LESSON MAKER PRO

Crowding or Chance?

Use population data to investigate what limits growth.

HIGH SCHOOL · BIO.8

BIO.8 "Construct an evidence-based explanation of how density-dependent and density-independent factors affect population growth."

NAME _____ DATE _____

COMPARE DEATH RATES

To compare populations of different sizes, calculate death percent = deaths / starting population * 100%. Under otherwise similar conditions, a higher death percent in a more crowded area supports a density-dependent effect. Similar death percents across areas of different densities are consistent with a density-independent effect. To find the final population, add births and subtract deaths.

WORKED EXAMPLE

Two same-size plots contain 75 and 150 plants. During the same disease outbreak, 9 plants die in the less crowded plot and 36 die in the more crowded plot. Compare the death percents. Which type of factor does the pattern support?

1. Less crowded plot: 9 / 75 * 100% = 12%.
2. More crowded plot: 36 / 150 * 100% = 24%.
3. The death percent is higher in the more crowded plot.

Answer: The pattern supports a density-dependent effect.

PRACTICE 6 problems

1 A garden has 40 aphids. Spiders eat 8 of them. What percent of the starting population dies?

ANSWER _____

2 A pond starts with 60 fish. During one month, 18 hatch and 6 die. What is the final population?

ANSWER _____

3 The plots are the same size and have similar conditions. Calculate the death percent in each plot.

PLANT DEATHS

Plot	Starting plants	Deaths
Less crowded	50	5
More crowded	100	20

ANSWER _____

4 A rainstorm hits two same-size plots. Calculate each death percent. Is the pattern consistent with a density-dependent or density-independent effect?

DEATHS AFTER A RAINSTORM

Plot	Starting plants	Deaths
Less crowded	20	2
More crowded	60	6

ANSWER _____

5 A crowded plot starts with 200 plants. During one month, 40 sprout and disease kills 50. What is the final population?

ANSWER _____

6 Parasites kill 27 of 90 fish in one pond. Calculate the death percent. Can this information alone show whether parasite deaths increase with crowding? Explain briefly.

ANSWER _____

APPLY IT Show your work

1 Students grow native flowers in two same-size school garden plots. Both plots have similar conditions except for crowding. During a fungal outbreak, new plants sprout and some die. Find each final population and death percent. What does the death pattern suggest about the fungus?

SCHOOL GARDEN

Plot	Starting plants	New plants	Fungal deaths
Less crowded	70	14	7
More crowded	140	28	42

ANSWER _____

2 Students monitoring shore crabs count two same-size tide pools before and after a cold snap. No crabs are born or move between pools during that time. Find each final population and death percent. What type of effect is consistent with these results?

SHORE CRABS AFTER A COLD SNAP

Pool	Starting crabs	Deaths
Less crowded	60	6
More crowded	180	18

ANSWER _____

CHALLENGE One step up

Two same-size garden plots have similar conditions except for crowding. A disease first kills the number of plants shown. Then a frost kills 25% of the plants remaining in each plot. No new plants sprout. Find both final populations. Use death percents to explain which event shows evidence of a density-dependent effect and which is consistent with a density-independent effect.

TWO EVENTS IN A GARDEN

Plot	Starting plants	Disease deaths
Less crowded	80	8
More crowded	160	48

WORK SPACE AND ANSWER

Crowding or Chance?

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A garden has 40 aphids. Spiders eat 8 of them. What percent of the starting population dies?	**20%**
2	A pond starts with 60 fish. During one month, 18 hatch and 6 die. What is the final population?	**72 fish**
3	The plots are the same size and have similar conditions. Calculate the death percent in each plot.	**Less crowded: 10%; more crowded: 20%.**
4	A rainstorm hits two same-size plots. Calculate each death percent. Is the pattern consistent with a density-dependent or density-independent effect?	**Both death percents are 10%. The pattern is consistent with a density-independent effect.**
5	A crowded plot starts with 200 plants. During one month, 40 sprout and disease kills 50. What is the final population?	**190 plants**
6	Parasites kill 27 of 90 fish in one pond. Calculate the death percent. Can this information alone show whether parasite deaths increase with crowding? Explain briefly.	**30%. No. A death percent from another pond with a different density but similar conditions is needed for comparison.**

PART 2 · APPLY IT

1. **Less crowded: 77 plants and 10% deaths. More crowded: 126 plants and 30% deaths. The higher death percent in the more crowded plot supports a density-dependent effect.** Compute each final population as starting plants + new plants - fungal deaths. Divide deaths by starting plants to compare death percents.
2. **Less crowded: 54 crabs and 10% deaths. More crowded: 162 crabs and 10% deaths. The equal death percents are consistent with a density-independent effect.** Subtract deaths from each starting population. In both pools, deaths are 10% of the starting population.

CHALLENGE

The final populations are 54 in the less crowded plot and 84 in the more crowded plot. Disease kills 10% and 30% of the starting populations, respectively, supporting a density-dependent effect. Frost kills 25% of the survivors in each plot, consistent with a density-independent effect.

Accept explanations that say a pattern supports or is consistent with an effect rather than proving its cause. In the challenge, calculate disease percents from starting populations and frost percents from the plants remaining after disease.