

Population Limits Lab

mrsajdak.com/populations · Low-write

Name _____

Date _____

Period _____

No population grows forever. A **limiting factor** is anything that keeps a population from growing bigger. Find the limits in four real cases.

Part 1. Duckweed pond (Tab 1)

SEP 5 Using Math · CCC Scale and Quantity

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

CLUE: A **J** curve keeps shooting up. An **S** curve rises, then levels off.

1. Write the numbers. Circle J or S.

Settings	Plants on day 10	Plants on day 30	Curve
Limits OFF · 200 m ² · normal			J S
Limits on · 200 m ² · normal			J S
Limits on · 400 m ² · normal			J S
Limits on · 200 m ² · fertilizer runoff			J S

2. With limits on at 200 m², the plants level off near _____. This is the _____.

WORD BANK carrying capacity · range of tolerance · overshoot

Example: density = plants ÷ area. 600 plants ÷ 100 m² = 6 plants per m².

Day 30 density: _____ plants ÷ 200 m² = _____ plants per m².

3. A bigger pond and fertilizer runoff both raised the top number. So the limits were _____ and _____.

WORD BANK space · nutrients · sunlight hours · predators

4. Turn on **Early frost**. It kills 6 of every 10 plants, crowded or not. Frost is:

☐ density-dependent ☐ density-independent

I know because frost hurts the plants the same whether the pond is _____.

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

SEP 4 Analyzing Data · CCC Stability and Change

Press **Run**. Watch the island, the reindeer line and the lichen line. Black dots are the real counts.

5. Write the model's numbers under the real counts.

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

Example: 1,000 reindeer ÷ 100 = 10 times the carrying capacity of 100.

6. Highest count _____ ÷ carrying capacity _____ = _____ times too many. This is called **overshoot**.

7. Before the crash, the lichen: ☐ grew thicker ☐ was almost all eaten ☐ stayed the same

The herd grew so big because the island had lots of lichen and no _____.

8. Uncheck **The hard winter** and run. Reindeer in 1966: _____. Did the herd still crash? ☐ yes ☐ no

The main limit was: ☐ the winter ☐ the food (lichen) The winter only made it happen _____.

9. Check **Wolves on the island**. The curve is now: ☐ J ☐ S The lichen: ☐ runs out ☐ stays mostly uneaten

Why? The wolves keep the herd _____ the carrying capacity. **WORD BANK** above · below · equal to

Part 3. Trout tanks (Tab 3)

SEP 3 Investigating • 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													

CLUE: Optimum range = all 20 lived. Zone of stress = some died. Zone of intolerance = none lived.

11. Optimum range: pH _____ to _____. No trout lived at pH _____ and pH _____.

12. Why is this good evidence that pH **caused** the deaths? Tick one.

- ☐ Only the pH was different. Everything else was the same.
☐ There were a lot of tanks.
☐ Trout are the state fish.

13. Some Adirondack lakes are about pH 4.8 from acid rain. Brook trout there will:

- ☐ thrive ☐ mostly die ☐ not change

My data: at pH 4.5, _____ lived, and at pH 5.0, _____ lived.

Part 4. Life strategies (Tab 4)

SEP 4 Analyzing Data • CCC Patterns

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

CLUE: r-selected = many young, little care. K-selected = few young, lots of care.

14. Write the numbers. Circle the curve type and r or K.

Species	Alive at 10%	Alive at 50%	Curve type (circle)	Circle	Years to recover
Black bears			late • constant • early	r K	
American robins			late • constant • early	r K	
Yellow perch			late • constant • early	r K	

15. A disease kills most of all three in one year. Most likely to go extinct:

- ☐ black bears ☐ robins ☐ yellow perch

Because it took _____ years to recover, and each mother has only _____.

Wrap it up

SEP 7 Argument from Evidence • CCC Stability and Change

16. **Claim:** No population can grow forever.

Evidence 1: In the pond, the duckweed stopped at about _____ plants.

Evidence 2: On St. Matthew Island, the reindeer went from _____ to _____.

Reasoning: Both populations ran out of _____.

WORD BANK resources (space, food) • time • predators • eggs

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