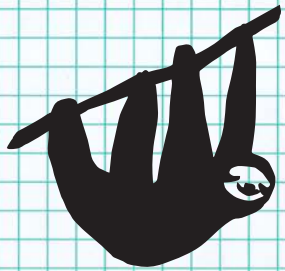


*Slide 1*



Evolution in Action

Resource  
Competition Game

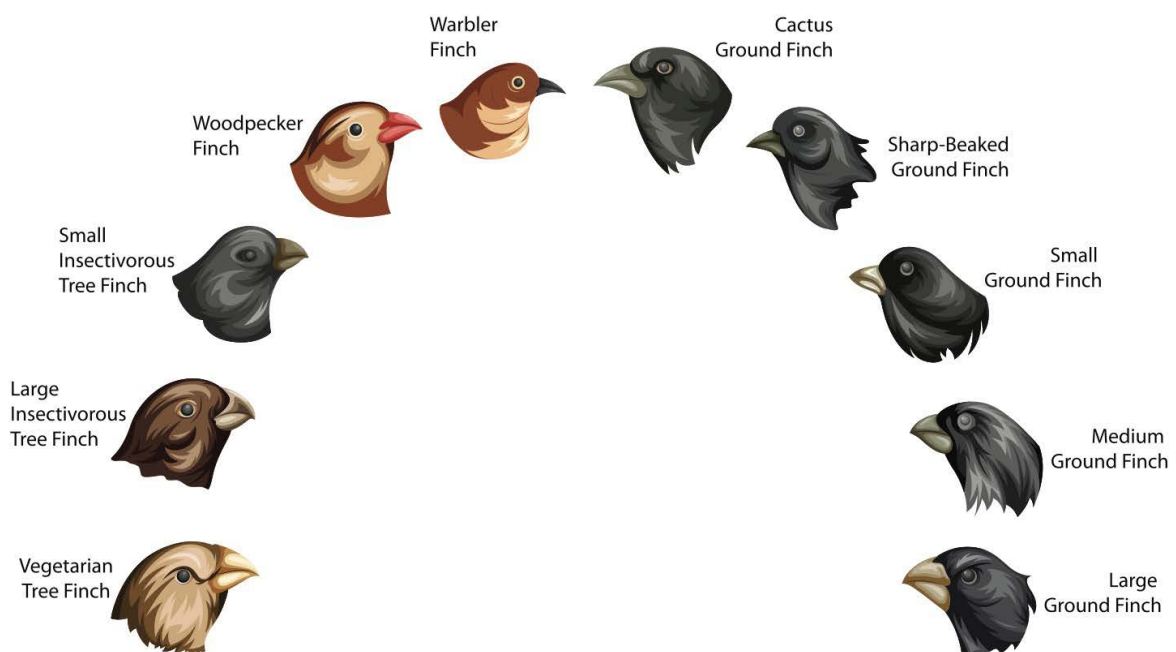


## Slide 2

### *How Darwin's finches got their beaks?*

You can ask that question in the beginning to increase the interest about the topic, and to illustrate why competition is important in evolutionary biology. No need to answer to this question at this point, as you will come back to it in the end of this workshop.

### How Darwin's Finches got their beaks?



### Slide 3

The idea of this slide is to define competition.

*What does it mean?*

You can also ask if participants know other interactions between species.

Effect on species A	Effect on species B	Interaction
-	-	Competition
-	0	Amensalism
-	+	Predation, herbivory, parasitism
0	0	No interaction (neutralism)
0	+	Commensalism
+	+	Mutualism

### COMPETITION IS ...

... an interaction between two organisms in which both of them are harmed.

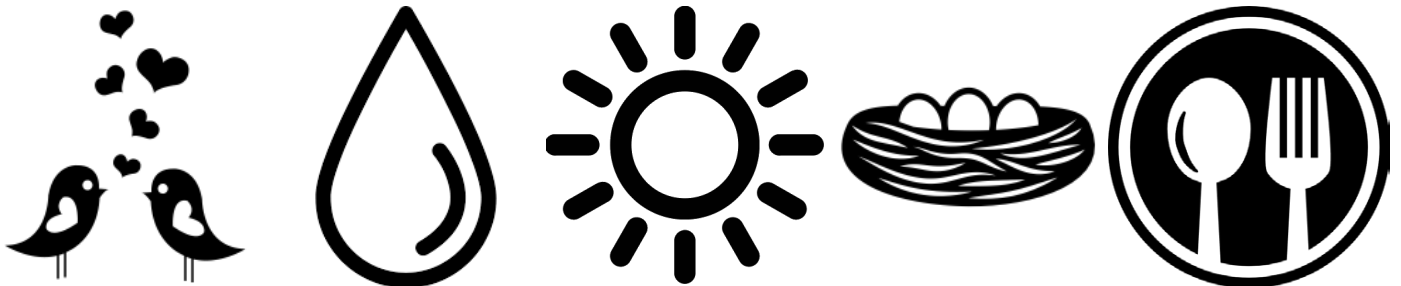
It can happen, for example, due to a limited supply of a resource.

## Slide 4

In this slide, you can ask what do organisms compete for?

- food / nutrients
- water
- mates (intraspecific competition)
- land / territory / nesting sites
- light (for example plants)

ORGANISMS CAN COMPETE FOR :



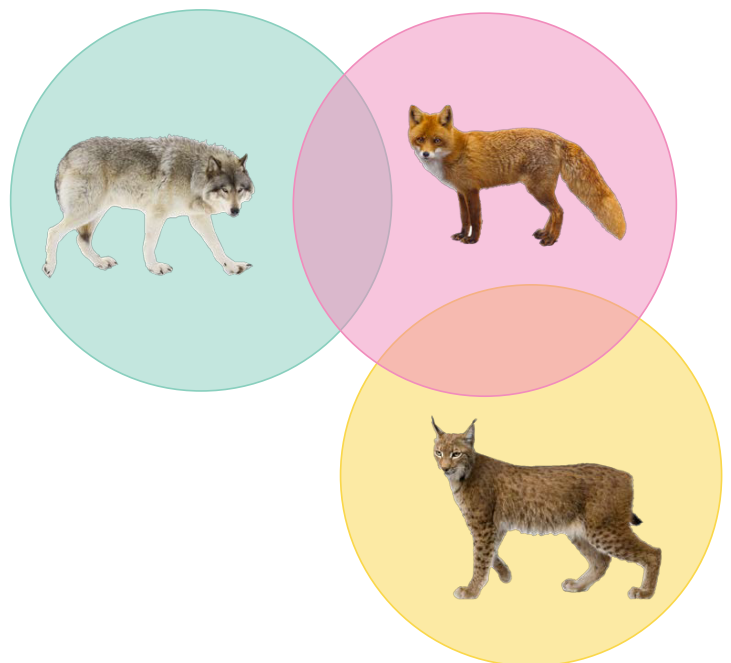
## Slide 5

Competition can be divided to intraspecific (within species) and interspecific (between species). The circles represent the ecological niches of different species. Interspecific competition occurs, when individuals of different species share a limiting resource in the same area, when the ecological niches overlap.

INTRAspecific competition



INTERspecific competition



## Slide 6

Here is an example of the ecological niche of the red fox, it consist of the habitat, activity, diet and interspecific interactions with other organisms.

### THE ECOLOGICAL NICHE OF THE RED FOX (*Vulpes vulpes*)

#### Habitat:

forest, grasslands, mountains, deserts, suburban areas

#### Activity:

active during all seasons, at night and twilight, occasionally during daylight

#### Diet:

omnivorous: small mammals (mice, rats, voles, ground squirrels, woodchucks, gerbils, gophers), small birds, reptiles, rabbits, porcupines, plants (grasses, fruits, roots), fish, frogs, worms, garbage and pet food.

#### Interspecies interactions:

predator, prey, competitor, host for parasites, disperse seeds



## Slide 7

*Based on previous slides, can you give examples under which circumstances red fox and grey wolf could compete in the nature?*

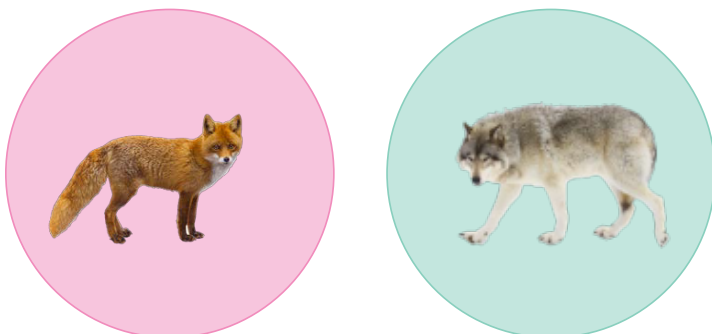
Answer: when they are sharing the same limiting resource in the same area.

For example, grey wolves and red foxes can be found in the same habitat. Also, their diets can overlap as both feed on small mammals and birds.

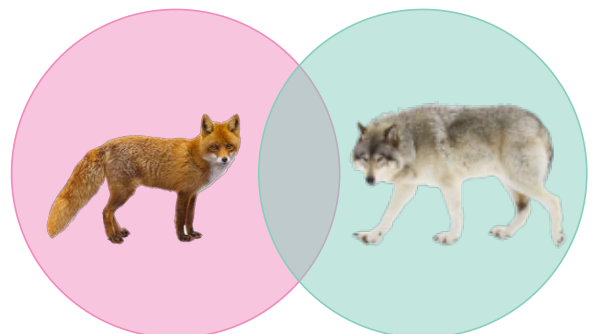
(Note. wolves can also sometimes predate on red foxes, but no need to pay attention to this in this workshop because predator-prey interactions is different from competition)

Overlapping ecological niches lead to **competition**

NO competition



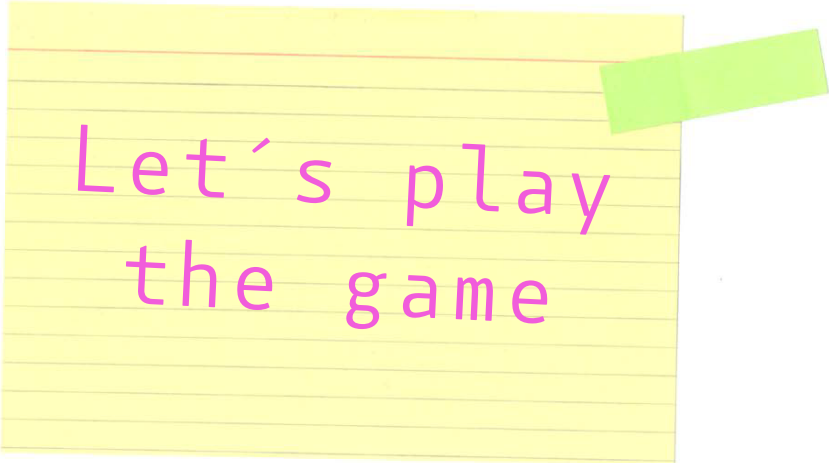
Competition



## **Slide 8**

Let's play the game!

You can divide the participants into groups and explain the rules of the game. (Check the game rules file)



Let's play  
the game

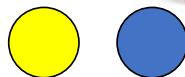
## Slide 9

In this slide, you can remind the participants that each species can collect specific resources during the game, which are indicated as different coloured circles. (Check the game rules file)

GREY WOLF  
(*Canis lupus*)



EURASIAN LYNX  
(*Lynx lynx*)



RED FOX  
(*Vulpes vulpes*)

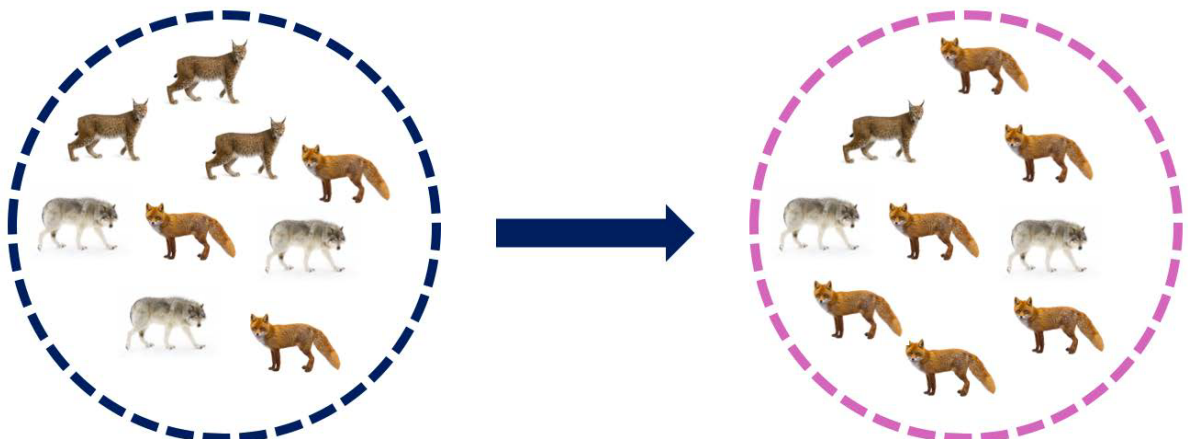


## Slide 10

This slide is for the participants to reflect and discuss what they have learned and experienced during the game.

### What did you learn?

In natural conditions, the available resources (food, space) are often limited. This can lead to a reduction in growth, survival and reproduction for one or the other species, which can affect animal community structures.



## Slide 11

### Gause's law

... or a competitive exclusion principle.

Two species that compete for the same resources cannot stably coexist. If one species has a slight advantage over the other species, it can lead to:

- 1) Extinction of the weaker competitor
- 2) Evolutionary or behavioural shift towards a different ecological niche

## Gause's law

...or a competitive exclusion principle.

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- 1) Extinction of the weaker competitor
- 2) evolutionary or behavioral shift towards a different ecological niche

## Slide 12

Example of a weaker competitor.

Mink populations have decreased significantly during last decades.

During the last decade, the expansion of American mink is the main threat to the conservation of the European mink.

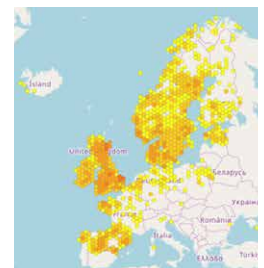
However, it is not the sole reason for the decline in the European mink population.

### Example: facing extinction?

European Mink  
(*Mustela lutreola*)



American Mink  
(*Neovison vison*)



During the last decade, the expansion of American mink is the main threat to the conservation of the European mink.

However, it is not the sole reason for the decline in the European mink population.

## Slide 13

Here is a nice example of how interspecific competition can affect species. An example by PR and BR Grants (2002, Science).

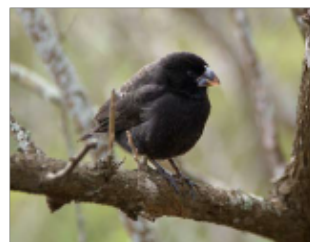
Read more: Peter R. Grant & B. Rosemary Grant 2006 Evolution of Character displacement in Darwin's Finches. Science, 313: 224-226. (You can find a link to this article from our website)

### Example: evolutionary shifts

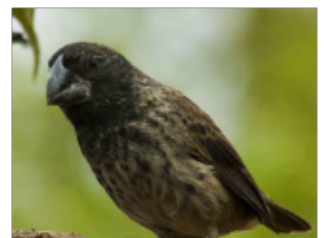
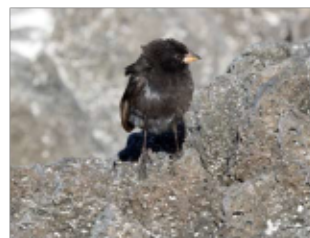
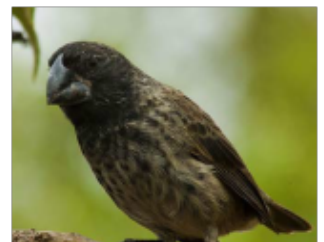
(From Peter ja Rosemary B. Grant)

Resource competition between two species (*Geospiza fortis* and *Geospiza magnirostris*) had caused the beak size to shrink in *G. fortis*.

*Geospiza fortis*



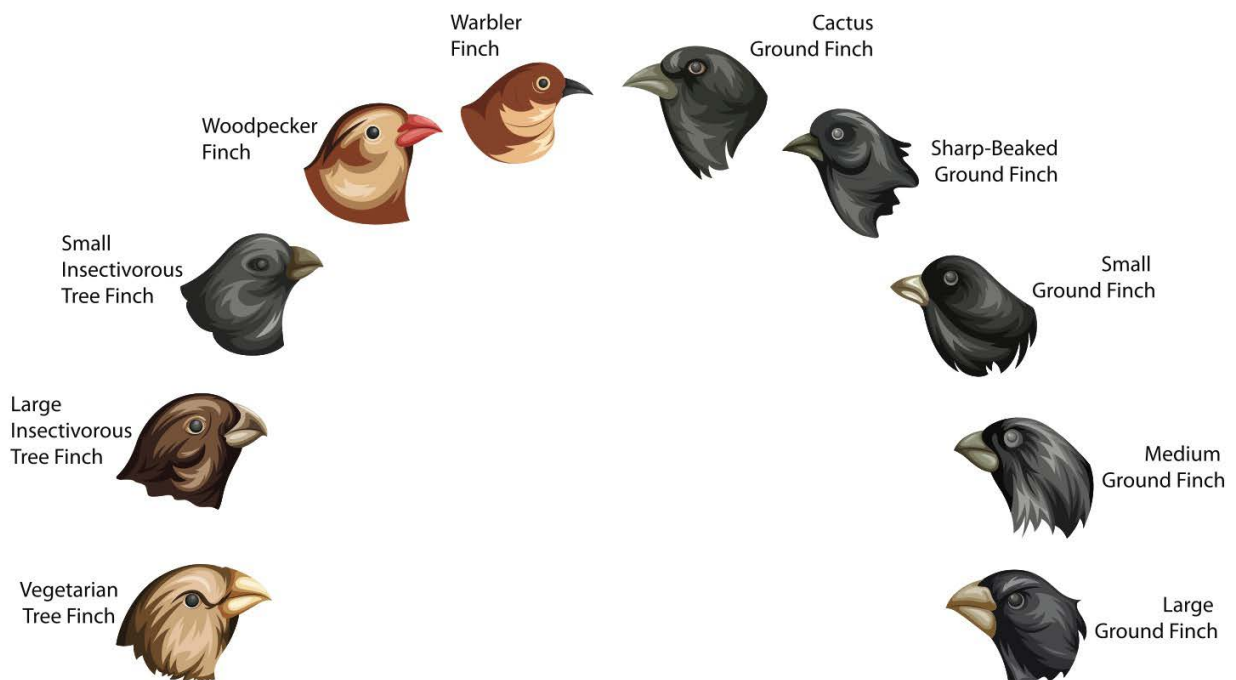
*Geospiza magnirostris*



## Slide 14

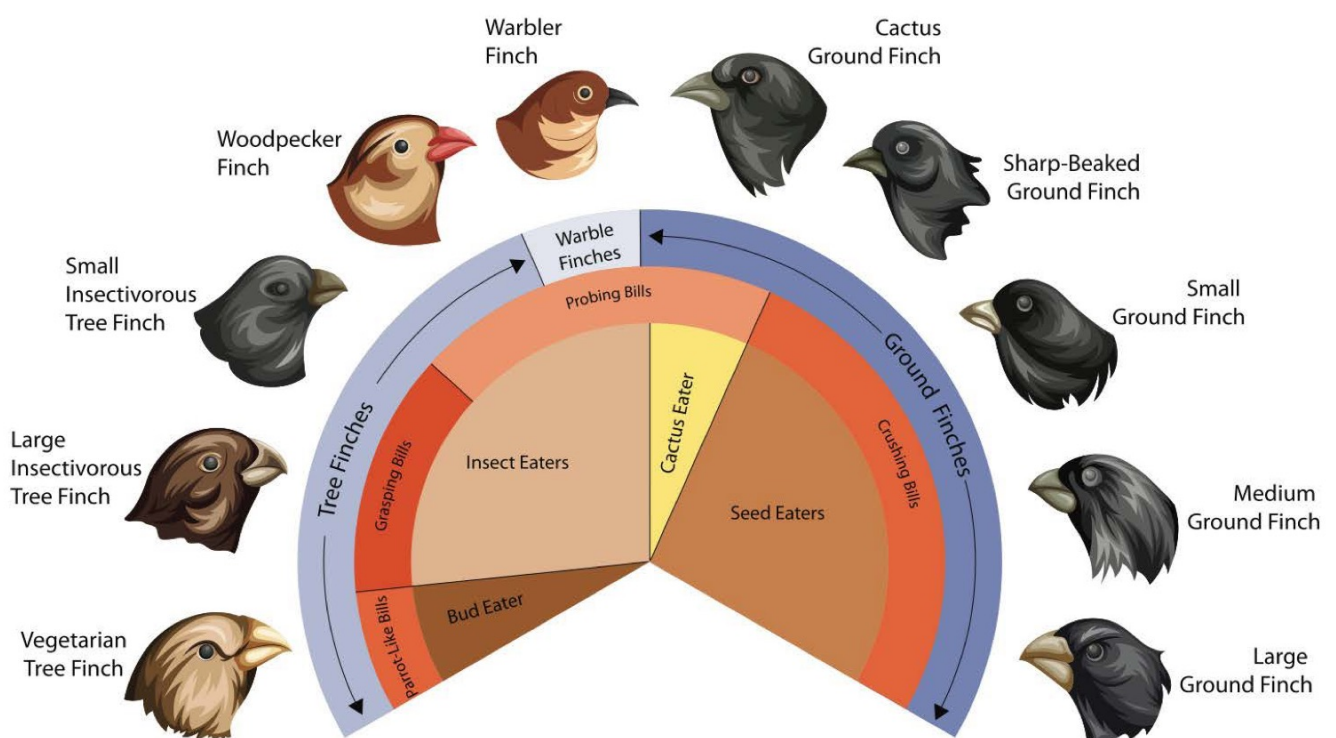
Back to the beginning. Now, you can ask again: How Darwin's finches got their beaks?

### How Darwin's Finches got their beaks?



## Slide 15

This variation in the shape of bird beaks are adaptations that make the species more fit to survive on available food. For example, to catch insects the beaks are sharper than those of feeding on cactus.



## **Slide 16**

Thank you for using our workshop in your teaching!

You can tell us what we have done well and how to improve our workshops and teaching materials further by contacting us at [evoluutiopajat@gmail.com](mailto:evoluutiopajat@gmail.com)

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