BATTLE OF THE BEAKS

Biology Practical—Beak adaptation

It is expected that the practical part of this task can be completed in 45–60 minutes. The activity is intended for the whole class, but you should work individually within the group. Discussion activities will depend on the time available. There are extension activities on the last page which you may like to try.

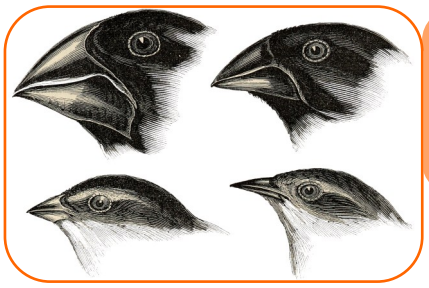
Your class will be provided with the following apparatus:

APPARATUS

- 7 pairs of scissors
- 7 teaspoons
- 7 pairs of fine tweezers
- 7 clothes pegs
- 28 plastic beakers or cups

MATERIALS

- large paperclips
- large rubber bands
- toothpicks
- macaroni (or other small pasta)
- marbles
- mini-marshmallows
- peas



The birds in this image are known as Darwin's finches, and are found only in the Galapagos Islands. They were first collected by Charles Darwin during his voyage on *HMS Beagle*. The birds have developed highly specialised beak shapes, depending on the food available on each island.

In any habitat, food is limited and the types of foods available can vary. Animals with variations allowing them to take advantage of available foods will be more likely to survive. We call beneficial inherited variations *adaptations*. Animals with the most helpful adaptations will be the most likely to live long enough to pass their genes on to the next generation.

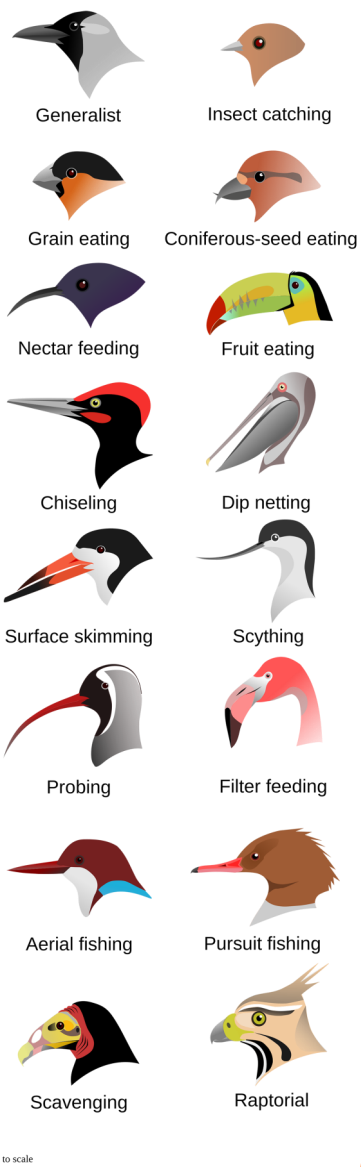
In this activity you will simulate bird feeding by using a beak to collect food and place it into a stomach. There are four different beak shapes and a range of different food types to choose from.

This activity will allow you to explore the wide variety of beak types that can be seen within the bird population, as well as developing an understanding of the way in which beak shape is related to the available food sources within an environment.

Note: Remember that you are in a classroom and you should behave appropriately. As this activity simulates a competitive environment, you may get carried away—but remember that you are not actually a hungry bird!

Practical activity

You should select one of either a spoon, tweezers, clothes peg or scissors plus a plastic cup, then sit quietly in a large circle. You are now birds. Your chosen implement is your beak, and the plastic cup is your stomach. The beak must be held in one hand and the stomach should be placed on the floor. The stomach must remain upright at all times, and you can only put food into it using your beak.



Wikimedia/L. Shyamal

The diagram above shows how different beak types are adapted to different feeding strategies. The generalist beak type is used by birds that are less specialised feeders.

Some food items (paperclips, rubber bands, marbles, etc.) will be placed in the feeding area, and spread out evenly among the birds. When the teacher says 'go' you are to use your beak to collect as much food as you can, and place it in your stomach. You will be given 1–2 minutes to feed. You have until the teacher says 'stop'. At this point you should stop feeding and count the items in your stomach, then return the items to the teacher and record the total on the next sheet.

Next the teacher will distribute a different food type, and you can repeat the experiment. Once you have tried all of the available food groups, you should collate your individual results into a class data set. For your final feeding activity, all types of food will be made available. You do not need to record the data for this round.

Discussion

In this experiment what is the dependent variable? What is the independent variable?

Why is it better to use data from the entire class averaged together when assessing results and creating a graph, rather than using only your own data? For this experiment is it better to use a bar graph or a line graph to display the data? Create the appropriate graph from your class data set.

What did you notice about your behaviour and the behaviour of the other 'birds'? Is this analogous to the behaviour of birds in the wild? Obviously most habitats have more than one food type available. This was simulated by the final feeding round in the activity. What was your strategy when all food items were available? How did this differ from your strategies in the previous scenarios?

What if the paper clips were high-protein beetles that were four times more nutritious than any of the other food items? Would your feeding strategy change?

What would happen if all of the birds simulated here flew to an island where no birds had been before, and the only available food was raisins. Which birds would be most successful? Which would be least successful? If we came back to the same island in 50 years, what would you expect to see?

Student worksheet

Read the procedure on the previous page, then make a hypothesis as to which beak type will be best at collecting which food type. State why you think this is the case.

Hypothesis:

_____
_____
_____
_____

Individual results:

Write your beak type in the box. During the experiment, fill in the quantity of each food item that you were able to collect.

Food type

Beak type	Paper clips	Rubber bands	Toothpicks	Macaroni	Marbles	Mini-marshmallows	Peas

Class results:

Calculate the average number of each food item collected by each beak type during your experiment, and fill in the table below. Use your data to create a graph showing the results of your experiment.

Food type

Beak type	Paper clips	Rubber bands	Toothpicks	Macaroni	Marbles	Mini-marshmallows	Peas
Scissors							
Spoons							
Tweezers							
Binder clips							

Look at your data tables and graph, then write your conclusions below.

_____
_____
_____
_____

Was your hypothesis correct? If your hypothesis was wrong, form another and test it out—that's how scientific theories are made!

Extension activities

Research the life of Charles Darwin and his voyage on *HMS Beagle.* Work as a group to develop a timeline of Darwin's work on the theory of evolution, until he published his book *On the Origin of Species* (1859). Make sure to mention other prominent scientists who were involved, including Alfred Russel Wallace, Charles Lyell and Joseph Dalton Hooker.

Visit a local park or woodland area and observe the birds that you find there. Make notes on their appearance, paying special attention to features that differ widely between species (such as beak shape). Take photographs or produce sketches of the birds you observe. Once you are back in the classroom, use ornithology books or the internet to identify the species of birds you have seen. Try to find out about the feeding habits of these birds—can you formulate a theory as to why the birds have the specific features you have noticed?

You will be allocated a beak type (a peg, pair of tweezers or a plastic spoon). In pairs, collect a beaker containing 30 peas, your beak implements and a stopwatch.
You have 15 seconds to compete with your partner for the food in your beaker. You can only use your beak to pick up food, and you cannot pick up another food item until the previous one is safely in your hand. If you drop any, you will need to use your beak to pick them up before you can continue. After 15 seconds count how many food items you have. The winner is the one with the most, and at this point the losing bird 'dies'—it has been outcompeted. The winning bird 'reproduces' - in our simulation the losing bird will swap their beak type to that of the winner. (Make sure you have plenty of each type!) Keep swapping partners and repeat the competition until you have done it three times. After three competitions record the frequency of beak types in your population. Now complete another three competitions before stopping and recording the frequency of beak types again. Explain what happened to the bird populations as the experiment progressed and why. Do you think this is an accurate representation of population dynamics in a real-life ecosystem?

In your experiment above, the losing birds died at the end of each round of the experiment. Eventually, the weakest species will die out altogether. This is a natural and essential part of the evolutionary process, but in some cases the extinction of species has been hastened by human intervention. Visit the IUCN Red List website (www.iucnredlist.org)and research some species which are critically endangered. Have these species been naturally outcompeted, or have humans played a role? Write a report on your findings. Be sure to mention a variety of species—not just the cute and cuddly!

Educational resources from
The Linnean Society of London

For more information contact:

The Education Officer
The Linnean Society of London
Burlington House
Piccadilly

The LINNEAN SOCIETY of London

A Forum for Natural History

www.linnean.org

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