

# BIOLOGICAL DIVERSITY

## DARWIN DOWN UNDER WITH TARONGA WESTERN PLAINS ZOO

*Stage 6: Year 11 Biology*

### **Knowledge and Understanding Outcome BIO11-10**

describes biological diversity by explaining the relationships between a range of organisms in terms of specialisation for selected habitats and evolution of species

#### **Today you will learn:**

Understand how adaptations increase an animal's ability to survive.

Understand that environmental pressures can promote speciation, change in species diversity and abundance.

#### **By the end of the lesson you should be able to:**

Use examples of divergent and convergent evolution as evidence to support evolution.

Describe how structural, physiological and behavioural adaptations of an animal support its survival.

Provide reasoning as to why a species has changed over time.

Describe how the Red Kangaroo has experienced speciation due to an accumulation of micro-evolutionary changes.

# BIOLOGICAL DIVERSITY STUDY DAY

## DARWIN DOWN UNDER WITH TARONGA WESTERN PLAINS ZOO

*Stage 6: Year 11 Biology*

Students should have **prior knowledge** on the process of **natural selection** and be able to describe the conditions required for **natural selection**.

### **Knowledge and Understanding Outcome BIO11-10**

describes biological diversity by explaining the relationships between a range of organisms in terms of specialisation for selected habitats and evolution of species

**Some of the main points to keep in mind throughout the workshop are:**

- The world is a changing place - the continents move, the climate changes, the plants and animals respond to these changes continuously.
- In Biology, we consider the ability of an animal to produce successful offspring as the ultimate achievement. This is known as fitness.
- Evolution can take place slowly or quickly due to various selective pressures.
- Human impact can, and is, affecting biodiversity.



## The Voyage of *The Beagle* (1831-1836)



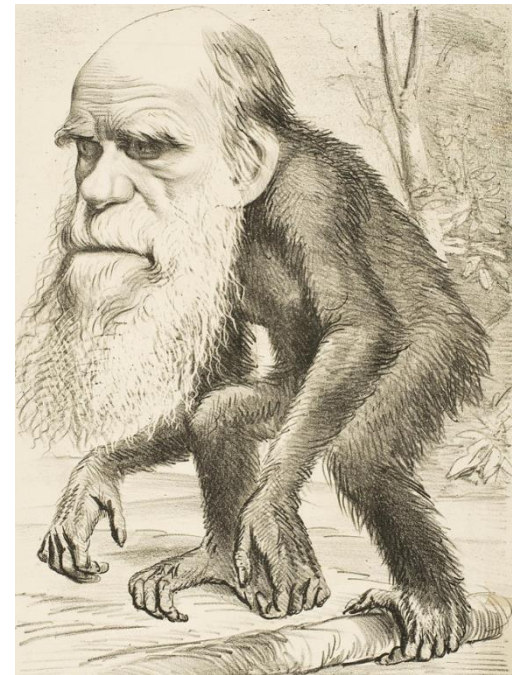
After his return home he formulated what he called "natural selection" to explain how living things adapt to a changing world.

**"It is not the strongest or the most intelligent who will survive but those what can best manage change"**

Charles Darwin

Australia has one of the highest extinction rates of flora and fauna in the world. Thinking about natural selection, do you think that the Koala is biologically fit? Do you think it is at risk of becoming extinct? Why/why not?

Charles Darwin studied the geology, animals, plants and peoples of the countries that he visited, which eventually led him to realise that living things must evolve over time.



Editorial cartoon depicting Charles Darwin as an ape (1871) Originally published in *The Hornet* magazine, 22 March 1871

## **Inquiry question: How do adaptations increase the organism's ability to survive?**

On Sep 15, 1835 the *Beagle* arrived in the Galapagos Islands. Extract from *The Voyage of the Beagle*: It is, that the different islands to a considerable extent are inhabited by a different set of beings. My attention was first called to this fact by the Vice-Governor, Mr. Lawson, declaring that the tortoises differed from the different islands, and that he could, with certainty tell from which island any one was brought.

### **A “dome-shell” Galapagos Tortoise**



**Habitat:**

**Adaptations:**

*Content descriptor: Investigate, through secondary sources, the observations and collection of data that were obtained by Charles Darwin to support his Theory of Evolution by Natural Selection, for example:*

- *Finches of the Galapagos Islands*
- *Australian flora and fauna*

### **A "saddle-back" Galapagos Tortoise**



**Habitat:**

**Adaptations:**













# CONVERGENT EVOLUTION

A kind of evolution wherein organisms evolve structures that have similar (analogous) structures or functions in spite of their evolutionary ancestors being very dissimilar or unrelated.

**Inquiry question: What is the relationship between evolution and biodiversity?**

*Content descriptor: Explain, using examples, how Darwin and Wallace's Theory of Evolution by Natural Selection accounts for:*

- convergent evolution
- divergent evolution

Example of Convergent Evolution		Explanation
<div> <div>Pythons</div> <div>Boas</div> </div> <div> <div> <div>Arboreal</div> <div>John Rummel</div>  </div> <div> <div>Semi-Arboreal</div> <div>John Palmer</div>  </div> <div> <div>Terrestrial</div> <div>Dan Lynch</div>  </div> <div> <div>Semi-Aquatic</div> <div>Georget Crisler</div>  </div> <div> <div>Semi-Fossorial</div> <div>Steve Wilson</div>  </div> </div> <div> <div> <div>Arboreal</div> <div>Pedro Bernardo</div>  </div> <div> <div>Semi-Arboreal</div> <div>Milan Kormick</div>  </div> <div> <div>Terrestrial</div> <div>Erin Boon-Aziz</div>  </div> <div> <div>Semi-Aquatic</div> <div>M. Cap Lisa</div>  </div> <div> <div>Semi-Fossorial</div> <div>Pedro Bernardo</div>  </div> </div>		

# ADAPTATIONS

*Content descriptor: Conduct primary investigations, individually or in teams, or use secondary sources to examine the adaptations of organisms that increase their ability to survive in their environment, including:*

- structural adaptations*
- physiological adaptations*
- behavioural adaptations*

**Inquiry question: How do adaptations increase the organism's ability to survive?**

**Structural**

**Behavioural**

**Physiological**

## Inquiry question: How do environmental pressures promote a change in species diversity and abundance?

*Content descriptor: Investigate changes in a population of organisms due to selection pressures over time for example:*

- Cane toads in Australia
- Prickly Pear distribution in Australia

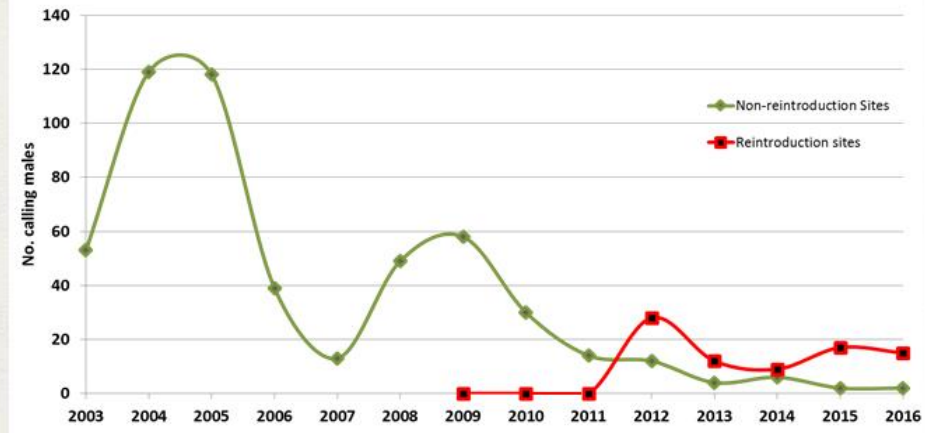
Photo by Paul Fahy



**Working Scientifically  
Outcome**  
**BIO11/12-5** analyses and  
evaluates primary and  
secondary data and  
information

The most reliable monitoring technique is to survey the number of breeding males. The breeding males reliably respond with their threat call when researchers shout near their sphagnum nests and the calls can be easily counted. In 2009, the first Corroboree Frog eggs were reintroduced back into the wild. The frogs that survived from these eggs became sexually mature and started being recorded as breeding males in 2012.

Source - <http://www.corroboreefrog.org.au/>



The graph shows the number of Southern Corroboree Frog males recorded in annual surveys from 2003- 2016.

The Southern Corroboree Frog is Listed on the IUCN Red List as Critically Endangered. Describe the changes in the population over the last 14 years and account for the changes.

# Apply your Knowledge

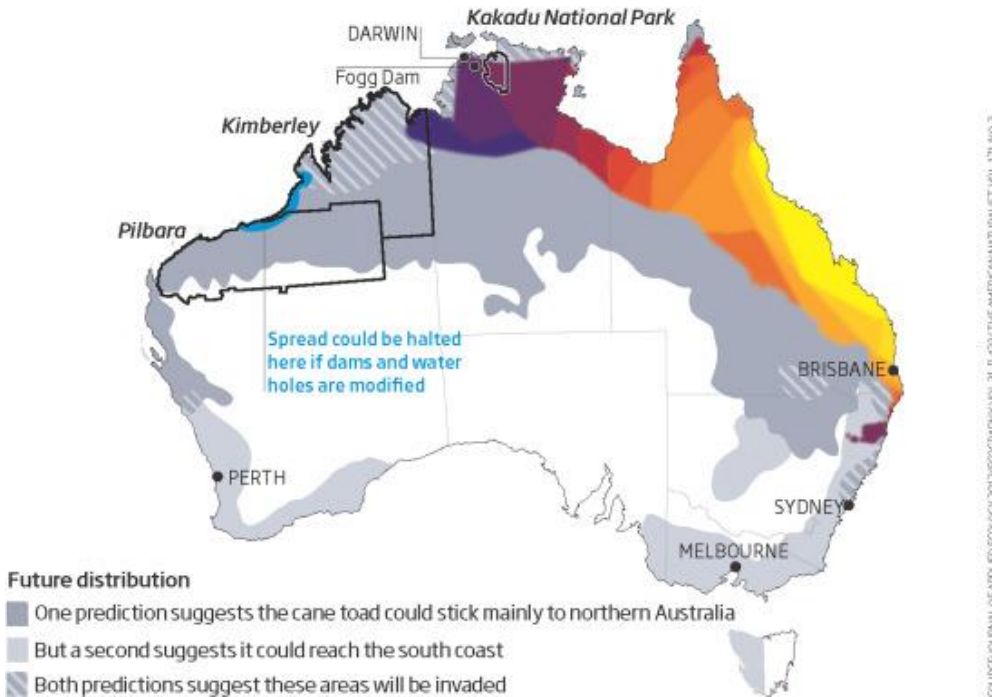
## Cane Toad Populations in Australia

**Working Scientifically Outcome BIO11/12-1**  
develops and evaluates questions and hypotheses for scientific investigation

### Faster and faster

Cane toads spread slowly for the first 50 years after their introduction on the east coast of Australia, but are now racing ever faster across the north of the country. Predictions of how far they will spread in the future vary

Cane toad range



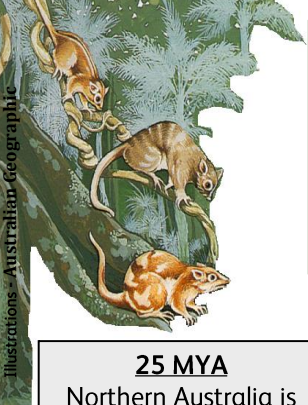
SOURCE: JOURNAL OF APPLIED GEOGRAPHY VOL. 31, P. 423 / THE AMERICAN NATURALIST VOL. 171, NO. 3

1. Describe the changes over time in the Cane Toad population

2. Why do predictions of how far they will spread in the future vary?

3. Based on your understanding of Natural Selection, describe why the Cane Toads are getting faster.





## Inquiry question: What is the relationship between evolution and biodiversity?

*Content descriptor: Analyse how an accumulation of micro-evolutionary changes can drive evolutionary changes and speciation over time, for example:*

- evolution of the horse
- evolution of the platypus

### RED KANGAROO EVOLUTION

#### **25 MYA**

Northern Australia is warm and wet and covered in rainforest. Kangaroo ancestors are arboreal.

#### **Features**

#### **20 MYA to present**

Musky Rat Kangaroos evolved 20MYA but still live in remnant areas of rainforest in Northern QLD.

#### **Features**



#### **20 -15 MYA**

Southern Australia is dominated by savannah/open woodland. Huge radiation of kangaroo species in this time. The first megafauna appear.

#### **Features**



#### **8 MYA**

Arid areas increasing as polar ice caps increase. Hopping Kangaroo species dominated.

#### **Features**

#### **5 - 3 MYA**

Rainforests return to large areas of northern Australia & PNG - some species of Kangaroo return to an arboreal existence— Tree Kangaroo's.

#### **Features**



#### **4 - 2 MYA**

Southern Australia experiences larger arid areas than present due to glaciations. The beginning of modern kangaroo evolution. Reds appear at 2MYA.

#### **Features**

#### **Present Day**

There are now over 60 species of Macropods in Australia. Red Kangaroo's are one of the most successful species in Australia.

## Apply your Knowledge

Based on your knowledge of Natural Selection, explain Darwin's following observations:

### Working Scientifically Outcome BI011/12-7

communicates scientific understanding using suitable language and terminology for a specific audience or purpose

Darwin's Observations	Explanation
West of the Blue Mountains, Darwin examined a rat-kangaroo and a platypus. Noting that they occupied ecological niches similar to those of the rabbit and water rat in the northern hemisphere, he wondered in his diary why a single creator would make such different animals for the same apparent purpose: "Surely two distinct Creators must have been at work."	
It was back in Europe when Darwin enlisted the help of John Gould who was surprised to see the differences in the beaks of the Galapagos birds and identified the 14 different specimens as actual different species. The other, similar birds Darwin had brought back from the South American mainland were much more common, but different than the new Galapagos species.	