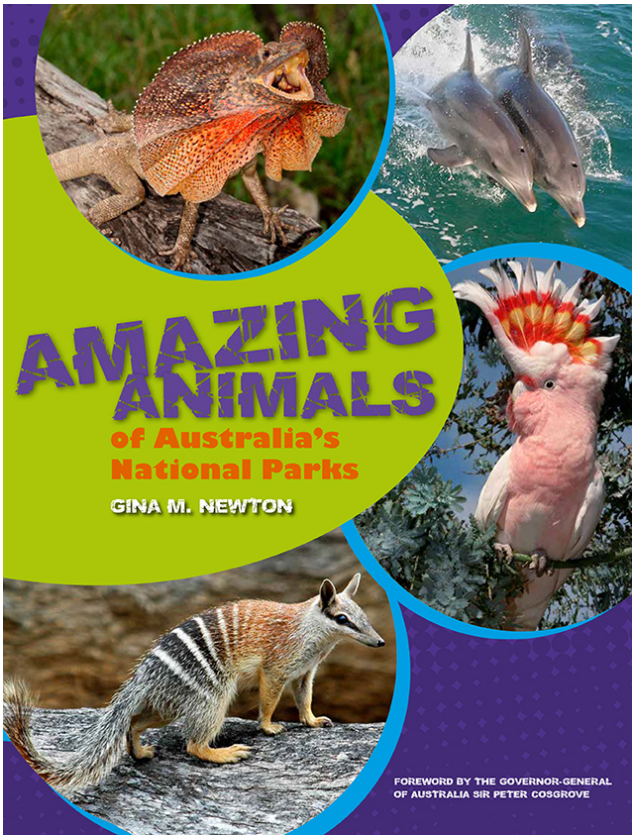
TEACHERS' NOTES: YEAR 6 (AGES 11–12)
Amazing Animals of Australia's National Parks
by Gina M. Newton



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AUSTRALIAN CURRICULUM LINKS (version 8.2)

The growth and survival of living things are affected by physical conditions of their environment (ACSSU094)

- researching organisms that live in extreme environments such as Antarctica or a desert
- considering the effects of physical conditions causing migration and hibernation

Background information for teachers and students

a) Extreme Environments

Over evolutionary time, animals have developed structural features and other adaptations (physical or behavioural) that help them to survive in their environment. These adaptations generally relate to how they feed, or how they reproduce successfully, or how they get around and when, or how they shelter or protect themselves from environmental conditions (like weather/climate) or other animals (like predators). These adaptations make a particular animal suited to its environment or habitat.

Australia has a variety of habitats that animals live in. Particular environments or habitats may have a particular set of conditions that require animals to have certain adaptations to deal with them. For example, different habitats will have different types of vegetation, soils, rocks, caves, water, biodiversity and climate. This means that finding food, shelter, water and getting around might pose different challenges for different animals. Extreme environments such as hot, dry deserts or cold, snowy mountain tops hold particular challenges for animals. Usually only certain animals can live there and many of these will have very specialised adaptations.

Australian Desert Areas

By far the largest Australian habitat—about 70 per cent of the continent—is the Arid Zone (p. 68). The Arid Zone occurs inland from the east coast and covers the whole of central Australia through to the western-central coast (refer to the endpaper map in the book). Australia's major deserts occur there—the Simpson Desert, the Gibson Desert and the Great Sandy Desert. Annual rainfall is very low in the Arid Zone, at 250 mm or less; this is compared to an annual average of over 8,000 mm in rainforest areas of the Queensland Wet Tropics. Within the Arid Zone, the arid grasslands (e.g. spinifex hummock grass and tussock grass) represent about one quarter of Australia's vegetation. The Arid Zone can be very hot by day but can quickly become cold at night.

Australian Alpine Areas

While not as cold and freezing as Antarctica, Australia also has a small alpine region in the Australian Alps which represents less than 0.3 per cent of the continent. Australia's highest mountain occurs here—Mount Kosciuszko, 2,228 m above sea level. Despite its small size, the Australian Alps receives 20–25 per cent of the continent's precipitation and provides water for half of Australia's population. The Australian Alps experience rain, hail, sleet, snow, frost, strong winds, low temperatures and frequent blizzards, especially during winter and spring. Animals and plants living at the higher altitudes must be adapted to a cold climate, long periods of persistent snow cover, and winter drought.

Of interest is the fact that the Australian Alps are managed collectively as a series of protected areas thanks to a memorandum of understanding between the governments of the ACT, NSW and Victoria. These protected areas include national parks such as Namadgi (ACT), Kosciuszko and Brindabella (NSW), and Alpine and Snowy River (Vic.), as well as the nature reserves of Bimberi and Scabby Range (NSW) and Victoria's Avon Wilderness.

b) Migration and Dormancy

Some animals have developed particular adaptive strategies that combine structural features and behavioural adaptations to deal with temporary or seasonal changes to the physical conditions of their habitat. Most important of these are migration and some form of dormancy.

Migration

Migration is when animals move from one location to another and, in most cases, back again. The distance travelled can range from quite small (e.g. hundreds of metres for a frog) to thousands of kilometres (e.g. Humpbacks may travel 5,000–10,000 km). Animals usually migrate in groups. They migrate to find food, water and/or more favourable living or breeding conditions. Animals typically migrate with the change of the weather and the seasons. They migrate to find a warmer climate, better food supplies or a safe place to give birth to their young. For example, for humpback whales, the best place to feed isn't the best place to breed. During the warmer months, they feed and lay down fat reserves in the food-rich waters of the Antarctic. In winter, they migrate to warmer waters off the Australian continent to mate and calve. These waters have relatively little food for the whales, so essentially they fast during winter.

Different environmental cues such as a change in weather, the length of the days (photo-period) or the availability of food may signal to the animals that it is time to commence their migration. Waiting too long to start the migration may be risky and the animals may lose the opportunity to fatten-up with food before leaving (e.g. some bird species double their weight before migrating). Also, if they arrive at their destination too late, they may lose the competitive edge of an early arrival. However, for some bird species (like the Red Wattle Bird), there may not always be the need to migrate to another environment and the inbuilt migration program might not be activated.

Different animals use different ways to help them to navigate on their migration and, while many aspects of animal migration still remain a mystery to science, scientists consider that the knowledge of where and how to migrate is genetic or instinctual. For example, sea turtles always migrate back to the same beach where they were born to lay their eggs. Some of the different ways animals may navigate on their migration include using a:

- 'sun compass'—animals that migrate during the day often use the sun as a compass to find their way
- 'star compass'—birds that migrate at night often use the stars as a compass
- 'magnetic compass'—this relates to Earth's magnetic lines of force (i.e. magnetic field) radiating from the North and South Poles; some birds and sea turtles use a magnetic compass
- 'polarised light map'—polarised light is made from different forms of light waves and makes a pattern (or map) in the sky that stays the same as the sun moves across the sky;

animals like insects, fish, amphibians and birds may use polarised light

- 'landscape map'—animals may use landmarks such as mountain ranges, rivers, lakes and coastlines to find their way
- 'olfactory map'—some birds use the sense of smell as part of their navigation toolbox, using odours from the environment, often in conjunction with using the sun and magnetic fields.

Dormancy

Many animals migrate to avoid the chill of winter and its associated food shortages. But there are also many animals that stay put during difficult environmental conditions. These animals generally display some form of dormancy, which involves slowing down their metabolism to save energy. The environmental stress might be mild enough that only brief spans of time each day (or night) are needed to conserve energy, or the stress may be extreme and require extended periods of energy conservation. For Australian animals, dormancy is generally triggered by very cold or very hot temperatures, or by a lack of food or water, or a combination of both.

There are several forms of dormancy displayed by animals. The more common of these is 'torpor', which is a sleep-like state in which the body processes (e.g. temperature and metabolism) slow down. Torpor generally only lasts a few hours a day or night, or a limited period such as a few days. Animals in the book that undergo torpor include reptiles, birds, marsupials and placental mammals like bats.

In contrast, 'hibernation' is a longer period of deep sleep (weeks to months) where metabolic rate (body temperature and heart rate) is slowed down considerably and the animal survives on fat stored over spring and summer. Only mammals undergo true hibernation. It is an overwintering strategy (generally also a time of low food resources) and is often referred to as 'winter sleep', with the animal resting in a warm place. The endangered Mountain Pygmy-possum (p. 98) is found only in high elevation areas of the Australian Alps. It is the only Australian marsupial that undergoes 'true' hibernation, similar to placental mammals of the Northern Hemisphere. Small-sized mammals, like the Mountain Pygmy-possum, are disadvantaged in extreme cold because they have a high surface area to volume ratio and therefore lose heat more quickly than larger animals. So, when times are really cold and food is scarce, it is even harder for them to maintain body temperature. Using a strategy of dormancy and allowing body temperature to fall is a good survival strategy.

In contrast to hibernation, 'aestivation' is a strategy of animal dormancy, often referred to as 'summer sleep', which is triggered by high temperatures or drought. It is characterised by a period of inactivity and reduced metabolism, and the animal rests in a cool or shady and moist place.

Many reptiles undergo a type of hibernation called 'brumation'. Unlike mammals, reptiles do not enter a deep sleep during dormancy. Instead their dormant phase is characterised by long periods of inactivity in a burrow, with bouts of activity in between (e.g. to warm up outside and drink and sometimes eat).

Activities

1. Key Glossary Words

Students can look up these words in the book's glossary: aestivate/aestivation; brumation; hibernate/hibernation; migration.

2. Investigating, Recording & Presenting

(Students could do these tasks in small groups of 2–4 or individually.)

- Animal adaptations in extreme environments
    - Read about the Arid Zone (p. 68) which contains Australia's extreme desert environments. By using the book and sometimes the glossary, students complete the 'Adaptation' or 'Function & Benefit for Survival' columns in Table 1. This will provide a useful overview of the range of different adaptations used by different animals in the Arid Zone, and the purpose the adaptations serve to aid in the survival of the animal.
    - Investigate and explain in a few sentences how the Thorny Devil (p. 70) uses capillary action to collect water for drinking.
- Animal adaptations and dormancy
    - This activity focuses on the Mountain Pygmy-possum and the Water-holding Frog, two animals that live in extreme habitats—the very cold, snow-covered mountain Alpine Habitat and the very hot, dry desert of the Arid Zone. Both species have specialised adaptations to their extreme environments. Using Table 2 and the book (and glossary) provide further explanations about the adaptations and their benefits for each animal in their respective habitat and list them in Table 2.
    - Make a 'dormancy diagram' that shows the survival behaviour and adaptations of either the Water-holding Frog or the Mountain Pygmy-possum as it responds to changing environmental conditions. Label the diagram and indicate the natural events that trigger its behaviour and, importantly, its break from torpor or hibernation.
    - There is only one mammal in the book that undergoes a true hibernation. What is it? Write the common and species names. Name two animals that undergo each of these kinds of dormancy: torpor, aestivation and brumation (HINT: the glossary may help).
- Migrations
    - This activity focuses on ten animals in *Amazing Animals of Australia's National Parks* that might undergo seasonal or sporadic migrations. Using the book and Table 3, investigate why these animals migrate, as well as when and where. Students complete Table 3. Then write a list of all the different reasons that these animals migrate. How many are there?

3. Making Connections

- When Table 1 is completed, the teacher could lead a discussion with the class on the results. Students could call out their answers. Teachers could prompt further questions or discussion as appropriate (e.g. if students identify different answers for the same animal). Did the students notice anything important? For example, were the same types of

adaptations used by different types of animals to overcome the same environmental challenge in the Arid Zone? Did the same type of animal always use the same adaptation to meet a similar environmental challenge?

- Discuss what the class found out for the Mountain Pygmy-possum and Water-holding Frog (Table 2). These species have some specialised adaptations to deal with their extreme environments. For example, the Mountain Pygmy-possum is the only Australian marsupial that undergoes a 'true' hibernation. Does the Water-holding Frog have a tadpole stage? If so, what challenge does that pose in the Arid Zone?
- As a class, students share their findings for Table 3 about animal migrations. The teacher might make a list of the different reasons for migrations on the whiteboard. Were any patterns obvious? Did different animal types migrate for the same or different reasons (i.e. to achieve the same environmental benefit)? What does the class think will happen in terms of these animal migrations in a future impacted by climate change (which will bring warmer temperatures, less rainfall in some areas and changes to seasonal rainfall patterns, and more extreme weather events)? Do students think some species might have to change the time they migrate or where they migrate to? If so, the class could discuss why they think this may be so.

5. Extension Activity

- Choose a migrating animal or bird from the book. Research how it might use one or two of the six navigation methods described in the background Information above. You may need to look up further information on the Internet or in the school library.

Funtivity

20 Questions

Eight students are each assigned a habitat section or the insect section in the book (the teacher could hand them a card with the habitat on it). They then choose their favourite animal from that section and write it on a card. Make sure no one else sees what they choose. In a random sequence, the other students ask 20 yes/no questions to identify the animal. Allow the class to refer to the book.

Art Exhibition

Students each create an art work of the animal that they admire most. On a small card, to be displayed next to the artwork, they write the animal's common and scientific names and why they admire the animal. Invite another class to come and view your exhibition and hold a vote for the top five pictures (use a box with a slot and provide paper and pencils for voting).

Table 1: Animals in *Amazing Animals in Australia's National Parks*, and some of their adaptations

Page	Animal	Adaptation	Function & Benefit for Survival
Arid Zone Environment			
70	Thorny Devil		collect and drink water
71	Smooth Knob-tailed Gecko		
72	Perentie		
73	Shingleback Lizard		
74	Mulga Snake		
75	Water-holding Frog	aestivating	
76	Malleefowl		
77	Major Mitchell's Cockatoo		
78	Cockatiel		
79	Budgerigar		
80	Crest-tailed Mulgara		
81	Giles' Planigale		
82	Bilby		
83	Red Kangaroo	crepuscular (active at dawn and dusk)	
84	Quokka		
85	Marsupial Mole	blind eyes and spade-like claws on front limbs	
86	Spinifex Hopping-mouse		

Table 2: Adaptations in extreme environments, with a focus on the Mountain Pygmy-possum in the high altitude mountain alpine environment and the Water-holding Frog in the Arid Zone

Mountain Pygmy Possum (p. 98) ***Adaptations to survive Alpine Habitat***	**Water-holding Frog** (p. 75) ***Adaptations to survive Arid Zone (desert)***
Hibernation (& body temperature): •	Conserving water: •
Nesting site: •	Aestivation (dormancy): •
Prehensile tail: •	Burrowing: •
Fur: •	Eyes on top of flattened head: •
Size: •	Breeding triggered by heavy rain: •
Cache food: •	Spreading egg masses: •
Supernumerary young: •	Tadpoles: •
Travelling long distance at night: •	Adult feeding: •
Females expel junior males: •	Male call: •

Table 3: Migrating animals in *Amazing Animals in Australia's National Parks*

Page	Animal Name	Migration		
		When	**Where**	**Why**
86	Spinifex Hopping-mouse			
94	Red Wattlebird			
104	Murray Cod			Spawn (lay eggs)
120	Whale Shark			a) b)
126	Australian Pelican			
122	Green Turtle			
123	Flatback Turtle			
130	Humpback Whale			
130	Southern Right Whale			
138	Locusts			