Beetles in Balance

Use population data to explain how an inherited trait changes over generations.

HS-LS4-3 "Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each number or percentage that shows the beetle trait distribution changing. Circle the evidence that explains why one wing-cover pattern had an advantage.

Wing Covers After Drought

1. This classroom example uses simulated data. On Harbor Island, beetles had striped or plain wing covers, a heritable trait passed from parents to offspring. Before a drought, a sample of 200 beetles contained 150 striped and 50 plain beetles. The drought dried the grasses. On exposed brown ground, striped beetles were easier for birds to notice. That observation suggested a survival difference, but one count could not establish change across generations.
2. After two breeding seasons, a new sample of 200 contained 90 striped and 110 plain beetles. Striped beetles decreased from 75% to 45%; plain beetles increased from 25% to 55%. Equal sample sizes permit direct comparison of counts. A bar graph could compare each trait's percentage at the two times. These are trait-distribution data, not allele-frequency calculations.
3. In a survival test on dry ground, 52 of 100 marked striped beetles survived one week, compared with 78 of 100 plain beetles. Among surviving females observed in nesting containers, plain females produced an average of 18 young and striped females 17. Birds captured more visible striped beetles. More plain survivors could contribute offspring inheriting their pattern. The survival difference, heritability and changing proportions together support an explanation of natural selection in this environment.

2 ANSWER WITH EVIDENCE

Use the passage

1. By how many percentage points did the striped trait change from before the drought to after two breeding seasons?

2. Use the survival results and the population counts to explain which wing-cover pattern was advantageous on the dry ground.

3. Why is it valid to compare the first and second beetle counts directly?

4. What should the horizontal and vertical axes show on a bar graph of the trait shift?

3 YOUR TURN

Your own words

Use this additional simulated classroom dataset. On a rocky shore, lizards have heritable wide or narrow toe pads. Before a storm, 60 of 200 lizards had wide toe pads and 140 had narrow toe pads. Two generations later, 120 of 200 had wide toe pads and 80 had narrow toe pads. During wet conditions, 82 of 100 wide-toe lizards escaped predator attacks, compared with 54 of 100 narrow-toe lizards. Make a two-time bar graph of the trait data, then write two or three sentences explaining how the data support a change in trait proportion.

ANSWER KEY

Beetles in Balance

HIGH SCHOOL · HS-LS4-3

PART 1 · READ AND MARK

Underline each number or percentage that shows the beetle trait distribution changing. Circle the evidence that explains why one wing-cover pattern had an advantage. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	By how many percentage points did the striped trait change from before the drought to after two breeding seasons?	**It decreased by 30 percentage points, from 75 percent to 45 percent.**
2	Use the survival results and the population counts to explain which wing-cover pattern was advantageous on the dry ground.	**Plain wing covers were advantageous. More plain beetles survived, 78 of 100 compared with 52 of 100 striped beetles, and plain beetles increased from 50 to 110 in equal-sized samples.**
3	Why is it valid to compare the first and second beetle counts directly?	**Both samples included 200 beetles, so the counts and percentages can be compared directly.**
4	What should the horizontal and vertical axes show on a bar graph of the trait shift?	**The horizontal axis should show wing-cover trait type, and the vertical axis should show the percentage of beetles.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Graph bars: wide toe pads, 60 before the storm and 120 two generations later; narrow toe pads, 140 before the storm and 80 two generations later. Wide toe pads rose from 30 percent to 60 percent, while narrow toe pads fell from 70 percent to 40 percent. Because toe-pad type is heritable and wide-toe lizards escaped predator attacks more often, 82 of 100 compared with 54 of 100, wide toe pads were advantageous and increased in proportion over generations.

Accept a correctly labeled two-time bar graph using either counts or percentages. The explanation should cite the increase in wide toe pads, the heritable trait information, and the higher survival of wide-toe lizards as evidence.