AS 91605 Demonstrate understanding of evolutionary processes leading to speciation

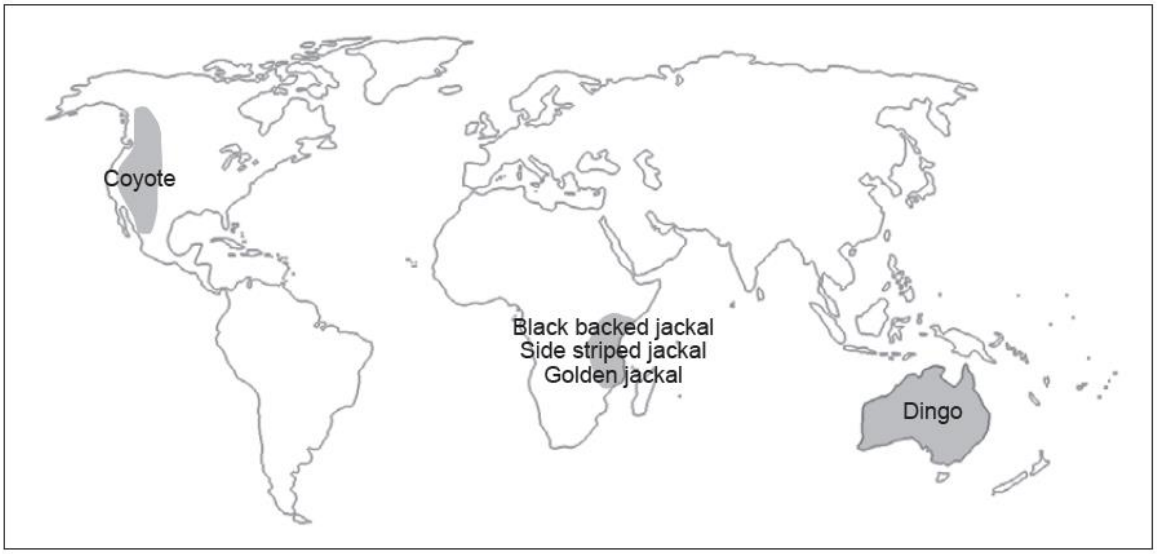
Speciation and Reproduction Isolation Mechanisms

(2014, 1)

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.



Black backed jackal

Side striped jackal

Golden jackal

Coyote

Dingo

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.

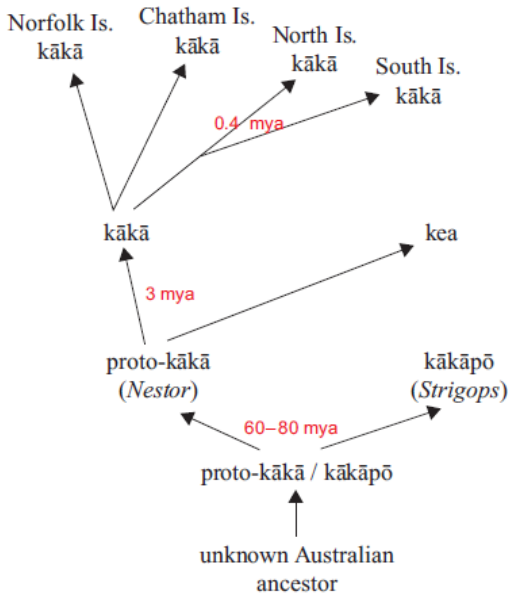
(2014, 3)

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



North Island Kaka

South Island Kaka

Kea – found only in the South Island

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.

(2013, 1)

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.

O. smithi

O. suteri

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.

The questions below are from the now expired AS 90717 Describe processes and patterns of evolution.

http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/biology/expired-standards/
However they may still be useful for AS 91605 Demonstrate understanding of evolutionary processes leading to speciation

(2012, 3)

Monarch flycatchers (*Monarcha castaneiventris*) are small, insect-eating birds, commonly found in the Solomon Islands of the Pacific.

A study of two populations of the same species from neighbouring islands found that birds on the island of Makira are completely black in colour; whereas on smaller adjacent islands, some of the birds are completely black and others are black with a chestnut-coloured belly. The geographical distance between islands is very small.

Chestnut-Bellied flycatcher

Black monarch flycatcher

The male birds are fiercely territorial, but researchers found that the males don't react when a differently coloured bird of the same species enters their territory.

A study of the bird's genomes found only one variation. The MC1R gene regulates production of melanin, which gives skin and feathers colour. The completely black and chestnut-bellied birds had different versions of the MC1R gene, resulting in a single amino acid mutation.

Discuss how the MC1R gene mutation could lead to speciation in populations of the monarch flycatcher.

In your answer you should:

- describe speciation
- explain how the MC1R gene may impact on the monarch flycatcher populations
- evaluate the possible long-term effects of this process on the species.

(2010, 2)

Dracophyllum is a diverse genus of about 50 plant species, four of which are shown below. It includes shrubs, trees and cushion plants.

Dracophyllum are found throughout New Zealand and New Caledonia and in some parts of Eastern Australia.

All members of the *Dracophyllum* genus are believed to have evolved from a single ancestor that lived around 24 million years ago. All of the 20 or so New Zealand species branched off from an Australian species within the last 8 million years. This is an example of **adaptive radiation**.

During that time, New Zealand has been subject to extensive glaciations, changes in sea level, mountain building and climate changes.

In your answer:

(a) Explain **natural selection**.

(b) Discuss the role of **natural selection** AND **environmental conditions** in the evolution of *Dracophyllum* in New Zealand.

- explain how **speciation** is likely to have occurred
- discuss the **isolating mechanisms** that would have contributed to speciation **in this example**.