Movement patterns of Malleefowl on the Eyre Peninsula

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Abstract

Malleefowl are still extant within areas of remnant Mallee vegetation across the Eyre Peninsula. Many of these areas comprise patches of uncleared scrub within a matrix of agricultural clearing. Monitoring grids have been established across the Eyre Peninsula by DEWNR and private landholders and are monitored annually with the assistance of volunteers. We investigated long term trends in mound activity over nearly two decades and found declining population trends. To further investigate this declining trend a grant was obtained from Eyre Peninsula NRM to partially fund a PhD student. Part of this study involved fitting GPS transmitters to birds using backpacks. A total of 7 birds have been radio-tracked in different areas across the Eyre Peninsula. All birds captured at active mounds were male. Interim results suggest males move up to 3 km from the mound during the breeding season. For two males monitored over two breeding seasons, different nests were used each season, located 700 metres and 7 km from the previous mound respectively. Numerous roosting sites were used by each bird. Interim results suggest Malleefowl will use fragmented patches of native vegetation within the agricultural matrix but do not often venture out into the cropping areas. High mortality of adult birds was recorded from foxes and cats.

Introduction

The Eyre Peninsula lies in the southern part of central South Australia. It is dominated by limestone plains interspersed with longitudinal sand dunes. The climate is considered semi-arid with average precipitation ranging from about 250 mm in the North East to about 500 mm in the South West. The predominant native habitat is mallee scrub (e.g. *Eucalyptus socialis, E. leptophylla, Acacia spp., Melaleuca spp. and Eremophila spp.*) which has been extensively cleared in the 20th century (Brandle 2010). Nonetheless, Malleefowl are still extant within areas of remnant Mallee vegetation across the Eyre Peninsula. Many of these areas comprise patches of uncleared scrub within a matrix of agricultural clearing.

Due to the elusive nature of the Malleefowl, monitoring their mounds for activity is considered an efficient proxy to monitoring population trends (Benshemesh 2004). To this end, monitoring grids have been established across the range of the Malleefowl by SA Department of Environment Water and Natural Resources (DEWNR), private landholders and the National Malleefowl Recovery Team. These grids are monitored annually with the assistance of volunteers. We investigated long term trends in mound activity over nearly two decades on the Eyre Peninsula grids and found declining population trends.

To further investigate this declining trend a grant was obtained from Eyre Peninsula NRM to partially fund a PhD student. The main question being investigated is the current and past movement patterns of adult Malleefowl on the Eyre Peninsula. Limited data are available on detailed adult Malleefowl movement and information such as their use of remnant patches and cropping land, how far they travel during the breeding season and off-season; seasonal preferences for habitat use; roosting behaviour; long distance movement to re-colonise habitats remain unanswered. Our project attempted to address these knowledge gaps with the use of new technology, namely a combination of GPS satellite tracking technology and population genetics, and vegetation surveys.

While previous studies looked at adult Malleefowl movement, technology limited the amount of data that could be collected. It was very hard to follow and find the birds outside of the study areas and some birds "disappeared" during the studies (Benshemesh 1992; Booth 1985). In another study that monitored Malleefowl breeding activity in NSW over twelve years, 25 adult Malleefowl were "lost". While one bird returned after two years, the rest were presumed dead (Priddel and Wheeler 2003).

With new GPS technology it is possible to track Malleefowl for as long as the tracker is operational. The batteries are recharged with solar panels on the unit which means that a recapture is not necessary reducing the stress to birds. The large number of location fixes over long time periods will enable information to be obtained that can inform management actions including habitat preferences, the importance of habitat remnants and adult survival.

Methods

Study sites

The Malleefowl monitoring grids on the Eyre Peninsula are in Hincks Conservation Park (CP), Munyaroo CP, Pinkawillinie CP, Secret Rocks Nature Reserve and private properties with heritage agreements near Cowell and Lock (Figure 1, red dots). Malleefowl were trapped in Hincks CP, Hambidge CP, Secret Rocks NR, Lock and Cowell heritage agreements (Figure 1, blue crosses).

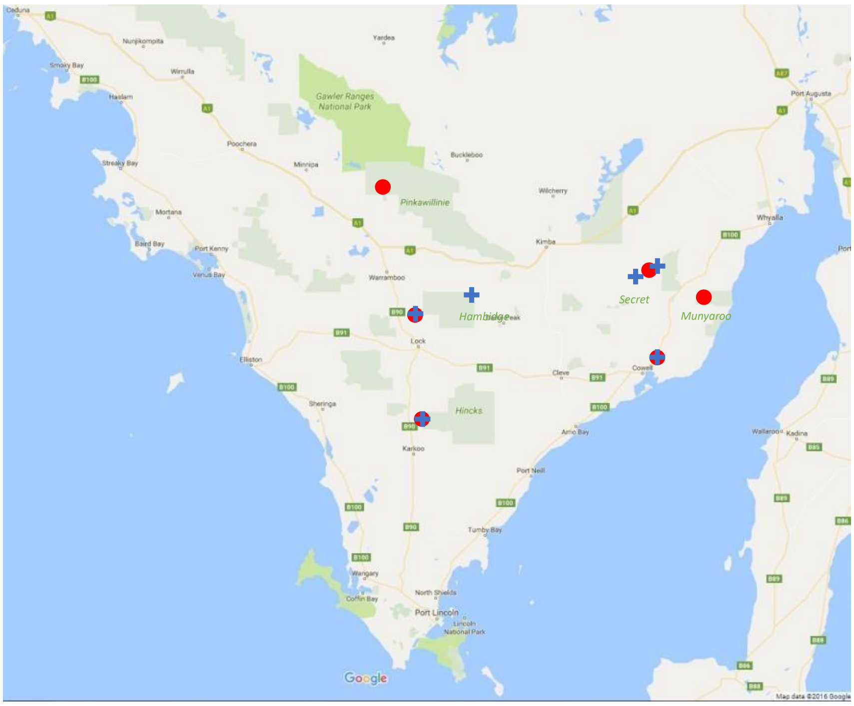

Figure 1 Eyre Peninsula, SA. Locations of monitoring grids in red and trapping sites in blue crosses

Trapping

Adult Malleefowl were trapped on their mounds during the breeding seasons 16/17 and 17/18. One of the original cage traps with 2 funnel-shaped walk-in entrances, as used and described by Priddel and Wheeler (2003), was borrowed from the authors for this purpose. Traps were monitored remotely and as soon as the Malleefowl triggered a signal through walking into the trap, the bird was captured, quickly processed and re-released. All captured Malleefowl were banded (ABBBS metal bands & plastic colour bands), measured (tarsus, skull and weight) and blood and feather samples taken. All individuals received a solar powered GPS unit (Microwave Telemetry, PTT-100 30-gram Solar Argos/GPS PTT) in the shape of a backpack (Benshemesh 1992; Priddel and Wheeler 1996; 1997). The PTT unit height was increased by gluing on a layer of neoprene to its underside, allowing the solar panels to protrude further over the folded back wings for unobstructed charging. The PTT harness is made of soft, durable shoe lace and secured with aluminium fishing crimps in multiple points; the antenna points backwards. Locations are fixed via GPS between 6-8 times daily, data is uploaded to a server every three days via satellite (ARGOS CLS). Movement data is downloaded from the Argos CLS website for analysis periodically. The data is parsed using MTI Argos-GPS Parser Software provided by Microwave Telemetry (MTI 2018).

Data analysis

All data analysis was performed with RStudio (R Core Team 2018). Basic analysis was mainly made with the R package tidyverse (contains e.g. dplyr, tibble), while graphs were produced with the R packages ggplot2 and ggmap. The R packages sf, adehabitatHR and rgdal were used for spatial and minimum convex polygon analysis.

A roosting site was defined as two or more consecutive, identical fixes (i.e. locations or coordinates) used by the Malleefowl during an interval of between half an hour before sunset and half an hour after sunrise. At this stage, only identical coordinates were considered. This doesn't allow for the GPS tracker's inaccuracy which will have to be considered in later analyses.

Data that was recorded between the bird's being trapped and its return to the mound were disregarded for analysis. In the case of one bird, which didn't return to the mound after being trapped, we disregarded 3 days of data to allow for trapping related movement changes.

Camera trap observations

Reconyx HyperFire camera traps were set up to help determine activity patterns at mounds.

Preliminary results

Seven birds have been fitted with radio transmitters to date. Five of these have since died from suspected cat or fox predation but one of these was considered to be related to stress from initial capture. Preliminary results of GPS data analysis show that Malleefowl movement patterns differ between seasons, i.e. breeding vs non-breeding, and time of day, i.e. day and night.

During the breeding season, movements were mainly restricted to within 1000 meters of the respective mound; however, much further distances were also recorded. One bird, for example, ranged to approximately 1.5 km, while two other birds have moved even further from the mound with over 2 km and 3 km, respectively.

In the non-breeding season, the movement range varied considerably. One bird never moved outside an area of ca 1.5 x 1.5 km even though he moved to a new mound ca. 700 m away from the first. However, another bird moved more than 9km from his initial breeding mound during the nonbreeding season and, in his second breeding season, started using a different mound ca. 7 km away from the initial mound.

One bird caught near Kimba has been tracked for 2 consecutive breeding seasons. In the first breeding season, the bird spent both days and nights within about 600 m of that season's mound. For the second breeding season, he "moved" to a different mound, about 700 m NE from the first. From this new mound, the bird moved up to nearly 1000 m during the day and over 1300 m to roost. Figure 2 shows that this bird prefers some areas over others, both during the day and night.

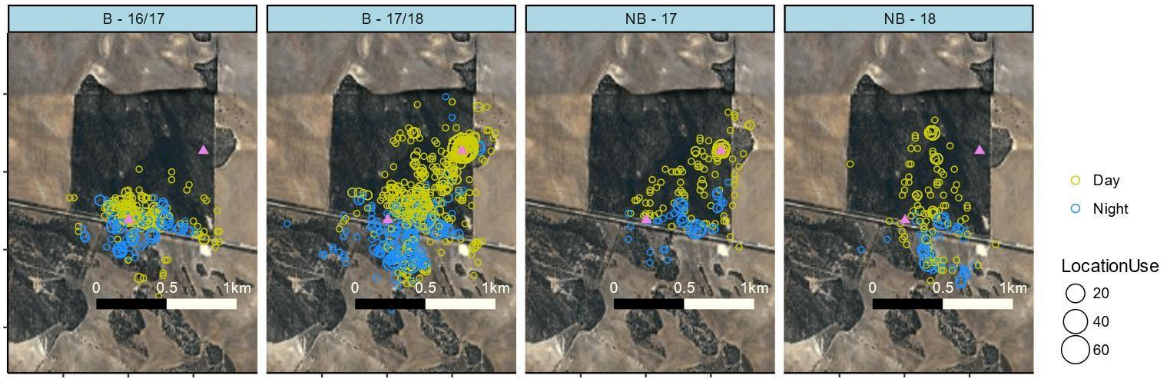

Figure 2 Day and night movement of the Kimba bird per season. The mound (pink) on the south edge of the bird's territory was used in the first breeding season, the mound in the NE in the second. Day and night fixes are coloured in yellow and blue, respectively. GPS data form 15/1/2017 – 2/7/2018

The night time data was used to calculate the frequency of use of different roosting locations. Most roosts were used only once (even during the breeding season) but most birds had some favoured roosts that they used up to 40 times. Roost sites were located up to 2.8 km from the mound and this varied with season. One bird that was tracked over two preferred roosting sites within ca. 600 m of the mound in the first season. In the second season, the maximum distance between a roost and the mound was about 1300 m. The bird favoured areas in the south of its territory for roosting regardless of the location of the current mound being worked (Figure 3).

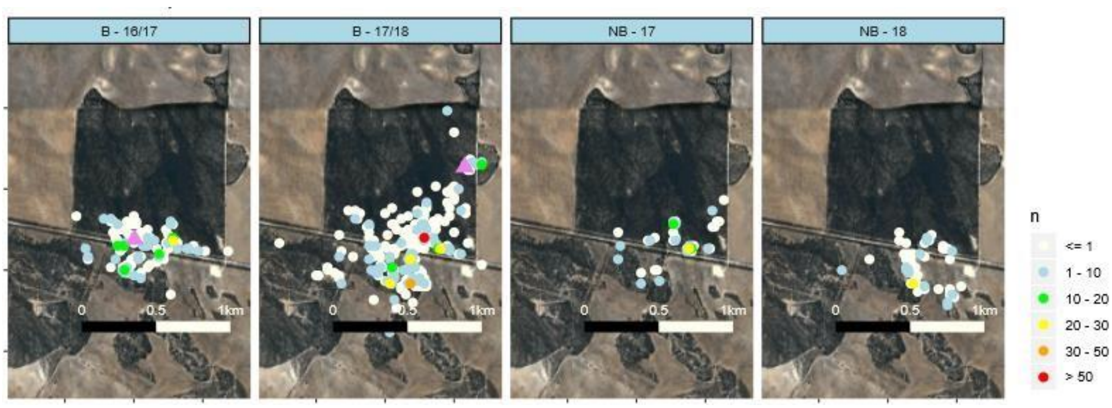

Figure 3 Kimba bird roosting site preferences. The frequency of use (popularity) of a location is indicated by colour, red being the most frequently used. GPS data form 15/1/2017 – 2/7/2018

The minimum convex polygon analysis shows that tracked Malleefowl had highly variable home ranges per site and season. The home ranges varied from 22 to 426 ha during the breeding season and from 63 to 587 ha during the non-breeding season. The bird caught near Kimba, for example, utilised a home range of 22 and 68 ha in each breeding season (combined 71 ha) and of 38 and 51 ha in the non-breeding season (combined 63 ha, Figure 4).

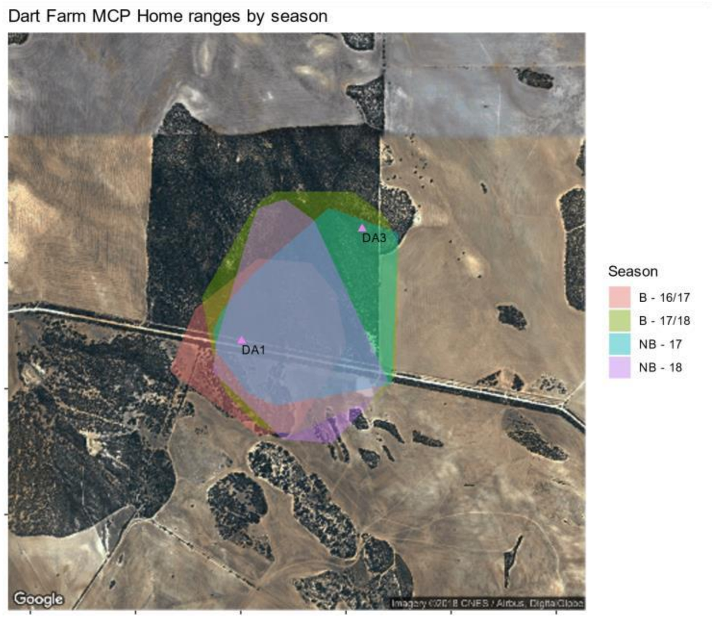

Figure 4 Kimba bird 95% home range per season (Minimum convex polygon analysis)

Discussion

The high mortality rate of adult Malleefowl from cat and fox predation is worrying and suggests these predators are a major threat to Malleefowl. No Malleefowl were killed at night suggesting that roosting sites may be safe from predators. One bird was hit by a car which also highlights the impacts of vehicles. All Malleefowl fitted with transmitters were male but their movement patterns were variable. The movement of Malleefowl varied between times of the day and seasons. Seasonal differences may be explained by the males' attachment to the mound during the breeding season. In four out of six cases the monitored males stayed closer to the mound during the day during the breeding season than outside of the breeding season.

Although most roosting sites are only used once, Malleefowl do appear to have a small number of favourite roosting areas that are used repeatedly. Vegetation surveys currently being performed are expected to shed light on the reason for this variance in roost site usage.

Large off-season movement has been recorded in two birds so far. One bird moved approximately 9 km away from the initial mound and later started a mound in that area. Another bird also moved roughly 7 km W from the initial mound. This shows us that Malleefowl are capable of long-distance movement and may utilise fragmented scrub patches within agricultural land. Although some birds were captured close to the edge of cleared land, no birds were observed straying more than 150 metres into cleared cropping land. One bird crossed open cropping land to gain access to another habitat fragment but we did not record ongoing use of cleared paddocks. Our data also suggest that Malleefowl can persist and breed in small habitat fragments of less than 100ha, although these patches were situated close to other larger habitat fragments.

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