

The image is a colorful, hand-drawn style cover for a biology resource. It features a central light green rounded rectangle containing the main text. The background is a light gray grid. Various biological and school-related icons are scattered around the central text, including DNA double helices, a pencil, a notebook, paper clips, and a penguin.

AP Bio

FRQ Fridays

2021 #4
Reproductive Barriers
& Natural Selection



FRQ Friday #25

2021 #4

In 1981 a single immature male *Geospiza conirostris* finch flew more than 100 kilometers from the Galápagos island of Española to the Galápagos island of Daphne Major, where no *G. conirostris* finches were living. The immigrant finch bred with a female *G. fortis*, a species of finch common on Daphne Major. The F₁ finches and later generations interbred only within their lineage. By 2012 scientists counted 23 individuals, including eight breeding pairs, within this hybrid lineage on Daphne Major. The hybrid lineage became known as Big Bird.

Birds with different beak shapes and sizes eat different types of food. The dimensions of the Big Bird beaks relative to the beaks of the major competitor finch species on Daphne Major are shown in Figure 1.

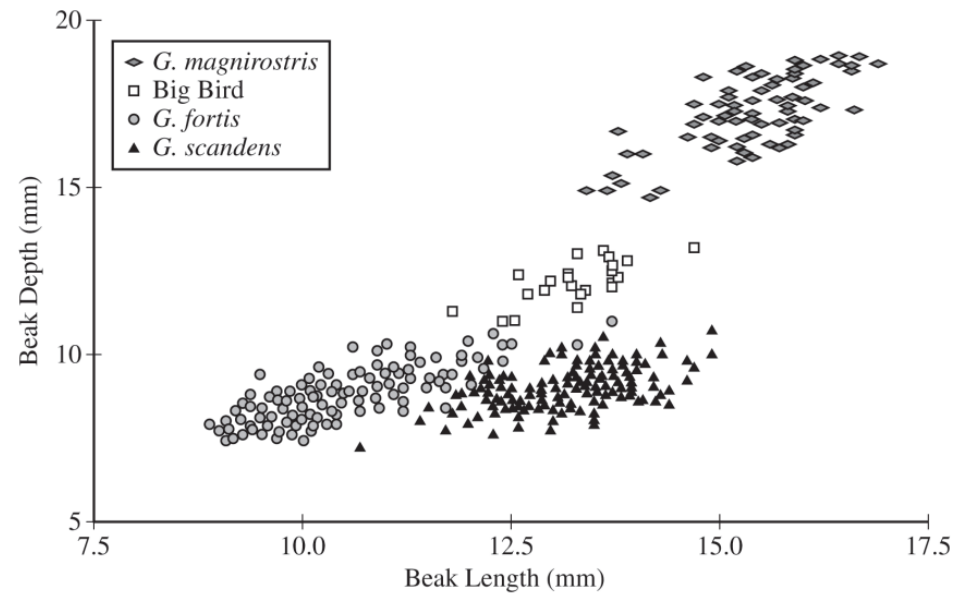


Figure 1. The dimensions of the beaks of the Big Bird lineage and of its major competitor species in 2012 on Daphne Major. Each symbol represents the beak dimensions of a single bird.



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(a) The Big Bird lineage became reproductively isolated from *G. fortis*. **Describe** one prezygotic mechanism that likely contributed to the reproductive isolation of the Big Bird lineage from *G. fortis*.

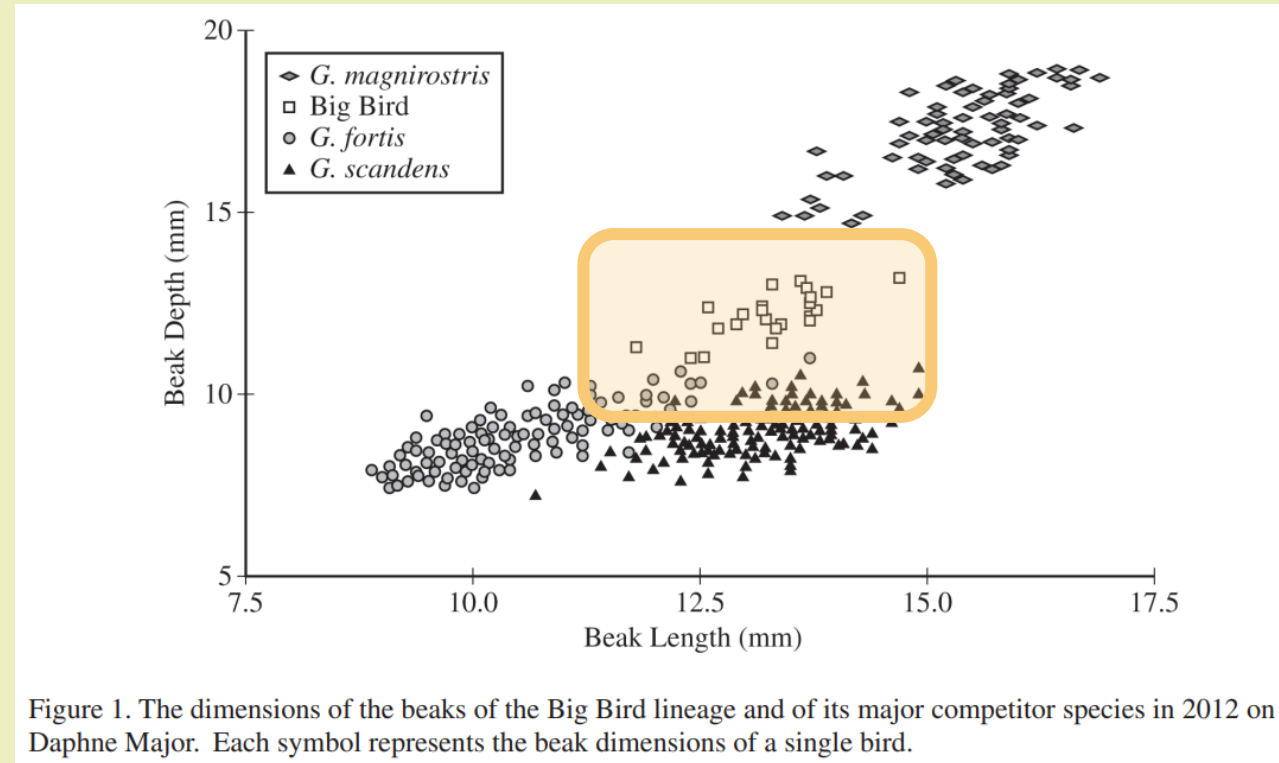
Accept one of the following:

- Beak shape/size or song or behavior or mechanical/chemical differences or time of mating or location on the island or primary food source differs between the Big Bird lineage and *G. fortis*.
- Description of another mechanism that prevents males and females from different populations from encountering each other/recognizing each other as potential mates.

A. One prezygotic mechanism that isolated Big Bird from *G. fortis* is **mating rituals**. As Big Bird formed into a new species, their mating partners may have shifted so *G. fortis* did not recognize them.



(b) Based on the data in Figure 1, **explain** why the Big Bird population has been able to survive and reproduce on Daphne Major.



- The birds have a beak size/shape that differs from the beaks of the competitor finches on the island. Thus, they probably do not compete with the other finch species for food but instead, eat food that the other finches do not consume.



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B. The Big bird population has been able to survive and reproduce on Daphne Major because their beak size and shape is unique. Big Bird's unique beak size and shape allows it to occupy a unique ecological niche, where it is not in constant competition for food.



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(c) A virus infects and kills all *G. magnirostris* on Daphne Major but does not affect the other finch species. Assuming food type and availability stay the same, **predict** the most likely change in the beak phenotype of the Big Bird population after six more generations.

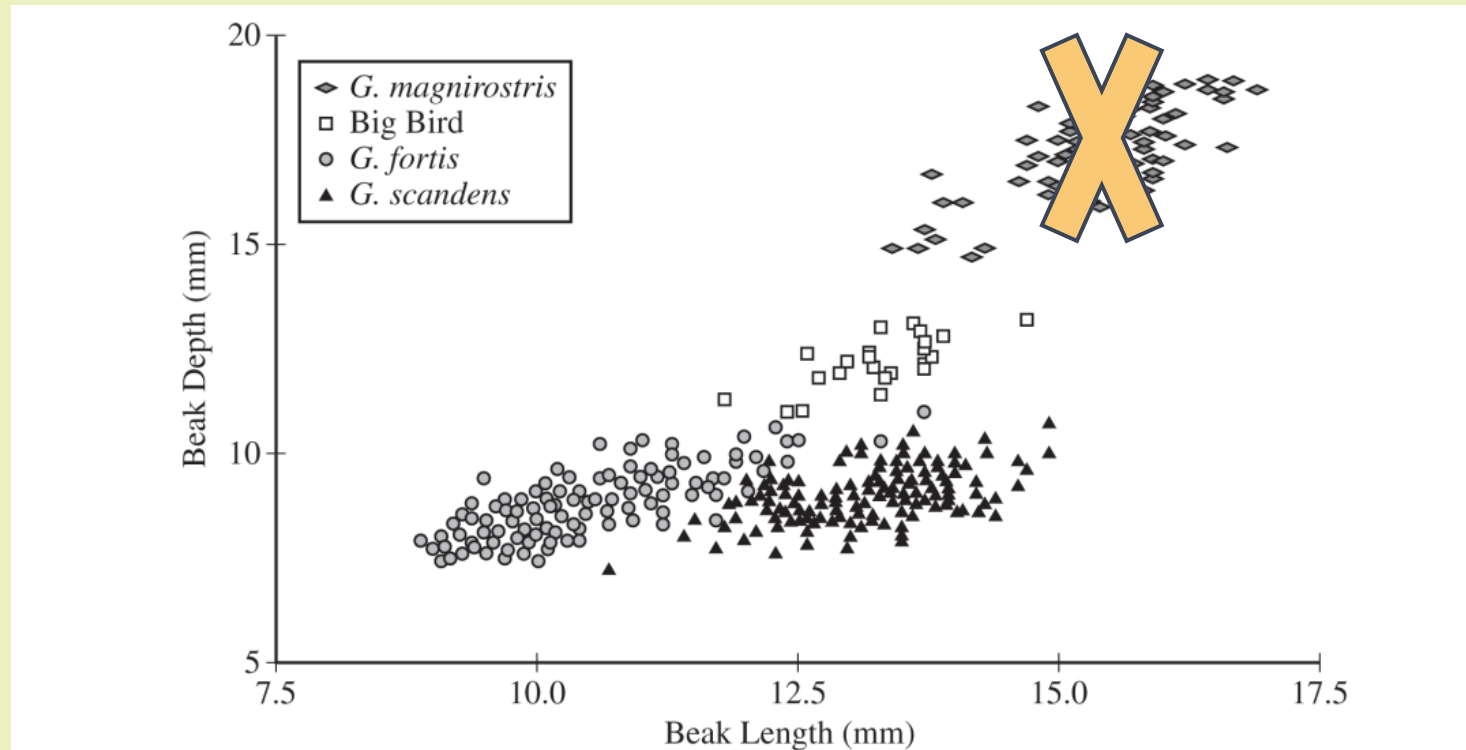


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Accept one of the following predictions:

- Option 1: The (mean) beak size will increase (in the population).
- Option 2: The (average) beak (in the population) will be longer and deeper.
- Option 3: The frequency of large beaks will increase (in the population).
- Option 4: The (mean) beak size will stay the same (in the population).

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C. I predict that Big Bird's beak phenotype will increase in length and depth after six generations.



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(d) Provide reasoning to **justify** your prediction in part (c).

Accept one of the following:

- Justification for options 1, 2, and 3: There will be directional selection for larger beaks because larger seeds are more accessible.
- Justification for option 4: There is little genetic diversity because all birds are descended from a single pair, and the birds are only six generations from the founder.

D. Big Bird's beak will increase in size because it provides a **selective advantage**. By having a larger beak, Big Bird will be able to expand their ecological niche into ~~the~~ G. magnirostris's former niche. **This will increase food supply**, so natural selection will favor the Big Bird variations with larger beaks.

