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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 3 Biology, 2014

91605 Demonstrate understanding of evolutionary processes leading to speciation

9.30 am Thursday 13 November 2014
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 2–12 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.

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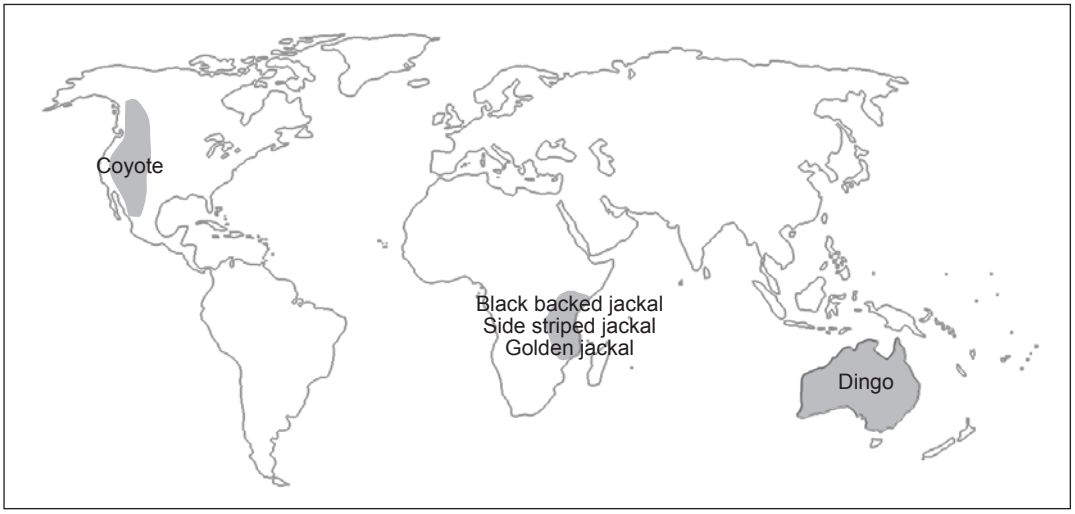
QUESTION ONE

The coyote, jackal, and dingo are closely related species belonging to the dog family. Their distribution is shown on the map.

The ranges of three distinct species of jackal, the side striped jackal, the golden jackal, and the black backed jackal, overlap in the Serengeti area of eastern Africa. These animals are highly territorial, but simply ignore the other jackal species and no interbreeding takes place.

The coyote, jackal, and dingo have been known to interbreed with the common domestic dog and produce fertile offspring.



Adapted from: Michael Kent, *Advanced Biology* (London: Oxford Press, 2000,) p 462.

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Black backed jackal
www.arts-wallpapers.com/desktop_wallpapers/travel_places/Africa-Kenya/images/adult_black%20backed_jackal__masai_mara__kenya.jpg

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Side striped jackal
http://rosswarner.com/8695.jpg

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Golden jackal
http://www.talkshoe.com/custom/images/icons/TC-131584-MainIcon.jpg

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Coyote
www.gpwmi.us/graphics/coyote2.jpg

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Dingo
http://images.nationalgeographic.com/wpf/media-live/photos/000/005/cache/dingo_514_600x450.jpg

Compare and contrast how these distinct species, although closely related, have evolved from a common ancestor.

In your answer:

- describe the term reproductive isolating mechanism
- explain how these species could have become reproductively isolated
- consider the selection pressures that have led to speciation in these cases, and whether this is true speciation.

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There is more space for your answer to this question on the following page.

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The examination continues on the following page.

QUESTION TWO

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Monarch butterfly caterpillars (*Danaus plexippus*) are specialist herbivores, feeding only on plants belonging to the milkweed family (*Asclepias spp*), on which the monarch butterfly lays its eggs.

Milkweeds produce poisonous alkaloids, which the caterpillars absorb. This makes the caterpillar poisonous to many animal predators. Monarch butterfly caterpillars eat around the base of the plant's leaf veins to cut off the flow of sticky toxic latex that can paralyse the caterpillar and glue its mouth parts shut.

Recently scientists found that some milkweed plants have developed a decrease in their toxicity levels but an increase in their ability to rapidly re-grow plant tissue after they have been damaged by browsing monarch caterpillars.

A monarch caterpillar feeding on milkweed.
http://cindyha.files.wordpress.com/2008/07/monarch-caterpillar.jpg

Adult monarch butterfly.
http://upload.wikimedia.org/wikipedia/commons/thumb/6/63/Monarch_In_May.jpg/800px-Monarch_In_May.jpg

Evaluate the evolutionary relationship between the monarch butterflies and the milkweed plants.

In your answer you should:

- describe the term co-evolution
- explain how this kind of relationship develops
- evaluate the selection pressures that work both for and against the milkweed–monarch relationship.

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QUESTION THREE

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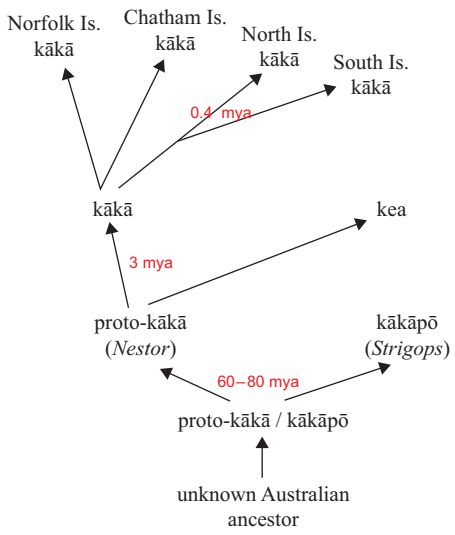
It is thought that both the kea and kākā descended from a common ancestor, proto-kākā, about 3 million years ago (mya) with the formation of the Southern Alps and a cooler climate within the South Island. Kea adapted to the alpine environment, whereas kākā adapted to the warmer northern forests. Two species of kākā, the Norfolk Island and Chatham Island kākā, are now extinct.

About 0.4 mya the North and South Island kākā differentiated and exist today as two non-interbreeding subspecies, with differing sizes and colouring, as shown below.

More recent concerns have been raised about the impact of predation and competition on kākā, where a large number of female nesting birds have been killed over three generations, and conservation measures have been introduced.

Evolution of kākā / kea / kākāpō complex



Adapted from: E. J. Grant-Mackie, J. A. Grant-Mackie, W. M. Boon & G. K. Chambers, 'Evolution of New Zealand Parrots', *New Zealand Science Teacher*, (2003) 103, pp 14–17.

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North Island kākā
Jean-Claude Stahl: http://nzbirdsonline.org.nz/species/kaka

For copyright reasons, this resource cannot be reproduced here.

South Island kākā
Cheryl Marriner: http://nzbirdsonline.org.nz/species/kaka

For copyright reasons, this resource cannot be reproduced here.

Kea – found only in South Island.
Mark Fraser: http://nzbirdsonline.org.nz/species/kea

Analyse the past events that have led to the evolution of kea and the four kākā species and subspecies from the ancestral proto-kākā, and evaluate the possible effects of current impacts on the existing New Zealand kākā.

In your answer:

- describe the meanings of allopatric speciation and sympatric species, and relate these meanings to the above example
- explain the events that have led to evolution of proto-kākā into kea, and four species and subspecies of kākā
- compare and contrast the impacts of past AND current events on speciation of the kākā after its divergence from the kea approximately 3 million years ago.

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There is more space for your answer to this question on the following page.

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Extra paper if required.
Write the question number(s) if applicable.

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