

IT'S NOT ONLY PREDATORS

SCIENCE/BASED CROSS-CURRICULUM ACTIVITIES

based on the investigations of Dr Helen Taylor, University of Otago
Visit the Allan Wilson Centre at <http://www.allanwilsoncentre.ac.nz>



TEACHER NOTES

We are very much aware that many of our native birds have become extinct with many more threatened with the same fate. On the brighter side, the growing awareness of the problem and the sharp rise of predator control groups throughout the country is helping to preserve our bird life. Birds such as the little spotted kiwi died out in both the North and South Islands through predation. It was only the introduction of 5 birds, 102 years ago to Kapiti Island in 1912 and the subsequent transfers from Kapiti to other predator free islands and mainland sanctuaries that have ensured the survival of this unique native bird. Their current conservation status is described as recovering* by DoC.



* There are other classification systems that differ from the DoC system. At www.iucnredlist.org the little spotted kiwi is listed as 'near threatened'.

This is also a most useful site for students to learn about threatened species throughout the world.

Any drastic reduction in the size of a population due to a catastrophic event is known as a population bottleneck. Population bottlenecks are also caused when new populations of a species are founded with small numbers of individuals (as often occurs in conservation translocations - see map). In this unit, based on the investigations of Dr Helen Taylor and other researchers, we examine another threat to bird survival – the problems caused by having such a small genetic base to start with (5 birds) and how this research can help our conservation strategies in the future.

EXTINCTION AND THE PROBLEM OF PREDATORS

- Discuss the meaning of extinction or extinct. Have students visit: <http://terrature.org/extinctbirds.htm> to discover birds that have become extinct in New Zealand and the reasons for their extinction. (Also visit: www.teara.govt.nz/en/extinctions/page-1)
- Do the students know that even today it is estimated that over 25 million birds are killed in New Zealand every year? What do students think are the main causes of so many birds being killed? Discuss and list. Have students heard of predators? Can they list the main predators that pose a constant threat to our birds. Did their list include rats, cats, possums, ferrets, stoats, weasels, hedgehogs and dogs? Assign each group a predator and have them conduct research on the threat they pose, (not just to birds but also reptiles, amphibians and insects) their impact, and how/why they came/were introduced at: www.doc.govt.nz/conservation/threats-and-impacts Have groups report their findings back.
- Use class shared reading to find out the threats to both our flora and fauna, that other animal pests pose. Brainstorm ways that these predators and pests can be controlled.

- Have students focus on the other causes of extinction and bird population decline including logging, pastures, deforestation ... listed on the [terrature](http://terrature.org) and [teara](http://teara.govt.nz) websites.

A BIRD THAT VERY NEARLY BECAME EXTINCT

- Tell students that the little spotted kiwi was once very common in both islands of New Zealand. Did they know that they can now only be seen on Kapiti Island, at the Zealandia Sanctuary in Wellington and on some predator-free islands. Visit: www.kapitiislandnaturetours.co.nz/the-island/birds > select the little spotted kiwi link and visit: <http://nzbirdsonline.org.nz/species/little-spotted-kiwi>
- Introduce students to the term 'population bottleneck' to describe a drastic reduction in the number of individuals in a population or species. Using the above websites have students identify the probable reasons that caused this population bottleneck for the little spotted kiwi; how many were taken to Kapiti Island (5)?
- Did students know that all of today's population of about 1700 little spotted kiwi all come from the same five ancestors that were put on Kapiti Island in 1912 and they are known as the founders of all today's little spotted kiwi populations. Today this species is listed (classified) as recovering by DoC.

UNDERSTANDING GENES AND INBREEDING

- Tell students that our present day little spotted kiwi are all descended from just 5 birds. This means many birds are closely related and will often breed with their relatives; this is known as inbreeding.



THAT THREATEN OUR BIRDS

- Tell students that in small populations, mating between relatives is more likely. This inbreeding can cause problems for a species' survival. To understand these possible problems, we have to know about genes and the roles they play.
- Introduce students to genes by playing the what are genes animation at: www.youtube.com/watch?v=5MQdXjRPHmQ
- As class shared reading have students discover the roles that genes play in further detail at: www.cyh.com/HealthTopics/HealthTopicDetailsKids.aspx?p=335&np=152&id=2287
Through discussion have students discover:
 - what genes are
 - where these genes are found
 - how genes work
 - problems with genes
- Focus on the idea of problems with human genes. Tell students that this can also happen with animals such as birds, especially if they come from a very small breeding population. Tell students that when a problem is caused by inbreeding it is called *inbreeding depression* and could lead to a species dying out.

EXTRA FOR EXPERTS AND OLDER STUDENTS

<http://evolution.berkeley.edu/evosite/relevance/IIIAPreservation.shtml>

- Make a more detailed study of inbreeding depression and its effects using the three sections of this website to find out:
 - how species preservation relates to population size
 - the possible effects of inbreeding depression
 - the problems of low genetic variation in a species
 (Vocabulary: 'deleterious alleles' - means a version of a gene that codes for a harmful characteristic. Deleterious alleles are more likely to be expressed in inbred individuals and are the major cause of inbreeding depression).

INBREEDING DANGER FOR LITTLE SPOTTED KIWI

- Through discussion, find out about the research that has been carried out by Dr Helen Taylor about the inbreeding danger to little spotted kiwi at: www.3news.co.nz Type *little spotted kiwi* into Search Box and select *Inbreeding danger for little spotted kiwi - study* (*1 Full URL and bottom of page). Discussion points:
 - the reason 5 birds were moved to Kapiti Island over 100 yrs ago
 - where their descendants are now found
 - what Dr Taylor wanted to find out by studying the genetics of the populations in two different locations
 - reasons why she chose these locations and how the populations are different
 - the contrast in what seems to be happening to the Zealandia*2 population and the Long Island population and the problems caused by generations of chicks being severely inbred
 - why relying on population growth to determine success may not always be enough to save a species

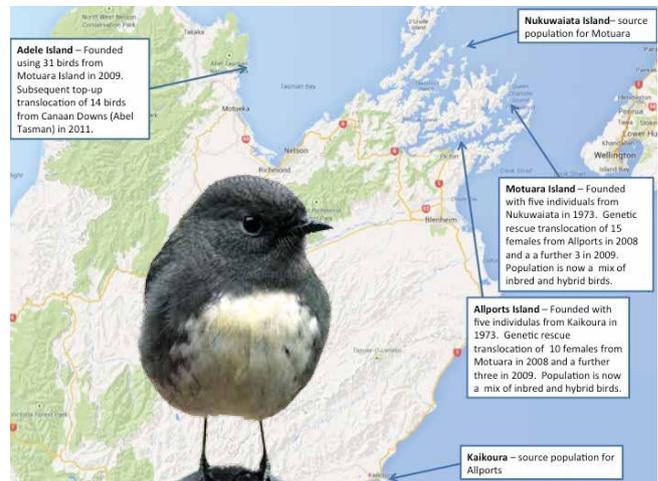
EXTENSION ACTIVITY

<http://sciencelearn.org.nz/Science-Stories/Conserving-Native-Birds/Exploring-genetic-variation>

- Download this science story, teacher lesson ideas and student activities exploring genetic variation and translocation of birds.
- At the completion of the lesson, have students write their own explanation of why it is so important to consider genetic variation when saving a threatened population and how this is carried out.

*1 www.3news.co.nz/nznews/inbreeding-danger-for-little-spotted-kiwi--study-2014120112#axzz3RjhqZKU2

*2 Please note the Zealandia population was founded with 20 pairs rather than the 50 stated in the story.



SOUTH ISLAND ROBIN RESEARCH

- Tell students that although the robin is not regarded as threatened, some populations founded on offshore, predator free islands suffered a bottleneck at translocation as only small numbers of birds were transferred to start these new populations. Dr Helen Taylor is now studying the possible effects of low genetic variation and inbreeding on the sperm of male birds in these translocated populations.
Visit: <http://nzbirdsonline.org.nz/species/south-island-robin> for further research on the South Island robin.
- Visit: <http://helen Taylorscience.weebly.com/my-work.html> and <http://kiwi.cougarline.co.nz/robin-conservation> to discover what Dr Taylor is trying to find out, eg collecting the sperm of the inbred male birds to find out if it is able to still fertilise the eggs of the female robins. To do this she compares the sperm cells of inbred birds with the sperm cells of outbred populations.

SIMPLIFIED VOCABULARY FOR STUDENTS

- **Morphology** – the length and shape of the sperm cells
- **Sperm Motility** – the speed and ability a sperm has to swim and move towards the egg
- **Sperm DNA Fragmentation** – breakages in the genetic material carried by the sperm

- Have students discuss and speculate on how this work could be very helpful to improve these inbred populations. Did students know that through research such as this, it was found that many kakapo males have a high number of abnormal sperm cells which is one explanation for high hatching failure in the species?
- To find out what the kakapo recovery team are doing to improve the fertility of the eggs to help save the kakapo visit: <http://kakaporecovery.org.nz/artificial-insemination/#sthash.sTPeGmRZ.dpuf>

CONCLUDING ACTIVITY

- Invite a representative from DoC and or local council to talk to the class about any predator control programmes happening in your district (also visit: www.naturespace.org.nz) Find out if there are ways your students can become involved in the programme and/or can establish their own local predator control programme.