

How rare is a white kiwi? - Teachers' Notes

Curriculum Links

This task has links to the Probability section of the Level 4 Statistics statement. It requires students to create a model diagram of the chance of a rare recessive trait occurring in a population. It also requires using fractions and percentages to describe probabilities. The white kiwi is an authentic and local context within which to develop a better understanding of scientific concepts related to Level 4 and Level 5 of the Living World.

Background

Investigating the mathematical meaning of terms can contribute to a student's mathematical literacy. Through working on a task such as this, a student can critically evaluate the mathematical appropriateness of a term like "rare" when it is applied to a situation.

What does rare mean with regards to genetic traits in kiwi?

Each kiwi has genetic information from both its father and its mother. This information can be presented as a trait, such as brown feathers or white feathers. Some traits are dominant and some are recessive. A dominant gene will overpower the recessive gene and thus for a recessive trait to occur, both parents must have the gene and then there is still only a 25% chance it will occur in the offspring.

For any kiwi we can describe whether they have the dominant gene from both parents (BB), the recessive gene from both parents (ww), or the dominant gene from one and the recessive gene from the other (Bw). Because each parent is equally likely to pass on either of their genes to their offspring, we can then easily construct tables to determine the possibilities for the chick.

Possible outcomes for chick if both parents have the recessive gene for white feathers (both parents (Bw))

	Father B	Father w
Mother B	BB (brown feathers)	Bw (brown feathers)
Mother w	Bw (brown feathers)	ww (white feathers)

There is a 25% chance of a chick having white feathers

Possible outcomes for chick one parent has the recessive gene for white feathers

	Father B	Father B
Mother B	BB (brown feathers)	BB (brown feathers)
Mother w	Bw (brown feathers)	Bw (brown feathers)

There is no chance of a chick having white feathers

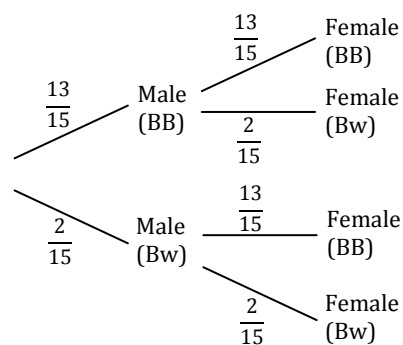
Possible outcomes for chick if both parents have white feathers

	Father w	Father w
Mother w	ww (white feathers)	ww (white feathers)
Mother w	ww (white feathers)	ww (white feathers)

There is 100% chance of a chick having white feathers

Once the student has developed the understanding of simple pairs, then they can extend this understanding to documenting the probability within a population, such as the 30 kiwi at Pukaha-Mount Bruce. They could decide that a certain number of kiwi (say 2 males and 2 females) carry the recessive gene and then develop a tree diagram to try and represent how rare the hatching of a white kiwi would be.

For example, if we assume that there are 15 male and 15 female kiwi, and two males and two females have the recessive gene:



Suggestions

Further research on the population and the individual white kiwi at Pukaha-Mount Bruce may be of interest to the student. Local iwi in the Mount Bruce area and of Northland have also been interviewed about the cultural significance of this rare event. Also, there is the social science-science connection between the mythological stories of rare animals and their genetic traits, such as the Ghost Bear of North America.

Further exploration of probability using tree diagrams and tables

<http://www.nzmaths.co.nz/resource/slater-mazes>

<http://www.nzmaths.co.nz/resource/rough-justice>