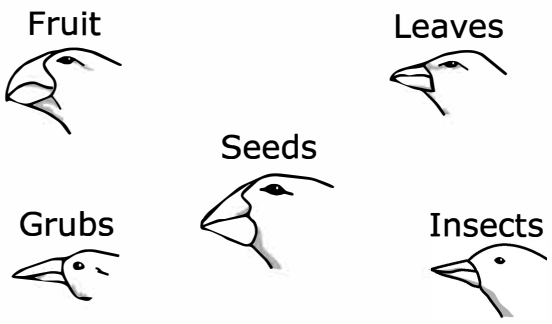
Stimulus 1

Students at a museum observed a special collection of birds with different-sized beaks. The students learned that the birds were all finches that had lived on the Galápagos Islands, and that the finches likely had a common ancestor. The students wondered why the birds have such a variety of beak sizes. They learned that each type of beak is adapted to eating different types of food. For instance, beaks with a greater beak depth are better adapted to eating seeds that are larger and have thick shells. Beak depth is the measured distance between the top and bottom of the beak. Figure 1 shows the different types of beaks in Galápagos finches.

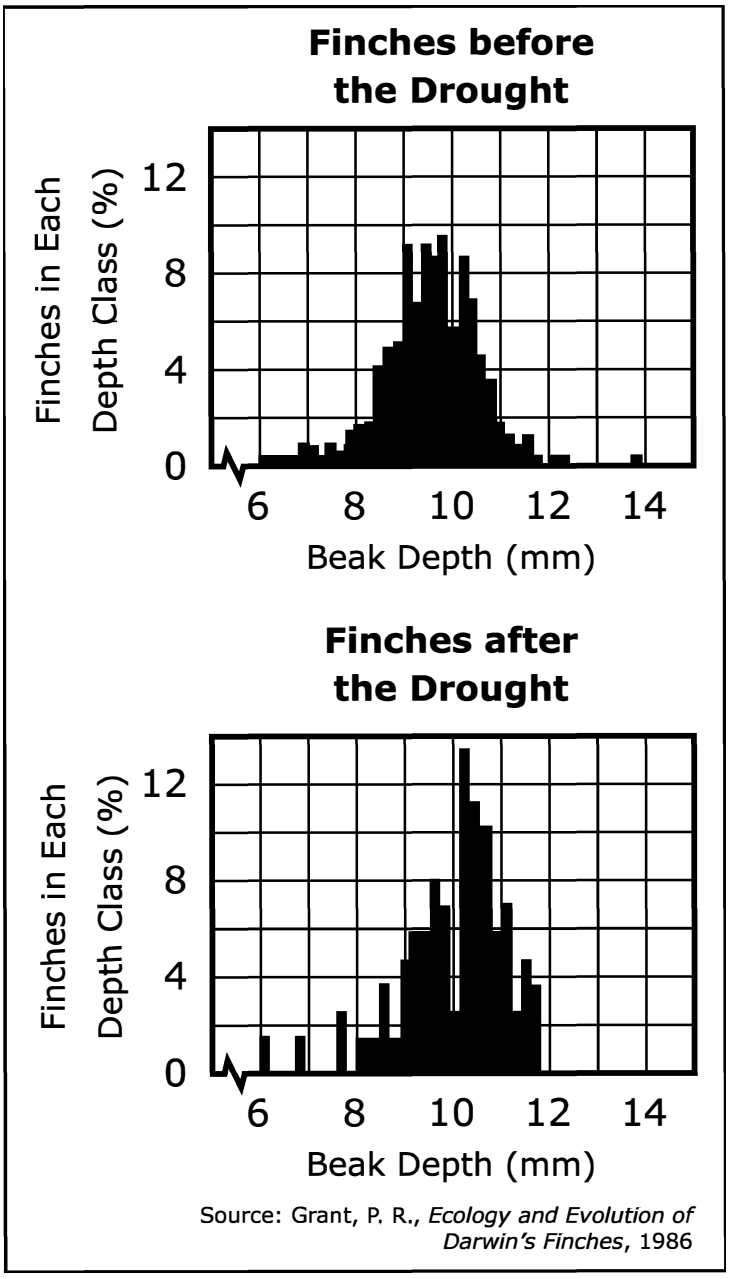
Figure 1. Different Beaks of the Galápagos Finches



Stimulus 2

The students learn that the finches on the Galápagos Islands are isolated from other populations of finches on the mainland. Scientists have observed changes in the characteristics of the island finches over many years. During this time, the islands had a severe drought that killed off many finches. During the drought, all food sources for the finches were scarce. Among the few plants that still developed seeds, the number of seeds had decreased, and many were large with thick shells. Figure 2 shows how the average beak depth of finches changed after the drought.

Figure 2. Percentage of Finches by Beak Depth

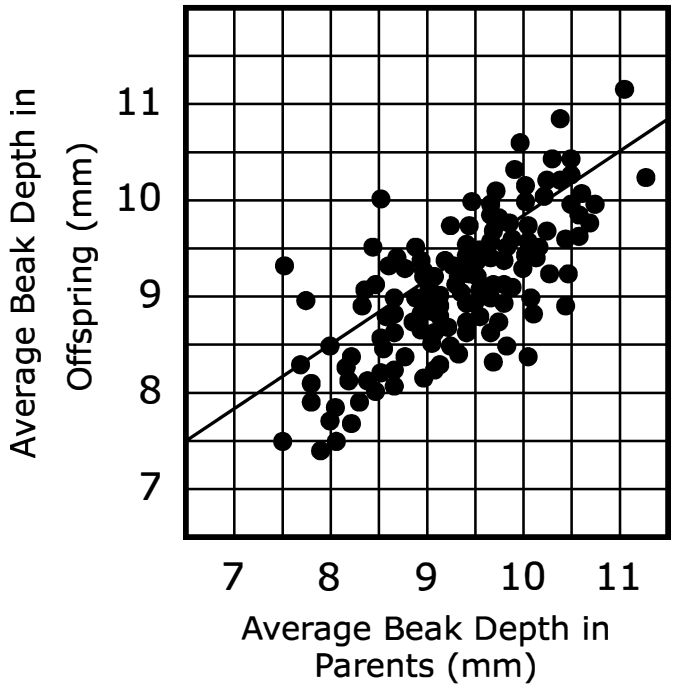


Source: Grant, P. R., *Ecology and Evolution of Darwin's Finches*, 1986

Stimulus 3

The scientists also measured the average size of the beaks of finch parents and offspring over time. Figure 3 shows the average beak depth of finch offspring compared with the average beak depth of the parents.

Figure 3. Comparison of Average Beak Depth in Finch Offspring and Parents

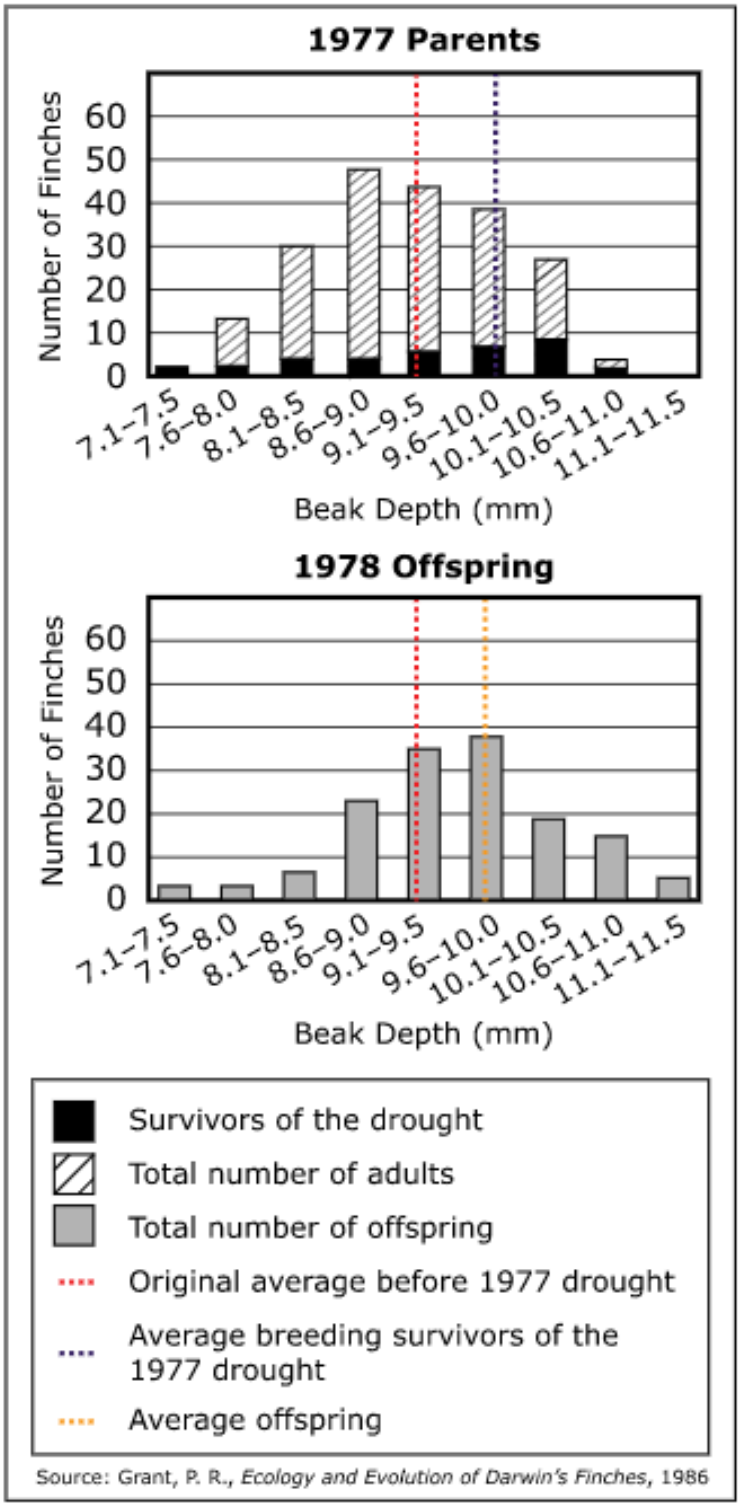


Source: Grant, P., and Grant, R., 2000

Stimulus 4

The scientists used the average beak depths to determine how the beak depth might have been affected by the drought. Figure 4 shows the beak depth of the parents and offspring before and after the drought.

Figure 4. Average Beak Depth before and after Drought



Source: Grant, P. R., *Ecology and Evolution of Darwin's Finches*, 1986

Item 1

Based on Figures 1 and 2, which type of beak is best suited to drought conditions?

- A. large-depth beak for eating seeds
- B. small-depth beak for eating leaves
- C. small-depth beak for eating insects
- D. medium-depth beak for eating fruit

Item 2

Based on Figure 4, how would the population of finches likely have changed if the drought had lasted more than five years?

- A. The population would have gradually decreased and then died out.
- B. The population would have rapidly increased and developed smaller beaks.
- C. The population would have decreased and have tended to have deeper beaks.
- D. The population would have increased when all finches switched to eating large seeds.

Item 3

A student claims that during drought conditions, finch parents with a survival advantage are more likely to have offspring survive to adulthood and reproduce. Complete the sentences supporting the student's claim.

Circle the correct answer from each list to complete the sentence.

Based on Figure 2, finches with [7.0–8.0 mm / 10.0–11.0 mm] beaks have about

[the same / two times the] chance of survival during a drought that they had in pre-drought conditions. This advantageous trait will be passed on to more offspring.

Rubric	
Score	Description
1	Based on Figure 2, finches with **10.0–11.0 mm** beaks have about **two times the** chance of survival during a drought that they had in pre-drought conditions. This advantageous trait will be passed on to more offspring.
0	The response is incorrect or irrelevant.

Item 4

A student claims that the drought contributed to the significant increase of finch offspring from parents with beak depths that provided a survival advantage.

Based on Figure 4, determine whether each piece of evidence supports this claim or does not support this claim.

Place a check mark in the circle to indicate your answer choice in each column.

	In 1977, the total number of finches with a beak depth 8.6–9.0 mm is more than the number of offspring in 1978 with the same beak depth.	In 1977, the total number of finches with a beak depth 8.6–9.0 mm was the highest in the population. In 1978, the number of offspring with a beak depth 9.6–10.0 mm was the highest in the population.	In 1977, the total number of finches with a beak depth 7.1–7.5 mm was nearly the same as the number of offspring in 1978 with the same beak depth.
Supports the Claim	○	○	○
Does Not Support the Claim	○	○	○

Rubric	
Score	Description
2	Supports the Claim • **In 1977, the total number of finches with a beak depth 8.6–9.0 mm was the highest in the population. In 1978, the number of offspring with a beak depth 9.6–10.0 mm was the highest in the population.** Does Not Support the Claim • **In 1977, the total number of finches with a beak depth 8.6–9.0 mm is more than the number of offspring in 1978 with the same beak depth.** • **In 1977, the total number of finches with a beak depth 7.1–7.5 mm was nearly the same as the number of offspring in 1978 with the same beak depth.**
0	The response is incorrect or irrelevant.

Item 5

The students made three arguments based on the data in Figure 2 and Figure 3.
Which arguments are supported by the data?

Write the correct answer in each box.

Supported	Not Supported

Finches with deeper beaks are well adapted to eating small seeds.

Finches with deeper beaks typically have offspring with deeper beaks.

Finches with deeper beaks have a survival advantage during droughts.

Rubric	
Score	Description
1	Not Supported by the Data • **Finches with deeper beaks are well adapted to eating small seeds.** Supported by the Data • **Finches with deeper beaks typically have offspring with deeper beaks.** • **Finches with deeper beaks have a survival advantage during droughts.**
0	The response is incorrect or irrelevant.

Item 6

A student considers a hypothetical scenario in which scientists observe an unanticipated decrease in the average depth of finch beaks during a drought in the Galápagos Islands.

- Use Figure 1 to explain one possible reason why this might happen.
- Predict how natural selection would affect the reproductive success of an individual finch with a smaller beak depth in this scenario.
- Use the data in Figure 3 to identify a cause and effect relationship between parent and offspring beak depth. Then explain how this relationship may affect the proportion of smaller beak depths to larger beak depths in future generations of finches within the hypothetical scenario.

Analyze the information carefully. Then write your response in the space provided. Support your answer with details.

Scoring Rubric	
Score	**Description**
3	The student answers all 3 parts correctly.
2	The student answers any 2 parts correctly.
1	The student answers any 1 part correctly.
0	The response is blank, incorrect, or irrelevant.

	• Figure 1 indicates that finches have beaks that are adapted to their particular diets. In the scenario where beak depths are decreasing, there must be a survival advantage for having a smaller-depth beak. It may be possible that a new food source became available to those finches (or they somehow adapted to being able to eat the large seeds with thick shells). • Natural selection will favor finches with traits beneficial for survival in a given environmental situation. If an individual finch with a smaller-depth beak has adequate access to a food source, it will have a greater chance for survival and reproduction. • The data in Figure 3 show that finch parents typically have offspring of approximately the same beak depths according to the average value. If finches with a smaller-depth beak have greater success at surviving and reproducing than finches with a larger-depth beak, then there will be more offspring with similar, smaller beaks than with larger beaks. If this trend continues, future generations will have a greater proportion of finches with smaller-depth beaks. The evidence in Figure 3 supports a cause and effect relationship for this trend in the given scenario.