

Population Limits Lab

mrsajdak.com/populations

Name _____

Date _____

Period _____

Every population can grow fast when nothing holds it back. But no population grows forever. In this lab you will find what holds four real populations back. A **limiting factor** is anything that keeps a population from growing bigger.

Part 1. Duckweed pond (Tab 1)

SEP 4, 5 • CCC Scale, Proportion, and Quantity

Set each row below, then press **Skip to the end**. The **Your runs** box keeps the numbers.

1. Fill in the table.

Settings	Plants on day 10	Plants on day 30	Curve: J or S?
Limits OFF • 200 m ² • normal			
Limits on • 200 m ² • normal			
Limits on • 400 m ² • normal			
Limits on • 200 m ² • fertilizer runoff			

2. With limits on at 200 m², the plants level off near _____. This number is the pond's _____.
Population density on day 30: _____ plants ÷ 200 m² = _____ plants per m².

3. A bigger pond and fertilizer runoff both raised the top number. Name the two limiting factors this shows.

4. Turn on **Early frost**. Frost kills 6 of every 10 plants, crowded or not. Is frost a **density-dependent** or **density-independent** factor? How do you know?

Part 2. Reindeer island (Tab 2, St. Matthew Island)

SEP 2, 4 • CCC Stability and Change

Press **Run** and watch the island, the reindeer line and the lichen line. The black dots are the real counts.

5. Compare the model to the real counts.

Year	1957	1963	1966
Real count	1,350	about 6,000	42
Model			

6. Highest count: _____ reindeer ÷ 128 square miles = _____ per square mile. The carrying capacity line is about _____. The herd grew to about _____ times the carrying capacity. This is called **overshoot**.

7. What happened to the lichen before the crash? Why could the herd grow so far past what the island could feed?

8. Uncheck **The hard winter** and run again. Reindeer in 1966: _____ Did the herd still crash? Was the real limit the winter or the food? Explain.

9. Check **Wolves on the island** (hard winter back on). What shape is the curve now? What happens to the lichen? Why?

Part 3. Trout tanks (Tab 3)

SEP 3 · CCC Cause and Effect

Every tank starts with 20 brook trout. Only the pH is different. Run all 30 days.

10. Write how many trout are alive in each tank on day 30.

pH	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Alive													

11. This is the trout's **range of tolerance**. Optimum range: pH _____ to _____. Zones of stress: pH _____ to _____ and pH _____ to _____. No trout survive at pH _____ and _____.

12. Why is this experiment good evidence that pH **caused** the trout to die?

13. Acid rain has pushed some Adirondack lakes down to about pH 4.8. Predict what happens to brook trout in those lakes. Use your data.

Part 4. Life strategies (Tab 4)

SEP 4, 6 · CCC Patterns

Run **Survivorship**, then **Recovery**. Use the **Life facts** box too.

14. Fill in the table. Curve type: late loss, constant loss or early loss. Strategy: **r-selected** (many young, little care) or **K-selected** (few young, lots of care).

Species	Alive at 10%	Alive at 50%	Curve type	r or K?	Years to recover to 90%
Black bears					
American robins					
Yellow perch					

15. A disease kills most of the animals in all three populations in one year. Which species is most likely to go extinct? Use your recovery numbers and one fact from the Life facts box.

Wrap it up

SEP 6, 7 · CCC Stability and Change

16. **Claim:** No population can grow forever. Give **evidence** from two different tabs. Then give your **reasoning**: what do the limits have in common?

NYSSLS: building toward HS-LS2-1, HS-LS2-2 and HS-LS2-6 (DCI LS2.A Interdependent Relationships in Ecosystems; LS2.C Ecosystem Dynamics). Environmental Science, Chapter 5, Lesson 5.3: What Limits the Growth of Populations? Tags: SEP = Science and Engineering Practice, CCC = Crosscutting Concept.