Beetles After Drought

Model how an environmental change affects inherited traits

BIO.4.4 "Design models and/or use simulations to investigate the interaction between changing environments and genetic variation in natural selection leading to adaptations in populations and differential success of populations."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the environmental change, circle the inherited color variants, and number the steps that connect color, survival, and offspring.

When the Riverbank Dried

1. For years, a riverbank stayed wet and dark. Then a long drought left its soil dry and pale. Ground beetles on the bank already had two inherited color variants: tan and dark. Birds hunting by sight could more easily spot dark beetles against the pale soil. A beetle did not change color when the soil dried. Instead, beetles of different colors had different chances of surviving long enough to reproduce. To explore what might happen, a class modeled two beetle populations facing the same drought. The populations differed in the color variants they had at the start.

2. Population A started with 12 tan beetles and 12 dark beetles. Population B started with 24 dark beetles and no tan beetles. The model used the same rule for both groups: on pale soil, birds ate one quarter of the tan beetles and three quarters of the dark beetles. Each survivor then produced two offspring with its own color. The offspring formed the next generation. The model assumed that color was inherited without change and that no beetles moved between populations. Those rules let the class compare the effect of starting genetic variation while keeping the environment the same.

3. After one round, nine tan beetles and three dark beetles survived in Population A. Their offspring formed a new population of 18 tan beetles and six dark beetles. In Population B, six dark beetles survived and produced 12 dark offspring. Population A kept its starting size of 24, while Population B fell from 24 to 12. Tan beetles became more common in Population A because more of them survived and reproduced on pale soil. If the soil had stayed dark, the model would need a different bird rule: dark beetles would be harder to spot than tan beetles.

2 ANSWER WITH EVIDENCE

Use the passage

1. How did the drought change which inherited color helped beetles survive?

2. Use the model's rules to find how many tan and dark offspring formed the next generation of Population A.

3. Which population was more successful after one round? Explain how starting genetic variation affected the result.

4. If the soil had stayed dark, which color would be harder for birds to spot? How might that change Population B's success?

3 YOUR TURN

Your own words

Invent a different species and an environmental change. In one paragraph, describe two starting populations with different inherited variants, give a survival and reproduction rule, and use numbers to predict which population is more successful after one round.

ANSWER KEY

Beetles After Drought

HIGH SCHOOL · BIO.4.4

PART 1 · READ AND MARK

Underline the environmental change, circle the inherited color variants, and number the steps that connect color, survival, and offspring. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How did the drought change which inherited color helped beetles survive?	**The drought left pale soil, where birds could more easily spot dark beetles. Tan beetles were less likely to be eaten.**
2	Use the model's rules to find how many tan and dark offspring formed the next generation of Population A.	**Nine tan survivors produced 18 tan offspring, and three dark survivors produced six dark offspring.**
3	Which population was more successful after one round? Explain how starting genetic variation affected the result.	**Population A had 24 offspring, compared with Population B's 12. Population A started with tan beetles, which survived at a higher rate on pale soil.**
4	If the soil had stayed dark, which color would be harder for birds to spot? How might that change Population B's success?	**Dark beetles would be harder to spot. Population B's dark beetles would have a better chance of surviving than they did on pale soil.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Salt water enters a freshwater stream where fish have inherited salt-tolerant or salt-sensitive traits. Population A starts with 10 tolerant and 10 sensitive fish. Population B starts with 20 sensitive fish. In my model, eight of every ten tolerant fish survive, but only two of every ten sensitive fish survive. Each survivor produces two offspring with its own trait. Population A has eight tolerant and two sensitive survivors, so it produces 20 offspring. Population B has four sensitive survivors, so it produces eight offspring. Population A is more successful because it started with a variant that helps fish survive the changed water.

For Your Turn, accept other plausible species and inherited variants if the survival rule, offspring counts, and comparison are consistent. Students should attribute the difference between populations to their starting variation and the changed environment.