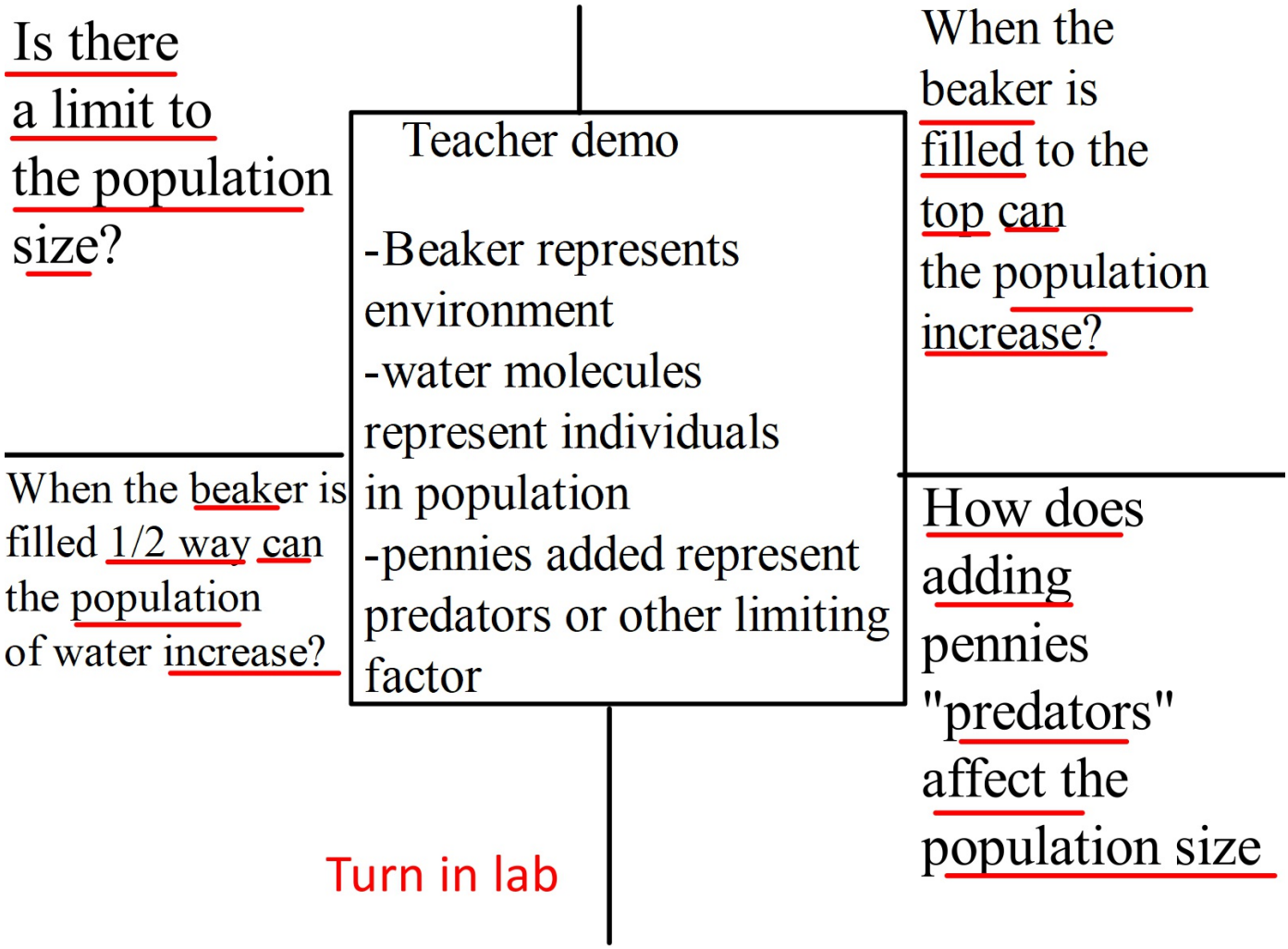
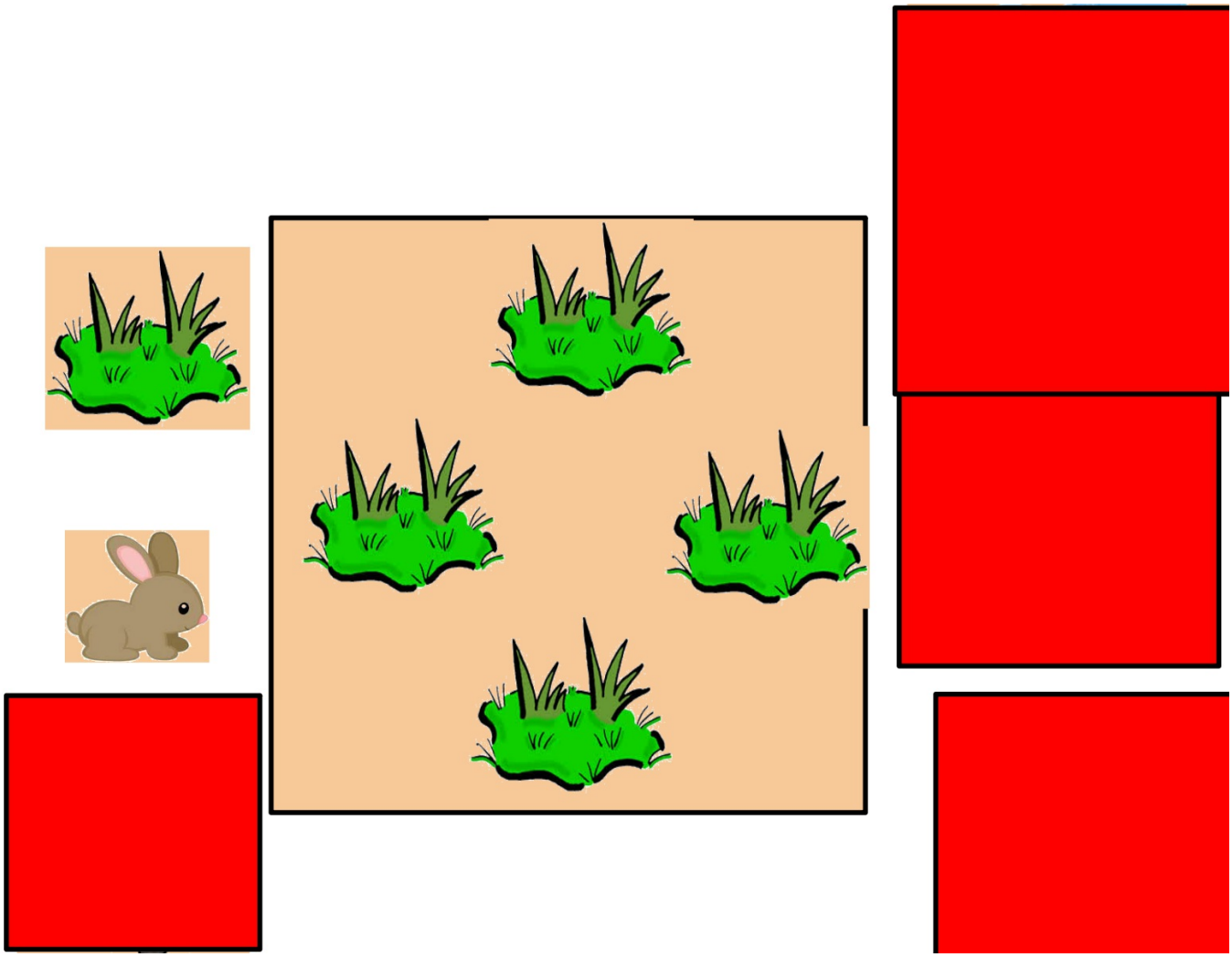

Is there a limit to the population size?
When the beaker is filled to the top can the population increase?
Teacher demo
-Beaker represents environment
-water molecules represent individuals in population
-pennies added represent predators or other limiting factor
When the beaker is filled 1/2 way can the population of water increase?
How does adding pennies "predators" affect the population size
Turn in lab



Objective: The student will identify the limiting factors of a population

Agenda: Warm up
Population Growth Capture Sheet/video
Duck Duck Growth

Homework: None (if you didn't finish the online lab- finish it tonight and turn it in tomorrow)

Name: _____ Date: _____

Population Growth Capture Sheet

Look at the ecosystem below. *Identify 2 biotic and 2 abiotic factors.*

Biotic Factors		Abiotic Factors
Duck **Fish** **Tree** **Grass** **Hawk** **Turtle** **Fern**		**Water** **Sun** **Clouds** **Salinity** **pH of Soil** **Temperature**

Identify 2 biotic and 2 abiotic factors in the ecosystem.

What populations might be in this ecosystem?

All biotic and abiotic factors are interrelated: a change in one factor will affect other factors.

Describe how a change in one abiotic factor that you identified may affect one of the biotic factors.

If you have a drought and the water level decreases then less fish may be able to survive in the lake.

For more information on limiting factors, watch this video and take notes:

Video: Limiting Factors in an Ecosystem (2:08) Video Link		
Definition of Density Dependent Limiting Factor & example	**Definition of Density Independent Limiting Factor & example**	**More examples of Abiotic & Biotic Limiting Factors**
Depends on the number of organisms (ex: amount of food available, competition, predation, parasitism/ disease)	Does NOT depend on the number of organisms ex: Rainfall	**Abiotic**: Sunlight, Climate, Temperature, Water, Soil chemistry, Fire, Natural Disasters **Biotic:** # of plants, # of animals, amount of competition, # of decomposers, # of parasites [redacted]

[redacted]

HOW DOES A POPULATION GROW?

Link to CK-12

[redacted]

[redacted]	
How populations increase	**Birth Rate and Immigration**
How populations decrease	**Death Rate and Emmigration**

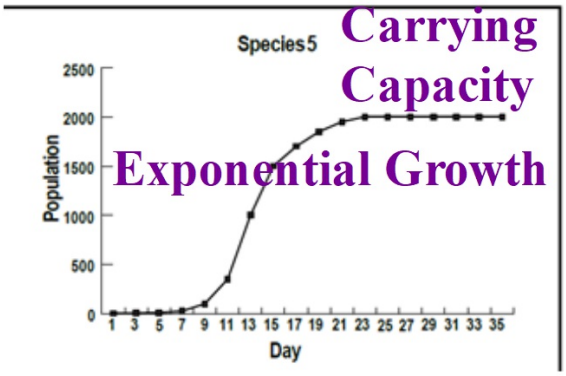
With a partner, list factors that increase a population's growth and factors that decrease a population's growth, and fit them into the equation format provided below.

Population Change = $\frac{\text{What factors increase a population's growth?}}{\text{(Birth + Immigration)}} - \frac{\text{What actors decrease a population's growth?}}{\text{(Death + Emmigration)}}$

Exploring Bacteria Population Growth

The graph below contains data for the population growth of a hypothetical bacteria population.

- *Identify the trends (pattern) in the population size. You should note two observations.*



Carrying Capacity

Exponential Growth

- *Based on the graph, what do you observe about bacteria growth?*

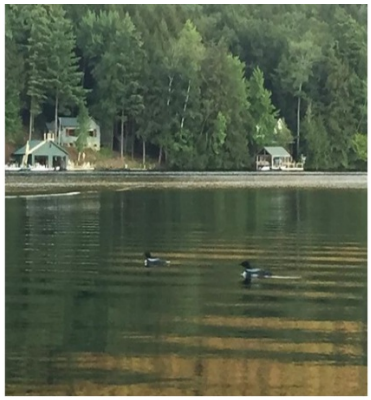
Exponential growth until their popula levels off (carrying capacity)

- *Construct an explanation for why bacteria don't take over the world.*

Bacteria run out of space and food

Carrying Capacity: Birth Rate + Immigration Rate= Death Rate + Emmigration Rate

Duck Duck Growth



- Paper Represents the Lake
-Black Beans represent fish in the lake
-Blue square represents 1 Duck
-Pink square represents 1 Duck
(Leave other squares until later in the lab)

Dropping a square on the paper w/ beans represents the ducks eating. Whatever beans the paper lands on have been eaten by the duck (remove them from the paper). Each duck must eat at least 4 fish every 2 days or they will die. If a duck dies it can not hunt anymore

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

X	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 unting	x	2	2	2	2	2	2	1	1	1	1
of ducks that Y urvived 2 days	2		2		2		1		1		0

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

_____
_____

2) **How will those factors affect the duck population?**

_____
_____

Scenario 1

Place 50 beans on the grid paper :Explain that the beans represent fish and the paper represents the lake.

1. Take the blue square of paper and drop it on the paper: Explain that the blue square represents a duck
2. How many fish the duck caught: Record the number of fish caught under Day one in the blue duck row.
3. Repeat step 4 and 5 for the pink duck.
4. Add the total number of fish for the blue duck and pink duck: Record this number under day one in the daily total row.
5. Repeat steps 4-7 for day 2 and day 3.
6. Take the daily total for day one and two and add them together: Record this number in the two day total under the day two column.
7. If the ducks did not catch a total of 4 fish in the two day span the ducks die **do not continue**
8. If the ducks caught a total of 4 fish in the two day span repeat steps 4-9 for day 3 and day 4.
9. Continue this process until the ducks die or until you reach day 10

Control

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 survive ___ days because there are ____ fish.

	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	2	2	2							
# of ducks that survived 2 days	2		2								

Make a hypothesis first

Place 50 "fish" black beans in the lake.

Take turns dropping the blue duck and recording the number of fish and dropping the pink duck. Remove the fish that the ducks eat. If a duck doesn't eat 4 fish every 2 days it dies. Drop the ducks 1/day.

Reproductive Growth

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 _____.

	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	2	2	2							
# of ducks that survived 2 days	2		2								

2

Place 100 fish in the lake. Drop the blue duck and pink duck for each day. Record the number of fish they ate and remove the fish that have been eaten. If a duck doesn't eat 4 fish every 2 days it dies. (remove any dead ducks)

Pollution

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 _____.

	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										

Place 25 fish in the lake. Drop blue and pink ducks. Record the number and remove the fish they eat. Remove any ducks that don't eat 4 fish every 2 days.

Drought

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 _____.

	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										

Repeat with 10 fish in the lake.

Ducklings

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 _____.

	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)

Place 50 fish in the lake. Drop the 2 ducks each day but they must catch 6 fish every 2 days or 1 of the 4 ducks dies. (2 ducks 2 ducklings)

After finishing the first 5 scenarios answer questions 1-7 on Duck Duck growth.

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?

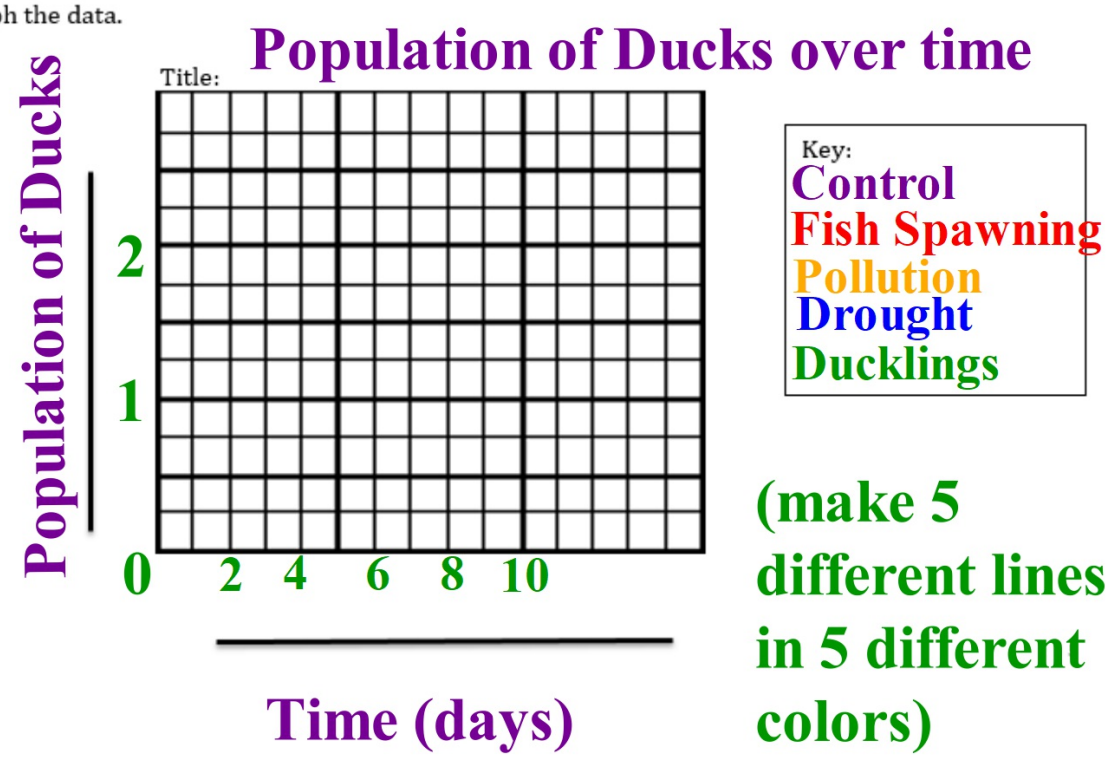
3. What pattern did you notice about the duck population as the fish population decreased more in scenario four?

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 <u>for each of the 5 scenarios</u>. 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.



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:

Example

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Number of fish caught	20	40	15	30	40	55	0	0	0	0
Daily Duck Total	2	4	8	16	32	64	60	120		
Two Day Total		4		16		30		0		0

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 two day total of ducks cannot be more than the number of fish caught in two days.

Double the number of ducks each day- that is the MAXIMUM number of ducks that can survive.

If all of the ducks can't survive then...

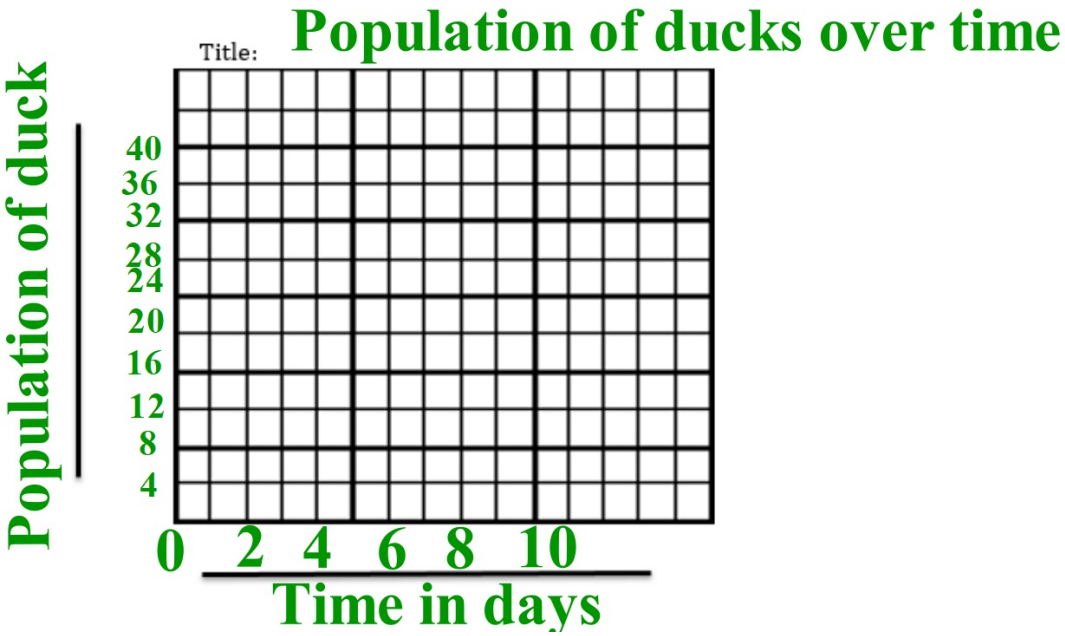
The number of ducks that can survive is number of fish caught (day 1 + day 2)/2 (10 + 20)/2= 15 ducks survive

Answer the following questions after finishing scenario 6

8. How did the duck population change in scenario 6?

9. Why do you think the population changed in this way?

10. 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.



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

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