Science for Policy

Research findings factsheet

Project 3.3.5

Threatened Species Recovery Hub

National Environmental Science Programme

Adaptive management to conserve the malleefowl

In brief

The malleefowl (*Leipoa ocellata*) is a ground-dwelling bird found in semi-arid regions of southern Australia that builds distinctive large mounds, which it uses to incubate its eggs in the heat of decomposing debris. It is listed as Vulnerable under Australian environmental law and has been the focus of extensive community conservation efforts. The species faces a range of threats including: habitat loss; altered fire regimes; competition with both native and introduced herbivores, like feral goats; and predation by introduced predators. The most common strategy to conserve malleefowl populations is to bait for foxes and cats; however, the effectiveness of this action on malleefowl is uncertain and highly disputed.

In this study, we outlined our approach to designing a large-scale adaptive management program for malleefowl. The aim of the program is to resolve uncertainty about the effectiveness of predator control as a management strategy for the species. To pursue this aim, we developed a communication strategy that facilitated and formalised collaboration among the numerous agencies and community groups concerned with malleefowl conservation.

Why the research was needed

The malleefowl (*Leipoa ocellata*) is an iconic mound-building bird that occurs across drier parts of the Australian continent. It is listed as Vulnerable nationally, and as Endangered in the eastern states of Australia. The species has experienced substantial range contraction from its pre-European distribution, following large-scale habitat clearance for agriculture. Although this clearance has slowed considerably in recent decades, malleefowl are still threatened by predation from introduced and native species, competition with herbivores (such as cattle, sheep, goats and kangaroos), who may also deplete the understorey vegetation thought to protect malleefowl from predation and provide them with nesting materials, and changing fire regimes. Malleefowl have rarely been seen to breed in areas burned less than 15 years previously, so broad-scale fires could be affecting the species' extent.

A range of land managers, including government agencies, mining companies, Traditional Owners, farmers and other private landholders and leaseholders, are undertaking actions to positively influence malleefowl populations. The National Malleefowl Recovery Team is responsible for providing recommendations to these land managers, but this task is hampered by significant uncertainty about which threats and conservation actions most strongly influence malleefowl persistence. In particular, there is considerable uncertainty about the effectiveness of predator control,

The historic distribution of the species (dark grey shading), along with the long-term monitoring sites (black dots).

even though this is probably the most common management action for the species. It is vital to assess the relative importance of the various threats to the malleefowl in order to identify the actions that will be most effective in conserving and securing it.

To fill these knowledge gaps and support improved conservation of the malleefowl we designed a large-scale experiment that, in particular, aims to resolve uncertainty about the effectiveness of predator control. The study has four main steps: 1) we engaged malleefowl advocates and land managers in framing the conservation problem; 2) we designed a monitoring network of sites to detect changes in malleefowl breeding activity; 3) we determined the best way to detect changes in predator activity at sites; and 4) we explicitly addressed the challenges of leadership in malleefowl protection, and long-term engagement, communication and sustained funding.

THE UNIVERSITY OF MELBOURNE

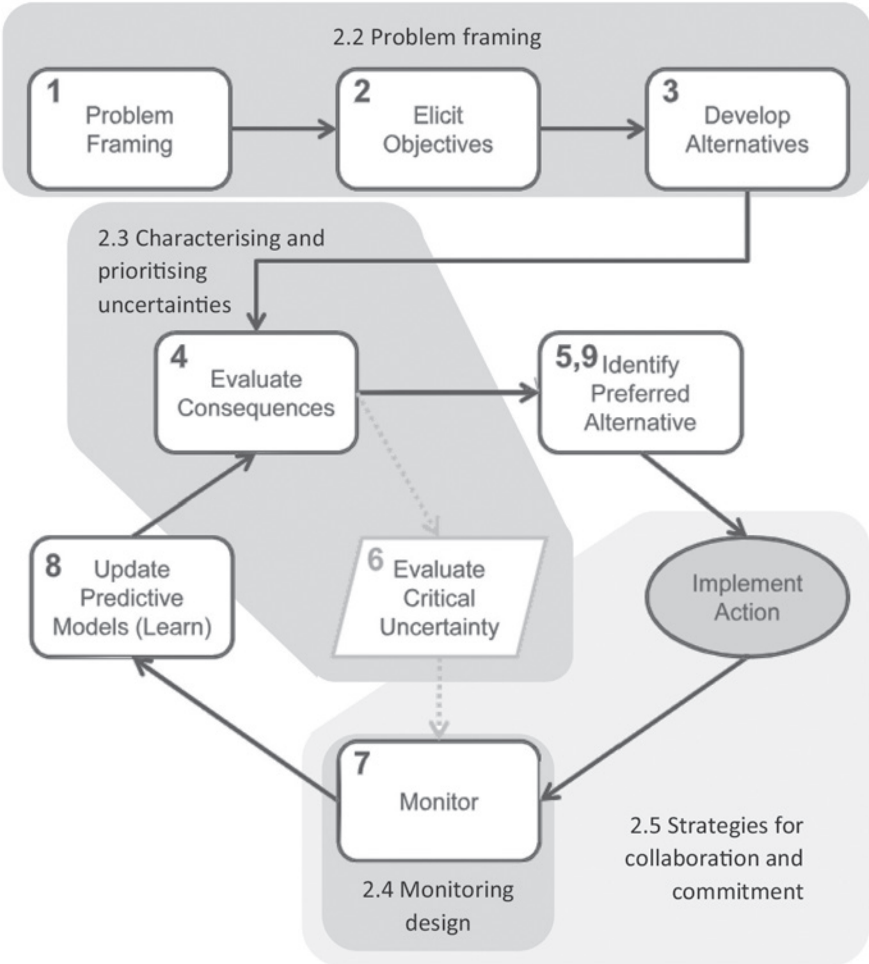
NATIONAL Malleefowl RECOVERY TEAM

Adaptive management

The malleefowl monitoring program has been designed within an adaptive management framework. Adaptive management is a form of structured decision-making that allows: 1) management to proceed based on the best available knowledge; 2) ongoing monitoring and analysis of the results to address areas of uncertainty; 3) new knowledge acquired to be fed back into the design of future actions to improve their effectiveness. It is much used in natural resource management as a way to resolve uncertainty while simultaneously managing ecological systems.

Adaptive management was initially applied in the management of fisheries, where there was uncertainty in population growth and carrying capacity, but it has since been applied to other fields such as fire management, weed control and population harvesting. In this case, the malleefowl adaptive management program initially aims to learn more about the effects of fox and cat control on malleefowl persistence. We used a power analysis to ensure our monitoring design would be adequate to answer these questions.

Adaptive management can also be tailored to resolve other uncertainties (such as the effect of fire or herbivore grazing) once the effect of predator control is better understood. Other management actions proposed to support the persistence of malleefowl include translocations, habitat revegetation, supplementary feeding and road signage.



The malleefowl adaptive management framework.

However, like predator control, there is considerable uncertainty about the relative effectiveness of these actions. By continuing to apply an adaptive management approach, different management strategies can be trialled sequentially or in different regions, and refined as knowledge gaps are filled.

Monitoring is a vital element in adaptive management. Recruiting citizen scientists is a low-cost and collaborative approach that can be used to support monitoring; however, it also requires commitment from program managers in engaging and motivating participants. Although potentially both effective and cost-effective, citizen science programs have to be rigorous and carefully targeted to meet the requirements of the adaptive management program. An extensive malleefowl mound-monitoring program has been developed over the past 30 years, growing from a handful of sites in the early 1990s to more than 150 sites in 2016. Initially, government agencies and consultants performed the monitoring, but gradually citizen scientists were recruited among interested locals as word spread through volunteer and friendship networks. We adapted the program according to the growing numbers of citizen scientists to ensure data accuracy.

Malleefowl. Photo: Western Australia,Butupa CC2.0 Wikimedia Commons

A camera trap at a malleefowl adaptive management site. PHOTO: Joe Benshemesh

Stakeholder engagement

We convened an expert elicitation workshop with 24 attendees, including community advocates and citizen scientists; state government staff responsible for research integration, for environmental management planning and for park management; federal government staff responsible for threatened species support; and university researchers with expertise in structured decision-making, adaptive management, and/or mallee ecosystems.

Findings

The workshop participants agreed that the fundamental objective of malleefowl conservation is to foster the long-term persistence of a self-sustaining malleefowl population. The group also acknowledged that a key barrier to malleefowl conservation is uncertainty surrounding the outcomes of management, especially the effectiveness of predator control.

Adaptive management sites

We designed the malleefowl adaptive management experiment specifically to resolve uncertainty about the disputed effectiveness of predator control. The experiment contains clusters of at least one control and one treatment site (each being a minimum of 10,000 ha). Predators such as foxes and cats are managed in and around treatment sites, while control sites are purposely left unmanaged. Sites within a cluster are expected to experience similar fluctuations in environmental conditions over time (such as habitat quality or rainfall patterns). This will help to constrain random variation, and enhance our ability to estimate the effect of predator management. We further accelerated learning about the effect of predator control on malleefowl persistence by replicating the control and treatment clusters across the species' range.

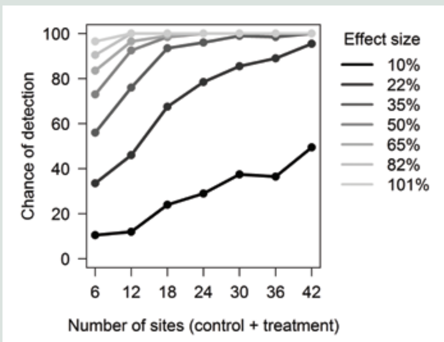
Adult malleefowl breed most years except after winter droughts. Through ground searches and remote sensing we identified past and present malleefowl breeding mounds; and because the birds will sometimes abandon old mounds to create new ones, we recommend repeating these searches every 10 years to identify new mounds.

We undertook a statistical power analysis to design a monitoring program that is able to provide learning around the benefits of fox (and potentially feral cat) management. In particular we are investigating whether malleefowl breed more frequently when predator activity is suppressed. The power analysis allowed us to estimate the likelihood that the control–impact experiment could detect improvements in malleefowl mound activity arising from predator management. The analysis used historic mound activity data to estimate changes across space and over time in the number of active mounds at monitoring sites. It also simulated data collection from multiple control–impact two-site clusters occupied by malleefowl. Our results suggest that an experiment of five years' duration comprising 36 or more sites (in 18 two-site clusters) has an 89% probability of detecting a 22% increase in mound activity.

Camera trapping

As the effectiveness of predator control is contested, an additional outcome of the malleefowl adaptive management experiment is to show whether predator management at treatment sites reduces predator activity below the predator activity observed at predator-unmanaged control sites. We proposed installing a series of solar-powered camera traps at the sites to estimate predator activity by counting photos of foxes or cats from each camera.

We performed a second power analysis to estimate the number of camera traps we would need at each site to distinguish control–impact differences in predator activity from random variation. For this analysis, we used pilot data from 16 camera traps at Wandown Nature Reserve, in Victoria, a 20 km2 patch of remnant mallee vegetation not subject to fox control. From these data we estimated spatial and temporal variation in fox photo counts. We used this spatial and temporal variation data to simulate control and predator-managed sites to see if a statistically significant difference in fox population size could be detected, given a set number of cameras. The power analysis estimated that if predator control efforts reduce fox activity by 75% from an unmanaged density of two foxes/km2, six cameras per site monitoring over a 12-month period will be sufficient to achieve an 96% probability of detecting this reduced fox activity.



Results of a power analysis showing the chance of detecting an increase in malleefowl mound activity given the number of adaptive management sites. For example with 42 sites you have an almost 50% chance of detecting a 10% effect, while 18 sites gives you an over 90% chance of detecting a 35% effect.

A mound being monitored by volunteers. Photo: Alys Young

Citizen science, stakeholder engagement

Common barriers to successful adaptive management are a lack of clear shared objectives among stakeholders, and failure to sustain monitoring for the time needed to learn, usually due to a lack of funding. The malleefowl adaptive management experiment relies on the work of 200 to 300 citizen scientists and several dozen land managers to monitor malleefowl mound activity at the adaptive management sites. Engaging this level of volunteer support would appear to be a major challenge but with a national volunteer effort that currently sees about 3500 malleefowl mounds monitored annually (understood to be the largest single species monitoring effort in Australia) there is a high level of confidence in being able to sustain this effort.

The project will also facilitate annual workshops with key stakeholders to refine objectives, resolve problems, share results and plan for the future. If the adaptive management meets its aims in successfully adapting to monitoring outcomes, it will become one of the world's largest adaptive management programs, both in terms of geographical extent and the number of jurisdictions and citizen scientists involved.

Cited material

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Malleefowl. Photo: Donald Hobern CC2.0 flickr

Further Information

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