

Natural Selection in Real Time

“When we made the comparison between the size of the offspring generation and the population before selection, we found a measured, evolutionary response had taken place and it was almost identical to what we had predicted” – Peter Grant

Darwin thought that evolution took place over hundreds or thousands of years and was impossible to witness in a human lifetime. Peter and Rosemary Grant have seen evolution happen over the course of just two years.

The Grants study the evolution of Darwin’s finches on the Galapagos Islands. The birds have been named for Darwin, in part, because he later theorized that the 13 distinct species were all descendants of a common ancestor. Each species eats a different type of food and has unique characteristics developed through evolution. For example, the cactus finch has a long beak that reaches into blossoms, the ground finch has a short beak adapted for eating seeds buried under the soil, and the tree finch has a parrot-shaped beak suited for stripping bark to find insects.

The Grants have focused their research on the medium ground finch, *Geospiza fortis*, on the small island of Daphne Major. Daphne Major serves as an ideal site for research because the finches have few predators or competitors. (The only other finch on the island is the cactus finch.) The major factor influencing survival of the medium ground finch is the weather, and thus the availability of food. The medium ground finch has a stubby beak and eats mostly seeds. Medium ground finches are variable in size and shape, which makes them a good subject for a study of evolution.

The first event that the Grants saw affect the food supply was a drought that occurred in 1977. For 551 days the islands received no rain. Plants withered and finches grew hungry. The tiny seeds the medium ground finches were accustomed to eating grew scarce. Medium ground finches with larger beaks could take advantage of alternate food sources because they could crack open larger seeds. The smaller-beaked birds couldn't do this, so they died of starvation.

In 1978 the Grants returned to Daphne Major to document the effect of the drought on the next generation of medium ground finches. They measured the offspring and compared their beak size to that of the previous (pre-drought) generations. They found the offsprings’ beaks to be 3 to 4% larger than their grandparents’. The Grants had documented natural selection in action.

While beak size is clearly related to feeding strategies, it is also related to reproduction. Female finches tend to mate with males that have the same size beaks. These factors together can add to the development of new species.

The Grants return each year to Daphne Major to observe and measure finches. They have been collecting data on the finches for 20 years and have witnessed natural selection operating in different ways under different circumstances. They have come a long way toward answering their original questions as to whether species of finches compete, why the populations are so variable, and how new species are formed.

Darwin's Finches Activity

Read the article on the back of this sheet.

Review these postulates of natural selection:

- Individuals within a population vary in their traits.
- Some of these variable traits are heritable- passed on to offspring.
- More offspring are produced than can survive because of limited resources such as food and nesting sites.
- Individuals with advantageous traits will survive and reproduce.

1. Write down each of the postulates from above. Underneath each statement, identify the specific data (look at the 'Grant's Finch Study Data' Figures 1, 2 and 3.) that supports each postulate.

For example:

Individuals within a population vary in their traits.

Figure 1. Shows a distribution of sizes of beak depths from small to large.

Do any other figures also support this statement? If so, write that down also.

2. Then answer the following questions:

1. How do you know that finches' beak depth is heritable? What evidence do you have from the Grants' research?
2. How did the finch population's beak depth change from before the drought to after?
3. Why do you think the average beak depth of the birds increased?
Hint: think of the type of food available

Grants' Finch Study Data

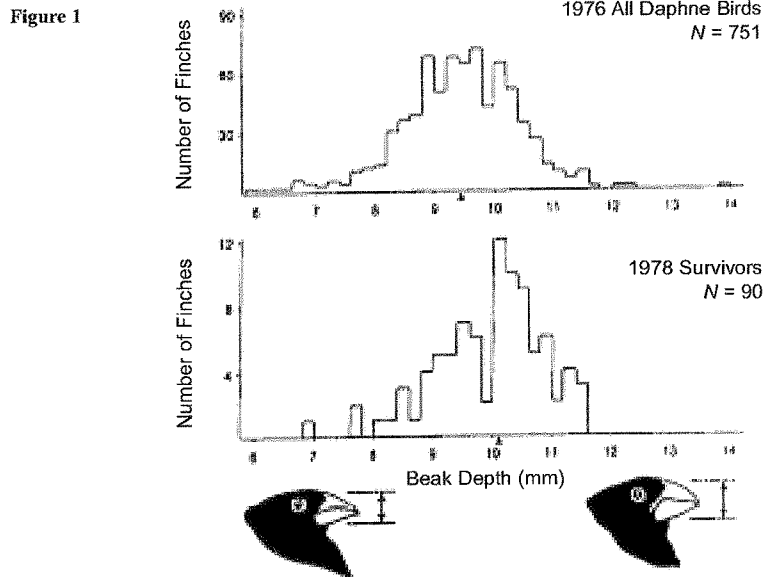


Figure 1: Histogram of distribution of beak depth of medium ground finches (*Geospiza fortis*) on Daphne Major, before and after the drought of 1977 (Grant 1986). Reprinted by permission of Princeton University Press.

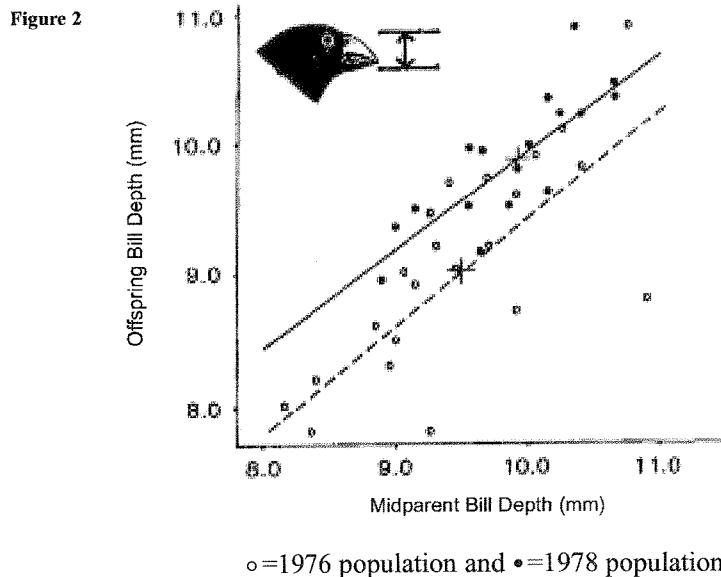


Figure 2: Relationship between beak depth of offspring and their parents in the medium ground finch (*Geospiza fortis*) population on Daphne Major. The slope of the relationship is the heritability (Boag 1983).

Figure 3

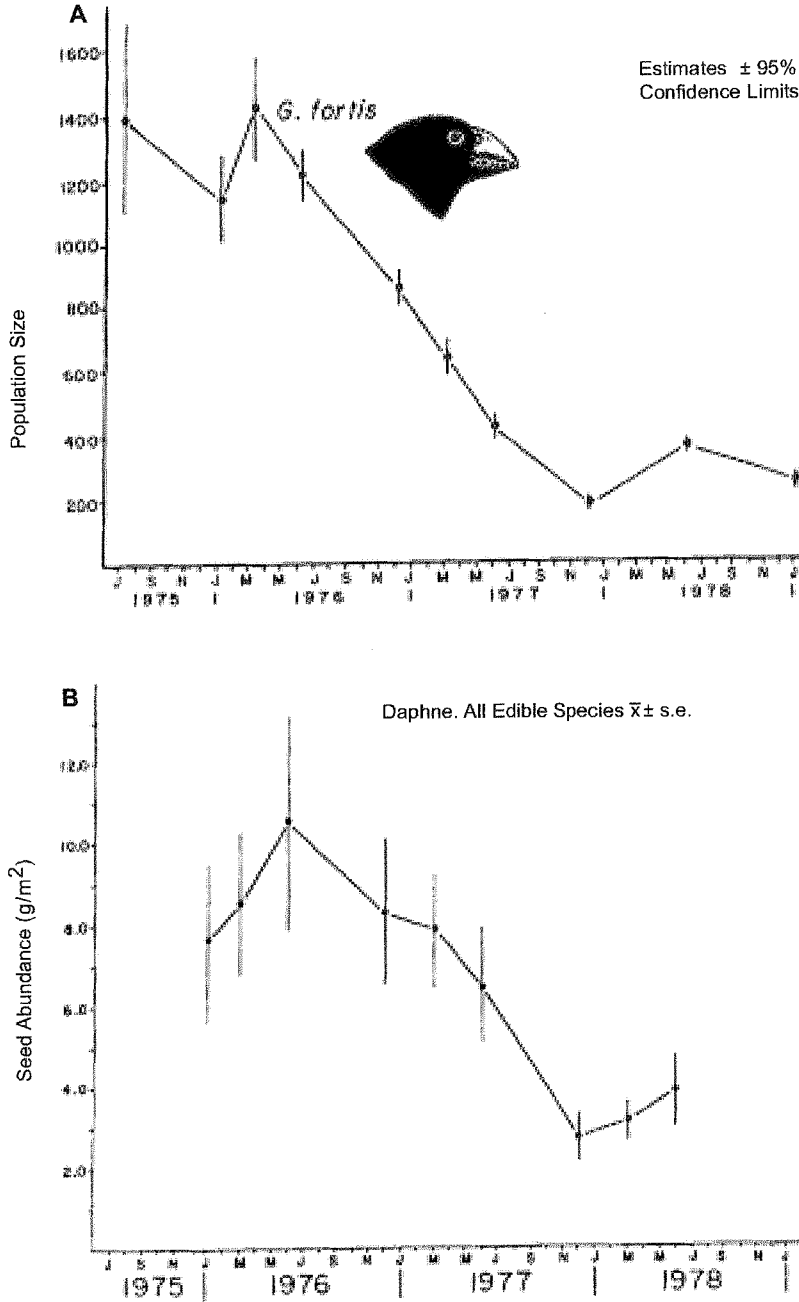


Figure 3: Changes in *Geospiza fortis* population and seed abundance on *Daphne major*, before and after the drought of 1977 (Grant 1986).