Arid Zone Monitoring
Species Profiles

Threatened Species Recovery Hub

National Environmental Science Programme




The Arid Zone Monitoring Project area encompasses the lands of many Indigenous groups: we acknowledge these Traditional Owners and their ongoing custodianship of Country, and pay respects to their past & present Elders.

The project was funded by the Australian Government's National Environmental Science Program through the Threatened Species Recovery Hub.

The Arid Zone Monitoring project supports people and groups who are using track-based survey methods to monitor Australia's desert fauna – Traditional Owners, Indigenous rangers, university researchers, consultants, and government staff.

The project aims to:

- Collate and analyse existing data to explore what could be achieved when desert groups and individuals share data into a national dataset.
- Provide guidance about future monitoring designs and data collection, to help people achieve their local, regional and national objectives more effectively.

These species profiles show summaries of the data shared by project partners into the national dataset, as well as information on animal signs and habitat that may be useful for future survey work. The profiles were produced by Tida Nou, Naomi Indigo, Anja Skroblin and Sarah Legge, using analyses and mapping carried out by Naomi Indigo, Anja Skroblin, Darren Southwell, Liam Grimmett, David Wilkinson, Diego Brizuela-Torres and Sarah Legge. They were designed by Steve Wilson, Mary Cryan and Jaana Dielenberg. They can also be accessed via the project website (built by Alys Young) at AridZoneMonitoring.org.au.

The project team would also like to thank the many people that generously shared photos to make these profiles, and sometimes checked content, including ABC Rural, Adam Stow, AJ Oswald, Alan Henderson (Mini Beast Wildlife), Alan Thompson, Alex James, Alice Springs Desert Park, Aliesha Dodson (Australian Wildlife Conservancy), Anders Zimny, Ann Jones (ABC), Anni Walsh (Arid Recovery) Arthur Georges, Ben Parkhurst, Bill Stilwell, Boundary Rider, Brad Leue (Australian Wildlife Conservancy), Cat Lynch (SA government), Robert Brandle (SA Arid Lands Board), Cecilia Temperli, Chris Jolly, Chris Watson, CLC Tjakura Rangers, CSIRO, Cumberland Island NPS, Danae Moore (Australian Wildlife Conservancy), Daniela Parra, Dash Huang, Days on the Claise, Dave (moloch05, Flickr), Dave Smith, David Nelson, David Wilson, Department of Agriculture and Fisheries (QLD), Department of Primary Industries and Development (WA), Donald Hobern, Dorian Moro (Wiluna Rangers), Doug Beckers, Fiona J Walsh, Fitch Images, Gary L Warner, Gavin Emmons, Geoff Brown, George Madani, Greg Long, Hannah Bannister, Hugh McGregor, Ian Fraser, Ian Morris, Ian Sutton, Ian Withnall, J Scofield, J Triepke, Jaana Dielenberg, Jamie Moore, Jean and Fred (Flickr), Joe Benshemesh (Maralinga), John Schilling (Flickr), Jonah Wy (http://www.naturetracking.com), Jonathan A Todd, Judy Dunlop, Julie Burgher, Justine E. Hausheer (The Nature Conservancy), Laurie Tait, Kim Webeck, Sam Rando (Central Land Council), Kayla Larson and Zan King (Kanyirninpa Jukurrpa), Kath Howard, Katherine Moseby, Katherine Tuft (Arid Recovery), Rachel Paltridge and Kate Crossing (Kiwirrkurra IPA), Leanne Hales (BHA), Matt Ward, Matthew Clancy, Mark Marathon, Michael Barritt and Karen May, Mike Swinbourne, Nathan Beerkens, Natural Habitat Highlights, Neil Edwards, Neil McCoy, Nic Gambold, Nicolas Rakatopare, Nina (Flickr), Northern Bushcraft, Norman Jackson, NPS Natural Resources, Parks Victoria, Paul Campbell, Peggy Rismiller, Peter Smith, Peter Waanders, Reece Pedler, Rick Southgate, Robert Ashdown, Robyn Jay, Ross Sadlier, Ryan Francis, Sandy Kokas-Magnussen, Sandy Schultz, Scott Trageser, Simon Ferguson (Territory Wildlife Park), Stephen Mahony, Steve Eldridge, Steve Swayne, Steve Wilson, T. Faith, Tangentyere Landcare, Theresa Nano, Tim Bawden, Tissa Ratnayeke, Tom Harley, Waltja Palya, the late Wayne Lawyer (to whom we pay tribute, and we thank AWC for allowing us to use some of his wonderful images), webeyer (Flickr), wilfredor, William Riddell, and any others we have inadvertently missed.

Cover images: S. Legge, J. Hausheer, A. Stow, S. Schultz, H. Bannister

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Arid Zone Monitoring
Species Profile

Mala, rufous hare-wallaby

Lagorchestes hirsutus

Language names

Mala, Atnukwa, Irlraku, Landaa, Landalyparti, Matjirri, Parranti, Tarnnga, Tiwilpa, Warku, Witjari, Raltatu, Ngartinpa, Tarnnga, Tjiwilpa, Tjanpitja, Ninngka, Tintipa, Tjunpu, Wirrini, Liwilpa, Kunatjinpa, Tipirri

National status: Endangered

IUCN Red List: Vulnerable

Newhaven Ranger Christine Ellis shares the release of a Mala on Newhaven with her family.

Animal Description

The mala is the mainland subspecies of the rufous hare-wallaby. It is a small kangaroo, weighing about 800 g - 2 kg, with brown-silvery fur and large ears with white edges. Its tail is sandy coloured with a grey tip.

Key threats

- Predation by cats and foxes
- Wrong-way fire
- Habitat change from too much grazing by feral herbivores (cattle, rabbits, camels)

Habitat

Mala used to be common in the Central and Western deserts and were an important food source for Traditional Owners. They live on sandplains and dunes, and more gravelly plains, with spinifex or tussock grasses, sometimes with mulga. They shelter in a tunnel or scrape under a grass clump or small bush. Mala eat spinifex leaves and seed, and also the leaves, seed and fruits of other plants.

Mala with pouch young.

Mala.

Mala scat

Mala scats are dark brown to black. They are shiny when fresh.

Mala scat.

Mala tracks

Mala move the same way as larger kangaroos, they either hop on their back legs, or move slowly by alternating between the front paws and back legs, with their tails dragging on the ground. If they are disturbed from their shelter, they hop away in a zig-zag motion (and often make a high squeak noise).

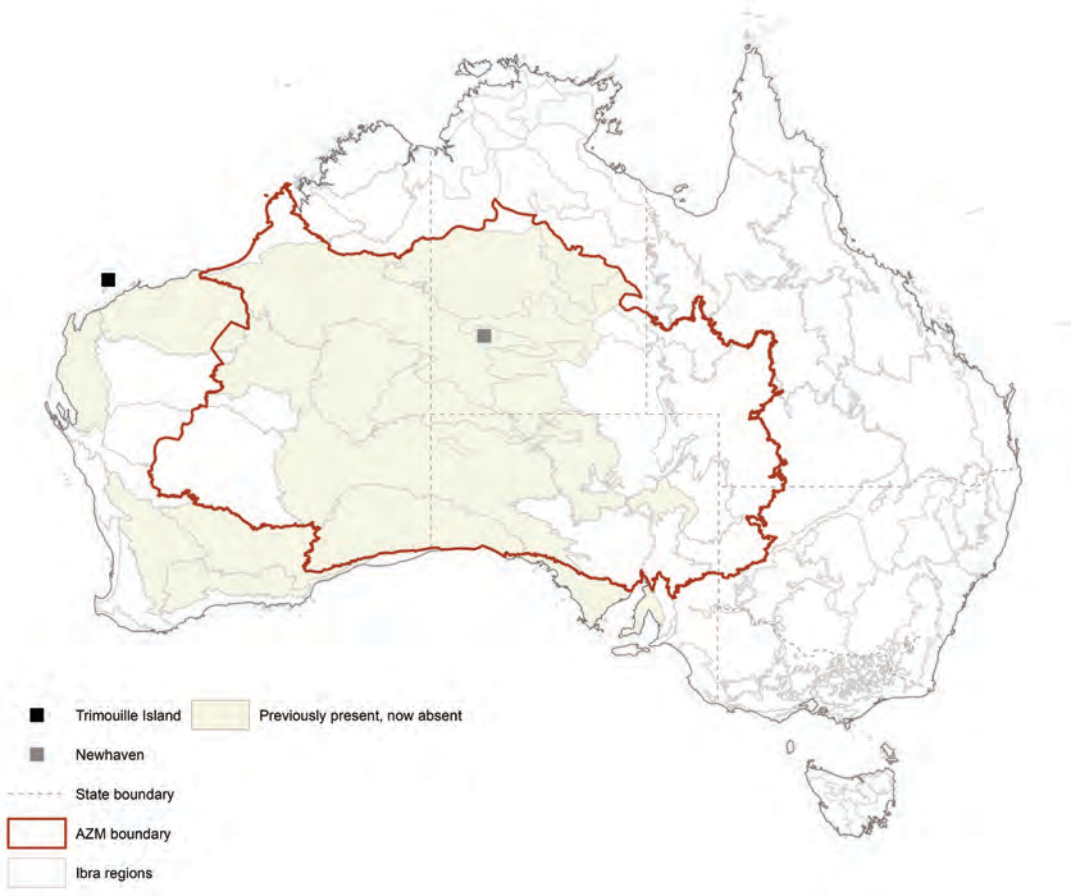
Mala tracks (arrow shows which way the mala is going).

Mala tracks (arrow shows which way the mala is going).

Arid Zone Monitoring project findings

Mala distribution

Mala used to be common across a large part of the deserts, before cats, foxes, and changed fire regimes almost drove them extinct. Luckily, 22 animals from the last wild population were taken into captivity in the 1980s, before Mala disappeared from the wild in 1991. All surviving Mala are now descended from these 22 animals. Mala were introduced to Trimouille island off the coast of WA, and they have been recently reintroduced to a fenced area at Newhaven Wildlife Sanctuary, on Warlpiri-Luritja country; this is the single dot on the Australian mainland, in the map below. Another subspecies of the rufous hare-wallaby lives on two islands off the WA coast (Bernier and Dorre). The previous distribution shown in the map below is from the Australian Mammal Action Plan[1].



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Further information

Arid Zone Monitoring project:

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Woinarski, J.C.Z & Burbidge, A.A. & Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne.)

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Mala, rufous hare-wallaby, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Pututjurru,
Brush-tailed bettong, Woylie

Bettongia penicillata

Pututjurru is the Warlpiri name for this species, and we use this name here, as the Newhaven Warlpiri Rangers have been involved in a recent reintroduction of this species to the deserts.

Language names

Karrpitji, Kurlkarri, Kurtutjarri, Maymirrka, Mirlpi, Pututjurru, Tjanpal, Wartayirrtjalpa

National status: Endangered

IUCN Red List: Critically Endangered

Pututjurru being released at Newhaven Wildlife Sanctuary by Newhaven Warlpiri Ranger Christine Ellis.

Animal Description

The Putitjurru is a small kangaroo, weighing 1-1.5 kg, with grizzled greyish-brown fur. Its tail is rufous-coloured, and has a crest of black hairs especially near the end. It can use its tail like a curly hand to carry clumps of grass back to its nest.

Key threats

- Predation by cats and foxes
- Habitat change from too much grazing by feral herbivores (cattle, rabbits and mice)
- Wrong-way fire
- Climate change (changing rainfall, temperature, droughts)

Habitat

Pututjurru used to live in many different sorts of habitats, from deserts to woodlands and dry forests. They shelter under grass clumps or dense bushes, making snug nests by lining them with grass and bark.

Pututjurru scat

Pututjurru scats are dark brown or black. They are shiny when fresh. You might be able to see small particles of plant material, and the odd bit of insect or invertebrate.

Pututjurru's curled tail. This animal was being checked ready for release at Newhaven Wildlife Sanctuary.

Pututjurru scats.

Pututjurru tracks

Pututjurru move the same way as larger kangaroos, they either hop on their back legs, or move more slowly by alternating between the front paws and back legs, with their tails dragging on the ground.

Fresh tracks from a Pututjurru resting on back legs with tail drag.

Fresh tracks from a Pututjurru hopping on its back legs on top of its toes.

Pututjurru diggings and nests

Pututjurru diggings.

Pututjurru shelter site in spinifex.

Animals that might be confused with Pututjurru during survey

- Other small kangaroos

Pututjurru tracks can be confused with tracks from other small kangaroo, such as mala and burrowing bettong. Burrowing bettong tracks are very similar, however the huge burrow systems that the burrowing bettong build may help to give clues about which bettong is present. The shape of Pututjurru's scats help to tell them apart from mala, which have small cube shaped scats (see mala profile).

Things to think about when surveying for Pututjurru

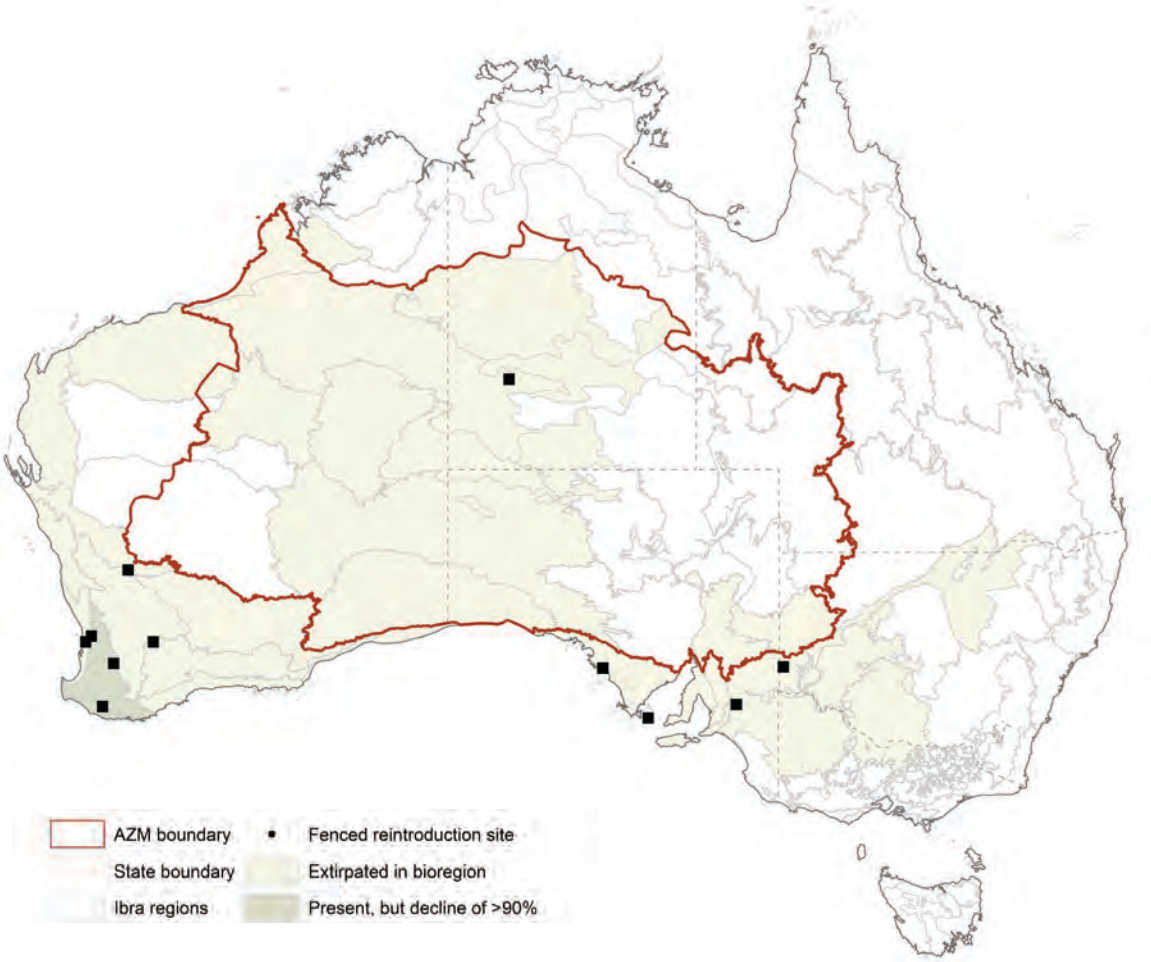
- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell tracks apart from other species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong

Arid Zone Monitoring project findings

Pututjurru distribution

Pututjurru used to be found in southwest Australia, across to central NSW, and through central Australia up to Broome. They have gone from all the drier parts of their range, mostly because of predation by foxes and cats, but hang on in southwest Australia where foxes and cats are controlled at large scales. Pututjurru have also been reintroduced to several large fenced and feral-free areas. The latest reintroduction happened at Newhaven Wildlife Sanctuary in 2021, on Ngalia Warlpiri country.

The map summarises the detections of Pututjurru in the AZM dataset. They show that Pututjurru have been recorded at Newhaven, following their reintroduction there in 2021. The grey dots show all the other sites that have surveyed since the 1980s, but where Pututjurru have never been recorded. These records were made by the Newhaven Warlpiri Rangers. Pututjurru are also found outside the AZM project area, in south-western Australia (dark shading on map). The information about the overall distribution in the map background is taken from the Mammal Action Plan[1].



Further information

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Arid Zone Monitoring
Species Profile

Spectacled hare-wallaby

Lagorchestes conspicillatus

Language names

Ilerakwe, Kwarlpe, Majiri, Milparti, Ngartama, Pukalpi, Wampana

National status: Not listed

IUCN Red List: Least concern

Spectacled hare-wallaby.

Spectacled hare-wallaby tracks in soft sand.

Animal Description

The spectacled hare-wallaby is grey-brown with golden tips to its hairs, and an orange ring around its eyes.

Key threats

- Habitat change from too much grazing by feral livestock, camels and rabbits
- Predation by cats and foxes
- Wrong-way fire (too hot, too frequent, too big)
- Climate change (less regular rainfall, high temperatures)

Habitat

The spectacled hare-wallaby lives on sand and gravelly plains, dunes, stony rises and hills with spinifex or tussock-grass, sometimes also with mulga. It builds a nest in a scrape under grass tussocks or shrubs for shelter from predators and hot daytime temperatures.

Things to think about when surveying for spectacled hare-wallabies

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year, for example before the wet or hot season (October) and in the early dry season or cool time (April).
- Follow advice of experienced trackers - know how to tell spectacled hare-wallaby tracks apart from other wallaby species before you go to survey.
- If you want to to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Arid Zone Monitoring project findings

Spectacled hare-wallaby distribution and detection rates

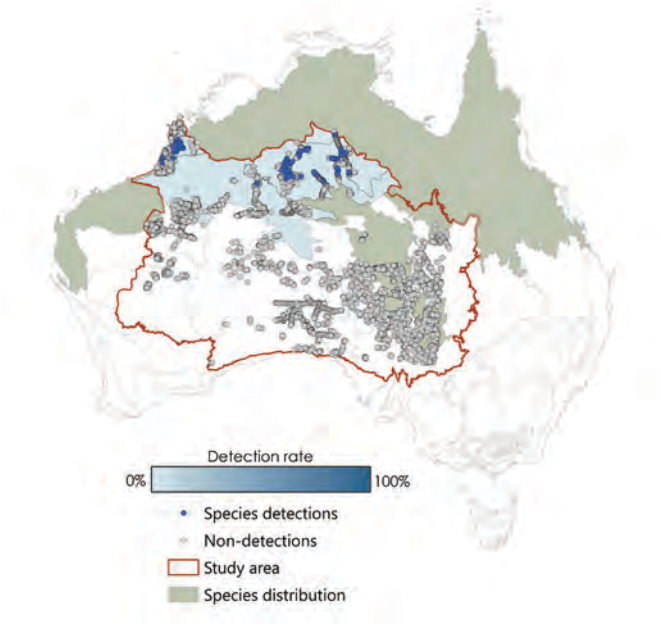
The map summarises the detections of spectacled hare-wallabies in the AZM dataset, and shows the average detection rate of all surveys carried out in each bioregion. Spectacled hare-wallabies have been detected in the northern part of the AZM project area. Each blue dot shows a survey site where spectacled hare-wallabies were recorded. The grey dots show all the other sites that were surveyed, but where spectacled hare-wallabies were not recorded. Spectacled hare-wallabies were detected at less than 1% of all surveys in the AZM dataset: they were the 20th most common native mammal species to be detected.

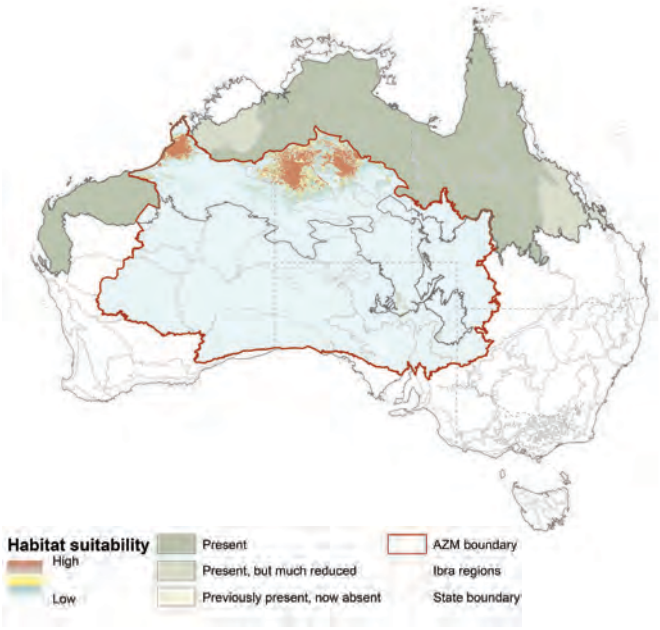
These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1].

Spectacled hare-wallaby habitat suitability

The habitat suitability model can tell us about where the northern Spectacled hare-wallaby is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that spectacled hare-wallabies prefer northern desert areas with moderate to high rainfall (>350mm) and relatively stable temperatures. Within the AZM project area, they are likely to be more common in the Northern Territory and West Kimberley, where the shading on the map is red-brown. The map only shows habitat suitability inside the AZM project boundary, but spectacled hare-wallabies occur further north, in the dark-shaded area of the map, and may be common there.





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It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Further information

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Arid Zone Monitoring
Species Profile

Northern nailtail wallaby

Onychogalea unguifera

Language names

Jurnma, Karapulu, Kururrungu, Lunpunpa, Tyurnme, Wawanpa, Wurtuwurtu

National status: Not listed

IUCN Red List: Least concern

Northern nailtail wallabies with joeys

Animal Description

Northern nailtail wallabies have a horny spur like a fingernail beneath a crest of fur at the end of the tail. No one knows what this nail is for. The northern nailtail wallaby is sandy coloured with a paler head and neck, brown flanks and a white stripe near the leg, and long ears.

Habitat

Acacia woodlands and shrublands with tussock grasses or spinifex, especially at the edges of blacksoil plains.

Key threats

- Habitat change from too much grazing by feral livestock, camels and rabbits
- Predation by cats and foxes
- Wrong-way fire (too hot, too frequent, too big)
- Climate change (less regular rainfall, high temperatures)

Things to think about when surveying for wallabies

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year, for example before the wet or hot season (October) and in the early dry season or cool time (April).
- Follow advice of experienced trackers - know how to tell northern nailtail wallaby tracks apart from other wallaby species before you go to survey.
- If you want to to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Arid Zone Monitoring project findings

Northern nailtail wallaby distribution and detection rates

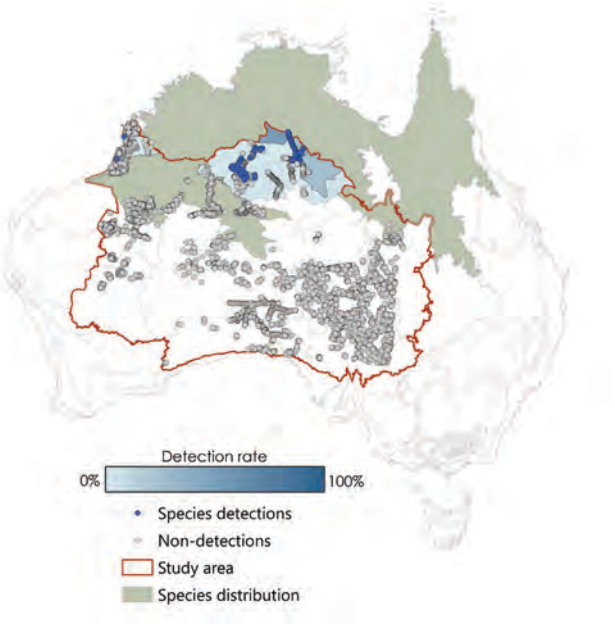
The map summarises the detections of northern nailtail wallabies in the AZM dataset, and shows the average detection rate of all surveys carried out in each bioregion, since the 1980s. Northern nailtail wallabies were detected where the northern deserts overlap with the species range in northern Australia. Each blue dot shows a survey site where northern nailtail wallabies were recorded. The grey dots show all the other sites that were surveyed, but northern nailtail wallabies were not recorded. Northern nailtail wallabies were detected at less than 1% of all surveys in the AZM dataset: it was the 19th most common native mammal species to be detected.

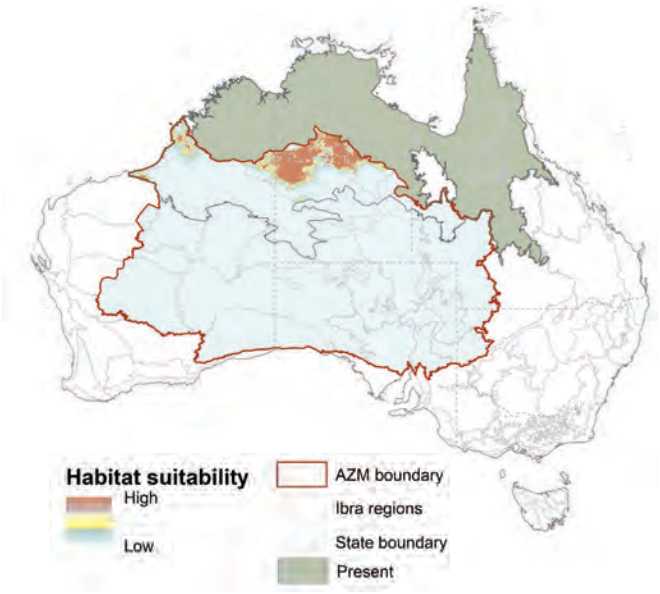
These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1].

Northern nail-tail wallaby habitat suitability

The habitat suitability model can tell us about where the northern nailtail wallaby is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that northern nailtail wallabies prefer areas with a monsoonal climate, and moderate annual rainfall (>350 mm). Within the AZM project area, they are likely to be more common in the Northern Territory and parts of Dampierland in the West Kimberley, where the shading on the map is red-brown. The map only shows habitat suitability inside the AZM project boundary, but northern nailtail wallabies occur further north, in the dark-shaded area of the map, and may be more common there.





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Arid Zone Monitoring
Species Profile

Warru, Wiliji (Black-footed rock-wallaby) *Petrogale lateralis*

Language names

There are five subspecies of the black-footed rock-wallaby, three of which live within the AZM project area. They each have different language names, but Warru is becoming widely used in central Australia, and Wiliji is used for the West Kimberley subspecies on Nyikina Mangala country. We use the common name Warru in this species profile. The subspecies also have different statuses under the EPBC Act:

- *P. lateralis lateralis* (Endangered)
  Kakuya
  Pakultarra
- *P.l. kimberleyensis* (Endangered)
  Wiliji
  P. l. centralis (Vulnerable)
  Arrwe
  Wakulyarri
  Warru
  Yukulyarri

The two remaining subspecies live in islands off the southern coast of Australia, and are not recorded in the AZM dataset:

- *P. l. hacketii* (Vulnerable)
  P. l. pearsonii (Near Threatened)

IUCN Red List: Vulnerable

Warru

Animal Description

Warru are greyish-brown with a paler belly and chest, and a dark stripe running from its head down the spine. They have a dark tail and feet. Warru have short, thick, woolly fur especially around the base of the tail, rump and flanks

Key threats

- Predation by foxes and cats
- Habitat change from too much grazing (livestock, camels, goats, rabbits)
- Wrong-way fire (too often, too intense, too big)
- Climate change (changing rainfall, temperature, droughts)

Habitat

Warru live in colonies amongst rocks. They come out of shelter at night to forage, sometimes travelling away from the rocks. They like to bask on the rock on sunny days in the cold months.

Warru scat

Warru scats are pellets of different shapes, which are shiny when fresh, and dry to black or dark brown. The pellets have grasses and plant material in them.

Animals that might be confused with the Warru during survey

- Rothschild's rock-wallaby
- Yellow-footed rock-wallaby

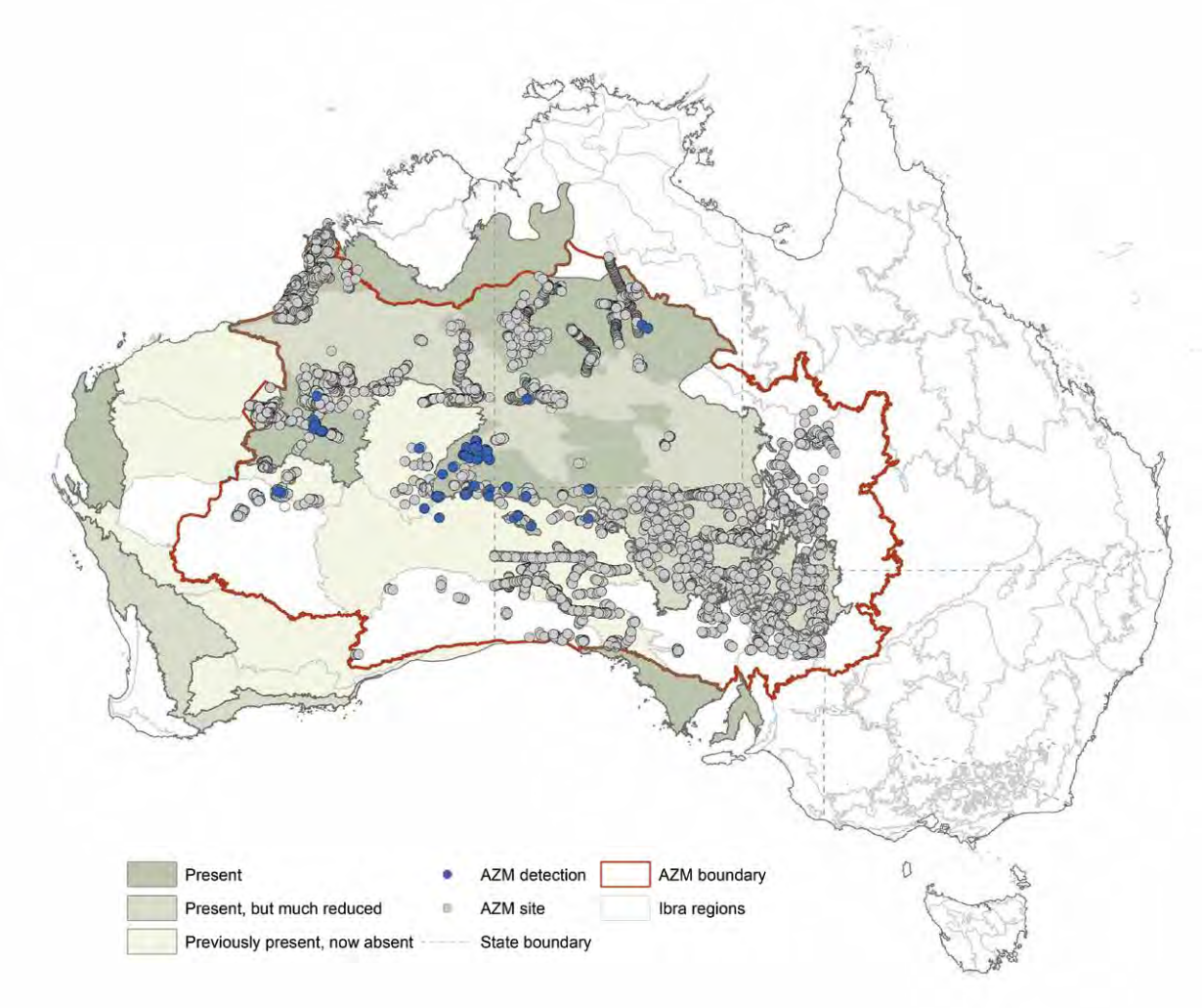
Rothschild's rock-wallaby is found only in the Ashburton and Pilbara region and on islands of the Dampier Archipelago, outside the AZM project area. Yellow-footed rock-wallabies are in the south-east of the AZM project area, but their range doesn't overlap with Warru.

Warru scat

Arid Zone Monitoring project findings

Warru distribution

The map summarises detections of Warru in the AZM dataset. Each blue dot shows a survey site where Warru were recorded. The grey dots show all the other sites that were surveyed, but where Warru were not recorded. The records cover two subspecies of Warru (*P. l. centralis, P. l. lateralis*). Some of the records in the western deserts have been made in places where Warru are now very rare (the light beige-coloured bioregions). These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1], and includes the range of all five subspecies.



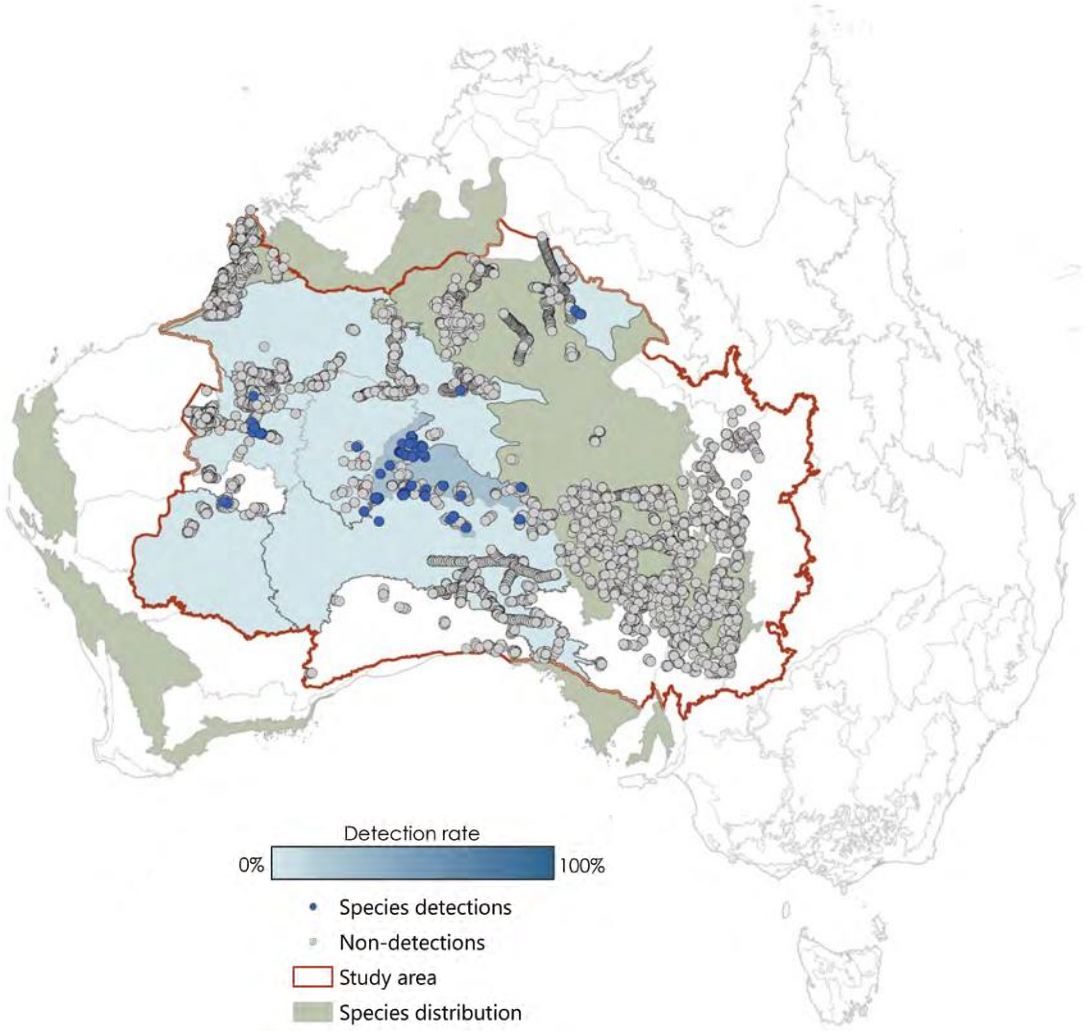
The map above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Warru detection rates

Warru were detected rarely, at only 0.23% of all surveys in the AZM dataset. This is not surprising because Warru stick close to their rocky shelters, so surveys will only record them if they are done in or near rocks.

The map below shows the detection rate for Warru across all surveys carried out in each bioregion. Detection rates have been highest in Ngaanyatjarra country (darker blue shading), possibly because the rangers carried out targeted surveys for Warru.



Things to think about when surveying for Warru

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- There are different ways of monitoring rock-wallbies: scat surveys, trapping and camera-trap surveys, so think about what will work best for you.
- Follow advice of experienced trackers - know how to tell Warru scat apart from euros and red roos before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Warru habitat suitability

The habitat suitability model can tell us about where Warru are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that Warru are found in higher areas, in rocky places. These are the red-brown shaded areas of the map. The map only shows habitat suitability inside the AZM project boundary, but Warru are also found outside the project area. The habitat suitability model does not predict well in large areas where there has not been any sampling, and the number of records for Warru in the AZM dataset are small; getting more survey data would improve the model.

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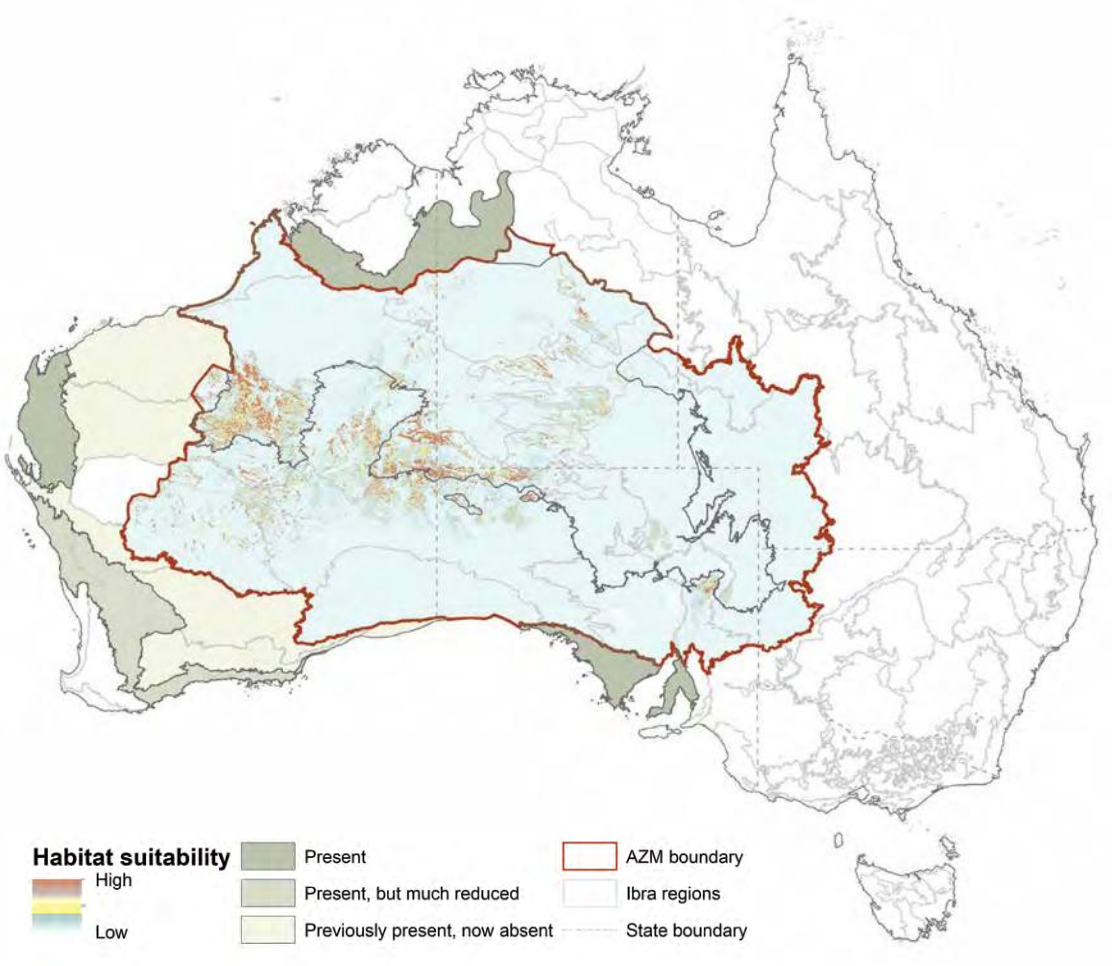

Further information

Arid Zone Monitoring project:

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Woinarski, J.C.Z & Burbidge, A.A. & Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne.)

Threatened Species Recovery Hub

National Environmental Science Programme

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Warru, Wiliji (Black-footed rock-wallaby), Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Agile wallaby

Notamacropus agilis

Language names

Parrjaniny

National status: Not listed

IUCN Red List: Least concern

Agile wallaby

Agile wallaby tracks (arrow shows which way it is moving).

Agile wallaby tracks (arrow shows which way it is moving).

Animal Description

The Agile Wallaby is a large wallaby with a sandy brown coat, with a white stripe on each side of the face and white stripes on each thigh. It has large ears with black edges. The body and tail length is up to 1.8 m. Males weigh up to 27 kg, while females are around 15 kg. The tip of the tail is black.

They can be active during the day or night. Agile wallabies often rest quietly in the shade during the day, and graze on grasses, legumes, fallen fruits and other herbs in the late afternoon. They are often seen in small groups.

Key threats

No major threats, but land clearing may threaten local populations in Queensland.

Habitat

Agile wallabies live in open forest, tropical woodlands and grasslands and on coastal sand dunes, especially near water. They are common in northern Australia and parts of the east coast of Queensland.

Agile wallaby scat

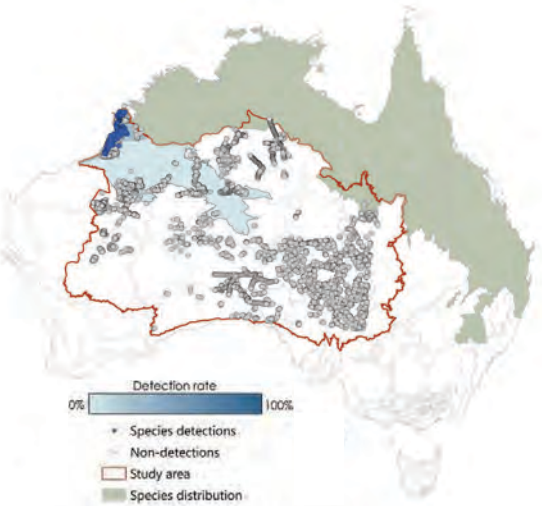
Scats of agile wallabies are usually seen in groups of four to eight around their feeding areas and sleeping places. Groups of scats from the same animal may vary in shape (oval, round, or slightly square shaped), and are 10-12 mm in width and filled with grass or plants.

Agile wallaby foot and tracks

The agile wallaby hops with its body held upright, its head held high and with forearms extended.

All wallabies in Australia have similar tracks. Wallabies have 5 clawed toes on the front foot, and these toes point forward. They have a long hind foot. The long fourth toe, with its large strong claw, and the shorter fifth toe, also with a strong claw, are the only ones that touch the ground when the wallaby moves. The second and third toes are joined up to their top joints, with claws used for grooming.

Agile wallaby detection rates

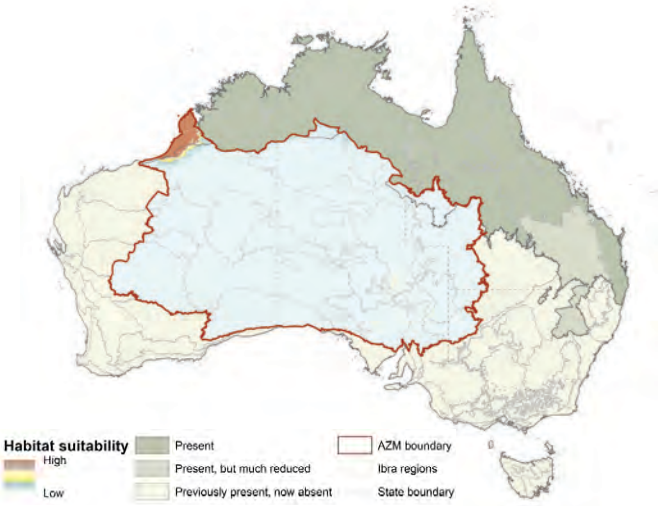


Agile wallabies were detected at 2% of all surveys from the AZM dataset. It was the 18th most recorded mammal species, and the 15th most recorded native mammal species. Agile wallabies are the most common kangaroo in tropical coastal Australia.

The map shows the detection rate for agile wallabies across all surveys carried out in the two AZM project bioregions in which it occurs. Note that the agile wallaby is only found in the coastal area of the Great Sandy Desert, even though the whole bioregion is shaded blue.

The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified. It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Agile wallaby habitat suitability



The habitat suitability model can tell us about where agile wallabies are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI).

The model tells us that agile wallabies prefer areas of higher annual rainfall (over 500 mm) that are close to water (<1 km). The map shows us they the coastal areas of the north-western deserts are good places for agile wallabies. The map only shows habitat suitability inside the AZM project boundary, but agile wallabies are also found across northern Australia, in the darker-shaded part of the map, and are common there.

Things to think about when surveying for agile wallaby

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell agile wallaby tracks apart from other species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Woinarski, J.C.Z & Burbidge, A.A. & Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne.)

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Agile wallaby, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Large kangaroos

Euro is *Macropus robustus* • Red kangaroo is *Macropus rufus*

Language names

Euro: Arenge, Areyneng, Arinenge, Jamarnti, Kanyala/ Kanyarla, Maraji, Nyatunya, Pikkarta
Red kangaroo: Aherre, Kulpira, Lulpira, Malu/ Marlu, Maunka, Mitimarlu, Wawirri, Yawirri

Euro
National status: Not listed
IUCN Red List: Least concern

Red kangaroo
National status: Not listed
IUCN Red List: Least concern

Euro.

Red kangaroo.

Two large species of kangaroos are often recorded using track surveys in the deserts: the red kangaroo and the euro. It can be hard to tell these species apart, so this profile has information on both species. A third species, the western grey kangaroo, could be detected in the southern deserts, but there are no confirmed records in the AZM dataset.

Euro description

Euros are also known as common wallaroo, eastern wallaroo or hill kangaroo. Their coat colour and texture changes in different types of country. They may be light tan, grey, brown, orange-brown or orange-red, with a rufous-brown neck and lighter belly. Adult males are much bigger and darker than females.

Red kangaroo description

Red kangaroos have short, red-brown fur on the back, but are paler on the belly and limbs. Males can reach 85 kg. Females are about half the size, and can be more blue-grey than brown.

Scats

The three big roos have scats that look the same. They are usually shaped like uneven little balls that are about 1-3 cm across depending on the size of the kangaroo. Inside is dry and made of grass and leaves.

Euro scats (all large kangaroos have similar scats).

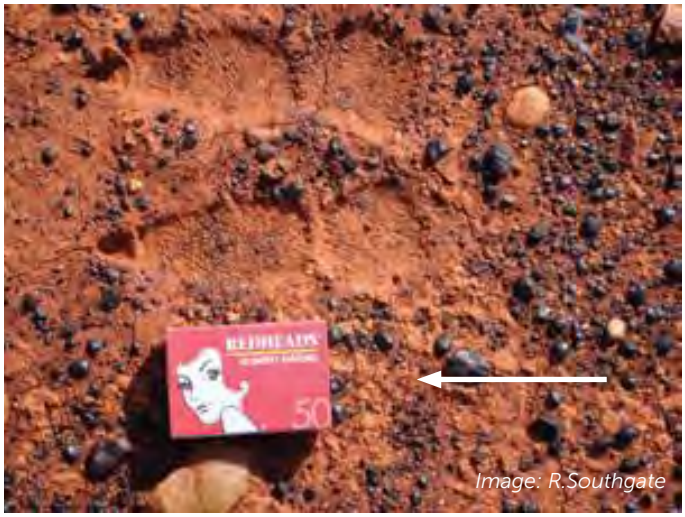
Tracks

All big kangaroos either hop on two feet or walk on all fours. They sometimes use their tails for balance.

Euro tracks

Hopping and walking Euro tracks. Compared to the red kangaroo, the Euro's toe and foot pad are squarer, and the gap between the toe and foot pad is slightly larger (arrow shows which way it is going).

Red kangaroo tracks



When the red kangaroo is hopping, the large fourth toe (with its strong claw) and the foot pad are the only parts of the foot to leave a track. Red kangaroo tracks have a round foot pad, a small gap between the fourth toe and foot pad, and the toe has a point at the end (arrow shows which way it is going).

Kangaroo gait tracks. When the kangaroo moves slowly, it's tail leave a drag mark in the sand (arrow shows which way it is going).

Kangaroo tracks (arrow shows which way it is going).

Western grey kangaroo

In the tracks of the western grey kangaroo, you can see the larger fourth and smaller fifth toe. Sometimes they stagger their feet a bit when they hop. Western grey kangaroo tracks are like the red kangaroo, but the toe and foot pad are squarer, and the gap between the toe and foot pad is a bit larger.

Things to think about when surveying for large roos

- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell roo tracks apart from other species, and practice telling euro and red roo tracks apart.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (such as right-way fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

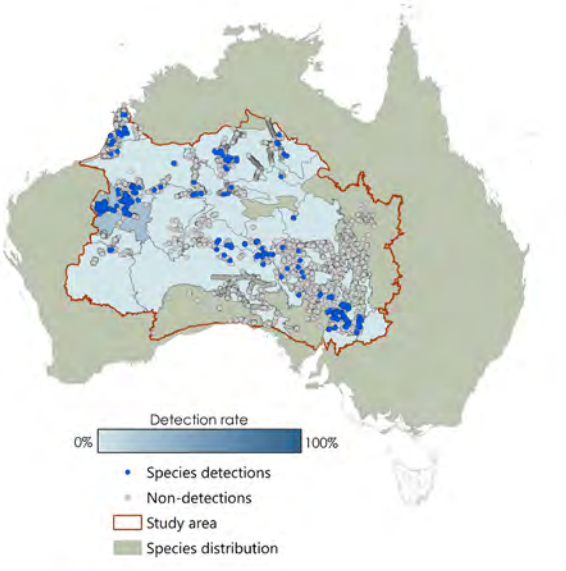
Arid Zone Monitoring project findings

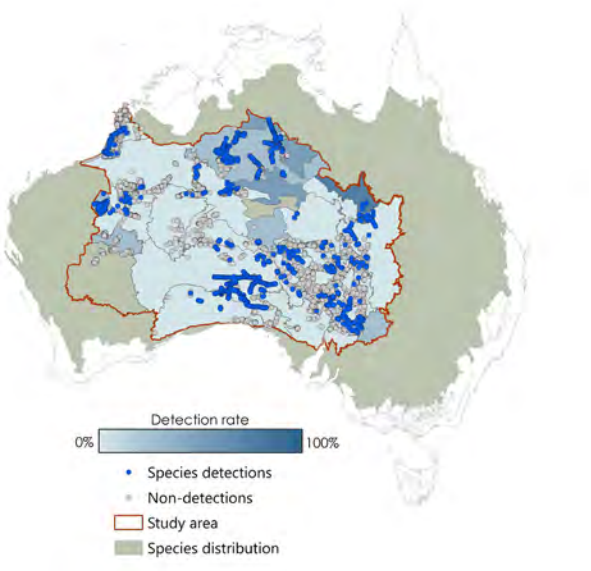
Large roo distribution and detection rates

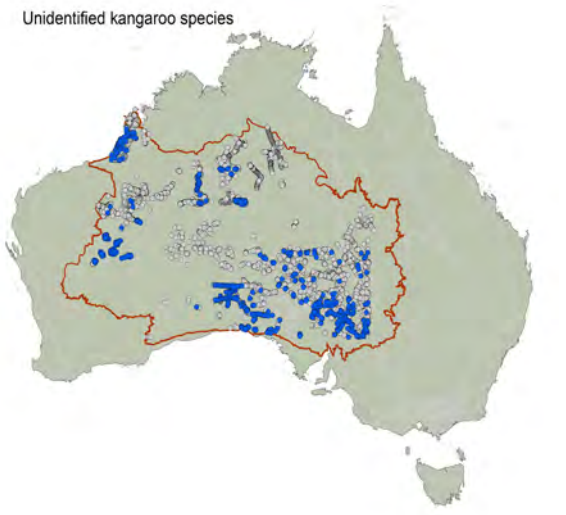
Each blue dot shows a survey site where a roo species was recorded. The grey dots show all the other sites that were surveyed, but where roo species were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. Bioregions are shaded to show the detection rate of roo species across all surveys carried out in that bioregion, since the 1980s. The information about the overall distribution in the map background is drawn from The Mammal Action Plan[1] and The Australian Faunal Directory[2].

Both species of large roo were detected throughout the deserts, but the red kangaroo was possibly more common in the north-eastern deserts. A more detailed analysis of roo detections at a subset of AZM sites that were revisited over five or more years, shows that roo detection rates don't vary consistently with time since fire nor the amount of green vegetation, suggesting they are able to thrive in many situations. It is hard to tell red kangaroos tracks apart from euros, so some of the records in the AZM database might be wrong.

The euro was detected at over 2% of all surveys in the AZM database. It was the 12th most commonly recorded animal, and the seventh most commonly recorded native mammal species. The red kangaroo was detected at over 8% of all surveys in the AZM database. It was the eight most commonly recorded mammal species, and the third most commonly recorded native mammal species.







As well as records of euros and red kangaroos, there are also many records of 'large kangaroo', which could belong to either species. This map summarises where all those records are (blue dots). The map also shows all where surveys took place but 'large kangaroos' were not recorded (grey dots).

The maps above are based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

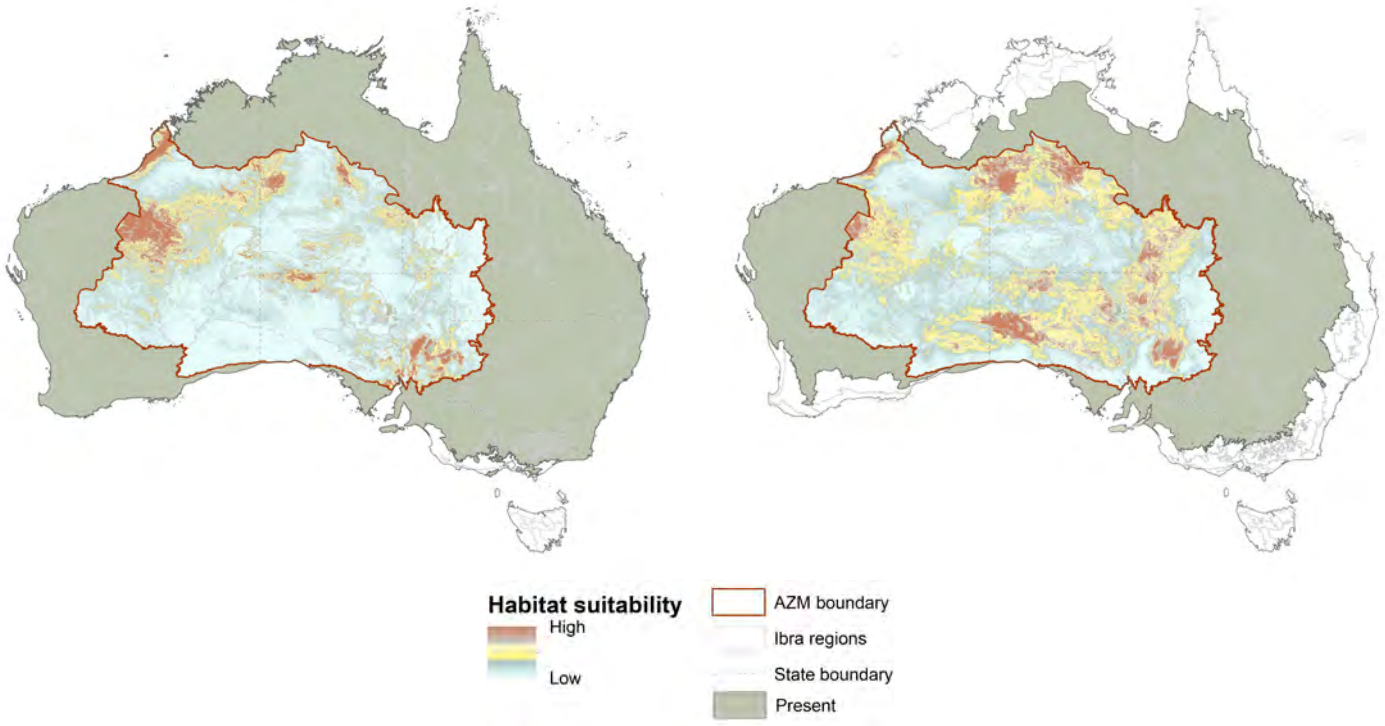
It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Large roo habitat suitability

The habitat suitability model can tell us about where a species is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model for euros suggests that they are mostly found in hilly country and ranges, with moderate rainfall. The model for red kangaroos suggests this roo is widespread, without strong preferences for landform, soil, terrain, and fire frequency. These are the red-brown areas of the maps.

The map only shows habitat suitability inside the AZM project boundary, but roos are also found outside the project area. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

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References

[1] Woinarski J.C.Z., Burbidge A.H., Harrison P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne).

[2] Australian Faunal Directory: https://biodiversity.org.au/afd/home Accessed June, 2021.

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Large kangaroos, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Hopping mice

Spinifex hopping mouse *Notomys alexis*
Dusky hopping mouse *Notomys fusus*
Fawn hopping mouse *Notomys cervinus*
Mitchell's hopping mouse *Notomys mitchelli*

Language names

Jilku, Jilyku, Jungunypa, Mpwenyelpe, Tarkawara, Tjunginpa, Wijipardu, Wilkiniti (Dusky hopping mouse)

Spinifex hopping mouse	Dusky hopping mouse	Fawn hopping mouse	Mitchell's hopping mouse
National status: Not listed	National status: Vulnerable	National status: Not listed	National status: Not listed
IUCN Red List: Least concern	IUCN Red List: Vulnerable	IUCN Red List: Near Threatened	IUCN Red List: Least concern

Dusky hopping mouse.

Not so long ago, there were ten different species of hopping mice, but five of these species became extinct soon after European colonisation. Of the five species that are left, four live in deserts, and three are recorded in the AZM dataset. Their distributions are mostly separate, but there are overlaps in some areas, making it hard to identify tracks to species level. This factsheet presents findings from the AZM dataset on the two most commonly recorded hopping mice species: the spinifex hopping mouse and the dusky hopping mouse. The factsheet mentions the Mitchell's hopping mouse and the fawn hopping mouse, but does not present AZM data on either.

Key threats

Habitat change from too much grazing by feral livestock and other herbivores (camels, rabbits, mice), and from weed invasion (especially buffel grass)

- Predation by cats and foxes
- Wrong-way fire
- Climate change (changing rainfall, temperature, droughts)

Animals that might be confused with hopping mice during surveys

- Other small mammals
- Small birds

Other small mammals do not hop, so check whether the back footprints are in pairs. Some birds leave hopping prints, but you can usually see their toes, unlike the tracks of a hopping mouse.

Telling between the hopping mice

Mitchell's hopping mice live in the southern deserts, but their range partly overlaps with the spinifex hopping mouse range. In the very eastern and north-eastern deserts, the dusky hopping mouse and the fawn hopping mouse might be more likely than the spinifex hopping mouse. Spinifex hopping mice prefer sandy areas with spinifex, dusky hopping mice prefer canegrass on sand dunes, fawn hopping mouse prefer open gibber flats and Mitchell's hopping mice prefer mallee shrublands on sand dunes.

Spinifex hopping mouse description

The spinifex hopping mouse has a soft fur coat which is grey, fawn or pale orange, with a white underbelly. They have large eyes and ears, big back feet, long tufted tails and move with a hopping and galloping gait. Spinifex hopping mice weigh around 35 g. Spinifex hopping mice (both males and females) have a small throat pouch with central bare area.

Spinifex hopping mice live in the sandy spinifex country of central Australia. They avoid the heat of the day by sheltering in a deep, humid burrow. Their burrows are often under the hummocks of plant species like canegrass and spinifex.

Spinifex hopping mouse (front view).

Spinifex hopping mouse (side view).

Fawn hopping mouse description

The fawn hopping mouse has pale fawn to gery upperparts and a white underbelly. Its bi-coloured tail is at least 12 cm long, and it weighs 30-50 g. It lives in gibber plains and claypans, and shelters in deep burrows during the day.

Dusky hopping mouse description

The dusky hopping mouse is 8-11 cm long and weighs about 35 g. It has large ears, dark eyes and long narrow hind feet to hop on. The tail is longer than their body with a black tuft on the end. Their fur is pale orange on the back and white on the underside. Dusky hopping mice have a throat pouch or chest gland which looks like a round fleshy lip covered in coarse white hairs.

Dusky hopping mice are usually in sand dunes covered with canegrass (*Zygochloa paradoxa*) or nitre bush (*Nitraria billardierei*) (not spinifex). They sometimes live in different habitats, even gibber plains, but always near a small sandy area for digging a burrow. They avoid the heat of the day by sheltering in a deep burrow. Dusky hopping mice eat mostly seeds, as well as green shoots and insects.

Dusky hopping mouse.

Mitchell's hopping mouse description

Mitchell's hopping mouse lives in the very southern deserts, and may be detected along the southern edge of the AZM project area. It is larger than the other two hopping mice, at about 50 g, but it has the same large back feet, long tufted tails and a hopping gait. Mitchell's hopping mice do not have a throat pouch.

Mitchell's hopping mice live in sandy areas of mallee shrubland and heath. They avoid the heat of the day by sheltering in a deep, humid burrow or in a hollow log.

Mitchell's hopping mouse.

Hopping mouse tracks

All hopping mice hop with their back feet together, leaving pairs of footprints. In good tracking conditions, you can see a ridge running across the middle of each back footprint. They can also use all four feet when moving slowly, and the tail leaves a mark in the track. Hopping mice often race along the same routes, creating a 'runway'.

Hopping mouse tracks with imprint of ridge running across the middle of each back footprint

Spinifex hopping mouse runway (arrow shows which way it is going).

Dusky hopping mouse runway.

Hopping mice burrows

Spinifex hopping mouse pop-hole.

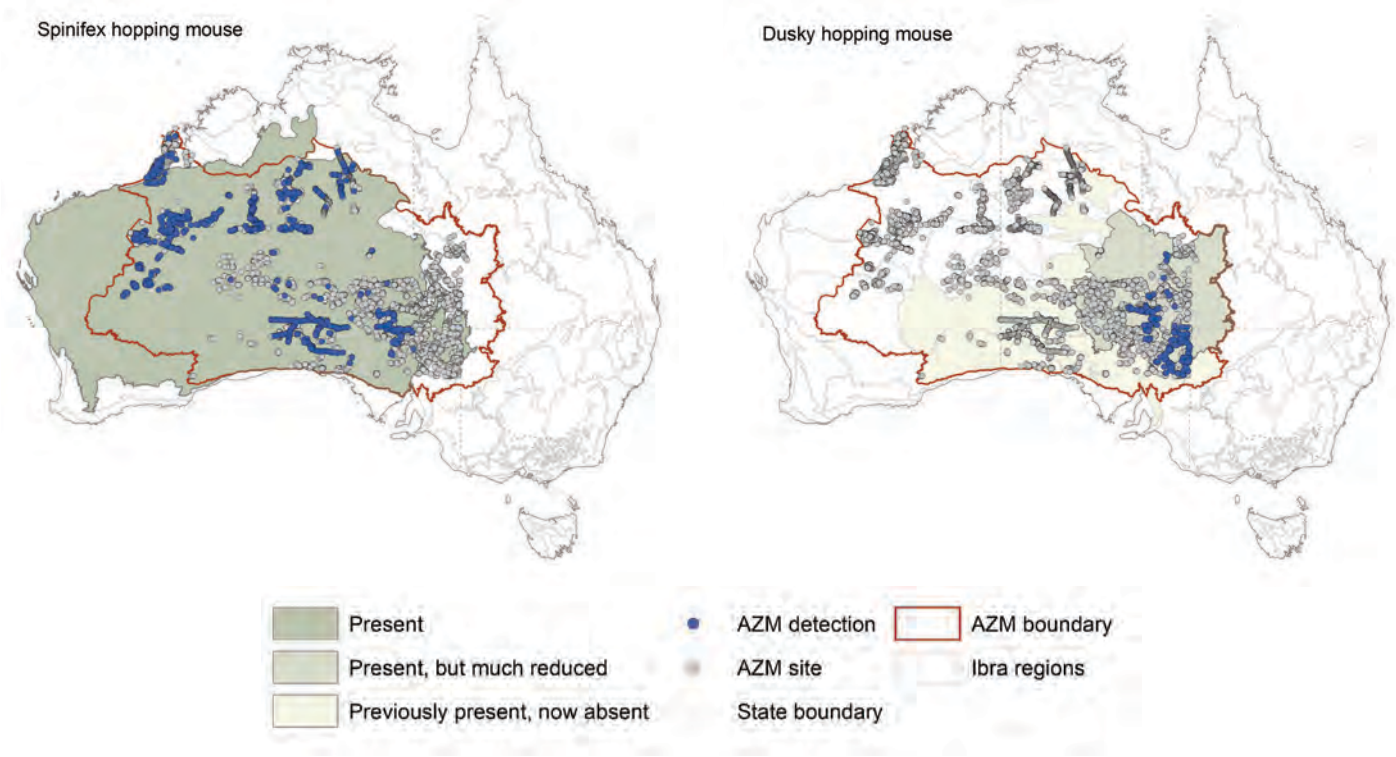
Dusky hopping mouse going down its pop-hole.

Arid Zone Monitoring project findings

Hopping mouse distributions

The maps show the detections of spinifex hopping mice (left) and dusky hopping mouse (right) in the AZM dataset. Spinifex hopping mouse are found across most of the project area, except the eastern bioregions, where they are replaced by dusky hopping mice and fawn hopping mice. Note the records for the spinifex hopping mouse from the very southern deserts could either come from spinifex hopping mice, or their close relative, the Mitchell's hopping mouse. Their tracks are very similar and their distribution overlaps. The dusky hopping mouse now lives in the deserts of northern SA and the southern NT, in a smaller area than their previous distribution.

Each blue dot shows a survey site where hopping mice were recorded. The grey dots show all the other sites that were surveyed, but where hopping mice were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is from the Australian Faunal Directory[1], the Mammal Action Plan[2] and amended by expert input[3].



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It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

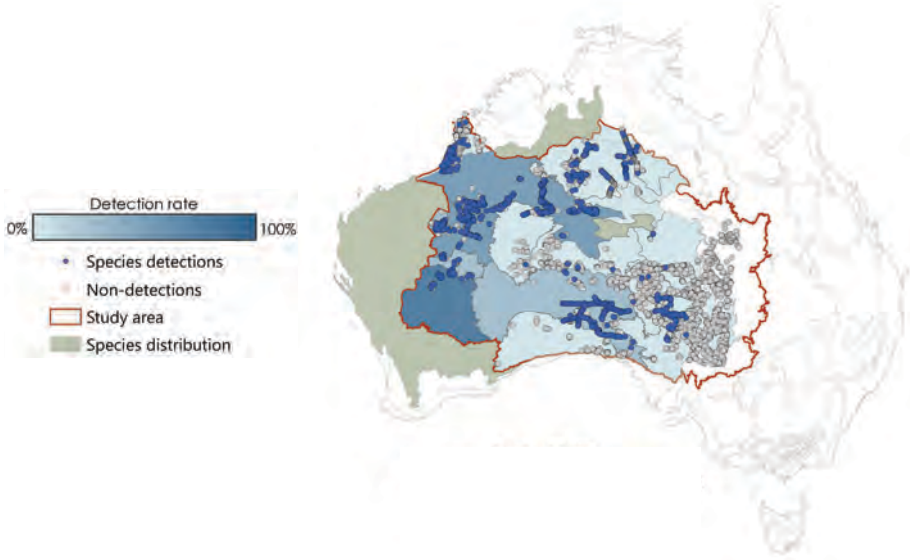
Things to think about when surveying for hopping mice

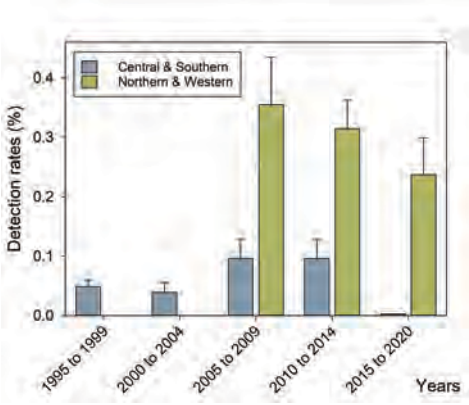
- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell hopping mice tracks apart from other small mammal species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Spinifex hopping mouse detection rates

Spinifex hopping mice were detected at over 12% of all surveys in the AZM dataset. It was the sixth most commonly recorded mammal species, and the second most commonly recorded native mammal species, behind the dingo.

The map shows the detection rate for spinifex hopping mice across all surveys carried out in each bioregion, since the 1980s. Detection rates have been lower in the east and southeast of the project area (lighter blue shading). The graph shows the detection rate for spinifex hopping mice in five-year blocks from 1995. The data show the average detection rates across bioregions in the central and southern deserts, versus bioregions in the northern and western deserts. The graph confirms that detection rates were higher in northern and western bioregions, and detection rates of this species decreased in the north and west has over the past 15 years. A more detailed analysis of spinifex hopping mouse detections at a subset of AZM sites that were revisited over five or more years, suggests that they detected less often soon after fire, and more often when there is more green vegetation, but these patterns were only seen at some sites.

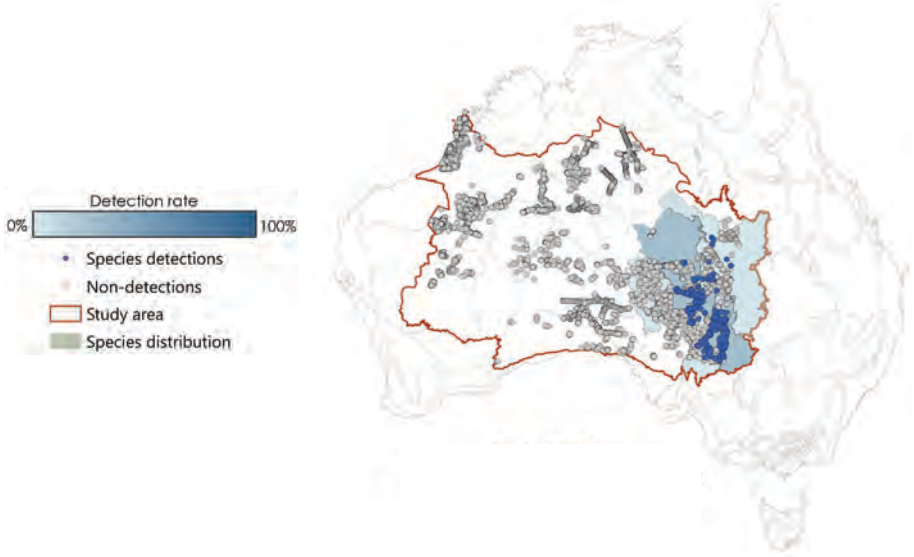




Dusky hopping mouse detection rates

Dusky hopping mice were detected at over 3% of all surveys in the AZM dataset. It was the 11th most commonly recorded mammal species, and the sixth most commonly recorded native mammal species.

The map shows the dusky hopping mouse detection rates across all surveys carried out in each bioregion, since the 1980s. The detection rate has been recorded fairly evenly across a small range. AZM detections of dusky hopping mice were more common between 2010-2021. This may be because rabbit control in the 1990s helped to reduce the numbers of cats and foxes, and some native mammal species expanded their range as a result. But it is also possible that some detections in early years were misidentified as spinifex hopping mouse (which would made dusky hopping mice seem rarer), or that people started targeting surveys for dusky hopping mouse in later years (making them seem more common).

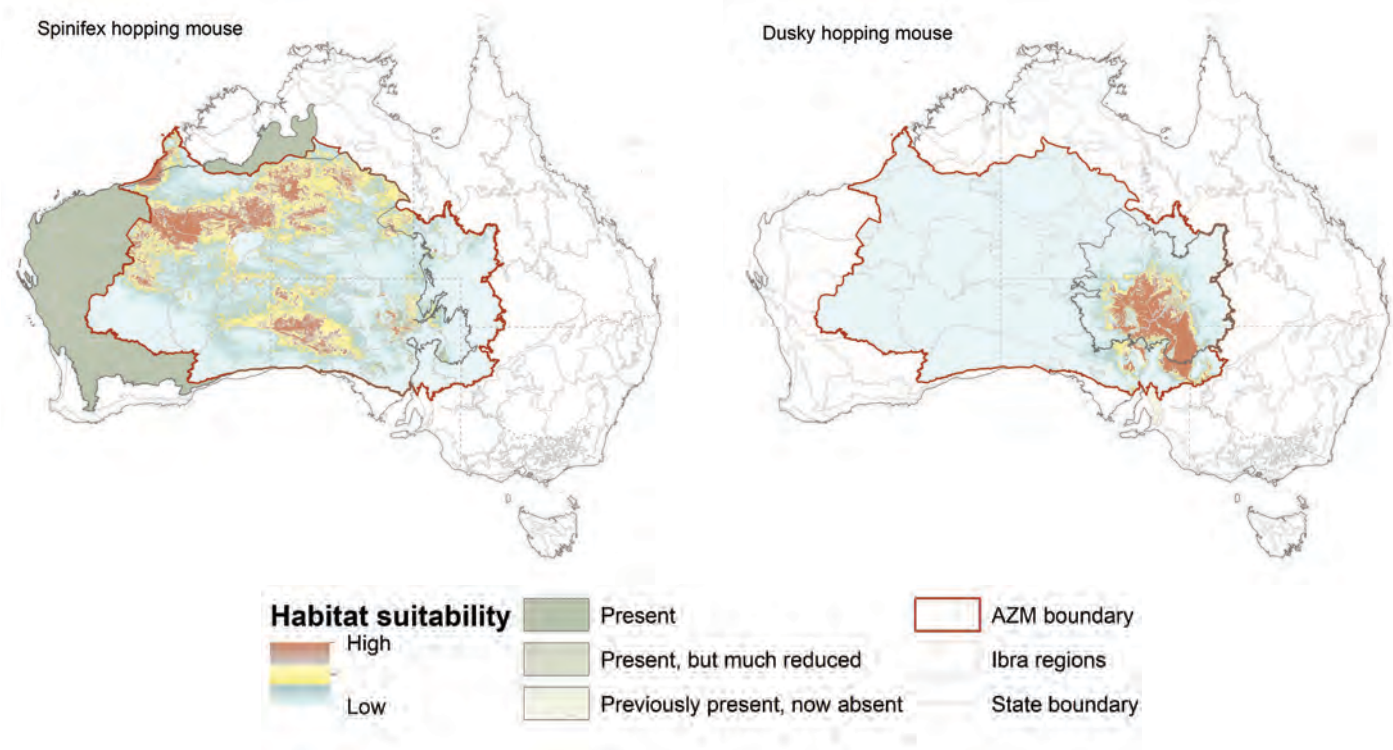


Habitat suitability

The habitat suitability model can tell us about where a species is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that spinifex hopping mice are relatively widespread without strong preferences for landforms, soil types, climate, habitat and fire frequency. In contrast, dusky hopping mice prefer to live in flat low areas away from hills (<200 m), and where the mean temperature is moderate (between 18-24 degrees Celsius). These are the red-brown shaded areas of the dusky hopping mouse map.

The maps only show habitat suitability inside the AZM project boundary, but spinifex hopping mice are also found to the west of the project area, and could be common there. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model for the spinifex hopping mouse.



Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021.

[2] Woinarski, J.C.Z & Burbidge, A.A. & Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne.)

[3] K. Moseby, H. Owens, Personal Communication 09/10/2020

Threatened Species Recovery Hub
National Environmental Science Programme

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Hopping mice, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Kowari

Dasyuroides byrnei

Language names
Kariri

National status: Vulnerable

IUCN Red List: Vulnerable

Kowari on gibber plain.

Kowari running across gibber plain.

Animal Description
Kowaris are carnivorous marsupials with olive grey fur, a white belly and a black brushy tail. Sometimes they may have rufous brown tinge. They have a pointed face with large upright ears and pale ring of fur around their eyes.

Key threats
- Predation by cats and foxes
- Habitat change from too much grazing by feral herbivores (livestock, camels, rabbits and mice)
- Climate change (changing rainfall, temperature, droughts)

Habitat
Kowaris live in stony gibber plains with sparse scrub between braided river channels and sand dunes in the Channel Country. The Kowari digs burrows and uses burrows made by other animals (bilby, some rodents).

Kowari scat
The kowari leaves strong smelling, twisted scats near its burrows and on rocks to mark its territory.

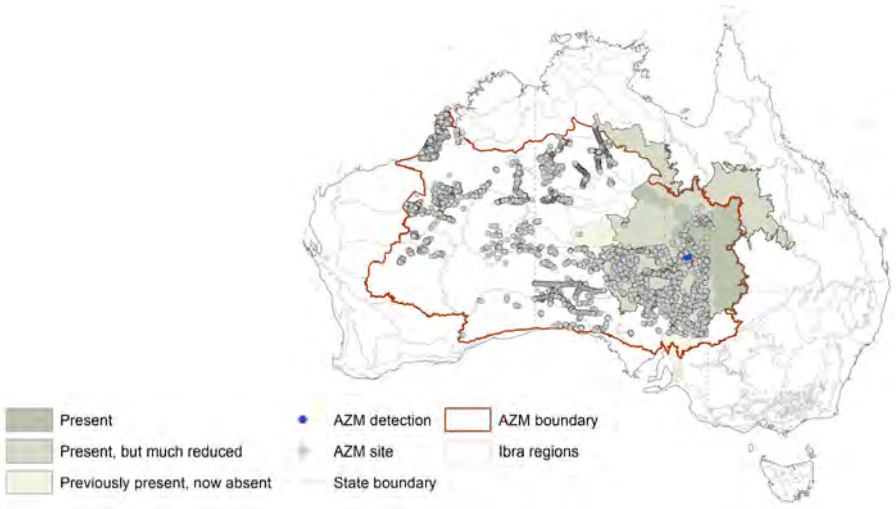
Kowari tracks
The kowari may have walking or bounding tracks. Tracks on sand are hard to find as kowaris are mainly on gibber plains.

Arid Zone Monitoring project findings

Kowari distribution

The maps summarise detections of kowaris over time in the AZM dataset. They show that kowaris are found in a small area in the Lake Eyre basin. Each blue dot shows a survey site where kowaris were recorded. The grey dots show all the other sites that were surveyed, but where kowaris were not recorded. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1]. Over time the population has experienced a reduction in range, disappearing from the lightly shaded areas and almost disappearing from the bioregions in the mid-shading. There are plans to reintroduce this species to the Arid Recovery reserve in South Australia.

Kowaris were detected at less than 1% of all surveys in the AZM dataset: of over 14,000 site surveys, kowaris were only detected twice. This reflects the low sampling within its distribution, and the difficulty of picking up tracks in this gibber-loving species.



The map above shows data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Things to think about when surveying for kowari

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell tracks apart from other species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Further information

Arid Zone Monitoring project:

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Woinarski J.C.Z., Burbidge A.H., Harrison P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne).

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Kowari, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Small mammals

Language names

Athakwere, Alepey, Ilkwennge, Jilku, Kilu, Mingkiri, Minini, Thakey, Thukia

The profile includes 10 types of small carnivorous marsupials and small rodents with tracks that are very hard to tell apart. It does not include hopping mice, as these animals have tracks that can be identified (see separate profile). Most of these species are not listed as threatened by either the EPBC Act, nor by the IUCN, except for the plains mouse.

Key threats

- Predation by cats and foxes
- Habitat change due to grazing by feral livestock, camels and rabbits
- Wrong-way fire
- Climate change (more drought could reduce good quality habitat)

Fat-tailed pseudantechinus

Pseudantechinus macdonnellensis

Animal description

It has grey-brown fur, very large ears and a sharp pointy muzzle. It has carrot-shaped tail swollen with fat which serves as a food reserve. It is 9.5-10.5cm long with a 7.5-8.5cm tail; it weighs 20-45g.

Habitat

Rocky country; in desert country they live in and near termite mounds.

Fat-tailed pseudantechinus.

Fat-tailed dunnart

Sminthopsis crassicaudata

Animal description

Large black eyes, large ears, a pointy snout and a fat tail. It has fawn to brown grey fur, with darker patches around the eyes and head. Some can have white patches around the ears. The belly and legs are light grey to white. It has a head and body length of 6.0-9.0cm, tail 4.5-7.0cm in length and weighs 10-20g.

Habitat

Widespread in different types of country, including grassland, gibber plans, saltbush and blue bush, claypans, pasture.

Fat-tailed dunnart.

Stripe-face dunnart

Sminthopsis macroura

Animal description

Large black eyes, large ears, a pointy snout and a fat tail. The fur is pale grey-brown on the upperparts, and whitish on the underparts. There is a dark stripe running down the front of its face, with a darker line of fur. It weighs 15-25g, and its tail (8-10cm) is longer than the head-body (7.5-9.5cm), unlike the fat-tailed dunnart (which has a short tail).

Habitat

Grasslands, shrublands, more common near drainage lines. They shelter in soil cracks, or under grass, logs and rocks.

Stripe-face dunnart.

Central pebble-mound mouse

Pseudomys johnsoni

Animal description

The central pebble-mound mouse has a pale yellow-brown to rufous brown back, with black guard hairs, and white belly. It is the same size as a mouse, weighing about 12-15g .

Habitat

This species is found in rocky country with open woodland, valleys and grassland. It likes pebble-covered ridges and plains with pebble mounds and grasses. It lives in burrows and makes mounds of pebbles close to the entry hole. It is easy to detect this species if you see their mounds, but their tracks and other signs are very similar to other small mammal species.

Central pebble-mound mouse.

Western pebble-mound mouse mounds; the central pebble-mound mouse builds similar mounds

Forrest's short-tailed mouse

Leggadina forresti

Animal description

They have light grey to yellowish brown fur. They have some darker hairs above, and a white belly. It has small ears and eyes, and a short, broad muzzle. They are small (15-25g) and have a short tail.

Habitat

Forrest's short-tailed mouse is found in different types of country: sandy plains, spinifex, shrubland, mulga woodland, savanna woodland, claypan, tussock grassland.

Forrest's short-tailed mouse.

Long-haired rat

Rattus villosissimus

Language names

Kurtangi, Kwetang, Nyemale, Rraarrtja, Yamputura

Animal Description

The long-haired rat has long pale grey-brown fur with very long black guard hairs that stick out past the main coat. The ears and tail are dark grey. The tail (12-18cm) is shorter than the head and body (13-22.5cm), and they weigh 60-280g.

Habitat

The long-haired rat is a nocturnal, terrestrial species of semi-arid or arid areas. They often shelter during the day in complex burrow systems or in a shallow temporary burrow. In dry times, populations shrink to refuges within the arid landscape where food and water are always available. Following extended periods of above average rainfall or flood this species can breed rapidly - populations increase in size disperse widely, then die away abruptly as food is reduced and water dries.

Long-haired rat.

Plains mouse

Pseudomys australis

National status in the EPBC Act: Vulnerable

IUCN Red List: Not listed

Animal description

It has grey fur on the back, and a cream or white belly. It has a stocky build, rounded snout and long ears.

Habitat

The plains mouse lives on plains and gibber stony plains. It likes country with cracking clay soils and creeks.

Distribution

Now only known from country west of Lake Eyre, and a small area west of Lake Torrens.

Burrow/Diggings

This species forms colonies which can cover large areas and create runways connecting many burrows and cracks.

Plains mouse.

Plains mouse burrow.

Plains mouse 'runway',

Sandy inland mouse

Pseudomys hermannsburgensis

Animal description

It has greyish-brown to sandy-brown fur and an off-white belly. It looks similar to the introduced house mouse but is more slender, with longer ears and tail and bigger eyes, and not as smelly as house mouse.

Adults weigh 9-15g, head and body length is 5.5-8cm and tail length 7-9cm.

Habitat

Open country, with sandy soils on plains and dunes. It eats spinifiex seeds so likes lots of spinifex grasses. It is one of the few types of small mammal whose numbers don't go strongly down after fire.

Sandy inland mouse.

Desert Mouse

Pseudomys desertor

Animal description

This mouse is medium-sized, and has orangey-brown fur, with long dark guard hairs, and distinctive pale rings around its eyes. The tail is about the same length as the body, or shorter (7-10cm). It weighs 12-35g. It eats mostly leaves, with small amounts of invertebrates and grass seed. It makes nests in grass tussocks, or in shallow burrows.

Habitat

Sand dunes or sand plains with spinifex. The desert mouse likes long-unburnt spinifex – it disappears from areas that have been recently burnt, or that are burnt often.

Desert mouse

House mouse

Mus musculus

Introduced species

Animal description

Yellowish-brown to blackish above, white to pale yellow below. House mice have a musty smell. House mice also have a notch on the inner surface of upper teeth and females have 5 pairs of teats.

House mouse.

Small mammals tracks

Small mammals have tracks that are not always clear and they can be difficult to tell apart. There are some differences to look out for. For example, tracks of small dunnarts are similar in size to small rodents. However, dunnarts have five forward-pointing, evenly spaced toes. In comparison, a rodent's front foot leaves four toe prints; two pointing forward and one on each side, and the hind feet have five toe prints, three pointing forward and one on each side. This configuration means each rodent foot imprint leaves a flower-like pattern, usually with a raised ridge of sand across the centre of each hind foot imprint. This is not as obvious in dunnart tracks. Tracks of the sandy inland mouse are difficult to distinguish from the similarly-sized house mouse (*Mus musculus*). Plains mouse tracks are similar, but larger.

Mouse tracks in sand. Note the flower shape with four toe prints, typical of rodents.

Small mammal tracks.

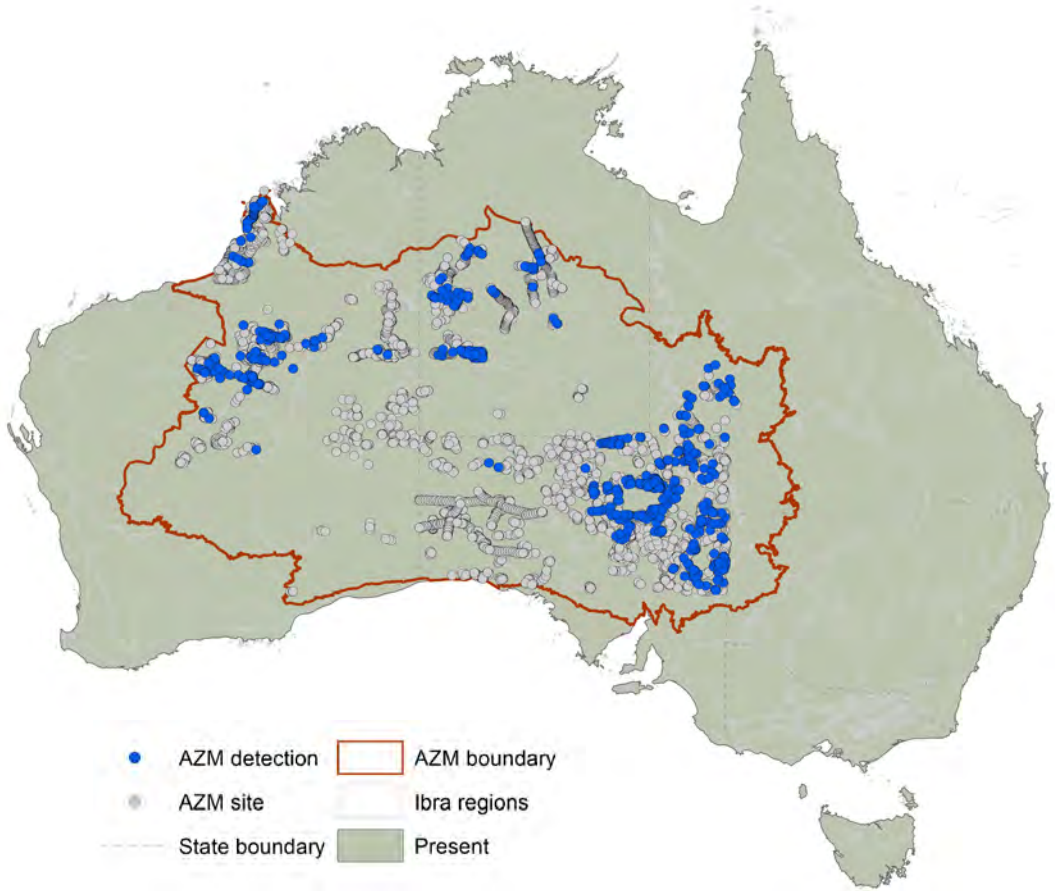
Things to think about when surveying for small mammals

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year, for example before the wet or hot season (October) and in the early dry season or cool time (April).
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Arid Zone Monitoring project findings

Small mammal detection

The map is based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified. It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, please let us know.



The map shows where small mammal detections in the AZM dataset over time. It shows that small mammals occur all over desert country. Each blue dot shows a survey site where small mammals were recorded. The grey dots show all the other sites that were surveyed, but where small mammals were not recorded. Tracks and signs that could not be identified to a species level make up all of the records in this group.

Small mammal detection rates

Small mammals were detected at over 9% of all surveys in the AZM dataset. It is possible their tracks are more common, but trackers do not consistently record the presence of small mammals, because it is hard to identify them to species level.

Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Small mammals, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Marsupial moles

Northern marsupial mole, Karrkaratul is *Notoryctes caurinus*
Southern marsupial mole, Itjaritjari is *Notorycytes typhlops*

Language names

Arkutelene, Itjaritjari, Kakarratulpa, Kakarrartuunpa, Karrkaratul/Kakarratul, Mantararrarr, Pujarrpujarrpa/Pujjarrpujarr, Tjalupantji, Tutharrutharra, Urrkemate, Yirtarrutju, Yitjarritjarri

Northern marsupial mole, Karrkaratul
National status: Not listed
IUCN Red List: Least concern

Southern marsupial mole, Itjaritjari
National status: Not listed
IUCN Red List: Least concern

Image: Kiwirrkurra Indigenous Protected Area

Kakarratul (northern marsupial mole) found by Kiwirrkurra Rangers .


Image: Joe Benshemesh

Itjaritjari (southern marsupial mole).


Image: Kiwirrkurra Indigenous Protected Area

Burrowing Kakarratul (marsupial mole) found by Kiwirrkurra Rangers.

Animal Description

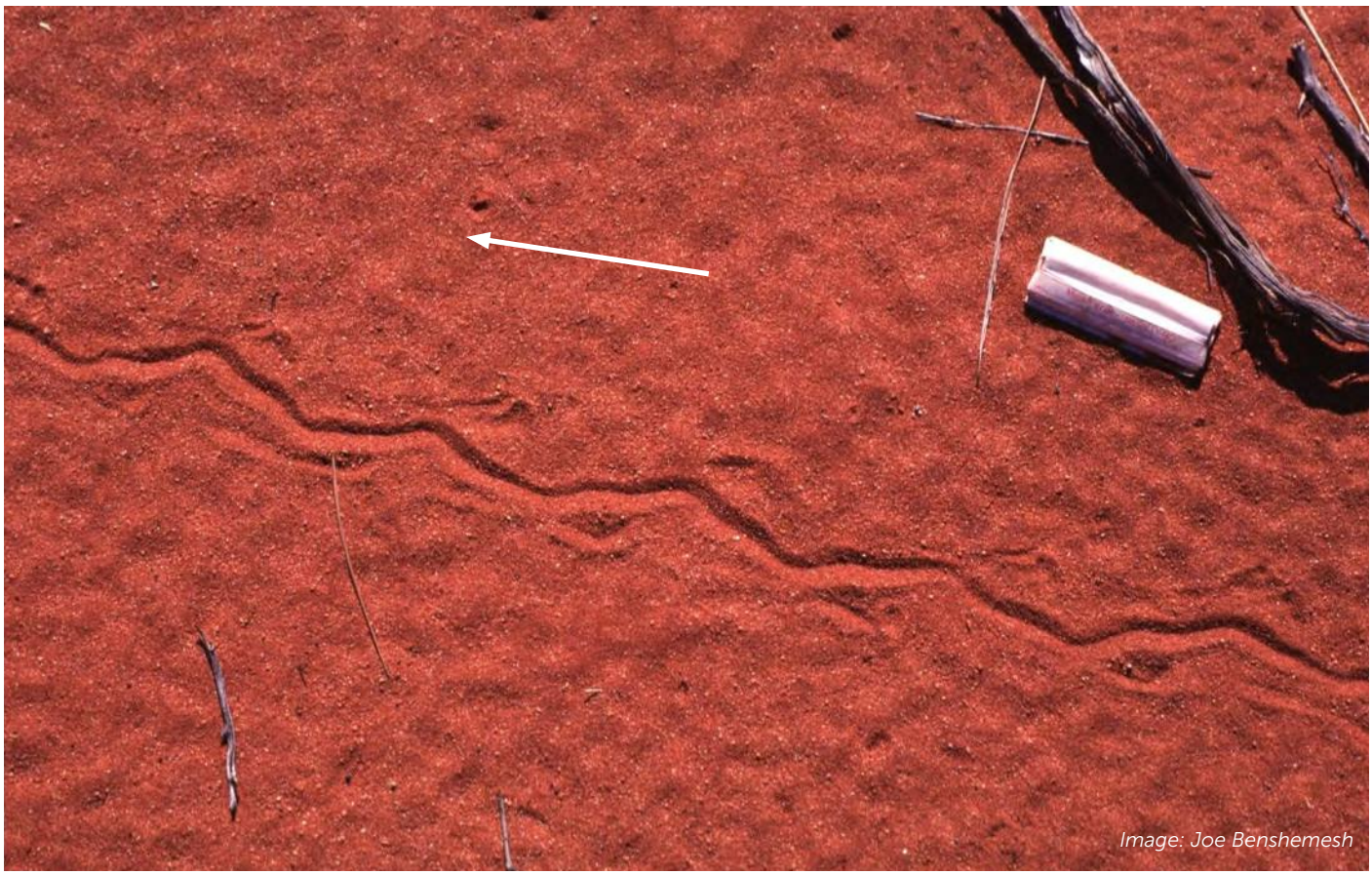
There are two species of marsupial moles, one lives mostly in north-western deserts, and the other lies in the southern deserts. Their ranges probably overlap, but it's hard to know where because the two species look so similar. They are small, with a head-body length of 12-16 cm and a short tail. Marsupial moles have bodies that are specialised for burrowing through sand. They have short, dense, pale golden fur, and a tubular body shape. They have short, strong legs with large shovel like claws for digging. Their eyes are tiny and do not work at all (they are blind), and their ears are tiny and simple.

Key threats

- Predation by foxes and cats
- Soil compaction by feral herbivores (camels, livestock, cattle, rabbits)

Mole signs (tunnels and tracks)

When on the surface, marsupial moles have a shuffling walk, with a zig-zag tail through the middle of the track and broken tracks from their limbs on either side. Karrkaratul (northern marsupial moles) have similar tracks to Itjaritjari (southern marsupial moles) but may have a less noticeable tail drag. When underground, marsupial moles "swim" through the soil and the mole packs (backfills) the sand behind it as it moves, so there is no empty tunnel.



Itjaritjari (southern marsupial mole) tracks on the surface (arrow shows which way it is moving).

Itjaritjari (southern marsupial mole) tracks on the surface and crater where it has dug into the sand.

Itjaritjari (southern marsupial mole) uplift from burrowing just under the surface.

Mole tunnels – there is no empty tunnel because it is backfilled as the mole moves through the sand.

A good way to find marsupial moles is to dig trenches that are about 1m deep, wait a couple of days for the sand to dry out, then check the sides of the trenches for signs of mole tunnels.

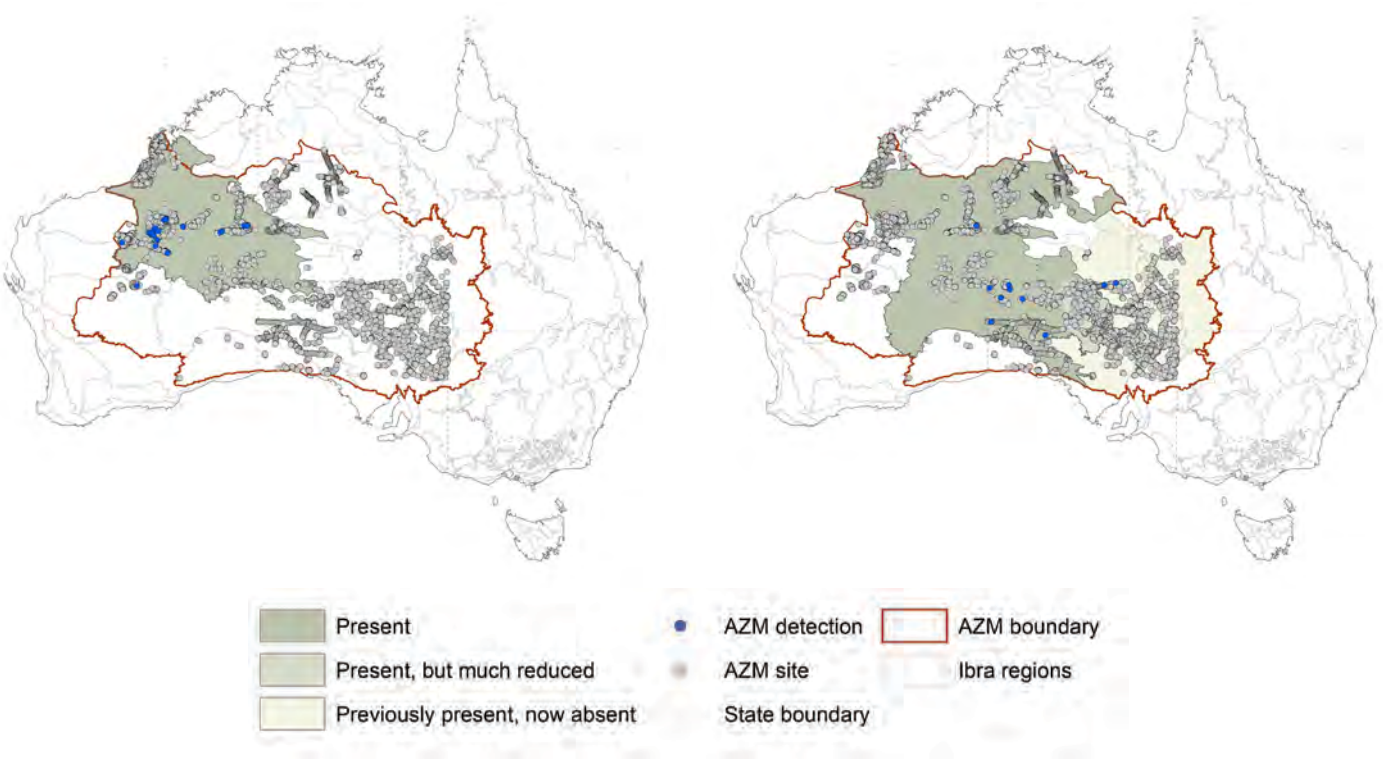
Habitat

Marsupial moles live underground in sand dunes and adjacent swales, and in sandy soils along river flats. They need deep loose sand to move through, so they aren't found in places with hard-packed soil. They spend most of their time underground, but will come up to the surface every now and then, particularly in wet weather. Underground sign is most common in big areas of dunes. They eat invertebrates, especially the ants, termites and beetle larvae.

Arid Zone Monitoring project findings

Marsupial mole distribution

The maps summarise detections of marsupial moles in the AZM dataset between 2000 and 2020. There are no records for 1980-2000. Karrkaratul (northern marsupial moles) have been detected in the Great Sandy, Little Sandy, the Gibson and Tanami Deserts of Western Australia. Itjariitjari (southern marsupial moles) have mostly been detected in South Australia. It's possible that records in WA and the NT near to SA have been mis-identified, in both directions. Each blue dot shows a survey site where marsupial moles were recorded. The grey dots show all the other sites that were surveyed, but where moles were not recorded.



Distribution of Karrkaratul (northern marsupial moles) (left) and Itjariitjari (southern marsupial moles) (right).

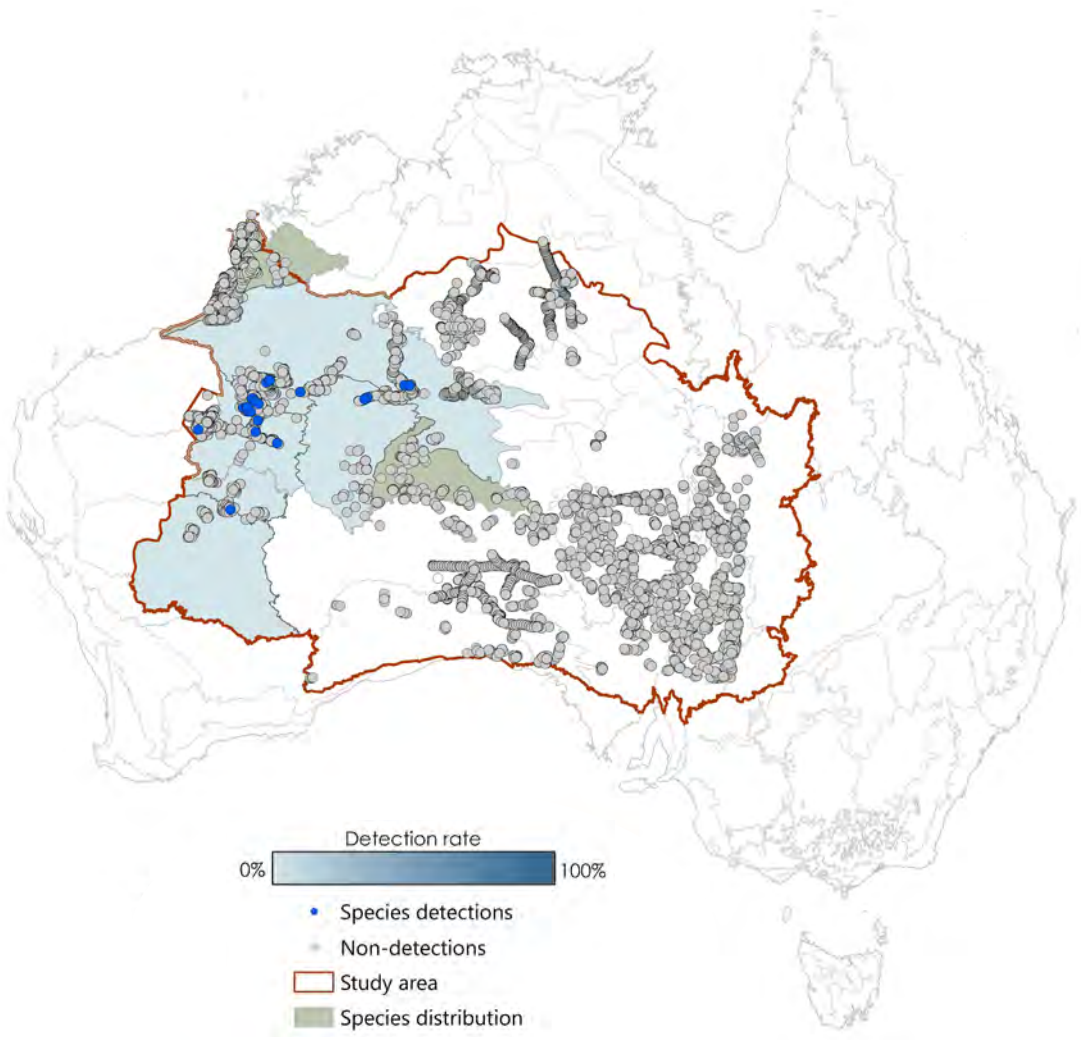
The maps above are based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Marsupial mole detection rates

Karrakaratul (northern marsupial moles) were detected at less than 1% of all surveys in the AZM dataset. It was the 26th most commonly recorded mammal species. Itjaritjari (southern marsupial moles) were also detected at less than 1% of all surveys in the AZM dataset, and they were the 28th most commonly recorded mammal species.

The map shows the detection rate for Karrkaratul (northern marsupial mole) across all surveys carried out in each bioregion, since the 2000s. Detection rates have been similar and low across the bioregions (light blue shading). A detection rate map has not been made for Itjaritjari (southern marsupial mole) because their detections were so low.



Things to think about when surveying for marsupial moles

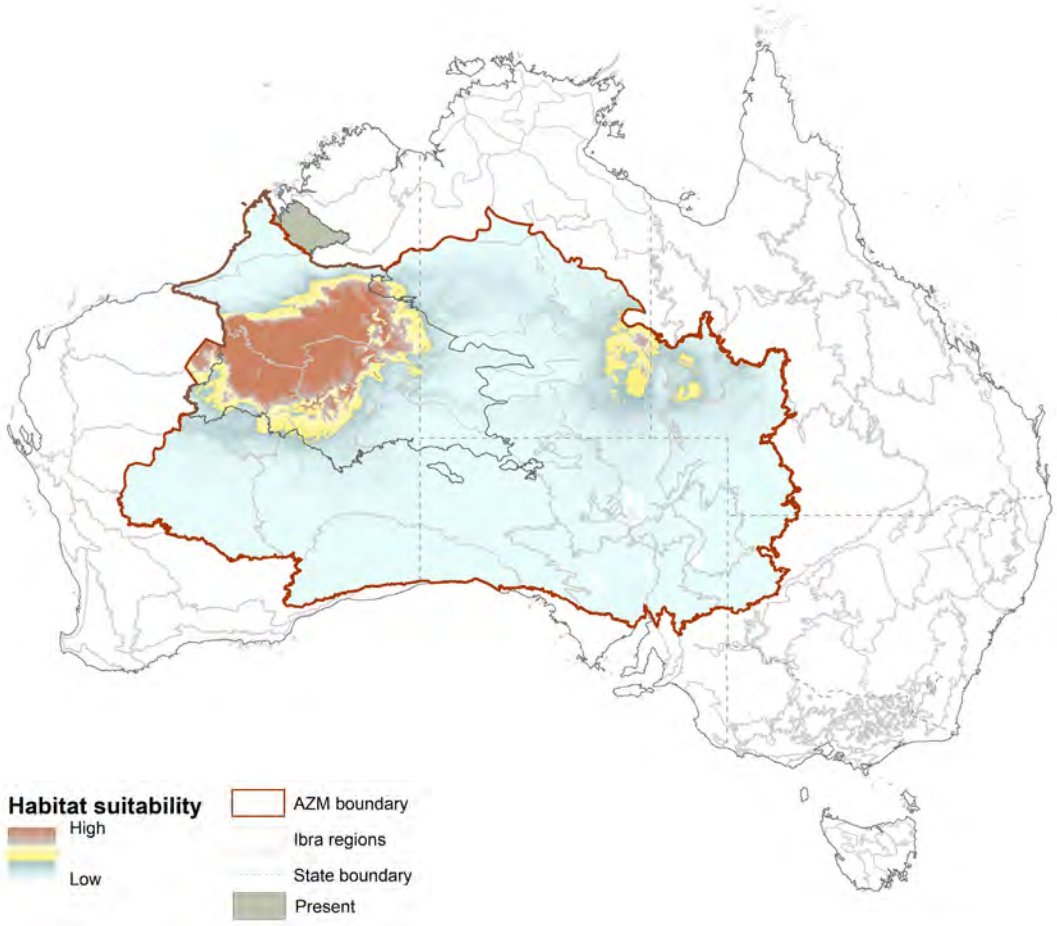
- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to marsupial mole surface tracks apart other animal like small reptiles, before you go to survey.
- Rather than looking for tracks on the surface, a better way to find marsupial moles is to dig trenches that are about 1 m deep, wait a couple of days for the sand to dry out, then check the sides of the trenches for signs of mole tunnels.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (such as right-way fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Northern marsupial mole habitat suitability

The habitat suitability model can tell us about where Karrkaratul (northern marsupial moles) are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggest moles are mostly found in areas with warm average temperatrues (> 23 degrees Celsius) with moderate rainfall. These are the red-brown and yellow coloured areas on the map - these places would be good to check, if surveys are targeting moles.

A habitat suitability map has not been made for Itjaritjari (southern marsupial mole) because their detections were so low.



Further information

Anangu Pitjantjatjara Yankunytjatjara Land Management Itjaritjari factsheet:
https://www.anangu.com.au/en/apy-information/land-management/threatened-species/768-itjaritjarifactsheets/file

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Woinarski J.C.Z., Burbidge A.H., Harrison P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne).

Threatened Species Recovery Hub
National Environmental Science Programme

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Marsupial moles, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Brush-tailed mulgara

Dasycercus blythii

Language names

Jajina, Kakati, Langamarlu, Minyiminyi, Murtja, Nyalurti

National status in the EBPC Act: Not listed

IUCN Red List: Least concern

Brush-tailed mulgara.

Brush tailed mulgara scats.

Fresh tracks from a brush-tailed mulgara (arrow shows which way the mulgara is moving).

Brush tailed mulgara burrow (note scat in front of burrow).

Animal Description

The mulgara is 15-20 cm long. Its fur is sandy-brown on the back and greyish on the underparts. The tail is black and bushy, and is short and pointed at the end. Mulgara are mostly active at night, and they hunt insects and other small animals.

Habitat

Brush-tailed mulgaras are mostly found in areas with mature hummock (spinifex) grasslands. They also use other vegetation types next to hummock grasslands, or paleo-drainage systems or drainage lines in sandplain or sand dune habitats.

Threats

- Predation by cats and foxes
- Habitat change from too much grazing by feral herbivores (cattle, rabbits and mice)
- Wrong-way fire
- Climate change (changing rainfall, temperature, droughts)

Brush-tailed mulgara scat

Brush-tailed mulgara scats are 20–30 mm long and 5mm wide. They are sometimes curved and can be different shapes and sizes. Their scats usually contain insect, fur and lizard parts.

Brush-tailed mulgara tracks

Mulgara move by bringing the back feet forward together in front of the front feet. Back feet imprints are rectangular, and sometimes clear toe marks can be seen.

Brush-tailed mulgara diggings and burrows

During the day mulgara rest in burrows at the base of grass clumps or bushes. Burrows can have many tunnels, and usually have scats at the entrance. Burrows have a rounded base and are the same size as some reptile burrows (such as small goannas).

Animals that might be confused with the brush-tailed mulgara during survey

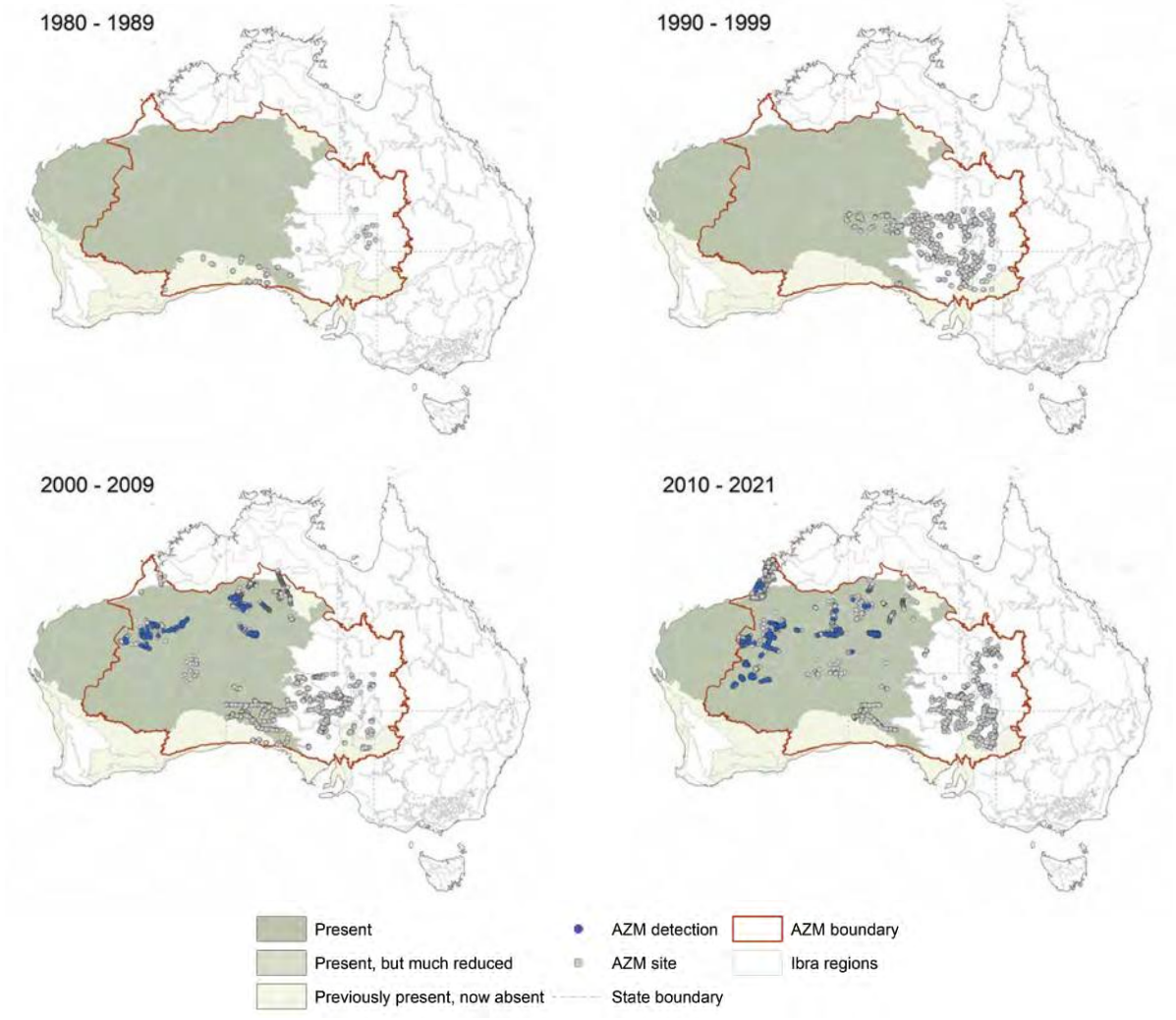
- Bilby
- Rabbit

Unlike brush-tailed mulgara, rabbits do not leave a distinct outline of their foot pads, because rabbits have fluffy feet. Mulgara tracks are smaller than both rabbit and bilby tracks and their back and front feet are the same size. It is very difficult to tell the difference between crest-tailed mulgara and brush-tailed mulgara tracks. Their distributions overlapped in the past, but the two species of mulgara now live in different regions: brush-tailed mulgara are found in the northwestern deserts, and crest-tailed mulgara are found in the border area of South Australia, Queensland and NSW. They also prefer different habitats: crest-tailed mulgaras like cane grass dunes whilst the brush-tailed mulgara prefers spinifex country.

Arid Zone Monitoring project findings

Brush-tailed mulgara distribution

The maps below summarise the detections of brush-tailed mulgara over time in the AZM dataset. They show that brush-tailed mulgaras have been recorded in northern and western deserts. Each blue dot shows a survey site where brush-tailed mulgaras were recorded in that decade. The grey dots show all the other sites that were surveyed, but where brush-tailed mulgaras were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. Mulgaras are also found outside the AZM project area, in Western Australia (dark shading on map). We can't tell exactly where their distribution ends in the east, as there has long been confusion between this species and its close relative species, the crest-tailed mulgara. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1].



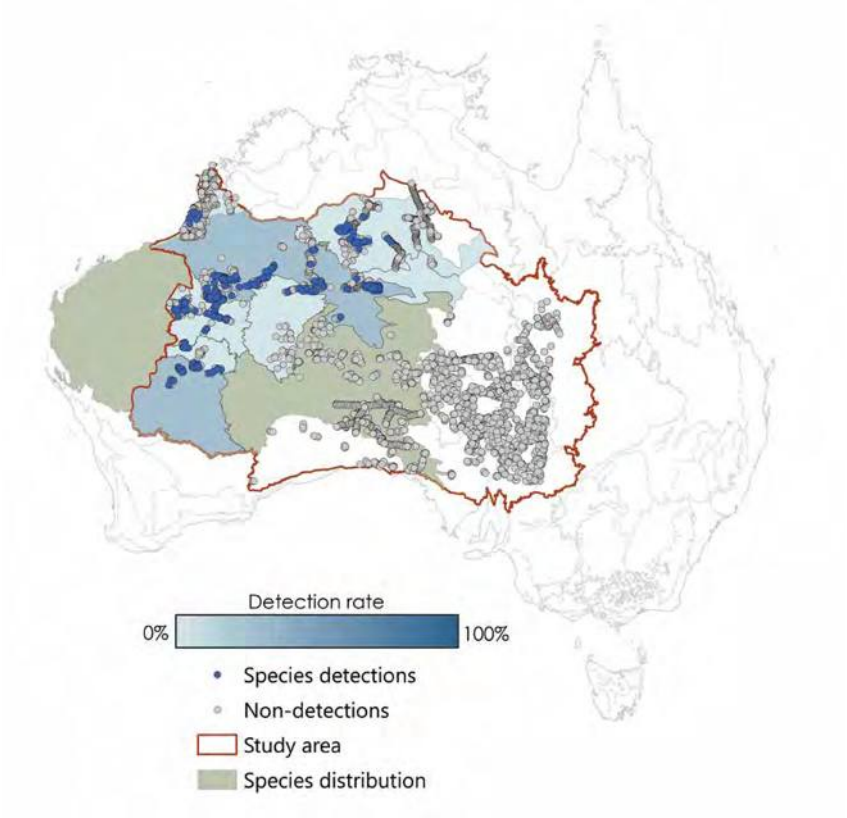
The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

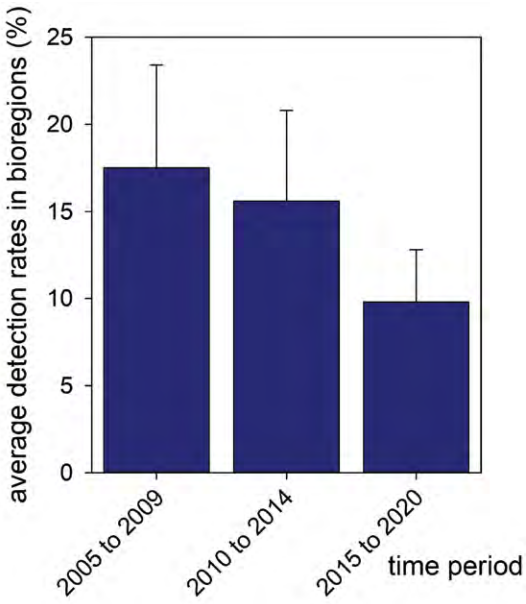
It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Brush-tailed mulgara detection rates

Brush-tailed mulgaras were detected over 4% of all surveys in the AZM dataset. It was the eighteenth most commonly recorded species, and the eighth most commonly recorded native mammal.

The map below shows the average brush-tailed mulgara detection rate across all surveys carried out in each bioregion. Detection rates have been similar across the northern and western bioregions. The graph shows the detection rates for brush-tailed mulgara, averaged across the bioregions where they have been detected, since 2005. Brush-tailed mulgara were detected at 10 – 20% of all surveys carried out in the northern and western bioregions. They often live in small populations scattered around their distribution, so sometimes surveys may miss them. This means that if you want to track changes in the mulgara population, it is good to sample many sites over time. The graph also suggests that detection rates may be decreasing. A more detailed analysis of mulgara detections at a subset of AZM sites that were revisited over five or more years, shows that brush-tailed mulgaras are usually detected less soon after fire, and detected more as the amount of green vegetation increases.





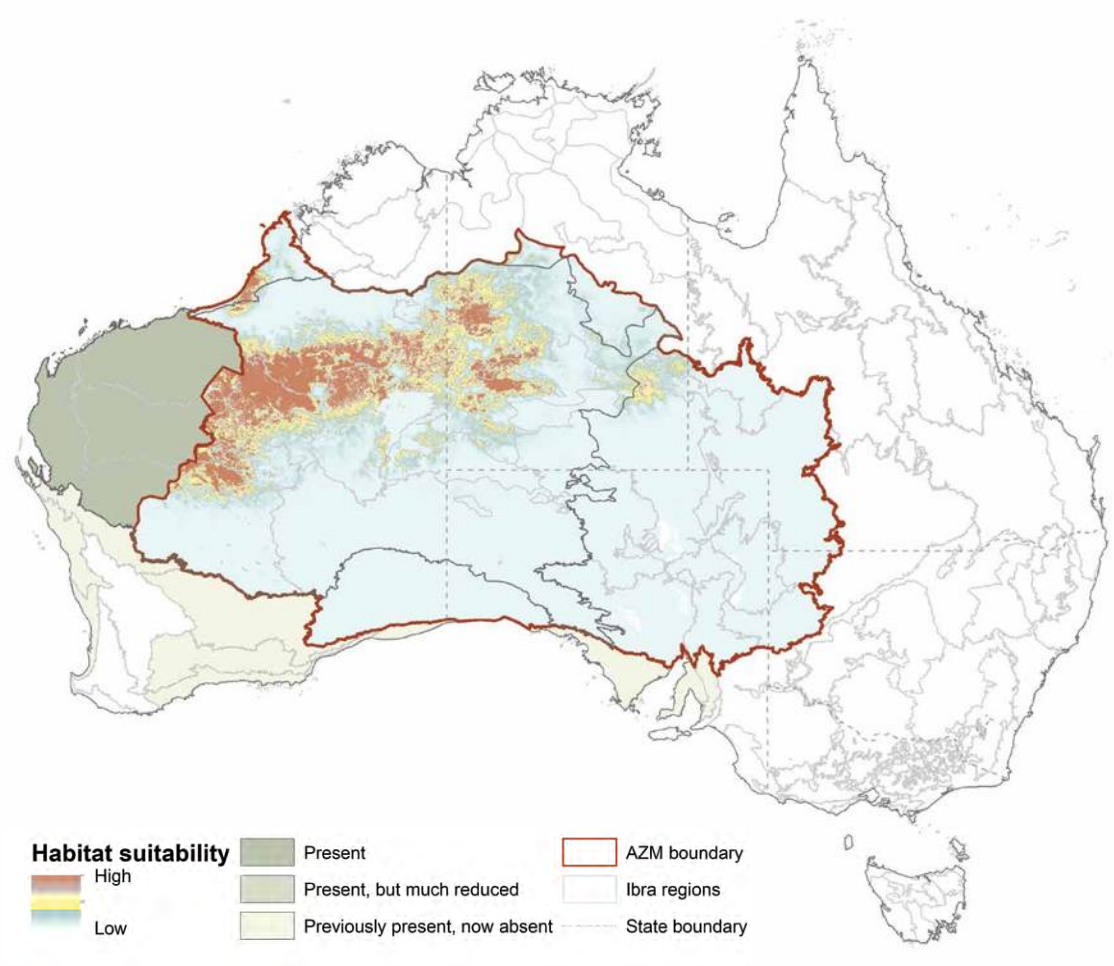
Things to think about when surveying for brush-tailed mulgara

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell tracks apart from other species such as rabbits and bilbies before you go to survey.
- Brush-tailed mulgara sign is more likely in country that they like – spinifex grasslands, near paleo-drainage lines (underground water). It is still important to survey in other areas. You might learn more about the types of habitat that mulgara prefer, or that mulgara are rarer when there are plenty of cats, or wrong way-fires.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Brush-tailed mulgara habitat suitability

The habitat suitability model can tell us about where brush-tailed mulgaras are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that mulgaras prefer places with high average temperatures (24-27 degrees Celsius) that are 300 m above sea level. The map only shows habitat suitability inside the AZM project boundary, but brush-tailed mulgaras are also found further west, in the darker shaded part of the map, and might be common there too. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert; getting more survey data from these areas would improve the model.



Further information

Arid Zone Monitoring project:
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References

[1] Woinarski, J.C.Z & Burbidge, A.A. & Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne.)

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Brush-tailed mulgara, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Crest-tailed mulgara

Dasycercus cristicauda

Language names

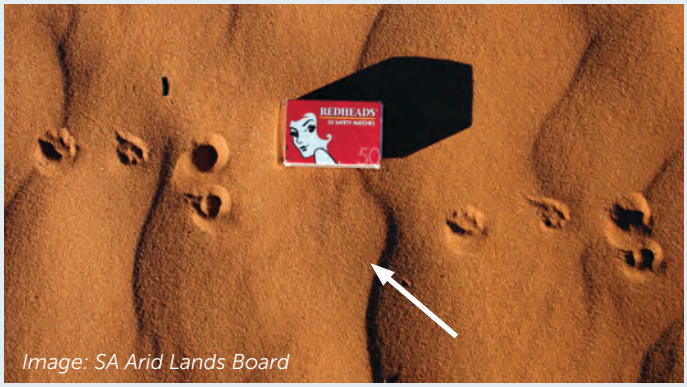
Amperte, Ampurta, Papanytji, Talimarlu

National status in the EPBC Act: Vulnerable

IUCN Red List: Least concern

Crest-tailed mulgara.

Brush-tailed mulgara scat (crest-tailed mulgaras have similar scats).



Crest-tailed mulgara tracks (arrow shows which way the mulgara is moving).

Brush-tailed mulgara burrow, with scat at entrance (crest-tailed mulgaras have similar burrows).

Animal Description

The crest-tailed mulgara has sandy coloured fur on the upper body turning into a light grey on the under parts. They have small ears, a short nose and short fat tails. Crest-tailed mulgaras have a 'mohawk' of long black hairs on the end of their tails. Adult males weigh over 100 g and females weigh 65 g to 120 g.

Key threats

- Predation by cats and foxes
- Habitat change from too much grazing by feral herbivores (livestock, camels, rabbits, mice)
- Wrong-way fire (too often, too intense, too big)

Habitat

Crest-tailed mulgaras live on sand dunes with not much vegetation, and also in sparse grasslands and herblands, centred on and around the Simpson Desert.

Crest-tailed mulgara scat

Crest-tailed mulgara scats are 20-30 mm long and 5 mm wide. They are sometimes curved and can be different shapes and sizes. Their scats usually contain insect, fur and lizard parts.

Mulgara tracks

Mulgara move by bringing the back feet forward together in front of the front feet. The prints of the back feet are rectangular, and sometimes you can see a ridge between the toes and feet.

Crest-tailed mulgara diggings and burrows

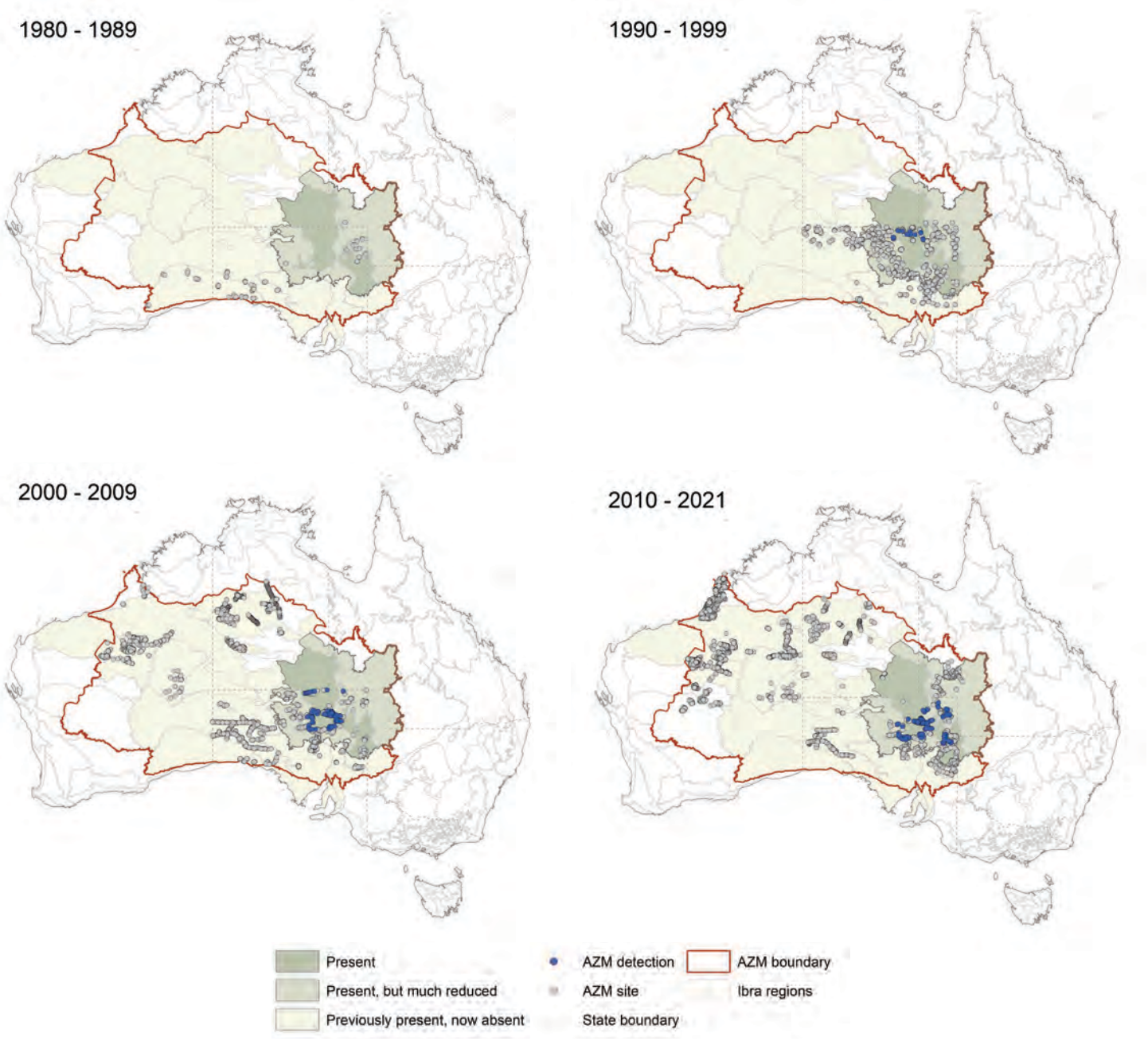
During the day mulgara rest in burrows at the base of grass clumps or bushes. Burrows can have many tunnels, and usually have scats at the entrance. Burrows have a rounded base and are the same size as some reptile burrows (such as small goannas).

Arid Zone Monitoring project findings

Crest-tailed mulgara distribution

The maps summarise the detections of crest-tailed mulgara over time in the AZM dataset. They show that crest-tailed mulgaras are found in north-eastern deserts of South Australia. Each blue dot shows a survey site where crest-tailed mulgara were recorded in that decade. The grey dots show all the other sites that were surveyed, but where crest-tailed mulgara were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1].

It is difficult to tell exactly where the crest-tailed mulgara distribution ends in the west, as there has long been confusion between this species and its close relative species, the brush-tailed mulgara. The distributions of the crest-tailed mulgara and the brush-tailed mulgara overlapped in the past, but it seems that the two species of mulgara now live in different regions: brush-tailed mulgara in the northwestern deserts, and crest-tailed mulgara in the border area of South Australia, Queensland and NSW. They also prefer different habitats: crest-tailed mulgaras like cane grass dunes whilst the brush-tailed mulgara prefers spinifex country.



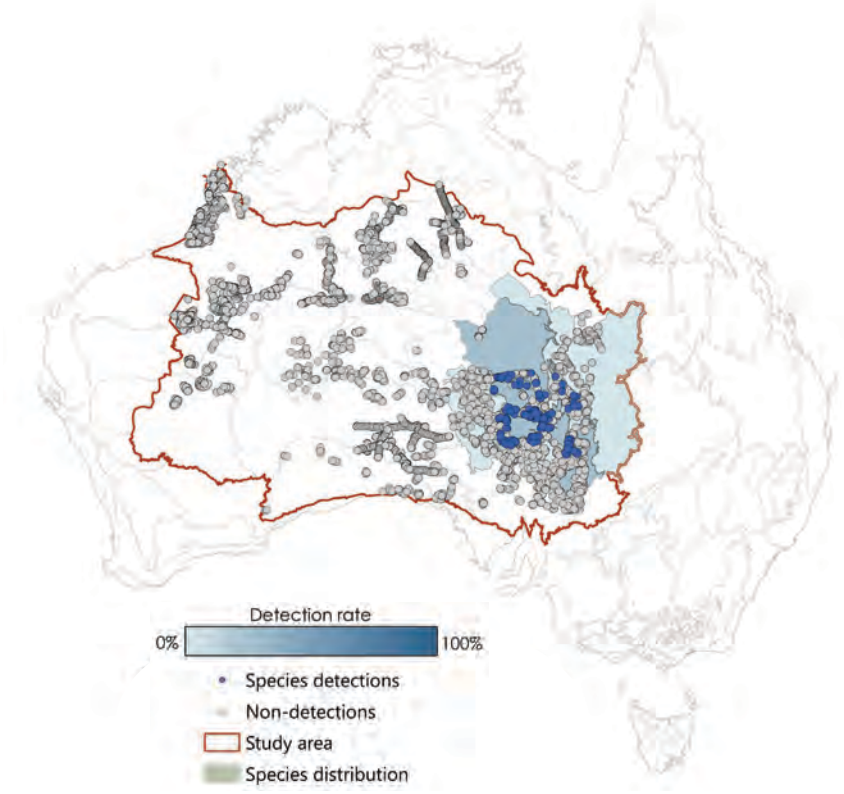
The maps above are based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Crest-tailed mulgara detection rates

Crest-tailed mulgaras were detected at almost 3% of all surveys in the AZM dataset. It was the 13th most commonly recorded mammal species, and the 8th most commonly recorded native mammal species.

The map shows the average crest-tailed mulgara detection rate across all surveys carried out in each bioregion. Detection rates have been highest in the bioregion at the centre of this species' distribution. Crest-tailed mulgara populations are known to fluctuate in response to seasons and environmental conditions. They often live in small populations scattered around their distribution, so sometimes surveys may miss them. This means that if you want to track changes in the mulgara population, it is good to sample many sites over time.



Animals that might be confused with the crest-tailed mulgara during survey

- Bilby
- Rabbit

Mulgara tracks look similar to very young rabbit tracks, but unlike crest-tailed mulgara, rabbits do not leave a distinct outline of their foot pads, because rabbits have fluffy feet. Mulgara toe and footprints are more distinct, and their hind feet tracks are more rectangular. Mulgara tracks are smaller than adult rabbit and bilby tracks.

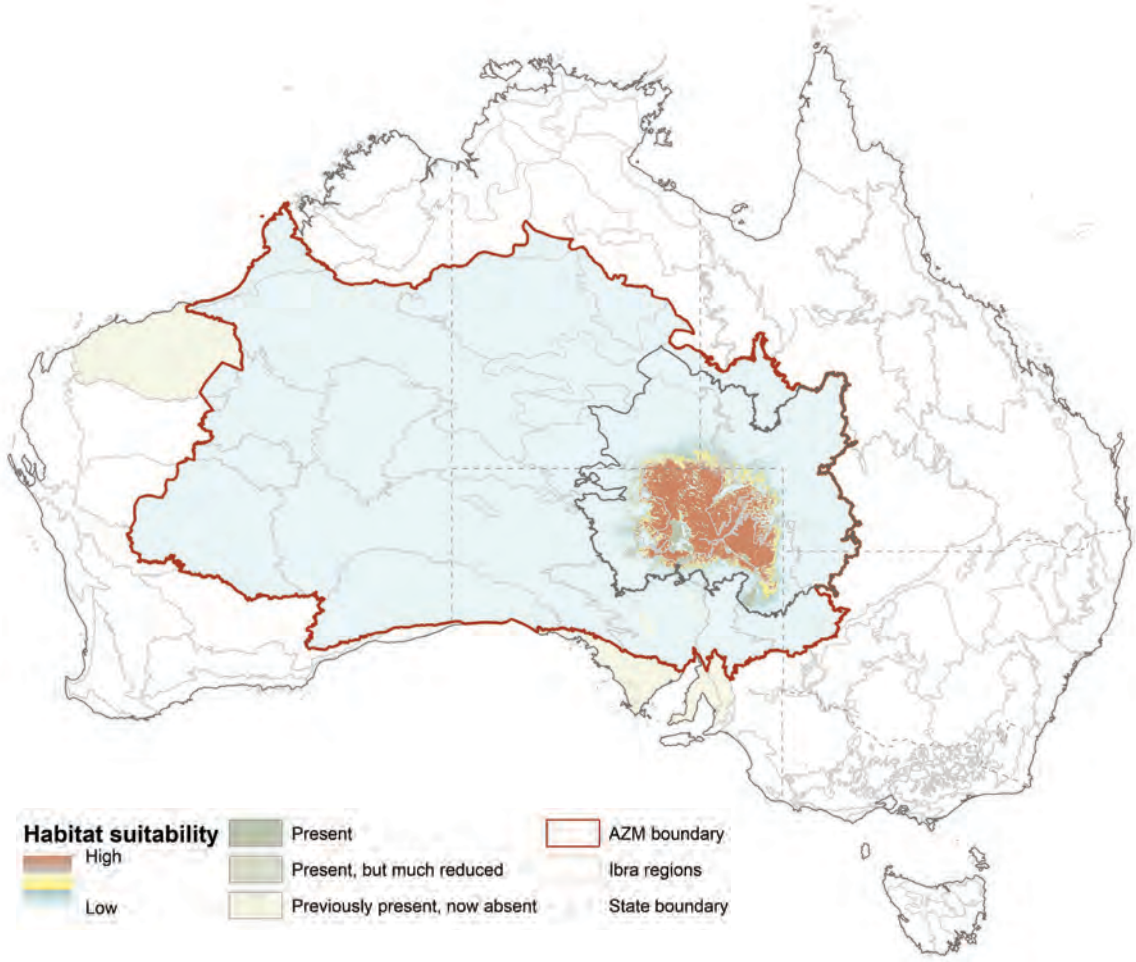
Things to think about when surveying for crest-tailed mulgara

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year- for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Crest-tailed mulgara sign is more likely in country that they like: dune areas in desert country with cane grass. It is still important to survey in other areas. You might learn more about the types of habitat that mulgara prefer, or that mulgara are rarer when there are plenty of cats, or wrong way-fires.
- Follow advice of experienced trackers - know how to tell crest-tailed mulgara tracks apart from rabbits and others species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire), you need to sample before and after the action. You might need help from a scientist to make the sampling design strong.

Crest-tailed mulgara habitat suitability

The habitat suitability model can tell us about where the crest-tailed mulgara is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that crest-tailed mulgaras prefer areas of low elevation (under 200 m) with moderate average temperature (less than 24 degrees Celsius). These are the red-brown shaded areas of the map, in north-eastern South Australia.



Further information

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Crest-tailed mulgara, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Short-beaked echidna

Tachyglossus aculeatus

Language names

Enewaylenge, Inape, Inarlenge, Kurrujartiny, Minaji, Mingwuwa, Nginu, Nyinawurtu, Tjilkamata, Tjirilya, Wajjingkarr, Yinalingi, Yinarlingi

National status: Not listed

IUCN Red List: Least concern

Short-beaked echidna.

Animal Description

Echidnas have long protective spines on their back. There is light-brown and black fur between the spines. These animals have a long, tubular and furless snout. They have a very small mouth which opens wide enough for a sticky worm-like tongue to flick out of.

Key threats

Echidnas have become rarer in some places, mostly due to habitat loss and change beause of too much grazing by feral animals, and changes to fire regimes.

Habitat

Echidnas live in many different habitats. They shelter in hollow logs, stumps, tree roots, caves or burrows (old burrows dug by another animal, or burrows they dig themselves), and under bushes.

Echidna scat

Echidna scats are long and cylindrical, often broken into pieces and have fragments of insects such as ants, termites, beetles, worms and soil. Echidnas often leave their scats on rockpiles or in feeding areas. When fresh, they can look shiny because they are covered in a layer of mucous.

Echidna scat showing ants and termites.

Echidna tracks

Echidna tracks show the front feet turning inwards. The long claws of their back toes often leave a drag mark between prints.

Echidna tracks (arrow shows which way it is going).

Echidna feet.

Close up of echidna tracks (arrow shows which way it is going).

Echidna diggings/feeding signs

Echidnas dig into ant and termite nests to reach their food, leaving conical holes (up to 20cm deep) or deep tunnels in termite mounds and ant nests.

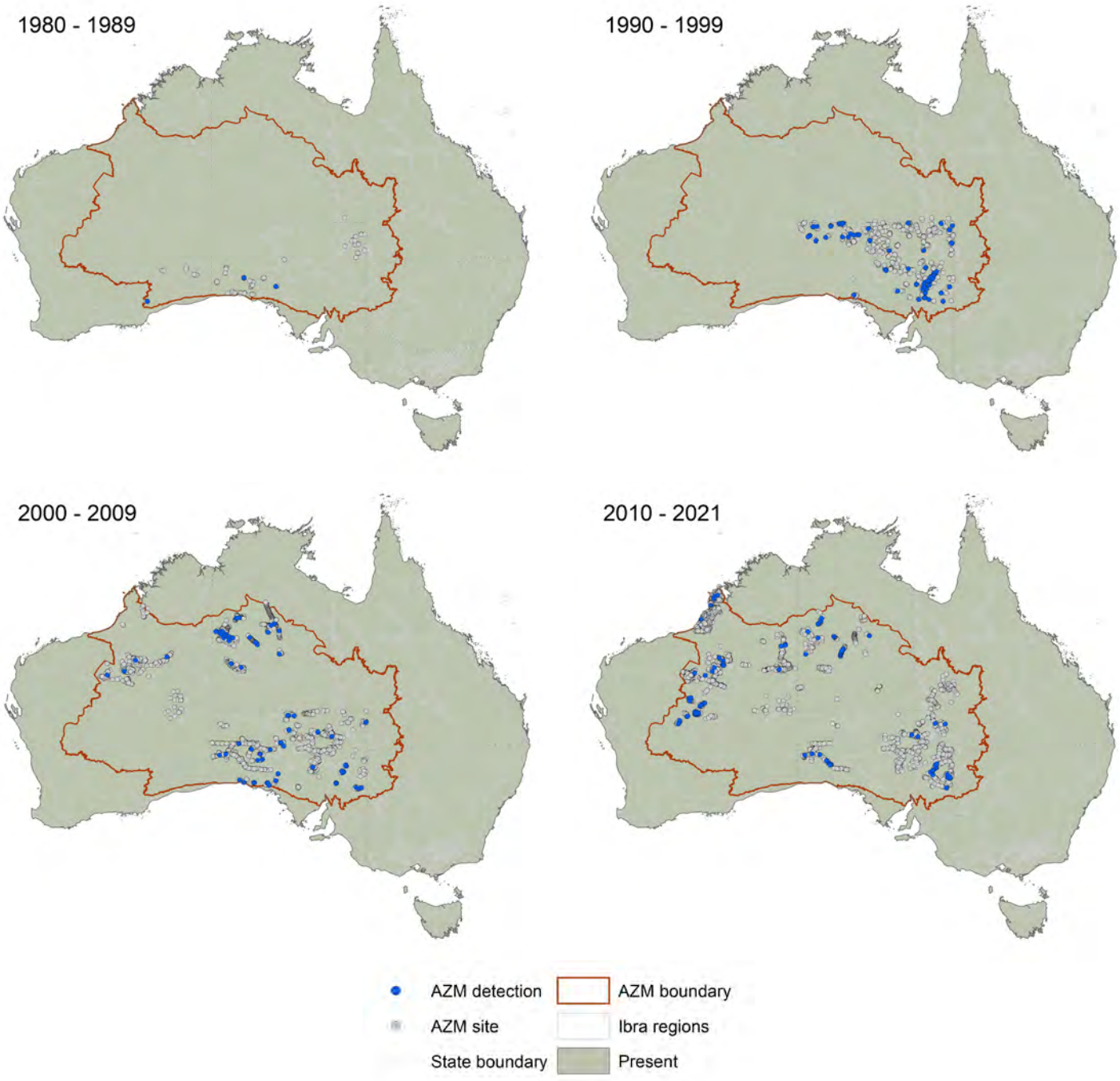
Echidnas also dig into rotting wood, leaf litter and areas of soft soil, leaving small scratches on the ground where soil and litter has been turned over by the echidna's snout in a corkscrew action.

Echidna diggings.

Arid Zone Monitoring project findings

Echidna distribution

The maps summarise the detections of echidnas over time in the AZM dataset. They show that echidnas have been recorded throughout the AZM project area. Each blue dot shows a survey site where echidnas were recorded in that decade. The grey dots show all the other sites that were surveyed, but where echidnas were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. Echidnas are also found outside the AZM project area, in all parts of Australia and Tasmania (dark shading on map). The information about the overall distribution in the map background is drawn from the Australian Faunal Directory[1].



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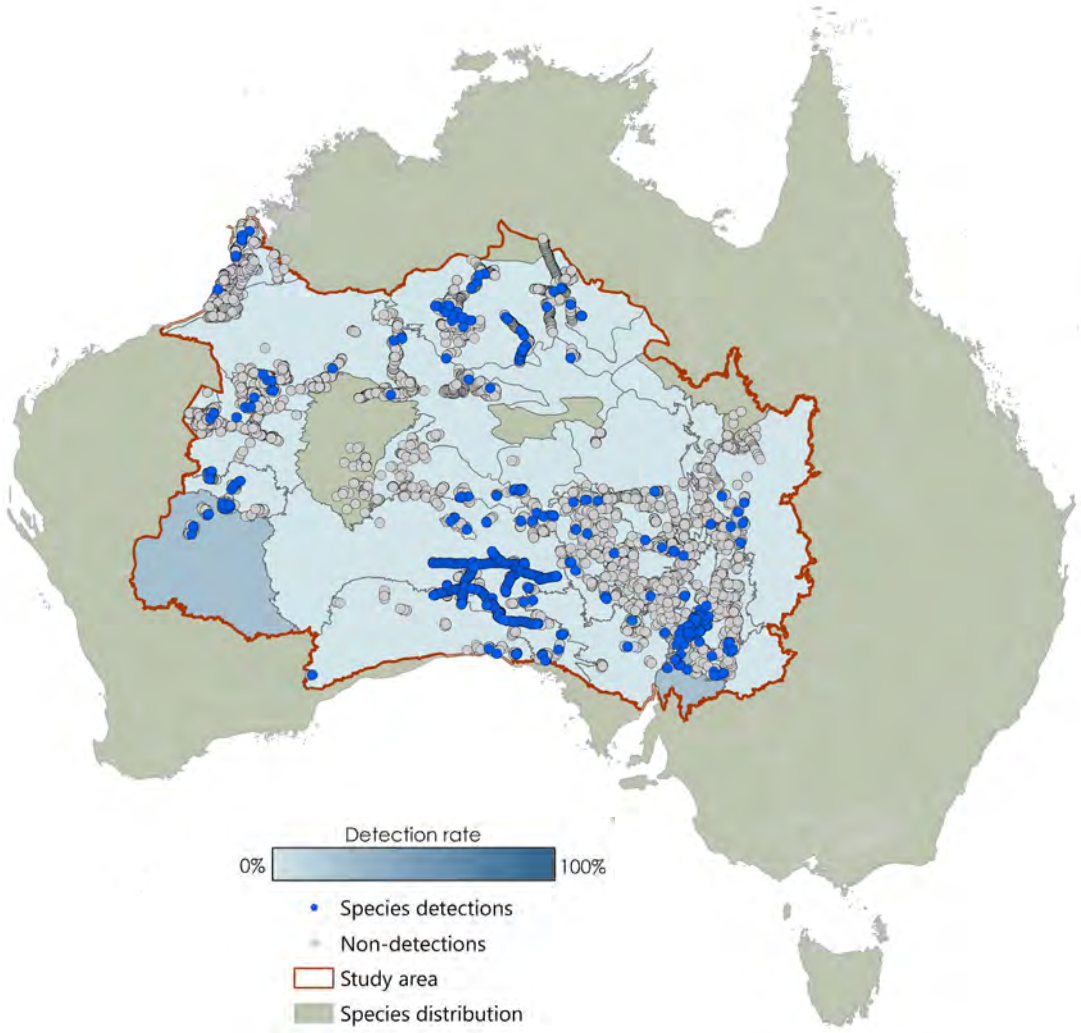
It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Echidna detection rates

Echidnas were detected at over 2% of all surveys in the AZM database. It was the 14th most commonly recorded mammal species, and the 9th most commonly recorded native mammal species.

The map below shows the echidna detection rate across all surveys carried out in each bioregion, since the 1980s. Detection rates for echidnas have been fairly even across the deserts.



Things to think about when surveying for echidnas

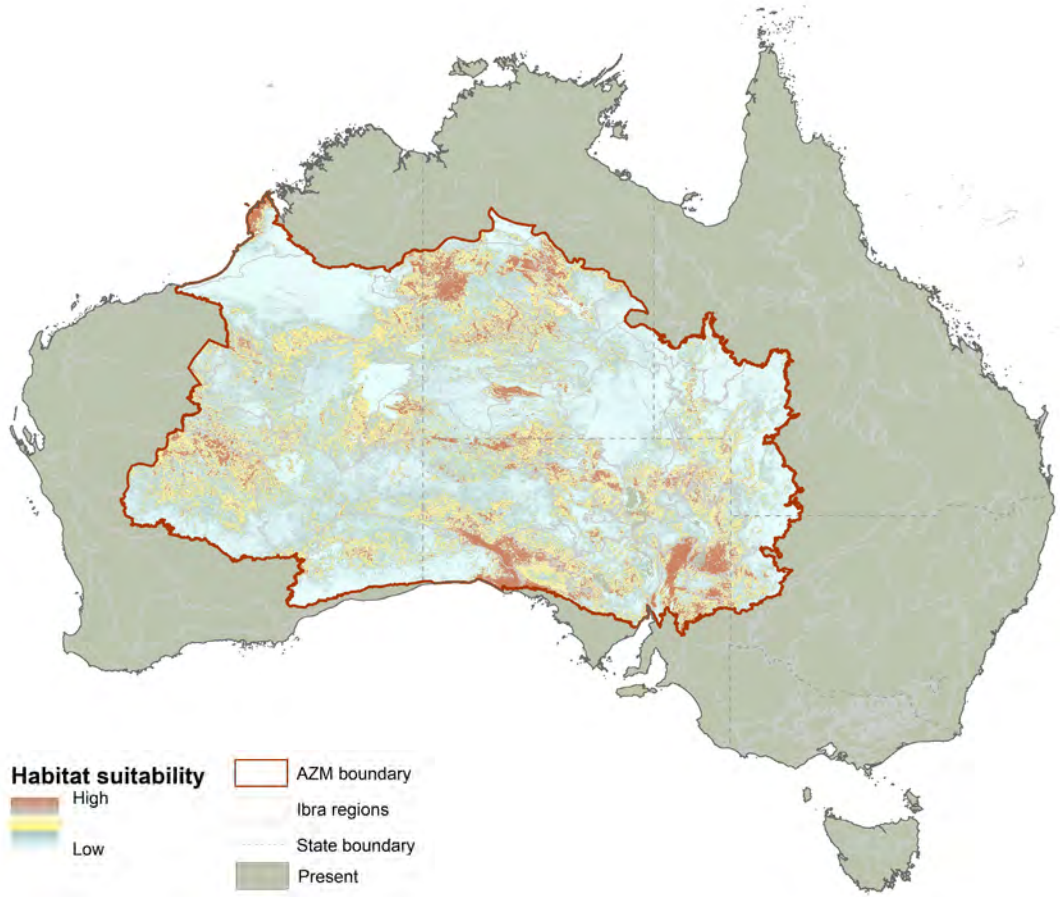
- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell echidna tracks apart from other species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Echidna habitat suitability

The habitat suitability model can tell us about where echidnas are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that echidnas are found throughout the AZM project area, across a range of climate, landforms, soil types and fire frequencies. The map shows that the best places for echidna – shaded as red-brown – are found right across the deserts.

The map only shows habitat suitability inside the AZM project boundary, but echidnas are also found outside the AZM project area, and there could be very suitable habitat here too. The habitat suitability model does not predict well in large areas where there hasn't been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

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References

[1] 1. Australian Faunal Directory. https://biodiversity.org.au/afd/home. Accessed June, 2021.

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Short-beaked echidna, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Minkajurru (Golden bandicoot)

Isodoon auratus

Language names

Natari, Makurra, Minganypa, Mingatjurra, Nyurlu, Wintarru

National status: Vulnerable

IUCN Red List: Vulnerable

Golden bandicoots disappeared from the deserts by about 70 years ago. They have recently been reintroduced at Matuwa by the Wiluna Martu Rangers and the WA government. This profile therefore uses the Martu name Minkajurru.

Animal description

The Minkajurru is the smallest of all the bandicoots. It has golden-brown fur that is covered with stiff long black guard hairs, small black eyes, short rounded ears and long claws.

Key threats

- Being killed by cats and foxes
- Habitat change from too much grazing by feral herbivores (livestock, camels, rabbits and mice)
- Wrong-way fire (too often, too intense, too big)

Habitat

Minkajurrus live in spinifex and tussock grasslands and sparse woodlands.

Minkajurru tracks

Minkajurrus have five toes in their front feet, but their tracks show only three toes. They also have five toes on their hind feet, but only three leave a mark.

Minkajurru diggings and burrows

Minkajurrus shelter in a grassy nest under tussocks or spinifex hummocks. When feeding at night they move between clumps of grasses and makes small cone shaped diggings looking for insects, small animals, roots and tubers.

Minkajurru.

Minkajurru twins.

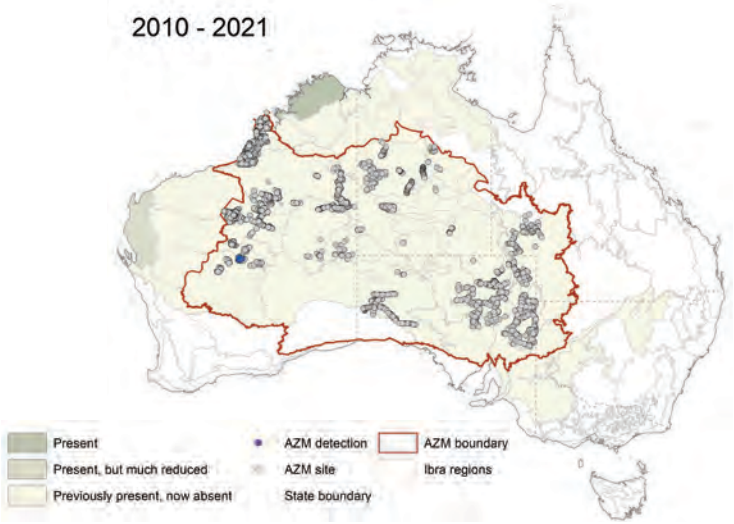
Minkajurru tracks (arrow shows which way it is going).

Arid Zone Monitoring project findings

Minkajurru distribution

Minkajurrus used to be found right across the deserts and northwestern Australia. They disappeared from the desert areas by the middle of the 20th century, hanging on only in the north Kimberley and also on some islands off the west and north coasts. In 2010, the Minkajurru was reintroduced in the Matuwa Kurrara Kurarra IPA, by the West Australian government and the Wiluna Martu rangers.

The map summarises the detections of Minkajurrus the AZM dataset, with blue dots. There is only a single place with records of the Minkajurru on the map – this is where the Minkajurru has been reintroduced. The grey dots show all the other sites that were surveyed, but where Minkajurrus were not recorded. Minkajurrus are also found in the north Kimberley, and on islands (Augustus, Barrow, Middle in WA; and Marchinbar Island in the NT). These records were made by Indigenous Ranger groups and government agencies. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1].



The map above shows data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Things to think about when surveying for minkajurrus

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year, for example before the wet or hot season (October) and in the early dry season or cool time (April).
- Follow advice of experienced trackers - know how to tell Minkajurru tracks apart from other species before you go to survey.
- If you want to to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Further information

Arid Zone Monitoring project:

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Woinarski, J.C.Z & Burbidge, A.A. & Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne.)

Threatened Species Recovery Hub

National Environmental Science Programme

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Minkajurru (golden bandicoot), Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Greater bilby

Macrotis lagotis

Language names

Artnangke, Aherte, Angkaye, Mangkapan, Maruru, Mankarr, Mirtuluju, Nini, Ninu, Tjalku, Walpajirri, Warrikirti

National status: Vulnerable

IUCN Red List: Vulnerable

Greater bilby

Animal Description

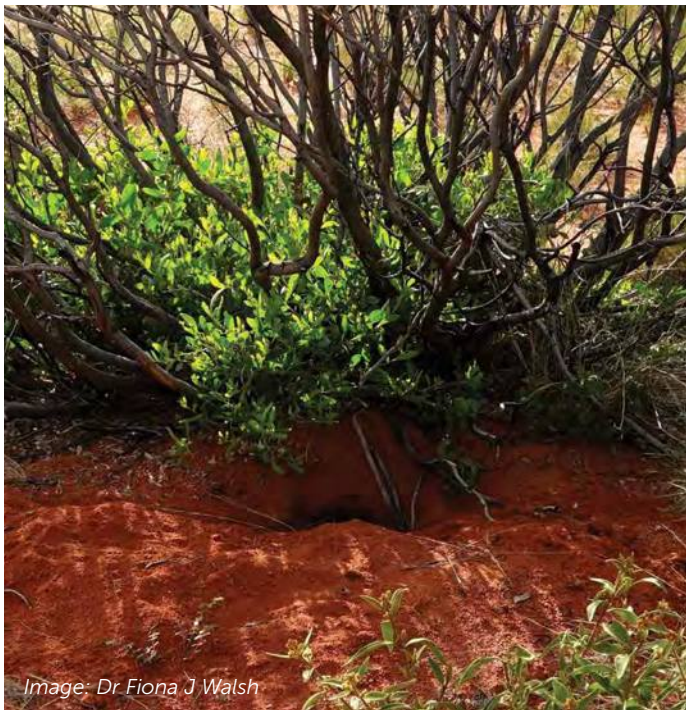
Bilbies are medium-sized desert mammals, related to bandicoots. Males are bigger than females. They are mostly active at night and spend the day in burrows.

Key threats

- Predation by cats and foxes
- Habitat change from too much grazing by feral herbivores (livestock, camels, rabbits and mice)
- Wrong-way fire (too often, too intense, too big)
- Climate change (changing rainfall, temperature, droughts)

Bilby signs (diggings and burrows)

Bilbies often dig their burrows under logs, trees, grass, or termite mounds. Look for tracks around the entrance. Diggings can be of different shapes and sizes but are usually conical, and less than 50cm deep.

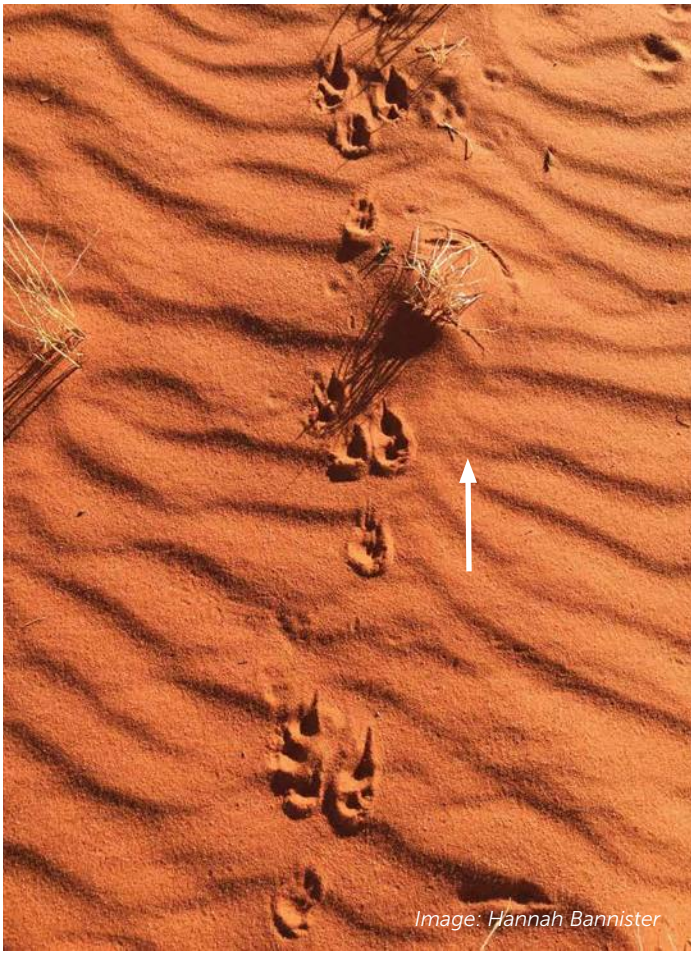


Bilby burrow entrance.

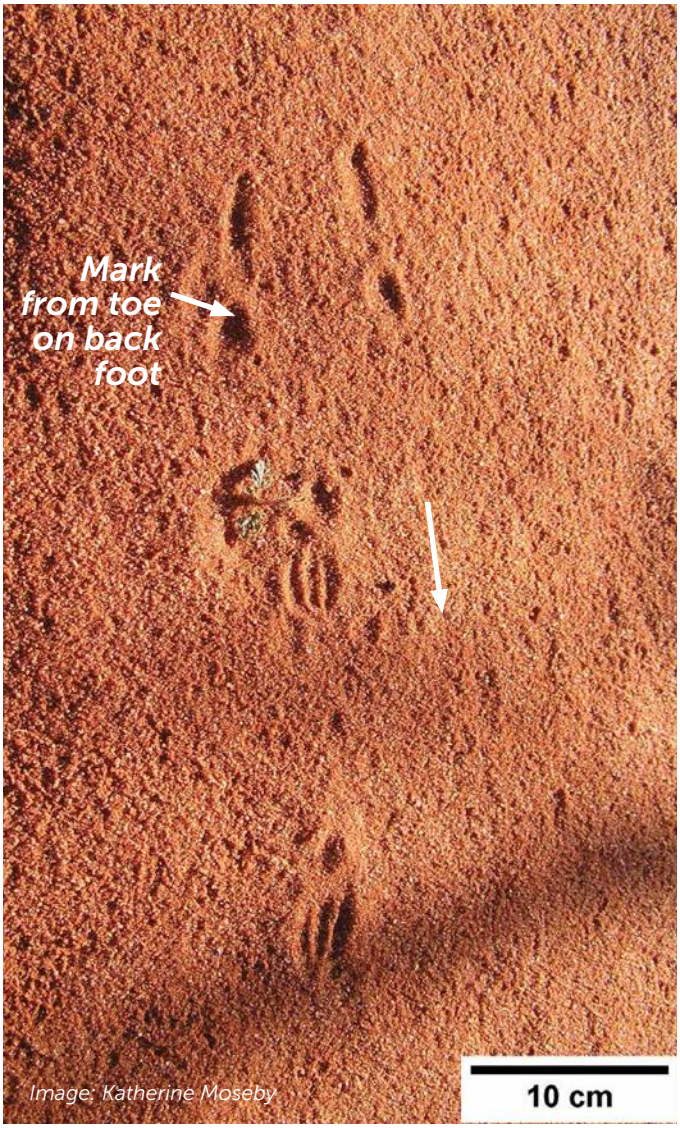
Bilby burrow. Note the tracks around the entrance.

Bilby tracks

The tracks from the back feet are narrower and longer than the tracks from the front feet. The track from the back legs is made mostly by the fourth toe.



Bilby tracks. The back legs land in front of the front legs (arrows show which way the bilby is going).



Bilby tracks (arrow shows which way the bilby is going).

Bilby scats are longer than wide. They are often found where bilbies are eating, not around burrows. They have bits of insects and sand in them.

Bilby diggings and scats.

Animals that might be confused with the bilby during a survey

- Mulgara
- Rabbit

Rabbits have the same step as bilbies, but rabbits do not leave a distinct outline of their foot pads because they have fluffy feet. Rabbits also have different shaped hind feet, and their tracks are more rounded. Mulgara tracks are smaller than bilby tracks, and their back and front feet are the same size.

Habitat

Bilbies live in sandplains and areas of laterite with spinifex (*Triodia* spp.) grass, and they like a mixture of long unburnt spinifex and freshly burnt areas. Bilbies eat a range of seeds, small invertebrates, fruits and grasses, and managing fire well can make bilby foods more common. Bilbies need the right type of ground to make burrows. Where the soil is too soft, you will not find bilbies because their burrows would collapse. Likewise, bilbies cannot live where the ground is too hard to dig. Even if the country provides the right soil, food, and cover, bilbies may not be able to live there if there are too many cats or foxes.

Fire management can make bilby foods more common. Favourite bilby foods include grubs, termites, some fruits, and grass seeds.

Insect larvae, e.g. witchetty grubs (Endoxyla leucomochla).

*Wild bush tomato (*Solanum centrale).

Termite mound.

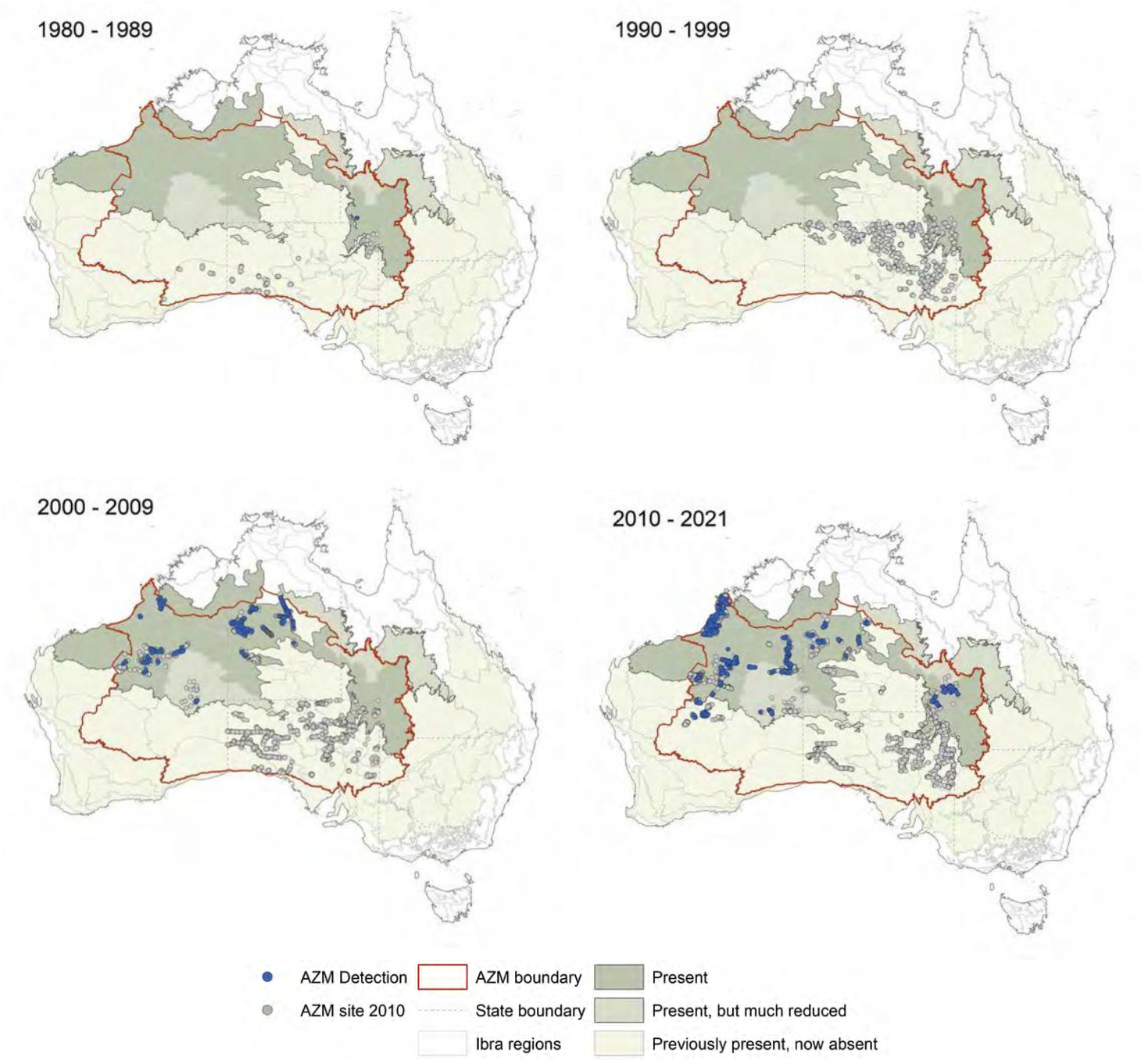
*Bush onion (*Cyperus bulbosus).

Arid Zone Monitoring project findings

Bilby distribution

Bilbies used to occur across most of the desert country (the shaded bioregions on the map). Since European colonisation, they have disappeared from over three-quarters of their range (the cream-coloured bioregions) and are only found in northern parts of their original distribution (darker shaded bioregions). The information about the overall distribution in the map background is drawn from the Mammal Action Plan[1].

The maps show the bilby detections in the AZM dataset over time. Each blue dot shows a survey site where bilbies were recorded in that decade. The grey dots show all the other sites that were surveyed, but where bilbies were not recorded in that decade. These maps show that bilbies are mostly recorded in north-western parts of the deserts, apart from a smaller population in south-west Queensland. We can also see that track-based monitoring is detecting bilbies in areas where they became locally extinct, but have since been reintroduced, in western WA. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers.



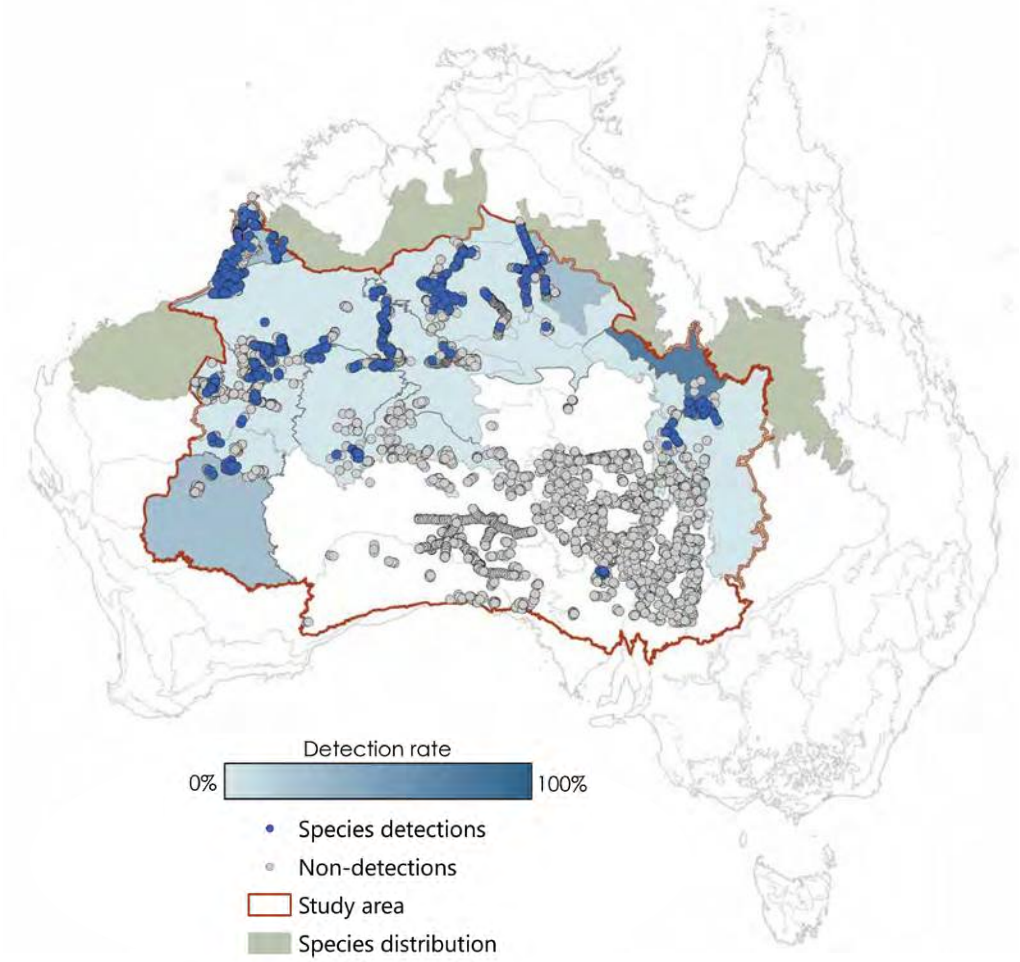
The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Bilby detection rates

Bilbies were detected at over 6% of all surveys in the AZM database. It was the sixteenth most commonly recorded species, and the sixth most commonly recorded native mammal. This is a relatively high detection rate, and reflects that many surveys are carried out to find out where bilbies are living.

The map below shows the average bilby detection rate across all surveys carried out in each bioregion, since the 1980s. The map shows that detection rates for bilbies have been highest in southeast Queensland (darkest blue shading). This is because most of the surveys there were targeting bilbies over other species, and sites where bilbies were present were revisited in later years.



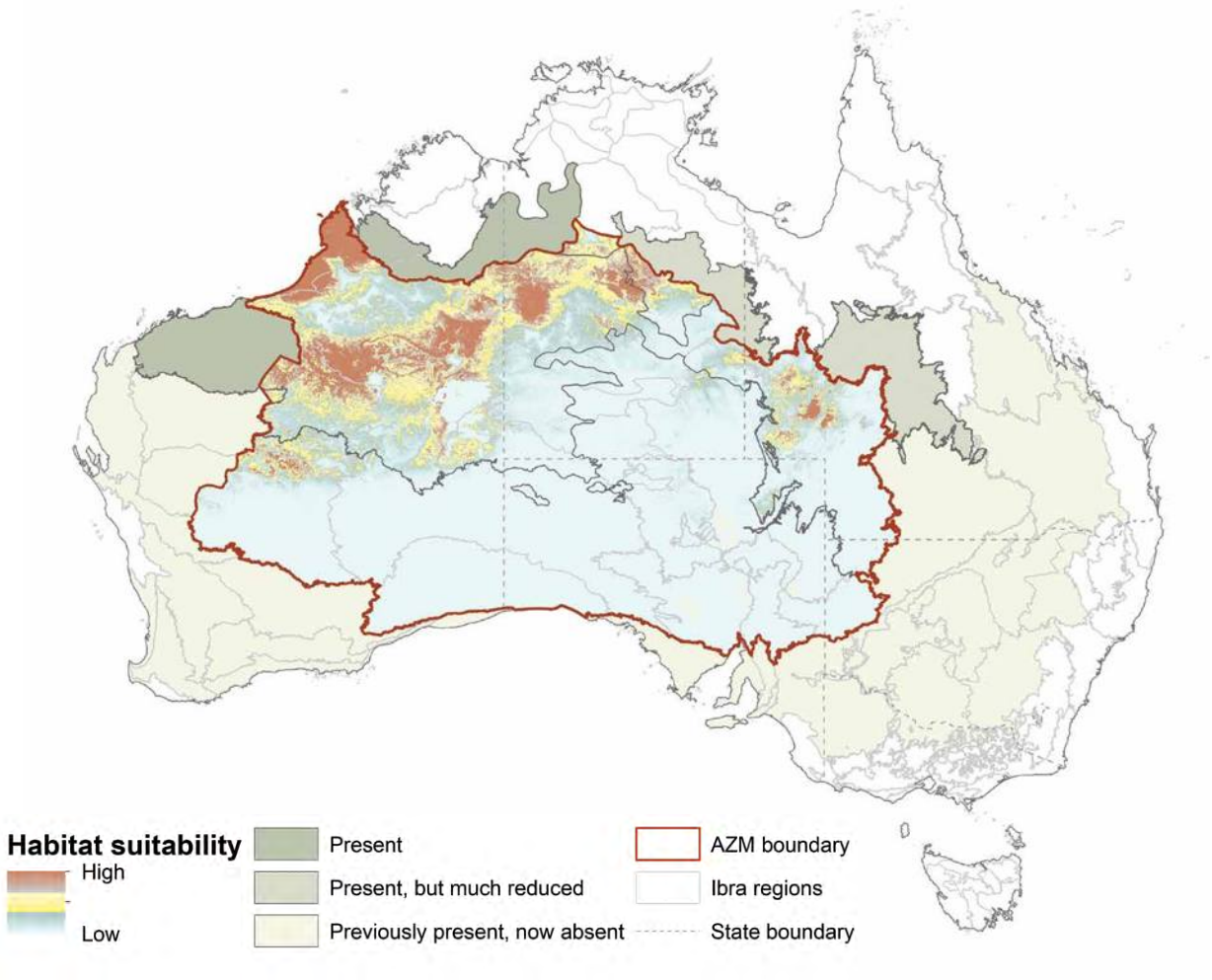
Things to think about when surveying for bilbies

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell bilby tracks apart from other species such as rabbits and mulgara before you go to survey.
- Bilby signs are more likely in country that they like – for example where there are bilby foods, where the soil is good for digging and the spinifex is long unburnt. Some country might have the right conditions, such as fire, foods and rain, but bilbies may not be there. It is still important to survey these places. You might learn that there are too many cats or foxes there, or wrong way fires.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Bilby habitat suitability

The habitat suitability model can tell us about where bilbies are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model showed that bilbies are now mostly found in warm areas where average temperatures are usually above 24 degrees. The best country for bilbies is the brown and yellow coloured areas on the map - these places would be good to check, if surveys are targeting the bilby. The map only shows habitat suitability inside the AZM project boundary, but bilbies are also found further north and west, in the darker shaded part of the map, and might be common in these places too. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert; getting more survey data from these areas would improve the model.



Further information

Arid Zone Monitoring project

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Woinarski, J.C.Z & Burbidge, A.A. & Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012. (CSIRO Publishing: Melbourne.)

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Greater bilby, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Southern hairy-nosed wombat

Lasiorhinus latifrons

National status: Not listed

IUCN Red List: Near Threatened

Southern hairy-nosed wombat.

Key threats

- Disease (outbreaks of mange)
- Competition with introduced herbivores
- Habitat change from too much grazing by feral herbivores (livestock, rabbits)
- Climate change (changing rainfall, temperature, droughts)
- Vehicle strike

Animal Description

Southern hairy-nosed wombats are stocky and robust. They have stout, flattened claws for digging. Their short tail is hidden by silky, greyish or tan fur. They can reach lengths of over 90 cm, and they weigh 19 to 32 kg.

Habitat

The Southern hairy-nosed wombat lives in semi-arid shrublands and mallee woodlands in the southern edge of the deserts, from the Nullarbor to NSW.

Wombat scat

Southern hairy-nosed wombat scats are oval rather than cube-shaped like those of common wombats. They leave scats near their burrows, and create well-trodden paths to particular bushes which are their favourite toilet sites. The scats are shiny when fresh and are made up of plant material.

Southern hairy-nosed wombat scats.

Path created by Southern hairy-nosed wombat to a favourite toilet site.

Southern hairy-nosed wombat scats around burrow.

Wombat tracks

A wombat's track is distinctive. Wombats have a slow, ambling gait and heavy flat-footed tread. They make both walking and bounding tracks.

Common wombat foot (southern hairy-nosed wombat foot is similar).

Southern hairy-nosed wombat tracks (arrow shows which way it is moving).

Southern hairy-nosed wombat walking tracks.

Burrows and warrens

Southern hairy-nosed wombats dig, and live in, warrens with many entrances. These warrens are shared by up to 10 individuals. The central warren is surrounded by a circle of small, simple burrows 100–150 m away.

Southern hairy-nosed wombat burrow.

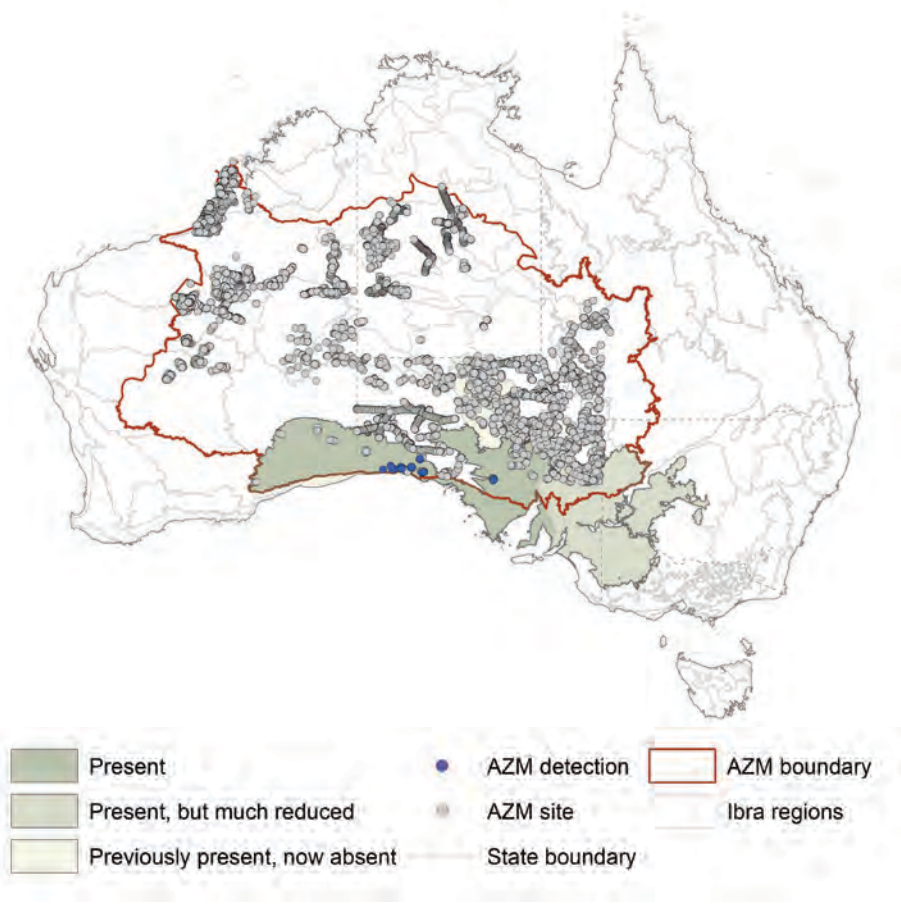
Things to think about when surveying for Southern hairy nosed wombat

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Arid Zone Monitoring project findings

Southern hairy-nosed wombat distribution

The map summarises the detections in the AZM dataset. It shows that Southern hairy-nosed wombats were only detected along the southern edge of the AZM project area. Each blue dot shows a survey site where Southern hairy-nosed wombats were recorded. The grey dots show all the other sites that were surveyed, but where Southern hairy nosed wombats were not recorded. Southern hairy-nosed wombats were detected at less than 1% of all surveys in the AZM dataset: of 15,000 site surveys, they were detected only 25 times. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1]. Southern hairy-nosed wombats are declining in the lighter shaded parts of its range.



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It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Further information

Arid Zone Monitoring project:

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Southern hairy-nosed wombat, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Dingo

Canis familiaris dingo

Language names

Akngwelye, Arengk, Arnapar, Arnwer, Artnwer, Artnwere, Inura, Itnura, Jarntu, Kngulya, Kurriti, Maliki, Marrany, Ngupanu, Nupanu, Papa, Wanapari, Warnapari, Winkkalki

National status: Not listed

IUCN Red List: Not assessed

Dingo.

Animal Description

Dingoes have a long nose (muzzle), pointy-upright ears and strong claws, a ginger coat, sometimes with white markings on their feet, tail tip and chest. Their bushy tail is 25–37 cm long. Coat colours of dingoes can vary and include red-ginger, sandy yellow, black, pale sandy yellow or black with tan patches.

Key threats

Dingo populations are stable in parts of their range, and absent or declining in other parts of their range due to:

- Hybridising with domestic dogs
- Habitat loss in eastern and southwestern Australia
- Persecution from people

Habitat

Dingoes are highly adaptable, found in many habitats, and in all states and territories except Tasmania. Dingoes need to drink water regularly, and that means they can't live in desert areas if there is no water available. They hunt other animals, especially kangaroos and wallabies, but also eat a lot of invertebrates, fruits and other plant material, and they eat carrion.

Dingo scat

Dingoes like to leave their scats on top of bushes and rocks. Dingo scats look like pet dog scats and are larger than fox scats, with a smoother surface and less hair and bone fragments.

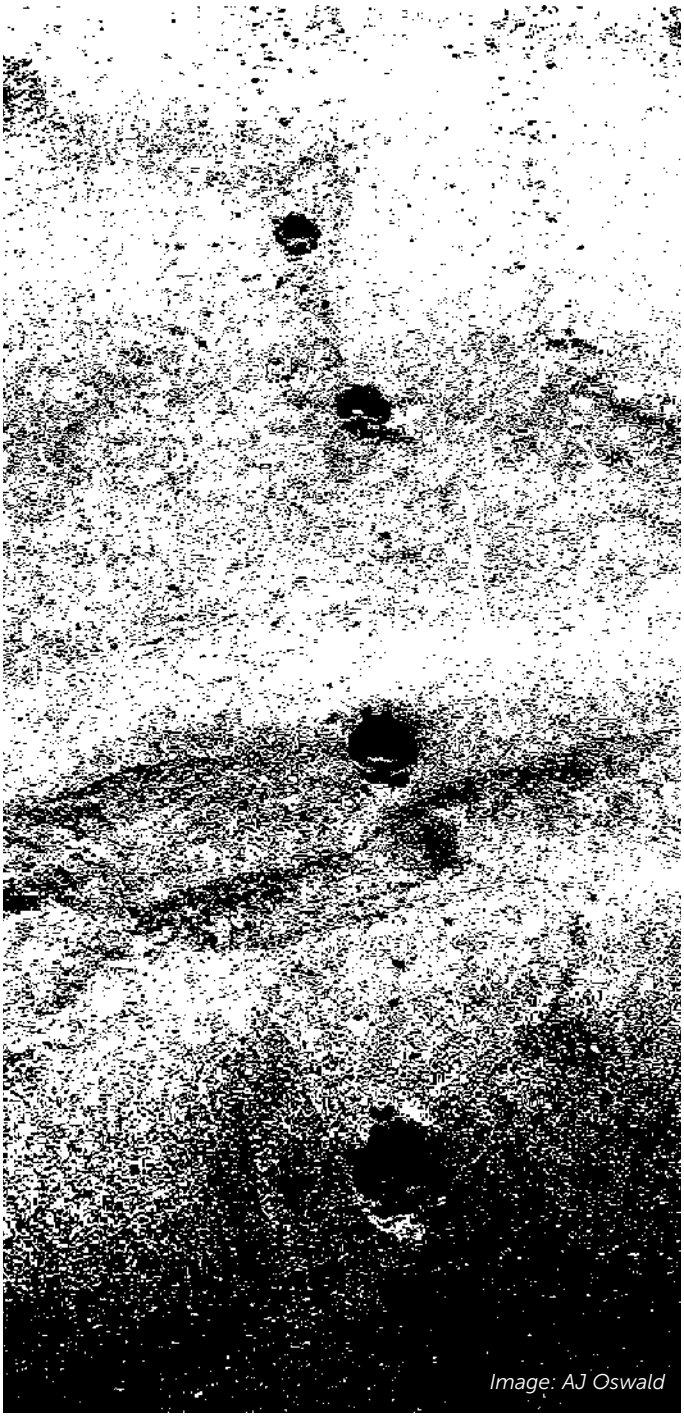
Old dingo scat.

Dingo tracks

Dingo tracks are larger than cat tracks. They are large and round, with claw marks. Two front-foot pads are nestled between the middle pads, making the track round. When walking, the back foot is placed in front and to the side of front foot. The front footprint is larger than the back footprint.

Dingo print.

Dingo track (arrow shows which way it is going).



Dingo tracks (arrow shows which way it is going).

Dingo tracks (arrow shows which way it is going).

Animals that might be confused with the dingo during survey

- Cat
- Fox

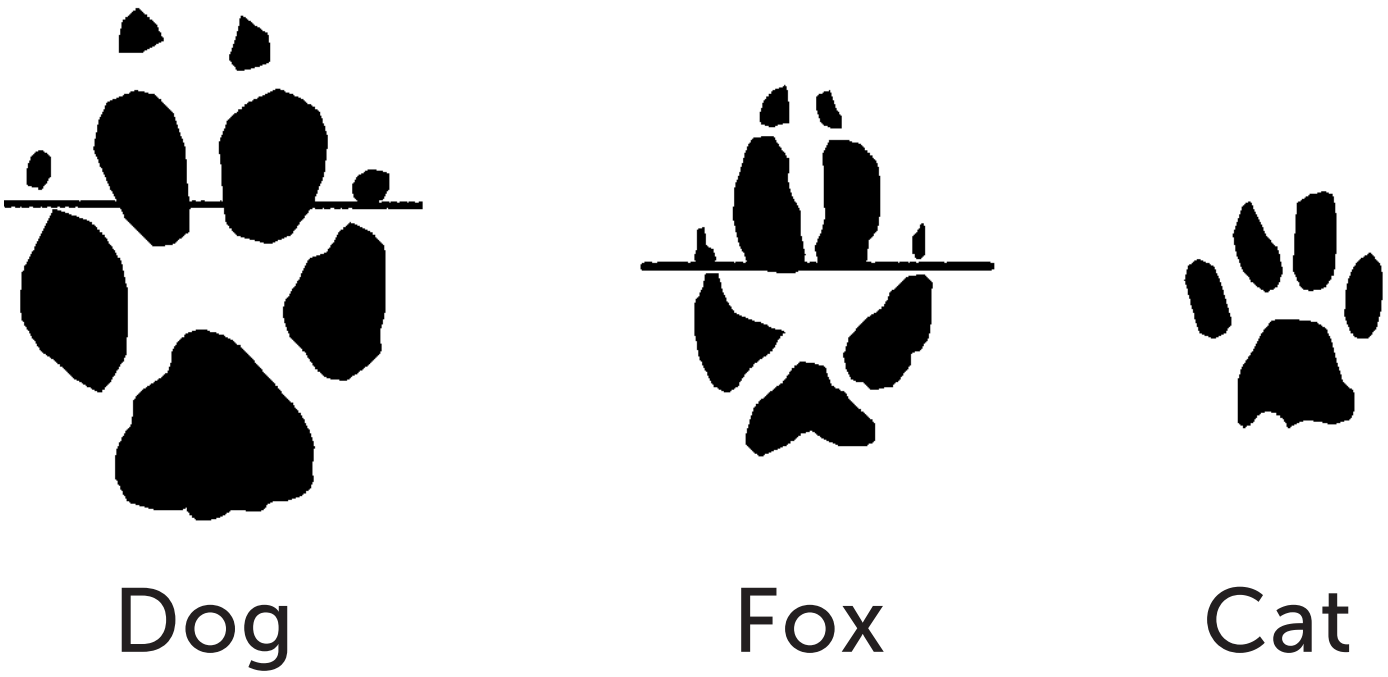


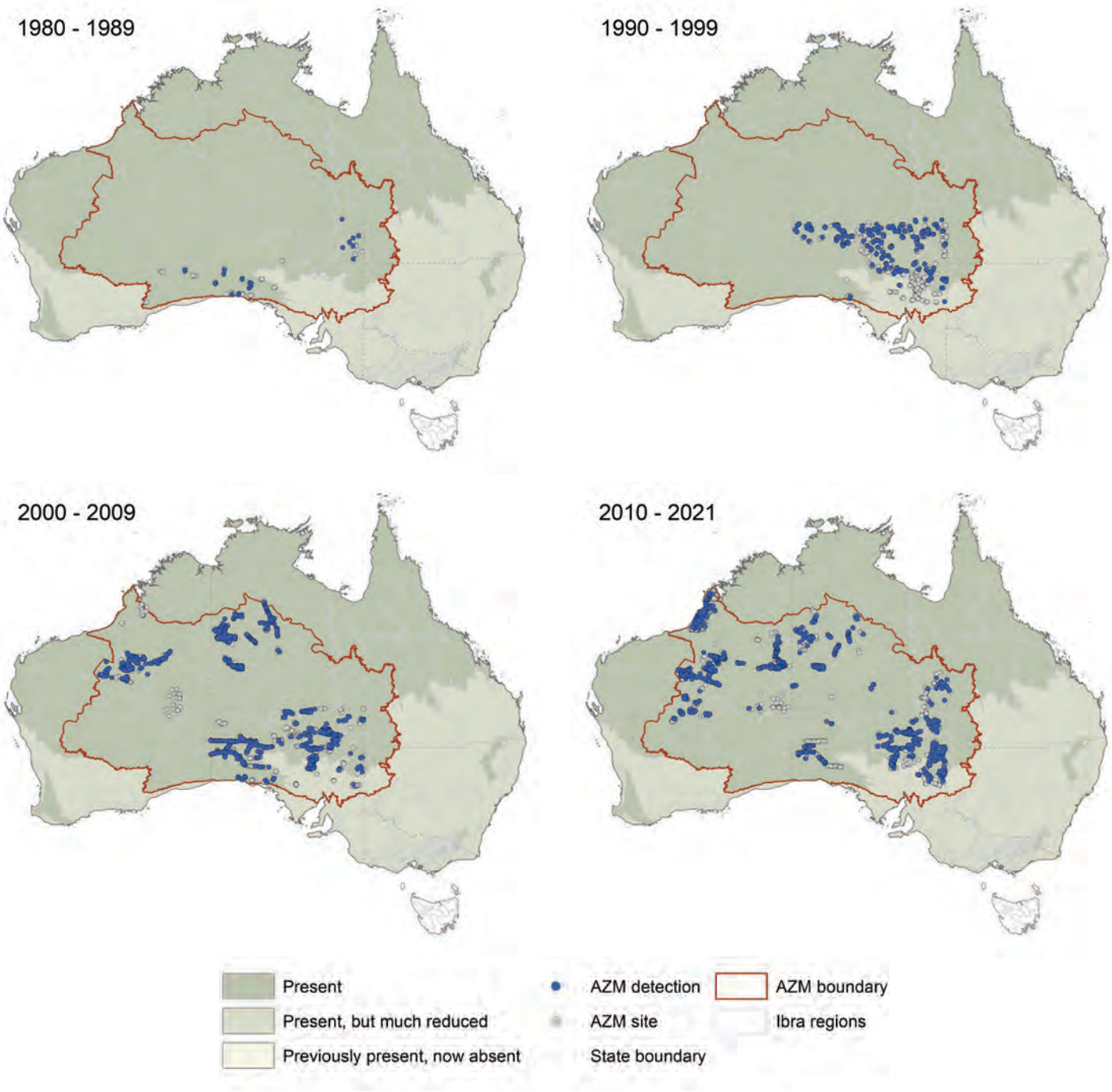
Image: Naomi Indigo

To tell the difference between these species check the position and alignment of the toe pads and the presence of claw marks – dingoes and foxes leave claw imprints in the sand whereas cats do not. Dingo tracks are larger and wider than fox and cat tracks. The two front toe pads of foxes stick out further in front of the two outer toepads, compared to dingoes.

Arid Zone Monitoring project findings

Dingo distribution

The maps summarise detections of dingoes over time in the AZM dataset. They show that dingos are found throughout central Australia. Each blue dot shows a survey site where dingoes were recorded in that decade. The grey dots show all the other sites that were surveyed, but where dingoes were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Mammal Action Plan[1] and Australian Faunal Directory[2].



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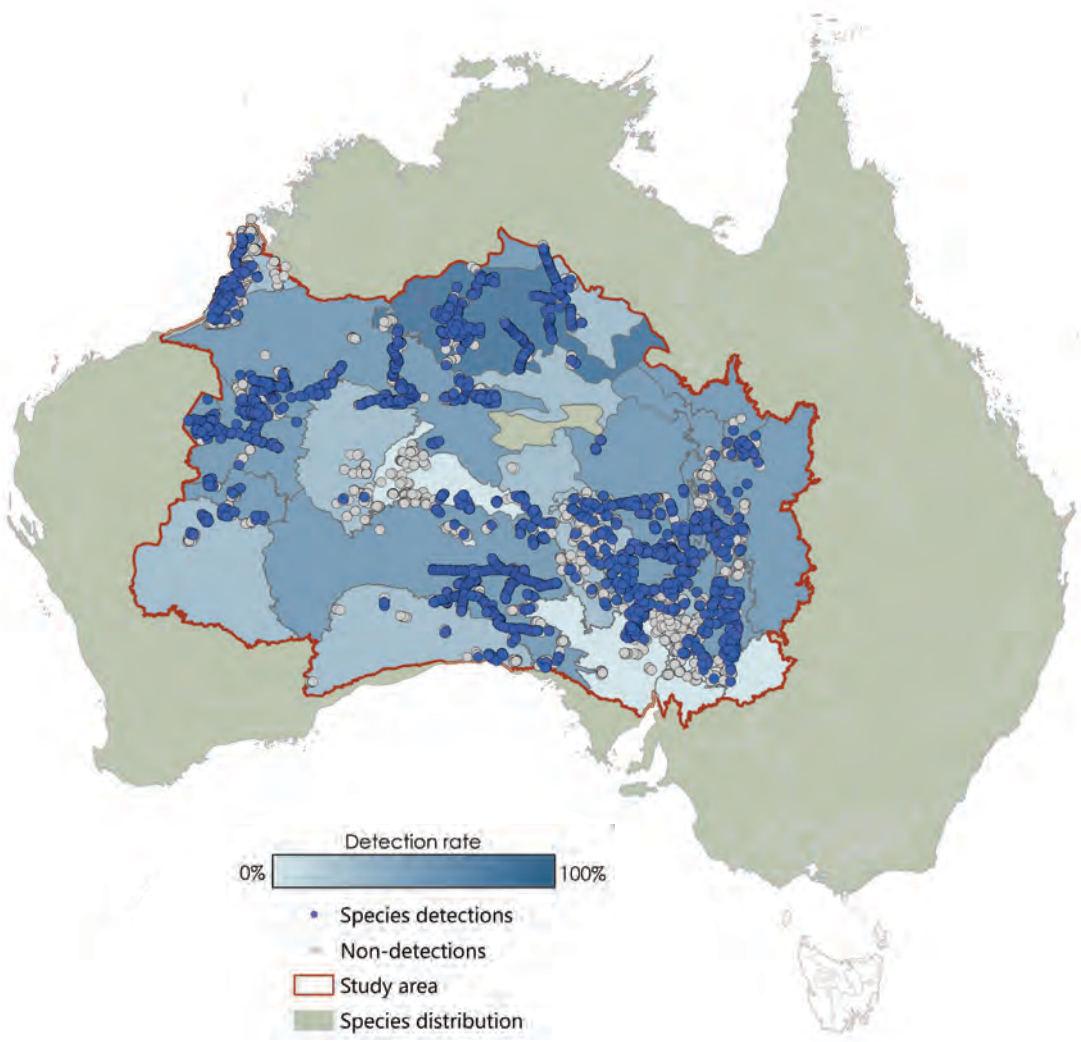
It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Dingo detection rates

The dingo was detected in one third (over 33%) of all surveys in the AZM dataset. It was the second most commonly recorded mammal species, and the most commonly recorded native mammal species.

The map below shows the average detection rate for dingoes across all surveys carried out in each bioregion, since the 1980s. Detection rates have been lower in the far southeast of the project area, on the eastern side of the dog fence (lighter blue shading). A more detailed analysis of dingo detections at a subset of AZM sites that were revisited over five or more years, shows that dingos are sometimes detected less often in long-unburnt areas, but generally their detection rates don't vary consistently with time since fire, the amount of green vegetation, nor recent rainfall. This may reflect that they are an adaptable generalist, able to make a living in many situations.



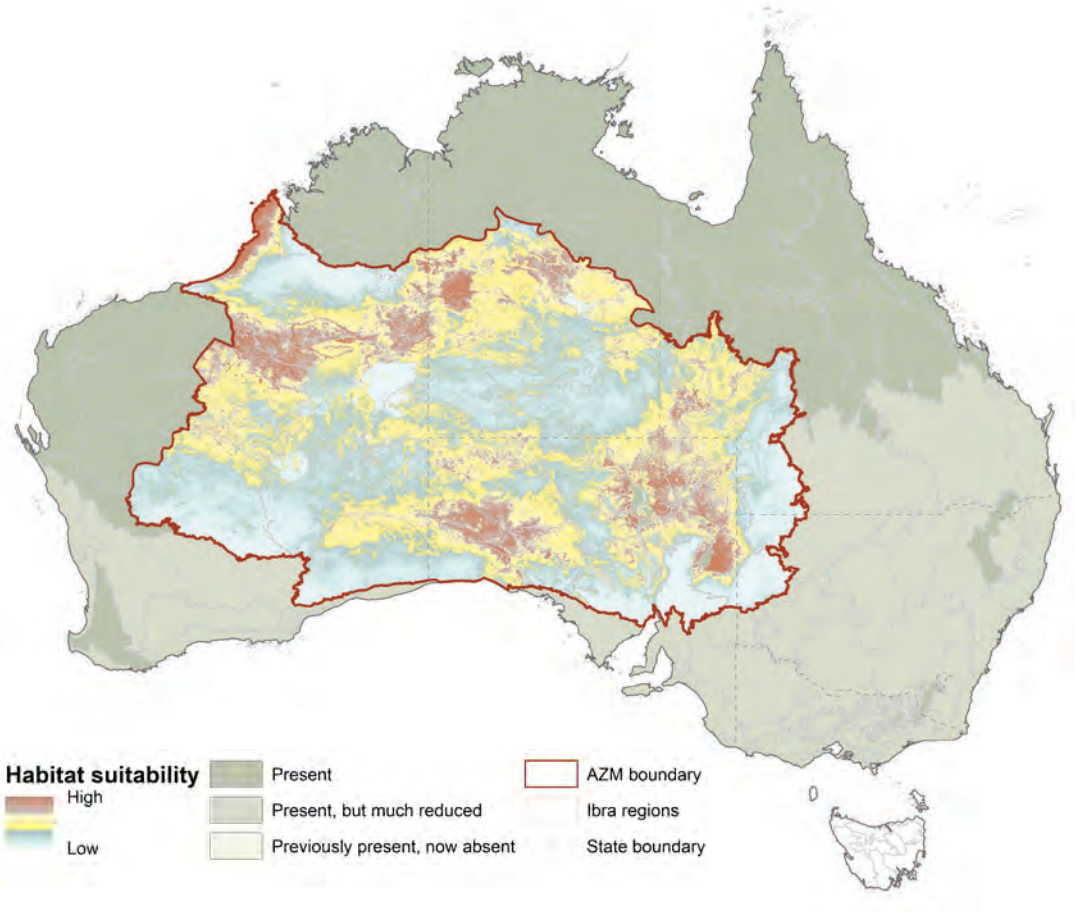
Things to think about when surveying for dingoes

- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell dingo tracks apart from foxes and cats before you go to survey.
- Look for tracks on the roads, as predators often use roads adjcent to sandplot sites.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (such as right-way fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Dingo habitat suitability

The habitat suitability model can tell us about where the dingo is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency. The analysis does not account for the Dingo Fence, which extends from Jimbour QLD to the Eyre Peninsula, SA, and limits the occurrence of dingoes to the east of it.

The model suggests that dingoes are found throughout the AZM project area, across a range of climate, landforms, soil types and fire frequencies. The map shows that the best areas, shaded red-brown, are spread right across the deserts. The map only shows habitat suitability inside the AZM project boundary, but dingoes are also found outside the project area. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

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References

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[2] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021.

Threatened Species Recovery Hub
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The Arid Zone Monitoring project is a collaboration between the NESP TSR Hub and over 30 Indigenous ranger groups and Indigenous organisations, 8 NGOs and NRM groups, 5 government agencies institutions, and many individual researchers and consultants. The project has gathered track and sign data from across Australia's deserts, using it to map the distributions of desert species and their threats. The national database includes almost 50,000 species presence records from over 5300 unique sites and almost 15,000 site visits, over the period from 1982 to 2020. The project area was defined by using IBRA subregional boundaries - the project boundary captures Australia's desert subregions where track and sign-based surveys are commonly used. The project showcases the collective work carried out by all groups working across the arid zone, and lays the groundwork for creating ongoing, national-scale monitoring for desert wildlife.

Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Dingo, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Rabbit

Oryctolagus cuniculus

Language names

Jipuku, Kuna-jirrnginjaningi, Kwey-ipert-ipert, Nani, Mula-mulka, Rapete, Rapita, Pintajatanpa, Mujunyku, Yurapiti

Introduced species: Competition and land degradation by rabbits is listed as a Key Threatening Process in national environmental law (the EPBC Act).

Rabbit.

Feral rabbit warren-close up.

Impacts

- Rabbits damage native vegetation, by grazing, browsing and eating seedlings before they can grow
- Rabbits dig up the roots of plants, cause soil erosion and degradation of large areas of country
- Rabbits compete with native wildlife for food and habitat
- Rabbits have caused declines in many native species of plants and animals

Animal Description

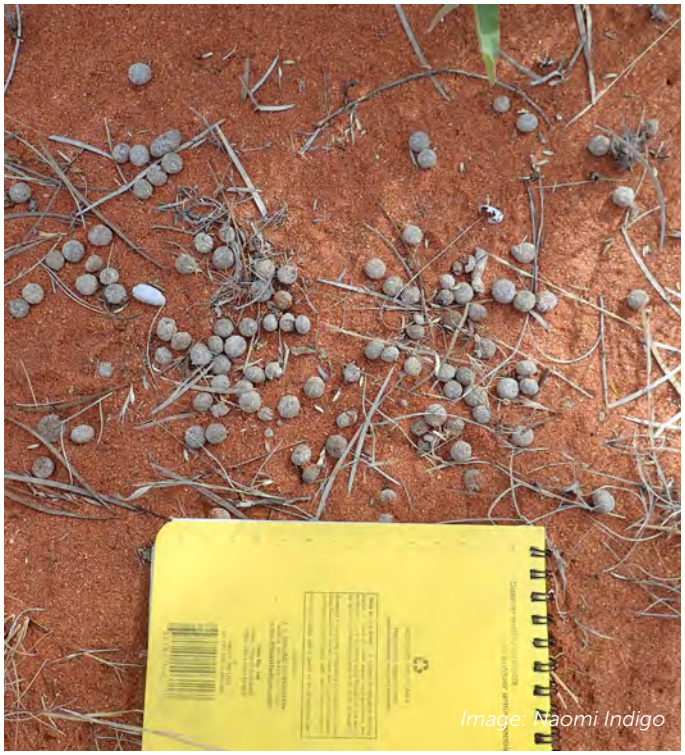
The rabbit is a small mammal with long hind legs, short front legs, short fluffy tail, and long ears. It weighs 1-2.25 kg. Rabbits vary in colour. They are often grey-brown or sandy brown; sometimes they are ginger, black or white.

Habitat

Rabbits are found right across Australia, except the monsoonal tropics. They have permanent populations around reliable water in desert country. Rabbits shelter in burrows, which can be quite deep and be part of a bigger system of burrows, forming a warren. These have many entrances connected by well-worn paths or runs. Sometimes they take over old warrens built by boodies, or burrowing bettongs.

Rabbit diggings and scats

Rabbit scats look like small round pills, often found in feeding areas or on slightly higher ground. Rabbit poo may be found in piles or heaps, they do this to mark their home territories.



Older rabbit scats.

Fresh rabbit scats.

Rabbit diggings.

Rabbit warrens.

Bounding tracks of a rabbit in sand (arrow shows which way it is going).

Rabbit tracks

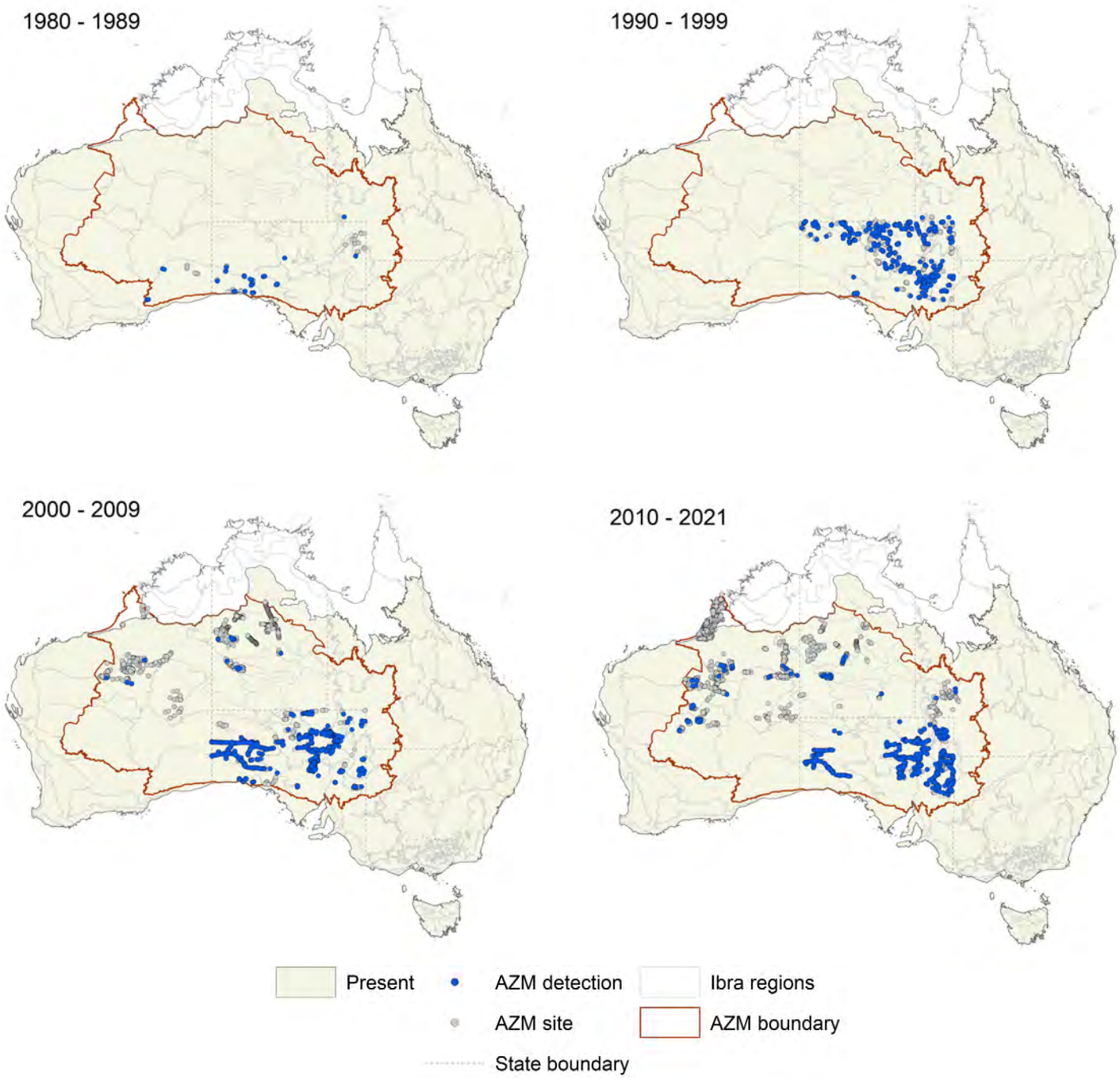
Rabbits have five small, clawed toes on their furry front and back feet. Its usually hard to see any toes and claws in the prints, because the fluffy feet make the edges of the print soft. The bounding gait of a rabbit means that the two large hind footprints (which are almost side by side), land ahead of the two smaller front foot tracks that are behind and almost in a line.

Arid Zone Monitoring project findings

Rabbit distribution

Rabbits were brought to Australia by Europeans. A few animals came on the First Fleet, and were bred for food, but not released. In 1859, some were released for sport shooting in Victoria. They quickly became feral, and after 50 years had crossed the continent, spreading everywhere except the tropics. This is the fastest invasion of a feral animal in the world.

The maps summarise the detections of rabbits over time in the AZM dataset. They show that rabbits are mostly detected in the southern deserts, and there is no clear trend in detections over time. Each blue dot shows a survey site where rabbits were recorded in that decade. The grey dots show all the other sites that were surveyed, but where rabbits were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1].



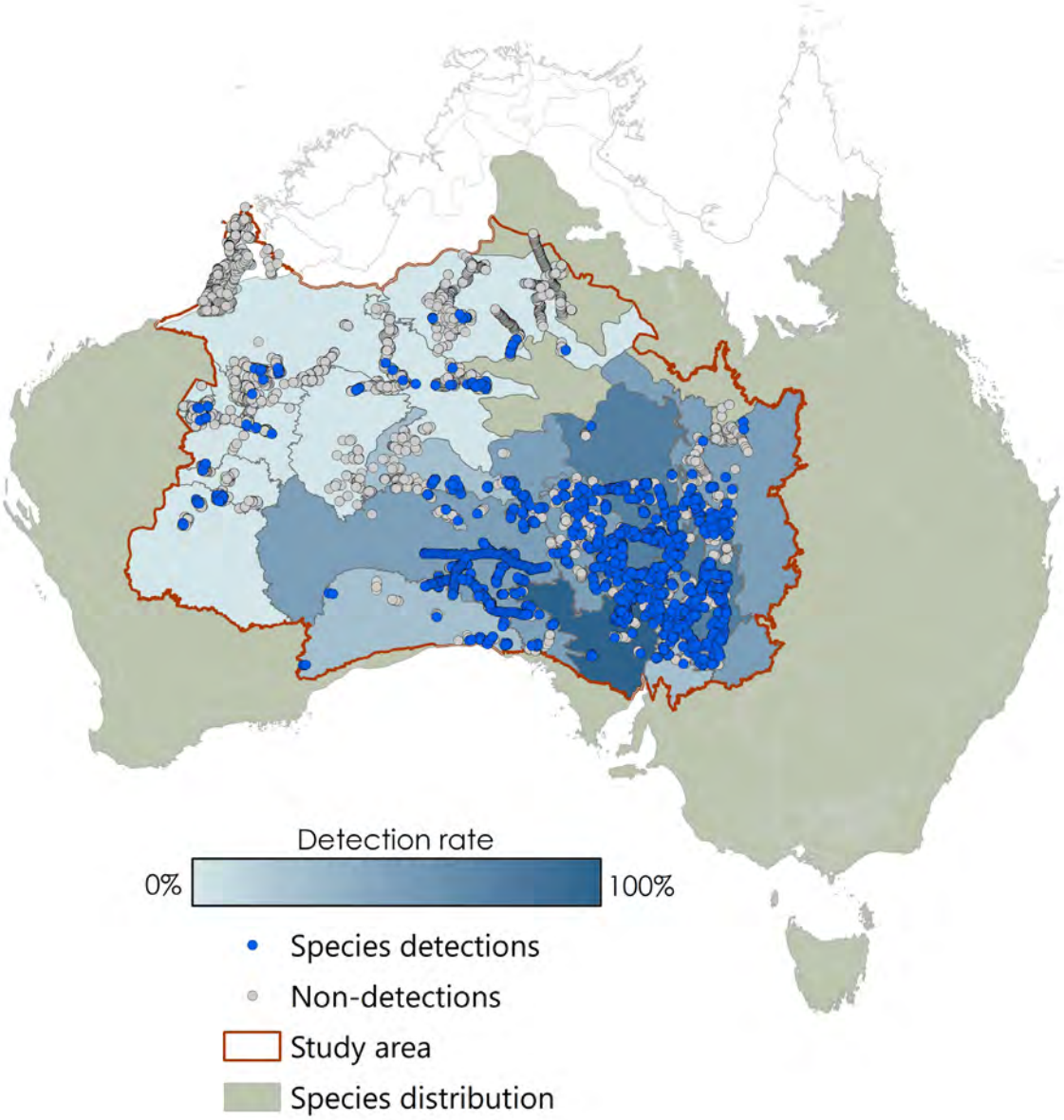
The maps above are based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Rabbit detection rates

Rabbits were detected at over 47% of all surveys in the AZM dataset. It was the most commonly recorded species.

The map shows the detection rate of all surveys carried out in each bioregion since the 1980s. Detection rates for rabbits are higher in the southern and eastern deserts (deeper blue shading) compared with elsewhere.



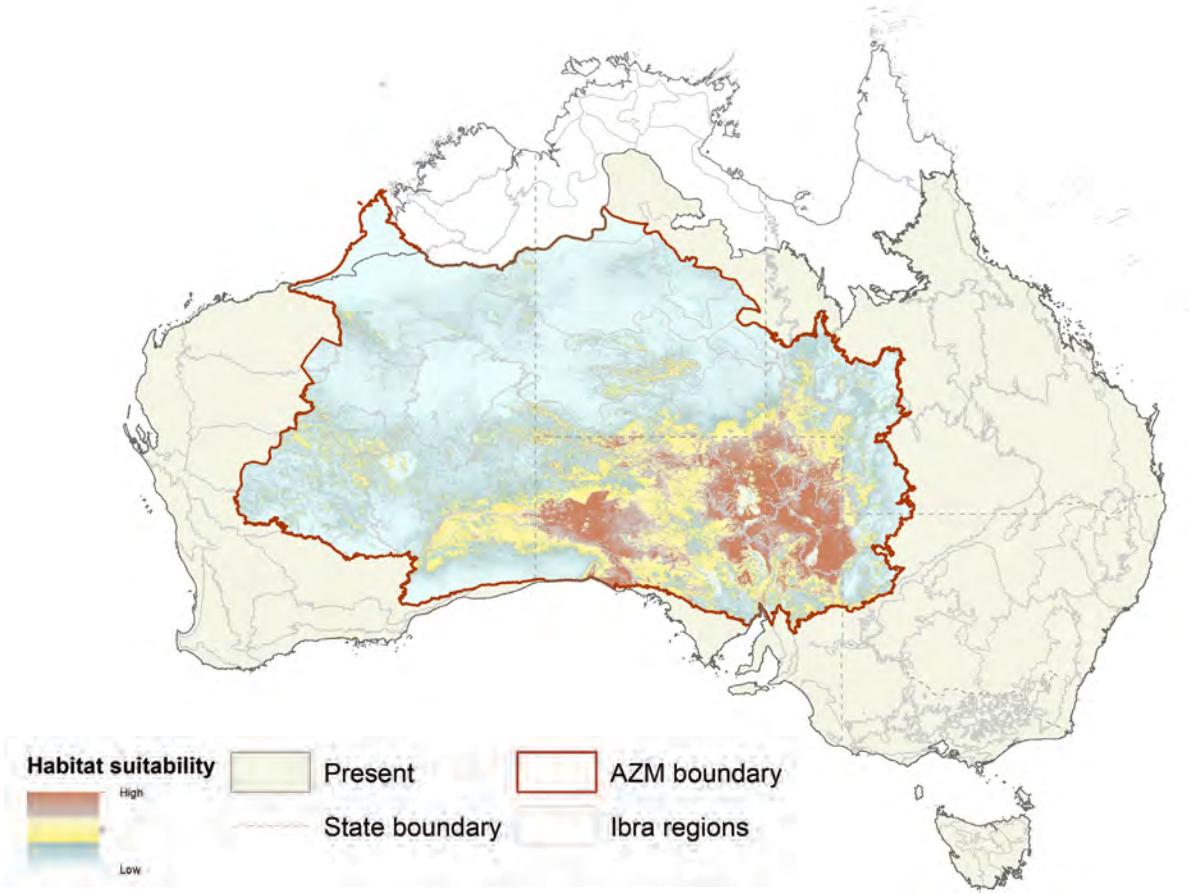
Things to think about when surveying for rabbits

- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell rabbit tracks apart from other species like bilbies before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (such as rabbit culling) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Rabbit habitat suitability

The habitat suitability model can tell us about where rabbits are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that rabbits are more common in areas of moderate temperature (<24 degrees Celsius) and low elevation (not too high above sea-level). The map shows us that we can expect to find rabbits in all parts of the south-eastern deserts, and that they might be especially common in some parts of South Australia, where the map shading is reddish brown. The map only shows habitat suitability inside the AZM project boundary, but rabbits are also found outside the project area, in the pale beige part of the map, and might be common in these places too. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

Summary of options for managing feral rabbits:
https://pestsmart.org.au/wp-content/uploads/sites/3/2021/03/CISS-Glovebox-Guide-Rabbit-web.pdf

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021.

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Rabbit, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Cat

Felis catus

Language names

Alknge atherrke, Mangwe, Miinau, Miiyawu, Mintja, Minyawu, Miyawu, Mulku, Ngaya, Nyarrapeng, Pirni, Pujukarti, Putji, Putjikata, Putjikatu, Pwethekate, Wiilyka

Introduced species: Predation by feral cats is listed as a Key Threatening Process in national environmental law

Cat.

Cat scat.

Cat tracks. Arrow shows which way the cat is moving.

Cat tracks in soft sand.

Impacts

- Cats hunt and kill native animals
- Cats have caused many Australian mammal species to become extinct, and still cause declines and local extinctions of animal populations
- Cats carry diseases that affect wildlife and people
- Reducing the number of cats can allow native animal populations to grow

Animal Description

Feral cats look like pet cats. The most common coat colour of feral cats is tabby, ginger or black. They mostly live alone, except when they are mating or when females have kittens. They can be active during the day or night, but usually they are active at night and spend most of the day in the safety of a shelter such as a rabbit burrow, log, or rock pile.

Habitat

Cats are found right across Australia, in every habitat, from rainforests to deserts.

Cat scat

Cat scat is usually buried under the sand. Sometimes there are signs on the disturbed sand such as scrapes, small diggings and tracks in many directions. The scats are about the width of a finger and sausage shaped, with slight twists. The scats can contain hair, bone fragment, bits of insect.

Cat tracks

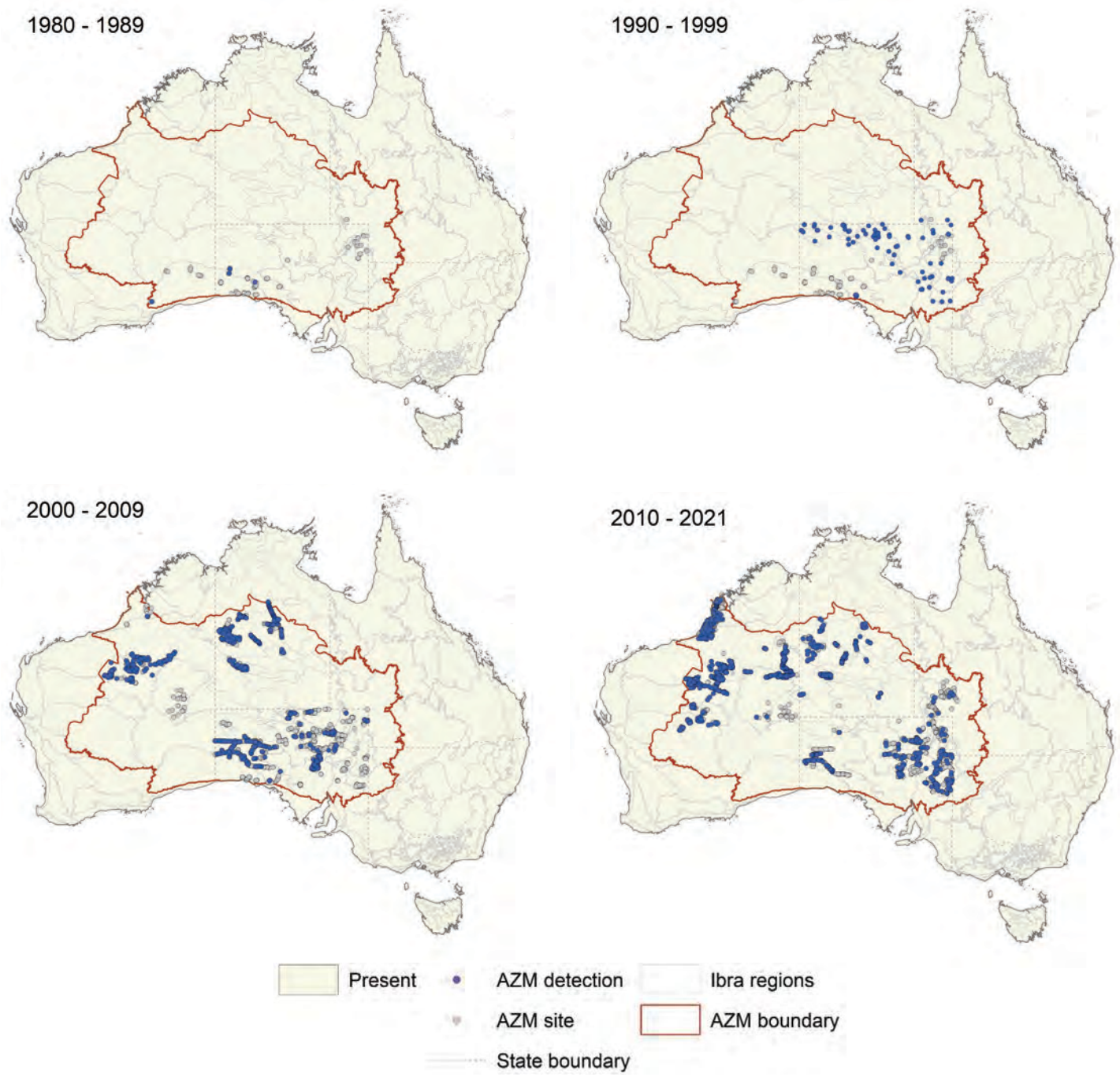
Cat tracks are round and show all four toe pads sitting around the front and sides of the large central pad. Cats usually only leave a faint imprint.

Arid Zone Monitoring project findings

Cat distribution

Cats were introduced to Australia by European colonists. They now occupy over 99% of Australia and most of the larger islands.

The maps below summarise detections of cats over time in the AZM database. They show that feral cats are found throughout central Australia, and have been detected wherever people have surveyed since the 1980s. Each blue dot is a survey site where cats were recorded in that decade. The grey dots show all the other sites that were surveyed, but where cats were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1].



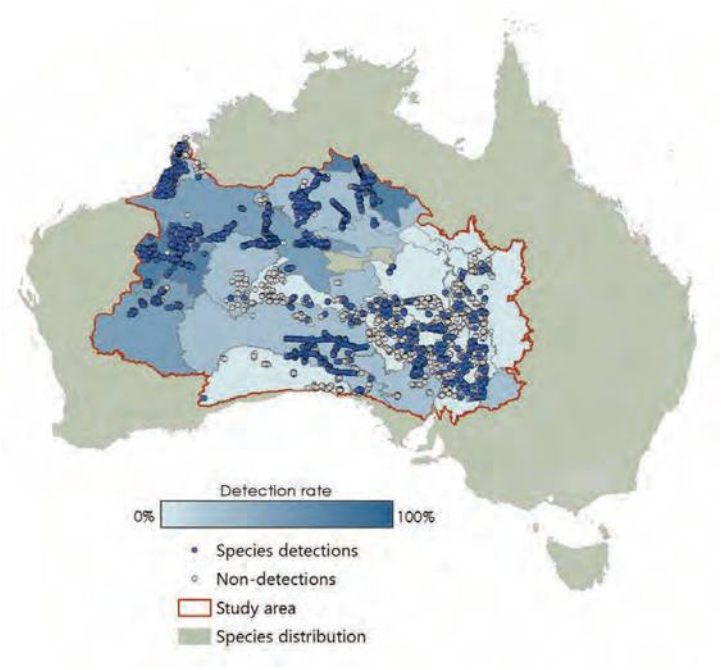
The maps above are based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

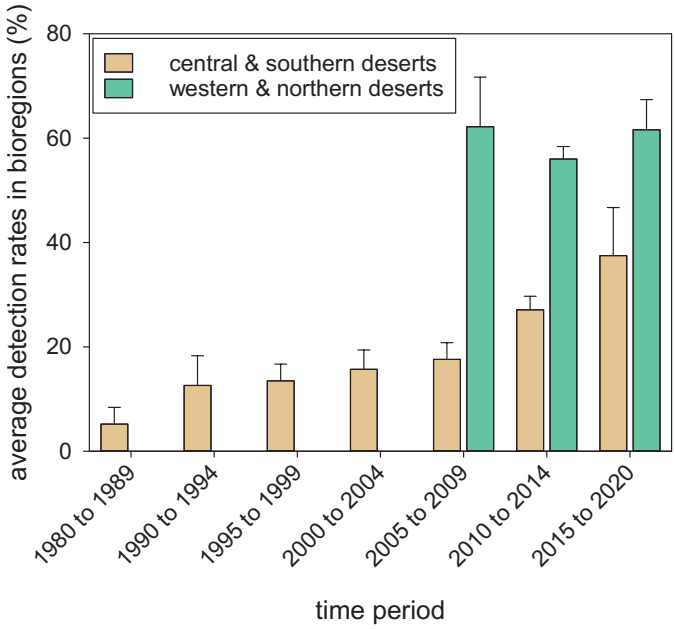
It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Cat detection rates

Cats were detected at 29% or almost a third of all surveys in the AZM dataset. Cats were the third most frequently recorded animal, behind rabbits and dingoes.

The map below shows the detection rate for cats across all surveys carried out in each bioregion, since the 1980s. Detection rates have been higher in the northern and western deserts (deeper blue shading), compared with the southern and central deserts. This pattern is also seen in the graph, which shows that the average detection rates across bioregions from northern and western deserts has consistently been higher over the past 20 years, than in southern and central desert bioregions. The graph also suggests that detection rates for cats in the southern and central deserts may have increased over time. A more detailed analysis of cat detections at a subset of AZM sites that were revisited over five or more years, shows that cats are detected more often soon after fire, and also when there is more green vegetation.





Animals that might be confused with the cat during survey

- Dingo
- Fox

To tell the difference between these species check the position and alignment of the toe pads and the presence of claw marks – dingoes and foxes claws leave an imprint in the sand whereas cats do not.

Dingo tracks are much larger and wider than cat tracks.

The two front toe pads of foxes stick out further in front of the two outer toepads, compared to dingoes.

Image: Naomi Indigo

Dog Fox Cat

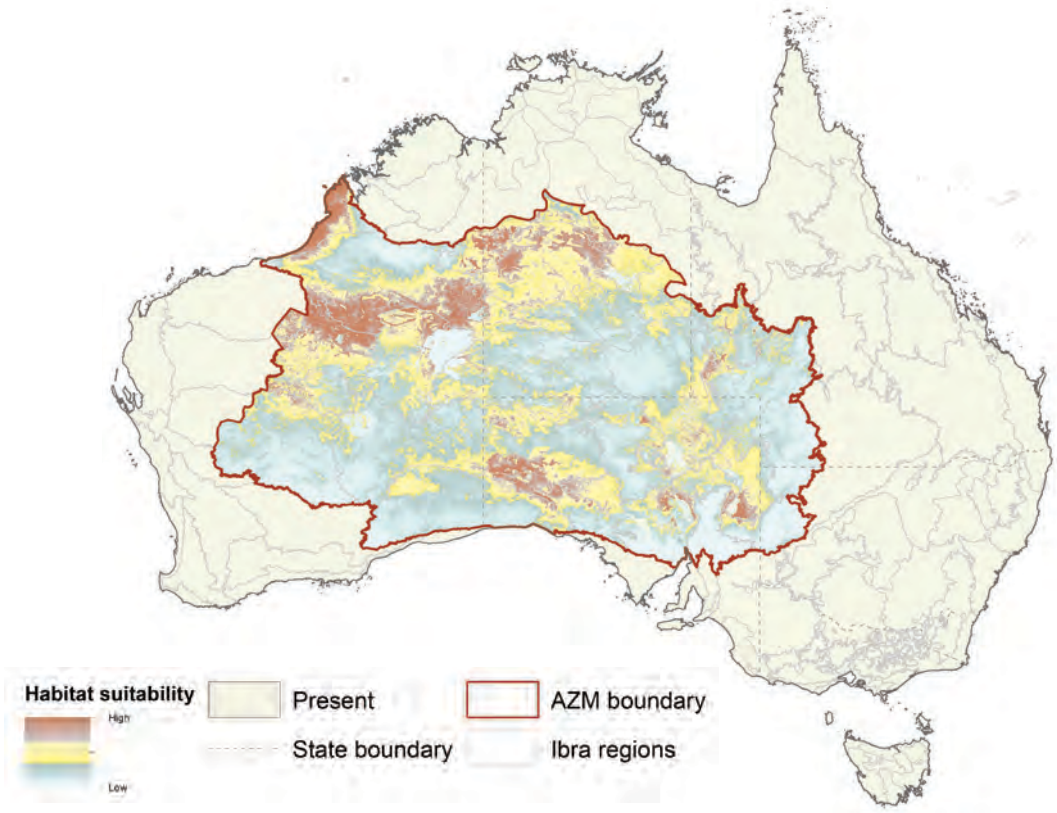
Things to think about when surveying for cats

- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell cat tracks apart from other species such as dingoes and foxes before you go to survey.
- Look for tracks on the roads, as predators often use roads adjcent to sandplot sites.
- Pay extra attention to finding signs around logs and thick bushes, where cats might rest during the daytime.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Cat habitat suitability

The habitat suitability model can tell us about where the cat is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of green vegetation (NDVI) and fire frequency.

The model suggests that cats prefer areas of high temperature and moderate to low elevation. The map shows us that we can expect to find cats in all parts of the desert, and that they might be more common in some parts of South Australia and Western Australia, where the map shading is reddish brown. The map only shows habitat suitability inside the AZM project boundary, but cats are found right across Australia and might be common in other places too. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

Summary about the impacts of cats on native wildlife:
https://www.nespthreatenedspecies.edu.au/media/eeufmpqx/112-the-impact-of-cats-in-australia-findings-factsheetweb.pdf

Summary of options for managing feral cats:
https://pestsmart.org.au/wp-content/uploads/sites/3/2021/02/CISS-Glovebox-Guide-Cat-web.pdf

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[1] Australian Faunal Directory. https://biodiversity.org.au/afd/home. Accessed June, 2021.

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Arid Zone Monitoring
Species Profile

Fox

Vulpes vulpes

Language names

Kirlmarrara, Ngatin, Puwutjuma, Tuuka, Waltaki

Introduced species: Predation by the European red fox is listed as a Key Threatening Process under national environmental law (the EPBC Act)

Fox.

Fox scat, with fur and bone fragments.

Fox tracks.

Fox tracks (arrow shows which way it is going).

Impacts

- Foxes hunt and kill native animals
- Foxes have helped to make many Australian mammal species to become extinct, and still cause declines and local extinctions of animal populations like bilbies
- Foxes carry diseases which can affect wildlife, pets and people
- Reducing the number of foxes can allow native animal populations to grow

Habitat

Foxes are found right across southern Australia, in every habitat, including in towns. They don't usually live in the tropics, although foxes are known from the northwest coast of the Great Sandy Desert and Dampierland. Foxes need access to water, so they are not in the driest parts of the desert unless it is raining. Foxes are active at night. During the day, the fox sleeps in dens, rabbit burrows, logs and other shelter.

Fox scat

Fox scats are similar to cat and dingo scats. They are about 2cm wide, and sometimes sausage shaped. They may contain fur, bones, feathers, insects and plant material. Fox scats are sometimes laid on high ground or near the bodies of dead animals.

Fox tracks

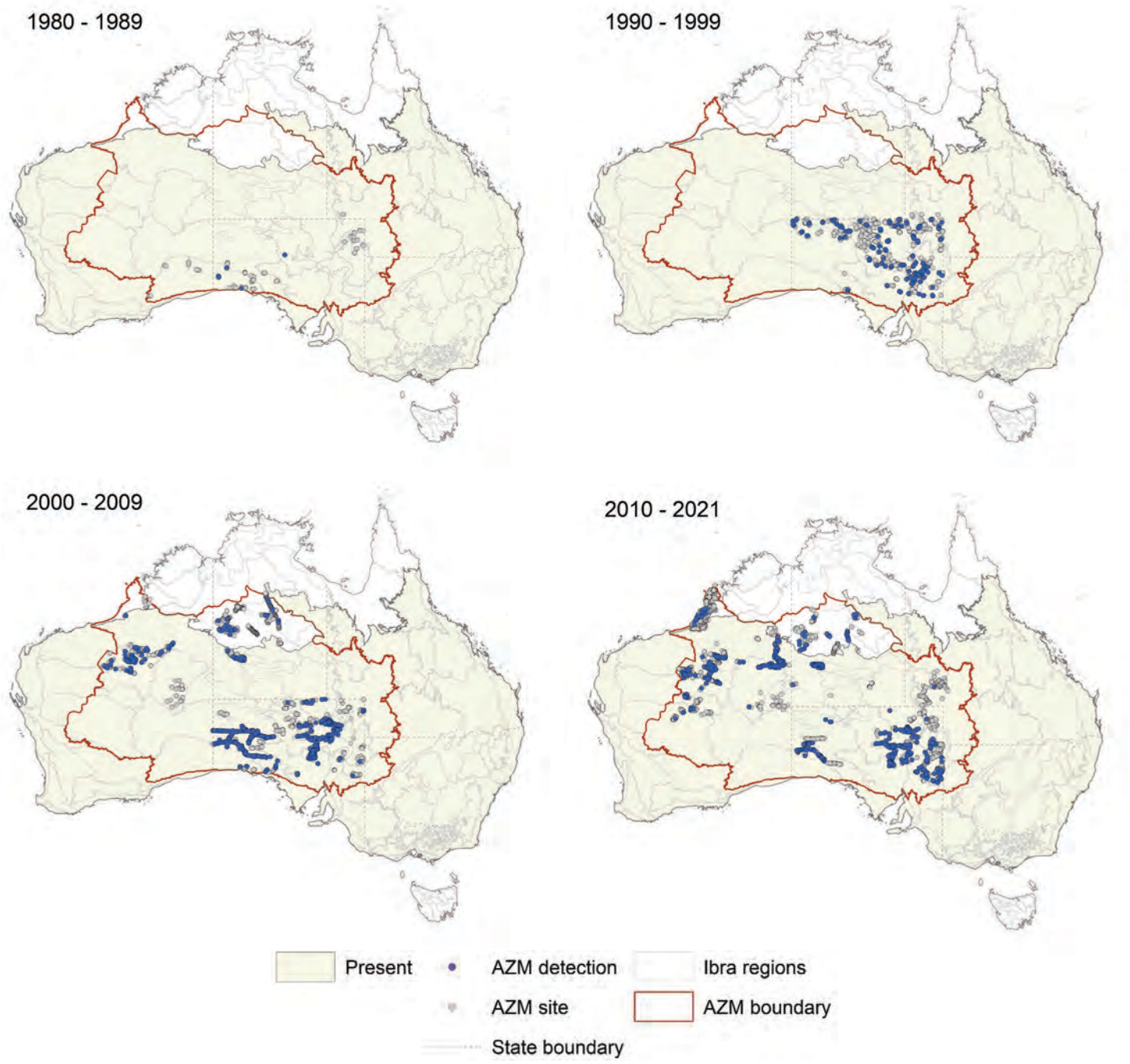
Fox and dog tracks look almost the same. Fox prints are smaller, and they have a narrower, more oval paw print than dogs, with the marks made by the central claws are closer together.

Arid Zone Monitoring project findings

Fox distribution

Foxes were introduced to Australia in the 1860s. Then established in southern Victoria in the 1870s, then spread quickly across temperate, sub-tropical, and inland Australia. They are mostly absent from the tropics.

The maps summarise the detections of foxes over time in the AZM dataset. They show that foxes have been detected wherever people have surveyed since the 1980s. Each blue dot is a survey site where foxes were recorded in that decade. The grey dots show all the other sites that were surveyed in that decade, but where camels were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1].



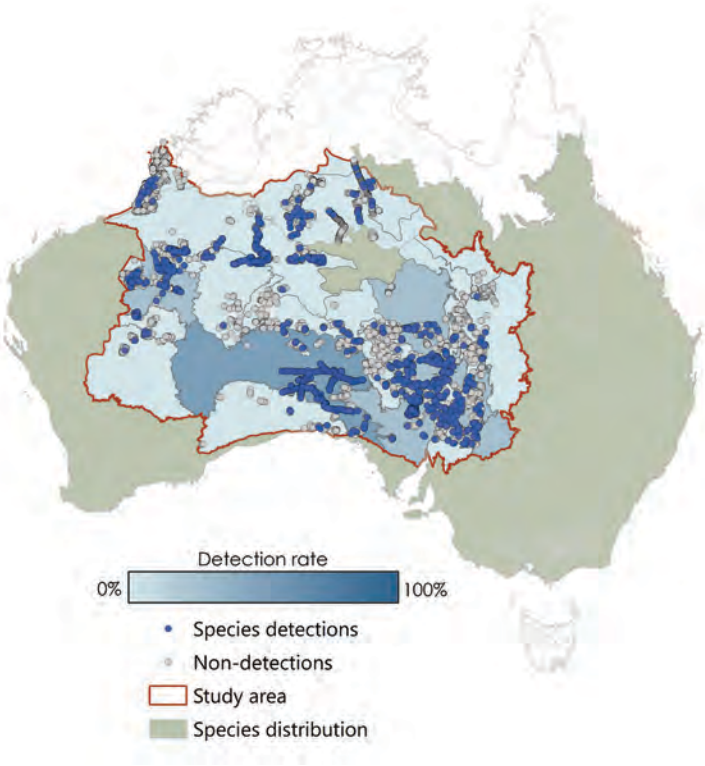
The maps above are based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Fox detection rates

Foxes were detected over 19% of all surveys in the AZM dataset. It was the fifth most commonly recorded mammal species, and the fourth most commonly recorded introduced mammal species.

The map shows the average detection rate for foxes across all surveys carried out in each bioregion, since the 1980s. Detection rates have been higher in the southern deserts (deeper blue shading), compared with the northern deserts. A more detailed analysis of fox detections at a subset of AZM sites that were revisited over five or more years, shows that foxes tend to be detected more in recently burnt areas, and when rain has caused an increase in the amount of green vegetation.



Animals that might be confused with the fox during survey

- Dingo
- Cat

To tell the difference between these species check the position and alignment of the toe pads and the presence of claw marks – dingoes and foxes leave a claw imprint in the sand whereas cats do not. Dingo tracks are larger and wider than cat and fox tracks. The front toes of foxes are further in front of the back toes, than those of dingoes.

Image: Naomi Indigo

Dog Fox Cat

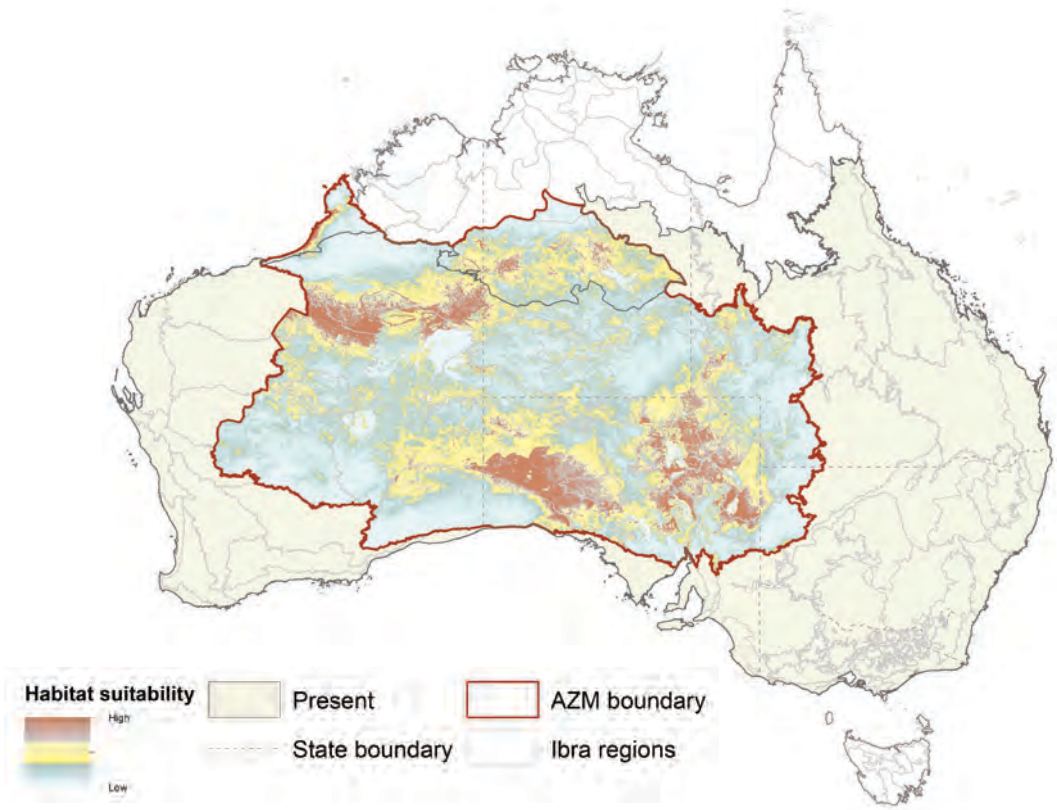
Things to think about when surveying for foxes

- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell fox tracks apart from dingoes and cats before you go to survey.
- Look for tracks on the roads, as predators often use roads adjcent to sandplot sites.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (such as right-way fire or culling) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Fox habitat suitability

The habitat suitability model can tell us about where foxes are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that foxes prefer low-lying areas and places with clear temperature differences between the night and day, such as are found in temperate regions. These are the red-brown shaded areas of the map. The map only shows habitat suitability inside the AZM project boundary, but foxes are also found outside the project area and can be very common in these areas. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

Centre for Invasive Species Solutions- Glovebox Guide for Managing Foxes:
https://pestsmart.org.au/wp-content/uploads/sites/3/2021/03/CISS-Glovebox-Guide-Fox-web.pdf

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

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Arid Zone Monitoring
Species Profile

Goat

Capra hircus

Language names

Nanekwete, Nanikute, Nanikuta, Nanikurr

Introduced species: An invasive herbivore; competition and land degradation by unmanaged goats is listed as a key threatening process under national environmental law (the EPBC Act).

Feral goats.

Feral goats can overgraze plants and stop young plants from regenerating.

Feral goat browsing native vegetation.

Impacts

- Overgrazing plants and stopping young plants from regenerating
- Soil damage and erosion
- Competition with native animals for food, shelter and water
- Fouling waterholes
- Spreading weeds

Animal Description

Feral goats are usually smaller than domestic goats. Male feral goats have beards and curved/curly horns. The coat colour of goats varies-they may be white, brown, black or a mixture of colours.

Habitat

Goats are very versatile, they can live in many different habitats and eats many different plants, but they prefer semi-arid shrubland and woodland with rocky outcrops.

Feral goats.

Feral goats.

Feral goats.

Goat tracks

Goats have cleaved hooves, with prints that are approximately 55 x 25mm in size.

Goat tracks.

Goat scat

Goat scats are solid dark brown oval shaped pellets.

Goat scat.

Things to think about when surveying for goats

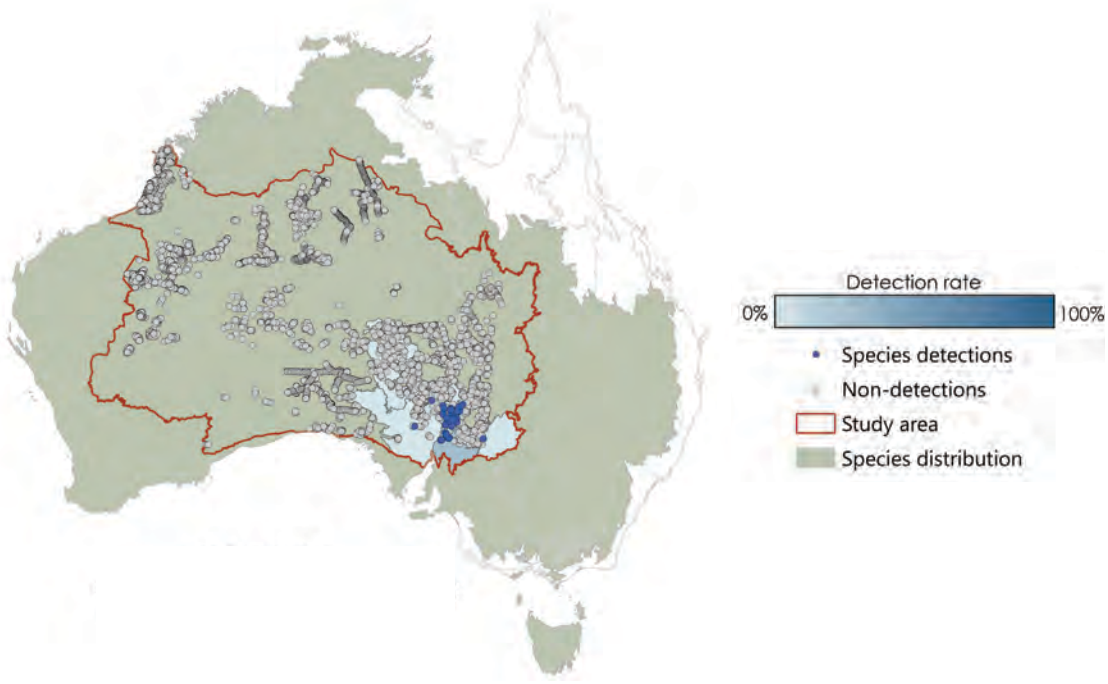
- Survey during good conditions (not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell goat tracks apart from other species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Arid Zone Monitoring project findings

Goat distribution and detection rates

Goats were introduced to Australia with the First Fleet and were taken to inland areas by early settlers, miners and construction workers as a source of meat and milk. They were allowed to roam freely, became feral and are now present in over 25% of the continent and some islands. There are around 2.3 million feral goats in Australia, mostly in semi-arid parts of WA, western NSW, southern SA and SW Qld.

The map shows the detections of goats in the AZM dataset. Goats have been detected in the south-eastern deserts, where the bioregions are shaded blue. Each blue dot is a survey site where goats were recorded. The grey dots show all the other sites that were surveyed, but where goats were not recorded. Goats were detected at less than 1% of all surveys in the AZM dataset. The information about the overall distribution in the map background is taken from Australian Faunal Directory (ABRS)[1]. Note that although the range is shown to cover most of the continent, goats are rare in the tropics and through the central part of the deserts.



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It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

Centre for Invasive Species Solutions - Moral code of practice for the humane control of goats
https://pestsmart.org.au/toolkit-resource/code-of-practice-feral-goats/#:~:text=Feral%20goat%20control%20techniques,during%20control%20or%20eradication%20programs

References

[1] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021.

Threatened Species Recovery Hub
National Environmental Science Programme

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Goat, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Donkey and horse

Donkey is *Equus asinus* • Horse is *Equus caballus*

Language names

Donkey: Kumppu, Kuwarta , Kwertengele, Mankirrikirrijuwal, Tangkeye, Tangkiyi, Tungki, Rtangkeye

Horse: Naantja, Nanthwe, Nyanytju, Nantuwu, Purni, Timana, Yawarta

Donkey: Introduced species
An invasive herbivore, noted in the key threatening process (Novel biota and their impact on biodiversity) listed under national environmental law (the EPBC Act).

Horse: Introduced species
An invasive herbivore, noted in the key threatening process (Novel biota and their impact on biodiversity) listed under national environmental law (the EPBC Act).

Feral donkeys in the Kimberley.

Feral horses.

Donkey tracks in soft sand. Arrow shows the direction the donkey is moving.

Horse tracks in wet sand. Arrow shows the direction the horse is moving.

Impacts

- Damage to plants (curly pod wattle, bean tree, quandong, plumbush and supplejack) and wetlands.
- Damage to cultural sites.
- Compete with wildlife for food.

Animal Description

Donkeys usually weigh around 300 kg and have different coat colours.

Horses are a bit larger than donkeys, and can weigh about 500 kg. They also have many different coat colours.

Habitat

Feral donkeys prefer hilly country. They can eat rougher vegetation than horses, and don't need water holes quite as much. Feral horses live in grasslands and shrublands with plenty of water. Both can travel further away from water than cattle.

Tracks

Donkeys and horses walk on one toe – their hoof is like the end of our middle finger. Donkey tracks are longer and narrower than horse tracks.

Donkey and horse scats

Donkey scats are roughly oval shaped pellets, which are green and moist when fresh. They are smaller than horse scats, and are usually around 5cm wide.

Horse scats are a usually in a pile of roughly round firm balls with a glossy shine. Fresh scats are olive green and consist of grassy material. Horse scats are quite large (12-18cm across).

Donkey scat.

Horse scat.

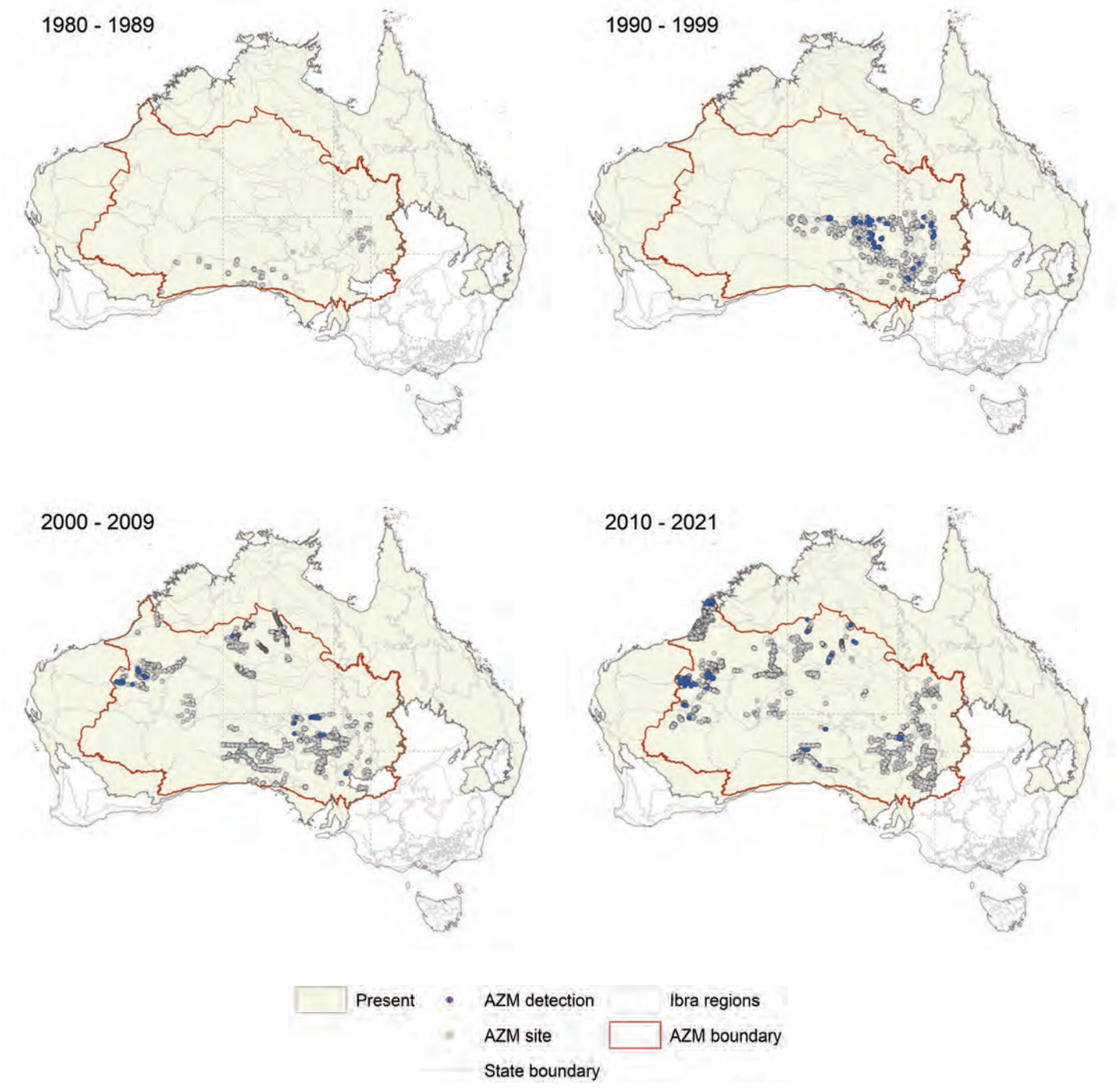
Erosion caused by horses in central Queensland.

Damage (removal of native plants and tracks through country) caused by horses in central Australia.

Arid Zone Monitoring project findings

Donkey distribution

The maps below summarise the detections of feral donkeys in the AZM dataset. They show that donkeys are found scattered throughout central Australia. Each blue dot is a survey site where donkey were recorded in that decade. The grey dots show all the other sites that were surveyed in that decade, but where donkeys were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1].



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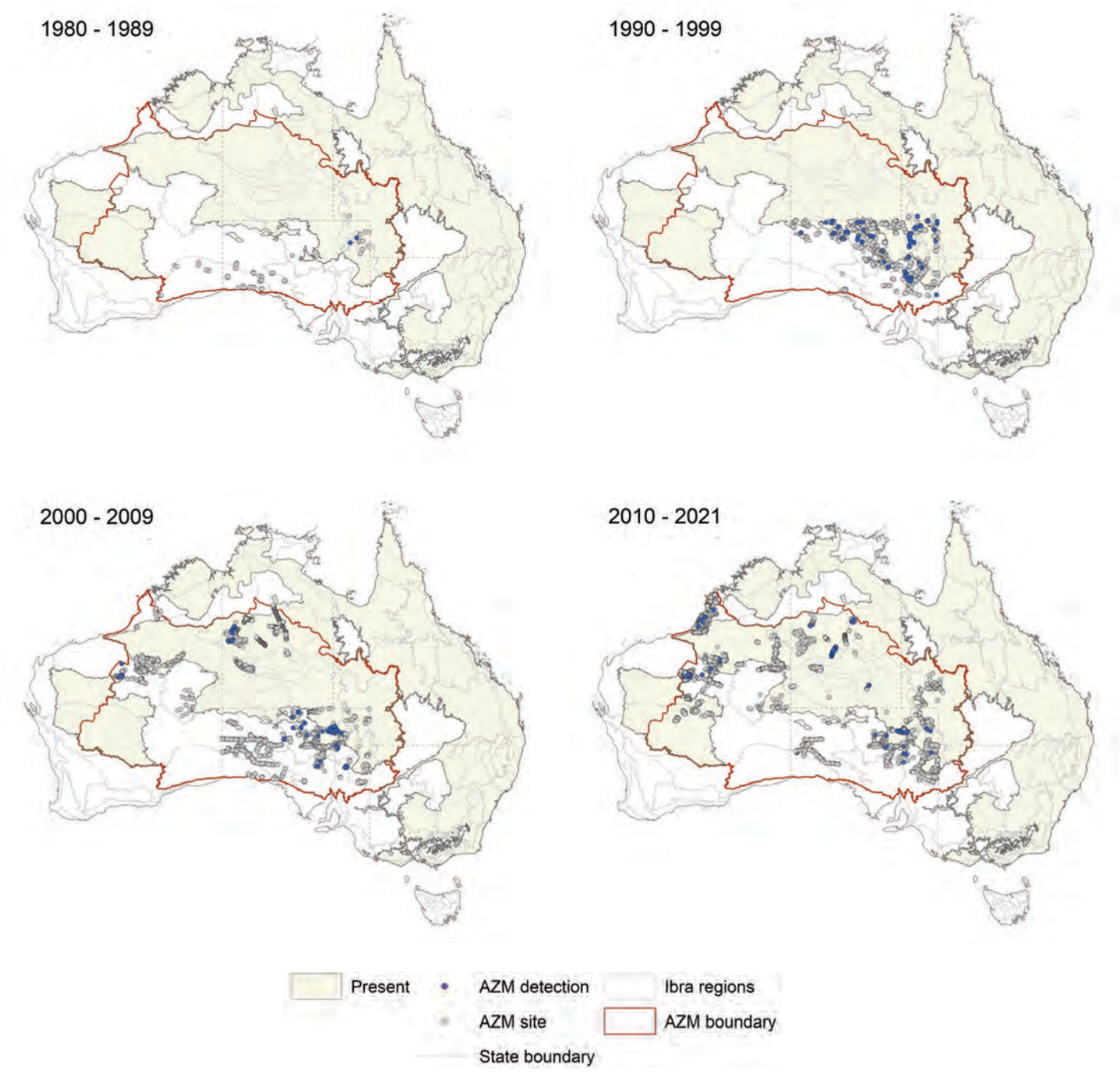
It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Horse distribution

The maps below summarise detections of feral horses in the AZM dataset. They show that horses are found scattered throughout central Australia and have been detected wherever people have surveyed since the 1980s. Each blue dot is a survey site where horses were recorded in that decade. The grey dots show all the other sites that were surveyed in that decade, but where horses were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1], and the AZM data suggests that the horses are found more widely than suggested by the Australian Faunal Directory.



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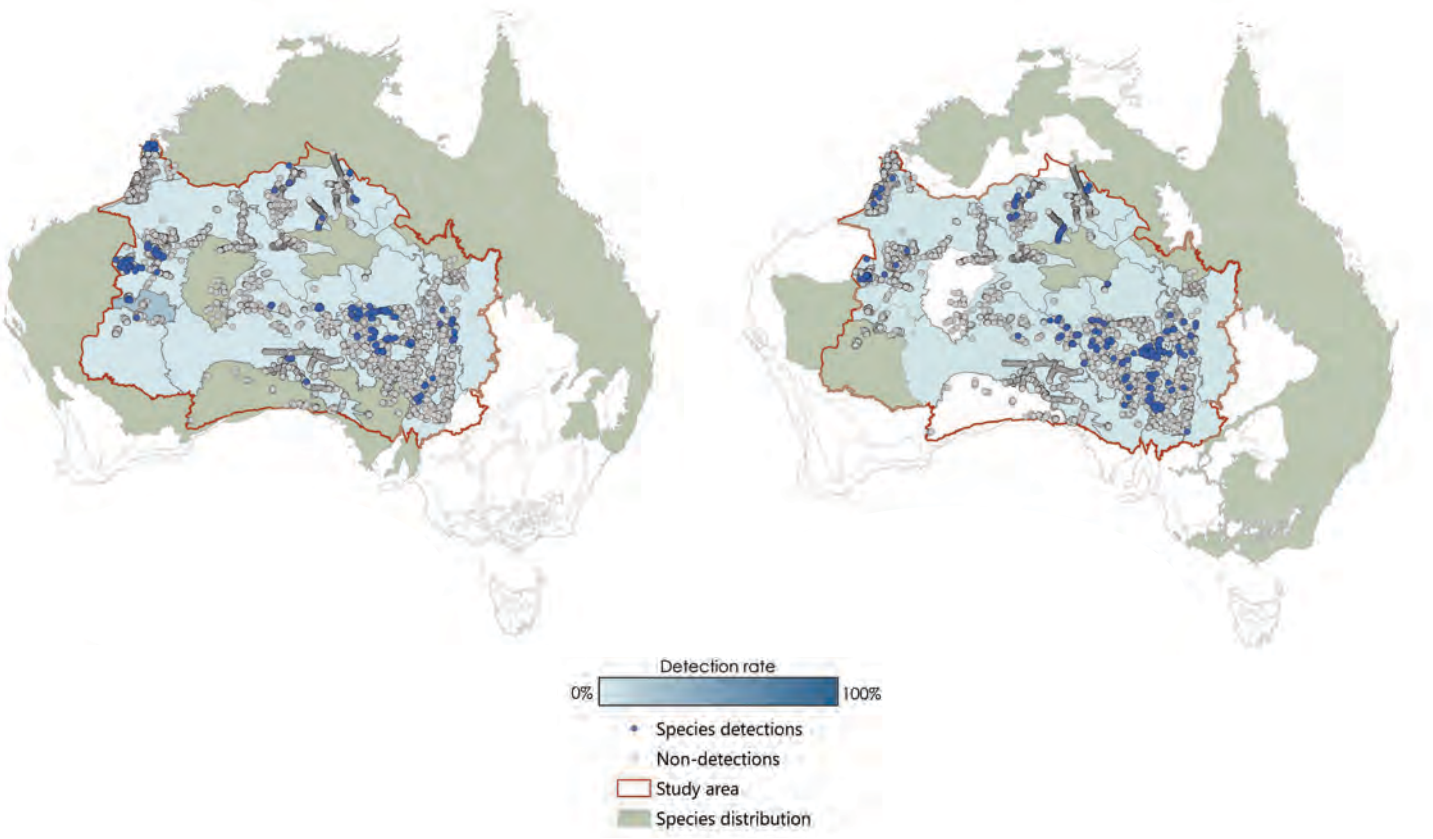
It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Donkey and horse detection rates

Horses and donkeys were each detected in almost 2% of all surveys in the AZM dataset. Horses were the 16th most commonly recorded mammal species, and the 6th most frequently recorded introduced mammal species. Donkeys were the the 17th most commonly recorded mammal species, and the 7th most frequently recorded introduced mammal species.

The maps below shows the average detection rate of donkeys (left) and horses (right) across all surveys carried out in each bioregion, since the 1980s. Detection rates for both species are similar throughout the project area.



Average detection rate of donkeys (left) and horses (right) across all surveys since the 1980s

Things to think about when surveying for donkeys and horses

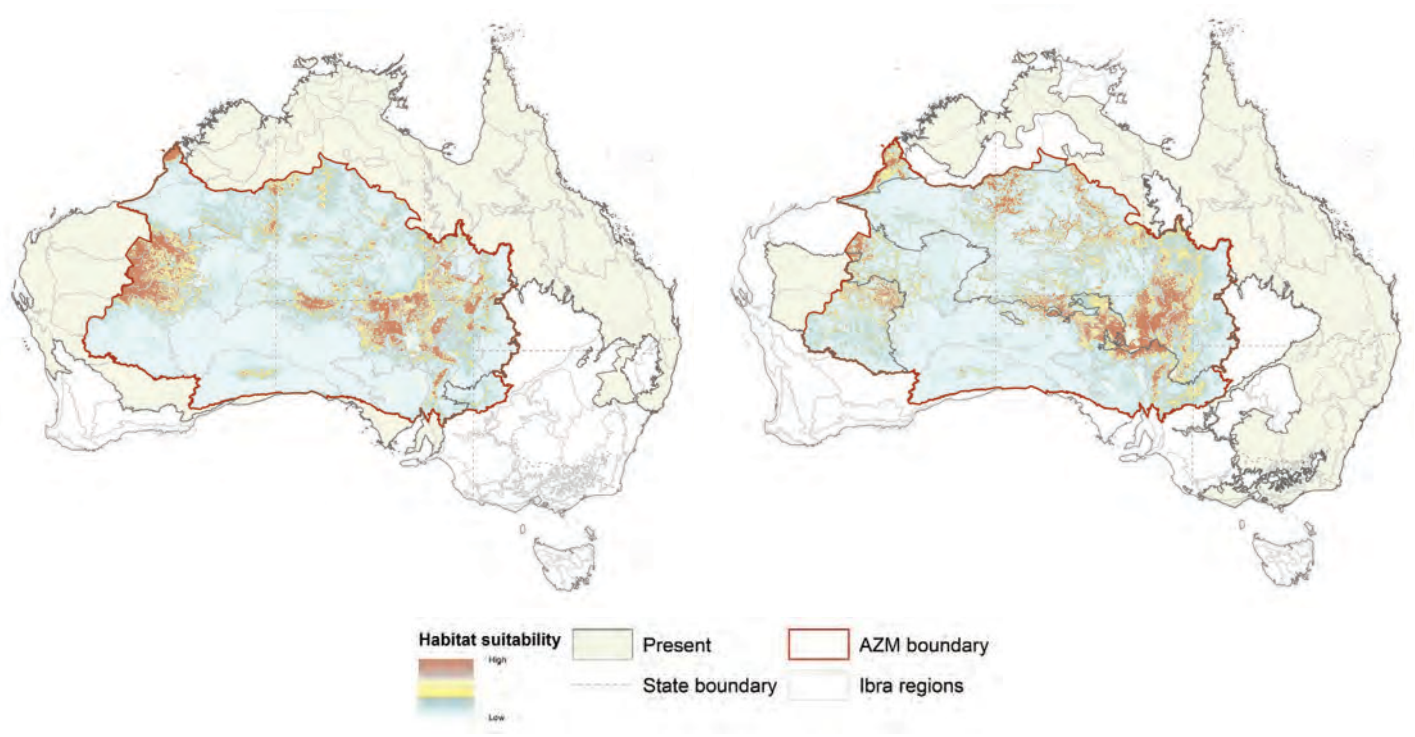
- Survey during good conditions (not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell donkey and horse tracks and scats apart from those of camels and other animals before you go to survey.
- Donkey and horse tracks and scats are easy to see, and last a long time on the sand surface. It's important to record the age of sign (e.g. less than a week old, older than a week) to help understand changes in detection rates.
- Pay attention to finding signs around water sources as donkey and horses will gather for a drink.
- If you want to see see changes over time, you will need to go back to the same areas to sample over several years. If you want to if management actions (culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Donkey and horse habitat suitability

Habitat suitability models can tell us about where donkeys and horses are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The models suggest that both donkeys and horses are more common in areas with a more monsoonal climate, as well as areas of low elevation close to water. The maps below shows us where we can expect to find donkeys (left) and horses (right), where the map shading is reddish brown.

The maps only show habitat suitability inside the AZM project boundary, but donkeys and horses are also found outside the project area, in the pale beige part of the map and might be common in these places too. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Habitat suitability model for donkeys (left) and horses (right).

Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Donkey and horse, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Cow

Bos taurus, Bos indicus

Language names

Maranpala, Pweleke, Puluka, Puluku, Purluman, Pulimanu

Introduced species

Feral bull in central Australia.

Waterhole damaged by cattle trampling.

Impacts

- Damage to country (trampling, compaction, soil damage and erosion)
- Compete with native species for food and water
- Foul waterholes and waterways (increased nutrients and sediments)
- Spread weeds (through dung)

Animal Description

Cows are large and muscular animals with a small head and long snout. Some have horns. Cows vary in colour but are commonly grey, red-brown or white. Females are generally smaller than males; bulls can reach nearly one tonne.

Cow hoof print.

Cow tracks in hard sand.

Cow tracks in soft sand.

Fresh cow scat.

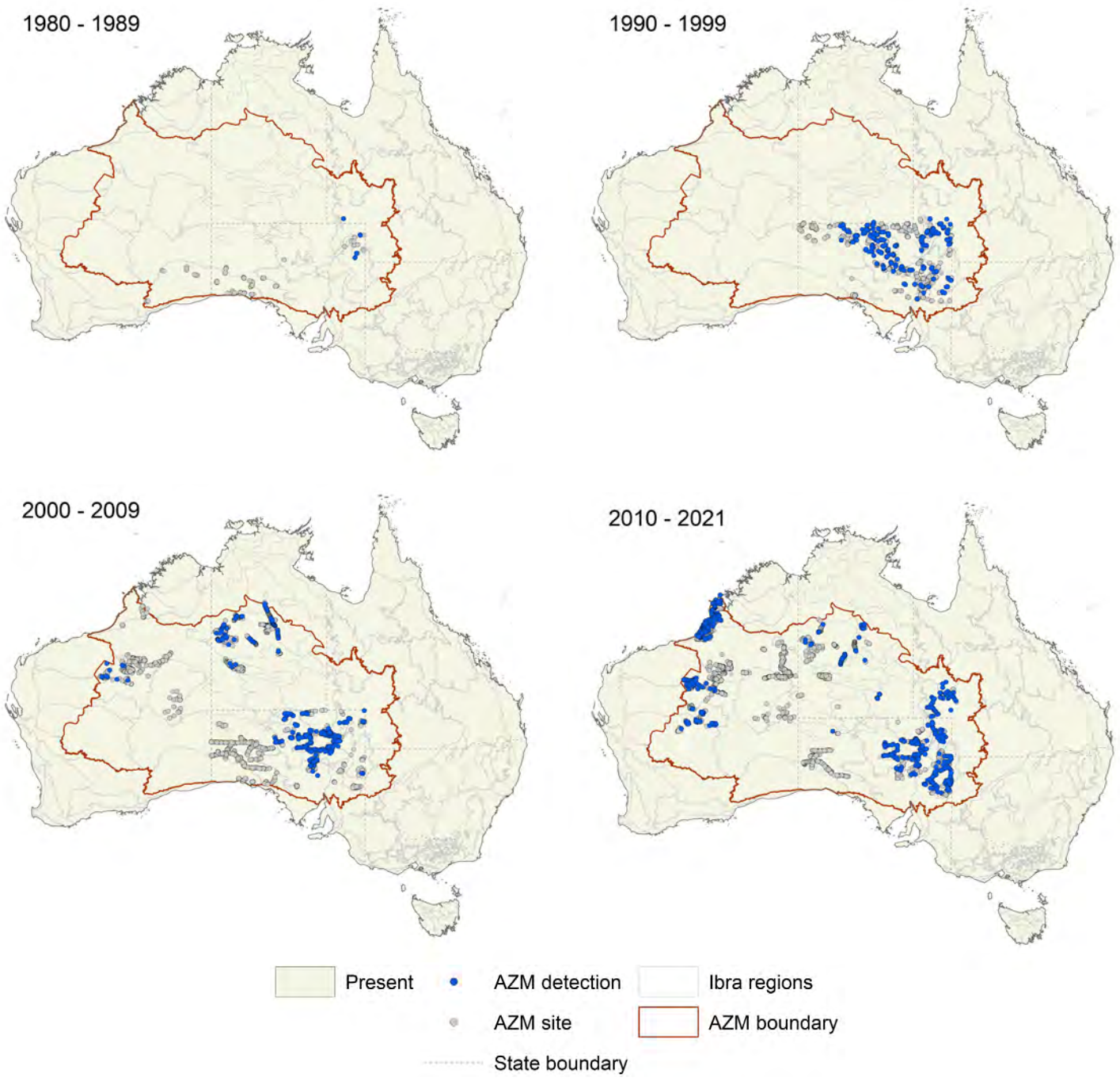
Old cow scat.

Arid Zone Monitoring project findings

Cow distribution

Cows (dairy and beef) were introduced to Australia in 1788 with the First Fleet. Managed herds of cattle occur in all states and territories of Australia and number about 25 million. There are also an unknown number of feral cattle, which have escaped domestic herds and are living wild.

The maps below summarise the detections of cows over time in the AZM dataset. They show that cows are found in many parts of central Australia, and have been detected wherever people have surveyed, since the 1980s. Each blue dot shows a survey site where cows were recorded in that decade. The grey dots show all the other sites that were surveyed, but where cows were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and researchers. The information about the overall distribution in the map background is taken from Australian Faunal Directory[1].



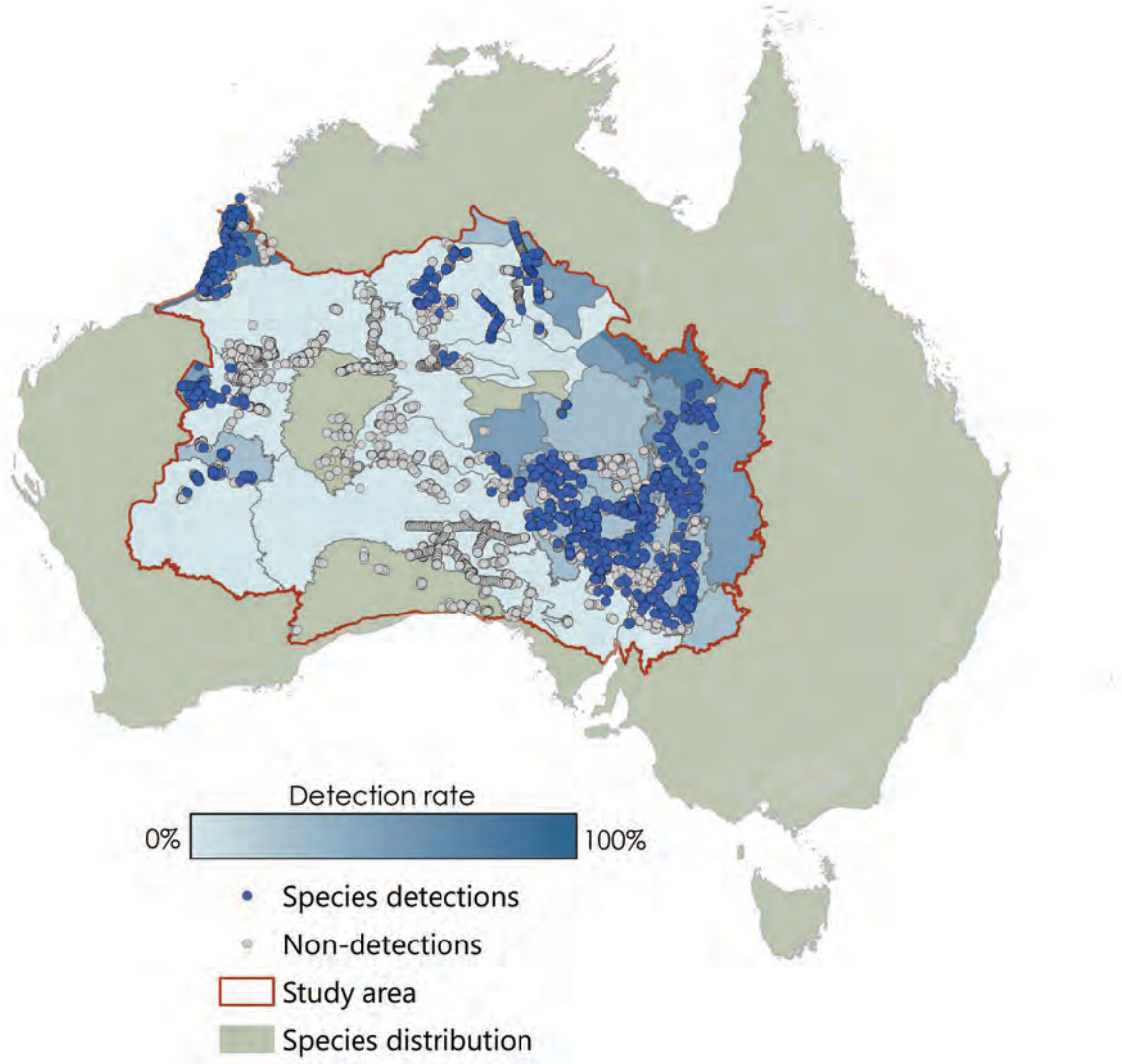
The maps above are based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Cow detection rates

Cows were detected in over 14% of all surveys in the AZM dataset. Across the whole AZM project dataset, cows were the 7th most frequently recorded mammal, and the 5th most common feral mammal species.

The map below shows the average detection rate for cows across all surveys carried out in each bioregion, since the 1980s. Detection rates have been higher in the eastern part of the project area, and in the far northwest (deeper blue shading), which are closer to cattle production areas.



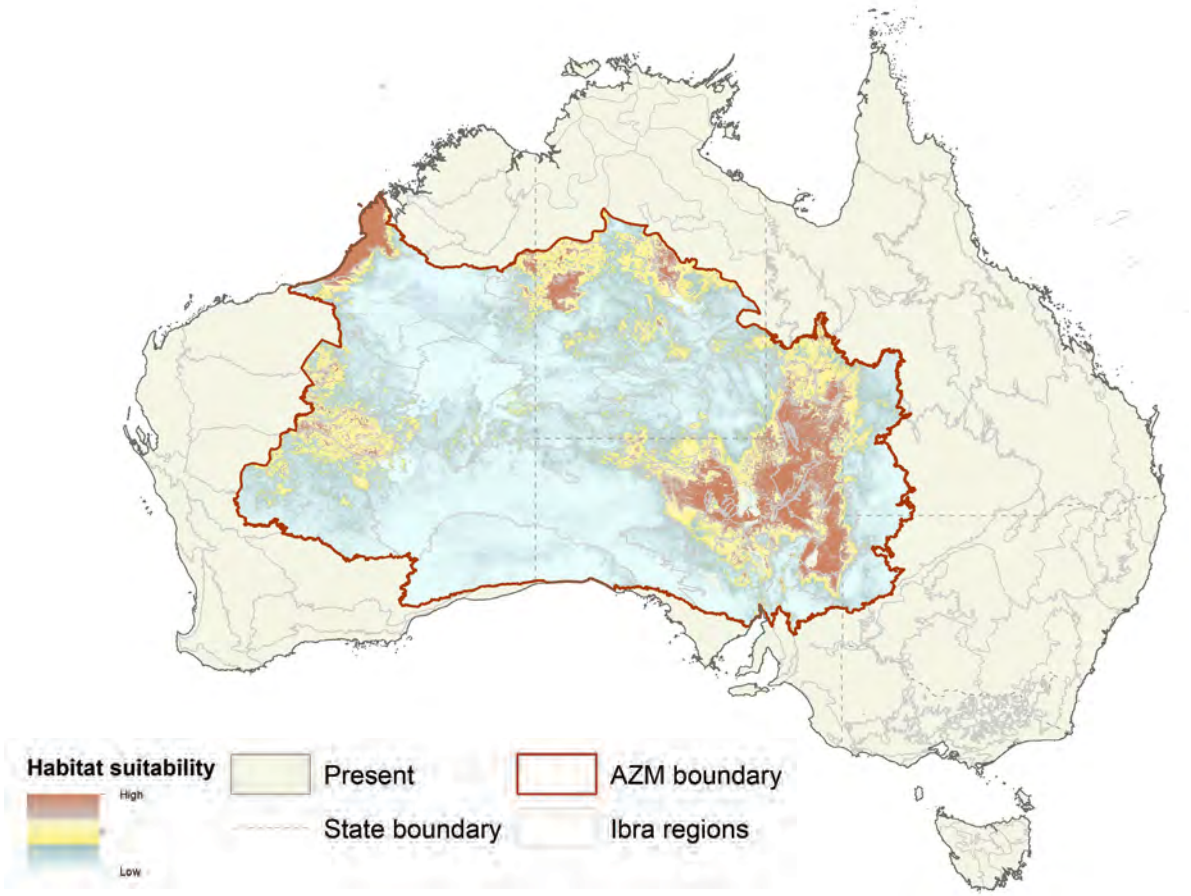
Things to think about when surveying for cows

- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell cow tracks apart from other species before you go to survey.
- Record the age of the sign, because cow tracks and scats can hang around for a long time and make cows seem more common than they really are.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Cow habitat suitability

The habitat suitability model can tell us about where cows are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that cows prefer areas of low elevation and moderate rainfall; in drier areas they need to be close to water. The map shows us cows are more likely to be found in the east, and the northern fringes of the deserts. The map only shows habitat suitability inside the AZM project boundary, but cows are also found outside the project area, probably in higher densities. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

Arid Zone Monitoring project:
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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Cow, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Camel

Camelus dromedarius

Language names

Artep mpwer, Auru, Kaajuwal, Kamala, Kamula, Kamule, Kamurl, Kamwerl

An invasive herbivore, noted in the key threatening process (Novel biota and their impact on biodiversity) listed under national environmental law (the EPBC Act). Was the subject of a national Feral Camel Action Plan from 2010, developed under the Australian Pest Animal Strategy.

Camel.

Camel scat.

Camel tracks in dried mud.

Camel tracks in soft sand. Arrow shows the direction the camel is moving in.

Impacts

- Damage to plants (curly pod wattle, bean tree, quandong, plumbush and supplejack) and wetlands.
- Damage to cultural sites.
- Compete with native animals for food.
- Damage to buildings, fences, and safety risk.

Animal Description

Camels are very large, weighing around 500 kg. Their dry or cool season coat is longer and darker than the wet or warm season coat.

Habitat

Camels are specialised desert animals, with adaptations to survive without daily access to water.

Camel scat

Camels produce round pellets, usually in large numbers. The pellets have bits of plant material in them.

Camel tracks

Tracks are very large and rounded, with a large gap between two pads at the front and back.

Animals that might be confused with the camel during survey

- Horse
- Donkey

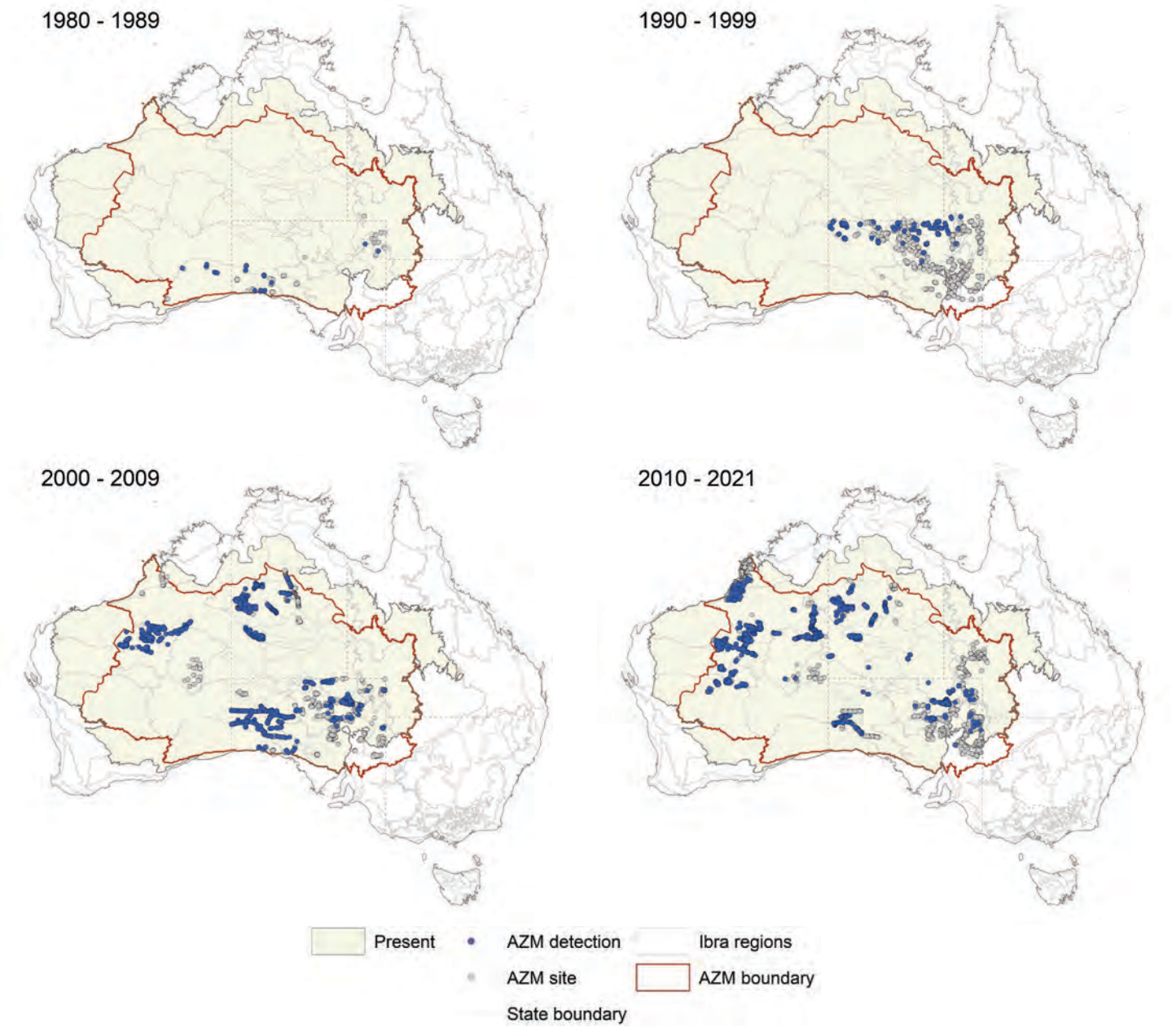
To tell the difference between these species, check the size of the tracks because camel tracks are much larger. Also the camel track has a large gap between two rounded toe pads. Donkeys and horses have an obvious "complete" hoof print that does not have separate toe pads.

Arid Zone Monitoring project findings

Camel distribution

Camels were introduced to Australia in the mid-1840s from Afghanistan and India to help with transport. When cars and trucks became used instead, from the 1920s, many camels were let go in the deserts, becoming feral. They quickly spread across central Australia. Camels can eat most desert plants and can go for a long time without water. This means they can reach almost all parts of all the deserts.

The maps below summarise the detections of feral camels over time in the AZM dataset. They show that camels are found throughout central Australia and have been detected wherever people have surveyed since the 1980s. Each blue dot is a survey site where camels were recorded in that decade. The grey dots show all the other sites that were surveyed in that decade, but where camels were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1].



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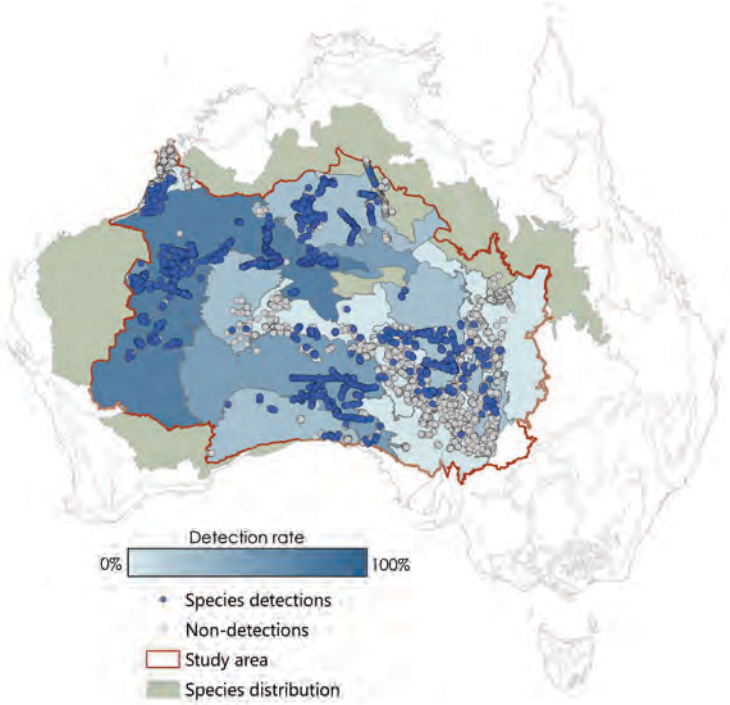
It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, please let us know.

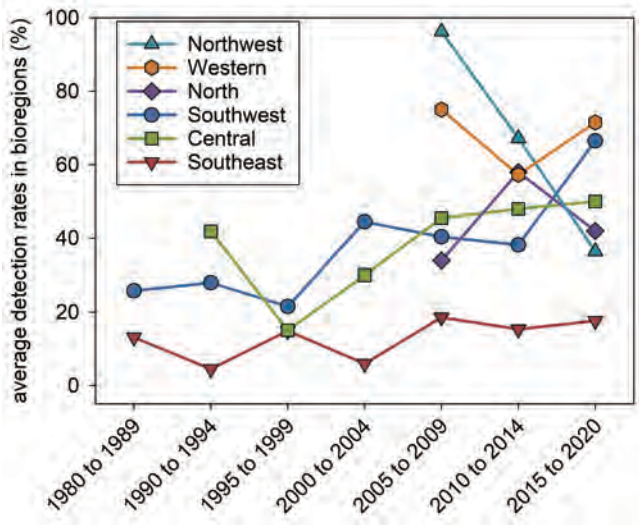
Camel detection rates

Camels were detected at 27% of all surveys in the AZM dataset. Camels were the fourth most frequently recorded mammal species, behind rabbits, dingoes and cats.

The map below shows the detection rate of all surveys carried out in each bioregion, since the 1980s. Detection rates for camels are higher in the north-western and western deserts (deeper blue shading) compared with elsewhere. This pattern is also shown in the graph, which shows the average detection rates in north-western and western desert bioregions has mostly been higher over the past 20 years, than in other regions. The graph also suggests that detection rates for camels in the northwest may have decreased in the last ten years. This might be because the national camel control program removed many camels from that region early in the last decade. A more detailed analysis of camel detections at a subset of AZM sites that were revisited over five or more years, shows that camel detections are not strongly affected by fire, nor the amount of green vegetation available. Camel detections are lower when rain has fallen in the last month, probably because the rain washes away older tracks.

Camel tracks and scats are easy to see, and last a long time on the sand surface. This can make camels look more common than smaller species whose sign does not last as long. That is why it is important to record the age of sign (e.g. less than a week old, older than a week) to help understand changes in camel detection rates.





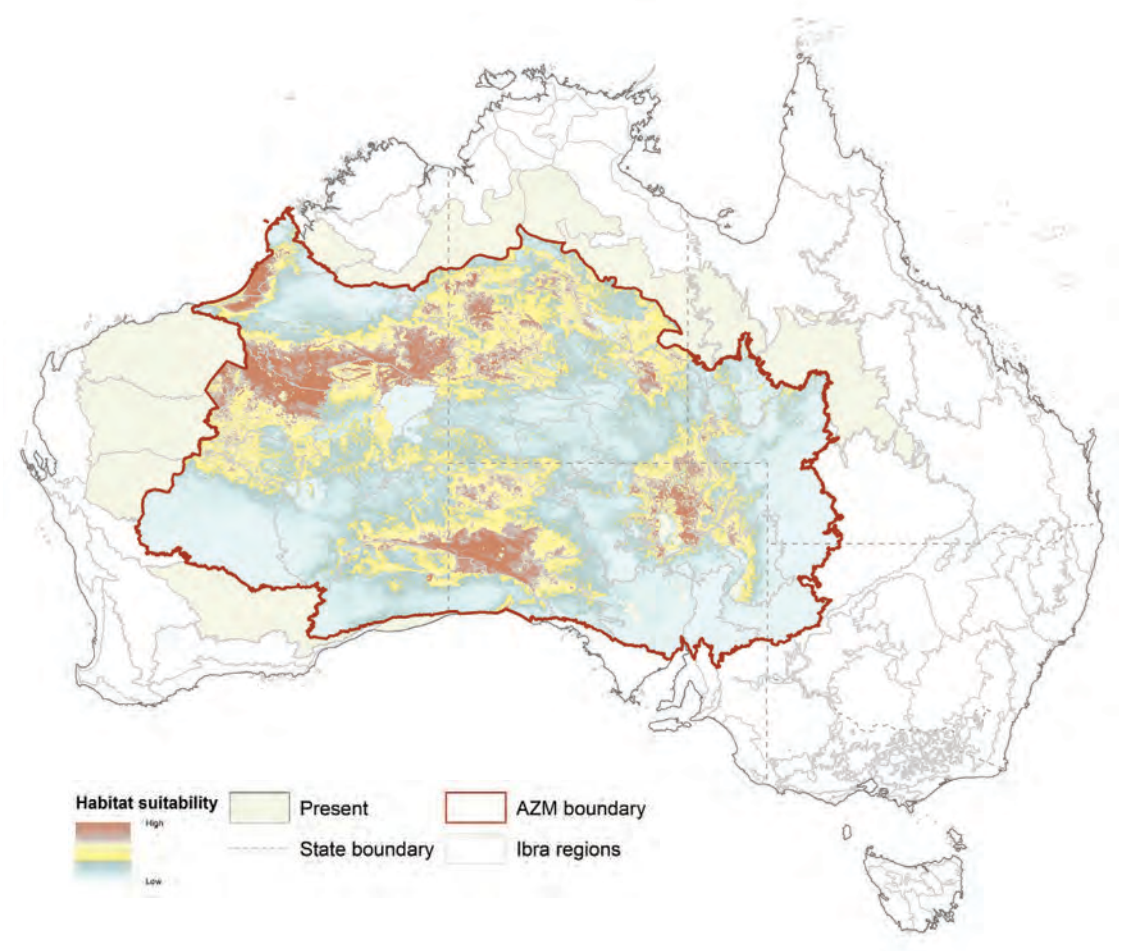
Things to think about when surveying for camels

- Survey during good conditions (not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell camel tracks apart from other species such as horses and donkeys before you go to survey.
- Record the age of camel sign.
- Pay extra attention to finding signs around water sources as camels will gather for a drink.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Camel habitat suitability

The habitat suitability model can tell us about where the camel is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that camels are more common in areas of high average temperature and low rainfall. The map shows us that we can expect to find camels in all parts of the desert, and that they might be more common in some parts of South Australia and Western Australia, where the map shading is reddish brown. The map only shows habitat suitability inside the AZM project boundary, but camels are also found further north and west, in the pale beige part of the map and might be common in these places too. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert and the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Camel, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Bush stone-curlew

Burhinus grallarius

Language names

Arepirlpe, Ilere, Ngamirliri, Pmilyura, Pmwelyarre, Wilu, Wiluru, Wirntiki

National status in the EBPC Act: Not listed

IUCN Red List: Least concern

Bush stone-curlew pair with young.

Bush stone-curlew tracks (arrow shows which the curlew is moving).

Animal Description

Bush stone-curlews are large, slender birds with grey to brown plumage, long legs and a long bill. They make loud haunting calls at night. The bush stone-curlew is seen singly, in pairs, or during the breeding season, in small flocks. They may be quiet and wary during the day, when they rest in the shade. If defending a nest, they make bold threat displays.

Key threats

Although bush stone-curlews are not nationally threatened, they have become rare in parts of their range, especially in south-eastern Australia, mainly because of losing habitat, and being hunted by foxes and cats.

- Habitat being lost and changed
- Too much grazing by feral herbivores (livestock, rabbits and mice)
- Climate change (changing rainfall, temperature, droughts)

Habitat

The bush stone-curlew is common in the tropics and rare and declining in southern Australia. It occurs in different types of country, including open forest, woodland, grassy plains, arid areas and along inland creeks and rivers, but prefers areas with intact woodland and ground habitat.

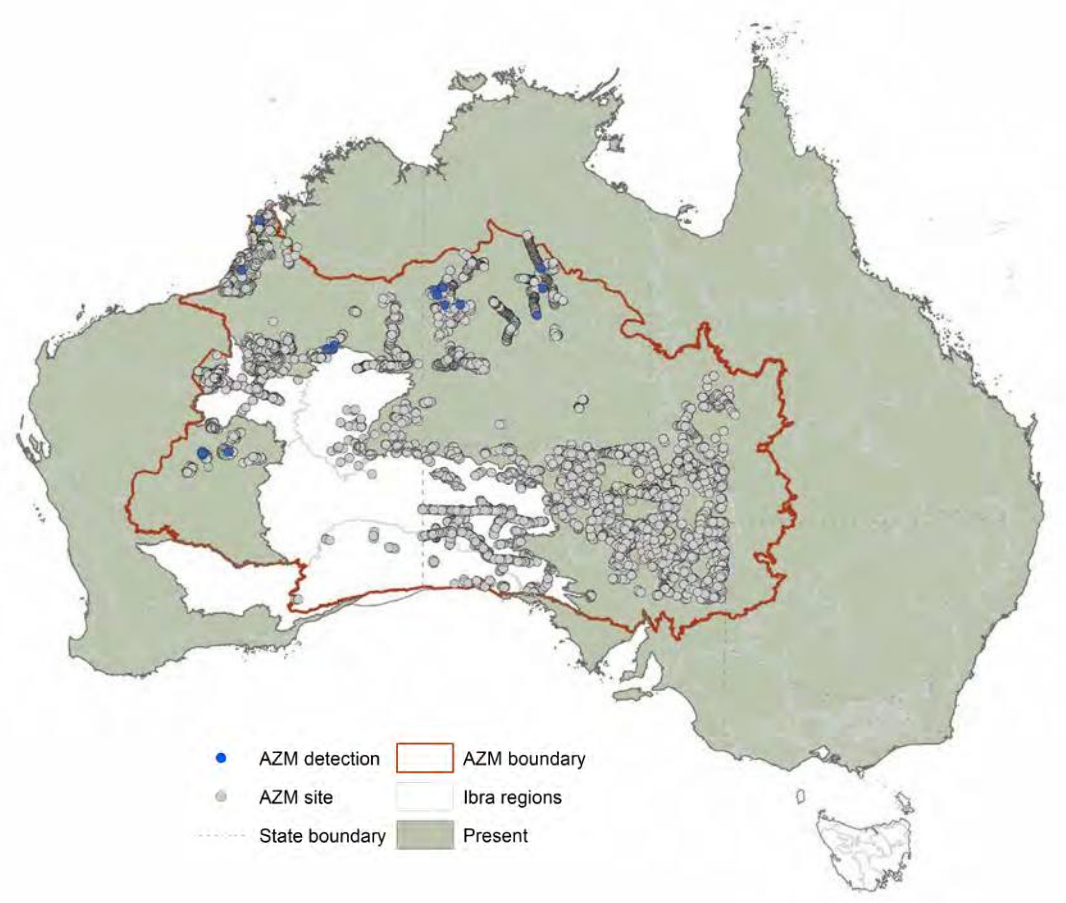
Bush stone-curlew tracks

The prints of bush-stone curlews have three forward pointing toes with no back toe visible.

Arid Zone Monitoring project findings

Bush stone-curlew distribution

The map summarises the detections of bush stone-curlews over time in the AZM dataset. It shows that there are relatively few records of the bush stone-curlew (only 20 out of nearly 15,000 records are of bush stone-curlews), and that most of these have been made in northern and western deserts. Each blue dot shows a survey site where bush stone-curlews were recorded. The grey dots show all the other sites that were surveyed, but where bush stone-curlews were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. Bush stone-curlews are also found outside the AZM project area, in the northern savannas of WA, NT and QLD, SE Queensland and in parts of NSW and Victoria (the shaded areas of the map). The information about the overall distribution in the map background is taken from Australian Faunal Directory[1].



The map above shows data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Further information

Arid Zone Monitoring project:

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Australian Faunal Directory. https://biodiversity.org.au/afd/home. Accessed June, 2021.

Threatened Species Recovery Hub

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Bush-stone curlew, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Malleefowl

Leipoa ocellata

Language names

Gabiny, Gnow, Nganamara, Ngarnamarra, Warntu

National status: Vulnerable

IUCN Red List: Vulnerable

Malleefowl.

Animal Description

The malleefowl is a large bird that lives on the ground. Its feathers are mottled grey, cream and rufous. Its grey head and neck, has a brown throat with a black line like a neck tie. Malleefowl are shy and hard to see.

Key threats

- Habitat change from too much grazing by feral herbivores (e.g. livestock, camels, goats, rabbits)
- Wrong-way fire (too often, too intense, too big)
- Predation by cats and foxes
- Climate change (changing rainfall, temperature, droughts)

Habitat

Malleefowl like dry, open forest and mallee country in arid and semi-arid areas. They need sand and lots of leaf litter to build mounds for breeding. They feed on seeds, flowers, fruit, herbs, insects, tubers and fungi. Malleefowl are sensitive to fire – they don't live in places that have burnt in the last few years. Frequent fire can damage their habitat, take away the leaf litter they need for nesting and their food supplies, and also makes them more prone to being hunted by cats and foxes.

Malleefowl mounds

Malleefowl build mounds to incubate their eggs. Looking for mounds that are being cared for by the birds is the best way to know if malleefowl are on country. Male birds look after the mounds, which are to 5 m in diameter and 1 m high, and are made up of sand, leaves bark and twigs. Mounds will have different shapes, depending on whether they are active or not.

Malleefowl will tend to use the same mounds for a few years. Sometimes, they build new mounds, so it is good to check areas for new mounds every 5-10 years.

Malleefowl mound.

Malleefowl mound (with leaf litter).

Malleefowl tracks

Malleefowl have a three-toed print, usually 10-12 cm long.

Malleefowl tracks (arrow shows which way it is going).

Malleefowl tracks (arrow shows which way it is going).

Animals that might be confused with malleefowl during survey

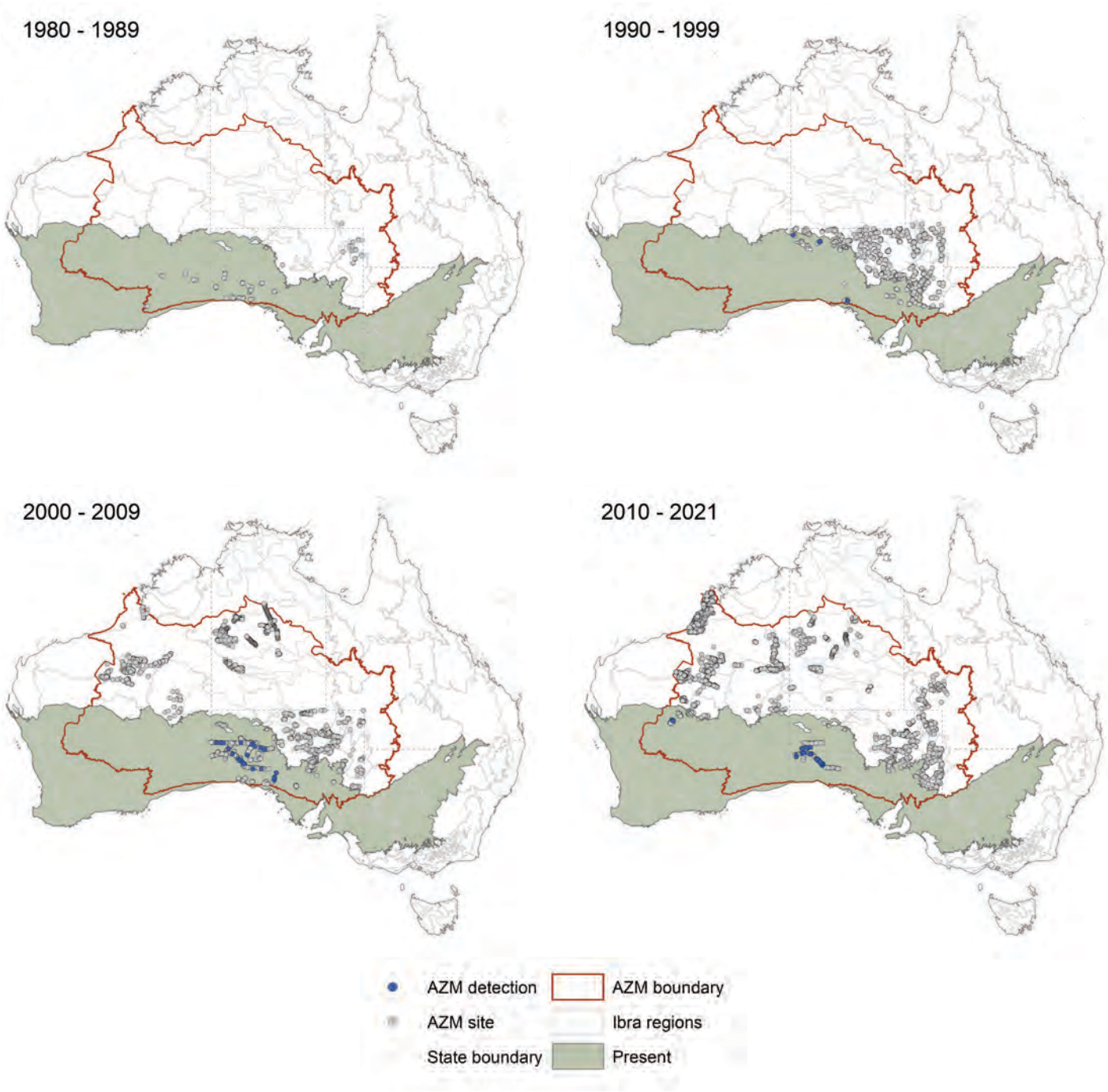
- Bustards
- Crows

Malleefowl walk like supermodels, with each foot placed directly in front of the other one. Bustards also walk like supermodels, but don't have a back toe print. Malleefowl tracks could be confused with crow tracks, except that malleefowl tracks are larger, with straight toes that are splayed wider apart. The profile on 'birds' has pictures of the tracks from these and other bird species.

Arid Zone Monitoring project findings

Malleefowl distribution

The maps show the malleefowl detections in the AZM dataset over time. Each blue dot shows a survey site where malleefowl were recorded that decade. The grey dots show all the other sites that were surveyed in that decade, but where malleefowl were not recorded. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1]. Malleefowl used to occur across most of the southern desert country (all the shaded bioregions on the map). Since European colonisation, they have disappeared from large parts of their range and hang on now in small patches.



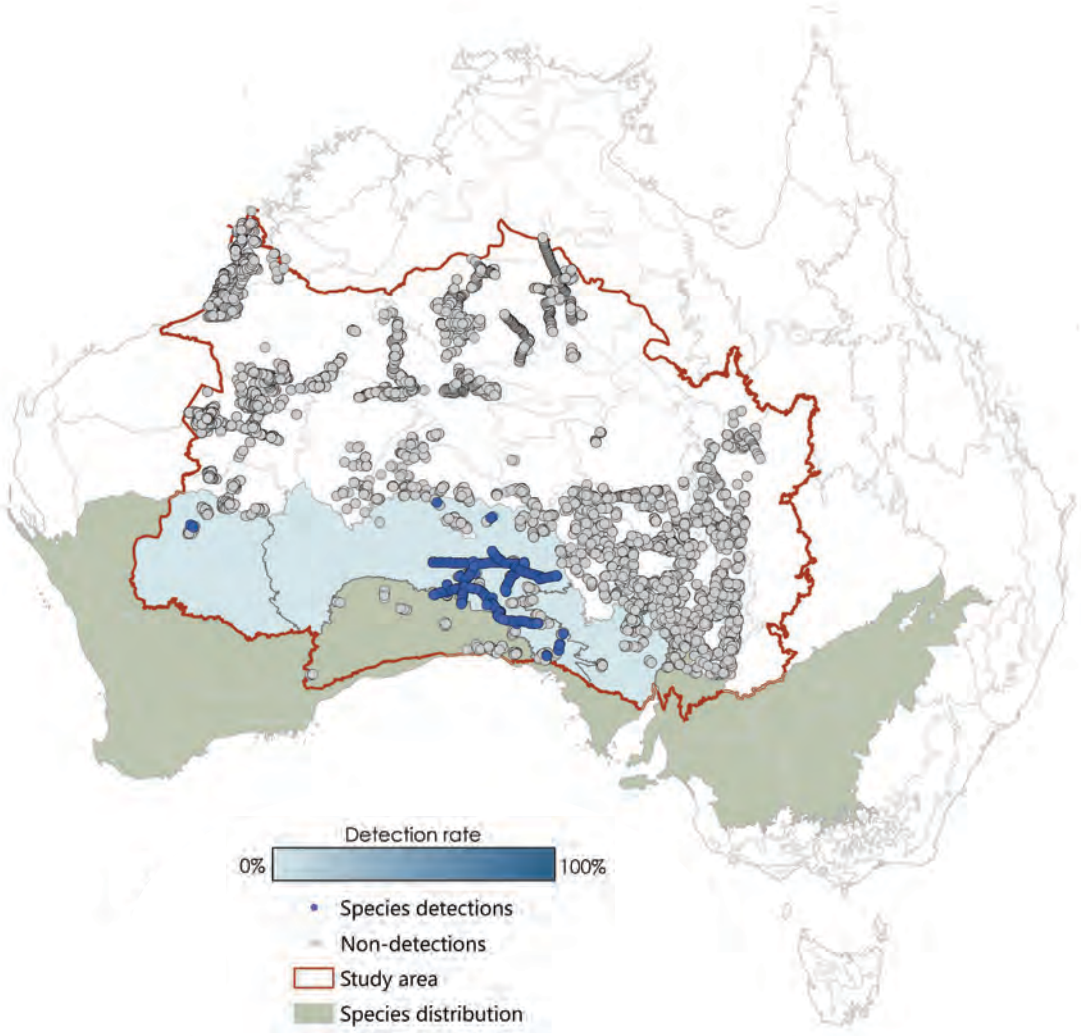
The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Malleefowl detection rates

Malleefowl were detected at less than 1% of all surveys in the AZM dataset. They were the third most commonly recorded bird species in the dataset.

The map shows the detection rate for malleefowl across all surveys carried out in each bioregion, since the 1980s. Detection rates have been similar from east to west (blue shading is the same).



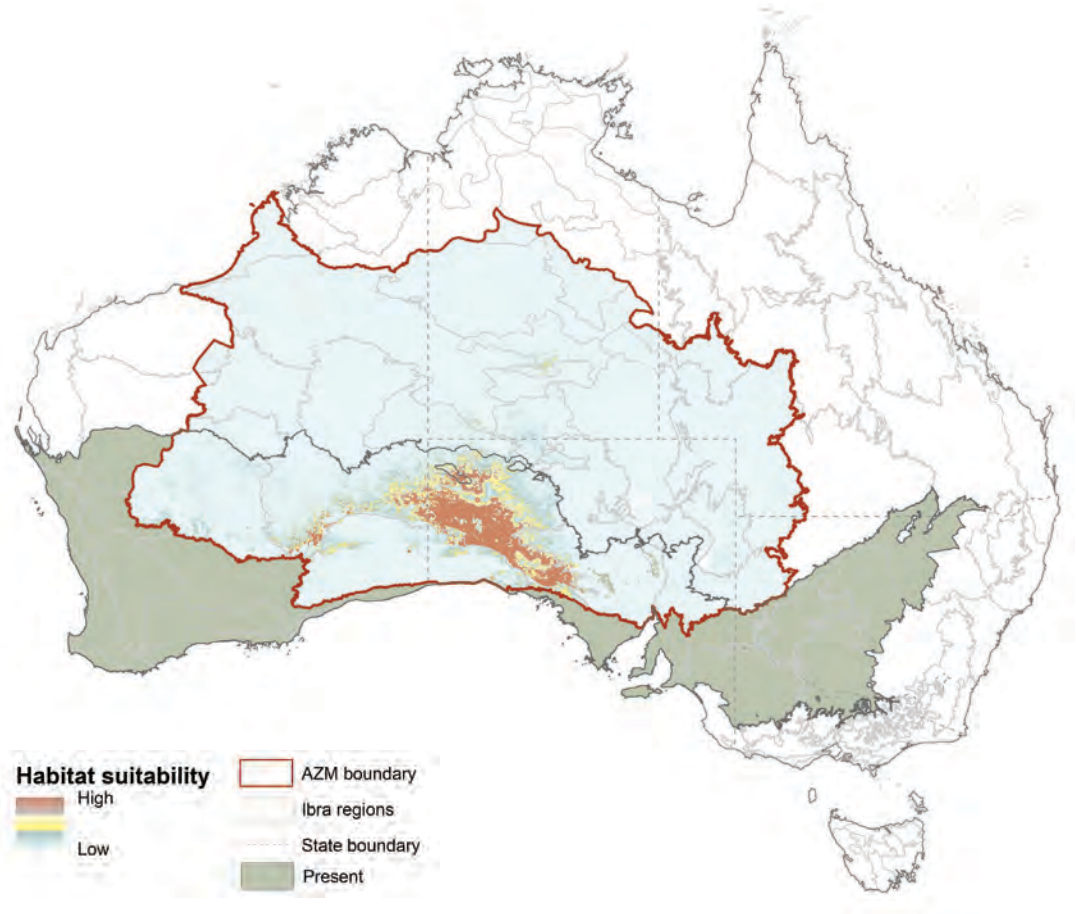
Things to think about when surveying for malleefowl

- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell malleefowl tracks apart from other birds before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (such as right-way fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.
- If you find active malleefowl mounds on your country, the National Malleefowl Recovery Team would love to hear about it. They can help ranger groups collect information in the same way, to provide good information about population trends.

Malleefowl habitat suitability

The habitat suitability model can tell us about where malleefowl are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that malleefowl are mostly found in areas of cooler climates (<20 degrees Celsius) where soil has low clay content. These are the red-brown areas of the map in the Great Victoria Desert. The map only shows habitat suitability inside the AZM project boundary, but malleefowl are also found further outside the project area, in the darker shaded regions of the map. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in the western part of the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

National Malleefowl Recovery Team: https://www.nationalmalleefowl.com.au/

National Malleefowl Monitoring Manual:
https://www.nationalmalleefowl.com.au/wp-content/uploads/2020/08/Monitoring-Manual-v2020_1.pdf

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021.

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Malleefowl, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Australian Bustard

Ardeotis australis

Language names

Arengwerrpe, Artewe, Arwengerrp, Arwengerrp, Barnarr, Itua, Jirri, Jurlaka, Kiparra, Kurtinja, Nganurti, Parrayan, Parrkarra, Parulpa, Wardilyka

National status in the EBPC Act: Not listed

IUCN Red List: Least concern

Australian bustard (female).

Young Australian bustard.

Animal Description

Australian bustards are large ground-dwelling birds, up to 1 m tall with long pale legs. The adult male has a black capped head, grey face and neck, mottled brown body with black and white checks on the edge of wings, a black band across their creamy chest. The female is similar but smaller.

Australian bustards are not nationally threatened, but the IUCN Red List notes that the population is declining, and the species has disappeared from some parts in the south of its former range.

Key threats

- Habitat change from too much grazing by feral herbivores (livestock, camels, rabbits and mice)
- Predation by cats and foxes
- Wrong-way fire
- Climate change (changing rainfall, temperature, droughts)

Habitat

Australian bustards like open woodlands and grasslands, including sand plains with spinifex and semi-arid heath. They also like to hunt in recently burnt country. They can be seen on their own, in pairs or family groups.

They can move long distances in response to fire and rainfall, which affect their food supplies. They are omnivores and eat leaves, buds, fruit, frogs, lizards and insects (especially grasshoppers).

*One of the food plants of the Australian bustard, the moonflower (*Capparis spinosa*).*

*Spotted spur-throated locust (*Austracris basalis*).*

Australian bustard tracks

Australian bustards have three front-facing toes. They walk like supermodels, with their feet placed in front of one another, so the tracks appear in a straight line.

Bustard prints.

Bustard tracks in soft sand (arrow shows which way the bustard is moving).

Bustard tracks in sand (arrow shows which way the bustard is moving).

Animals that might be confused with the bustard during a survey

- Emu
- Malleefowl
- Bush-stone curlew

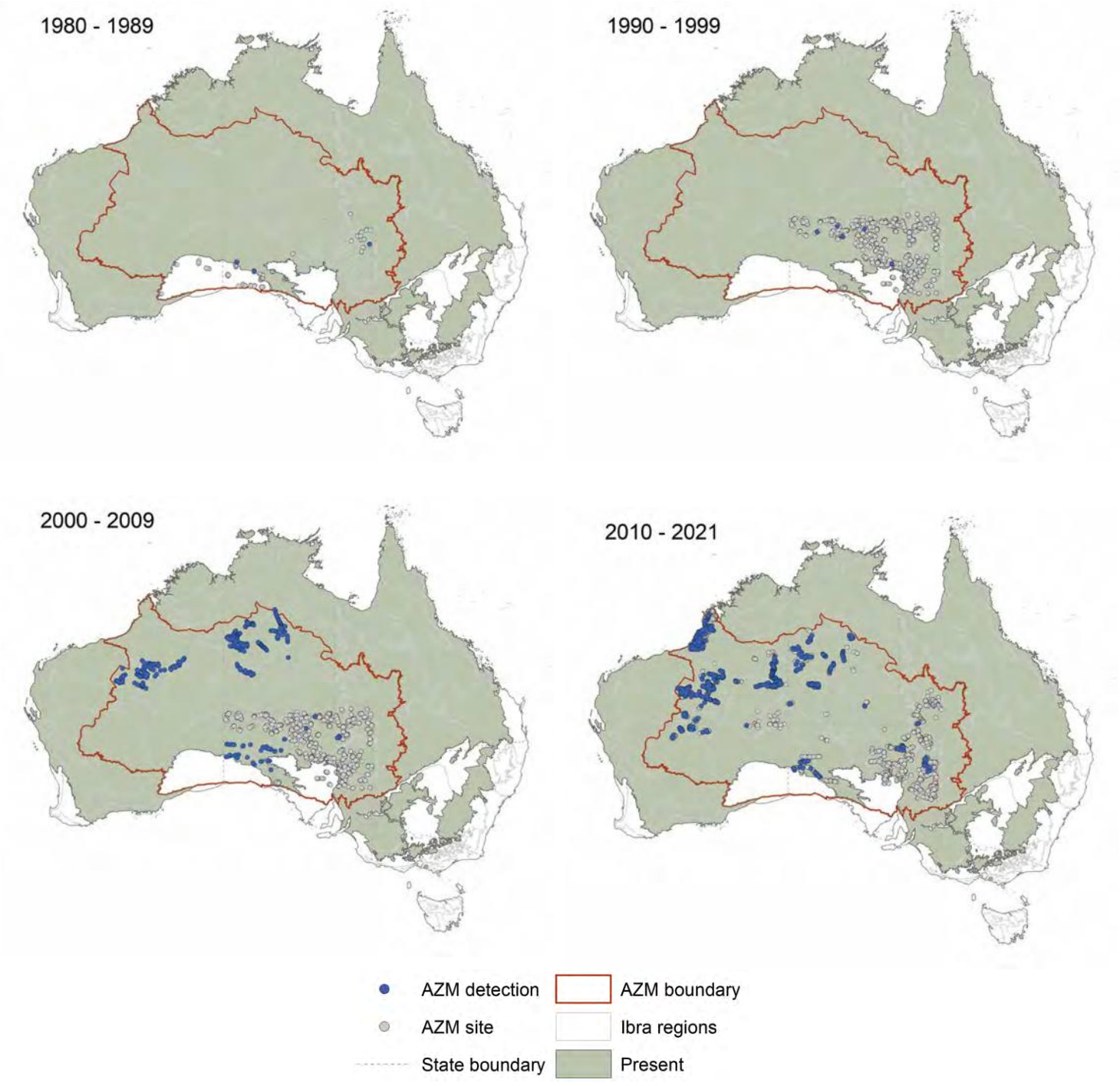
Emu have larger tracks (>120 mm long) with a long middle toe. Malleefowl tracks have a back toe. Bush stone-curlews have smaller tracks (45-60 mm long) with a narrow middle toe.

Australian bustard scat.

Arid Zone Monitoring project findings

Australian bustard distribution

The maps summarise the detections of bustards over time in the AZM dataset. They show that Australian bustards have been recorded across most parts of the deserts. Each blue dot shows a survey site where Australian bustards were recorded in that decade. The grey dots show all the other sites that were surveyed, but where Australian bustards were not recorded in that decade. Australian bustards are also found outside the AZM project area (all of the dark shaded bioregions on the map), but their numbers are declining in parts of southern Australia, and they are now mainly found in central and northern Australia. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from Australian Faunal Directory[1].



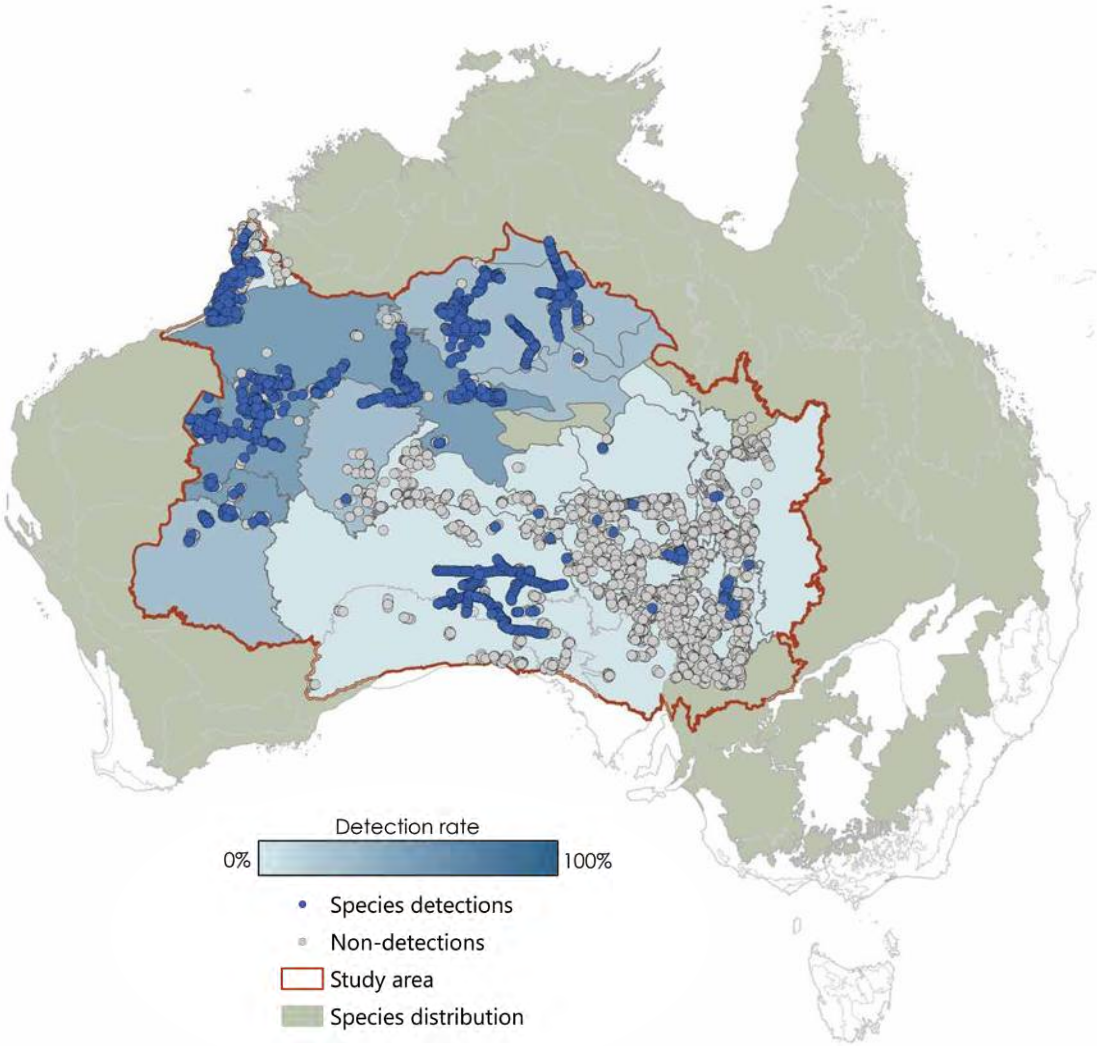
The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Australian bustard detection rates

Australian bustards were detected at over 13% of all surveys in the AZM dataset. It was the seventh most commonly recorded species, and the most commonly recorded native bird species.

The map shows the average bustard detection rate across all surveys carried out in each bioregion, since the 1980s. Detection rates for bustards have been highest in bioregions with the darkest blue shading, in the northern and western deserts. A detailed analysis of bustard detections at a subset of AZM sites that were revisited over five or more years, shows that bustard detections increase in long-unburnt areas, and as the amount of green vegetation increases.



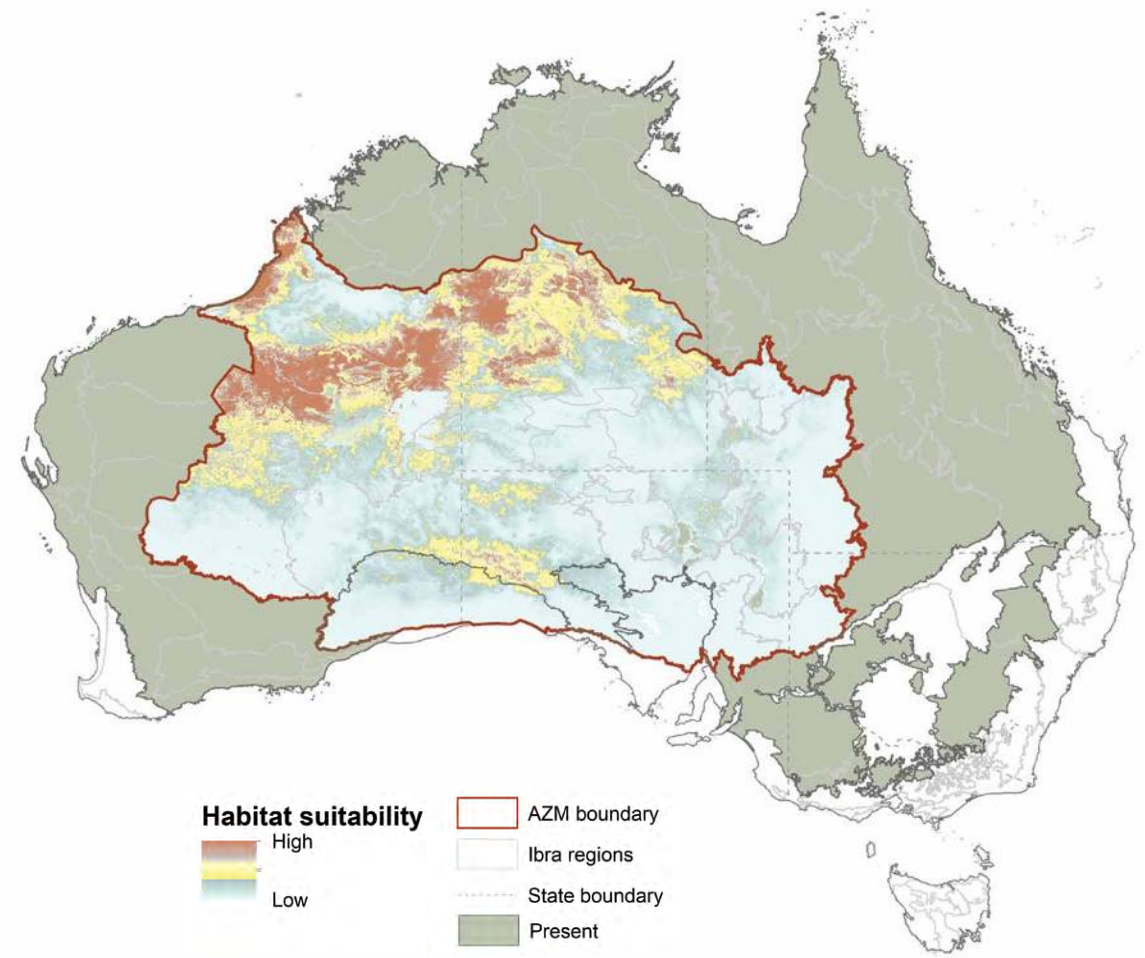
Things to think about when surveying for Australian bustards

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell bustard tracks apart from other species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Australian bustard habitat suitability

The habitat suitability model can tell us about where Australian bustards are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that bustards are widespread, but are now more commonly detected in the northern deserts, in areas with more stable, higher average temperatures. These are the red-brown shaded areas of the map. The map only shows habitat suitability inside the AZM project boundary, but bustards are also found in large area outside that boundary. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert and the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

Arid Zone Monitoring project

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

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Arid Zone Monitoring
Species Profile

Emu

Dromaius novaehollandiae

Language names

Ankerre, Arleye, Arrang, Atnhelengkwe, Ilia, Jakipirri, Jebarra, Kalaya/Karlaya, Karnanganja/Karnanganyja, Nyindi, Pijarta, Tjakipiri, Wirnirni (emu chick), Yankirri

National status: Not listed

IUCN Red List: Least concern

Emu with chicks.

Animal Description

Tall flightless bird with long legs and neck, grey shaggy feathers and blue and white skin on the face.

Key threats

Although emus are very common in some parts of their range, in other areas they have become rarer. This could be happening if wrong-way fire is reducing the emu's food, or if fires happen when emus are nesting.

- Habitat being lost and changed
- Too much grazing by feral herbivores (cattle, rabbits and mice)
- Wrong-way fire
- Climate change (changing rainfall, temperature, droughts)
- Fences and roads

Habitat

Emus eat a broad range of plants, grasses, fruits, seeds, flowers, herbs and insects.

Favourite emu food plants include Acacia and Cassia species, the currant bush (*Scaevola spinescens*) and fruit from the quandong (*Santalum spicatum*).

Emu nest.

*Quandong (*Santalum spicatum*).*

*Currant bush (*Scaevola spinescens*).*

*Giant crested grasshopper (*Macrolopholia spp*).*

Emu scat

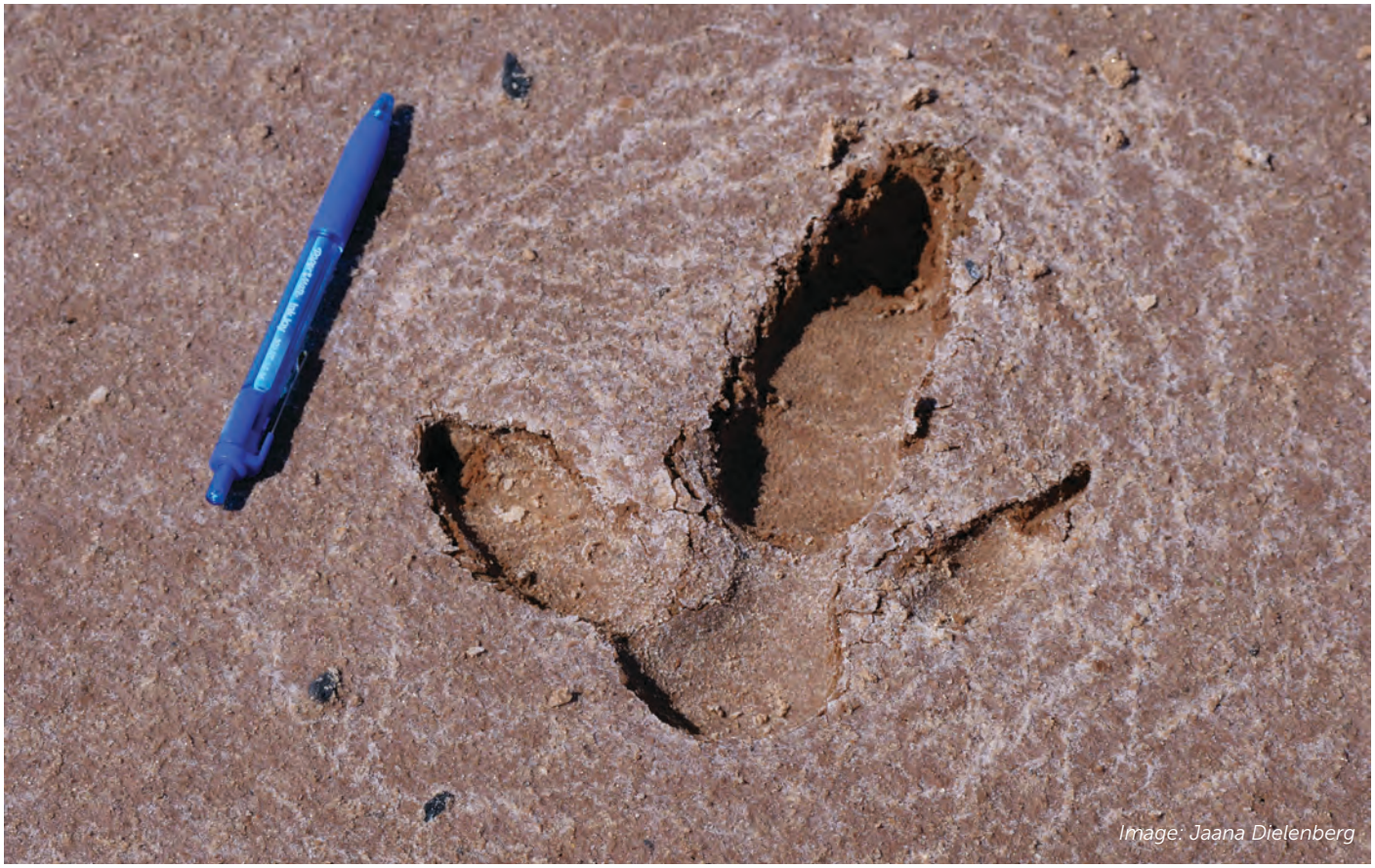
Emu scats can look different depending on what they eat.

Quandong seednuts in emu scat. Quandong is one of the favoured food plants of the emu.

Emu scats look different, depending on what they eat.

Emu tracks

The emu has three broad toes. They leave tracks that are alternating (one print in front of the other) rather than paired (like kangaroo and wallaby).



Emu track. Emus have three toes – the central toe is 14-17cm long and 2-3cm wide.

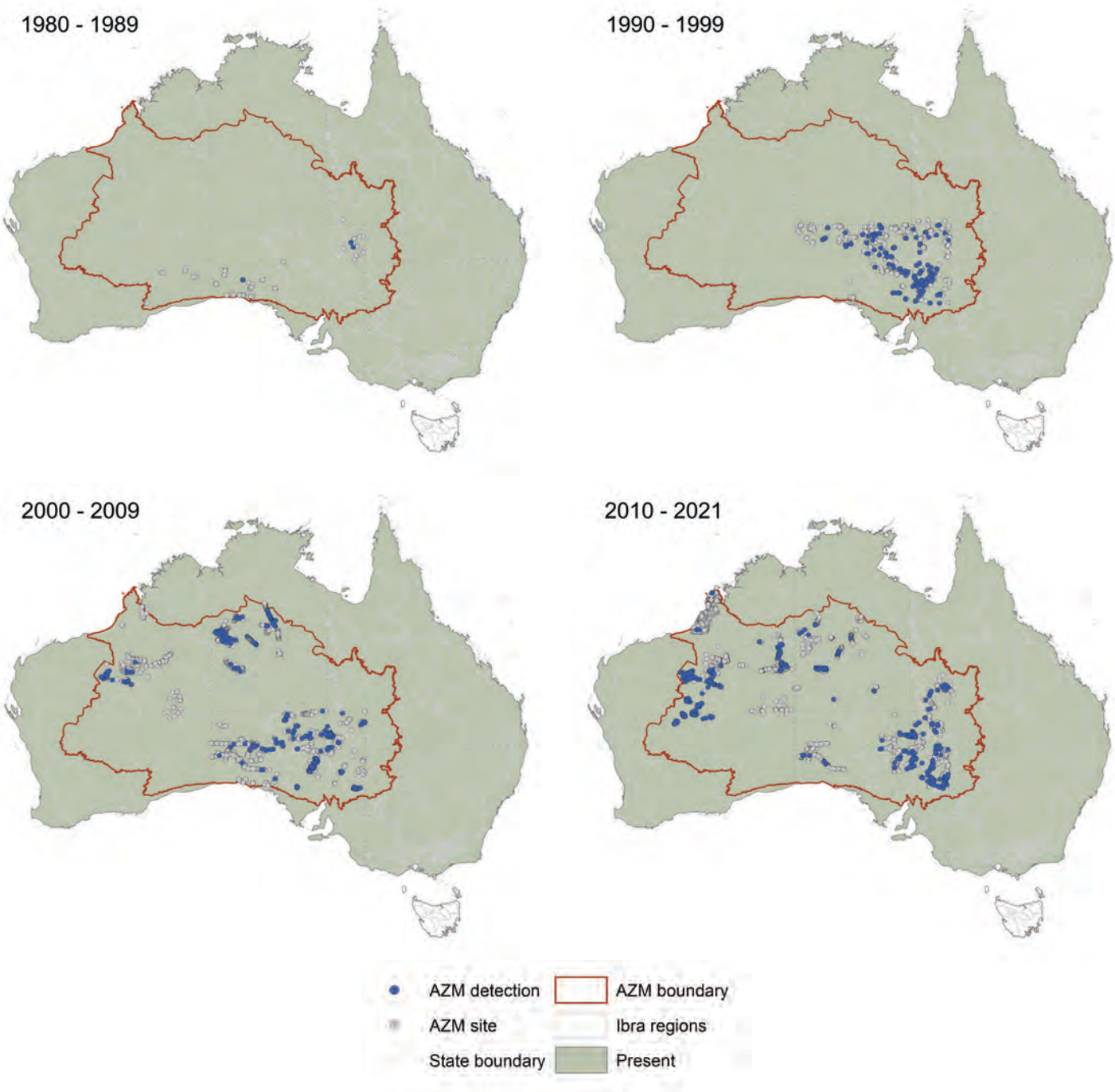
Emu tracks (arrow shows which way it is going).

Emu tracks (arrows shows which way it is going).

Arid Zone Monitoring project findings

Emu distribution

The maps summarise the detections of emus over time in the AZM dataset. They show that emus have been recorded throughout the AZM project area. Each blue dot shows a survey site where emus were recorded in that decade. The grey dots show all the other sites that were surveyed, but where emus were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. Emus are also found outside the AZM project area, in most parts of Australia (dark shading on map). The information about the overall distribution in the map background is taken from Australian Faunal Directory[1].



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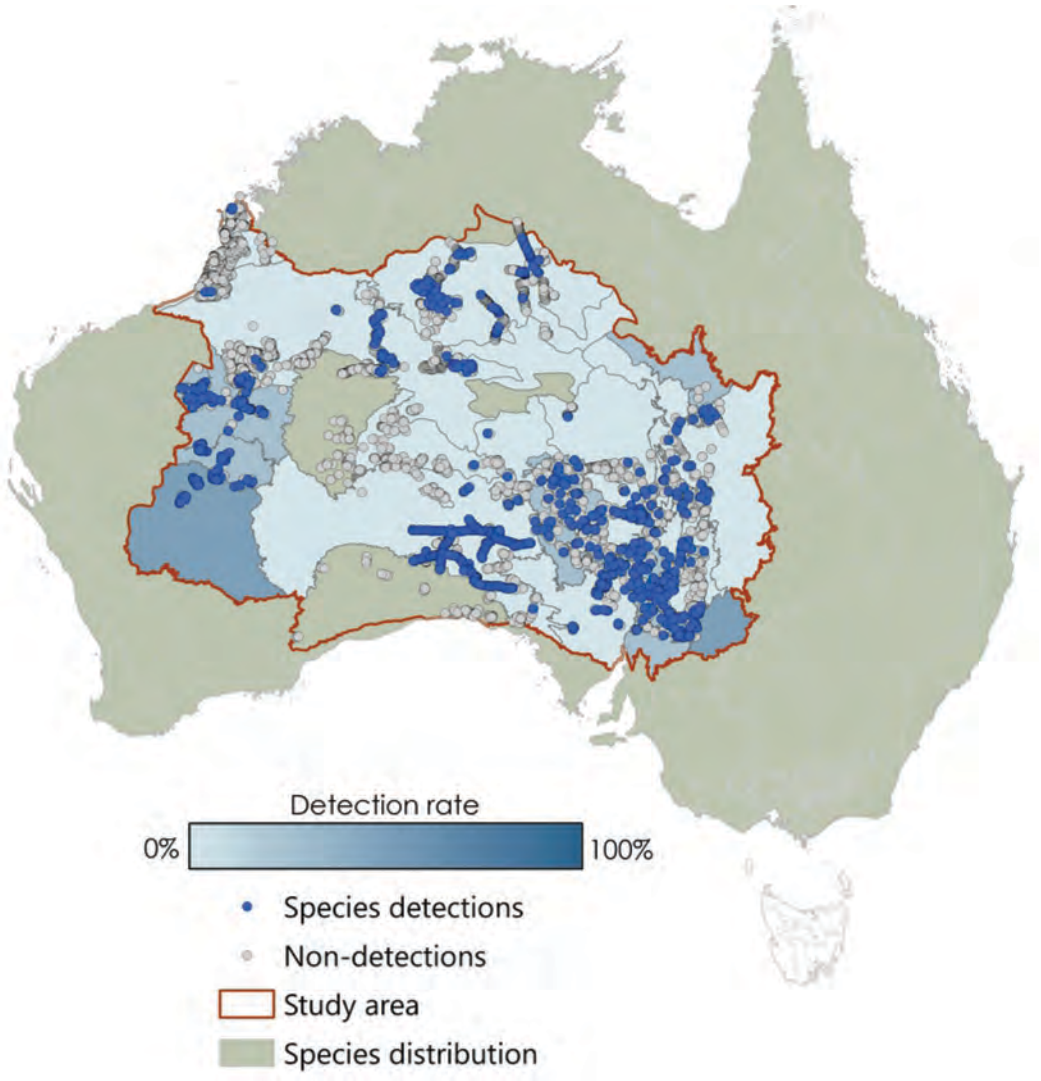
It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Emu detection rates

Emus were detected at over 9% of all surveys in the AZM database. It was the second most commonly recorded bird species.

The map below shows the average emu detection rate across all surveys carried out in each bioregion, since the 1980s. Detection rates for emus are highest in the southeastern deserts and the southwestern deserts. These bioregions are near agricultural areas, where emus can reach higher densities. A detailed analysis of emu detections at a subset of sites within the AZM dataset that were revisited over five or more years shows that emu detections go up and down over time, but are higher when there is more green vegetation, and are usually higher in longer unburnt vegetation.



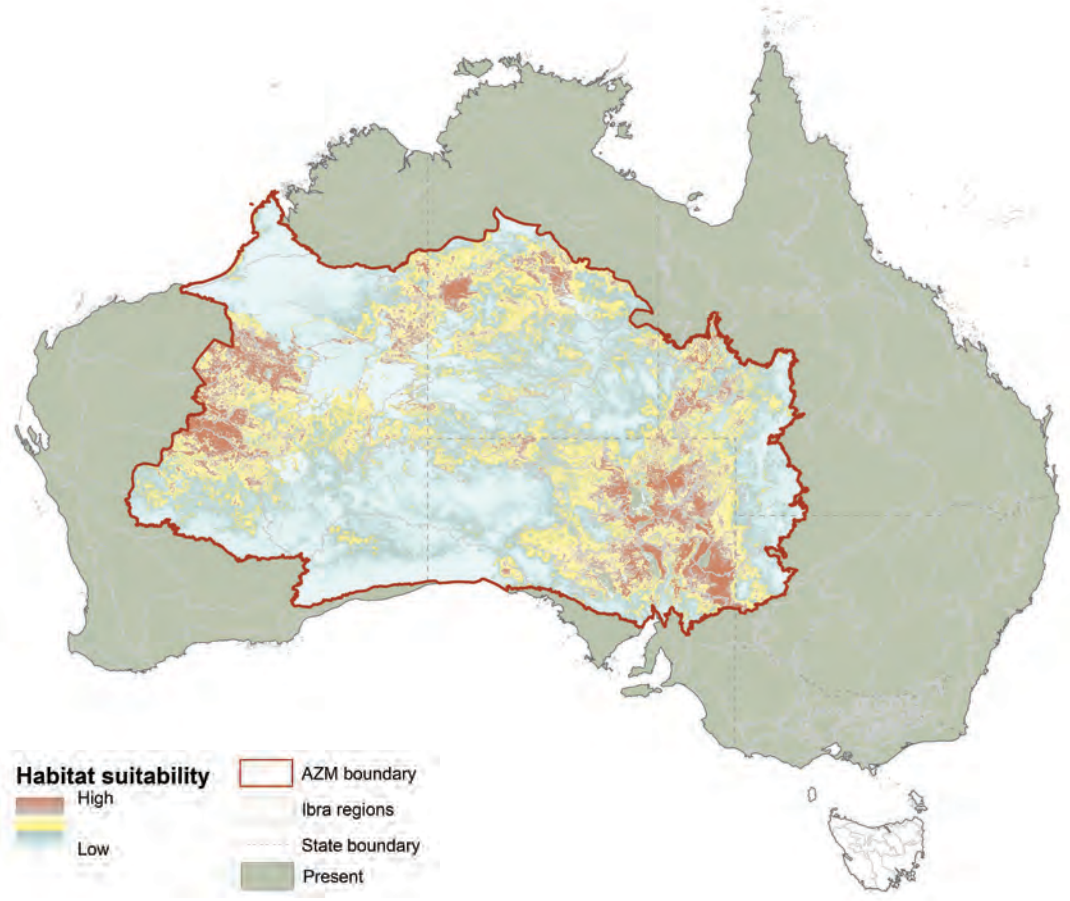
Things to think about when surveying for emus

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Emu habitat suitability

The habitat suitability model can tell us about where emus are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that emus are widespread across a range of climate, landforms, soil types and fire frequencies, except in areas close to the sea. These are the red-brown shaded areas of the map. The map only shows habitat suitability inside the AZM project boundary, but emus are also found throughout most of Australia except in Tasmania. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Emu, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Birds

Bird tracks are difficult to identify down to the species level in track-based surveys. This factsheet shows some bird tracks to help with identification in the field.

Australian bustard (bush turkey)

Ardeotis australis

Bustard tracks don't have a back toe. They walk like supermodels, with each foot placed in front of the other.

Australian bustard.

Bustard tracks.

Emu

Dromaius novaehollandiae

Emu tracks are much larger than other bird tracks, with an especially long middle toe.

Emu with chicks.

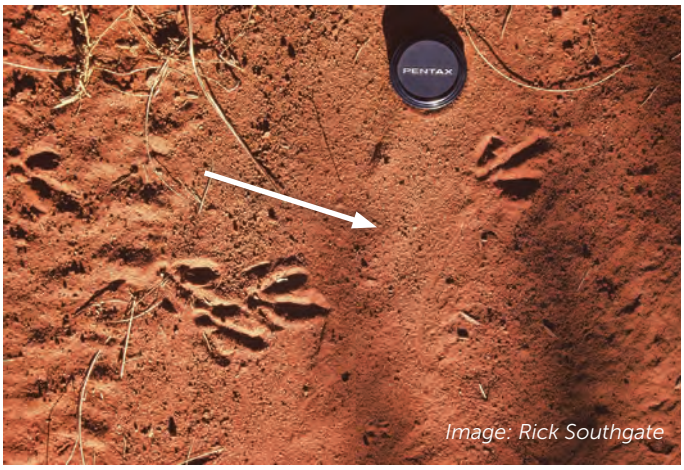
Emu tracks (arrow shows which way it is moving).

Bush stone-curlew

Burhinus grallarius

Bush stone-curlew tracks don't have a back toe. They are similar to, but smaller than, the tracks of bush turkeys (Australian bustards).

Bush stone-curlew.



Bush stone-curlew tracks (arrow shows which way it is moving).

Malleefowl

Leipoa ocellata

Malleefowl (like bustards) walk like super models, with each foot placed directly in front of the other one. Their tracks could be confused with crow tracks, except that malleefowl tracks are larger, with straight toes that are splayed wider apart.

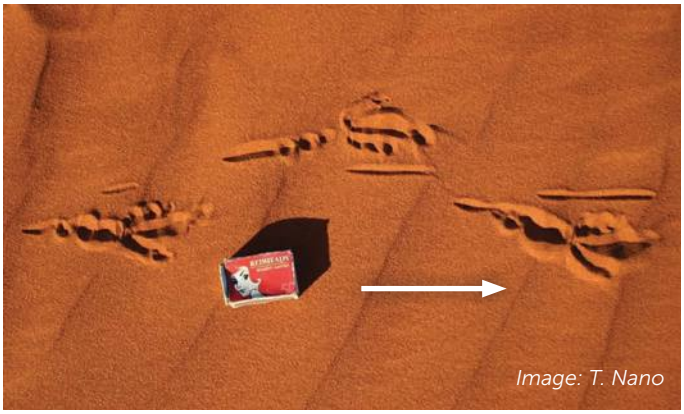
Malleefowl.

Malleefowl track (arrow shows which way it is moving).

Crows

Crows and ravens have strong feet with clear footpads. They usually walk with their well feet apart, and sometimes they will hop. Their tracks can be confused with malleefowl tracks, but the back toes of malleefowl don't have clear footpads.

Torresian crow.



Crow tracks (arrow shows which way it is moving).

Pigeons

Pigeons have short legs and so their tracks are close together. Pigeon tracks often meander around as they search for seeds on the ground. They have three front toes and one back toe.

Crested pigeon.

Crested pigeon tracks (arrow shows which way it is moving).

Little buttonquail

Turnix velox

Little buttonquail tracks are quite easy to identify because they have three small forward facing toes and no back toe.

Little buttonquail.

Little buttonquail tracks (arrow shows which way it is moving).

Place where buttonquail has been digging and foraging, called a 'platelet'.

Babblers

Bird tracks, especially those of babblers and wrens, can be confused with hopping mice tracks. Although both species hop with both feet together ("bipedal hopping gait"), babbler tracks are longer and have obvious toes. The toes of a hopping mouse are not long and not easy to see .

White browed babbler .

Babbler tracks (arrow shows which way it is moving).

Spinifex hopping mouse tracks for comparison with similar babbler tracks (arrow shows which way it is moving).

Miscellaneous unidentified bird tracks

Small bird tracks (arrow shows which way it is moving).

Miscellaneous unidentified bird tracks

Bird track (arrow shows which way it is moving).

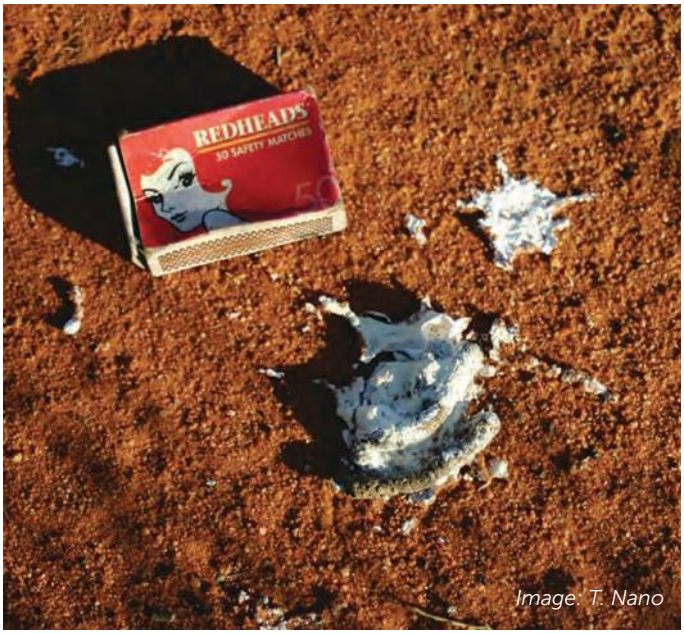
Bird track (arrow shows which way it is moving).

Scats

Many bird scats look the same. Scats have a white splash and a paste of black or dark waste products.

Small bird scat.

Emu scat with quandong seeds.



Bustard scat.

Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

Threatened Species Recovery Hub
National Environmental Science Programme

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The Arid Zone Monitoring project is a collaboration between the NESP TSR Hub and over 30 Indigenous ranger groups and Indigenous organisations, 8 NGOs and NRM groups, 5 government agencies institutions, and many individual researchers and consultants. The project has gathered track and sign data from across Australia's deserts, using it to map the distributions of desert species and their threats. The national database includes almost 50,000 species presence records from over 5300 unique sites and almost 15,000 site visits, over the period from 1982 to 2020. The project area was defined by using IBRA subregional boundaries - the project boundary captures Australia's desert subregions where track and sign-based surveys are commonly used. The project showcases the collective work carried out by all groups working across the arid zone, and lays the groundwork for creating ongoing, national-scale monitoring for desert wildlife.

Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Birds, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Small reptiles

Small reptiles leave tracks that are seen during track-based surveys, but it can be hard to identify these tracks to the species. This profile has information on the some of the small reptiles tracks that are commonly found during surveys.

Small skinks

***Ctenotus* sp.**

Language names

Alyalkarr-alwaykarr, Alyalkarr-alyalkarr, Ikwarre, Iyenkarr, Jipila, Liwirungu/Wurrkarn, Murluny-murluny, Mutinga, Pupurla

Animal description

Ctenotus is the largest group of lizards in Australia, with nearly 100 species. Ctenotus skinks have smooth scales, long limbs with five toes and long tails.

Leopard skink, Ctenotus patherinus.

Burton's legless lizard

Lialis burtonis

Burton's legless lizards have a pointed snout, and very small flaps instead of front and back feet. Colour can be different depending on location.

Burton's legless lizard.

Legless lizard

Delma butleri

Delma butleri is greyish brown to olive brown with dark edges on the scales. All legless lizards are slender with smooth shiny scales.

Delma butleri.

Sand sliders

***Lerista* sp.**

Leristas have smooth scales and small ear openings. Some have 4 well-developed limbs, but most do not have any limbs (no front or back feet). Identification can be difficult.

Lerista labialis.

Tracks

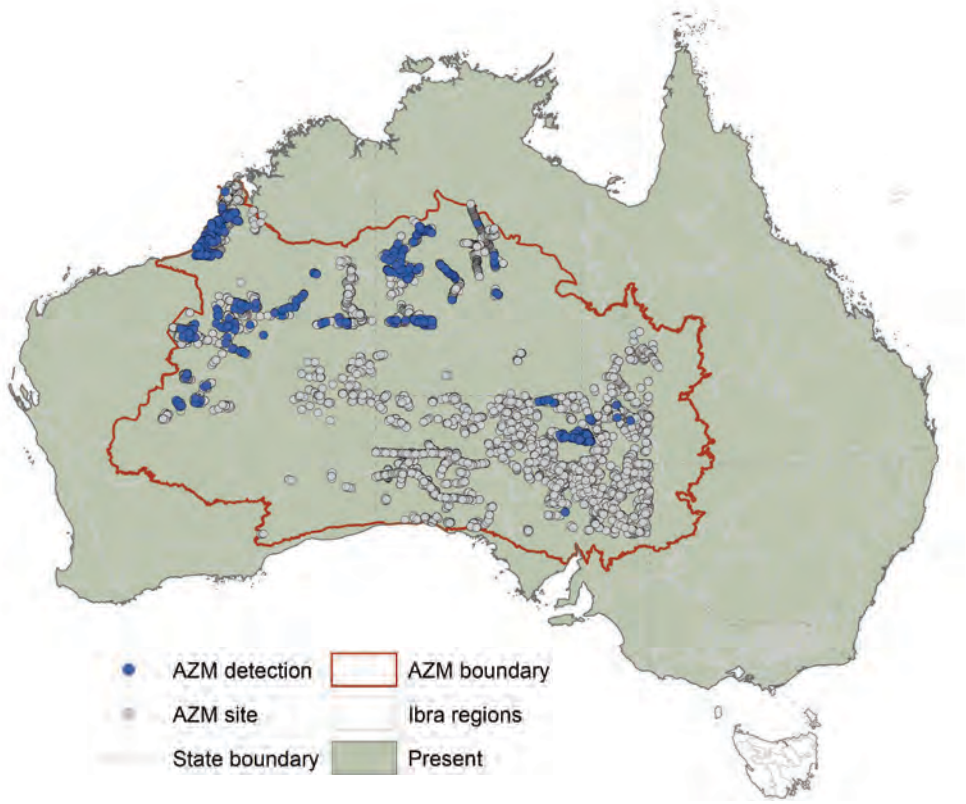
Small snakes and legless lizards make wavy tracks in the sand (arrow shows which way it is going).

Sand slider tracks.

Arid Zone Monitoring project findings

Small reptile distribution

Within the AZM dataset small reptiles were recorded at 11% of all surveys in the AZM dataset. These records were unidentified to the species level. Each blue dot shows a survey site where a small reptile was recorded. The grey dots show all the other sites that were surveyed, but where small reptiles were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers.



The map is based on data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified. It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, please let us know.

Things to think about when surveying for small reptiles

- Survey during good conditions (not too windy or straight after rain).
- Organise to do surveys at regular times every year, for example before the wet or hot season (October) and in the early dry season or cool time (April).
- Follow advice of experienced trackers - know how to tell tracks apart before you go to survey.
- If you want to see if management actions (like right-way fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Further information

Arid Zone Monitoring project:

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Small reptiles, Project 3.2.5 findings factsheet.

Arid Zone Monitoring Species Profile

Dragons

Language names

Antekakarle, Jiningka, Jirrkala, Kapalya, Kweleparr, Mutukalya, Nyarl, Pampirta, Rjimpilka, Tjimpilyka, Wiji

Dragon detections

The maps in this profile are based on data shared by data providers with the AZM project. Each blue dot shows a survey site where dragon species were recorded. The grey dots show all the other sites that were surveyed, but where dragon species were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. In each map, the information about the overall distribution in the map background is taken from the IUCN[1].

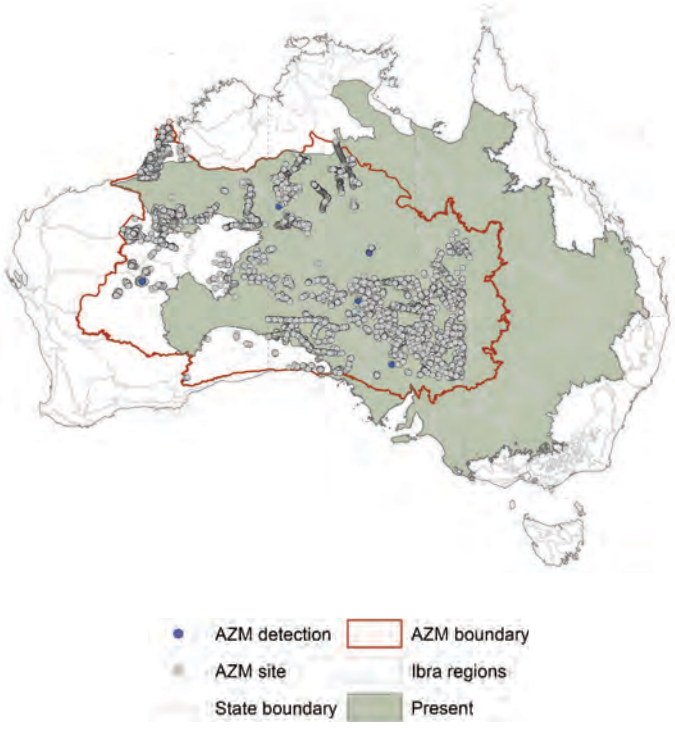
The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified. It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, please let us know.

Central bearded dragon

Pogona vitticeps

The central bearded dragon has a wide head, and a round "beard" of a row of spines on the throat and along the side of the body and back of the head. It can vary in colour and pattern from grey to rich orange, with light coloured blotches between the neck and hips. The species is found mostly in woodlands in arid and semi-arid habitats.

Central bearded dragon.

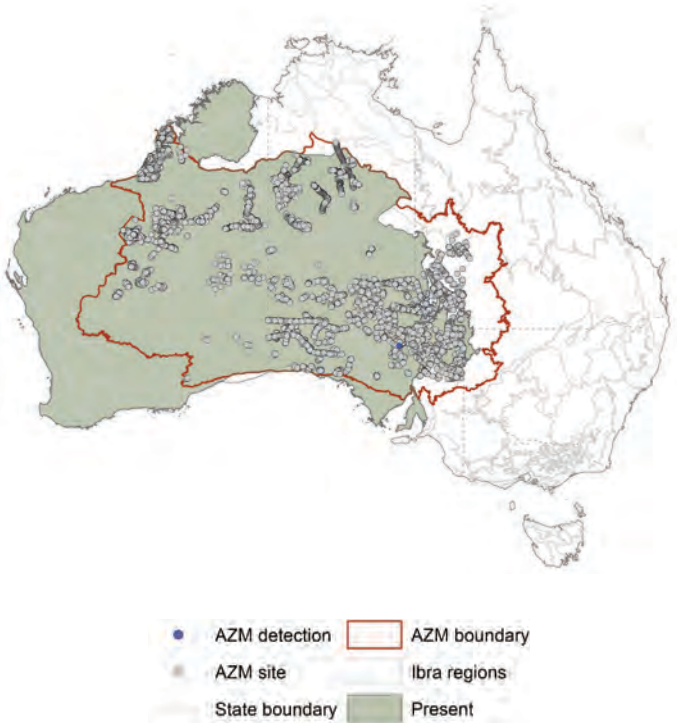


Western bearded dragon, dwarf bearded dragon

Pogona minor

A medium sized dragon up to about 38 cm long, usually dark brown to grey, with a spiny 'beard' of scales. It lives in woodlands, heathlands, dunes and desert country.

Western bearded dragon, dwarf bearded dragon.

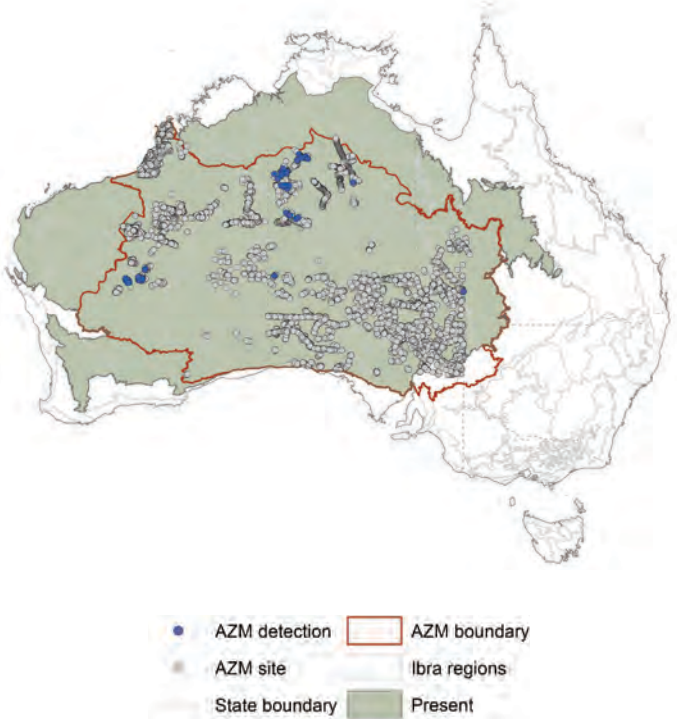


Central military dragon

Ctenophorus isolepis

This dragon is reddish brown with dark edged white spots and light stripes on the back and along the mid-body. Males have a thick stripe from the chin to the chest, throat and down the front legs. It is found in sandy deserts and loamy flats, and forages on bare ground between low open vegetation.

Central military dragon..

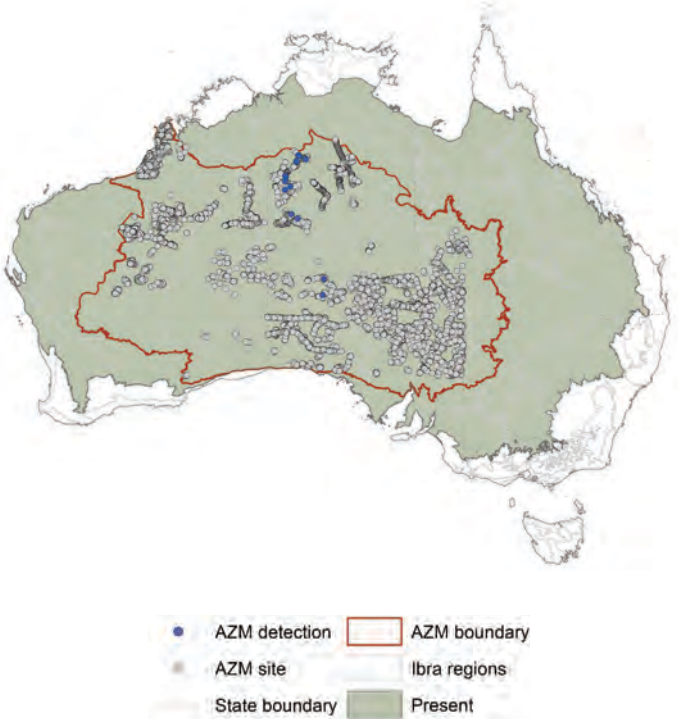


Central netted dragon

Ctenophorus nuchalis

This dragon has a round head, with a blunt snout and short limbs and tail, and small spines on the back of the head. It is pale yellowish brown with a dark netted pattern and a pale stripe on the back. It can have a bright orange head and throat during breeding season. It is often seen sunbaking up high and sheltering in burrows in the base of stumps and shrubs. The species is widespread, and common in recently burnt areas.

Central netted dragon.

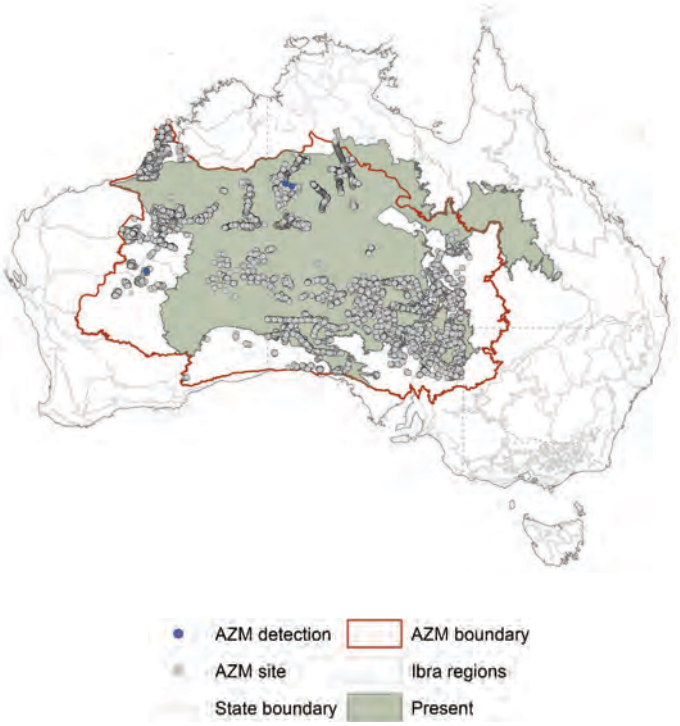


Pebble dragon (or earless dragons)

***Tympanocryptis* spp.**

Pebble dragons are greyish brown to reddish brown, redder on legs with pale lines along the back. They have a distinctive head shape, and hidden ears (no external ear structures). All arid zone species of pebble dragons are found in stony hills and plains.

Pebble dragon.

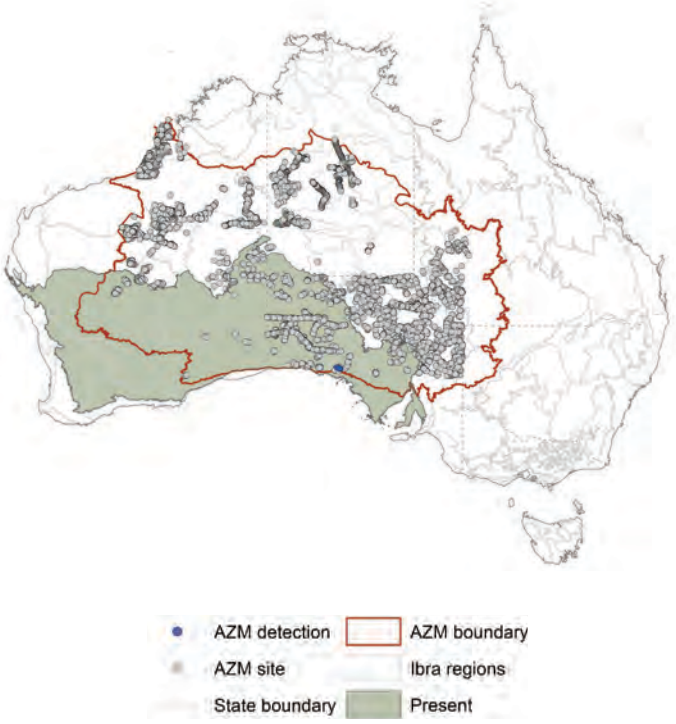


Crested dragon

Ctenophorus cristatus

Crested dragons are brown-grey brown with comb-like scales around eyes. They live in arid and semi-arid country in southern WA and SA.

Crested dragon.

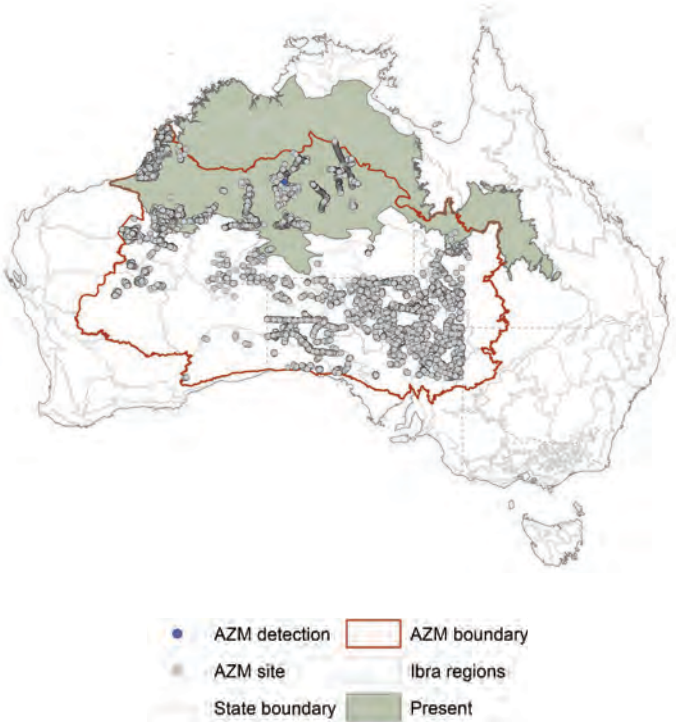


Lally's two-lined dragon

Diporiphora lalliae

These dragons are brown-grey and brown with two lines running along body, with patchy markings. They occur in the northern deserts and southern tropical savannas of the Kimberley and the Northern Territory.

Lally's two-lined dragon.

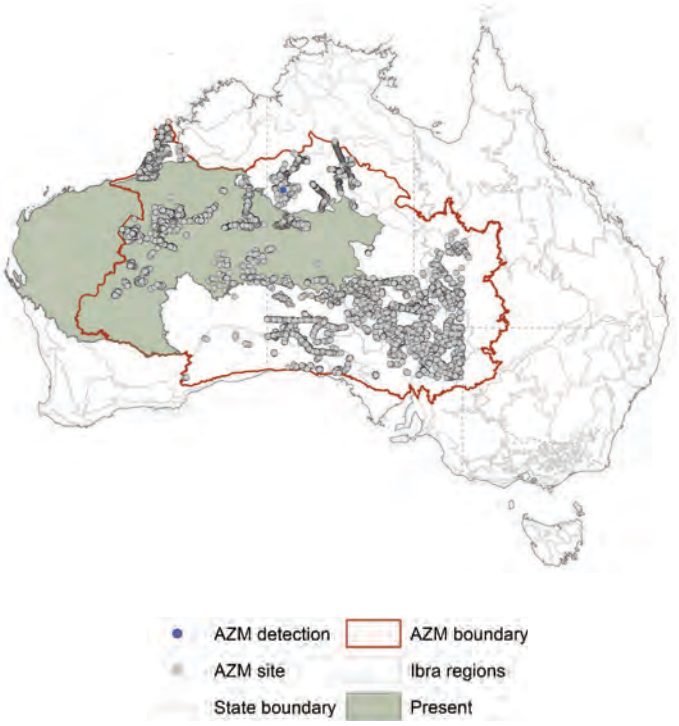


Long-nosed dragon

Gowidon longirostris

These are agile dragons with very long tails. They are pale grey-brown, with a darker patch in middle of back and a white stripe on face, pale yellow stripe on body. They live in woodlands and desert country.

Long-nosed dragon.

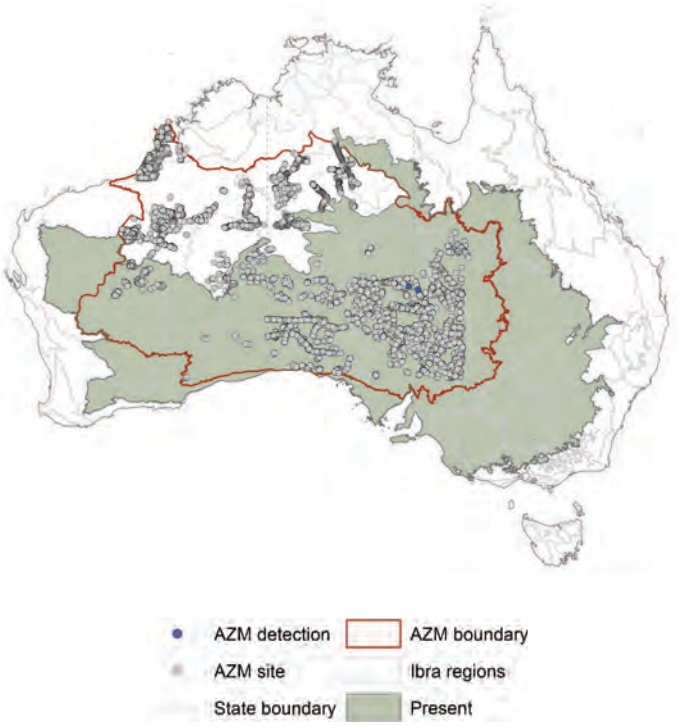


Painted dragon

Ctenophorus pictus

Painted dragons are brown to yellowish brown to orange, with dark-edged pale bars, blotches or spots on top of a stripe that runs down their back. Males have blue on their lips, throats and front limbs. The top of the chest and shoulders in bright yellow and orange. Painted dragons live in areas with stony soils and open-acacia- dominated woodlands or shrublands in parts of southern and central Australia. They can often be seen sunbaking on top of stones and stumps.

Painted dragon.



Dragon tracks

Dragon tracks can be hard to see, but their long tail leaves a distinctive line.

Dragon tracks.

Scats

Reptile scats contain uric acid and usually have a small white hard section.

Dragon scat.

Dragon burrow

Central bearded dragon burrow.

Dragon detection rates

Dragon species detection rates in AZM data.
The rank columns tells us how commonly the species was detected compared with other reptile species that were recorded during almost 15,000 sandplot surveys. Detections of dragons are very low, mostly because the tracks are hard to identify to species level, and most trackers therefore don't record them at all. If you want to monitor dragons, other survey methods might be work better than track-based monitoring.

Species name	No. of detections	% surveys in which species was detected	Rank
Unidentified Dragon species	168	1.12%	8
Central military dragon	86	0.57%	11
Central netted dragon	14	0.10%	19
Central bearded dragon	9	Less than 0.1%	22
Crested dragon	5	Less than 0.1%	25
Central pebble dragon	3	Less than 0.1%	26
Lally's two-lined dragon	1	Less than 0.1%	33
Long-nosed dragon	1	Less than 0.1%	34
Painted dragon	2	Less than 0.1%	37
Western bearded dragon	1	0.01	41

Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021

Threatened Species Recovery Hub
National Environmental Science Programme

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Dragons, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Thorny devil

Moloch horridus

Language names

Arnkerrthe, Irntaakupma, Jirntikurru, Ngiyari, Mayiparttula, Mingari, Miniri, Mirnirri, Ngiyari, Nywerr, Unyerre

National status: Not listed

IUCN Red List: Least concern

Thorny devil.

Animal Description

The thorny devil is an umistakable spiny lizard with short legs and tail, a small head and a large spiny lump on the neck. They can change colour and can be rich orange-red, yellow/olive and grey. The length of their head and body is about 9 cm. They drink by standing still on wet sand, and the water travels up by capillary action along grooves in their skin to their mouth.

Key threats

No major threats, but likely preyed on by cats and foxes.

Habitat

Thorny devils are found in the arid and semi-arid regions of Western Australia, the Northern Territory and western South Australia. Their distribution just extends into south-western Queensland. Thorny devils prefer dune-fields and spinifex grasslands with sandy soil, but can also be found in shrublands. The thorny devil is not found in stony country or mountain slopes as the hard soil stops them from making burrows to shelter in. They are usually active in March-May and in August-December. At other times, thorny devils sleep in their burrows as it is too cold.

An example of thorny devil habitat- grass covered sand-dune with scattered shrubs.

Thorny devil scat

Thorny devils feed only on small black ants, and can eat up to 5000 at a time.

Image: © Alan Henderson – Minibeast Wildlife https://www.minibeastwildlife.com.au/

A fresh scat of a thorny devil.

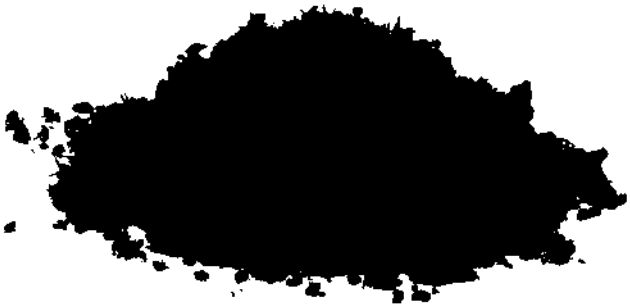


Image: © Alan Henderson – Minibeast Wildlife https://www.minibeastwildlife.com.au/

A broken up scat of a thorny devil, showing that it feeds only on ants.

Thorny devil tracks

Thorny devils move slowly with a jerky gait, with their tail held up.

Thorny devil tracks.

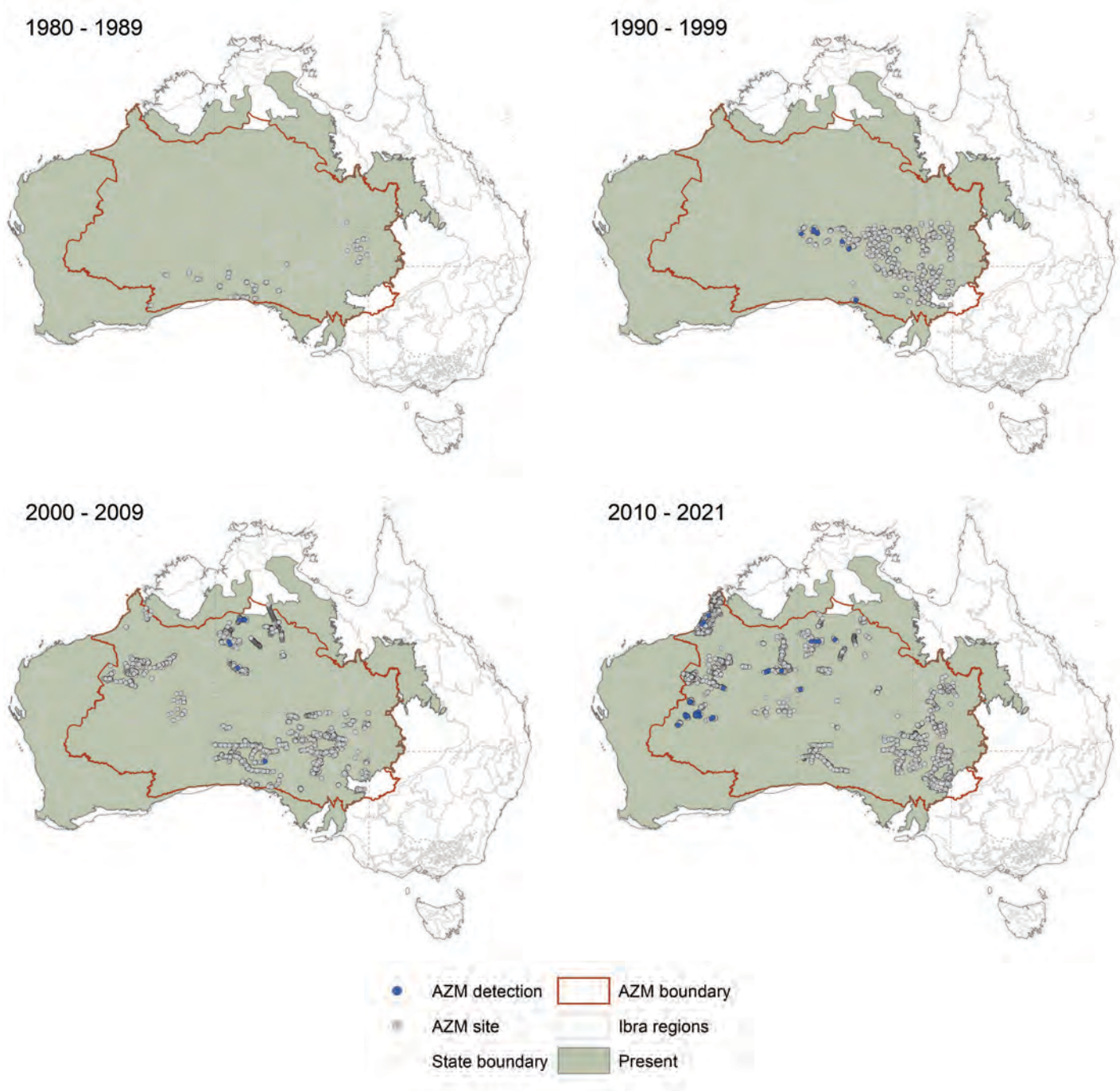
Things to think about when surveying for thorny devils

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell tracks apart from other species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (such as right-way fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Arid Zone Monitoring project findings

Thorny devil distribution

The maps summarise detections of thorny devils over time in the AZM dataset. It shows that they have been detected at a low rate across a large area of the deserts. Each blue dot shows a survey site where thorny devils were recorded in that decade. The grey dots show all the other sites that were surveyed, but where thorny devils were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from IUCN[1].

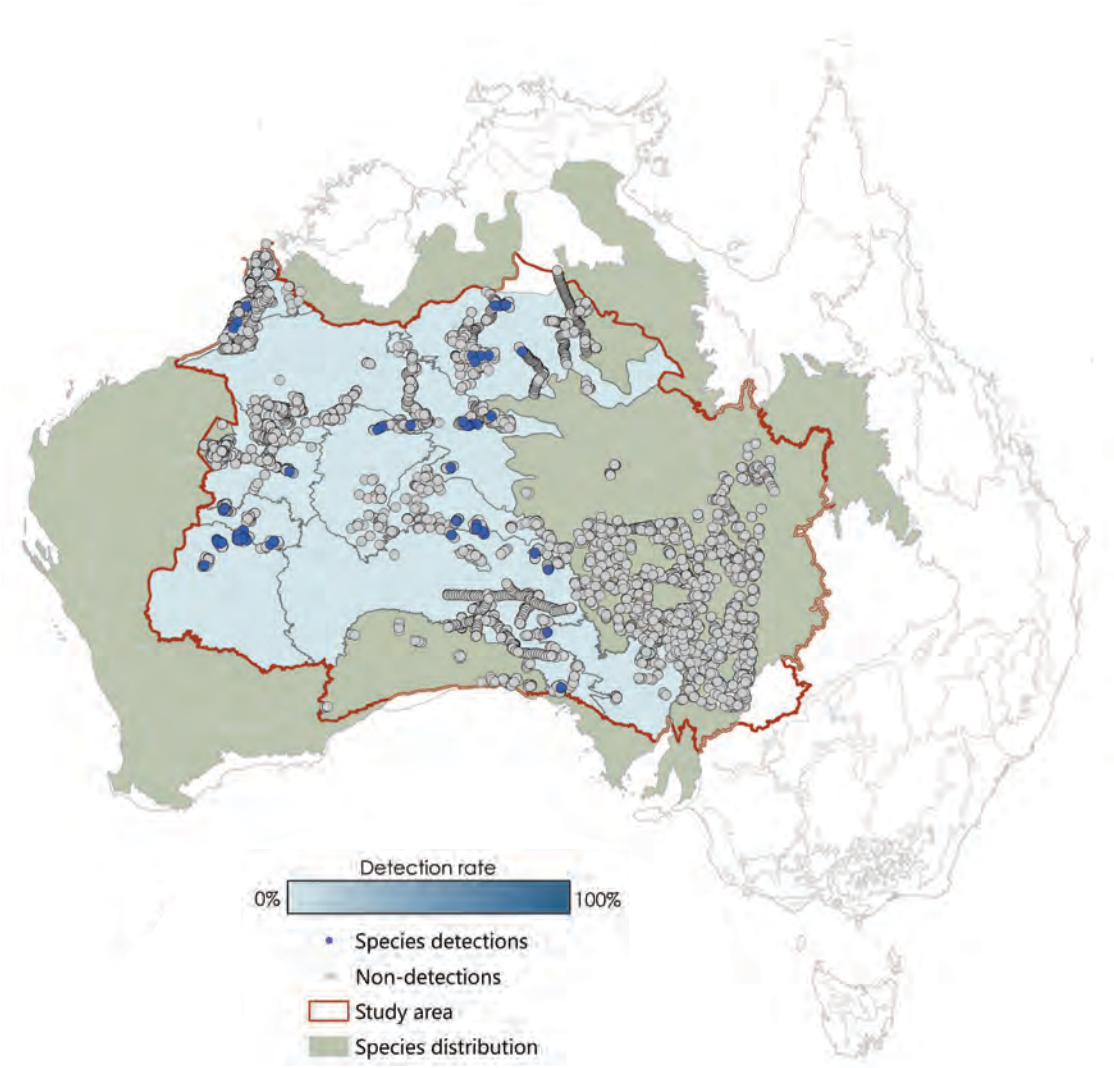


The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Thorny devil detection rates

Thorny devils were detected at less than 1% of all surveys in the AZM dataset. It was the 8th most commonly recorded reptile species.



Further information

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References

[1] Species distribution information compiled during a 2017 reptile assessment carried out by IUCN (https://datadryad.org/stash/dataset/doi:10.5061/dryad.83s7k), and updated by expert opinion (R. Tingley).

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Thorny devil, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Large skinks

Desert skink is *Liopholis inornata*
Night skink is *Liopholis striata*

There are three species of large skink in the genus *Liopholis*. One, the great desert skink (*L. kintorei*) is nationally threatened and is sometimes the focus of desert surveys. The information in the AZM dataset on *L. kintorei* is presented in a separate species profile. This profile summarises the information on the other two species, *L. inornata* and *L. striata*.

Desert skink

Liopholis inornata

National status in EPBC Act: Not listed
IUCN Red List: Not listed

Animal Description

Smooth scaled skink with blunt head. Scales vary from yellowish brown to rich coppery red, with rows of black spots on body and bars on the tail.

Distribution

Desert country in southern WA across to southern Qld.

Habitat

Sand ridges and sand plains with spinifex and shrubs. Desert skinks dig burrow systems with hidden exit points.

Desert skink.

Desert skink burrow.

Night skink

Liopholis striata

Animal description

Smooth tailed skink with blunt head. Brown to brick red, scales have dark edges.

Distribution

Central deserts, WA, southern NT and NW SA.

Habitat

Sand plains and sand dunes with spinifex vegetation. Night skinks excavate deep burrow systems with multiple entrances.

Night skink.

Arid Zone Monitoring project findings

Large skink distributions and detections

Night skinks were detected at 1% of all surveys, and desert skinks were detected at less than 1% of all surveys in the AZM dataset.

The maps summarise detections of night skinks (left) and desert skinks (right) in the AZM database. Each blue dot shows a survey site where the species was recorded. The grey dots show all the other sites that were surveyed, but where the species was not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is based on information collected by IUCN[1].

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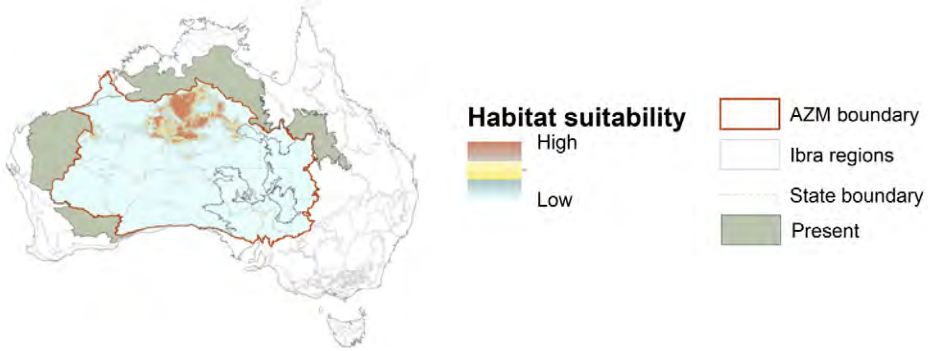
Night skink habitat suitability

The species distribution model can tell us about where the night skink is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency. The model suggests that night skinks prefer to inhabit in northern areas of the arid zone that have moderate elevation (>300 m) and stable, warm temperatures. There were not enough records in the dataset to run this modelling for desert skinks.



Further information

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Large skinks, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Tjakuṛa, great desert skink

Liopholis kintorei

Language names

Arrarn, Minijarti, Mitjitji-mitjitji, Mulyamitji, Tjalapa, Warrana

National status: Vulnerable

IUCN Red List: Vulnerable

Tjakuṛa (great desert skink).

Animal Description

Tjakuṛa (great desert skinks) are quite large, they can be up to 40 cm long. They have a blunt head. Their body is reddish-brown above, and the smooth scales have dark brown edges.

Key threats

- Predation by cats and foxes
- Habitat change from too much grazing by feral herbivores (livestock, camels, rabbits)
- Wrong-way fire (too often, too intense, too big)

Habitat

Tjakuṛa (great desert skink) likes sandy soils in spinifex sandplains, shrublands and woodlands. It lives in family groups, and builds burrows to shelter in.

Tjakuṛa (great desert skink).

Burrows

Tjakura (great desert skinks) create a complex burrow system with multiple (up to 20) entrances. Some exits are concealed under shelter, such as a clump of grass. Burrows are about 10 cm wide. The entrance has a flat bottom.

Tjakura (great desert skink) skink burrow.

Tracks

Tjakura (great desert skinks) tracks have a straight line made by the tail drag, with claw marks close to this tail drag. The tracks are most obvious at the entrance to the burrow.

Animals that might be confused with the Tjakura during survey

- Other large skinks

Tjakura tracks can be confused with tracks from other large skinks, but Tjakura are larger. The complicated burrows of Tjakura help to tell them apart from other large skinks. Check out the species profile for 'large skinks' to compare.

Tjakura (great desert skink) tracks (arrow shows which way it is going).

Latrine site

Tjakura (great desert skinks) use a shared site for poo (a latrine site), close to their burrows. Individual scats are dark with small white pieces and are about 5 cm long and 1 cm wide.

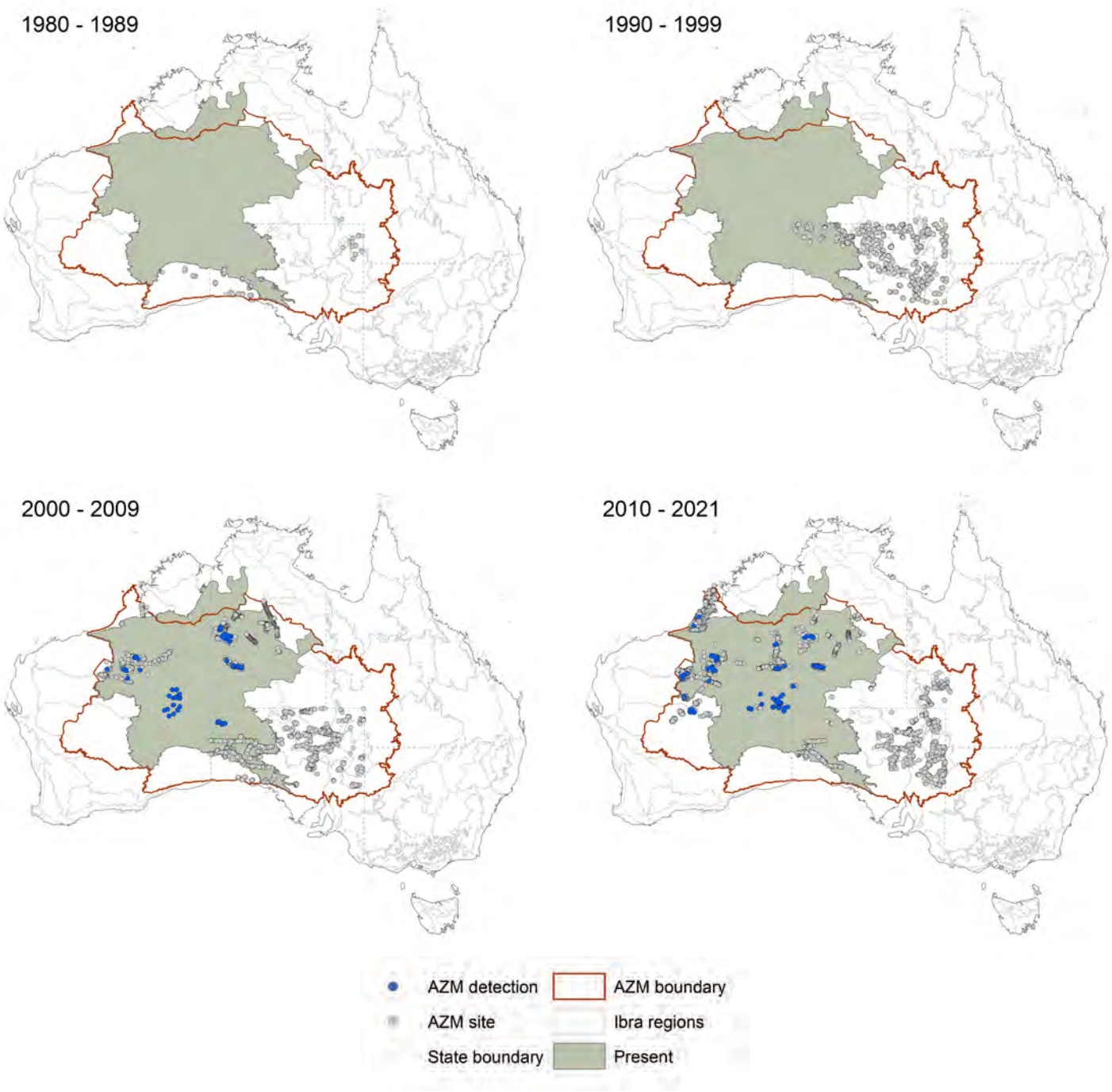
Latrine site of Tjakura (great desert skinks).

Close up of latrine site of Tjakura (great desert skinks).

Arid Zone Monitoring project findings

Tjakura (great desert skink) distribution

The maps summarise detections of Tjakura (great desert skink) over time in the AZM dataset. They show that Tjakura (great desert skinks) are found in the north-western deserts, including in some areas just outside their accepted range. Each blue dot shows a survey site where Tjakura (great desert skinks) were recorded in that decade. The grey dots show all the other sites that were surveyed in that decade, but where Tjakura (great desert skinks) were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1], and from IUCN[2].



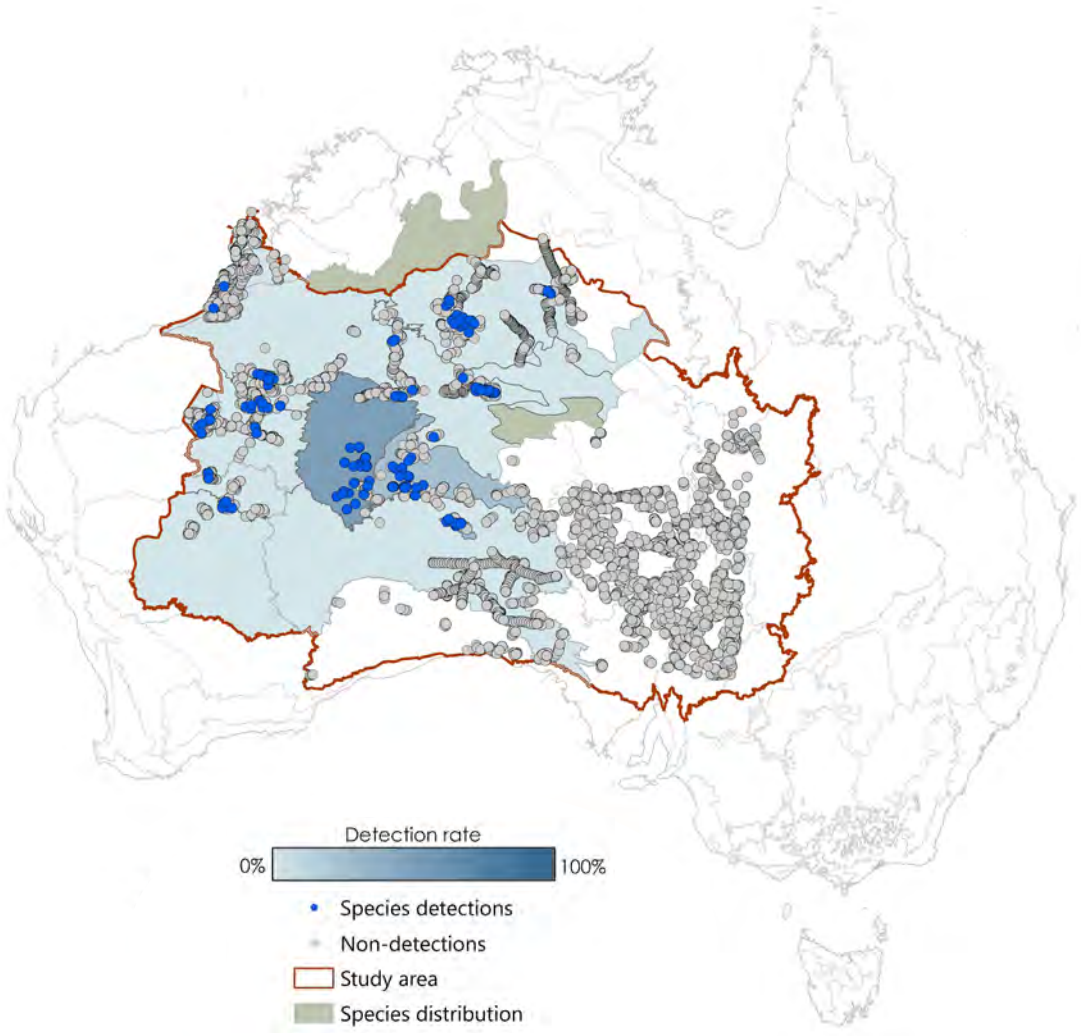
The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Tjakura (great desert skink) detection rates

Tjakura (great desert skinks) were detected at over 2% of all surveys in the AZM dataset. It was the third most commonly recorded reptile species.

The map shows the detection rate for Tjakura (great desert skinks) across all surveys carried out in each bioregion, since the 1980s. Detection rates have been highest in the western deserts (darkest blue shading). This could be because many surveys in that area targeted Tjakura, which would make them seem more common than they really are.



Things to think about when surveying for Tjakura (great desert skinks)

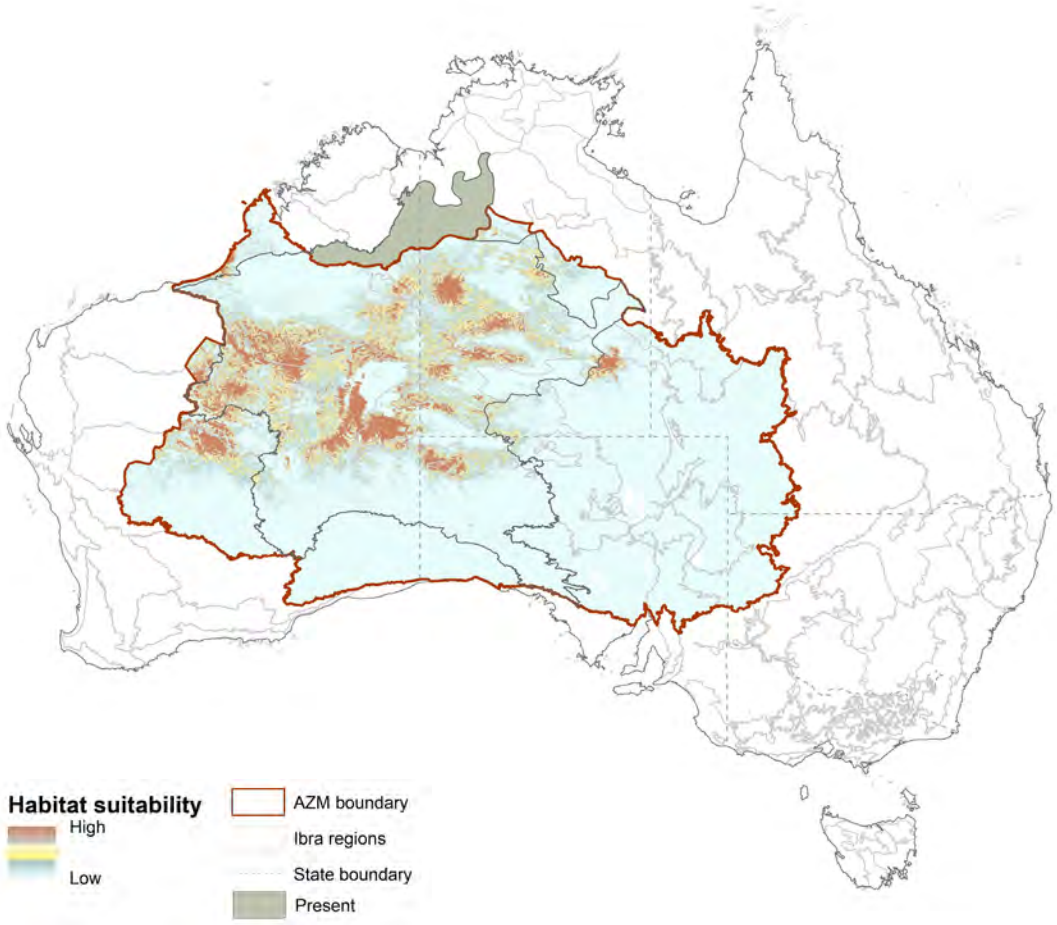
- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell great desert skink tracks apart from other small reptiles before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Tjakura (great desert skink) habitat suitability

The habitat suitability model can tell us about where Tjakura (great desert skink) is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that Tjakura (great desert skinks) are typically found in higher elevation areas (>350m) with warm temperatures (>20 degrees Celsius). These are the red-brown shaded areas of the map.

The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert; getting more survey data from these areas would improve the model for the Tjakura (great desert skink).



Further information

Arid Zone Monitoring project

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021.

[2] Species distribution information compiled during a 2017 reptile assessment carried out by IUCN (https://datadryad.org/stash/dataset/doi:10.5061/dryad.83s7k), and updated by expert opinion (R. Tingley).

Threatened Species Recovery Hub

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Tjakura (great desert skink), Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Centralian blue-tongue lizard

Tiliqua multifasciata

Language names

Antherrarte, Ikangker, Ilparnkwere, Kalamira, Langka, Lhwelk, Lungkara, Lungkarda, Lungkata, Lunkuta, Ngalyak, Ntharrarta, Nyarlamira, Palyu palyu, Pilirri, Ulhelke

National status in the EBPC Act: Not listed

IUCN Red List: Least concern

Centralian blue-tongue lizard.

Animal Description

The centralian blue-tongue lizard is a robust lizard with short body and short tail. It is pale grey to grey-brown with orange to yellow-brown bands on body and tail, black stripe from eye to ear.

Key threats

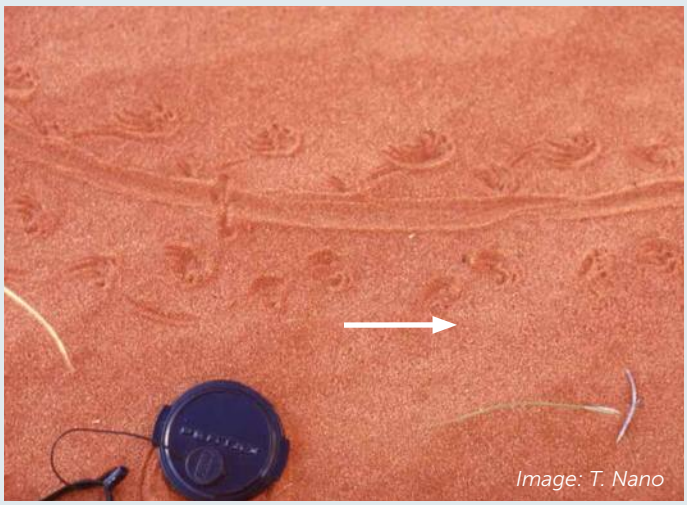
No major threats, but preyed on by cats and foxes.

Habitat

The centralian blue-tongue lizard lives in semi-arid to arid sand plains and dunes with spinifex vegetation.

Centralian blue-tongue lizard tracks

Centralian blue-tongue tracks show the broad body track with a narrow trail mark, with claw marks on each side.

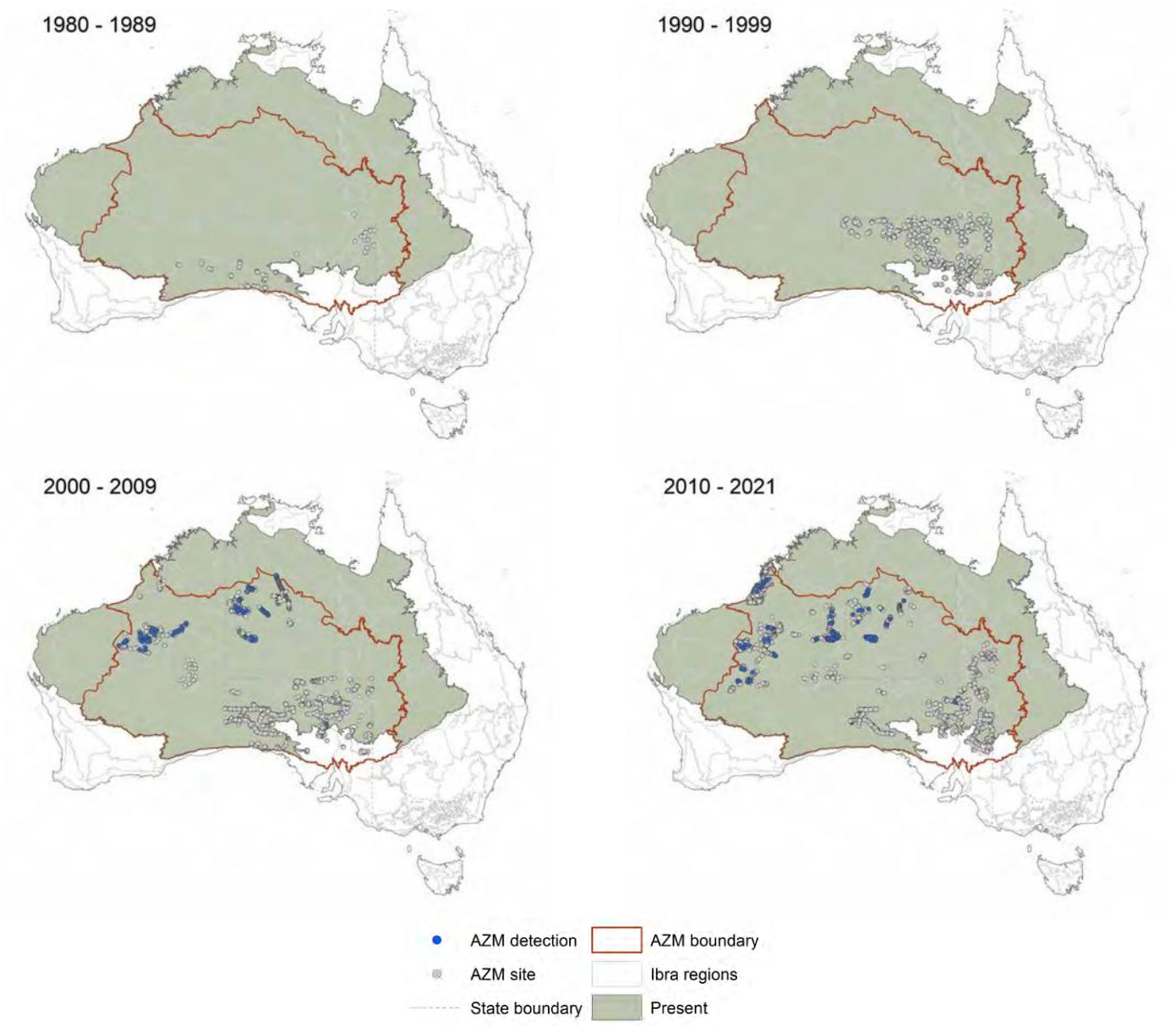


Centralian blue-tongue tracks (arrow shows which way it is moving).

Arid Zone Monitoring project findings

Centralian blue-tongue lizard distribution

The maps summarise detections of centralian blue-tongue lizards over time in the AZM database. They show that centralian blue-tongue lizards have been detected in the north-western part of the AZM project area. Each blue dot shows a survey site where centralian blue-tongue lizards were recorded in that decade. The grey dots show all the other sites that were surveyed, but where centralian blue-tongue lizards were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from IUCN[1].



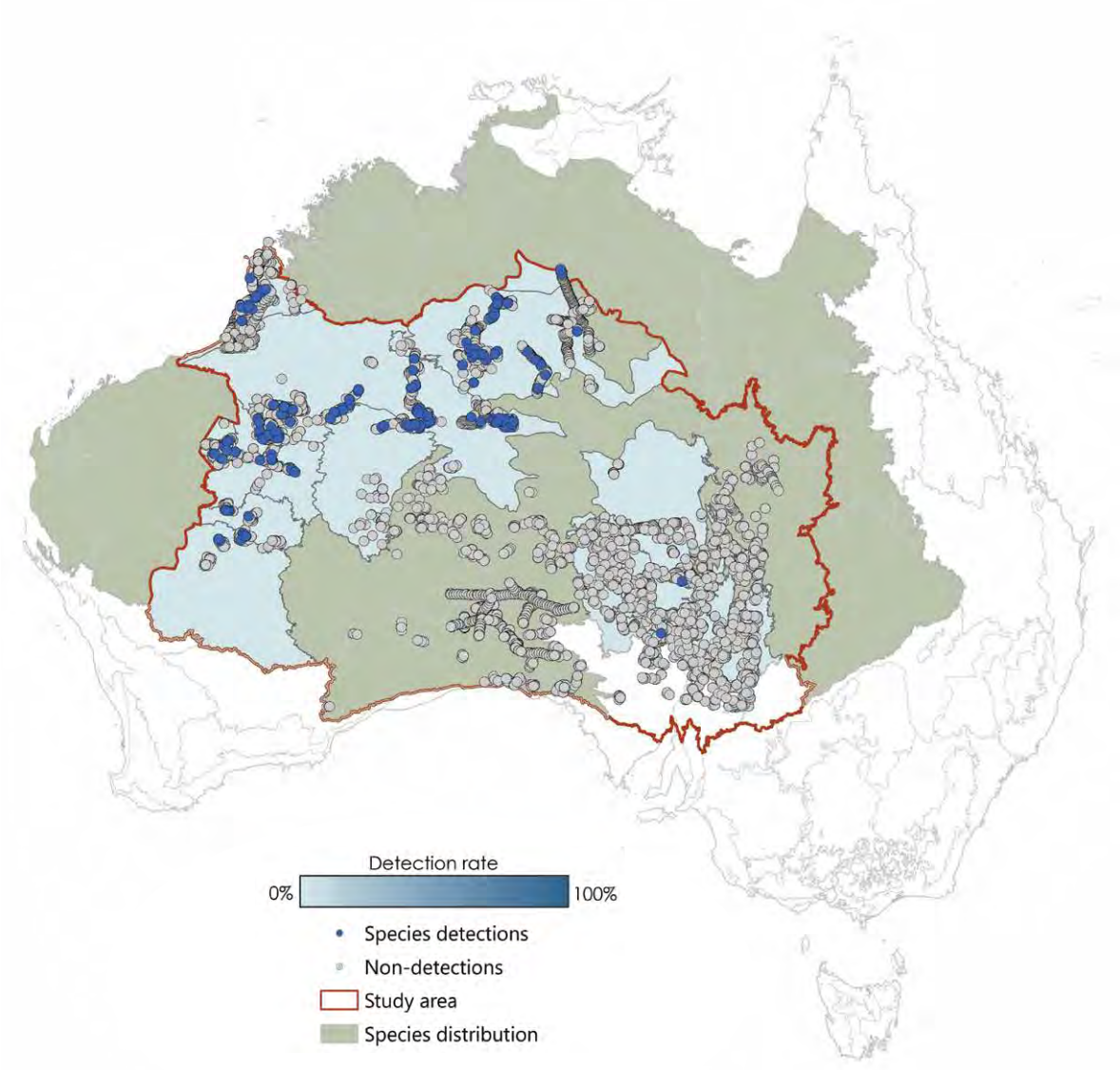
The map above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Centralian blue-tongue lizard detection rates

Centralian blue-tongue lizards were detected at over 1% of all surveys in the AZM dataset. It was the 6th most commonly recorded reptile species.

The map below shows the average detection rate for centralian blue-tongue lizards across all surveys carried out in each bioregion, since the 1980s.



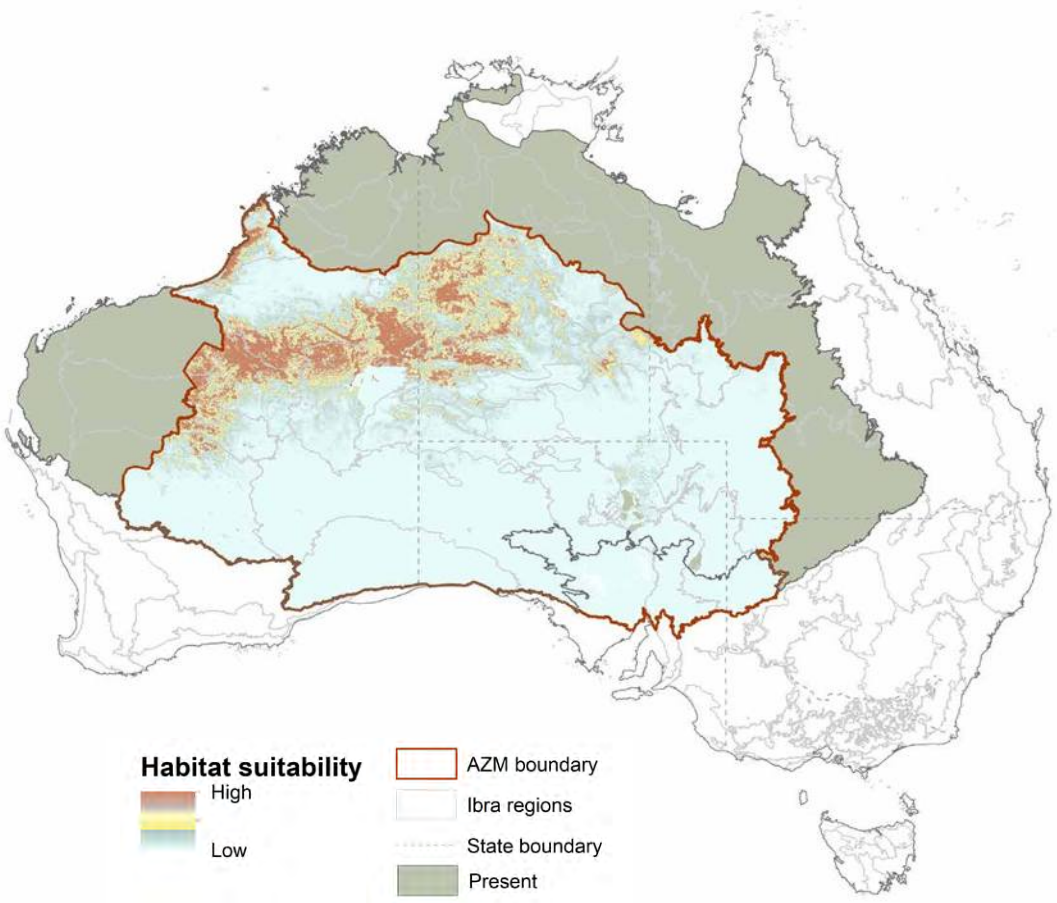
Things to think about when surveying for centralian blue-tongue lizards

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell centralian blue-tongue lizard tracks apart from other species before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Centralian blue-tongue lizard habitat suitability

The habitat suitability model can tell us about where centralian blue-tongue lizards are most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that centralian blue-tongue lizards prefer areas of higher elevation and high average temperatures, between 22-27 degrees Celsius. The map shows us that we can expect to find centralian blue-tongue lizards in all parts of the north-western desert, where the map shading is reddish brown. The map only shows habitat suitability inside the AZM project boundary, but centralian blue-tongue lizards are found outside the project area and might be common in other places too. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert; getting more survey data from these areas would improve the model.



Further information

Arid Zone Monitoring project:
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References

[1] Species distribution information compiled during a 2017 reptile assessment carried out by IUCN (https://datadryad.org/stash/dataset/doi:10.5061/dryad.83s7k), and updated by expert opinion (R. Tingley).

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Centralian blue-tongue lizard, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Shingleback, bobtail, sleepy lizard

Tiliqua rugosa

Language names
Pikurta/pikurtu

National status: Not listed

IUCN Red List: Least concern

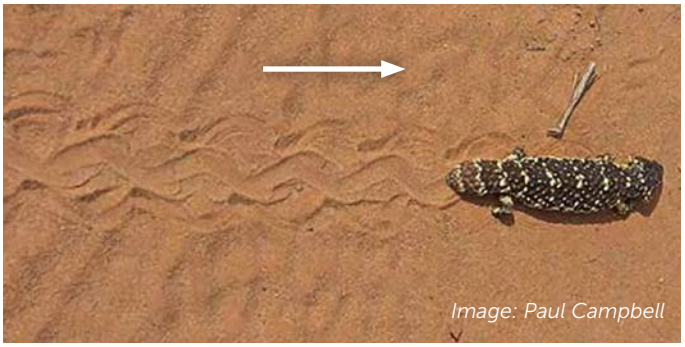
Shingleback.

Animal Description
The shingleback has unmistakable scales, with a triangle-shaped head and tail that make it hard to tell the front from the back end. It is usually dark brown to black with pale bands on the body and tail, and a cream-coloured belly. The shingleback is a close relative to the blue-tongued lizards, and also sticks out its blue tongue when it wants to look scary.

Habitat
The shingleback lives in semi-arid to arid shrublands, desert grasslands and dune fields. They like to shelter in leaf litter and under grass, rocks and logs. In cooler weather shinglebacks enjoy sunbaking.

Threats
No major threats, but preyed on by cats and foxes.

Tracks
Shinglebacks are slow-moving. Their tails leave a zig-zag drag pattern in sand and their legs leave alternating drag marks.

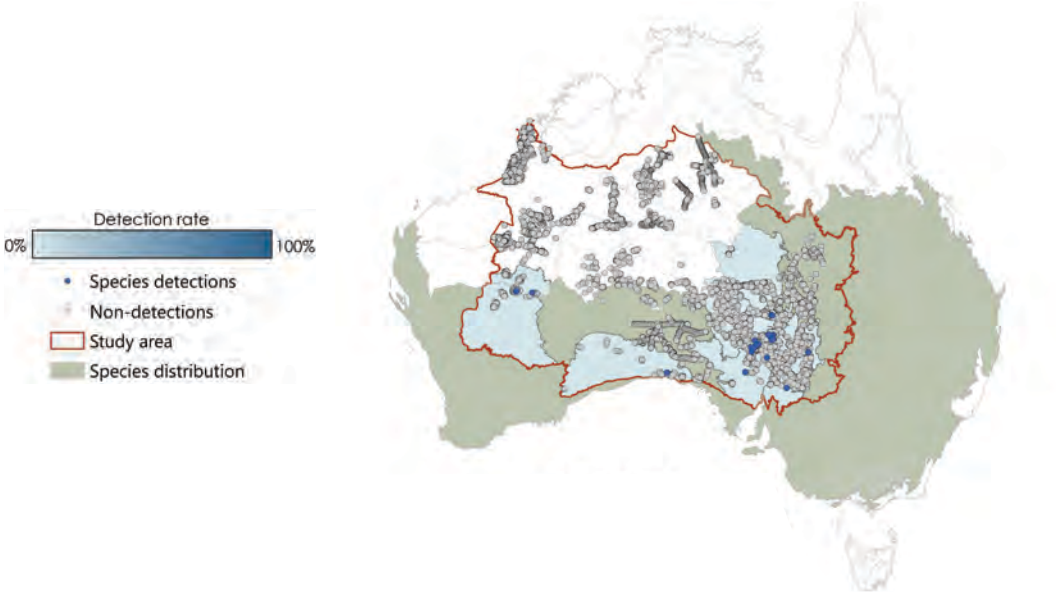


Shingleback and tracks.

Arid Zone Monitoring project findings

Shingleback detection rates

The map shows detections of shinglebacks in the AZM database. They were detected in the south-eastern and western parts of their distribution. Each blue dot shows a survey site where shinglebacks were recorded. The grey dots show all the other sites that were surveyed, but where shinglebacks were not recorded. Shinglebacks were only detected at less than 1% of all surveys in the AZM dataset. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1].



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It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Things to think about when surveying for shinglebacks

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell shingleback tracks apart from other small reptiles before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021.

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Shingleback, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Small goannas

Small goannas are often detected during track-based surveys, but it can be very hard to say what species left the track or sign. This profile shows some of the small goannas that may be detected across the deserts.

Spiny-tailed monitor

Varanus acanthurus

Language names

Jalangarti, Kalawurru, Maruntu, Parnka, Wirlka.

Animal Description

Large lizard with red, brown or black skin and cream/yellow spots, striped neck and a very spiny tail.

Habitat

The spiny-tailed monitor lives in rocky country, and shelters in burrows, under or between rocks.

Spiny-tailed monitor.

Black-headed monitor

Varanus tristis

Animal Description

Long, round keeled tail. Pale grey to black/brown with dark rings and spots on the back. Head and neck black. Tail black with spots forming rings on the base.

Habitat

Widespread in rocky outcrops in semi-arid and arid regions. Can be found under bark, in hollow wood, rock crevices and unused fairy-martin nests.

Black-headed monitor.

Short-tailed pygmy monitor

Varanus brevicauda

Animal Description

Small monitor about 23cm long, reddish-brown with dark round markings on the body.

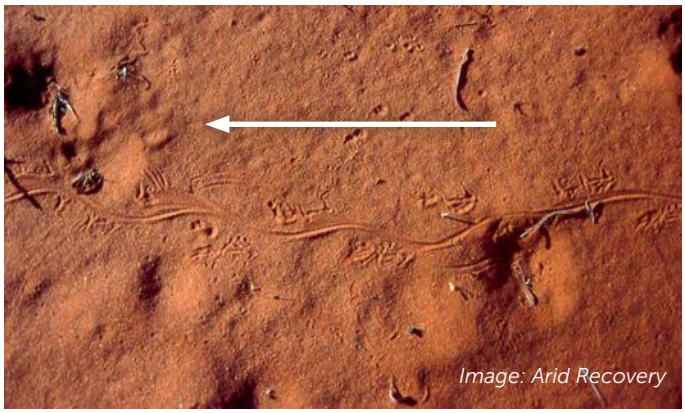
Habitat

The short-tail pygmy monitor lives in sandy desert country with spinifex grass.

Short-tailed pygmy monitor.

Tracks

Small goannas have tracks showing a tail drag mark with claw prints on either side. If they are running, the tail may be held off the ground.



Goanna walking tracks (arrow shows which way it is going).

Goanna running tracks.

Burrow

Small goanna burrow.

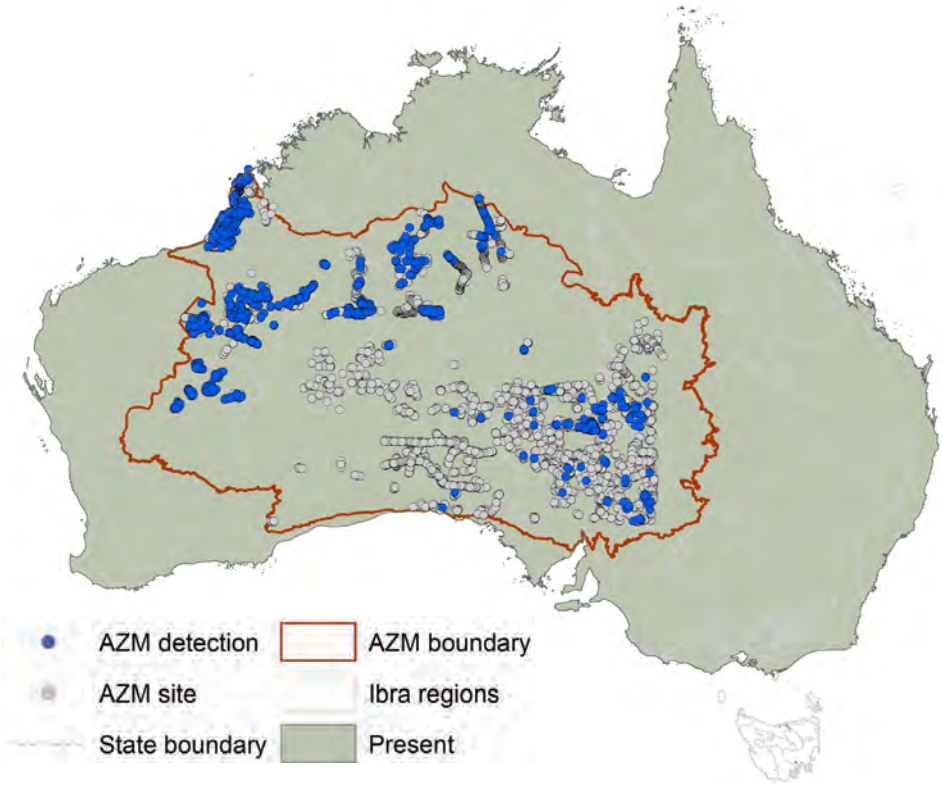
Scats

Goanna scat.

Arid Zone Monitoring project findings

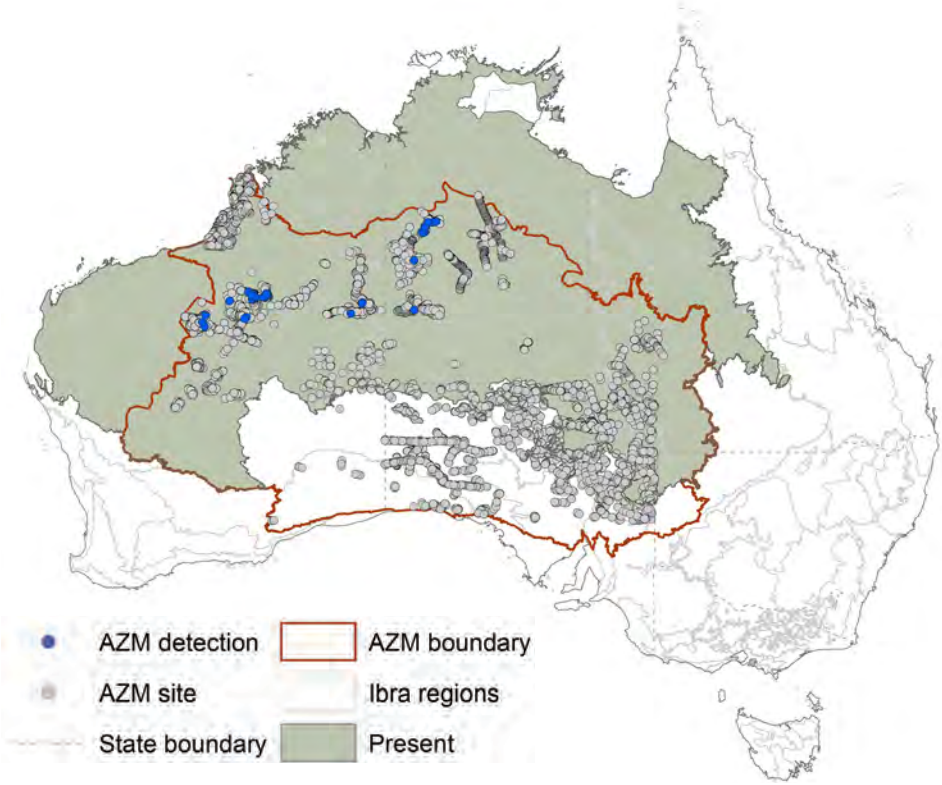
Unidentified goanna detections

The map summarises detections of unidentified goannas in the AZM database. Each blue dot shows a survey site where a goanna species was recorded. The grey dots show all the other sites that were surveyed, but where goannas were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers.



Spiny-tailed monitor distribution

Each blue dot shows a survey site where a spiny-tailed monitor was recorded. The grey dots show all the other sites that were surveyed, but where spiny-tailed monitors were not recorded. The information about the overall distribution in the map background is drawn from IUCN[1].

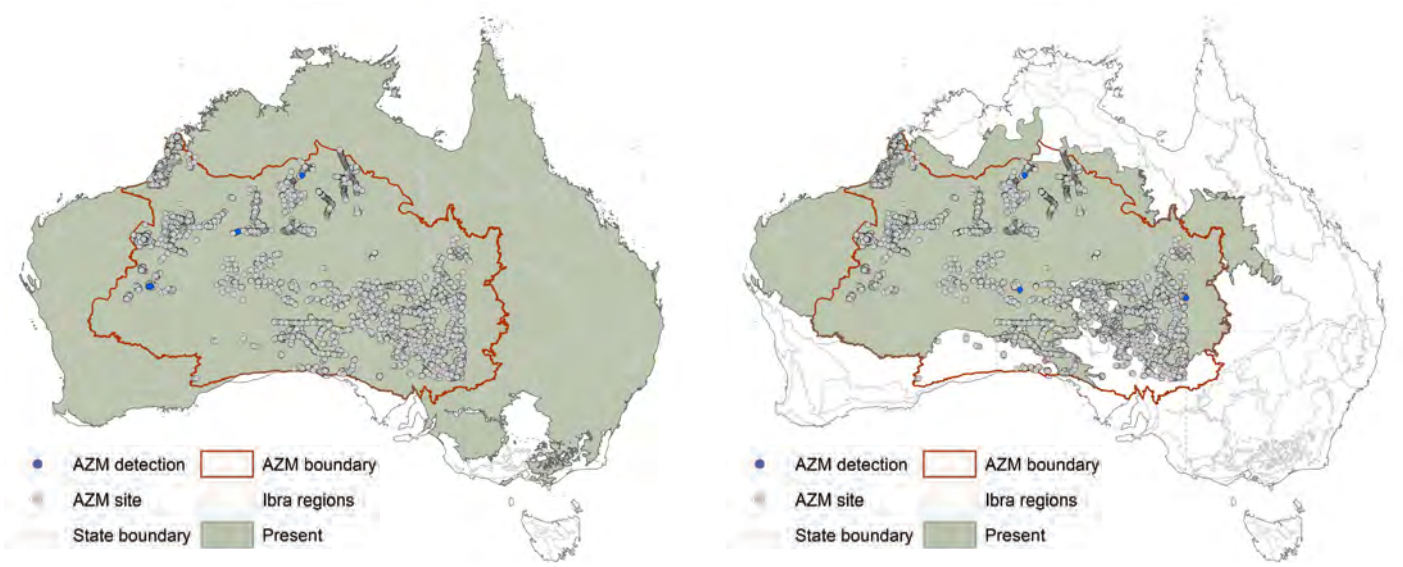


Black-headed goanna distribution

Each blue dot shows a survey site where a black-headed monitor was recorded. The grey dots show all the other sites that were surveyed, but where black-headed monitors were not recorded. The information about the overall distribution in the map background is drawn from IUCN[1].

Short-tailed monitor distribution

Each blue dot shows a survey site where a short-tailed monitor was recorded. The grey dots show all the other sites that were surveyed, but where short-tailed monitors were not recorded. The information about the overall distribution in the map background is drawn from IUCN[1].



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Small goanna detection rates

Small goanna species detection rates in AZM data. Rank tells us how commonly the species was detected compared with outer reptile species that were recorded suring sandplot surveys.

Species name	Number of AZM detections	Number of surveys	% detection rate	Rank
Goanna	1944	14435	13	1
Spiny-tailed monitor	33	14435	0.22	15
Black-headed monitor	5	14435	0.03	25
Short-tailed pygmy monitor	3	14435	0.02	29

Further information

Arid Zone Monitoring project:

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Small goannas, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Gould's goanna, sand goanna

Varanus gouldii

Language names

Alewatyerre, Tingka, Jalkarna, Kurrkardi, Warlkan, Rumiya, Parnajalpa

National status: Not listed

IUCN Red List: Least concern

Gould's goanna, or sand goanna.

Animal Description

This is a large goanna reaching well over 1 metre in length. It is light yellow to blackish brown with dense dark speckling and pale spots. It has a dark stripe that runs from the eye down the back. There are narrow bands down the tail, with a pale yellow tip. Gould's goanna is sometimes confused with the yellow-spotted goanna (*Varanus panoptes*), but Gould's is less stocky than the yellow-spotted goanna.

Key threats

Foxes may eat young goannas in parts of their range. In the tropics and sub-tropics, Gould's goannas can be poisoned by eating cane toads. Despite these issues, the overall population of Gould's goanna is not under great threat.

Habitat

Gould's goannas are found in many different habitats of arid and semi-arid Australia. They dig large burrows for shelter, and can also use rock crevices and hollow logs or dense litter for sheltering. They eat other animals, alive or dead (carrion).

Gould's goanna tracks

A young Gould's goanna tracks (arrow shows which way it is going).

Monitor and Lerista tracks.

Goanna scat

Goanna scat.

Reptile scats contain uric acid and usually have a small white hard section.

Animals that might be confused with the sand goanna during survey

- Yellow-spotted goanna
- Perentie

It can be hard to tell these species of large goanna apart from their tracks, but these larger goannas tend to leave a straighter tail mark, and their footprints are larger than the Gould's goanna.

Gould's goanna diggings and burrow

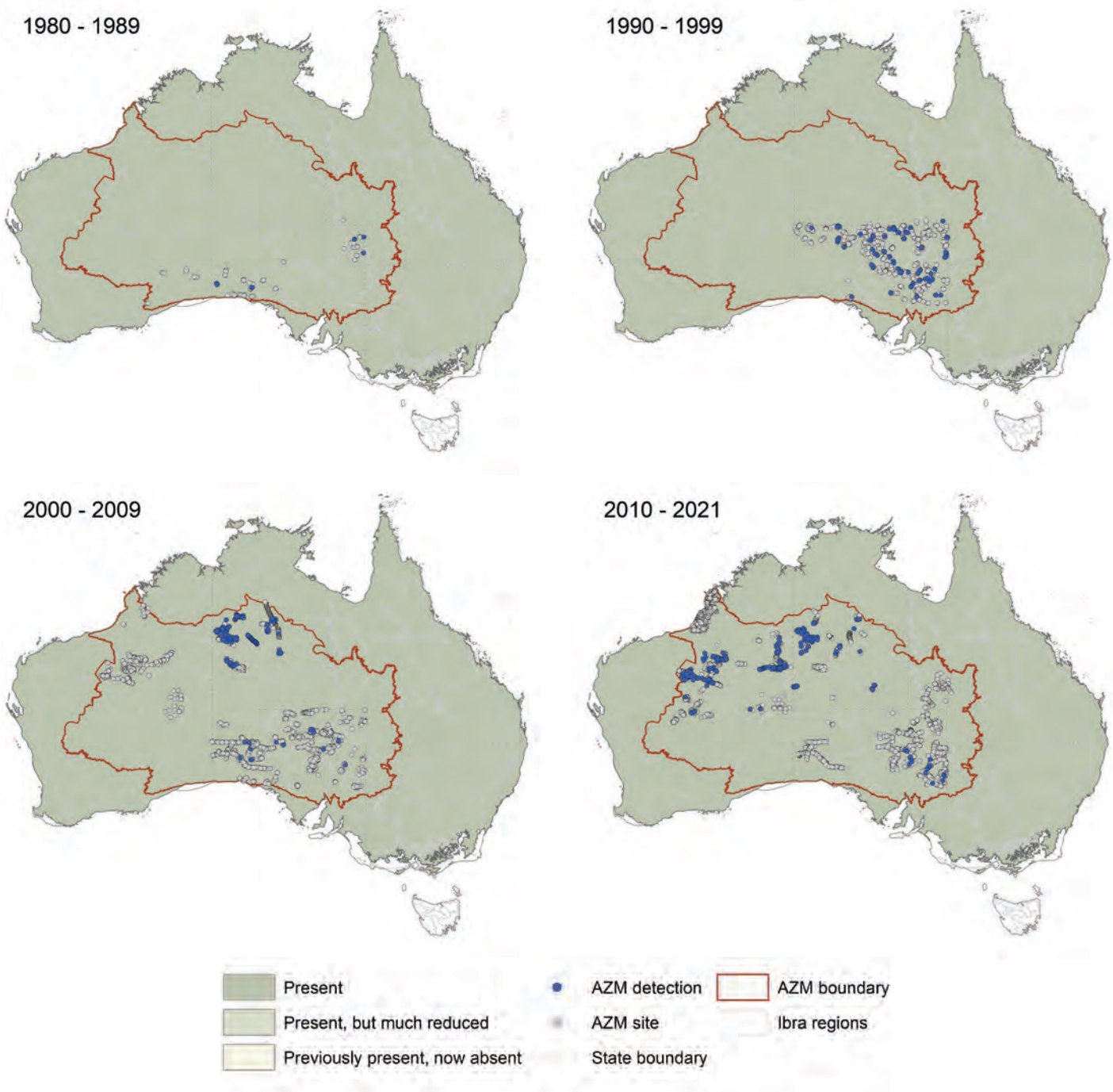
Diggings of a young Gould's goanna.

Tracks of a young Gould's goanna, leading to a burrow.

Arid Zone Monitoring project findings

Gould's goanna distribution

The maps summarise detections of Gould's goanna over time in the AZM database. Gould's goannas were detected right across the project area. Each blue dot shows a survey site where Gould's goannas were recorded in that decade. The grey dots show all the other sites that were surveyed in that decade, but where Gould's goannas were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from IUCN[1].



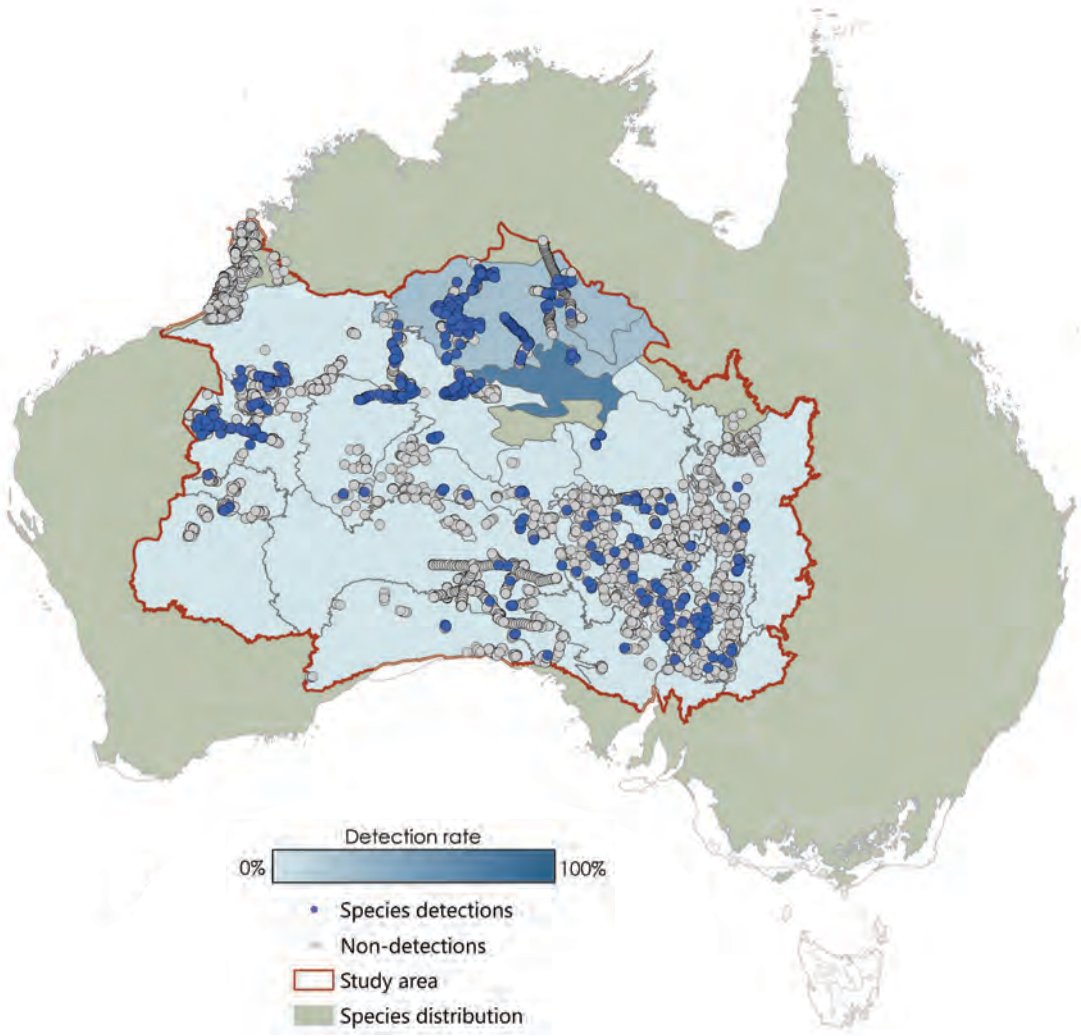
The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Gould's goanna detection rates

Gould's goanna were detected at over 5% of all surveys in the AZM dataset. It was most commonly recorded reptile species. The AZM database includes almost 2000 records of 'goanna' that are not identified to species – some of these may be Gould's goanna.

The map below shows the average Gould's goanna across all surveys carried out in each bioregion. The darker blue are bioregions where the Gould's goanna was detected most frequently, and it appears that they are more common in the northern deserts.



Things to think about when surveying for Gould's goanna

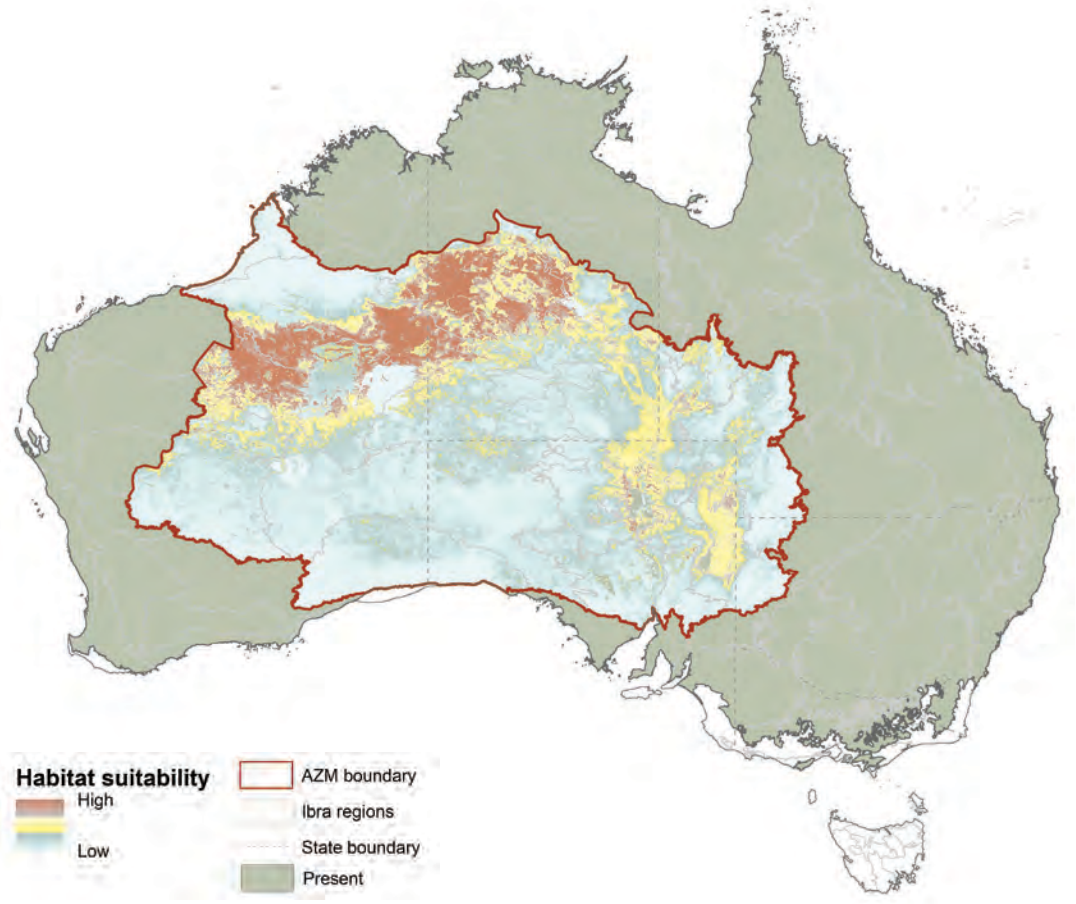
- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell Gould's goanna tracks apart from other species such as perenties or yellow-spotted goannas before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (like right-way fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Gould's goanna habitat suitability

The habitat suitability model can tell us about where the Gould's goanna is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests us that Gould's goannas prefer to live in areas that have warm temperatures with annual means greater than 20 degrees Celsius and in areas where soils have low clay content. They are more common in northern deserts, in the red-brown shaded areas of the map.

The maps only show habitat suitability inside the AZM project boundary, but Gould's goannas are also found outside the project area, and could be common there. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert or the Great Victoria Desert; getting more survey data from these areas would improve the model.



Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] Species distribution information compiled during a 2017 reptile assessment carried out by IUCN (https://datadryad.org/stash/dataset/doi:10.5061/dryad.83s7k), and updated by expert opinion (R. Tingley).

Threatened Species Recovery Hub
National Environmental Science Programme

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Gould's goanna, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Perentie

Varanus giganteus

Language names
Atywemp, Dilti, Echunpa, Lirripitji, Yalapara

National status: Not listed

IUCN Red List: Least concern

Perentie.

Animal Description
The perentie is a large, long-necked lizard with strong limbs and long tail. It has dark brown or black, large circular patches with pale centres, in rows across its body. The head, neck and throat are cream with black net-like markings.

Key threats
Foxes may eat young perentie in parts of their range, but the species is not under threat.

Habitat
The perentie shelters in rocky outcrops, in rock crevices or burrows, then comes out to forage in the desert sandplains, dunes and claypans.

Perenties shelter in rocky outcrops, rock crevices or burrows.

Goanna scat (perentie scats are similar).

Perentie scat

Reptile scats contain uric acid and usually have a small white hard section.

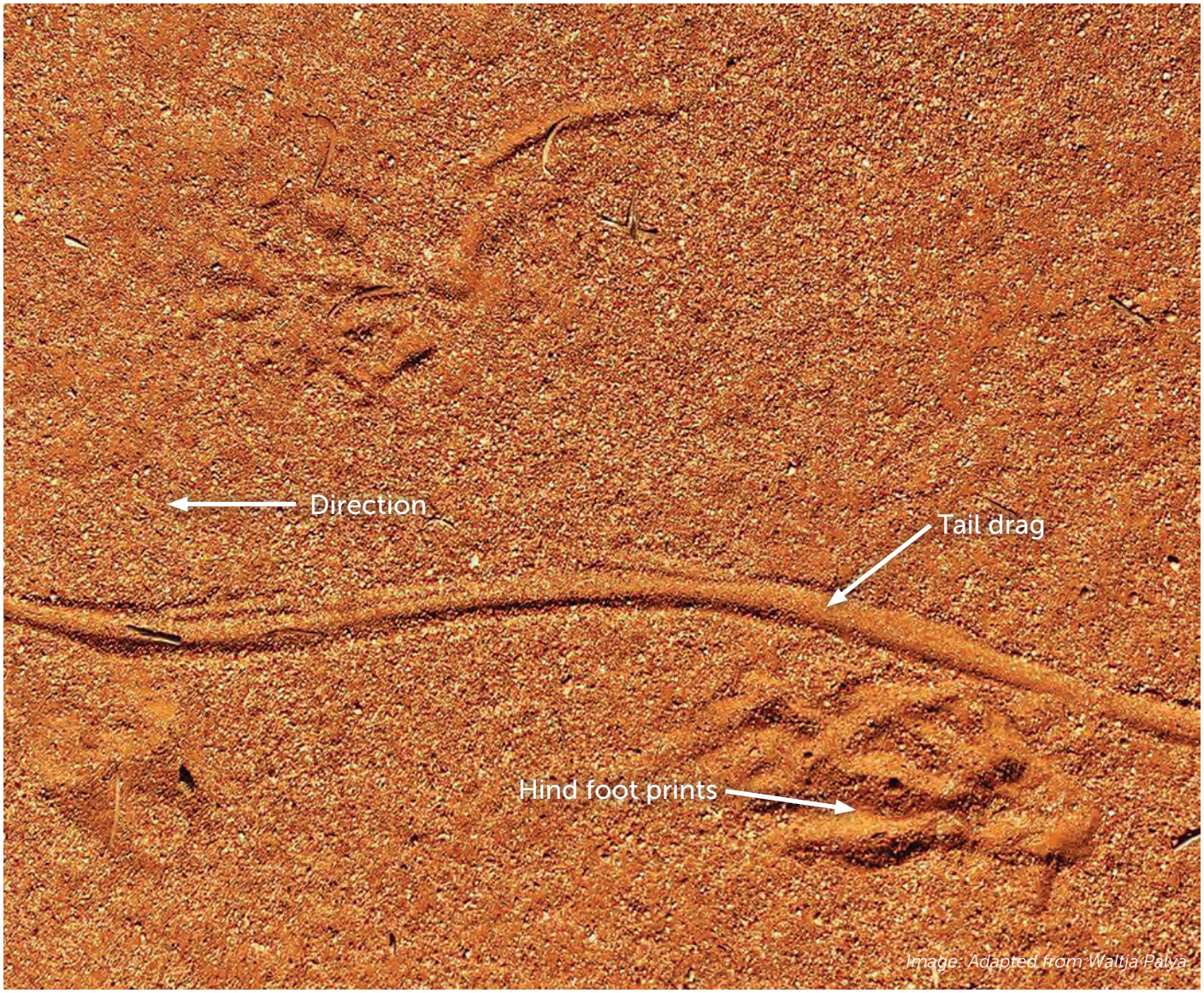
Animals that might be confused with the perentie during survey

- Sand goanna (Gould's goanna)
- Yellow-spotted goanna

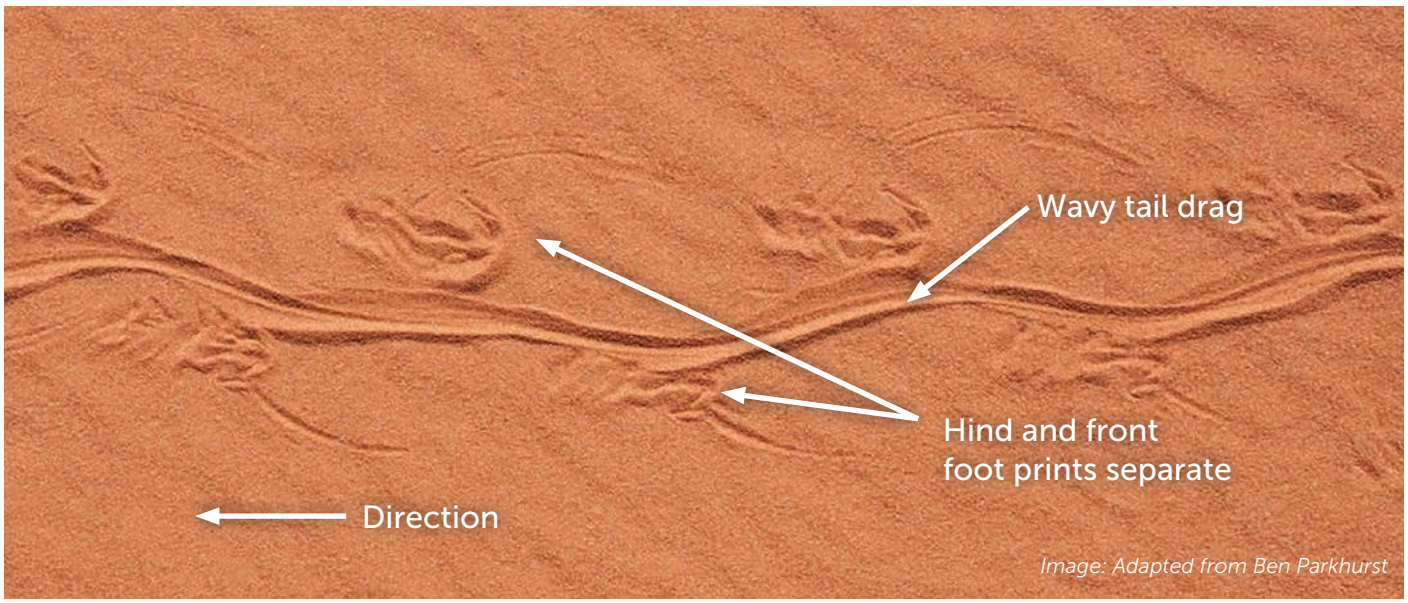
It can be hard to tell these species of large goanna apart from their tracks. Sand goanna (or Gould's goanna) have a wavier tail drag and smaller set of paired front and hind foot prints on each side than Perentie or yellow-spotted goannas.

Perentie tracks

Goannas leave a set of footprints with a tail drag through the middle. Tracks of a fully grown adult perentie are large, and the hind and fore front prints almost overlap.



Perentie track. Notice hind and front prints almost overlap, foot prints large.

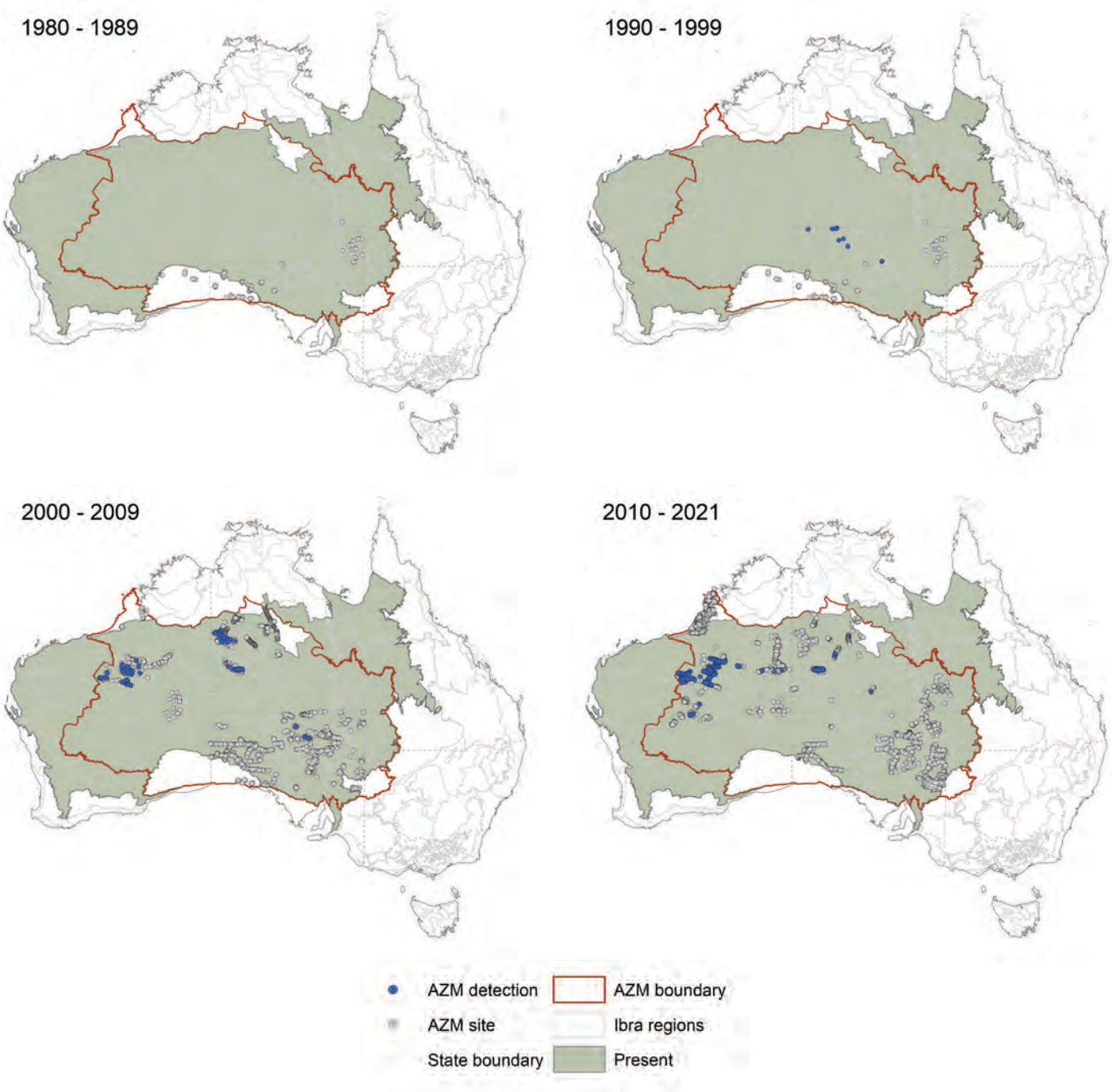


Sand goanna - note the smaller front prints separate and in front of the larger hind prints. Thick white arrow which way it is going.

Arid Zone Monitoring project findings

Perentie distribution

The maps summarise detections of perentie over time in the AZM dataset. Each blue dot shows a survey site where perentie were recorded in that decade. The grey dots show all the other sites that were surveyed, but where perenties were not recorded in that decade. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the Australian Faunal Directory[1] and the IUCN[2].



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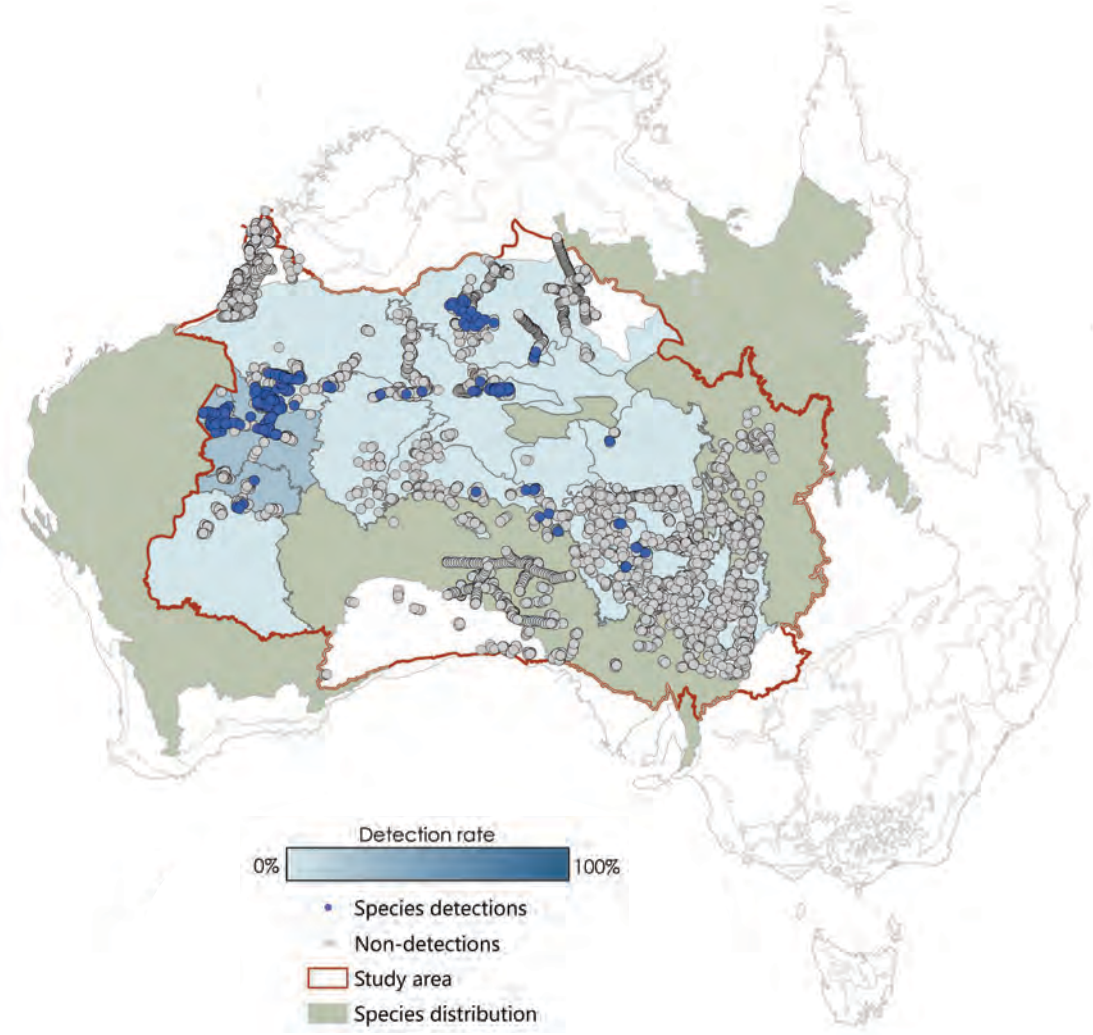
It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Perentie detection rates

Perenties were detected at over 3% of all surveys in the AZM dataset. It was the second most commonly recorded reptile species, after sand goannas (Gould's goannas). The AZM database includes almost 2000 records of 'goanna' that are not identified to species – some of these may be perentie.

The map below shows the detection rate for perentie across all surveys carried out in each bioregion, since the 1980s. Detection rates have been highest in the western desert (darker blue shading).



Things to think about when surveying for perentie

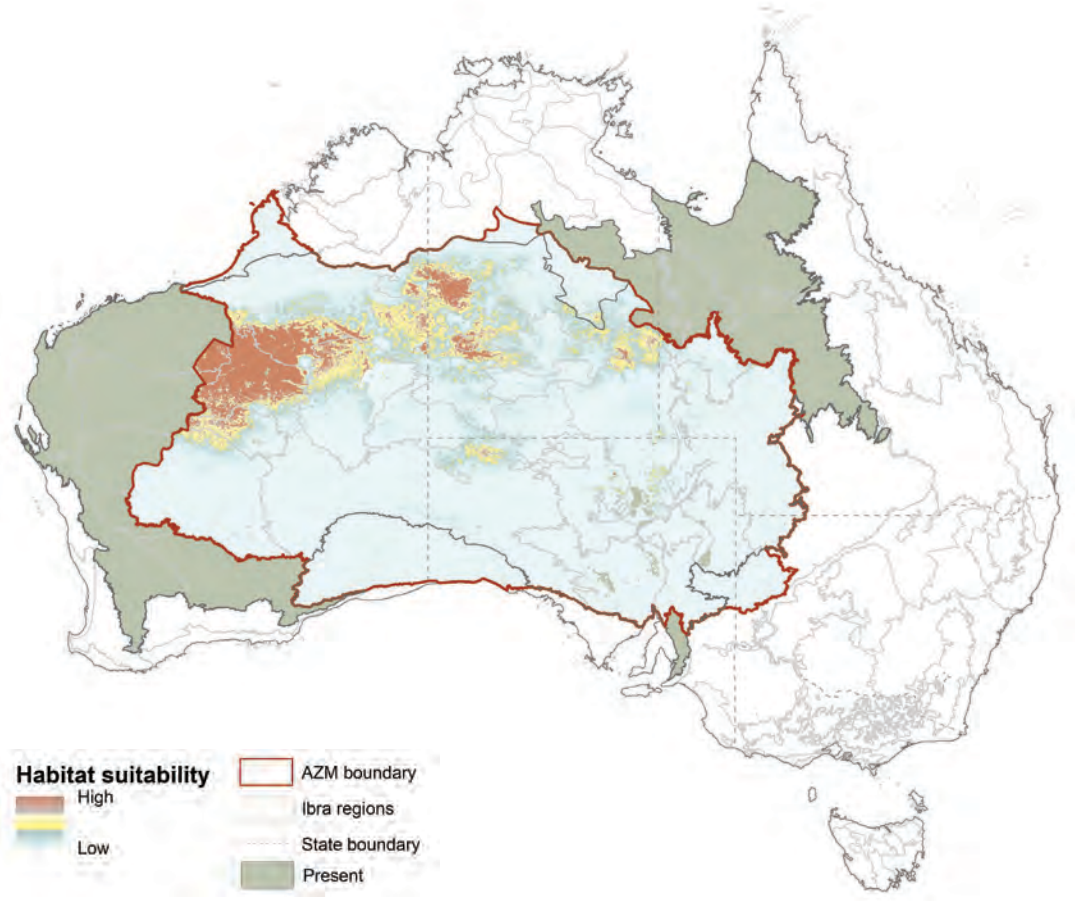
- Survey during good conditions (in the early morning is best, not too windy and not straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Follow advice of experienced trackers - know how to tell perentie tracks apart from other goannas before you go to survey.
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (such as right-way fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Perentie habitat suitability

The habitat suitability model can tell us about where the perentie is most likely to be found. The analysis considered climate factors like annual, seasonal and daily temperature and rainfall; landform factors like elevation and slope; soil factors; and habitat factors like the amount of vegetation (NDVI) and fire frequency.

The model suggests that perenties prefers places of moderate elevation (>200 m above sea level), that are warm on average (>22 degrees), but with large differences between day and night temperatures. These are the red-brown areas of the map in north-western Australia.

The map only shows habitat suitability inside the AZM project boundary, but perentie are also found outside the project area. The habitat suitability model does not predict well in large areas where there has not been any sampling, for example in parts of the Great Sandy Desert; getting more survey data from these areas would improve the model.



Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

References

[1] ABRS. Australian Faunal Directory. 2021; https://biodiversity.org.au/afd/home. Accessed June, 2021.

[2] Species distribution information compiled during a 2017 reptile assessment carried out by IUCN (https://datadryad.org/stash/dataset/doi:10.5061/dryad.83s7k), and updated by expert opinion (R. Tingley).

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Perentie, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Yellow-spotted monitor

Varanus panoptes

Language names

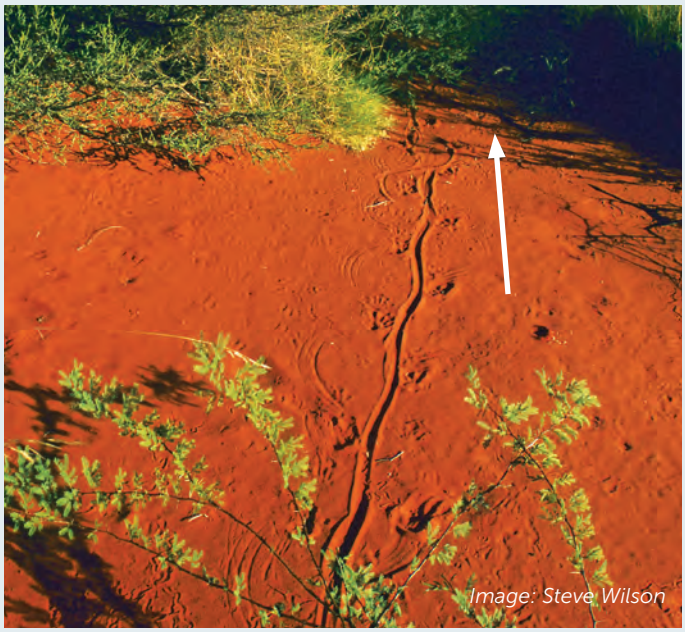
Jalangarti, Kalawurru, Maruntu, Parnka, Wirlka

National status: Not listed

IUCN Red List: Least concern

Yellow-spotted monitor.

Goanna scat.



Goanna tracks (arrow shows which way it is going).

Animal Description

A large powerful goanna, reaching over a metre in length. The yellow-spotted monitor is light yellow to blackish brown with pale yellow spots, and a tail with a pale-yellow tip. It is sometimes confused with the Gould's goanna (or the sand goanna, *Varanus goudii*), but the yellow-spotted monitor is stockier. The yellow-spotted monitor will often stand up on its back legs and tail (tripoding) to get a better view, or to look scarier if they feel threatened. They are really fast runners, and will dash off to the nearest tree if they are chased.

Key threats

Yellow-spotted monitors are killed in northern Australia if they eat cane toads. In the deserts, cats and foxes may eat young monitors, but the species is not under great threat there.

Habitat

The yellow-spotted monitor is a versatile predator that prefers to live and hunt near water or drainage lines. They are great diggers, building burrows to shelter in if there are no existing burrows available.

Scat

Reptile scats contain uric acid and usually have a small white hard section.

Tracks

Goannas leave a set of footprints with a tail drag through the middle.

Animals that might be confused with the yellow-spotted monitor during survey

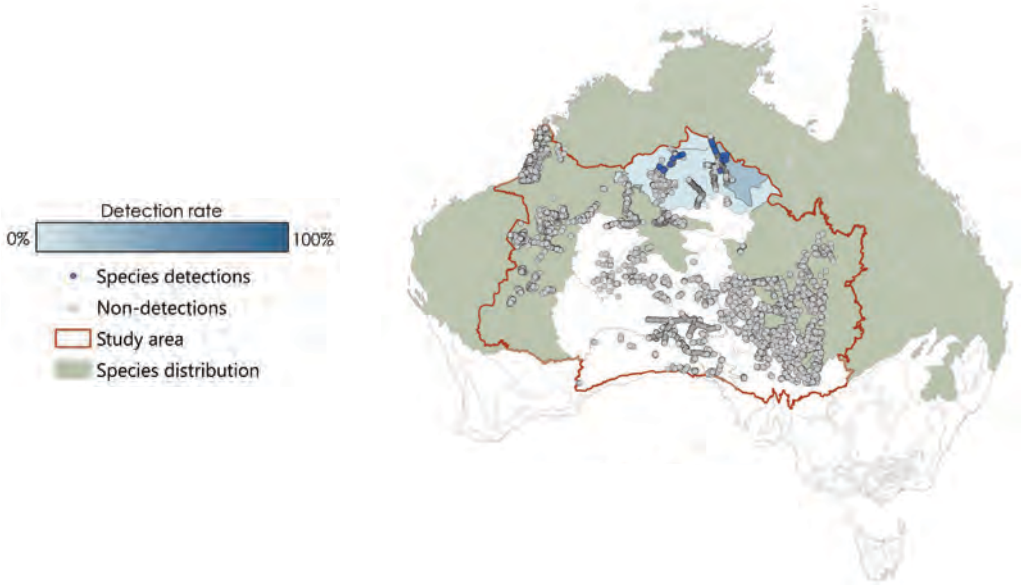
- Sand goanna (Gould's goanna)
- Perentie

It can be hard to tell these species of goanna apart from their tracks. The yellow-spotted monitor and perentie have a straighter drag and larger set of paired front and hind foot prints on each side, compared with the smaller Gould's goanna.

Yellow-spotted monitor detection rates

The map summarises detections of yellow-spotted monitors in the AZM dataset. The map shows that yellow-spotted monitors occur mostly in the northern parts of Australia and not in the central arid region. Each blue dot shows a survey site where yellow-spotted monitors were. The grey dots show all the other sites that were surveyed, but where yellow-spotted monitors were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the IUCN[1].

Yellow-spotted monitors were detected at less than 1% of all surveys in the AZM dataset: of 14,435 site surveys, they were detected only 35 times. It was 10th most commonly recorded reptile species. The AZM database includes almost 2000 records of 'goanna' that are not identified to species – some of these may be the yellow-spotted monitor.



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It is possible that extra surveys have been carried out over the past 40 years that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Things to think about when surveying for yellow-spotted monitor

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- If you want to see changes over time, you will need to go back to the same areas to sample over several years. If you want to see if management actions (feral animal culling or fire) are working, you need to sample many different sites, before and after the action. You might need help from a scientist to make the sampling design strong.

Further information

Arid Zone Monitoring project:
https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

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Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Yellow-spotted monitor, Project 3.2.5 findings factsheet.

Arid Zone Monitoring Species Profile

Large snakes

This profile includes two species of **very dangerous** poisonous snakes, and three species of python. They all leave large, similar tracks that are hard to tell apart. None of the large snakes in this profile are listed as threatened under the EPBC Act, although some species (such as mulga snake) may be declining from places where they can hunt toxic cane toads. There are some studies which shows the woma is decreasing in parts of its range.

Language names

Arreperlp, Arripere, Ilparralhia, Ilperrelheye, Kwerreny, Liru, Lumpurra, Ngurrupulkka, Pwekerrenye, Warna, Wiril

Mulga snake (king brown snake) *Pseudechis australis*

Dangerous

Animal Description

The mulga snake is the largest of Australia's poisonous snakes, reaching lengths over 2 m. Colour is variable, the scales are pale brown to olive to rich reddish brown with a pale base and darker hind edges, that make the snake look like it is wearing a fishnet stocking. Its belly is cream to white.

Habitat

Mulga snakes live in lots of different habitats, including arid and semi-arid country. In drier country mulga snakes prefer water courses and moister areas. It may be active during the day, or at night during hot times of year, hunting small mammals, reptiles, birds and frogs.

Mulga snake.

Mulga snake.

Western brown snake

Pseudonaja mengdeni

Dangerous

Language names

Lirrapurta *(and see list above for other names that may be used for the western brown snake)*

Animal description

The western brown snake is usually about 1.2 m long but can grow up to 2 m. It has a slender body and narrow head. Colours range from light brown to almost black, with a cream, yellow, orange or grey belly, sometimes with darker blotches. There are two forms-orange with black head, or pale head with grey nape.

Habitat

Like mulga snakes, western brown snakes are found in lots of different habitats in arid and semi-arid country. Western brown snakes are usually active during the day, but will hunt at night during hot times. They hunt small mammals, reptiles and birds.

Western brown snake.

Western brown snake.

Woma python

Aspidites ramsayi

Language names

Ahenenye, Aheye-inenhe, Ertnweye, Kuniya, Ngawininyi, Piilyurru, Utneye

Animal Description

The woma is a large python that usually reaches lengths of about 1.5 m, but can pass 2 m. It can be pale brown, yellow-brown, red-brown to olive, with darker uneven bands along its body.

Habitat

Womas are found in desert country and surrounding areas. Womas are active at night and shelter in abandoned burrows of other animals, such as goannas or mammals, and in big soil cracks during the day. They also hunt small animals in these same burrows and cracks, especially small reptiles.

Woma python.

Woma python.

Black-headed python

Aspidites melanocephalus

Language names

Kalurrjawa, Lirramunga, Purruyura

Animal description

The black-headed python is light to dark brown, with dark bands across its body, and has a shiny black neck and head. It is usually about 1.5-2 m long, but can reach over 3 m.

Habitat

The black-headed python lives in the northern part of Australia and and its distribution edges into the northern deserts. During the day, they shelter in burrows. They are active at night, hunting reptiles including other snakes.

Black-headed python.

Centralian carpet python

Morelia bredli

Language names

Antetherrke, Inturkulya, Yintajirrki

Animal descrption

Centralian carpet pythons can grow to 2 m or longer. They are brown or reddish brown and may have different pale patterns along the body, and a yellow or cream belly.

Habitat

Centralian carpet pythons live in dry desert country of the southern NT. They like to climb in trees or in rocky country.

Centralian carpet python.

Tracks

All these large snakes make a wavy pattern in the sand as they move across it. It can be hard to tell the difference between species from their tracks.

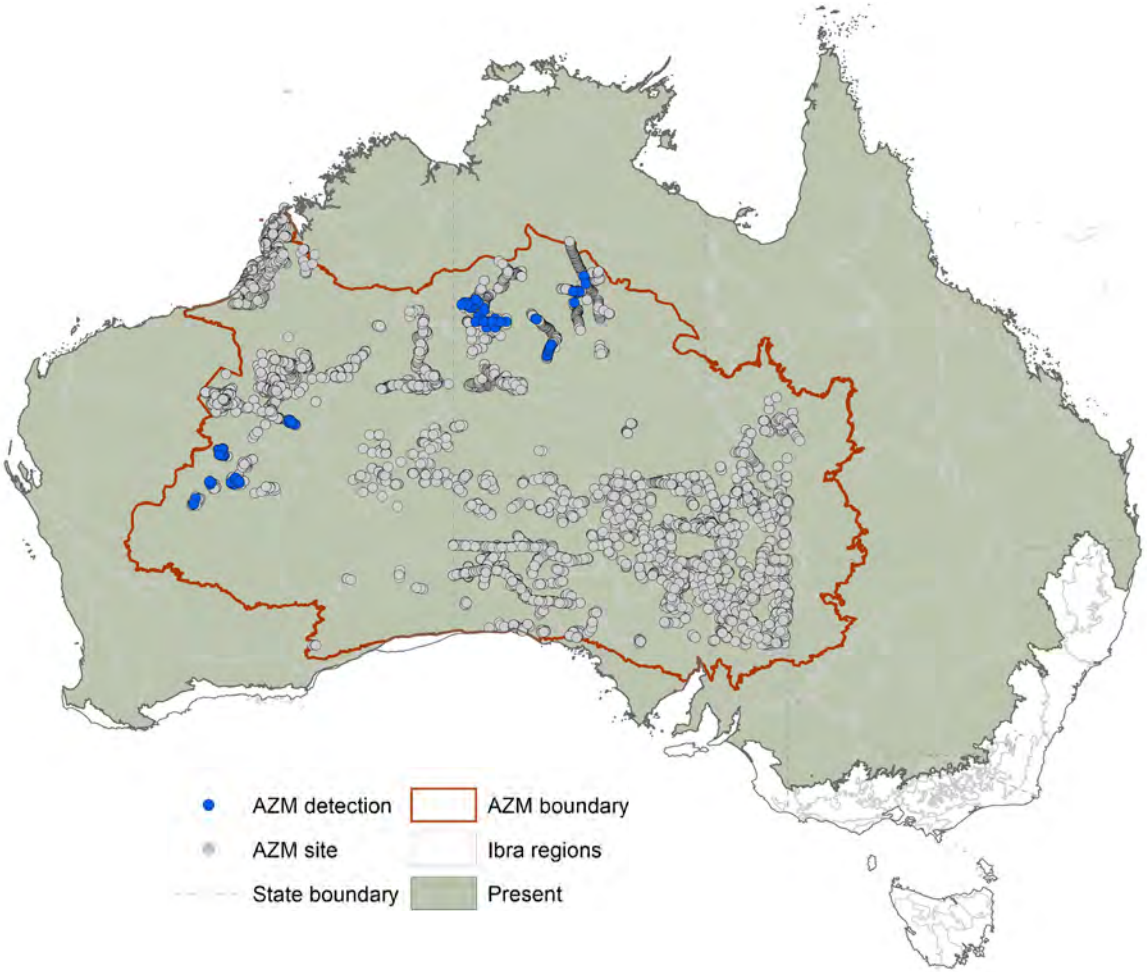
Woma tracks. All snakes make this wavy pattern, squishing the sand up behind their body as they push themselves forward.

Snake tracks

Arid Zone Monitoring project findings

Mulga snake detections

The map summarises detections of mulga snakes in the AZM database. Each blue dot shows a survey site where mulga snakes were recorded. The grey dots show all the other sites that were surveyed, but where mulga snakes were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers. The information about the overall distribution in the map background is taken from the IUCN [1].



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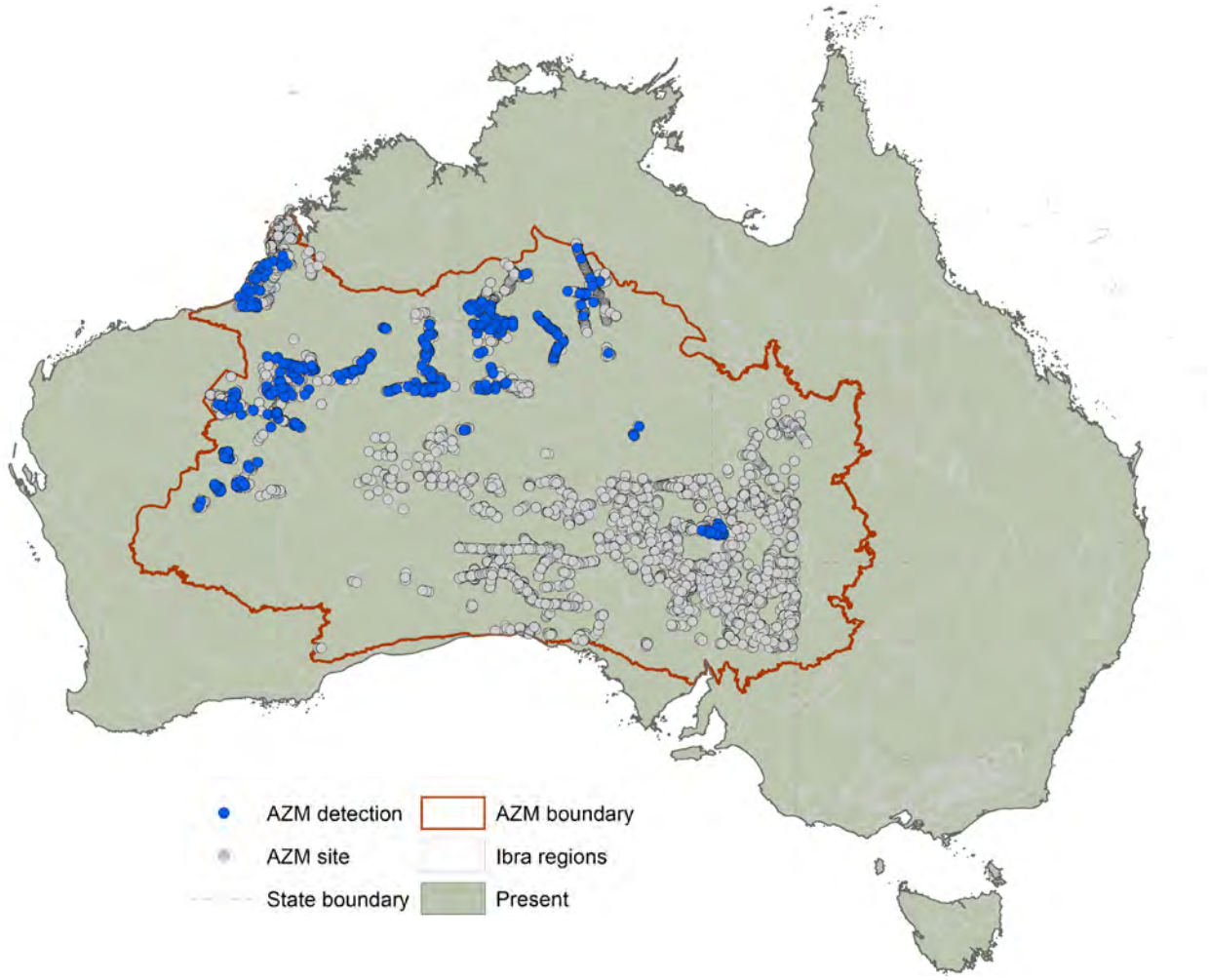
Things to think about when surveying for large snakes

- Survey during good conditions (in the early morning is best, not too windy or straight after rain).
- Organise to do surveys at regular times every year – for example, before the wet or hot season (October) and in the early dry season or early cool time (April).
- Information collected by ranger groups can help improve knowledge about reptile populations and the impact of threats such as the cane toads as they spread through the northern part of WA.
- Don't pick up poisonous snakes! Doing a snake handling course is the best way to learn how to handle dangerous snakes the right way, if needed.

Large snake detections

The map summarises detections of snakes in the AZM database. Snakes could refer to mulga snakes, western brown snakes, black-headed pythons, Woma pythons, carpet pythons, or some other large snake. Snakes were detected at over 3% of all surveys in the AZM dataset. Each blue dot shows a survey site where snakes were recorded and the grey dots show all the other sites that were surveyed, but where snakes were not recorded. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers.



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Further information

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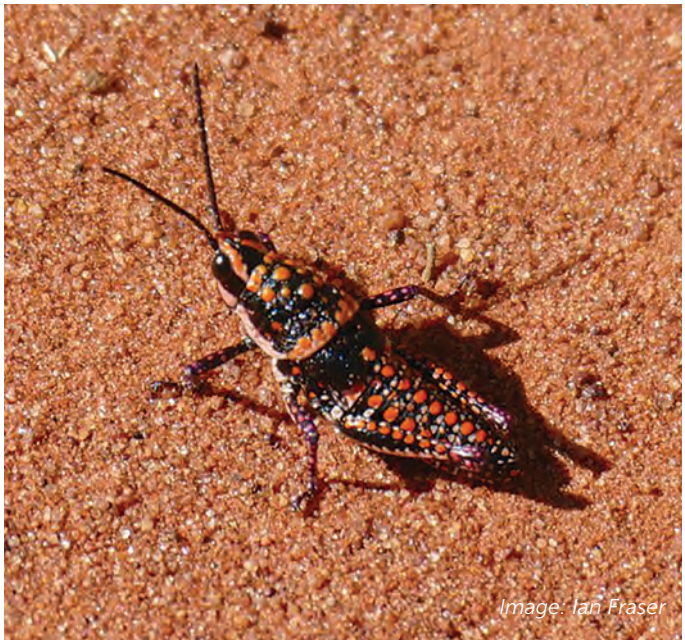
Arid Zone Monitoring
Species Profile

Invertebrates

Animal Description

Many types of invertebrates live in the deserts. In Australia, it is thought that around 300,000 of invertebrates are found on land, but there are many species still to be described[1]. This profile shows examples of more commonly seen invertebrate tracks, to help trackers tell them apart from vertebrate tracks. If you can see invertebrate tracks clearly during your survey, it probably means the tracking conditions are very good.

Invertebrates and their signs (diggings and tracks)



Pyrgomorph grasshopper.

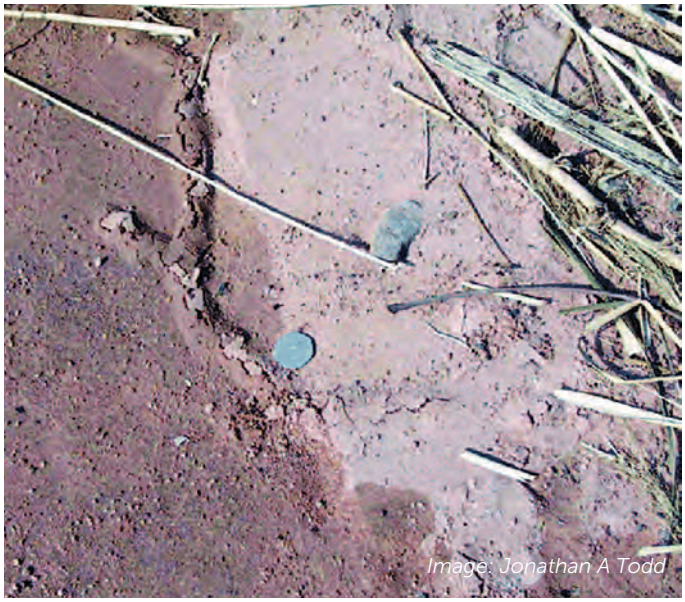
Giant crested grasshopper.

Grasshopper tracks (arrow shows direction of travel). Some grasshoppers bury themselves in the sand just below the surface. This produces a distinctive mark that can sometimes be mistaken for a mammal foot imprint. The eyes and antennae are just visible above the surface.

Antlion larvae.

Antlion larvae pits. The antlions bury themselves at the bottom of the pit and wait for small insects to fall in. Antlions leave a narrow trail in the sand when moving outside their pits.

Mole cricket.



Mole-cricket burrowings can be mistaken for signs of marsupial moles, as they can also burrow close to the surface. The size (width) of the burrow may help tell which animal made the sign - smaller width burrows are most commonly made by mole crickets.

Beetle tracks (arrow shows which way it is going). Beetles leave regular 'railway' track imprints from the legs on either side of the body.

Beetle track (arrow shows which way it is going).

Ant track (arrow shows which way it is going).

Grub track (arrow shows which way it is going).

Ant nests.

Ant nests.

Scorpion digging and burrow.

References

[1] Key to Australian Freshwater and Terrestrial Invertebrates. https://keys.lucidcentral.org/keys/v3/TFI/content/Introduction%20page.html. Accessed October 2021.

Threatened Species Recovery Hub
National Environmental Science Programme

This project received support from the Australian Government's National Environmental Science Program.

The Arid Zone Monitoring project is a collaboration between the NESP TSR Hub and over 30 Indigenous ranger groups and Indigenous organisations, 8 NGOs and NRM groups, 5 government agencies institutions, and many individual researchers and consultants. The project has gathered track and sign data from across Australia's deserts, using it to map the distributions of desert species and their threats. The national database includes almost 50,000 species presence records from over 5300 unique sites and almost 15,000 site visits, over the period from 1982 to 2020. The project area was defined by using IBRA subregional boundaries - the project boundary captures Australia's desert subregions where track and sign-based surveys are commonly used. The project showcases the collective work carried out by all groups working across the arid zone, and lays the groundwork for creating ongoing, national-scale monitoring for desert wildlife.

Cite this publication as NESP Threatened Species Recovery Hub, 2021. Arid Zone Monitoring Species Profile: Invertebrates, Project 3.2.5 findings factsheet.

Arid Zone Monitoring
Species Profile

Frogs

Frogs are not recorded often during track-based surveys. A few different species of frogs live in desert country. They only come out in good rain, and for the rest of the time the burrow underground. Sometimes people record desert spadefoot toads when they see their burrows, so this profile has some information about desert frogs, especially desert spadefoot toads.

Desert spadefoot toad.

Desert spadefoot toad.

Desert spadefoot toads coming out from their burrows after rain.

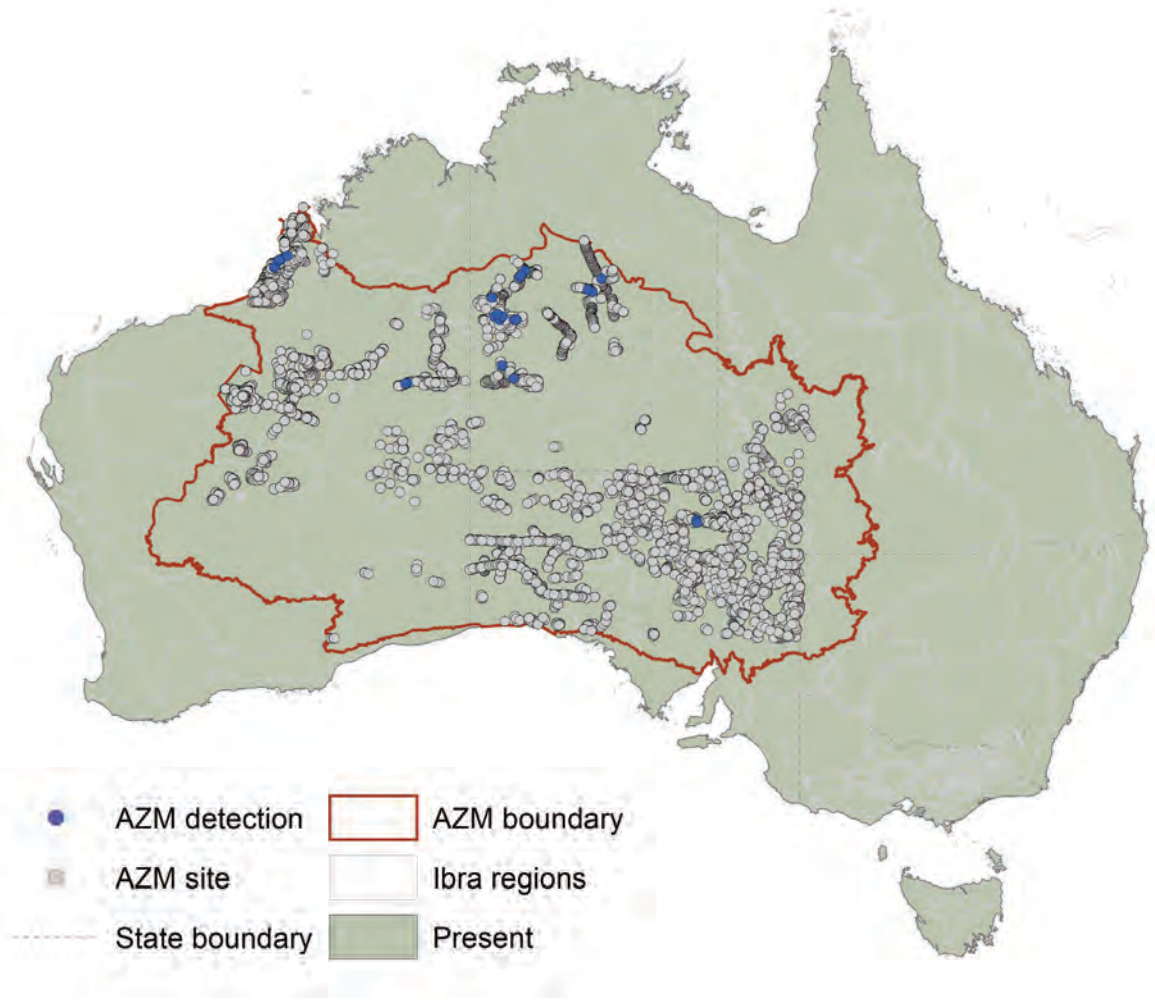
Frog tracks (arrow shows direction of travel).

Sand patch where desert spadefoot toads have emerged from their burrows after good rain.

Arid Zone Monitoring project findings

Frog detections

Each blue dot shows a survey site where frogs were recorded. The grey dots show all the other sites that were surveyed, but where frogs were not recorded. Frogs were detected at less than 1% of all surveys in the AZM database. These records were made by Indigenous Ranger groups, land councils, NGOs, government agencies and university researchers.



The maps above show data shared by data providers with the AZM project. The data are from track and sign surveys. This method is great for detecting species that live in sandy deserts, but not as good for species that prefer rocky habitats, or species with distributions that are mostly outside the central deserts. The method also works best for larger-bodied animals with tracks that are easily identified.

It is possible that extra surveys have been carried out that have not yet been shared. If you see 'gaps' in the maps that you could fill by sharing your data, let us know.

Further information

Arid Zone Monitoring project:

https://www.nespthreatenedspecies.edu.au/projects/arid-zone-monitoring-surveys-for-vertebrates-across-arid-and-semi-arid-zones

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