

What Limits the Water Fleas? A Claim-Evidence-Reasoning Case

Learning target: I can use data from three jars to make a claim about which resource limits a population, support it with specific numbers, and explain the reasoning that connects resource supply to carrying capacity.

Claim, evidence, reasoning

About 45 min

Individual

MS-LS2-1 · assesses

MS-LS2-4 · practice

writing

data analysis

Name _____

Date _____

Period _____

Directions

Read the scenario and study the dataset. Answer the warm-up questions first; they will organize your evidence. Then write your Claim, Evidence and Reasoning in the boxes. A strong response quotes specific counts and days from the table, compares the jars, and explains **why** the numbers came out the way they did using the ideas of limiting resource and carrying capacity.

You will need: This worksheet, Pencil, Scrap paper for evidence sentences

The scenario

Daphnia, often called water fleas, are tiny crustaceans about the size of a sesame seed that live in ponds and eat single-celled algae. A class set up three identical one-liter jars of filtered pond water, put ten Daphnia in each, and placed them side by side under the same lamp at the same temperature. The only difference was feeding. **Jar A** received 1 milliliter of green algae culture every day. **Jar B** received 3 milliliters every day. **Jar C** received 3 milliliters every day through Day 12 and then nothing. Every three days the class counted the Daphnia in each jar and measured the dissolved oxygen, which stayed above 7 milligrams per liter in every jar for the whole experiment (Daphnia are fine above about 3).

Daphnia counted in each jar (teaching dataset)

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Day	Jar A (1 mL algae/day)	Jar B (3 mL algae/day)	Jar C (3 mL/day, then none after Day 12)
0	10	10	10
3	16	18	18
6	24	32	33
9	32	55	54
12	38	85	86
15	41	110	92
18	42	122	70
21	41	126	44
24	42	125	25

Simulated data built to be realistic for Daphnia, which can reproduce every few days when well fed. Not from a real class.

Warm-up: organize the evidence

1. List everything that was kept the same across the three jars. Then explain why the oxygen measurement matters for deciding what limited the Daphnia.

2. Jar B received three times as much food as Jar A. Divide Jar B's Day 24 count by Jar A's Day 24 count. How does the ratio of the populations compare with the ratio of the food supplies?

3. Jars B and C were treated the same until Day 12 and their counts match closely until then. On what day does Jar C's count first fall, and what does the gap between Day 12 and that day suggest?

Your argument

CLAIM

Claim: State what resource limited the size of the Daphnia populations and how the carrying capacity of a jar depended on it.

EVIDENCE

Evidence: Give at least three specific pieces of evidence from the table, with days and counts. Include a comparison between Jar A and Jar B, a comparison between Jar B and Jar C after Day 12, and one fact that rules out oxygen, light or temperature.

REASONING

Reasoning: Explain how each piece of evidence supports the claim. Use the terms limiting resource, carrying capacity and competition, and explain why the populations leveled off instead of growing forever, and why Jar C fell instead of staying level.

4. What result in Jar C would have **contradicted** your claim? Describe the counts you would have expected to see if food were not the limiting resource.

Evidence sentences with numbers in them

A piece of evidence is a sentence with at least one number and a comparison. Try these frames: 'By Day __, Jar A had only __ Daphnia while Jar B had __.' 'Jar C peaked at __ on Day __ and fell to __ by Day __, after feeding stopped on Day 12.' 'Oxygen stayed above __ mg/L in all jars, so __.' Write three such sentences on scrap paper before filling in the Evidence box, then use the Reasoning box to say what each sentence proves.

Design Jar D

Design a fourth jar that would test whether Jar B's population could have grown even larger with more food, or whether some other resource (space, oxygen or waste build-up) would take over as the limiting resource at higher numbers. State the feeding rate, what you would measure besides the count, and sketch the two different curves you would expect depending on which answer is correct. Then write a sentence explaining why the limiting resource can change as a population grows.