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Friday 10 June 2016 – Morning

LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE

R072/02/1 How scientific ideas have developed

INSERT

Duration: 1 hour



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- This Insert contains the case study required to answer Question 1. Question 1 accounts for 25% of the total marks.

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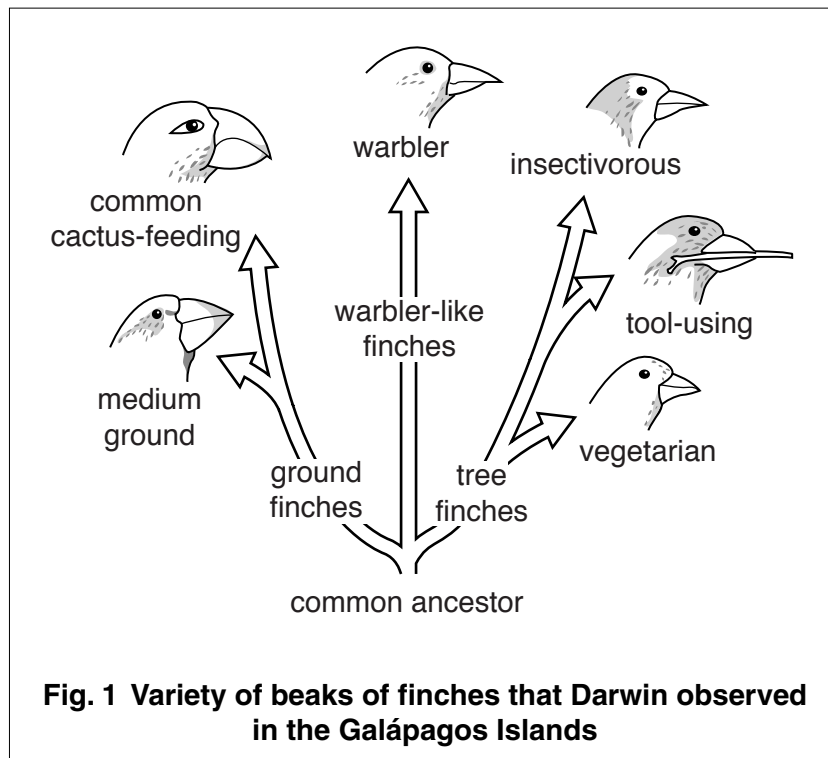
Natural Selection

The Galápagos Islands

Charles Darwin visited the Galápagos Islands in 1835. These islands are in the Pacific Ocean more than 1000km from the coast of Ecuador. The islands have many unusual biological species which do not exist in other places. Survival isn't easy on these islands. It is very hot during the day, freezing cold at night and there isn't much food. Darwin spent only five weeks there. He started writing to a friend about his ideas in 1836 – but did not publish his book *On the Origin of Species* until 1859.

Darwin's finches

Darwin noticed a lot of very similar small birds called finches on the islands. He did not realise at first that they were all related to each other. There are several species of finches which do not interbreed. Each species feeds on one type of food in a specific way and has a beak which is suited to the type of food that it eats. The finches have few predators or competitors.



Studies of finch DNA in the twentieth century have shown that all the finches on the Galápagos Islands have evolved from one common ancestor, as shown in **Fig. 1**. A species of South American finch came to the islands about 3 million years ago. Groups of the birds began to occupy new habitats and feed in different ways. Over the years, the finches became distinct from the mainland population. For example, the common cactus finch has a long beak that reaches into blossoms, and the medium ground finch has a short beak which allows it to break open the seeds that are buried under the soil.

Studies of finches by Peter and Rosemary Grant

Having read about Darwin's journeys and his ideas about evolution, British biologists Peter and Rosemary Grant decided to study the finches in the Galápagos. They landed in 1973 on the tiny uninhabited island of Daphne Major, which is an extinct volcano.

Daphne Major has two main types of finches.

Common name	medium ground finch	common cactus finch
Scientific name	<i>Geospiza fortis</i>	<i>Geospiza scandens</i>
Beak	short	long
Main food	small or large seeds	pollen and nectar from cactus flowers

The Grants studied the population of medium ground finches. Finches can grow to different sizes. In 1976 the Grants observed all 751 finches on the island and measured the size of their beaks (**Fig. 2**). They were able to compare the mean size of the parent finch beaks to the size of the beaks of their offspring (**Fig. 3**).

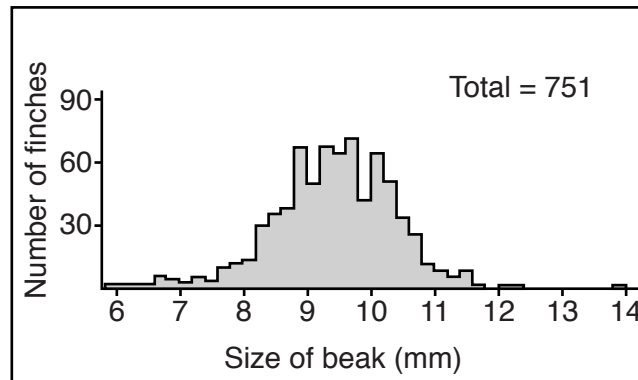
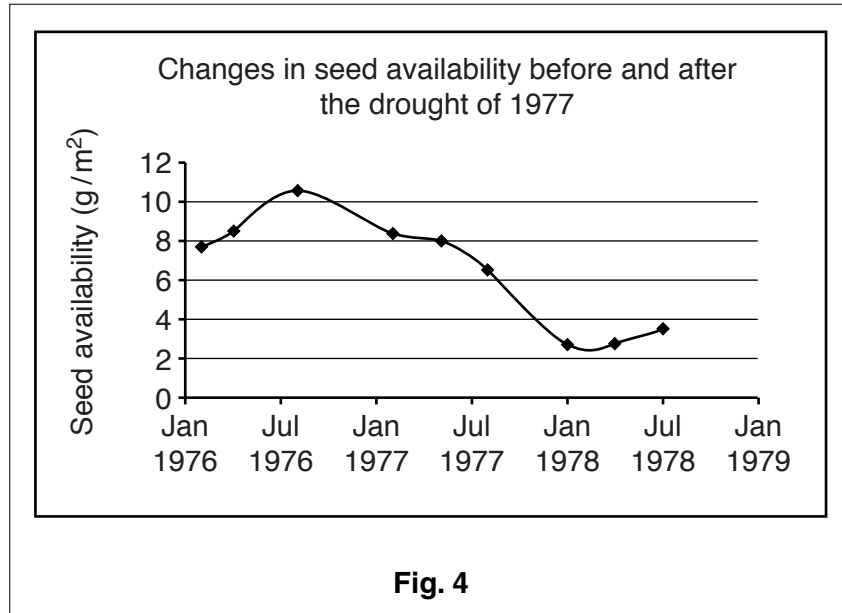


Fig. 2 Distribution of size of beaks in 1976

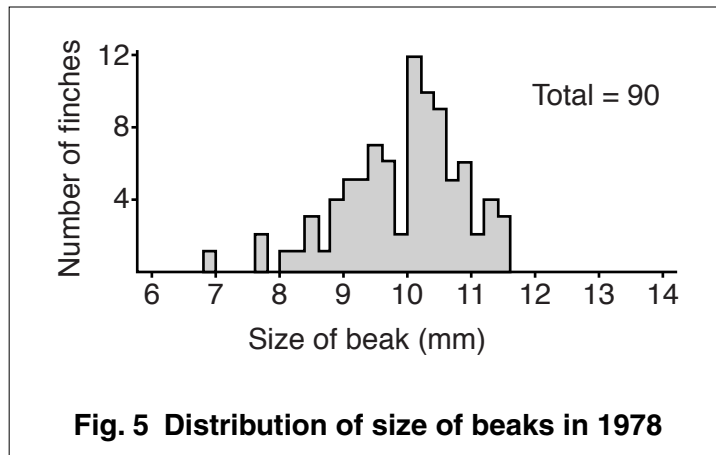
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Fig. 3 Mean size of beak

The major factor that influences the population of the finches is how much of their food is available. In 1977 there was a drought. For 551 days the islands received no rain. There was a decrease in the tiny seeds that medium ground finches usually ate (**Fig. 4**).



Finches with larger beaks could crack open larger seeds. The smaller-beaked birds couldn't do this. In 1978 the Grants returned to Daphne Major to continue their study of medium ground finches. They found only 90 birds and again measured their beaks (**Fig. 5**).



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