

91605



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NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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SUPERVISOR'S USE ONLY

## Level 3 Biology, 2013

### 91605 Demonstrate understanding of evolutionary processes leading to speciation

2.00 pm Tuesday 12 November 2013

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of evolutionary processes leading to speciation.	Demonstrate in-depth understanding of evolutionary processes leading to speciation.	Demonstrate comprehensive understanding of evolutionary processes leading to speciation.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

**TOTAL**



ASSESSOR'S USE ONLY

You are advised to spend 60 minutes answering the questions in this booklet.

## QUESTION ONE

Skinks belonging to the genus *Oligosoma* are endemic to New Zealand, and appear to have undergone a rapid phase of divergence 23 to 35 million years ago, when it was estimated that much more of New Zealand's land mass was under water.

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*O. smithi*

<http://www.ryanphotographic.com/scincidae.htm>

*O. suteri*

<http://whereisremi.files.wordpress.com/2010/02/024-2.jpg>

Two *Oligosoma* species (shore skink, *O. smithi*, and egg-laying skink, *O. suteri*) exist as sympatric species in north-eastern New Zealand. Despite living within the same area, the species are not closely related.

*O. smithi* are medium-sized skinks, active in daylight and give birth to live young. *O. smithi* is widely distributed in both coastal regions and off-shore islands, and shows genetic variation.

In contrast, *O. suteri* are significantly larger, nocturnal and lay eggs. Distribution of *O. suteri* is much more limited (northern off-shore islands), and shows remarkably little genetic variation.

Discuss the natural selection pressures that have most likely affected speciation and distribution of these two *Oligosoma* species over the past 35 million years.

In your answer you should:

- describe the type of speciation that has happened between these *Oligosoma* species, with reasons
- explain how biological and geographical factors have contributed to speciation
- evaluate differences in genetic diversity and distribution patterns between the two species.

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## QUESTION TWO

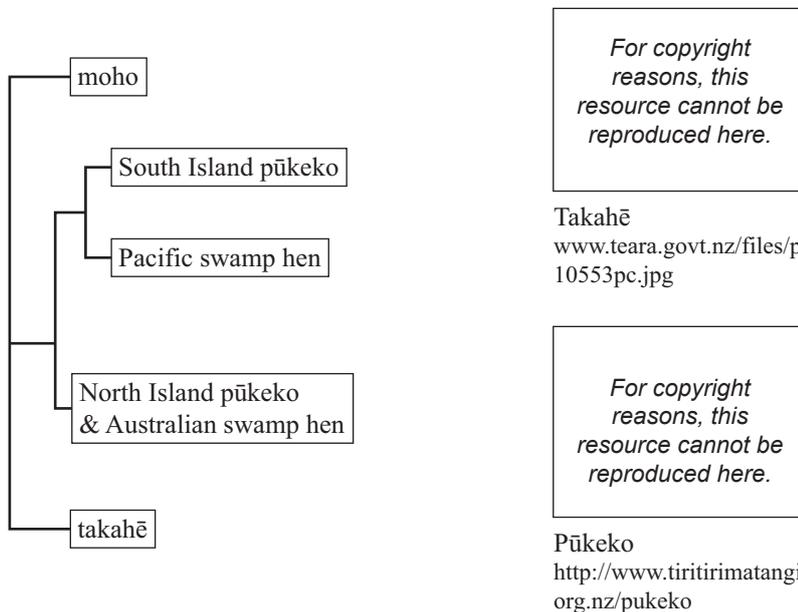
The pūkeko (*Porphyrio melanotus*) and takahē (*Porphyrio hochstetteri*) look similar and share a common ancestor, but have evolved differently.

Fossil evidence suggests takahē have been present in New Zealand lowlands and forest margins for at least 5 million years. It is flightless, a slow breeder and now endangered. There are an estimated 227 adult birds in Fiordland's isolated alpine habitat and on four predator-free off-shore islands. The North Island takahē or moho is extinct.

The pūkeko invaded New Zealand within the past 1 000 years. A cooperative breeder, it has become well established within open grassland, swamps, and agricultural lands.

Recent DNA evidence points to the pūkeko in the North Island having close connections with the Australian swamp hen, whereas South Island pūkeko show close relation to the Pacific swamp hen.

The lineage is shown below.



Analyse both the pattern of evolution and the processes that have led to the establishment of takahē and pūkeko as separate species in New Zealand.

In your answer:

- describe what is meant by punctuated equilibrium, and explain why the takahē/pūkeko pattern of evolution is an example of this
- explain the evolutionary selection pressures acting on both species over time
- compare and contrast how the takahē and pūkeko became established in New Zealand.

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