Science for Saving Species

Research findings factsheet

Project 3.3.5

Threatened Species Recovery Hub

National Environmental Science Programme

Evaluating the effect of predator control as a conservation strategy for malleefowl

In brief

The malleefowl (*Leipoa ocellata*) is a threatened ground-dwelling bird that occurs across much of southern, semi-arid Australia. It is found in low densities and therefore difficult to observe in the environment.

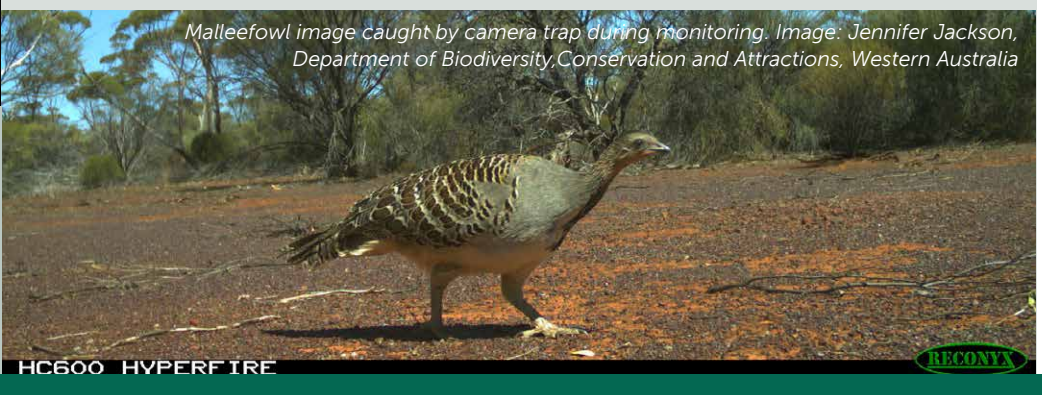
The National Malleefowl Monitoring Program is a long-term citizen science–led program that has been recording data on malleefowl for over 30 years. It has found that malleefowl populations across Western Australia and South Australia have been in substantial decline over the period.

Fox control, and to a lesser extent feral cat control, have been key actions undertaken with the aim of helping mallefowl populations recover, however the effectiveness of this strategy has not previously been tested experimentally at a landscape-scale.

Working in collaboration with the National Malleefowl Monitoring Program, we established an experimental trial to test the effectiveness of managing feral predators. We also analysed monitoring data from the citizen science–led program to determine trends and drivers of malleefowl breeding activity.

We found that in the short term at least, predator baiting provided no benefits to malleefowl breeding activity, although the experiment should continue for results to be conclusive. We found that environmental drivers such as winter rainfall and fire severity had the strongest association with breeding activity.

This project has demonstrated significant value in using citizen science programs for recording robust, long-term and nationwide data. Without the participation of volunteers, the large scale of this project would likely not have been possible.



Malleefowl image caught by camera trap during monitoring. Image: Jennifer Jackson, Department of Biodiversity,Conservation and Attractions, Western Australia

Background

The malleefowl (*Leipoa ocellata*) is an iconic ground-dwelling bird with an extensive distribution across a range of habitats and environments in southern Australia. The bird is perhaps best known for building large mounds of sand and organic matter to incubate its eggs, with the mounds up to 90 cm high and typically 4 m wide.

The geographic range of the malleefowl has contracted considerably since the arrival of Europeans due to land-clearing for agriculture. As a result, the species is categorised as threatened under state and federal legislation, and listed as Vulnerable on the IUCN Red List. The malleefowl continues to face a suite of threatening processes, including degradation of habitat, mortality from introduced mammalian predators such as foxes (*Vulpes vulpes*) and feral cats (*Felis catus*), competition with introduced grazers and changes in fire regimes.

Due to its cryptic nature and low densities, the species is difficult to observe. This in turn makes monitoring populations difficult. The National Malleefowl Monitoring Program is designed to allow reliable data on this species to be collected by citizen scientists from across the malleefowl's broad range in Australia. The long-term monitoring program is sustained almost entirely

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LEFT: Our current data is insufficient to suggest that fox control benefits malleefowl. Image: Nicolas Rakotopare

Background (continued)

by citizen scientists and has grown from a handful of sites in 1989 to almost 140 sites today.

Predator control is the most common conservation strategy for malleefowl; however, the response of malleefowl to the baiting of foxes and feral cats is highly disputed. An analysis of 15 years of mound activity data from the monitoring program between 1990 to 2005 found no evidence that fox baiting influenced malleefowl breeding numbers, even though baiting suppressed the abundance of foxes. In 2012, the same dataset was assessed with different methods and, again, no change to malleefowl breeding numbers was evident following the introduction of predator baiting. Both results were surprising, given that baiting with 1080 poison is the most common method for conserving malleefowl, and also that experimental research has shown that intense predator-baiting increased the survival of captive-reared malleefowl in the younger life stages.

Research aims

We aimed to resolve uncertainty about the effectiveness of predator control as a conservation strategy for the malleefowl using two approaches:

1. We analysed trends and drivers in malleefowl breeding activity using a 28-year mound activity dataset that was collected primarily by citizen scientists.
2. We established a landscape-scale predator control experiment across southern Australia to run alongside the long-term monitoring program that tested the benefits of adaptive management approaches on malleefowl breeding activity.

What we did

We first gathered together malleefowl monitoring data that the citizen science monitoring program had collected over the past 28 years across Australia.

For each site, where possible, we collected information such as time since fire, rainfall over the winter months, proportion of cleared land within 5 km, density of baiting and, as an index of fox abundance, the presence of fox scats on inactive malleefowl mounds.

We estimated trends and drivers of malleefowl breeding activity using a modelling framework that included nest count data collected between 1989 and 2017 across 127 sites in Victoria, South Australia, Western Australia and New South Wales. The modelling approach allowed us to deal with missing data and uncertainty in the number of active mounds recorded by citizen scientists at monitoring sites.

In the second component of our project, in collaboration with dozens of partner organisations, we established an adaptive management experiment, to test the impact of management as it occurred. We established 22 experimental treatment and control sites in eight clusters across continental Australia. We managed foxes and feral cats in and around the treatment sites, while deliberately leaving the control sites unmanaged. We initially aimed for sites to be 2 x 2 km in size, however, high variation in mound density meant that sites ranged from 105 – 4000 ha. Predator baiting occurred across an area of at least 10,000 ha around treatment sites.

Through the network of managers and citizen scientists, we monitored malleefowl breeding activity annually and recorded the activity of foxes and feral cats using 200 continuously operating motion-triggered cameras (8–10 cameras at each site). We fitted statistical models to camera trap data that quantified the effect of predator control on fox and feral cat activity, as well as its effect on malleefowl breeding activity.

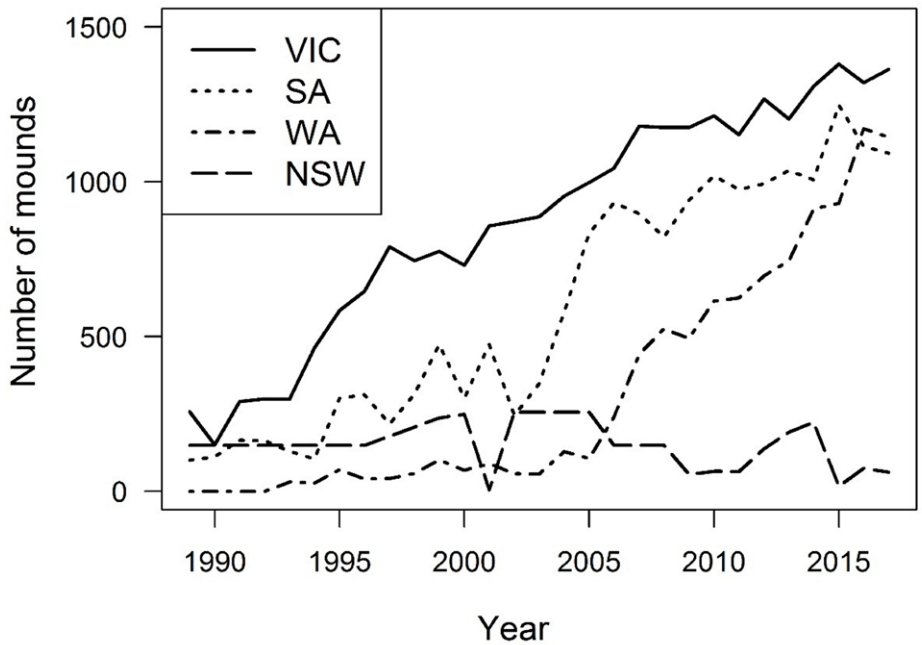
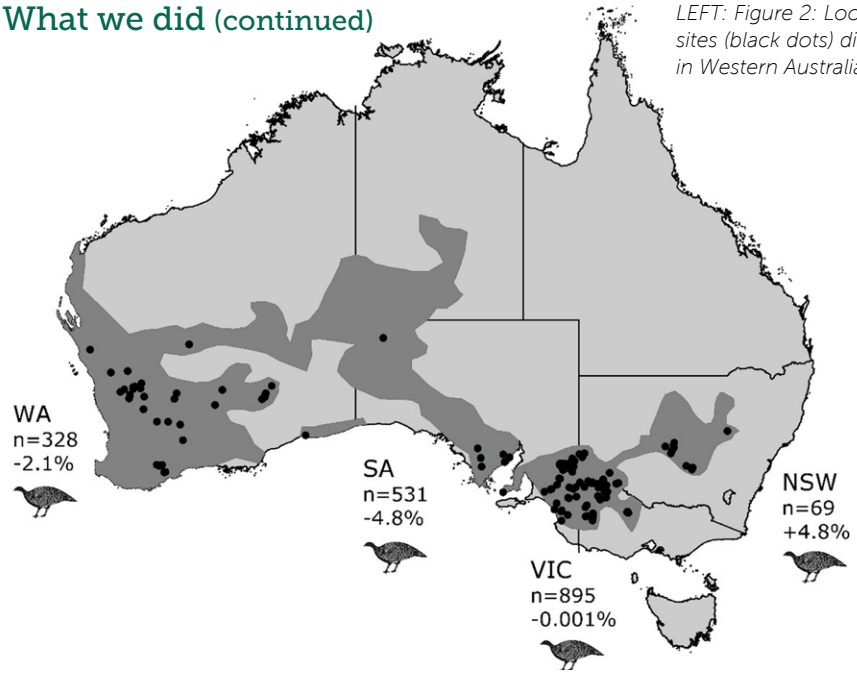


Figure 1: Number of malleefowl mounds monitored by volunteers between 1989 and 2017.

What we did (continued)



LEFT: Figure 2: Location and number of the long-term malleefowl monitoring sites (black dots) distributed across the species' historic range (dark shading) in Western Australia, South Australia, Victoria and New South Wales.

A malleefowl mound being monitored by volunteers. We found strong associations of winter rainfall and breeding activity. Image: Alys Young, University of Melbourne

Key findings

Long-term monitoring program

Our analysis of the long-term monitoring data suggests that malleefowl breeding activity has decreased by 4.8% annually in South Australia and 2.1% annually in Western Australia. This supports previous findings that malleefowl conservation in these states has not been able to improve population outcomes. Breeding activity is stable in Victoria and appears to have increased by 4.8% annually in New South Wales.

However, the apparent trend in New South Wales should be treated with caution because of the relatively small number of data points available in that state. Declines and even local extinctions have been recorded in some regions in New South Wales. We found strong evidence of positive associations between winter rainfall and time since fire on malleefowl breeding activity. Rainfall in the winter months is thought to benefit malleefowl body condition and egg production. Well-timed rainfall also enables the decomposition of organic matter in the mound, which provides heat for egg incubation.

By contrast, malleefowl breeding activity was negatively associated with habitat patch size and the proportion of a site burnt, suggesting that small reserves are important for their conservation and that the extent and frequency of fires should be managed carefully. Importantly, while we found that our index of fox abundance (the proportion of inactive mounds with fox scats) decreased as baiting effort increased, we found little evidence that reducing fox activity benefits malleefowl breeding activity.

Predator control experiment

The 200 motion triggered cameras captured 1345 independent records of foxes and 118 of feral cats. Camera detection rates for foxes was highest in Victoria, followed by South Australia and southern Western Australia. Very few foxes were detected in northern Western Australia. By contrast, detection rates for feral cats, while much lower, were comparatively consistent across the states.

Analysis of data from the predator control/adaptive management experiment also revealed strong positive associations between malleefowl breeding activity and winter rainfall, but no overall effects of the experimental predator-baiting programs on malleefowl breeding activity.

In Victoria and South Australia, evidence was weak that fox control reduced monthly fox activity rates. However, this result was highly uncertain due to the considerable variation in fox detections between cameras and across sites.

We found no evidence that baiting of feral cats reduced cat activity, but given the small number of detections, this is highly uncertain. So far, we have not found that predator baiting has any benefit for malleefowl breeding activity.

Implications

Our study suggests that the breeding activity of the malleefowl has declined in all states they occur in, except Victoria and New South Wales. However, our results for New South Wales are highly uncertain due to limited data.

A unique feature of this research is that most of the data collection and processing was done by volunteers and citizen scientists. We have been able to demonstrate that data collected by citizen scientists using a consistent protocol can be combined to generate statistically robust estimates of population trends at a national scale over a relatively long timeframe.

The large scale of this project across time and space was likely only achievable with citizen scientist assistance. A critical ingredient of this project's success has been the enthusiasm and involvement of the individuals who championed the project.

Using citizen scientists also reduces reliance on competitive funding resources and increases the chance that the flow of data be affordable and sustainable. Using the specialised National Malleefowl Monitoring Database also streamlined the data collection and analysis process, helping to avoid data piling up during the analysis and evaluation stage. Use of the database has been critical to the influence of the program in conservation management decisions.

We have successfully implemented one of the largest predator-control experiments in Australia, and one of the largest-ever attempts at adaptive management. So far, evidence from the adaptive management experiment is insufficient to suggest that baiting approaches to predator control benefit malleefowl. However, the experiment should continue so that each site remains in operation for at least another five years. This will provide more certainty to the findings and ensure any possible effects of predator control on predators and malleefowl that have been missed so far are detected.

We collected 1345 independent records of foxes using camera traps. Image: Jennifer Jackson, Department of Biodiversity,Conservation and Attractions, Western Australia

Cited material

Benshemesh, J, Southwell D, Barker R, M, McCarthy (2020) Citizen scientists reveal nationwide trends and drivers in the breeding activity of a threatened bird, the malleefowl (Leipoa ocellata). *Biological Conservation* 246, 108573

Further Information

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