Department of
Parks and Wildlife

Kimberley Education Manuals

Series 1

Cane Toads Years 4–6

Includes:

- curriculum-linked lesson plans
- project ideas and
- background information for Kimberley teachers.

Acknowledgements

Many people and agencies have contributed to this resource and their assistance to the Department of Parks and Wildlife is gratefully acknowledged.

The production of this resource has been made possible through funding from Perth Zoo, and the Cane Toad Strategy for Western Australia.

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June 2015

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Perth Zoo
SAVING WILDLIFE

Key messages

This resource series aims to introduce the topic of cane toads to Kimberley classrooms. Some students will already be familiar with cane toads, they may already be in your town or community; others will be awaiting the impending arrival of toads with a mix of interest and trepidation. Toads are misplaced animals and are surviving and thriving in their new habitat with detrimental effect. These lessons introduce basic facts about toads, what they look like, what they eat, their life cycle, and how they affect our native wildlife, with an emphasis on individual actions that allow students to participate in the control of threats to our natural environment.

The key questions we are examining through these activities at all year levels are:

- What is a toad?
- How can cane toads affect native animals?
- What can we do to help?

Introducing cane toads to your classroom

The following passage can be used to introduce the topic of cane toads to your class. You may also like to organise an incursion with the Parks and Wildlife cane toad education team, participate in a community 'toadbust' or set up a community information event once you have completed all the lessons (see p12).

Cane toads look a lot like our native frogs. Can you tell the difference? Toads were brought to Queensland almost 100 years ago to eat beetles that were destroying sugar cane crops. They liked Australia so much that their population has been growing ever since. With lots of bugs to eat, nice warm weather, and plenty of water for swimming and laying eggs, the Kimberley is a perfect home for toads. Toads first made it to the Kimberley in 2009, and are spreading westwards at around 50km every year.

A lot of our Kimberley animals like to eat frogs. Did you know that we have around 20 different kinds of frogs in the Kimberley? Animals that eat frogs sometimes try to eat toads, too, as they can look very similar to frogs. Unfortunately cane toads are poisonous, so animals that eat a toad can get very sick and even die. There are some smart animals that know not to eat toads, or maybe they just don't like the taste of frogs like some people don't like the taste of fish or pumpkin or broccoli.

To help out the rest of our animals, some people like to go 'toadbusting', that is, going out in the evening to collect as many toads as they can find. It's important to know what a toad looks like, as we don't want to accidentally collect any of our native frogs. Toads have an 'm-shaped' bony brow ridge, dry warty skin and poison glands on their shoulders. If you aren't used to seeing toads, and you think you have found one, let Parks and Wildlife know. If you see toads a lot where you live, you might like to go toadbusting. We'll talk about how to do this in later lessons.

Scientists are also looking at other ways to protect our native animals from toads, like teaching them not to eat toads using special baits or inventing special traps using chemicals found in the toad's skin (pheromones).

The best way to make sure our native animals are looked after is to know how to tell the difference between a toad and a native frog, and to keep an eye out for all the different animals you might see roaming around the Kimberley. Don't forget to teach your friends and family about cane toads, too.

Series 1, Edition 2 Cane toads: Yr 4-6

This resource is the second edition of the first series of the Department of Parks and Wildlife Kimberley educational manuals. Further series will cover the Kimberley's biodiversity, marine environments, fire and introduced species. Each series comprises two editions, offering sets of six curriculum-linked lesson plans for Years 1-3, and 4-6 in addition to background information and useful resources for educators. Printable worksheets and presentations to use in the classroom are available on the accompanying USB.

Contents

Evolution of amphibians

Background information for teachers

The basics

Cane toads belong to the Anuran order of the class Amphibia. Amphibians are divided into three orders; the salamanders (Urodela, 'the tailed ones'), the frogs and toads (Anura, 'the tail-less ones'), and the caecilians (Apoda, 'the legless ones').

Amphibians evolved during the Devonian period over 350 million years ago, as plants began to grow at the edges of ponds and swamps providing a new food source for fish. Over time, some fish evolved developing lungs and limbs which enabled them to live in shallow water and paved the way for breathing and walking on land. After tens of millions of years this transition from water to land produced the amphibians.

The word amphibian means 'two lives', a reference to the metamorphosis of most frogs. The larva of a frog, a tadpole, has gills to breathe and a long finned tail to move, much like a fish. In the process of becoming a young frog their body transforms to adapt to life on land. They grow lungs to breathe, form legs to walk, and lose their tail. When this transformation is complete the young frog is called a metamorph.

Amphibians typically have soft, moist skin, which is permeable to water to help regulate moisture levels. Amphibians lay shell-less eggs that are also permeable to water, which stops them from drying out if laid in a moist environment. These features make amphibians highly sensitive to environmental changes, and they are often referred to as 'ecological indicators'. Recent decades have seen a dramatic decline in amphibian populations around the world, many of which are now considered threatened or extinct.

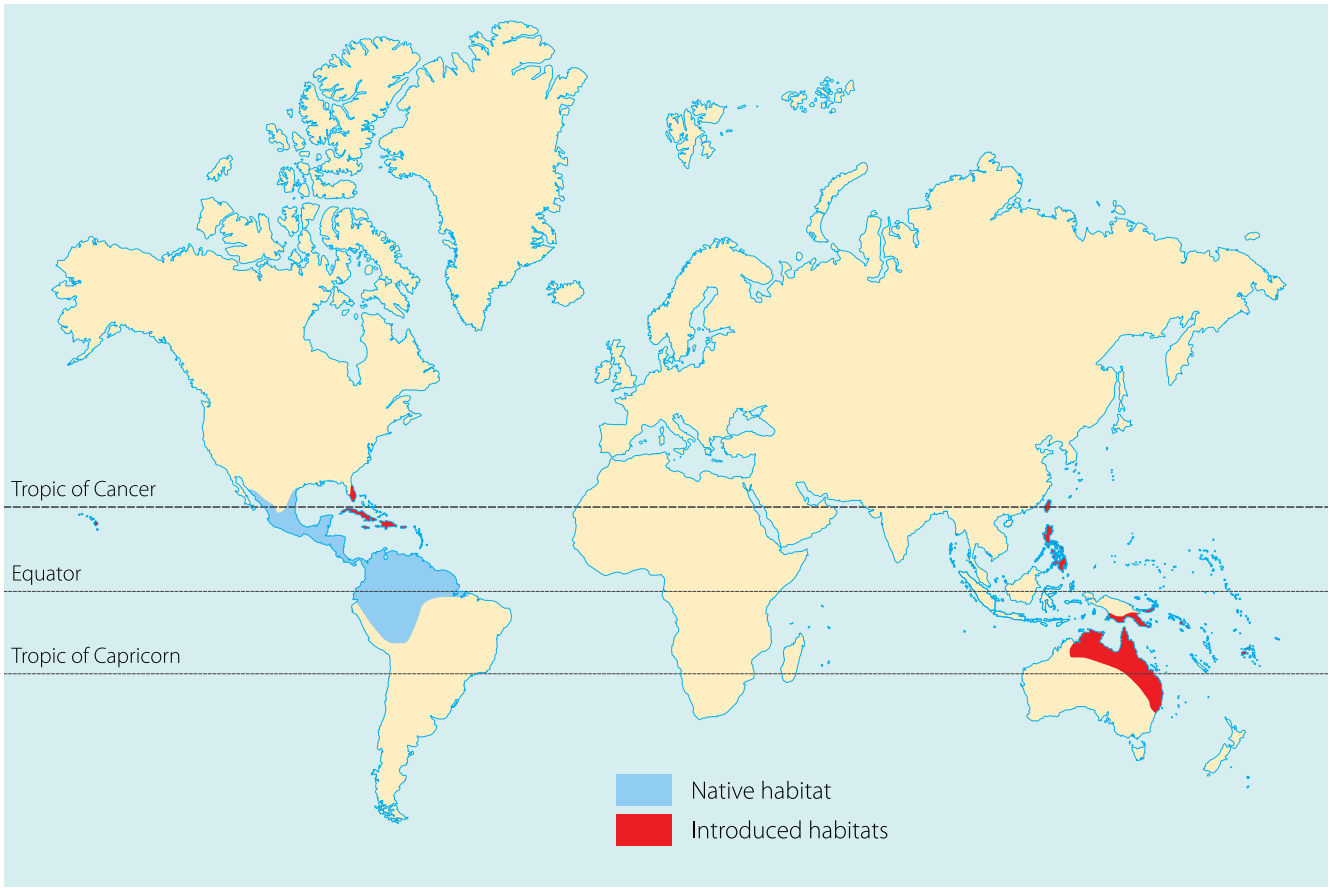
A history of toads in the Kimberley

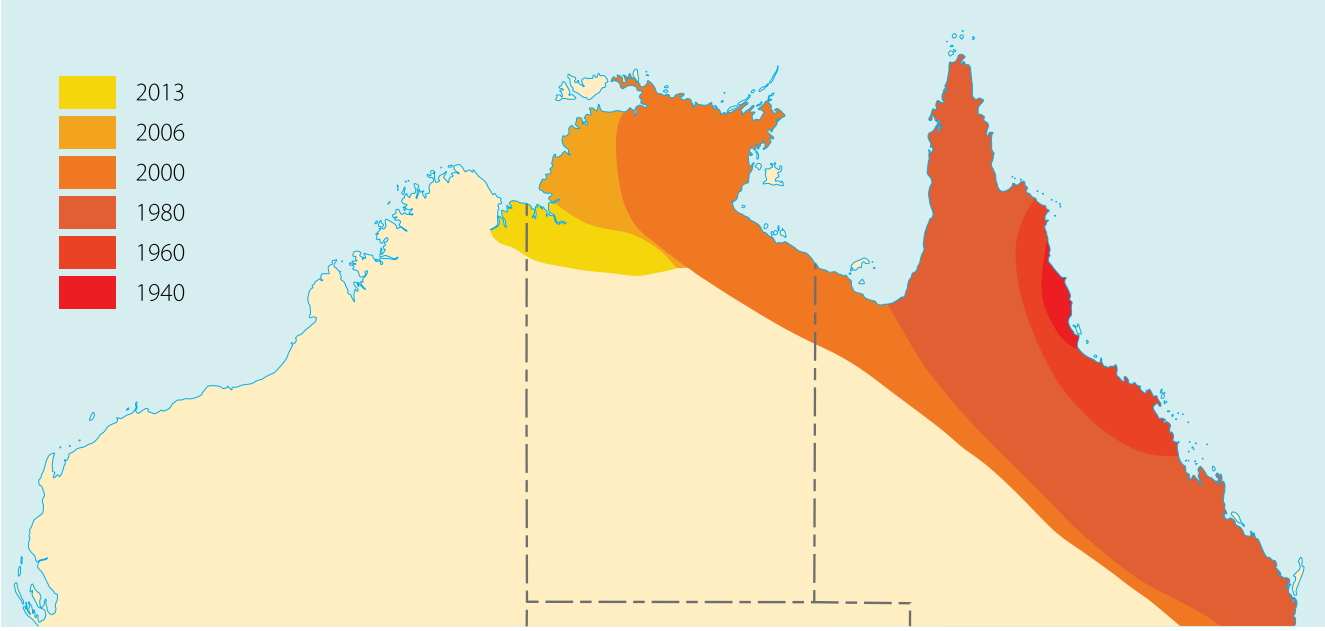
The cane toad (*Bufo marinus* or *Rhinella marina*), also known as the giant toad, giant neo-tropical toad, or marine toad, is the largest toad in the world, growing up to 23cm in length. The cane toad is native to southern and central America, with their natural range extending north from Brazil to the state of Texas in the United States. The map below shows the native range of the cane toad in blue, and their approximate present range in red.

During the 1930s, sugar crops around the world, including in Queensland, were suffering significant damage from pest beetles. Reports from both South America and Hawaii suggested that the introduction of cane toads could help manage the beetle population through predation, and thus increase the yield of sugar. As a result, in 1935, a man by the name of Reginald Mungomery, from the Bureau of Sugar Experiment Stations, was sent to Hawaii to organise the importation of 101 cane toads to Australia. These original cane toads were released in the cane fields of Gordonvale, Queensland. It wasn't long before an additional 3000 toads were released into sugar plantations across northern New South Wales and central Queensland.

The success of cane toads in pest insect control in Australia was never measured. Agricultural chemicals designed to combat the pest beetles were developed and became widely available shortly after the introduction of the cane toad. Cane toads found the climate and environment in Queensland very similar to their natural American habitat and started to breed prolifically. Stories are told of people taking cane toads from one sugar plantation to another to reduce numbers of venomous snakes.

In Australia, cane toad populations are currently found along the east coast from northern New South Wales to far North Queensland, and in recent decades they have expanded across the top of the Northern Territory, westwards to the east Kimberley in Western Australia.





Tell us more

Cane toads are the only 'true toads' found in Australia. True toads are mainly terrestrial (live on land) and have dry, warty skin. Cane toads are heavily built, and typical adults are 10-15cm in length. With the right conditions, toads can grow to more than 20cm in length and weigh more than 1kg, but in dense populations they are lucky to reach 10cm.

Appearance

The skin of a cane toad is dry and rough, rather than moist and slippery like most native frogs. Toads have visible warty lumps on their backs, with males having more prominent, sandpapery lumps than females. Colour can vary from a dull brown to yellowish or blackish, with juveniles more highly patterned than adults. The underside of the toad (its belly) is a dirty cream colour, with grey and cream mottling that fades with age. A 'mango-shaped' eye and an 'm-shaped' bony brow ridge further distinguish cane toads from native frogs.

Toxicity

Large parotid ('poison') glands are clearly visible on the toad's shoulder behind its round tympanum (ear), and exude a milky toxin when the toad feels threatened. Cane toads are poisonous at all stages of their life cycle, including as eggs and tadpoles.

Behaviour

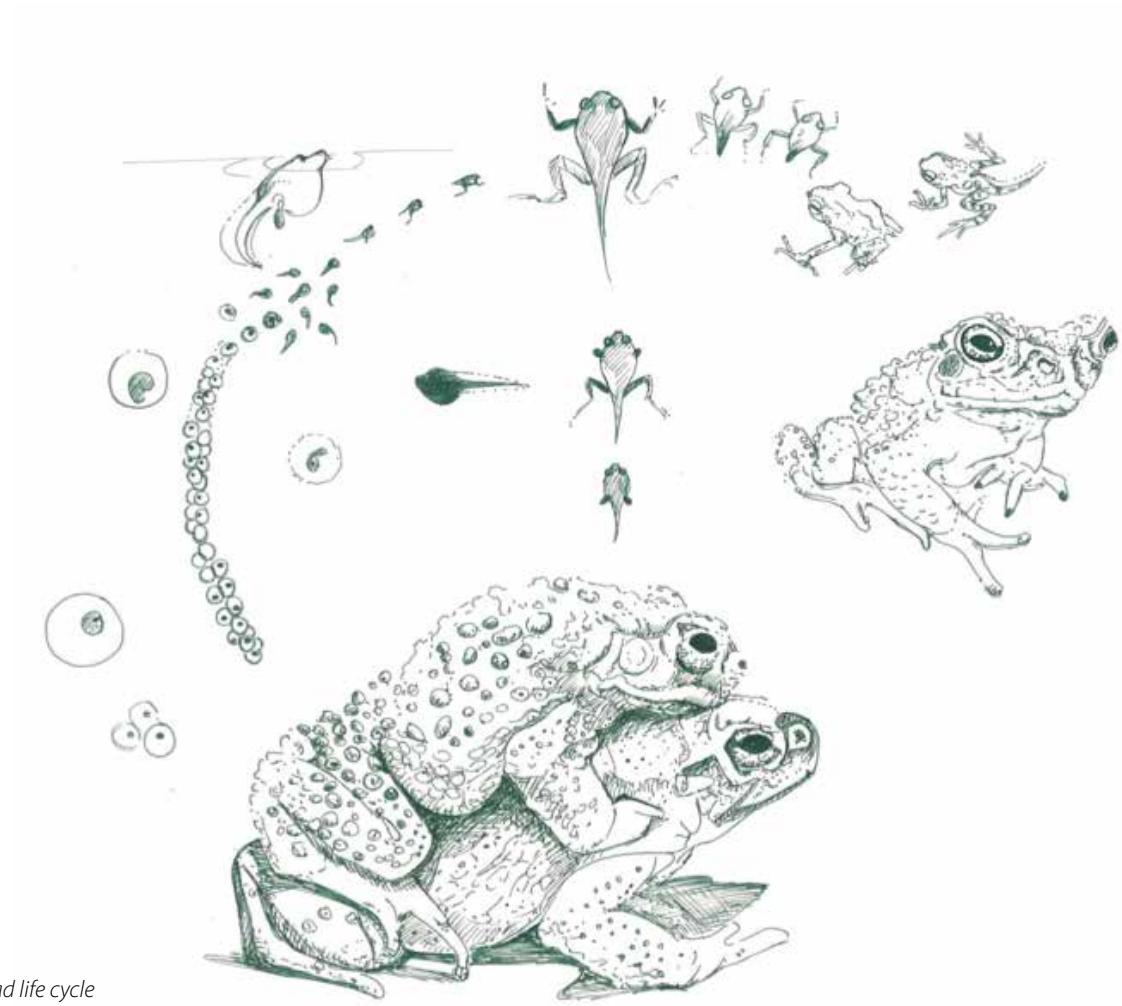
Cane toads are most active at night, hiding in moist places during the day and coming out after dark. They are frequently observed sitting in a distinctive upright position in open areas, or under light sources as they wait for insects to come close enough to catch. Toads walk and bound short distances but cannot climb smooth surfaces or leap long distances or great heights. Males can produce a guttural trill lasting up to 30 seconds, while females do not call.

Life cycle

Female toads generally breed once a year and can lay up to 35,000 eggs in one sitting. Only a very small percentage of these eggs will develop and hatch as tadpoles. The eggs are laid in gelatinous strands at the edge of shallow freshwater pools, and take around two days to hatch depending on water temperature.

Cane toad tadpoles are an opaque jet black, and reach a maximum of 30mm in length. Their tails are almost the same length as their bodies, with a central black muscle and transparent fins. The tadpoles form large, slow-moving groups that do not rise to the surface to breathe as native frogs do. After approximately three weeks the tadpoles metamorphose into small toads; growing legs, developing lungs and losing their tail. These tiny cane toads, approximately 1cm in length and identifiable by a mottled belly and little orange spots on their backs where warts will later develop, are referred to as metamorphs.

Like cane toad eggs, only around 0.5 per cent of metamorphs will ever make it to adulthood. For those that do, their orange spots turn into warts, and their parotid glands further develop as they grow, increasing their toxicity. In the tropics, cane toads take around a year to reach sexual maturity, and their average lifespan is five years.



Cane toad life cycle

University of Sydney researcher, Georgia Ward-Fear and the Balanggarra Rangers are investigating whether goannas can learn to avoid toads

How do cane toads affect Kimberley animals?

Whenever a new plant or animal species is introduced into an environment, it is bound to have an impact on the existing ecosystem. Whether it is a new weed species that strangles native trees, or a species of bird that competes with others for food and nesting sites, the effect of these new species can range from minimal to catastrophic.

Cane toads were introduced to sugar cane fields internationally with mixed impacts on native populations. In Egypt, toad populations failed to establish and thus had a negligible impact on the native flora and fauna. In the Asia-Pacific region, toads found the climate and environment very similar to their native habitat and populations quickly expanded. The IUCN (World Conservation Union) includes the cane toad in its list of 100 'world's worst invaders', and since 2005 the biological effect of the cane toad has been listed nationally as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999*.

In Australia, cane toads impact native animals in a variety of ways. As toads take their place in the intricate food webs of Kimberley ecosystems, their main impact on native wildlife is through lethal toxic ingestion, poisoning predators who try to eat them. Toads may also upset the balance by eating small invertebrates and the eggs of other species, competing for food and shelter with other frogs, and taking over the nests of burrowing animals such as bee-eaters. These additional effects, however, have minimal impact on overall native populations.

As cane toads are toxic throughout their life cycle, any predators that usually eat frog eggs, tadpoles, or frogs are likely to come into contact with the toad's potent bufotoxins (poisons). While some crustaceans, reptiles, fish, birds and mammals are able to eat toads without dying, or inherently know to avoid toads, many frog-eaters will die or become severely ill after eating, or even just mouthing (putting it in its mouth but not swallowing), a toad. Cases report domestic dogs dying within 15 minutes of ingesting the cane toad's bufotoxin. Kimberley animals most likely to be affected include goannas, blue-tongue lizards, frog-eating snakes such as king browns, freshwater crocodiles and northern quolls. Indirect ('follow-on') effects may be further observed following a shift in abundance of these significant predators within the ecosystem's food web.

Examples of native animals affected by cane toads

With a broad range of threats such as fire, development, other introduced species, and annual variation in weather patterns, it is difficult to pinpoint the exact population effect of cane toads. Many species impacted by toads, such as northern quolls, have already been in decline for many decades thus a correlation between the arrival of toads and a decrease in the species cannot be confirmed. Certain species that experience a significant decline following the initial arrival of toads may be found in abundance in areas with long-term toad populations. It is possible that some of these species adapt to knowingly avoid toads as a food source, whereas others may experience a come-back as the initial 'frontline' passes and the population density of toads settles to a lower level. While it is indisputable that the introduction of cane toads is in itself a major threat to many large Kimberley predators, no species extinctions caused by cane toads have been recorded in Australia so far.

What can we do to minimise impacts?

Shortly after the arrival of toads in the Kimberley in 2009, the State Government released the *Cane toad strategy for Western Australia*, a ten-year plan highlighting management options, methods of minimising the impact of toads and potential long-term solutions. A key component of the strategy is community involvement, which complements scientific research and government-led operations conducted by the Cane Toad Initiative. An updated strategy was released in May 2014 to reflect the current status of toads in Western Australia, and to consolidate the aims and objectives for cane toad management into the future taking into account the results of ongoing research.

Individuals and communities

The most effective way to control cane toads on a small scale, such as in a backyard or school ground, is through toad-proof fencing and regular toadbusts.

As toads are poor climbers and jumpers, a regularly maintained low fence can prevent most toads from entering your enclosed area.

Toadbusting, or going out and collecting toads by hand, then allows for the removal of any existing toads within your yard. These toads can then be euthanased using a humane method such as cooling followed by freezing (see brochure *Euthanasing cane toads*). If your yard contains a pond, you may like to try cane toad tadpole trapping by using a dead toad as 'bait' inside a funnel trap made out of an old soft drink bottle (see p12). Cane toad tadpoles are attracted to the adult toad's bufotoxins and congregate in the trap, allowing for easy removal. Active communities might consider setting up drop-off-points where residents can bring in live toads they have collected to be positively identified, euthanised, and disposed of appropriately. While toadbusting proves ineffective on a landscape scale, regularly toadbusting in key locations can reduce the density of the area's toad population.

Cane Toad Initiative for Western Australia

Parks and Wildlife manages the Cane Toad through a multi-faceted approach in addressing the continued westward progression of cane toads. As well as preventing the premature spread of 'hitchhiker toads' through quarantine measures such as the use of a cane toad detector dog, a large focus is given to monitoring the Kimberley region's biodiversity (variety of flora and fauna species) with the aim of developing management strategies to minimise the impact of toads. Further emphasis is placed on education, as a sound level of public awareness and an understanding of the potential impacts of toads sets the foundation for engaging stakeholders, such as pastoralists, traditional owners and the wider community, in toad management.

Cane toad detector dog, Reggie, searches freight leaving the East Kimberley

Further research

Research into a number of potential strategies to reduce the impact of toads has been carried out by institutions around Australia over the past few decades. Initial research by the University of Sydney into chemical ecology and the the use of pheromones to influence toad behaviour showed potential, although further studies have discounted it as a viable control option. Similarly, lungworms, a parasite present in both cane toads and native frogs, were thought to provide another biological solution, but again field testing determined this was not an effective landscape-scale control method.

It is widely believed that the only possibility for complete eradication of the cane toad population will come from a genetic or immune control option. Progress in this field is slow, as it requires the comparison of cane toad and native frog genomes. Scientists from the University of Western Australia have succeeded in mapping genomes of both the cane toad and one native frog species so far, but the development of a 'silver bullet' for cane toad control is still a long way off.

For now, many scientists have shifted their focus to projects that may reduce the impact of toads in new areas, through strategies such as taste aversion. This involves feeding key species at risk metamorphs, which contain only a small amount of bufotoxins, or feeding them toad-meat sausages with an added nausea-inducing chemical. It is hoped that by ingesting either the metamorphs or sausages and becoming ill, the animal will learn to associate the smell and taste of toads with nausea and know not to eat them in future. Field trials are currently being conducted with both goannas and northern quolls.

Additional resources for the classroom

Fiction books

- ***Toad Rage***, Morris Gleitzman, 2005, Yearling. Series also includes ***Toad Heaven, Toad Away, Toad Surprise***.

  Limpy the toad doesn't understand why humans hate his kind and are always trying to run them over. In a bid to improve toad-human relations, Limpy sets out on a journey to prove to humans just how fabulous toads really are.

- ***Quoll***, Sandra Kendell, 2008, Windy Hollow Books. **Picture book**.

  As cane toads arrive in the top end, quoll does her best to protect her babies from this new intruder. Introduces the concept of extinction, species at risk and the Northern Territory Island Ark project.

Non-fiction books

- ***Finding out about… Cane Toads***, Greg Pyers, 2006, Echidna Books.
- ***Animal Invaders: Cane Toad***, Barbara A Somervill, 2008, Cherry Lake Publishing.
- ***Frogs and Tadpoles of Australia***, Marion Anstis, 2007, New Holland Publishers (Young Reed).
- ***Frogs: Fascinating… and Fragile***, Louise Schofield, 2003, Thomson Learning Australia.
- ***Australian Junior Field Guides: Frogs***, Eleanor Stodart, 1989, Weldon Publishing.
- ***Everything you need to know about Frogs***, 2011, Dorling Kindersley.
- ***Field Guide to the Frogs of Western Australia***, M J Tyler & P Doughty, 2013, WA Muesum

Posters and brochures

Contact the Parks and Wildlife cane toad team on 9168 4200 for hardcopies of posters or class sets of brochures, or for stickers featuring the 6 Kimberley frogs most commonly confused with toads. Parks and Wildlife brochures and posters are available online at: http://www.dpaw.wa.gov.au/plants-and-animals/animals/cane-toads .

Frogs of the Kimberley – produced by the Western Australian Museum and Alcoa.

Cane toads and… bluetongue lizards; crocodiles; quolls; goannas - Parks and Wildlife poster series.

Is it a cane toad? Safety and cane toad; Euthanasing cane toads - Parks and Wildlife brochure series.

Websites

An interactive book, written by researchers at Fogg Dam near Darwin in an attempt to explain their work to local students: http://sydney.edu.au/science/biology/shine/educational_resources/docs/fogg-dam-interactive-book.pdf

Parks and Wildlife cane toad page: http://www.dpaw.wa.gov.au/plants-and-animals/animals/cane-toads

WA Museum's Frogwatch Kimberley page: http://museum.wa.gov.au/explore/frogwatch/regions/kimberley

WA Museum's Frogwatch Schools (southwest) page: http://museum.wa.gov.au/explore/frog-watch-schools

Purchase taxidermied toads for your classroom: http://toadfactory.com/

SPICE offer science materials for high school students, however you may find it suitable/adjustable for your classes: http://spice.wa.edu.au/resource/ac_science_biology/

Apps

Cane toad – produced by SPICE and Parks and Wildlife. Features Kimberley and southwest frogs that are commonly confused with toads and includes pictures, frog calls, and a 'frog log' for you to record sightings.

Food webs – produced by SPICE. Provides interactive food web activities. Two habitats are covered in the app, Herdsman Lake (Perth) and the Kimberley.

Videos

Behind the News has a few stories on toads, including a couple that explain how we are trying to protect our native animals through taste aversion:

- Toad training: http://www.abc.net.au/btn/story/s3991562.htm
- Cane toad snags: http://www.abc.net.au/btn/story/s2817830.htm

For older students (PG rated):

- Invasion of the Killer toads', ***Aussie Animals Attack***, National Geographic, 2012, Madman Entertainment.

For teachers:

- ***The unnatural history of Cane Toads***, Mark Lewis, 2003, Umbrella Entertainment
- ***Cane toads the conquest***, Mark Lewis, 2001, Pinnacle Films.

Incursions, excursions and toadbusts

Contact the Parks and Wildlife cane toad education team on 9168 4200 for ideas tailored to your school.

Incursions

Learn how to identify a toad, toad safety, and cool facts about toads and some of our native critters. With a regularly changing program we have something to suit every classroom. We can tailor activities to your location if you wish to continue your toad studies on an excursion or camp.

Toadbusts

If toads are in your community, or you are planning a camp to a location with toads, we can help you plan a toadbust. You will need to supply torches, gloves, bags, handwashing stations or antiseptic hand gel and plenty of adult supervisors. Toadbusts work most effectively within an enclosed area such as a school-ground, but may also be held at other key locations where you wish to reduce the density of toads, for example around a waterhole or within a gorge. These locations should be decided in consultation with Parks and Wildlife.

Extension activities, projects and games

- Research native frogs found in your local area and make posters to teach your community about them,
- Hold a cane toad information stall during lunch time where your class teaches other students how to identify a toad and what to do if they find one,
- As a class, create a toadbust checklist brochure to distribute to families, listing equipment needed, safety practices, collection method, and recommended method of euthanasia (cooling followed by freezing, see http://www. dpaw.wa.gov.au/canetoads).
- Design a cane toad trap. Build and test it. Google 'cane toad trap design' for lots of ideas. Some useful sites include: http://www.pestales.org.au/lessonplans/toadtrap.htm

  http://www.environment.nsw.gov.au/resources/pestsweeds/cane_toad_infosheet.pdf
- Trap tadpoles in a pond or creek. Tadpoles are attracted to pheromones in the adult toad's toxin. Information can be found here: http://www.canetoadsinoz.com/cane_toad_tadpole_control.html . Don't follow the method of squeezing a toad's glands to get poison out, this is dangerous! Just use a whole dead toad as your bait.

  To make a trap from an old 1.25L or 2L soft drink bottle:

  1. Cut the top third off the bottle
  2. Using gloves, put a dead toad in the bottom (humanely euthanised)
  3. Invert the top third of the bottle and push it back into the body of the bottle (so it's like a funnel).
  4. Leave overnight somewhere where you suspect toad tadpoles are living. Tie your trap to a tree with string or fishing line if you are placing in a creek.
  5. Collect your trap and remove any toad tadpoles (using gloves). Contact Parks and Wildlife on 9168 4200 or canetoads@dpaw.wa.gov.au for confirmation that they are toad tadpoles and advice on euthanasia

Australian Curriculum (AC) Links	Lesson 1 **Australian Curriculum - Science**	Lesson 2 **Australian Curriculum- Science**	Lesson 3 **Australian Curriculum- Science**
Year 4	Living things have life cycles (ACSSU072) *Describing the stages of life cycles of different living things such as insects, birds, frogs and flowering plants*	Living things have life cycles (ACSSU072) *Describing the stages of life cycles of different living things such as insects, birds, frogs and flowering plants*	Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073)
Year 5	Living things have structural features and adaptions that help them survive in their environment (ACSSU043) *Describing and listing adaptions of living things suited for particular Australian environments*	Living things have structural features and adaptions that help them survive in their environment (ACSSU043) *Describing and listing adaptions of living things suited for particular Australian environments*	Living things have structural features and adaptions that help them survive in their environment (ACSSU043) *Describing and listing adaptions of living things suited for particular Australian environments*
Year 6	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) *Researching organisms that live in extreme environments such as the Antarctica or a desert*
Australian Curriculum (AC) Links	Lesson 4 **Australian Curriculum Geography**	Lesson 5 **Australian Curriculum- Science**	Lesson 6 **Australian Curriculum- Science**
Year 4	Interpret geographical data to identify distributions and patterns and draw conclusions (ACHGS030) *Interpreting the data presented in picture, line, bar or column graphs, for example, information collected from a survey about waste produced in the school or their home*	Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) *Predicting the effects when living things in feeding relationships are removed or die out in an area*	Suggest ways to plan and conduct investigations to find answers to questions (ACSIS065) *Exploring different ways to conduct investigations and connecting these to the types of questions asked with teacher guidance*
Year 5	Interpret geographical data and other information, using digital and spatial technologies as appropriate, and identify spatial distributions, patterns and trends, and infer relationships to draw conclusions (ACHGS037) *Interpreting data presented in line, bar, column and pie graphs, for example, data about bushfires or floods or a local issue*	With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS231) *Exploring the range of questions that can be asked about a problem or phenomena and with guidance, identifying those questions that could be investigated*	With guidance plan appropriate investigation methods to answer questions or solve problems (ACSIS086) *Experience a range of ways of investigating questions, including experimental testing, internet research, field observations and exploring simulations*
Year 6	Interpret geographical data and other information using digital and spatial technologies as appropriate, and identify spatial distributions, patterns and trends, and infer relationships to draw conclusions (ACHGS044) *Identifying spatial distributions and patterns, for example, a map of the per capita income of countries, including at least one country from the Asia region*	With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS232) *Asking questions to understand the scope or nature of a problem*	With guidance, plan investigation methods to answer questions or solve problems (ACSIS103) *Following a procedure to design an experimental or field investigation*

Lesson one: Toad life stages

Department of Parks and Wildlife

Australian Curriculum - Science

Year 4	Year 5	Year 6
Living things have life cycles (ACSSU072) *Describing the stages of life cycles of different living things such as insects, birds, frogs and flowering plants*	Living things have structural features and adaptions that help them survive in their environment (ACSSU043) *Describing and listing adaptions of living things suited for particular Australian environments*	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)

Teacher notes: Students use prior knowledge of how people change as they grow and recall some of the physical descriptors that denote what stage a person is at in the human life cycle. Students then transfer this knowledge to an animal, the cane toad, and expect that the toad will go through changes during its life cycle. Students recognise features of cane toads at each life stage, including key identifiers used to distinguish toads from native frogs.

Resources: Information sheet 1.1, one copy per group. Information sheet 1.2, one copy for teacher. A4 set of laminated photos depicting each stage of toad life cycle (see resource pack) with magnets/blu-tack/sticky tape, class set of iPads with Cane Toad app (optional).

For each student: Information sheet 1.3, science book or blank paper, pencils for drawing

Introduction: Human life cycle

Draw a life cycle outline on whiteboard as per Information sheet 1.1 but leave the circles blank.

Ask students to give suggestions about what they think are the five stages of the human life cycle. Elicit the responses as listed in Information sheet 1.1.

Arrange students into mixed ability groups. Hand each group a copy of Information sheet 1.1. As a class elicit one or two descriptor for each of the stages of the human life cycle. For example: egg – inside tummy, tiny. Baby – cries, nappies, small. Child – talking, walking, live with adults. Teenager – tall like parents, boys get muscles, do things on their own. Adult – have children, beards, go to work.

Groups are given 5 minutes to come up with as many descriptors as possible for each stage and write them on their sheet (Information sheet 1.1).

Bring class together and write all suggestions onto the life cycle on the board around the appropriate stage.

Discuss how there are changes in people throughout their life cycle e.g. start moving by crawling but people grow then they move by walking. Why do students think these changes might occur?

Activity: Cane toads through the life cycle

Draw a blank life cycle outline on the board titled 'Cane toad.' Check for prior knowledge about the toad by filling in the life cycle stages with the help of the students.

Complete the life cycle to reflect Information sheet 1.2. Have students stick the laminated photos on the board next to the corresponding life stage. Compare the pictures and come up with 2-3 descriptors for each stage. If you have iPads with the ***Cane Toad*** app, compare photos and descriptions of 'Cane toad adult', 'Cane toad juvenile' and 'Cane toad metamorph'.

Ask students if they know how to identify a toad in any of its life stages. Toads and frogs go through the same life cycle, but it is possible to differentiate them at each stage. Explain that you want to know what to look for to be able to tell the difference between a toad and a native frog right through the life cycle. Write any identifiers students come up with next to your life cycle on the board. Key identifiers for adults are **dry, warty skin**, an **'m-shaped' bony brow ridge**, and **poison glands on the shoulders**. At what stage/s of the life cycle do these features first develop? Tadpoles and metamorphs are harder to distinguish from native species, although some key features are listed on Information sheet 1.3 (**tadpoles, metamorphs and juveniles should not be euthanased by the general public as they are more difficult to differentiate from native frogs**).

Hand out Information sheet 1.3 to students.

Activity: Cane toads through the life cycle (cont)

Students illustrate the complete toad life cycle in their science books or on paper (or cut out and glue pictures from Information sheet 1.3 to show the life cycle).

Teacher reads through each of the descriptors on Information sheet 1.3. Are any of the descriptors students came up with at Steps 2-3 listed?

Students compare all descriptors and write one next to each stage of the life cycle that is unique to that stage (eg 'long stings like spaghetti' for eggs or 'poison glands on shoulder' for adult).

As a class, share descriptors students have chosen to represent each life stage. Add these to your life cycle on the board. Ask students which descriptor is common through all stages of the toad's life cycle. Answer: poisonous. Write 'poisonous' in the middle of the life cycle with arrows pointing out to each stage.

Reflection: Are you breeding toads? Radio ad

Inform students that many local residents may unwittingly be breeding toads in their backyards. Backyard ponds, paddling pools, and even puddles are great breeding spots for toads. Toad eggs can hatch in just over a day in warm weather, and with the right conditions they can go from eggs to tadpoles to metamorphs in just over 2 weeks (under normal conditions it's closer to a month). It's important to empty out any standing water regularly to stop toads (and mosquitoes) breeding in it.

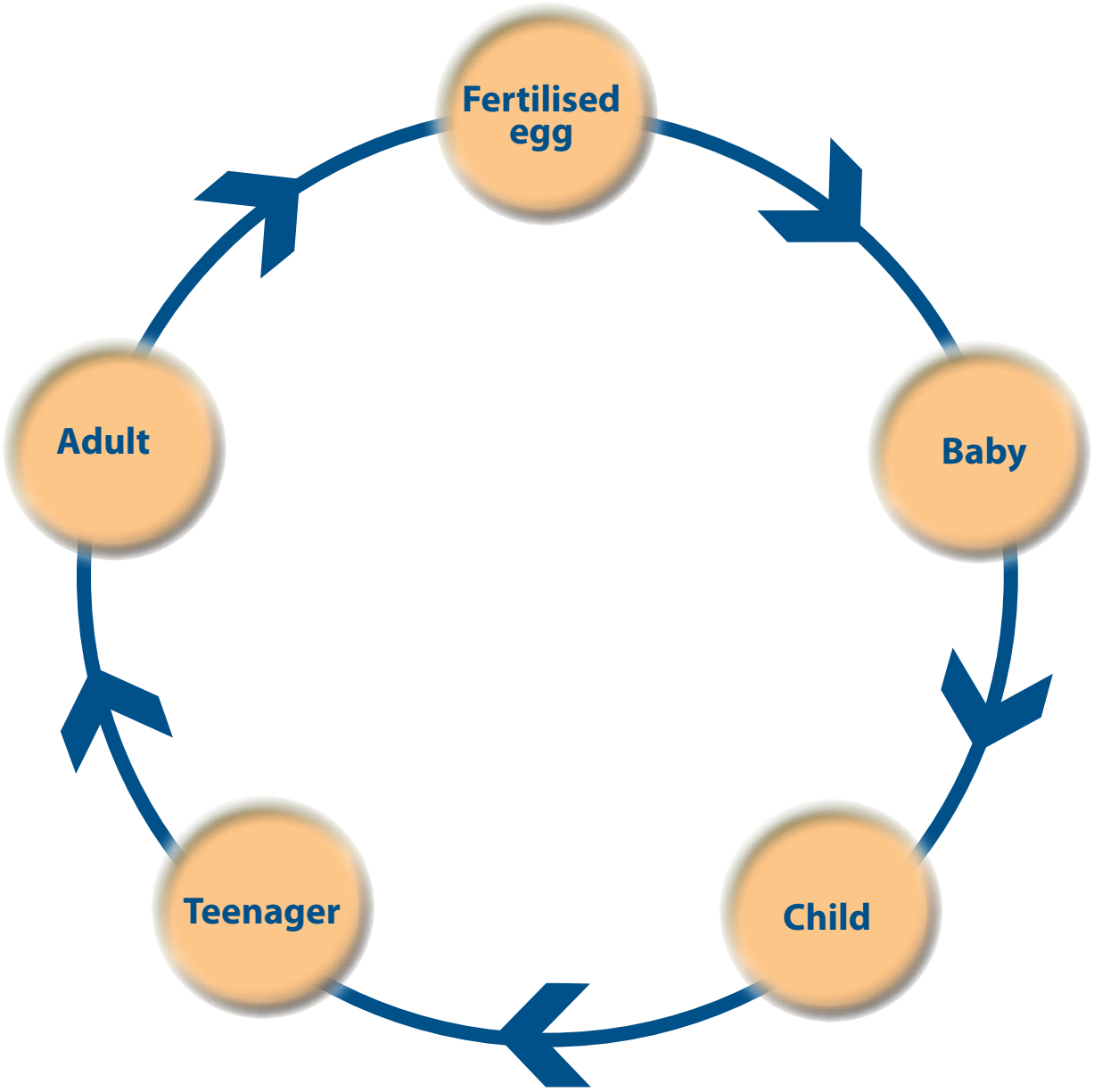
Working in pairs or small groups, students are to come up with a 20-30 second radio ad informing listeners about the toad's life cycle and what they can do to prevent toads breeding in their yard.

Some points to include are:

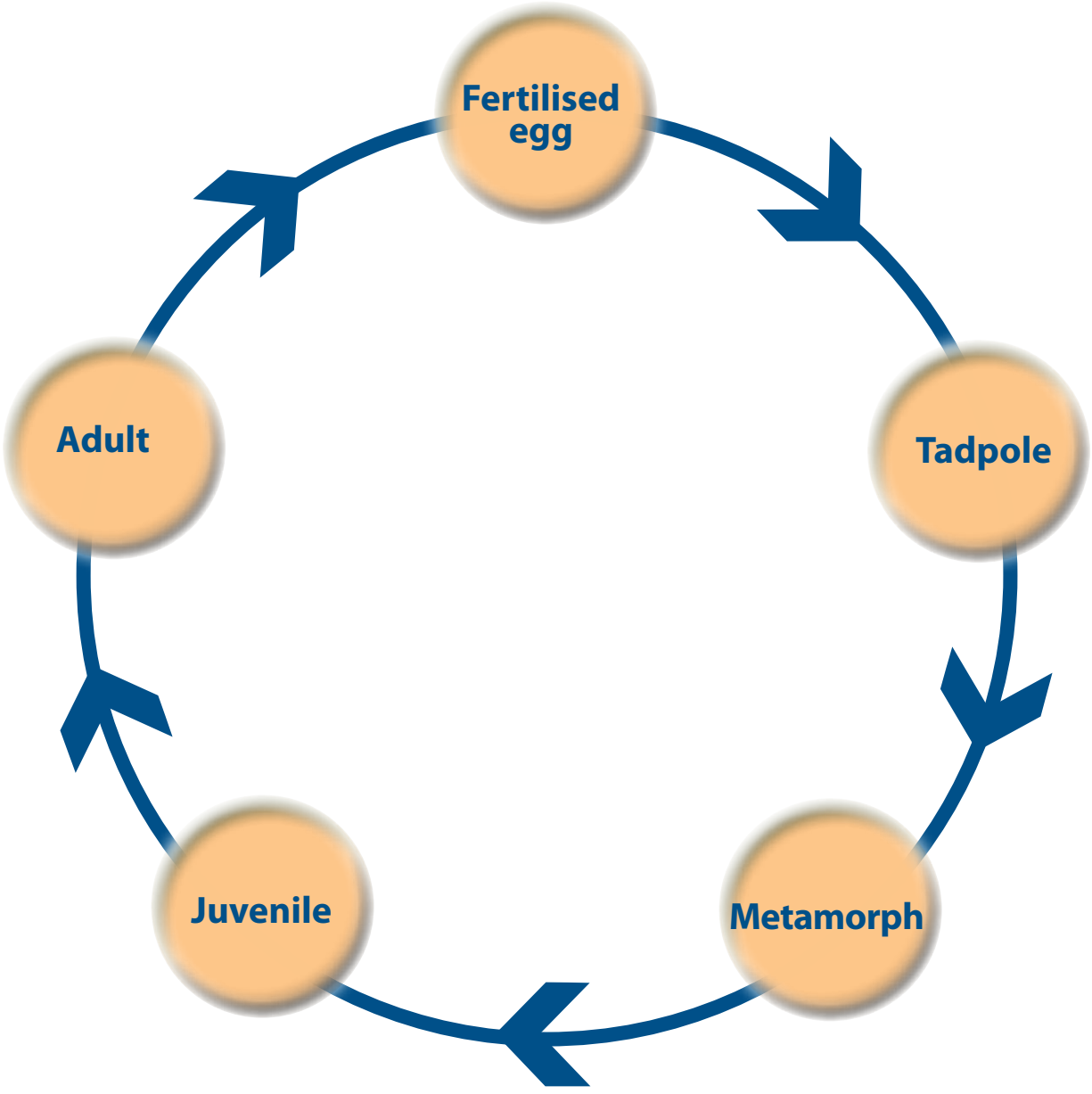
- Identification features of eggs, tadpoles and adult toads (metamorphs and juveniles are optional),
- How to prevent toads from breeding in your backyard (eg empty out water at least once a week so there's nowhere to lay eggs, toadbust regularly to reduce numbers of adult (breeding) toads)
- What to do if you do find toads in your yard (download the Cane Toad app to help with identification, visit dpaw.wa.gov.au/canetoads for more information on keeping toads out of your backyard and on euthanasia, if toads are new to your community keep the toad (or eggs/ tadoples) alive in a bucket or plastic container with air holes and call Parks and Wildlife's cane toad team on 9168 4200)

Consider sharing your best ads with the rest of the school at an assembly, record them as a podcast, or get in touch with your local radio station to see if you can record them to be played on air.

Information sheet 1.1



Information sheet 1.2



Information sheet 1.3

Fertilised eggs

- **Long strings like spaghetti**
- **Small black dots in a row**
- Found in water
- Make no sound
- Poisonous

Tadpole

- **Black body, black tail with clear fins**
- **Have only a body and a tail**
- Found in water
- Poisonous
- Make no sound
- Arms and legs may begin to grow
- Eat toad eggs (cannibals)

Metamorph

- **Size: 1-2cm**
- **Active during the day**
- No tail
- 2 arms and 2 legs
- Poisonous
- Lives at water's edge

Juvenile

- **Look like a small adult toad ('M-shaped' ridge, dry skin**
- **Orange or red spots where warts will grow later**
- Mainly on land but near water
- Poisonous
- Active at night
- Eat metamorphs (cannibals)

Adult

- **'M-shaped' ridge above the eyes**
- **Poison glands on shoulder**
- **Rough, dry, warty skin**
- Males produce a mating call
- Females vibrate only (they make no sound)
- Active at night
- Eat mainly insects
- Poisonous

Lesson two: Gills to lungs

Department of Parks and Wildlife

Australian Curriculum - Science

Year 4	Year 5	Year 6
Living things have life cycles (ACSSU072) *Describing the stages of life cycles of different living things such as insects, birds, frogs and flowering plants*	Living things have structural features and adaptions that help them survive in their environment (ACSSU043) *Describing and listing adaptions of living things suited for particular Australian environments*	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)

Teacher notes: Most frogs and toads undergo metamorphosis. The purpose of this lesson is to show how animals (specifically the cane toad) adapt to live in different physical environments to ensure survival throughout their life cycle. Toads metamorphose from being adapted to water at birth to being able to live on the land later in life. The toad adapts the way it breathes, using gills when it is living in the water to having lungs once it is becomes a terrestrial animal.

How toad tadpoles transform (times are approximate as they depend on environmental factors):

Tadpoles emerge from the egg as a hatchling with internal gills.

After 24 hours they develop external gills.

After 72 hours the hatchling loses the external gills.

From 72 hours through to 2 days they have only internal gills.

The lungs and rear legs begin to form.

After 3 days the forming lungs have a limited role in respiration.

Metamorphosis begins

Front arms form under the skin then 'pop' out, lungs fully formed.

The metamorph moves to the water's edge, stops eating and absorbs its tail.

Tail completely absorbed, lungs formed and functioning.

Metamorphosis is complete.

Resources: Cane toad life cycle cards from Lesson one (in resource pack)

For each student: A3 copy of Worksheet 2.1, scissors, glue.

Introduction: Lungs or gills?

Draw up two columns on the board and have students try to work out the heading (common physical attribute) for each group of animals (see table over page).

Write two animals at a time, one from the 'yes' column and one from the 'no' column. Have the students discuss what the rule might be. For example, after 'barramundi and crocodile' they may say the 'yes' column is animals that 'don't have legs'. However once the next two animals are written down the rule does not work so the students need to come up with a new rule.

Continue revising and applying their rules, as you write down further pairs of animals. You may need to prompt, giving ideas to steer them in the right direction.

Barramundi	**Crocodile**
Crabs	**Humpback whale**
Shark	**Penguin**
Tadpole	**Dolphin**
Stingray	**Frog**
Cherabin	**Cane toad**
Dragonfly nymph	**Turtle**
Octopus	**Platypus**
Catfish	**Dugong**

The rule you are looking for (announce it if the students have exhausted their own ideas) is that all the left hand animals have gills even though all the animals live predominantly in the water.

Once the concept has been attained ask students to add some animals to the list (e.g. seahorse, seal, mussel, walrus).

LEAVE THE TABLE ON THE BOARD

Activity: How toads metamorphose

Revise the life cycle of a cane toad. Draw it on the board (next to the gill/lung table) as students supply the information (stick up pictures from Lesson one). Ask students to compare the 'gill/lung' concept attainment table on the board and the life cycle. Ask students to guess which life stages have gills, lungs or both (you may like to circle them in different colours to show this).

What do students notice? A cane toad starts life as a tadpole which has gills, but grows into a toad that has lungs. This means tadpoles need water to survive, but adult toads can live away from water although they need to return to it to breed (or their tadpoles won't have any water).

Examine the word **meta-morph-osis.**

Meta: word root 'change'

Morph: word root 'form'

Osis: suffix 'process'

Hand out Worksheet 2.1 and read through it together as a class (refer to Teacher notes).

Individually, students cut out the lungs and gills (on the right) and glue to the matching stage of development (on the left). The hatchling needs to have the internal gills glued on first then the external glued over the top (by just the black tab so they can be bent out and the internal gills seen underneath).

Reflection: Who am I?

Refer to life cycle on the board. Ask students to add detail to the life cycle by drawing stages 'B', 'C', 'D' and 'E' in order in place of the tadpole. Review key identifying features of life stages for both tadpoles and the entire life cycle (refer to both Worksheet 2.1 and Lesson one).

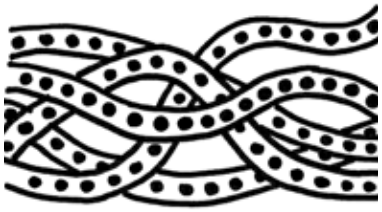
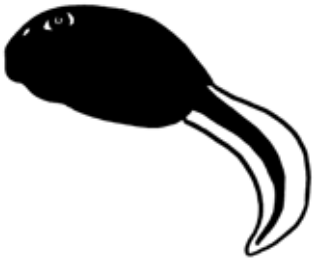
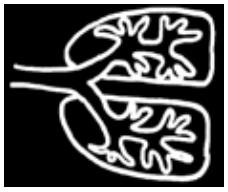
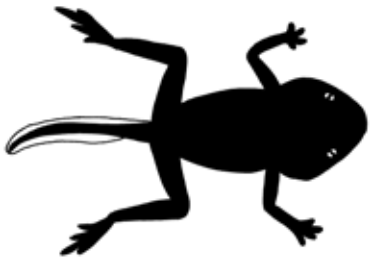
Students take it in turns to give three clues describing one of the stages whilst the rest of the class tries to guess whether they are thinking of an egg, a 'B', C', D', or 'E' or tadpole, a metamorph, juvenile or adult.

For example,

- I breathe air. I have a tail. I have two legs. I have two arms. Answer: 'E'.
- I have internal gills. I have a tail. I am at least three days old. I have lost my external gills. Answer: 'C'.
- I live in water. I am stuck together in a row. I can't move by myself. Answer: eggs.

Cane toad metamorphosis

Worksheet 2.1

A		Eggs	WATER	A	
B		Hatchling. (24 to 72 hour old) Internal and external Gills.		B	  External and Internal gills.
C		Tadpole 3 day old. Loses external gills. Internal gills remain.		C	 Internal gills only
D		Tadpole. Rear legs forming. Lungs forming.		D	 Lungs
E		Metamorphosis begins. Tadpole. Front arms appear. Tail begins to be absorbed.	LAND	E	 Lungs
F		Metamorph toad. Tail completely absorbed. Uses lungs for breathing. Metamorphosis complete.		F	 Lungs

Lesson three: Frogs without water

Department of Parks and Wildlife

Australian Curriculum - Science

Year 4	Year 5	Year 6
Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073)	Living things have structural features and adaptions that help them survive in their environment (ACSSU043) *Describing and listing adaptions of living things suited for particular Australian environments*	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) *Researching organisms that live in extreme environments such as the Antarctica or a desert*

Teacher notes: This lesson starts by using the knowledge students have about adaptions animals use to survive in their environment. As students learnt in Lessons one and two, toads, like all frogs, need water to breed in and to live in as tadpoles. This lesson shows students how the water-holding frog (*Cyclorana platycephala*) is able to survive in the desert where there is no permanent water. The water-holding frog covers itself in a mucous cocoon made out of dead skin and stores water in its bladder to prevent itself from drying out during long periods without water. In this way, the water-holding frog can survive for many years underground until sufficient rainfall arrives and the frog is able to breed again.

Mucous cocoons are not the only way frogs go for long periods without water, depending on students' interest you may wish to research additional adaptations that allow frogs to survive in dry environments. You may like to compare different native frogs with cane toads to see which can last the longest without water. Why might our native frogs be better adapted to dry hot climates than cane toads?

Resources: Dishwashing sponges cut into 2cm square pieces, plastic bags (1 per small group).

For each student: A4 printout of Worksheet 3.1, A3 printout of Worksheet 3.2, scissors, glue, paper or science books

Introduction: Adaptations for different environments

Hand out Worksheet 3.1 to each student. Give students time to fill out as much as they can then bring together to complete the sheet as a class.

Review the answers (below), students may like to suggest other animals that have an unusual characteristic.

Discuss how the different animals have adapted / evolved to suit the environments in which they live.

Answer sheet for worksheet 3.1

Animal	Unusual characteristic	Reason for characteristic
Giraffe	Long neck	Reach up higher than other animals for leaves to eat
Elephant	Trunk	Get water to the mouth, use like a hand to grab food
Duck	Webbed feet, water proof outer feathers	They can swim on the water easily
Monkey	Long tail and feet that work like hands	Gives them the ability to swing from tree branches
Wombat	Back-to-front pouch	Stop dirt going onto their babies when digging burrows
Camel	Hump full of fat	Go for up to two weeks without eating
Turtle/tortoise	Hard shell	Protection from predators (some can pull legs and head into the shell)
Owl	Exceptionally large eyes and a neck that turns 270° left or right	To see prey at night
Stick insect	Looks like a stick	To camouflage against predators

Activity: Comparing two frogs

Divide the board into two halves.

5 min class brainstorm. On one half of the board record any fact about frogs that students know. Think back to Lessons one and two, and focus on where frogs live, where the students have seen them, where do they see them at school or home.

On the other half of the board record attributes of a desert environment.

Consider the two lists. Do the students think you would find a frog in a desert? Remember that frogs need water to lay their eggs and to live in as tadpoles (think back to the ads students made in Lesson one).

Some frogs have adaptions to allow them to live in the desert. To examine one such frog, students complete the puzzle and then compare and contrast the two frogs that appear (one frog is a cane toad, but let students figure that out themselves).

Students cut out then complete the puzzle (Worksheet 3.2).This activity gives the students pictures and information about two different frogs.

Once students have cut out and then glued them onto two separate A4 pages, read through the information on the puzzle pieces and decide which of the two frogs would be better suited to the desert environment and why.

To finish the activity students draw a desert environment around the water holding frog or write descriptors of a desert environment around the picture

Reflection: Conduct an experiment to see how the water-holding frog survives

Students pair up and design a simple experiment to see how the water-holding frog survives.

Give students two small squares of a washing up sponge (they are going to pretend these are a toad and a water-holding frog). The idea is to see if a sealed plastic bag (representing the cocoon-like layer of mucous and dead skin) aids the frog to remain moist overnight.

Students design and carry out a simple experiment

For example:

Aim: To stop the 'frog' drying out overnight

Hypothesis: _____

_____

Equipment: 2x sponge pieces, water, snap-seal or freezer bag.

Procedure/Method:

1. Wet both sponges and squeeze out.
2. Sit the 'toad' sponge out in the open on a hard non-absorbent surface.
3. Place the 'water-holding frog' sponge in a bag and seal.
4. Leave overnight and check the following morning to see which still holds the most water.
5. Record results.

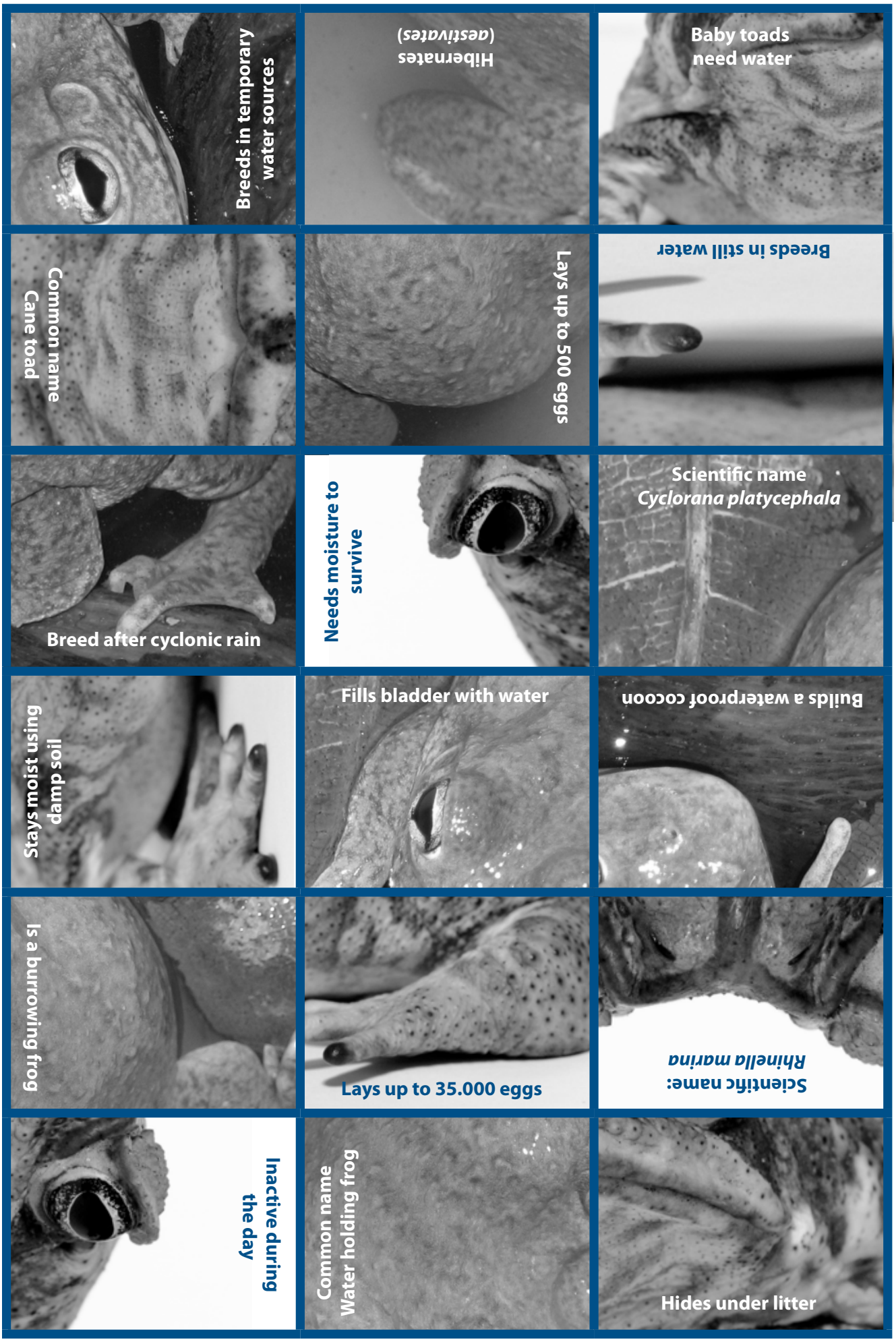
Results: _____

_____

Conclusion: _____

Worksheet 3.1

Animal	Unusual characteristic	Reason for characteristic
Giraffe	Long neck	
Elephant		Get water to the mouth, use like a hand to grab food
	Webbed feet, water proof outer feathers	Can swim on the water easily
Monkey	Long tail and feet that work like hands	
	Back-to-front pouch	Stop dirt going onto their babies when digging burrows
Camel		Go for up to two weeks without eating
	Hard shell	Protection from predators (some can pull legs and head into the shell)
Owl	Exceptionally large eyes and a neck that turns 270° left or right	
Stick insect		To camouflage against predators


Baby toads need water
Hibernates (aestivates)
Breeds in temporary water sources
Breeds in still water
Lays up to 500 eggs
Common name Cane toad
Scientific name Cyclorana platycephala
Needs moisture to survive
Breed after cyclonic rain
Builds a waterproof cocoon
Fills bladder with water
Stays moist using damp soil
Scientific name: Rhinella marina
Lays up to 35.000 eggs
Is a burrowing frog
Hides under litter
Common name Water holding frog
Inactive during the day

Lesson four: Toad habitats around the world

Department of Parks and Wildlife

Australian Curriculum - Geography

Year 4	Year 5	Year 6
Interpret geographical data to identify distributions and patterns and draw concl usions (ACHGS030) *Interpreting the data presented in picture, line, bar or column graphs, for example, information collected from a survey about waste produced in the school or their home*	Interpret geographical data and other information, using digital and spatial technologies as appropriate, and identify spatial distributions, patterns and trends, and infer relationships to draw conclusions (ACHGS037) *Interpreting data presented in line, bar, column and pie graphs, for example, data about bushfires or floods or a local issue*	Interpret geographical data and other information using digital and spatial technologies as appropriate, and identify spatial distributions, patterns and trends, and infer relationships to draw conclusions (ACHGS044) *Identifying spatial distributions and patterns, for example, a map of the per capita income of countries, including at least one country from the Asia region*

Teacher notes: This lesson examines toad distribution in the context of climate. Climate is the main contributing factor to the survival of cane toads in a new location. Toads are adapted to a warm, moist environment, thus tend to be located in the equatorial region. The cane toad is able to survive in air temperatures ranging from 5°C to 40°C; however the ideal breeding temperature is in water that is between 25°C to 30°C. There are other factors such as altitude which will affect localised climates within this zone and the availability of permanent water. This lesson may provide the opportunity to further investigate climate zones and classification. By understanding the climatic conditions suitable for sustaining toad populations, it is possible to predict the future distribution of toads through Western Australia. This information may then be used by scientists to develop management strategies to reduce the impact of toads on native species before the toads arrive.

Resources: 1x A3 World Cane Toad Distribution map, 1 x 'Native Cane Toad Habitats' per group, 1 x location for each group from the 'Possible Cane Toad Habitats' (print and cut locations into strips), 1 x A3 Australian Cane Toad Distribution map. Atlas, globe or internet. String/wool and magnets/sticky tape/blu-tack.

Introduction: The cane toad's native habitat

Place students into groups of two or three and give each group a copy of 'Native Cane Toad Habitats'.

Give brief overview of the data presented in the native cane toad habitat climate graphs. Draw on the board one of the graphs pointing out each of the key parts so the students can extract data from the graphs (looking at the title, axes labelling, range covered etc).

Demonstrate to the students how to find the lowest average minimum temperature, highest average minimum temperature and the total annual rainfall for Venezuela (write on the board in a table shown below). Together with the class obtain the same information from the Costa Rica graph (write on the board). Finally ask the students in their groups to gather the data from the Mexico graph (write on the board). The rainfall figures supplied below are approximations only therefore there may be some variation.

Native Cane Toad Habitats

Country	Lowest average minimum temperature	Highest average maximum temperature	Average annual rainfall
Venezuela	20°C	37°C	980mm
Costa Rica	16°C	26°C	1860mm
Mexico	19°C	35°C	1440mm

Possible Cane Toad Habitats

Country/State	Lowest average minimum temperature	Highest average maximum temperature	Average annual rainfall
Hawaii	19°C	32°C	430mm
Alaska	-13°C	20°C	450mm
Egypt	10°C	35°C	30mm
Philippines	24°C	34°C	2200mm
Cuba	19°C	32°C	1190mm
Florida	17°C	31°C	1270mm
Scotland	1°C	19°C	1120mm
Peru	15°C	26°C	10mm

Students study the 'Native cane toad habitat' graphs in conjunction with the table you have drawn on the board. What is common about the three places that cane toads naturally inhabit? Answer: Warm to hot temperatures and high rainfall. Draw the conclusion that cane toads need a wet and warm environment to survive.

Activity:

In the same groups from the introductory activity, give each group one location strip from the 'Possible toad habitats'.

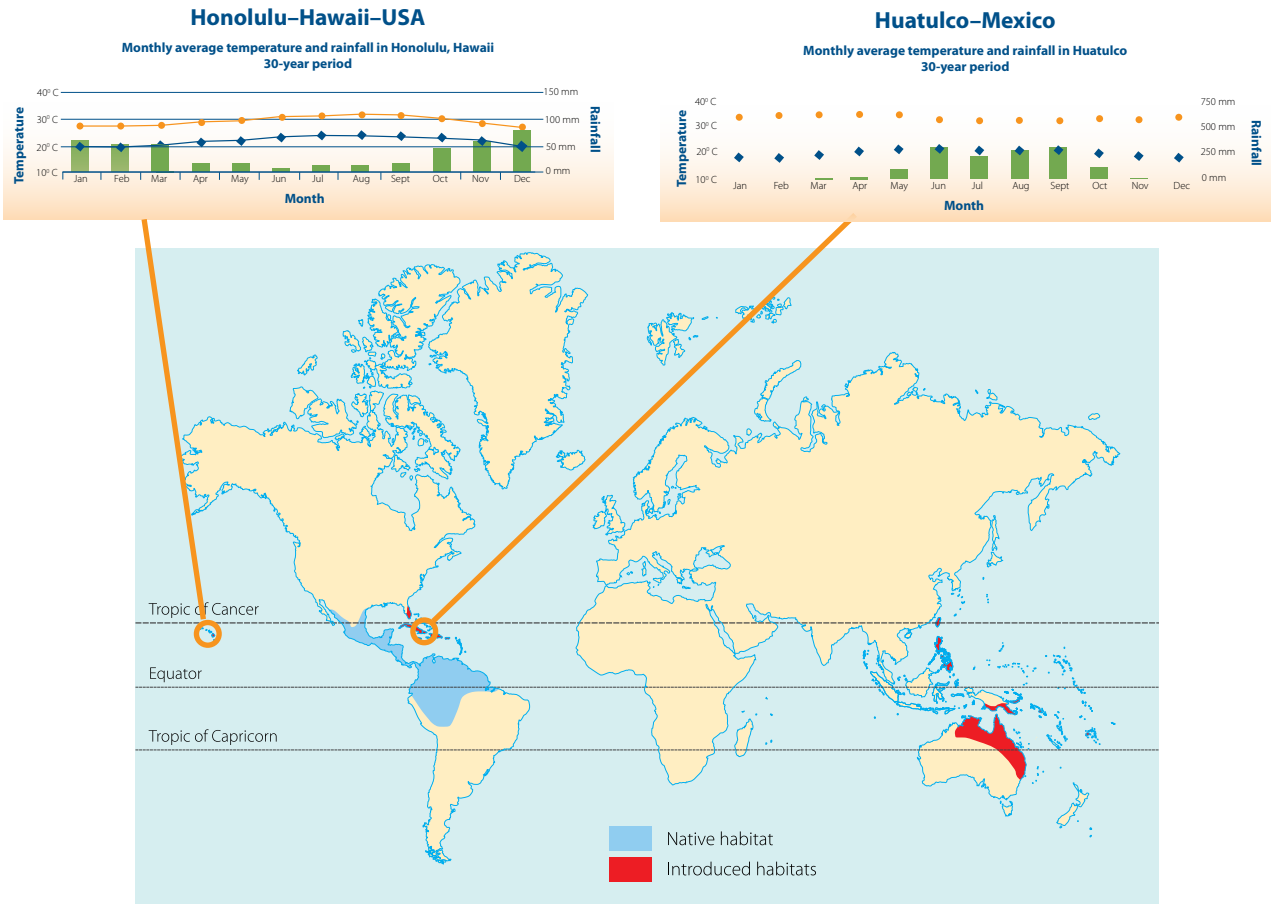
Each group applies the method used in the introductory exercise to decipher the temperature and rainfall information on their location slip.

Each groups decides if their location is a place that a cane toad could exist or not and give the reason.

For Example: It gets too cold. There is not enough rain.

Students use an atlas or the internet to find where their location is on a world map.

Using the World map placed on a pin board or whiteboard, have each group present their information and pin up their paper strip using string or wool to show location (as per diagram). Use different coloured string to show if toads could or couldn't survive in each location.



Once all locations are attached students reflect on where all the possible habitats are located. If internet is available students could use the following website to investigate some Australian locations' climates to see if they would sustain a population of cane toads:

http://worldweather.wmo.int/en/home.html.

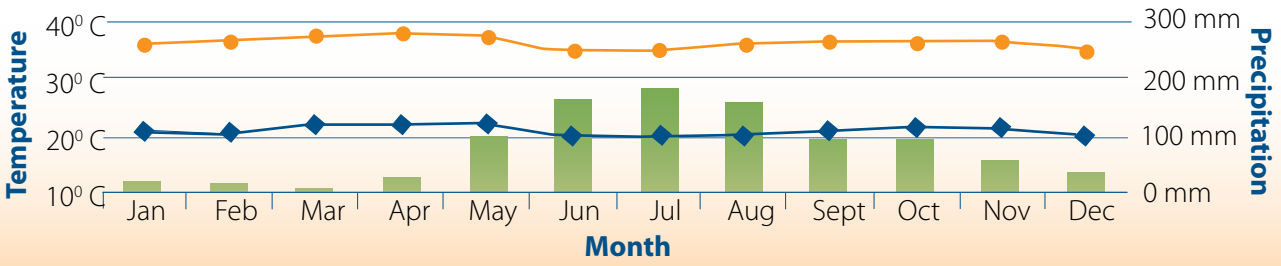
Compare your findings with the Australian cane toad distribution map. After further research, you may wish to map the potential future distribution of toads across Australia.

Ask students how mapping distribution in relation to climate is a useful tool for land managers (they can tell where to focus their attention, know if an area is likely to be affected and so forth).

Native Cane Toad Habitats

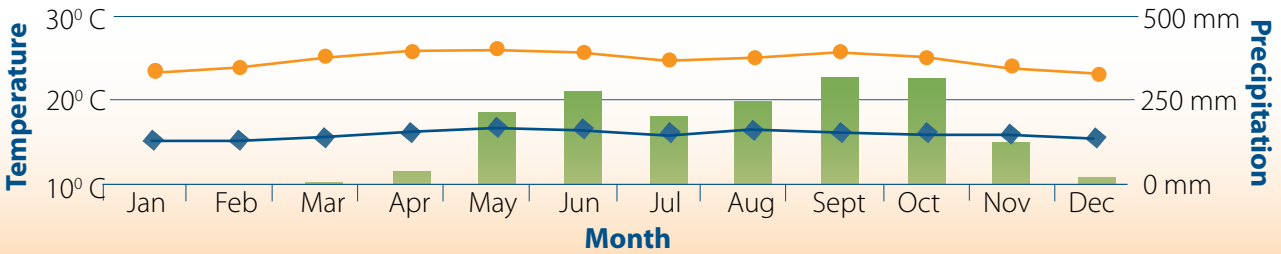
Ciudad Bolivar–Venezuela

Monthly average temperature and precipitation in Cd. Bolivar
30-year period



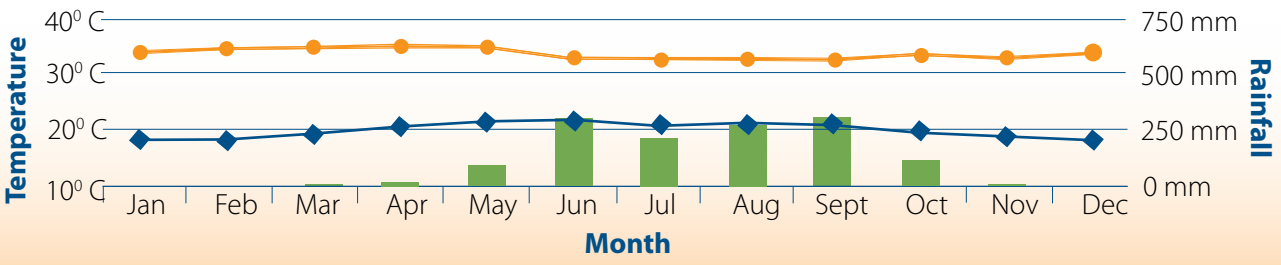
San Jose–Costa Rica

Monthly average temperature and precipitation in San Jose
30-year period



Huatulco–Mexico

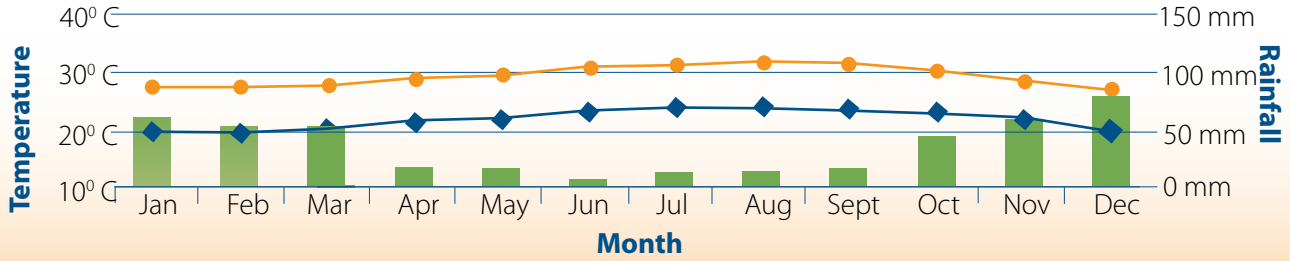
Monthly average temperature and rainfall in Huatulco
30-year period



Possible Cane Toad Habitats

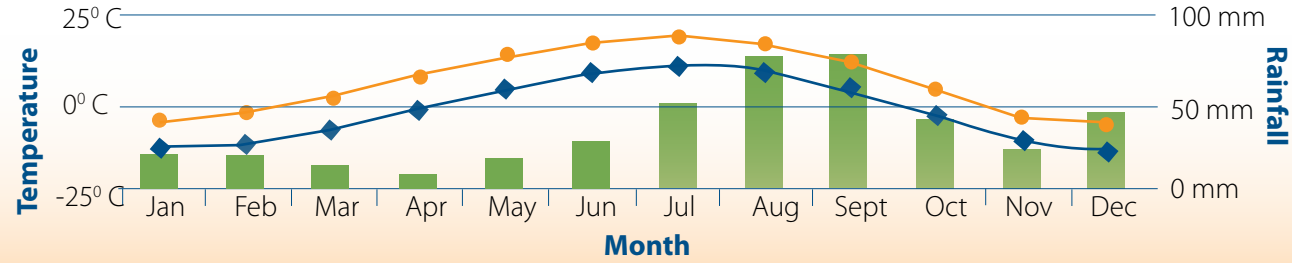
Honolulu–Hawaii–USA

Monthly average temperature and rainfall in Honolulu, Hawaii
30-year period



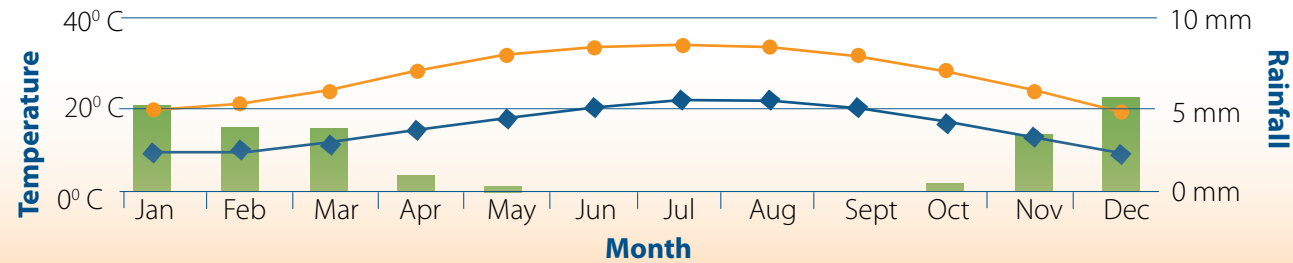
Anchorage–Alaska–USA

Monthly average temperature and rainfall in Anchorage, Alaska
30-year period



Cairo–Egypt

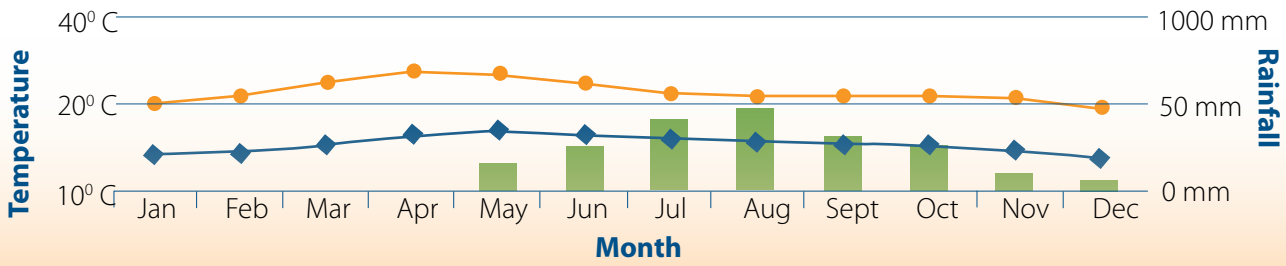
Monthly average temperature and rainfall in Cairo
30-year period



Possible Cane Toad Habitats

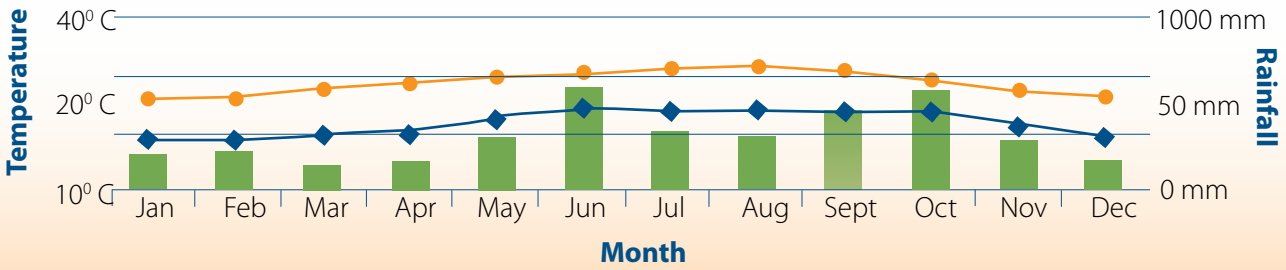
Manila–Philippines

Monthly average temperature and rainfall in Metro Manila
30-year period



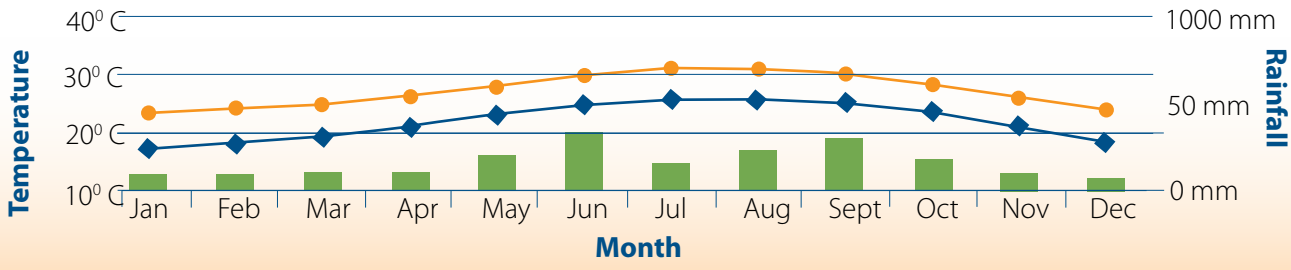
Havana–Cuba

Monthly average temperature and rainfall in Metro Manila
30-year period



Miami–Florida–USA

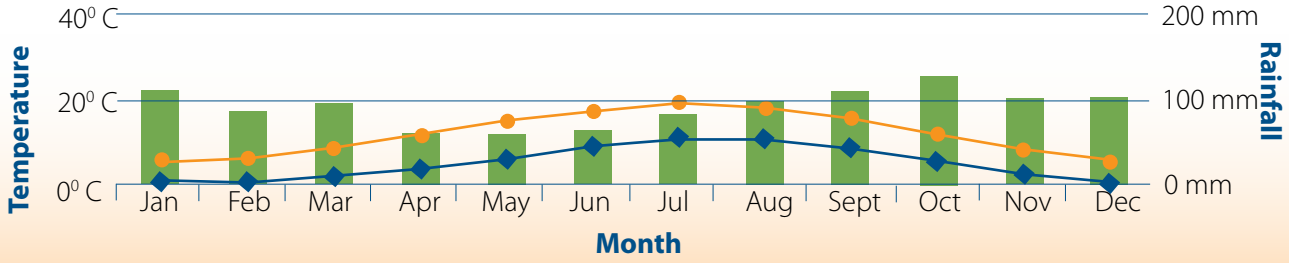
Monthly average temperature and rainfall in Miami, Florida
30-year period



Possible Cane Toad Habitats

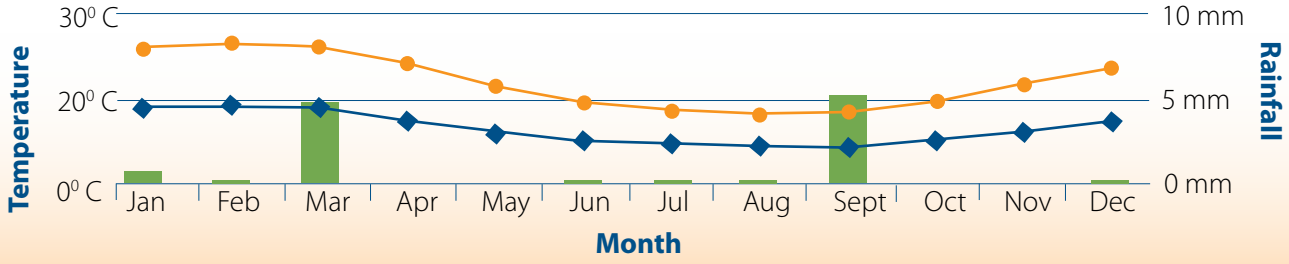
Glasgow–Scotland

Monthly average temperature and rainfall in Glasgow
30-year period

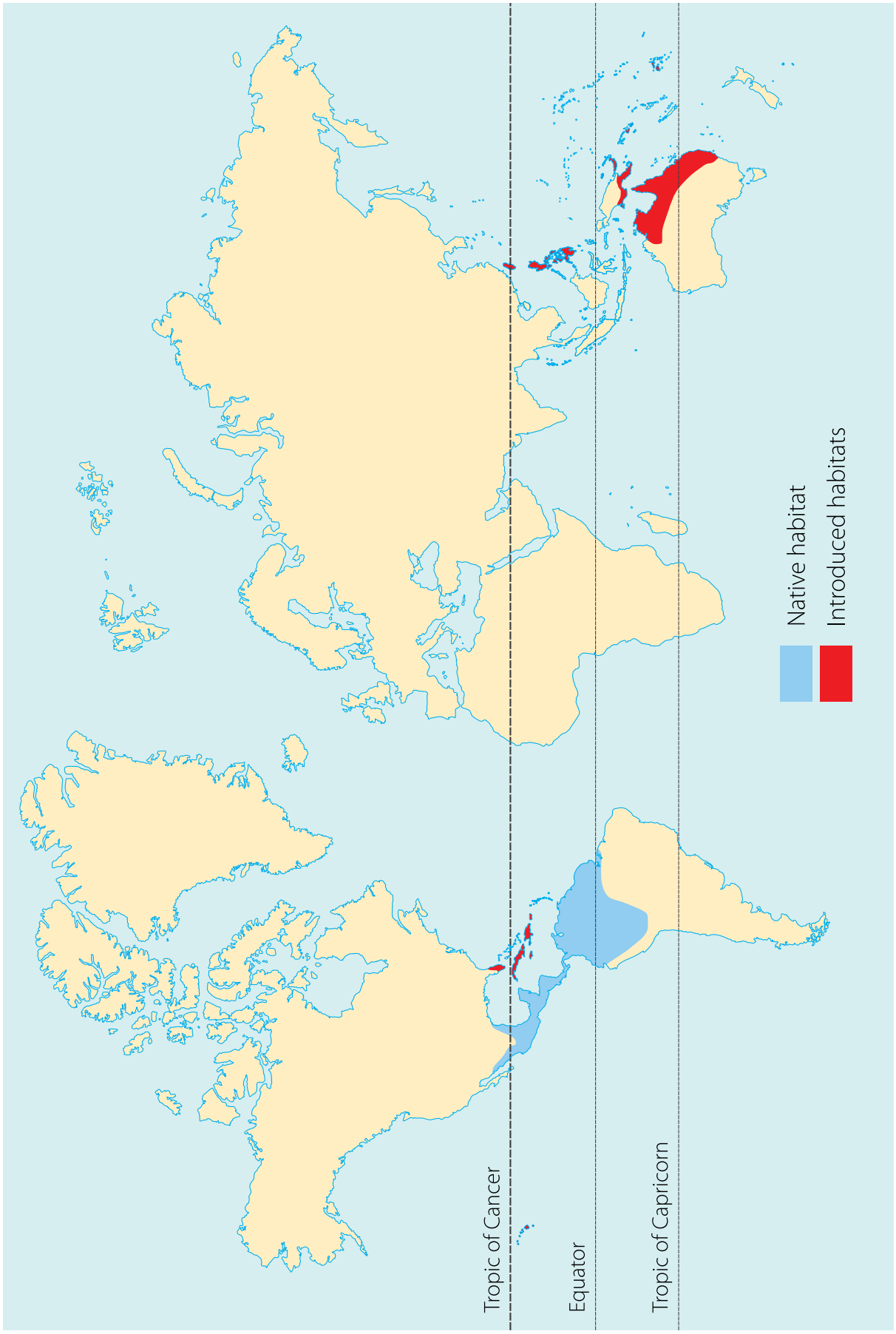


Lima–Peru

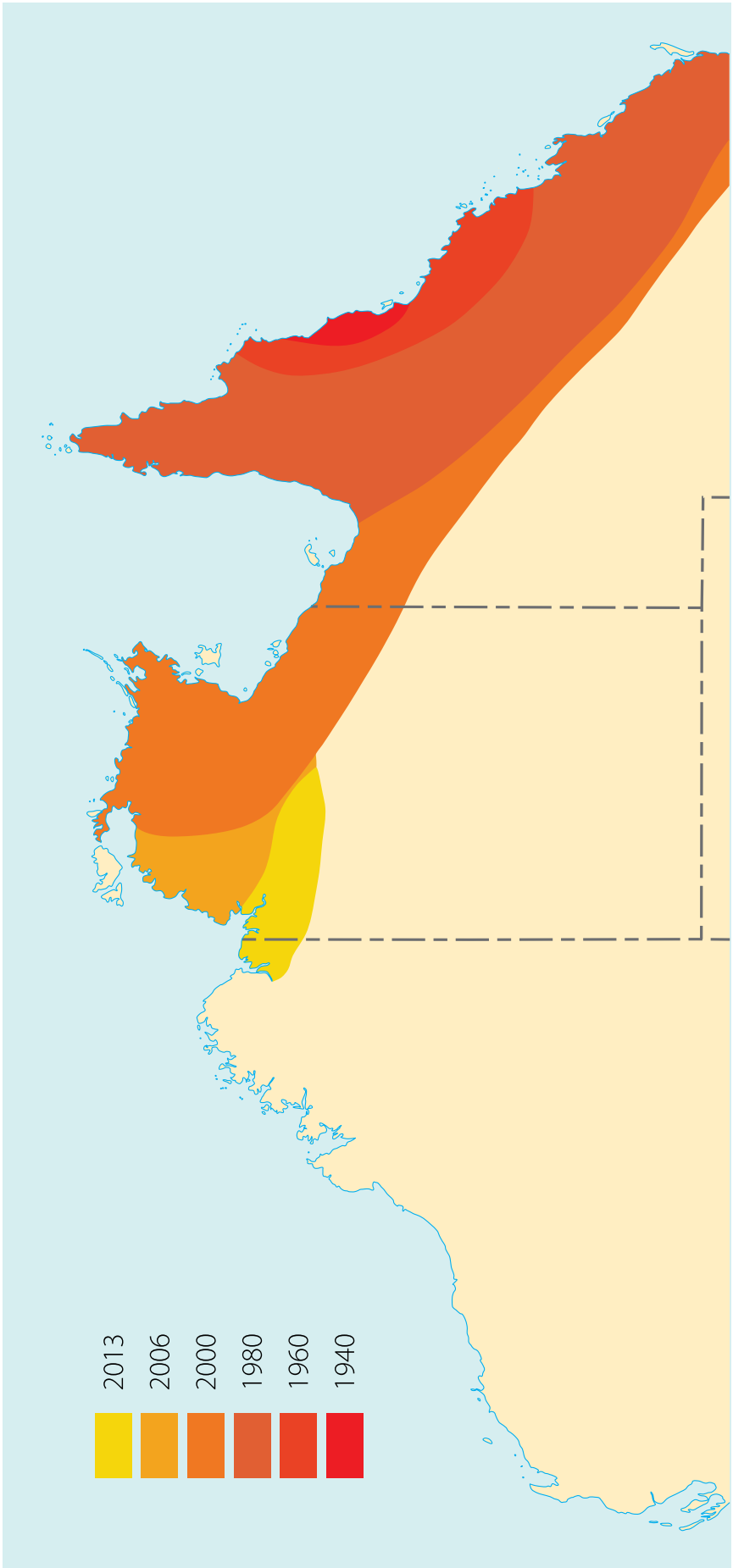
Monthly average temperature and rainfall in Lima
30-year period



World Cane Toad Distribution map



Australian Cane Toad Distribution map



Lesson five: Intruders in the food web

Department of Parks and Wildlife

Australian Curriculum - Science

Year 4	Year 5	Year 6
Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) *Predicting the effects when living things in feeding relationships are removed or die out in an area*	With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS231) *Exploring the range of questions that can be asked about a problem or phenomena and with guidance, identifying those questions that could be investigated*	With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS232) *Asking questions to understand the scope or nature of a problem*

Teacher notes: All living things need energy to survive. As a rule, all plants are producers and all animals are consumers. Producers obtain their energy from the sun through photosynthesis. Consumers acquire their energy from eating plants and other animals. Some species have had to break these rules to adapt to their environment, for example the venus fly trap catches insects and consumes them and there are several animals that photosynthesise, including the spotted salamander and specific types of sea slug and aphid More information on photosynthesising animals can be found in the following link: https://www.youtube.com/watch?v=AcX2n1rC4W4.

Relationships between plants and animals within an ecosystem are commonly portrayed as food chains or webs. These diagrams demonstrate where each species commonly gains their energy (ie what they eat). Any ecosystem will contain a balance of producers and consumers as appropriate to that environment, this means that populations of different species are relatively stable. Changes in climate, fire regimes and human influence may all shift the balance within an ecosystem. When a new species is introduced to an ecosystem, the existing producers and consumers will be impacted at varying levels.

A new animal may compete with others for food, or it could become a readily available food source for an existing predator allowing that particular predator's population to increase. This could in turn lead to a decrease in available shelter for other animals, or an increase in other animals that are lower in the food chain as they are no longer the major food source for the predators. In the case of cane toads, their introduction may lead to a decrease in some predators due to lethal toxic ingestion (poisoning animals that eat them). In their native habitat of South America, toads have natural predators that have evolved to tolerate their poison. As Australia has no native toads, most Australian predators have not evolved in this way and cannot tolerate toads. Some predators such as birds and fish flip over frogs and eat them through their bellies, as this is the easiest way to access their internal organs. In this manner, they also avoid the toad's poison glands. Even where some members of a population will die from eating toads, others may avoid them altogether. Scientists are still researching whether these surviving individuals have learnt not to eat toads, or have an inherent aversion to them, or if these individuals just don't like eating frogs so similarly avoid toads. Research is also being undertaken to determine whether key species at risk such as goannas and quolls can be taught not to eat toads, see:

Toad training: http://www.abc.net.au/btn/story/s3991562.htm

Cane toad snags: http://www.abc.net.au/btn/story/s2817830.htm

An interactive book has been developed to further explain the work of researchers who are trying to understand the impact of toads on our native species (on Resource USB or available at: http://sydney.edu.au/science/biology/shine/educational_resources/docs/fogg-dam-interactive-book.pdf).

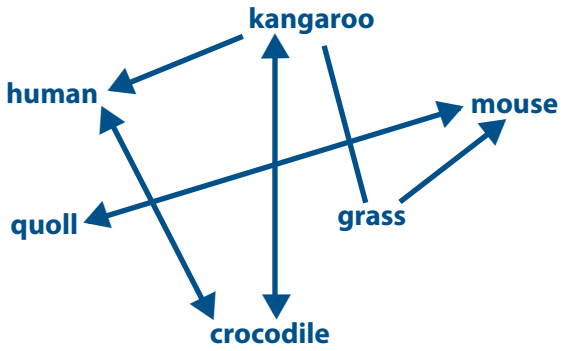
Resources: Food web cards (1 card per pair), glue, A3 paper x 1 per pair, coloured pencils, string. Laminated food web card sets (on Resource USB), 1 per group.

Introduction: Food web terminology

On the board introduce the words 'producer' and 'consumer'. Tell students that producers are plants that get eaten by animals (they produce their own 'food' using the sun's energy). Consumers are the animals that eat plants and/or other animals.

Ask students to give examples of plants and animals. Write suggestions under the correct heading (producer/consumer). Roughly group the animals as you're writing them into three clusters (herbivore, omnivore and carnivore) around the 'consumer' heading. Once happy with the number of animals, circle each cluster. Elicit/prompt students for the correct heading for each of the three animal clusters

Build a simple food web with four or five animals from the list students have supplied on the board, starting with a producer. Show how to build a web and which way the arrows point. The linking arrow always points in the direction of energy transfer (from the 'food' towards the animal that is eating it).



Grass is eaten by the mouse; therefore the arrow goes from the grass to the mouse as this is the direction of energy transfer. Crocodiles eat kangaroos; therefore the energy transfer arrow goes from the kangaroo to the crocodile.

Activity: Where do you fit in the Kimberley food web?

Place students into pairs (mixed ability) or individuals to enable all of the native animal cards to handed out (ie all cards except toads).

Hand each pair on animal card.

Students glue their animal onto the middle of an A3 sheet of paper

One student from each pair goes to visit other pairs. Students are to find what other animals eat their animal or some of the animals that their animal eats. They can record on a piece of paper or orally recount the information that they have found each time they return to their partner.

Students use the arrow (energy transfer) system taught in the introduction to start to build a food web around their animal.

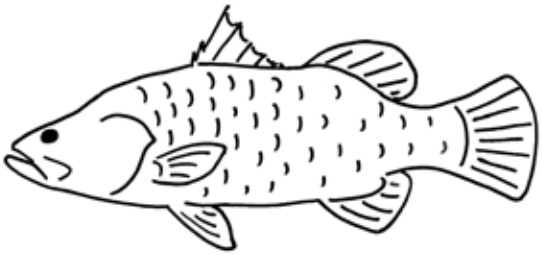
Reflection: The impact of toads

Teacher and students use all the information gathered in the activity to build an extensive food web using the laminated animal cards on the whiteboard.

Once completed, teacher swaps the frog for a cane toad to see how the food web is upset by the introduced pest animal. Animals that suffer lethal toxic ingestion (die after eating a cane toad) include quolls, king brown snakes and yellow spotted monitors. Note that not all of these predators will die once cane toads arrive, some will be naturally predisposed to avoid frogs and toads just as some people avoid certain types of food they don't like. Key predator populations will experience a decline following the arrival of toads, but given time to adapt their numbers may increase again as observed in the Northern Territory.

Pose questions about what might happen to the numbers of quolls, goannas and king browns. What does it mean for the animals that are not directly affected by the cane toad? Loss of predators may mean an increase in numbers, however competition for habitat may be detrimental. It is a complex web of interaction, the introduction of just one animal can upset the natural balance (refer to 'Teacher notes'). You may like to watch the Behind the News stories listed in the 'Teacher notes' to learn about research aimed at protecting our native predators against toads.

Split students into groups of 4. Give each group a laminated set of animal cards (including 4 toads). Have groups use the cards to design a game that teaches other students about cane toad's impact on Kimberley food webs. This could be a card game, board game, or any other kind of game. Each group creates a set of rules/instructions for their game and after playing it, swaps games with another group or teaches their game to another class.



Barramundi

(Carnivore)
Eats: frogs, insects, fish, prawns and spiders

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Brolga

(Omnivore)
Eats: frogs, insects and wetland plants

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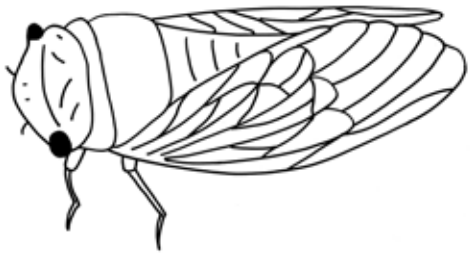

Cicada

(Herbivore)
Eats: plant sap

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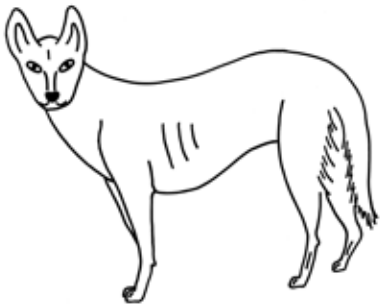

Dingo

(Carnivore)
Eats: mammals, lizards and birds

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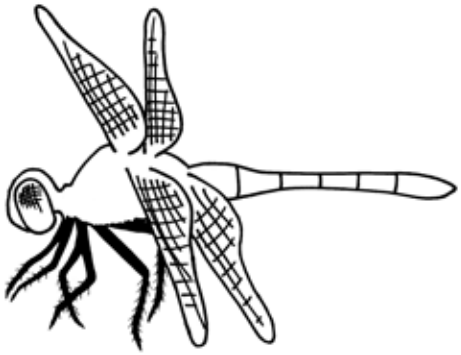

Dragonfly

(Carnivore)
Eats: insects

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Eucalyptus

(Producer)

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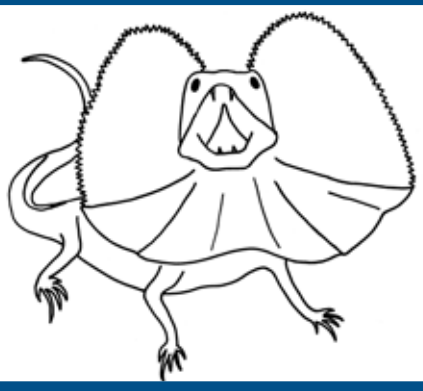

Frilled lizard

(Carnivore)
Eats: small mammals, insects and small lizards

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Grevillea

(Producer)

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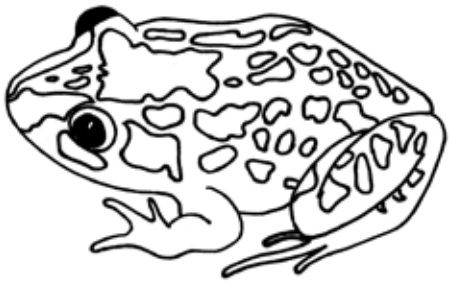

Marbled frog

(Carnivore)
Eats: frogs, insects, prawns and spiders

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Parks and Wildlife

Northern quoll

(Carnivore)
Eats: frogs, spiders, insects, small mammals and small reptiles

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Parks and Wildlife

Rainbow bee-eater

(Carnivore)
Eats: flying insects including bees

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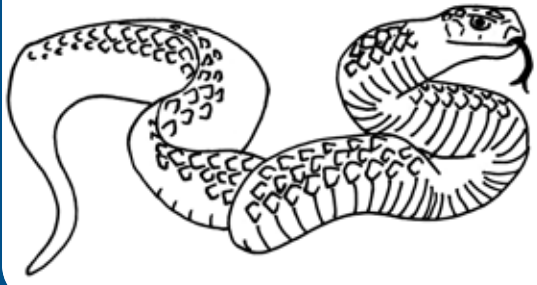

King brown

(Carnivore)
Eats: mammals, lizards, frogs and birds

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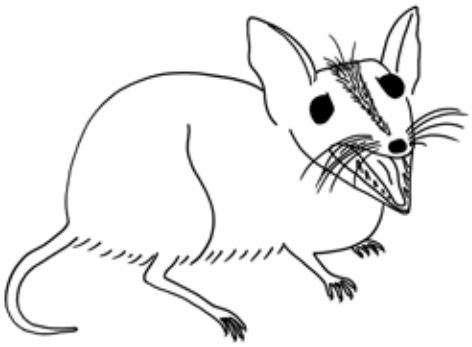

Stripe-faced dunnart

(Carnivore)
Eats: insects, lizards and small mammals

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Sugarbag bee

(Herbivore)
Eats: pollen and nectar

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Yellow spotted monitor

(Carnivore)
Eats: frogs, snakes, small mammals, lizards and insects

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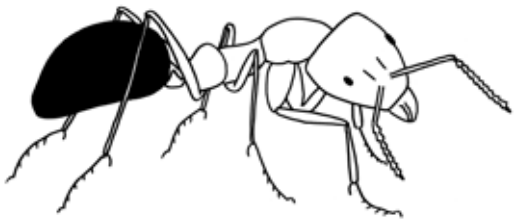

Meat ant

(Omnivore)
Eats: plants and dead animals

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Cane toad

(Carnivore)
Eats: insects (mainly moths & beetles) and spiders

The Government of Western Australia
Department of Parks and Wildlife


Pest
Cane toad
(Carnivore)
Eats: insects (mainly moths & beetles) and spiders
The Government of Western Australia
Department of Parks and Wildlife


Pest
Cane toad
(Carnivore)
Eats: insects (mainly moths & beetles) and spiders
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Pest
Cane toad
(Carnivore)
Eats: insects (mainly moths & beetles) and spiders
The Government of Western Australia
Department of Parks and Wildlife

Lesson six: What can we do to help our native animals?

Department of Parks and Wildlife

Australian Curriculum - Science

Year 4	Year 5	Year 6
Suggest ways to plan and conduct investigations to find answers to questions (ACSIS065) *Exploring different ways to conduct investigations and connecting these to the types of questions asked with teacher guidance*	With guidance plan appropriate investigation methods to answer questions or solve problems (ACSIS086) *Experience a range of ways of investigating questions, including experimental testing, internet research, field observations and exploring simulations*	With guidance, plan investigation methods to answer questions or solve problems (ACSIS103) *Following a procedure to design an experimental or field investigation*

Teacher notes: In conclusion to their study of toads, students investigate and conduct methods of protecting native animals in a localised area. Students draw on knowledge of toad biology and behaviour from Lessons one-five to design a way of protecting their selected area. Your project site could be your school yard, a local swimming hole, a park, a meeting place or anywhere else in your community. A confined project area will be easier to monitor and provide more control options (eg fencing, toadbusts, study to monitor what other animals are living there, community education campaign). Students may have come across various cane toad control methods during the course of this unit of work, additional ideas are provided with the Extension activities and projects on p12.

It is important to impress on students that animals, including toads, are not to be killed or harmed in the process.

The investigation has four parts:

1.Observation 2.Question 3.Hypothesis 4.Experiment/Analyse (examine results and draw conclusions)

The introductory activity builds on the previous lesson's discussion of food webs to demonstrate the impact of the toads on a native predator, the goanna. Thinking in the context of protecting goannas and other native predators, students develop their own investigations.

Resources: Netball bibs/coloured sashes, Cane Toad Information Sheet 6.1 x 1 per pair (or display on smartboard), various materials for conducting investigation.

Introduction: Wildlife game – Observing how a toad a can affect the environment

The aim of the game is for students to see the effect of toads on a simple food chain. It needs to be played outside in an area approximately the size of half a basketball court. The time for each game will vary, one minute is suggested throughout the instructions as a guide only.

Instructions:

Separate students into seven groups. The first group are the goannas, the second and third groups are combined to make the frogs the rest of the groups are combined and these make up the insect group. You should end up with three new groups which may be represented (for a class of 28 students) as 4 goannas, 8 frogs and 16 insects. Use sashes, netball bibs or coloured card/streamers as identifiers for each group.

Announce that, for this game, goannas can only eat frogs and frogs can only eat insects.

Separate the groups to a different part of the court and when directed they try to tag (eat) their food source.

Students try to tag (eat) their respective animal.

Once a student has been eaten they move out of the game area. Play for a minute then stop and evaluate what has happened to each of the animal groups.

Reset the game to play again, swap students around so they are in different animal groups. This time the teacher informs all the students that one of the frogs will be a toad and if eaten then the goanna is out of the game. One of the frogs is secretly informed that they are a toad. Again end the game after one minute. Re-evaluate the animal groups. "What is different this time?"

Reset the game swap students around and this time have two students as secret toads. Stop the game after one minute. Evaluate the animal numbers, "What is happening to the goannas?"

Reset the game swap students around and this time have three students as secret toads stop the game after one minute. Evaluate the animal numbers, "What is happening to the goannas?"

Activity: Make a plan

Students are posed the question 'What is an effective way to protect our native animals from cane toads?'

Brainstorm everything students have learnt about cane toads from previous lessons (for example, they need water to breed and live in as tadpoles, need warm climate, eat bugs, attracted to lights, poisonous).

Hand out or display the Cane Toad Information Sheet 6.1. Ask students to pick which information they think would be useful for protecting native animals from toads, and add it to the board.

Discuss any methods students already know about for protecting native animals from toads (eg toadbust, regularly empty water, fence, toad sausages, traps, community education). Add these to the board in a different colour. If you have time, have students research these and other methods of protecting native animals from toads.

As a class, select a location for your investigation (for example school ground, park, local swimming pool, backyards).

Put students in pairs to work together to hypothesise what they themselves could do to protect native animals from toads. Allow students time to write their hypothesis: 'The best way we can protect native animals (or a specific animal) at …… (location) from cane toads is to……..'. Note that it is the 'best way' needs to take into account materials available, allocated timeframe and students' skills and experience. 'Best' needs to be realistic. Whilst students may not have access to some of the most effective methods of protection there is still plenty of scope for taking action in their local communities.

Students then write out and/or illustrate their proposed investigation, following the headings: aim, hypothesis (as developed above), materials, safety measures, method (steps required), results (include questions that students are asking to test the success of the investigation and/or a table or graph to display findings).

Important points to consider

Animal ethics: Animals, including toads, are not to be harmed in any projects (toads may be collected for euthanasia by cooling and freezing following positive identification, refer to http://www.dpaw.wa.gov.au/canetoads for more information). The trapping and handling of native animals by unlicensed individuals (including school groups and students) is prohibited. If you are trapping toads consider ways to make sure you won't accidentally catch native animals, too. Trapping invertebrates (bugs) is acceptable, again it is necessary to consider animals that might accidentally be caught as part of your experiment such as small lizards.

Health and safety: Note that toads have poison glands and are known to carry bacteria. They should only be handled with gloves or a plastic bag covering the hand, and hands should be washed with soap afterwards. For limited handling of toads, we recommend using a bag over the hand rather than gloves as it's an item most people have at home and it prevents wastage. For a real toadbust gloves are appropriate, however some children like to suck on them or blow them up like a balloon and find it hard to break this habit even after they have just been handling toads with the gloves. Toads should be held by their rear legs, with their back facing away from you to reduce the likelihood of coming into contact with their toxin on the very rare occasion that it spurts from the animal. Safety glasses are also advised for this reason. High visibility vests are recommended in combination with close adult supervision for activities taking place along roads, tracks or around car parks.

Reflection: Get to work!

Choose at least one project students have designed and test it. If none of the students' ideas are suitable, as a class come up with a new project that you are able to carry out, such as an evening toadbust, toad-proofing the school fence, or conducting a school-wide campaign teaching others how to correctly identify toads and keep them out of their yards (you could build on your radio ads from Lesson one).

Once you have finished your project, don't forget to analyse your results and make improvements for next time. If you're testing more than one project, compare your results.

When you're done, spread the word. Send your stories, work samples and and photos to canetoads@dpaw.wa.gov.au to be included in our quarterly schools newsletter, *Kimberley Schools Wrap*.

Cane Toad Information Sheet 6.1

Cane toad – *Rhinella marina*

- Tadpoles survive in water only
- Cane toads hide in shady places
- Adult toads are active at night
- Metamorph (baby) toads need permanent water
- Toads can't climb up a smooth surface like some other frogs can
- Need males and females to breed
- Cannot move very quickly
- Males call out to attract the females to water sources for breeding
- Toads can't jump very high
- Tadpoles are attracted to the poison of adult toads
- Attracted to lights where insects congregate
- Toads eat insects
- Good swimmers

References

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www.canetoadsinoz.com/cane_toad_tadpole_control.html
http://australianmuseum.net.au/Cane-Toad

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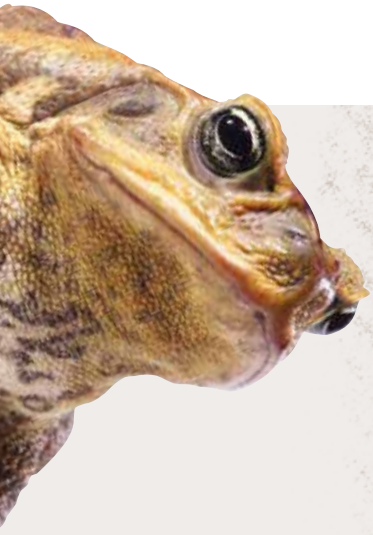

Department of
Parks and Wildlife

For more information contact the Parks and Wildlife cane toad team
on (08) 9168 4200 or email canetoads@dpaw.wa.gov.au

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