks that survived 2 days | 2 |  |  |  |  |  |  |  |  |  |  |

**(Stop and answer questions after scenario 5)**

**Scenario Six**: **Exponential** **Population Growth of Ducks**

You will now see the population grow until it can no longer expand. **Every day the population of ducks increases exponentially** (**doubles** for example: Day 1 has 2 ducks, Day 2 has 4 ducks, Day 3 will have 8 so on so forth). For simplicity reasons **each “duck” will now be required to catch 2 fish every 2 days**. Place 200 “fish” in the “lake”. Take turns dropping the “ducks” into the lake. Each drop of the pair of ducks counts as one day. (For example: drop blue duck once and pink duck once equals one day). Record fish caught for each day. **Add the appropriate number of gray/black “ducks” each day to represent the population growth. (day 2 drop 1 blue, 1 red, and 2 gray ducks)** **Remember: now each duck needs to catch 2 fish every 2 days.**

Hypothesis: I believe the duck population will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Data Table:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Day 0 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
| Number of fish caught | x |  |  |  |  |  |  |  |  |  |  |
| # of ducks hunting | x | 2 | 4 | 8 |  |  |  |  |  |  |  |
| # of ducks that survived 2 days | 2 |  | 4 |  |  |  |  |  |  |  |  |

**Double the daily total each day to determine the number of ducks for each day. Ducks need to catch 2 fish every 2 days to survive. The # of ducks that survived 2 days cannot be more than the number of fish caught in two days. (Count up the number of fish for the 2 days…divide that number by 2. That is the number of ducks that can survive)**

Name: Period:

**Duck Duck Growth Analyzing the Data: (complete after finishing scenario 5)**

**Directions:** Answer each question in a complete sentence **adding evidence from your data** as needed.

1. What pattern did you notice about the duck population as the fish population increased in scenario two?
2. What pattern did you notice about the duck population as the fish population decreased in scenario three?
3. What pattern did you notice about the duck population as the fish population decreased more in scenario four?
4. How did the ducklings influence the survival time of the overall duck population?
5. What variable controlled how long the duck population survived?
6. Are there any other factors that would influence the population of the ducks?
7. Graph the number of ducks every 2 days for each of the 5 scenarios. Graph each scenario as a separate line on the graph and make a key. Title your graph, Label both axis, Make a scale and graph the data.

 Title:

Key:

**Answer the following questions after finishing scenario 6**

1. How did the duck population change in scenario 6?
2. Why do you think the population changed in this way?
3. Graph the total number of ducks every 2 days for scenario 6. Make sure to include a title for each axis, graph title, and units on the axis.

 Title:



**Conclusion**: CER: (**Claim**, **Evidence**, **Reasoning**)

Make a claim about why limiting factors such as amount of food, pollution, and drought can limit population size. Give evidence (data) from your lab to support your claim. Provide scientific reasoning to explain the data you are presenting.

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