Malleefowl in the Western Australian wheatbelt: An ecological study informed by community knowledge.

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1. Malleefowl decline in the Western Australian wheatbelt

The Malleefowl (*Leipoa ocellata*) is one of many terrestrial fauna species that has experienced a decline in its distribution and abundance in Australia (Burbidge and McKenzie 1989; Recher and Lim 1990; Garnett and Crowley 2000). It is listed as endangered at the national level and the national recovery plan (Benshemesh 2000) suggests a contraction of 45% in the western portion of its range. Studies in south-eastern Australia (Frith 1962, Priddel and Wheeler 1999) have reported rapid and widespread declines of Malleefowl in response to agricultural development and the introduction of exotic predators. These threatening processes operate in Western Australia also and so there is concern that similar declines may have occurred. However, previous estimates of decline have been restricted to detailed studies of individual populations (e.g. Priddel and Wheeler 2003) or continent wide assessments based on presence only data (Benshemesh 2000). Despite the wealth of research conducted on this species, there is uncertainty about the extent or even reality of decline in Western Australia with claims for both decline (Benshemesh, 2000) and increases in range/abundance (Serventy and Whittell, 1976).

There is a need to more accurately quantify any changes in distribution and abundance of Malleefowl in Western Australia and assess the relative contributions of various processes that threaten Malleefowl persistence. Currently, a wealth of community collected presence-only data exists for the species and despite the recognised shortcomings of this type of data (Austin 2002; Wintle *et al.* 2005) it has potential to answer key questions about the status of Malleefowl.

This study addressed the following questions:

- Can we use presence-only data to assess changes in species distribution?
- Has the Malleefowl suffered a range contraction within the Western Australian wheatbelt?
- Is there a relationship between changes in the range of Malleefowl and landscape-scale environmental predictors?

Methods

We sought to quantify changes in the range of Malleefowl in the Western Australian wheatbelt by (i) basing our methods on those used in the national recovery plan and applying them to an expanded dataset of community collected sightings data dating from 1839 to 2006; and (ii) collecting presence-absence data from landholders and community members, allowing us to more rigorously examine decline. Areas where Malleefowl populations were apparently stable were compared with those with few recent (post-1990) sightings, and various landscape attributes were considered as possible causes of change. Issues relating to false absence were also explored.

Results

Our results suggest that Malleefowl have suffered a range contraction within Western Australia but this contraction is smaller than previously claimed. In contrast to south-eastern Australia, Malleefowl appear to have persisted across much of their former range within the agricultural landscapes of south-west Western Australia, with declines largely confined to the western margin of the species' former range. The contraction in the range of Malleefowl was

correlated with the number of years since commencement of agricultural activity and also with extent of land clearing. Analysis of sightings data also showed that false absences had the potential to exert substantial influence on estimates of species decline.

Conclusion

The Malleefowl has suffered less of a range contraction in Western Australia than previously claimed, particularly within the Western Australian wheatbelt. This conclusion is in part due to the compilation of a larger dataset than was previously available to researchers assessing this species. However, it is also likely that the species has persisted within large areas of the wheatbelt because agricultural development has been relatively recent (< 50 years ago) compared with areas in eastern Australia. As a result, these landscapes are of higher quality in that they are less fragmented and the remaining habitat has had less exposure to agents of degradation such as grazing, altered fire regimes and weed invasion. It is probable that the decline of Malleefowl will continue unless these processes are mitigated. The correlation between Malleefowl decline and extent of land clearing suggests that the future extinction of Malleefowl from highly fragmented areas within the wheatbelt is likely, particularly given the presence of exotic predators.

This study was limited to making broad estimates of Malleefowl decline using relatively coarse-scale spatial data but nevertheless represents a step forward in the use of presence-only data to assess species decline. Presence-only data can provide a useful starting point for understanding patterns of decline, provided an appreciation of bias within the data (e.g. false absence) is incorporated into the analysis. Collection of absence data via community survey is an effective way to account for such bias on a broad scale, particularly when studying a high-profile iconic species such as the Malleefowl. However, collection of spatially and temporally structured presence-absence data across a range of environmental gradients is necessary to provide rigorous assessments of population trends in decline over time.

2. Fire regimes of Malleefowl habitat in the Western Australian wheatbelt.

Wildfire is listed as a major threat to the persistence of Malleefowl (Benshemesh 2000) and it has been suggested that Malleefowl require habitat that is 30 to 60+ years post fire in order to maintain breeding populations (Benshemesh 1992). In eastern Australia, this is cause for concern as Malleefowl habitat that meets such criteria is rare. However, in the Western Australian wheatbelt, the threat posed by fire has not previously been assessed. The frequency and spatial extent of fire events is not known, and the manner in which different habitats respond to fire has not been adequately studied.

Objectives

This study seeks to understand the role that fire plays in the ecology of Malleefowl in the Western Australia wheatbelt. More specifically, it seeks to answer the following questions:

1) What are the frequency and extent of fire events in remnants in the Western Australian wheatbelt? Does this regime differ as remnant size changes?
2) What is the response of known Malleefowl habitats to fire? Are there differences in vulnerability/ recovery time to fire between different Malleefowl habitats (e.g. mallee, *Acacia*/*Allocasuarina* shrublands)?

Preliminary results

The frequency and extent of fire events in remnants in the Western Australian wheatbelt post 1988 were identified using a series of LANDSAT satellite images. Images existed for every second year between 1988 and 2004. Fire regimes were quantified for three categories of native vegetation:

1. Small remnants (100 - 500 ha);
2. Large remnants (> 500 ha)
3. Continuous vegetation (within pastoral country adjacent to wheatbelt).

For the small remnant category, a sample consisted of the entire remnant. For the other two categories, 500 ha circular sample areas were taken from within the remnant. The position of these sample areas was determined at random. This method was used to maintain balanced sample effort between remnant categories.

Fire regimes for Malleefowl habitat in the wheatbelt are summarised in Table 1 below.

	Sample remnants		
	Small	**Large**	**Pastoral**
Number of samples	**127**	**156**	**30**
Burnt 1988-2004 (%)	**5**	**16**	**33**
Burnt prior to 1988 (%)	**7**	**24**	**40**
Avg proportion burnt (%)	**26**	**48**	**69**

Our findings show that fire frequency and extent are low in small remnants within the WA wheatbelt and suggest that fire does not represent a threat within these areas. Therefore, it may be more appropriate for conservation practitioners to focus on predator control or other threats that are active within small remnants. However, as remnant size increases (i.e. >500 ha), fire frequency and extent increases, suggesting that in large remnants or continuous vegetation, fire may represent a significant threat to the persistence of Malleefowl.

Future work

The response of known Malleefowl habitats to fire will be explored in a space for time study. The study will focus on the two habitat types most commonly occupied by Malleefowl within the Western Australian wheatbelt: 1) Mallee (most prominent in the southern wheatbelt); and 2) *Acacia*/*Allocasuarina* shrublands (most prominent in the northern wheatbelt).

Habitat attributes of direct relevance to Malleefowl (e.g. canopy height and cover, litter accumulation) will be measured in areas of varying post-fire age. These areas will range from burnt pre-1968 to burnt in 2004. Measurements will be used to determine how long it takes for burnt habitat to resemble that of a long unburnt area.

By determining how long it takes for burnt habitat to structurally resemble that of long unburnt habitat, the study will help inform land managers about appropriate fire regimes for the conservation of Malleefowl.

References

Austin, M.P. (2002) Spatial prediction of species distribution: an interface between ecological theory and statistical modelling. *Ecological Modelling* **157:** 101-118.

Benshemesh, J. (1992) The Conservation Ecology of Malleefowl With Particular Regard to Fire. Ph.D thesis. Monash University, Clayton, Vic.

Benshemesh, J. (2000) *National Recovery Plan for Malleefowl,* Department for Environment and Heritage, Adelaide.

Burbidge, A.A. and McKenzie, N.L. (1989) Patterns in modern decline of Western Australia's vertebrate fauna: causes and conservation implications. *Biological Conservation* **50:** 143-198.
Frith, H.J. (1962) Conservation of the mallee fowl, *Leipoa ocellata* Gould (Megapodiidae). *CSIRO Wildlife Research* **7:** 33-49.
Garnett, S. and Crowley, G. (2000) *The Action Plan for Australian Birds 2000,* Environment Australia, Canberra.
Priddel, D. and Wheeler, R. (1999) Malleefowl conservation in New South Wales: a review. R.W.R.J. Dekker, D.N. Jones, and J. Benshemesh (Eds). *Proceedings of the Third International Megapode Symposium, Nhill, Australia, December 1997. Zoologishe Verhandelingen 327,* pp. 125-141.
Priddel, D. and Wheeler, R. (2003) Nesting activity and demography of an isolated population of Malleefowl (*Leipoa ocellata*). *Wildlife Research* **30:** 451-464.
Recher, H.F. and Lim, L. (1990) A review of current ideas of the extinction, conservation and management of Australia's terrestrial vertebrate fauna. *Proceedings of the Ecological Society of Australia* **16:** 287-301.
Serventy, D.L. and Whittell, H.M. (1976) *Birds of Western Australia.* University of Western Australia Press, Perth.
Wintle, B.A., Elith, J., and Potts, J.M. (2005) Fauna habitat modelling and mapping: a review and case study in the Lower Hunter Central Coast Region of NSW. *Austral Ecology* **30:** 719-738.