I don't like crickets, **I love** them

With searing summers, low rainfall and nutrient-poor soils, the Australian outback is a harsh place to survive, let alone thrive. A Curtin University research project is looking into the diets of monitor lizards to find out why these resilient reptiles are so well-adapted to these conditions.

by Dr Sophie Cross

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Main Black-headed monitor (*Varanus tristis*).
Photo – David Bettini

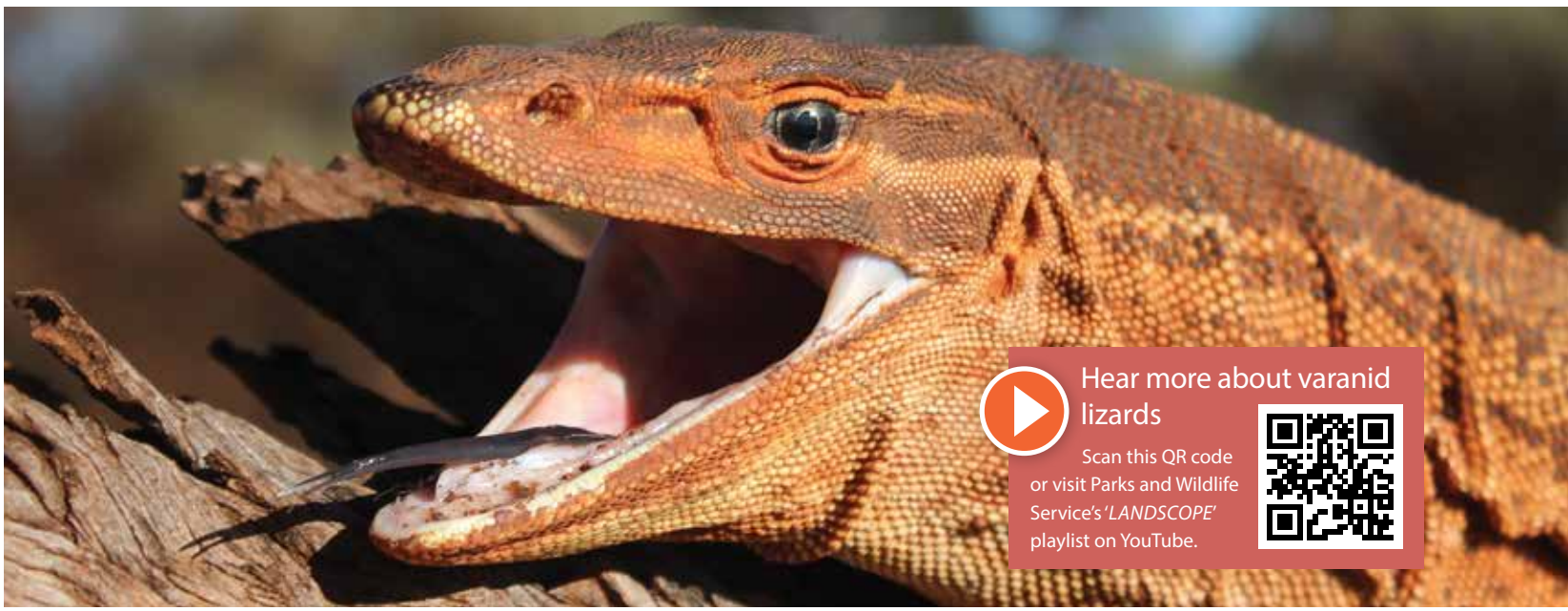
Top Little Sandy Desert lake.
Photo – Marie Lochman

Above Perentie (*Varanus giganteus*).
Photo – Judy Dunlop/DBCA

Outback Australia covers a vast proportion of Australia, with approximately 70 per cent of Australia's landmass comprising arid or desert environments. The outback is a spectacular place, but these landscapes can be harsh and unforgiving. Summer temperatures frequently reach over 45 degrees Celsius, and rainfall tends to be low but highly variable. Combined with low rainfall, soils in arid environments tend to have low water retention and be extremely nutrient-poor. Rainfall is a primary driver of food productivity, and arid environments tend therefore to be resource-poor and low-productivity habitats.

Limited food availability significantly influences the species capable of surviving and persisting in arid environments. Large mammalian predators tend to be constrained by limited food availability in arid systems, as these species tend to have high-energy requirements. However, arid Australia is essentially a land of lizards, supporting among the highest diversity of reptile species worldwide – from small skinks to large, 2.5-metre monitor lizards.

Monitor lizards (*varanids*) are an incredible faunal group, comprising the largest size range within a genus of any vertebrate taxa, ranging from 20 centimetres to three metres in length. Western Australia has almost the entire size range of monitors, ranging from the Dampier Peninsula monitor (*Varanus sparnus*) at approximately 20 centimetres, to Australia's largest lizard species, the perentie (*Varanus giganteus*) at approximately 2.5 metres. In arid Western Australia, monitor lizards are often the apex predators, occurring at relatively high diversity. So, how is it that large, carnivorous reptiles thrive at high diversity and abundance in challenging environments?



Hear more about varanid lizards

Scan this QR code or visit Parks and Wildlife Service's '*LANDSCOPE*' playlist on YouTube.

DIVERSITY IN DIET

Diet is a fundamental component of an animal's ecology, and understanding what animals eat is critical to determining how species can persist and thrive within their environment. By identifying prey that are key to an animal's diet, we may begin to understand their habitat requirements, potential resource competition between species, and how predator and prey species interact.

We assessed the diets of museum specimens of three species common in the mid-west region of Western Australia: the black-headed monitor (*Varanus tristis*), Gould's monitor (*Varanus gouldii*), and yellow-spotted monitor (*Varanus panoptes*). These species share overlapping habitats and niches across their range – the black-headed monitor is primarily an arboreal species, living in trees, hollow logs, and crevices, and the Gould's monitor and yellow-spotted monitor are primarily ground-dwelling species, although both can sometimes be found in trees.

Animals that occupy similar habitats and niches may have similar diets, potentially resulting in resource competition.

Our study analysed stomach contents of each of the three species to determine their key prey items, and whether they rely on different prey sources to reduce resource competition.

All three species had exceptionally broad diets, and diet overlapped extensively.

Monitor lizards living in an environment where prey is seasonally active, have developed a generalist feeding strategy allowing them to adjust their diet in response to prey availability.

"Limited food availability significantly influences the species capable of surviving and persisting in arid environments."

Top left A species of Grylidae cricket.
Photo – Jiri Lochman

Top Perentie (*Varanus giganteus*), Australia's largest monitor species.
Photo – Judy Dunlop/DBCA

Above Yellow spotted monitor (*Varanus panoptes*).
Photo – Dr Sophie Cross

Above A mating pair of perenties (*Varanus giganteus*).
Photo – Dr Sophie Cross

Above right Spiny-tailed monitor (*Varanus acanthurus*).

Below right Rosenberg's monitor *(Varanus rosenbergi).*
Photos – David Bettini

Although the monitor lizards had broad diets, the common prey items were invertebrates, particularly lizards.

AN APPETITE FOR SUCCESS

Invertebrate prey are typically abundant and are a staple in the diets of many predators living in arid zones, particularly in seasons with low rainfall. While abundant, invertebrates typically provide a lower-energy food source due to their small size, and to meet energy-requirements must be consumed in high quantities.

Vertebrate prey provide a high-energy food source, but tend to be scarce or seasonally available. Vertebrate predators need a significant energy investment to hunt and capture prey, and high metabolic requirements associated with capture of prey in hot, arid conditions can be extremely costly.

Large predators requiring high-energy intake may be unable to rely solely upon invertebrate prey to survive arid environments. This study rarely recorded vertebrate prey items in the diet of the three species assessed, and where present, vertebrate prey primarily consisted of small reptilian species or scavenged mammalian carrion. Monitor lizards are well-adapted to arid environments, and can aestivate (spend periods of time dormant and in a state of torpor in summer), and survive on relatively infrequent feeds and low-energy food items.

The success of the monitor lizards in Australia is likely driven by their ability to feed on invertebrate prey items, and aestivate when environmental conditions exceed their tolerance levels. Assessing the diet of species is crucial to understanding how animals can persist in challenging and harsh environments.

WHERE CAN I SEE A MONITOR LIZARD?

Monitor lizards are found throughout Australia, from arid regions to tropical areas. In Western Australia, common species such as Rosenberg's monitors (*Varanus rosenbergi*), black-headed monitors, and Gould's monitors can be found in bushland surrounding Perth, and throughout much of Western Australia. Other species, such as the yellow spotted monitor, and Australia's largest species, the perentie, require taking a trip further north to the Goldfields, Midwest, Pilbara or Kimberley regions.

Dr Sophie Cross is a behavioural and restoration ecologist at Curtin University. She has a passion for all things reptilian, and is an avid wildlife photographer. She currently works as research associate at Curtin University, in the ARC Centre for Mine Site Restoration and Curtin University Behavioural Ecology Lab. She can be contacted at sophie.cross@curtin.edu.au