

Explaining Biodiversity: Why so many ground finches in the Galapagos?

TEACHER GUIDE

We've figured out something about how new species arise, and we have some kind of explanation for how the more than seventeen species of finches endemic to the Galapagos islands came to be.

But why so many species? What factors might have led to such diversity?

Students are given six cards, each with a different ground finch species (sample at right) and a map of the archipelago. Using the data, the map, and their whiteboards, they should work to uncover any patterns that might help to answer our question about why there are six different species of ground finches in the Galapagos.

The concept we are working with implicitly is “niche”.

Niche helps us to understand two things. (1) In terms of evolution, the niche is the environment in which this species has evolved and continues to evolve. It's part of each species' natural selection story. (2) In terms of ecology, if two species overlap too much in their niche, they will suffer from inter-species competition. So, having a distinct niche from other species allows coexistence.

If you have not already talked about this word “niche”, you should only disclose this vocabulary to students AFTER they have identified the concept. That is, if they are talking about differences in habitat, geography or diet as part of their explanation for biodiversity or the coexistence of six unique ground finch species on this tiny island chain.


How to structure this activity:

At this point in the year, some classes will be ready to handle this activity in a rather unstructured manner. Simply give them the materials (including the student handout with questions) and ask them to look for patterns in diet, habitat and geography among the six species. As they uncover these patterns, wander the room and problematize particular pieces. For example, “*Are there any pairs of species that seem like they mostly rely on the exact same foods and live in the same places?*” The two species of cactus finch are a great example: they share are very similar diet and habitat needs. The key realization here is that the two species are not found on the same islands. In other cases, species pairs overlap geographically but have subtle differences in their dietary or habitat needs or preferences. The goal is to then hold a productive whole-class conversation.

Some classes may require you to provide more structure. You can assign individual table groups to only compare and contrast one pair of species (which you can choose strategically). You can ask students to first work on mapping the species to islands or even edit the map resources so that it already indicates the distribution of each species, reducing the data processing load. You may also choose to offer some very directed questions, projecting them at the front of the class.

What you should avoid: (1) Try not to steal the “aha” moment from your students. The information on these cards and the task of recognizing similarities and differences affords them an opportunity to uncover the concept of niche and to understand how niche helps us explain biodiversity. (2) The other outcome you should try to avoid is *over*-structuring the activity. At some point students may become so focused on complying to the task and therefore can no longer do the intellectual work of noticing patterns and connecting back to our question. We recognize time is a huge constraint in many classrooms at this point in the calendar year, and so we encourage you to think about how to best structure this activity for your students in a productive manner that moves the work along.

Finch Cards: Why so many ground finches in the Galapagos?



Large Ground Finch
(*Geospiza magnirostris*)

Diet: Feeds mainly on large seeds but also takes *Opuntia* cactus fruits, caterpillars and large insects. It feeds on seeds of *Bursera graveolens*, but its main seed source includes the woody seeds of *Tribulus cistoides*. Its large, strong bill allows it to crack open these hard seeds.

Habitat: Frequents arid scrubs in the lowland areas of each island.

Location (islands where this species is found): Wolf, Pinta, Marchena, Genovesa, Isabela, Fernandina, Santiago, Rabida, Pinzon, and Santa Cruz islands.

This is the table from the student handout. We've added some summary information, highlighting a portion of the similarities and differences between the species in terms of diet and habitat. The other piece you will need to look at is the Galapagos map, where students record island locations.

Species	Diet	Habitat	Similarities to Other Ground Finches	Differences from Other Ground Finches
small ground finch	small seeds, buds and insects, but seeds are the main food; also feeds on fruits from <i>Opuntia</i> cactus.	all elevations, from arid lowland areas with cacti, deciduous shrubs and small trees, to moist highland forest dominated by trees of genus <i>Scalesia</i>	-eats seeds -uses/eats <i>Opuntia</i> cactus (mostly the fruit) -eats insects	-small seeds -can live in almost any habitat, so it may be able to exploit habitat that other species on the island might not prefer
medium ground finch	variety of seeds, fruits and insects. It takes mainly small seeds, flowers of <i>Opuntia helleri</i> cactus, seeds of <i>Tribulus</i> plants and insects	forest edges and scrubby areas. but it can be found in all habitat types and at all elevations; prefers arid lowland zones and transition areas where it is common; during the non-breeding season, mostly seen in highlands.	-eats seeds -uses/eats <i>Opuntia</i> cactus (mostly the flowers) -eats insects -found in arid lowlands (like many of the other species) -seems to eat wide variety—both things the small finches eat and things large finches eat	-moves to “highlands” when not in the breeding season -can live in many habitats, including “transition” areas, forest edges and scrubby areas
large ground finch	mainly large seeds but also takes <i>Opuntia</i> cactus fruits, caterpillars and large insects; seeds of <i>Bursera graveolens</i> , but main seed source includes woody seeds of <i>Tribulus cistoides</i> ; large, strong bill allows it to crack open these hard seeds	frequents arid scrubs in the lowland areas of each island.	-eats seeds -uses/eats <i>Opuntia</i> cactus (mostly the fruit) -eats insects -found in arid lowlands (like many of the other species)	-large seeds -woody seeds -hard seeds (<i>Tribulus</i>) -large insects -stays in the lowlands
common cactus finch	prickly-pear cactus <i>Opuntia helleri</i> provides food—the finch feeds on pulp, fruits, flowers and insects associated with the plant; diet varies across seasons as cactus provides pollen and nectar, collected thanks to the specialized beak of this species; fruits and seeds are important components of its diet too	frequents arid lowland areas where cactus <i>Opuntia helleri</i> is present. It is rarely seen higher in more humid areas.	-eats seeds -uses/eats <i>Opuntia</i> cactus (all of it, really) -eats insects	-really eats ALL parts of the <i>Opuntia</i> cactus -though nearly the same diet and habitat as the Hispaniola cactus finch, it lives on different islands
Hispaniola cactus finch	most of its food from the prickly-pear cactus <i>Opuntia helleri</i> , from which it takes pulp, flowers, fruits and insects feeding on cactus flowers	frequents the arid lowlands with dry scrub, and the areas with cacti of genus <i>Opuntia</i> ; often seen on the ground.	-eats seeds -uses/eats <i>Opuntia</i> cactus -eats insects -lives in arid lowlands -found on the ground, mostly	-though same diet and habitat as common cactus finch, it lives on different islands
vampire finch	main part of diet is made up of seeds and invertebrates; other sources of food include bird eggs, guano, leftover fish, and nectar from <i>Opuntia</i> cactus; when food sources are scarce, may feed on the blood of other birds	found on or near the ground	-eats seeds -eats insects/invertebrates -uses/eats <i>Opuntia</i> cactus	-eats a bunch of stuff that other finches do not eat and can even resort to taking blood meals