Monitoring Priority Threatened Species

An overview of monitoring methods for the Malleefowl *(Leipoa ocellata)*

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Acknowledgement of Country

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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About

This literature overview collates information on one of the 110 priority threatened species identified in the *Threatened Species Action Plan 2022-2032* and has been reviewed by invited practitioners experienced in monitoring the species.

The *Survey Guidelines for Monitoring Threatened Species* project, a collaboration of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) and the Terrestrial Ecosystem Research Network (TERN), aims to improve our knowledge of threatened species by enhancing accessibility and sharing of quality scientific threatened species data. Developing best practice field survey guidelines and recommendations will better equip practitioners to conduct standardised, repeatable surveys.

By identifying the monitoring methods typically implemented by practitioners, documenting and assessing the techniques known to work, and identifying opportunities to standardise the methods, we can move towards ensuring all monitoring is species-appropriate, comparable between practitioners and populations, and repeatable over time. Further, together with consistent terminology, guidelines, instructions, and data collection, we can refine efforts and resources to measure and share information. Data collected using robust, standardised methods will improve our knowledge of threatened species and underpin threatened species recovery at scale. This project is essential to establishing monitoring protocols and data repositories to enhance the accessibility and sharing of threatened species data.

TERN has prepared the literature overviews for the Department of Climate Change, Energy, the Environment and Water. For further information, please visit the EMSA Threatened Species Survey Guidelines website. Additional information, particularly monitoring methods and techniques not included that should be considered, can be brought to the author's attention by emailing tern@adelaide.edu.au for consideration for future updates.

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1 Background

1.1 Conservation status and species trajectory

1.1.1 Current EPBC Act status

- Vulnerable

1.1.2 Summary of data held in the Threatened Species Index

The Threatened Species Index (TSX) provides reliable and robust measures of change in the relative abundance of Australia's threatened and near-threatened species at national, state and regional levels. Understanding these changes in species populations is crucial for monitoring Australia's conservation progress and allows users to measure and report on the benefits of conservation investments, and to justify and design targeted management responses. Currently, the index is restricted to birds, plants and mammals, with new groups to be added in the near future.

The table below summarises Malleefowl data held in the TSX. More information on the TSX, including how to contribute threatened species monitoring data to the index, can be found at tsx.org.au

Table 1. Summary of Malleefowl data held in the Threatened Species Index

TSX information	Malleefowl data held in the TSX
Data held in the TSX	Yes
Number of data sources	2
Number of unique sites	159
Average time series length (years)	16.1
Average number of sampling years	14.3

1.2 Distribution

- The Malleefowl is distributed widely across southern Australia, from the west coast to the western side of the Great Dividing Range, where it occurs as widely scattered localities in arid and semi-arid rangelands and dryland cropping zones (DEPWS 2021).
- Malleefowl have been recorded in north-western Victoria, the Great Victoria Desert, the Wheatbelt region of Western Australia, the Petermann Range, MacDonnell Ranges, Tanami Desert (Mt Theo), Idracowra Station, Burt Well, Tea Tree, Connors Well, Aileron and Central Mount Stuart (DEPWS 2021).

1.3 Habitat

- Within arid and semi-arid regions, Malleefowl prefer shrublands and low woodlands that are either dominated by Mulga (*Acacia aneura*) and mallee eucalypts (DEPWS 2021).
- Malleefowl prefer communities that comprise of tall, dense and floristically-rich mallee in higher rainfall areas and a spinifex understorey (OEH 2017).
- Malleefowl favour areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers (OEH 2017).

1.4   Ecology

- The Malleefowl is a large bird, with a combined head and body length of up to 60 cm and a body mass of 1.5–2.5 kg. It has powerful grey legs, a short dark bill and a flattish head. The tail is long and rounded (DEPWS 2021).

- Malleefowl pairs occupy large stable home ranges. The species feeds on the ground, mostly consuming seeds, but other plant matter and invertebrates are also eaten. Individuals roost in shrubs and trees at night (DEPWS 2021).

- The Malleefowl is monogamous and reproduces by incubating eggs in a large mound—measuring up to 3–5 m wide and up to 1 m high— constructed by the monogamous pair using leaf litter and soil. When the mound has reached a suitable temperature, the female begins to lay eggs that are then incubated by a combination of solar radiation and heat produced by rotting organic matter in the egg chamber. The male alone tends the mound, regulating the internal temperature during incubation. Young have to dig themselves from the mound after hatching and are independent (DEPWS 2021).

1.5   Threats

Known threats to Malleefowl include (Wheeler 2018):

- Loss of habitat
- Predation by introduced species
- Competition with introduced herbivores
- Increased fire frequency
- Inbreeding
- Climate change, particularly the increasing frequency and severity of drought (Benshemesh 2013), increased heat extremes and extended heat waves

2 Existing monitoring methods

2.1 Summary of existing methods used

- Direct observation
- Direct observation: special techniques (spotlighting)
- Signs (tracks, scats, hair-tubes) (includes opportune and sand plots)
- Camera trapping
- Refuge checks (burrows, dens nests, caves etc)
- Aerial surveys

2.2 Existing survey requirements

- Optimal time of year/season/climate conditions (timing with resource availability etc)
    - Spring
    - Breeding season
    - For track counts one week after wet or windy weather
    - October, November, December or early January
- Optimal location of surveys
    - To obtain new records:
            Semi-arid zone or agricultural regions
            Sandy areas
- Minimum survey effort
    - Area surveys for mounds, footprints and birds requires 10 hours per 50 ha
    - Transect surveys require 30 hours where transects are 1 km apart for footprints per 5000 ha
- Other factors:
    - Monitoring for long term trends may use different methodologies than for monitoring for short term occupancy.

2.2.1 Existing protocols

Existing protocols identified are identified in Table 2.

Table 2. Survey guidelines, protocols, and key resources that identify Malleefowl monitoring methods

Protocol	Comments	Reference
Survey guidelines for Australia's threatened birds	Recommends area searches for active mounds, track and sightings in areas of suitable habitat, transect surveys along sandy tracks for footprints and aerial surveys to detect of nesting mounds. Research underway to use airborne infra-red scanners to detect the heat emitted from open Malleefowl nests.	(DEWHA 2010)
National Malleefowl Monitoring Manual	Recommends searches for mounds and adding to a national database. Includes in-depth guidelines and protocols for monitoring Malleefowl, Recommends that mounds identified as active should be monitored annually. Includes recommendations for surveyor training	(National Malleefowl Recovery Team 2020)
Guide for setting up camera traps for the National	Guide to setting up camera-traps with detailed diagrams and equipment lists.	(National Malleefowl Recovery Team 2017)

2.3 Methods to consider

The methods listed below have been identified as potential methods and techniques to survey for the species, either to identify presence or absence, or to assist determining population size and status. Further review of the literature and consultation with experts is required, particularly to identify and assess specific techniques for examining population ecology factors.

2.3.1 Available methods
- Mound monitoring
- Camera traps

2.3.2 Additional methods
- LiDAR
- Aerial photography
- Opportunistic observation
- Landholder surveys/citizen science
- Thermal
- Tracks and scats
- Aerial surveys
- Sand plots
- Active nest surveys
-

2.3.3 Methods to rule out
All survey methods typical for terrestrial birds are considered suitable (no specific methods ruled out)

2.3.4 Relevant Ecological Monitoring Standards Australia (EMSA) modules
The following Ecological Monitoring System Australia (EMSA) modules developed by TERN for the Australian Government should be considered for surveying the Malleefowl:
- Vertebrate fauna
- Targeted surveys
- Camera trapping

Opportune.

In addition, the Plot Description, Floristics, Cover, Soils, Condition and Vegetation Mapping modules may be beneficial for assessing the suitability of a location against the species' habitat preferences.

2.3.5 Other 110 priority species with potential links
- Similar monitoring methods:
    – other ground primarily dwelling birds such as the Western Ground Parrot

3   Considerations for survey guidelines development

Key considerations should a full literature review and/or survey guidelines be developed for Malleefowl are highlighted below.

- Special equipment required:
  - Thermal imager (ideal)
  - LiDAR (Anditi 2022; NSW Government 2021; Umwelt 2012)
  - Cybertracker LiDar sequence using android device is available, see Saffer and Peake (2014); Sackmann and Jamieson (2018); National Malleefowl Recovery Team (2020) Appendix 2 for "the step by step process to complete the CyberTracker LiDAR sequence using an Android device"; Parvin *et al.* (2021).
  - UAV

- Estimated time and surveyor effort:
  - Estimated time and effort is highly dependent on the search area
  - Minimum of annual sit visits for long-term monitoring are recommended
  - Allow minimum of 3 days required for transect surveys
  - Allow minimum of 2 days required for areas surveys (depending on the area).
- Vegetation communities or landscapes of the species' preferred habitat not suitable for the optimal survey methods:
  - None have been identified to date.

3.1   Key documents for further review

- Protocols:
  - National Malleefowl Monitoring Manual – there are different versions, most recent is 2020 (National Malleefowl Recovery Team 2020)
  - AM Camera setup guide (National Malleefowl Recovery Team 2017)
- Scientific papers and reports:
  - Using high-definition aerial photography to search three dimensions for Malleefowl mounds is a cost-effective alternative to ground searches (Thompson et al. 2015)
  - Trial of motion-sensitive cameras for monitoring a range of animals in Malleefowl monitoring sites (Benshemech 2013)
  - Surveying Breeding Densities of Malleefowl Using an Airborne Thermal Scanner (Benshemesh & Emison 1996).
  - Sackmann and Jamieson (2018). Comparative Assessment of Malleefowl Mound Search Techniques. In, Proceedings of the 6th National Malleefowl Forum.
  - Citizen scientists reveal nationwide trends and drivers in the breeding activity of a threatened bird, the Malleefowl (*Leipoa ocellata*) (Benshemesh et al. 2020)
  - Adaptive management informs conservation and monitoring of Australia's threatened Malleefowl (Hauser et al. 2019)
  - Document Library. A comprehensive list of papers and documents on the Australian Malleefowl (National Malleefowl Recovery Team n.d.)

3.2 Key agencies and organisations involved in the species research and recovery

- National Malleefowl Recovery Team
- Australian Wildlife Conservancy
- National Malleefowl Group Inc.
- Bush Heritage Australia
- Southcoast NRM

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EMSA

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