

3

91605



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Tick this box if you
have NOT written
in this booklet

Level 3 Biology 2021

91605 Demonstrate understanding of evolutionary processes leading to speciation

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 room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (///). This area may be cut off when the booklet is marked.

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

QUESTION ONE: WHIO

Whio (blue duck), *Hymenolaimus malacorhynchos*, are endemic to New Zealand. Like many of New Zealand's endemic birds, they are not good flyers and do not even fly over ridges to neighbouring rivers. They eat small water invertebrates and live in rivers that have a lot of rapids. Other duck species would not be successful in these rivers.

Whio have many features that are not seen in other ducks; for example, large webbed feet with strong claws, enabling even a new chick to navigate the currents and river-edge boulders.

Although there appears to be limited gene flow between neighbouring populations, gene flow between the North and South Island is very rare, and scientists feel they may eventually diverge into two species.



North Island whio.

www.nzbirdsonline.org.nz/species/blue-duck

South Island whio.

Evaluate the evolution and potential future of the whio species.

In your answer:

- describe the term 'species' and 'speciation'
- explain how genetic drift would influence the success of the whio
- discuss how lack of gene flow and natural selection would influence **future** speciation in the whio.

QUESTION THREE: OLIVE SHELLS IN NEW ZEALAND

Olive shells (*Amalda*) are marine gastropods that live mostly in temperate waters (areas with mild temperatures with little change). The global diversity of living *Amalda* is greater than 90 species (plus 30–60 extinct species).

The New Zealand *Amalda* has one of the best demonstrations of evolutionary morphological stasis; a prerequisite for punctuated equilibrium theory.

Amalda generally live in sandy near-shore environments, where they are predators. They feed mostly on bivalves. The environment they live in, being deep water with soft sediment, means there is a high probability of fossilisation. In New Zealand, *Amalda* has a fossil record dating back 45 million years. Scientists from Massey University have examined the rate of evolution using two types of genetic marker to see if they showed gradualism or punctuated equilibrium as a rate/pattern of evolution.



Figure 1: Distribution of *Amalda*.

Source: Gemmell MR, Trewick SA, Hills SFK, Morgan-Richards M. Phylogenetic topology and timing of New Zealand olive shells are consistent with punctuated equilibrium. *J Zool Syst Evol Res.* 2019;00:1–12. <https://doi.org/10.1111/jzs.12342>

