Malleefowl monitoring
in the Murraylands and Riverland region
2016-2022

Birds, science and community

Photo: Tom Hunt

LANDSCAPE SOUTH AUSTRALIA
MURRAYLANDS AND RIVERLAND

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This project is supported by the Murraylands and Riverland Landscape Board through funding from the Australian Government's National Landcare Program.

Introduction

The malleefowl *(Leipoa ocellata)* is an iconic animal of the Australian semi-arid woodlands, from which is gets its name. It is a ground-dwelling and ground-nesting bird, but not flightless. Although a reluctant flier, it can nonetheless take strong, sustained flights over some distance. At night, it roosts in the canopies of Mallee trees, but its main defence against predators is its cryptic appearance and behaviour. Its typically slow, silent movement and camouflaged plumage allow it to travel unnoticed through the bush. The malleefowl is also a totem for the human inhabitants of the Mallee. It is not uncommon to hear Mallee farmers boast about the number of active nest-mounds on their scrub blocks from one year to the next. Amongst First Nations communities, the malleefowl is renowned as a traditional food, although it is rarely, if ever, hunted today.

Decline and conservation status

The malleefowl has declined in distribution and population since European colonisation of Australia, largely due to the direct and indirect effects of post-colonial land use. Habitat loss through land clearance is the primary driver of this decline. Land clearance, along with pastoral grazing of intact native woodlands, also exacerbates the impacts of secondary threats such as predation by native and introduced predators, and competition from native and introduced herbivores. Today, the malleefowl can still be found in Victoria, New South Wales, South Australia and Western Australia, but it appears on endangered species lists in all these states and is listed as Vulnerable under the national *Environment Protection and Biodiversity Conservation (EPBC) Act.*

The importance of the Murraylands and Riverland region

The Murraylands and Riverland Landscape Board region is world renowned for its malleefowl populations and is considered as one of the most reliable places to observe the species. It is a significant destination for Australian and international birders, nature lovers and citizen scientists. In fact, a species/area search in the Atlas of Living Australia will return approximately half of the nation's malleefowl records from this region. The malleefowl is almost ubiquitous in this region, due to the extent and quality of suitable habitats, ranging from the heathy Mallee of Ngarkat and Billiatt, through the parallel dune Mallee of the Murray and calcrete Mallee of the Western Murray flats, to the mixed Mallee and Black-oak woodlands of the South Olary Plain. For these and other reasons, this region is among the most important of Australia's network of Natural Resource Management regions for malleefowl conservation, a role reflected in the region's strong commitment to scientific monitoring of the species.

Monitoring malleefowl populations

Due to the secretive nature of malleefowl, their populations are impossible to monitor by simply sampling areas and counting bird sightings. However, their breeding effort is highly conspicuous, and consequently, it forms the focus of the national malleefowl monitoring program. Known areas of malleefowl breeding habitat are sampled annually at permanent sites, where the number of known nest-mounds found to be active each year provides a short-term measure of breeding activity and, over time, an indicator of population density through long-term trends.

The Murraylands and Riverland Landscape Board has participated in this monitoring program since its inception over 30 years ago and has more monitoring sites than any other NRM region, including some of the most productive known breeding areas. Through this monitoring, undertaken primarily by a dedicated community of volunteers, the landscape board has been a major contributor to the research that underpins the best available knowledge about malleefowl conservation to date. Key outcomes of this research were the long-term trend analyses assessing the relative impacts of various environmental factors on malleefowl breeding.

Emerging insights from long-term data

This research is beginning to reveal that despite long held assumptions that exotic predators are the primary threat to malleefowl populations, other factors such as the direct and indirect effects of grazing by both exotic and native herbivores, as well as climatic factors also have a significant impact. In response, the landscape board was one of the first NRM regions to join the National Malleefowl Adaptive Management Predator Experiment (AMPE).

This experiment aims to empirically test the relationships between predator activity, malleefowl breeding activity, and predator control efforts by land managers, particularly fox baiting. of volunteers, the landscape board has been a major contributor to the research that underpins the best available knowledge about malleefowl conservation to date. Key outcomes of this research were the long-term trend analyses assessing the relative impacts of various environmental factors on malleefowl breeding.

A broader focus: threatened Mallee birds

Malleefowl is also one of several threatened Mallee bird species that are the focus of an Australian Government funded regional partnership project delivered by the landscape board. Improving habitat viability and other recovery actions for EPBC listed Mallee woodland birds is a collaboration between the landscape board community and other project partners.

In addition to the malleefowl, the species targeted include:

- Striated grasswren *(Amytornis striatus howei)* - Murray Mallee subspecies
- Regent parrot *(Polytelis anthopeplus monarchoides)* - eastern subspecies (Vulnerable)
- Red-lored whistler *(Pachycephala rufogularis)* (Vulnerable)
- Mallee whipbird *(Psophodes leucogaster leucogaster)* (Vulnerable)
- Mallee emu-wren *(Stipiturus mallee)* (Endangered)
- Black-eared miner *(Manorina melanotis)* (Endangered)

Of these, the malleefowl is the most widespread of these species, while most of the others are confined to the Mallee woodlands of the area surrounding the South Australia, New South Wales, and Victoria borders. The main goals of the project are to deliver land management outcomes that benefit the full suite of species and to ensure monitoring programs are well designed, informative and fit-for-purpose.

On-ground actions to support recovery

A key on-ground component of the project that is expected to benefit most of these bird species including the malleefowl, has been the removal of redundant pastoral dams in conservation areas. Though no longer required for livestock, these dams continue to provide water sources for feral goats and elevated populations of kangaroos, leading to overgrazing threatened Mallee bird habitat. Removal of these dams is expected to:

- Reduce grazing pressure
- Improve water infiltrations
- Allow vegetation to regenerate

For most of these birds, this means greater cover from predators. For the malleefowl, it also means less competition for food resources including seeds, fruits, flowers and the green growing shoots of many plant species they depend on. The benefits for these species are expected to increase over time, making continued monitoring essential to evaluate the project's long-term impact.

Strengthening monitoring accuracy

The Threatened Mallee Bird project has supported the continuation of Malleefowl nest-mound monitoring and the AMPE over the past 5 years, along with additional measures to improve the accuracy of monitoring data. One challenge with the mound-monitoring method is that occasionally, malleefowl will construct a new nest-mound at locations away from previously known sites. If these new mounds are not detected during routine visits, the monitoring results may underestimate breeding activity.

To address this, the landscape board and project partners have used a combination of traditional and innovative methods, including LiDAR, to search for new mounds to calibrate the monitoring results. The landscape board has also supported the establishment of 2 new mound monitoring sites within the region, that will make this method more informative and reliable.

Purpose of this report

This report provides a summary of the malleefowl monitoring activities undertaken during the Threatened Mallee Bird project, along with an analysis and discussion of trends in the results. For context, monitoring data from the 2 years prior to the project's commencement (2016-17) are also included, capturing the inception of the AMPE.

Photo: Tom Hunt

Mound monitoring

Methods

Mound monitoring is the way that malleefowl breeding activity is measured. Monitoring occurs at permanently designated sample sites, which are distributed across the region to account for geographical variation in breeding activity.

Each site is typically 2 km x 2 km in size. hen a site is first established, a systematic search is conducted to locate all nest mounds. These include both active and inactive mounds, as malleefowl may:

- Use the same mound repeatedly across breeding seasons
- Switch to different mound for reasons that are not fully understood
- Build entirely new mounds
- Choose not to breed at all in unfavourable years

All mounds located during the site setup are recorded spatially.

In each subsequent season, the mounds are revisited during monitoring and breeding activity is noted along with many other features including presence of feathers, tracks, scats (of malleefowl and other animals including predators), the dimensions of the mound to name a few. The proportion of active mounds where breeding activity is noted is a short-term indicator of malleefowl population density, while long-term trends in this measure is an indicator of population trajectories.

Site calibration

To maintain the accuracy of this method, sites should be systematically searched again periodically to detect any new mounds that may have been built and not noticed by monitors. There is no set frequency for this to occur, but insights into this question are documented in the sample site calibration section below.

Land use zones

Because local environmental and historical factors influence malleefowl populations, these sites are divided into 2 categories: agricultural zone and the pastoral zone (Figure 1).

Agricultural zone

The agricultural zone, which is largely south of the River Murray, has more fertile soils, higher and more reliable rainfall but less native vegetation cover due to historical land clearance for farming. Consequently, malleefowl populations in the agricultural zone tend to be relatively fragmented since their reluctance to disperse confines them to isolated patches of suitable habitat.

Pastoral zone

The pastoral zone is largely north of the River Murray where soils are less fertile, and rainfall is consistently lower and less seasonally reliable. However, the pastoral zone has not seen the same level of land clearance as the agricultural zone and has more or less continuous native vegetation cover. This vegetation has Mallee woodland interspersed with non-eucalypt woodland and other native habitat types. The vegetation is also degraded by the impacts of its pastoral history and the ecosystem is somewhat less productive due to lower rainfall and habitat suitable for malleefowl breeding is consequently fragmented here also. In an effort to compensate for this difference, the area for malleefowl mound monitoring in the pastoral zone is spread over smaller but more numerous sample sites.

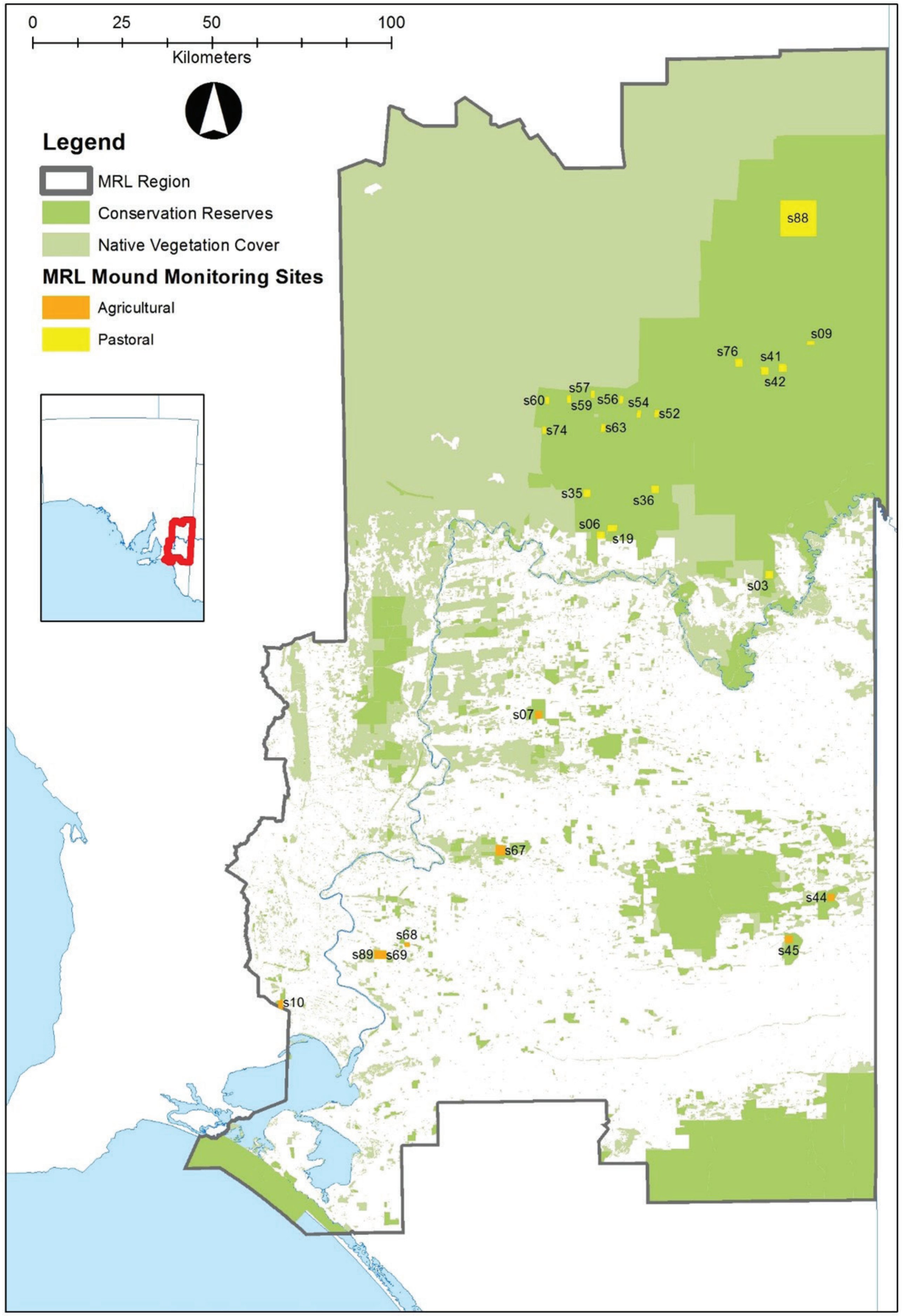

Figure 1: *Map of mound monitoring sites illustrating the spread across the agricultural and pastoral zones*

Results

A total of 32 mound monitoring sample sites were monitored between 2016 and 2022. However, for consistency in comparing results over time, only the 24 sites that were monitored every year during this 7 year period are presented here. These include 7 sites in the agricultural zone and 17 sites in the pastoral zone. In the agricultural zone, site sizes range from 155 ha to 675 ha and contained between 29 and 65 nest mounds, with an average density of 0.118 mounds per ha. In the pastoral zone, sites range between 200 ha and 430 ha in size and contain between 6 and 40 mounds at an average of 0.062 mounds per ha. The total sample area was 8244 ha (3014 ha in the agricultural zone and 5230 ha in the pastoral zone). In the agricultural zone, 357 mounds were visited and 326 in the pastoral zone, a total of 683 mounds overall (Table 1, Figure 1).

Table 1: *The number of mounds and area covered at each site across the zones in the region.*

Land use zone	Site code	Site name	Mounds	Area (ha)
Agricultural	s07	Bakara CP	63	400
Agricultural	s67	Bandon	59	675
Agricultural	s68	Ettrick	29	155
Agricultural	s10	Ferries - McDonald CP	65	582
Agricultural	s45	Karte CP	32	400
Agricultural	s69	Murray Bridge Army Range	49	402
Agricultural	s44	Peebinga CP	60	400
		Total	**357**	**3,014**
		(Average density) 0.119 mounds/ha		
Pastoral	s09	Chowilla RR	19	200
Pastoral	s03	Cooltong CP	40	400
Pastoral	s59	Gluepot 11	15	200
Pastoral	s60	Gluepot 12	15	200
Pastoral	s63	Gluepot 15	13	200
Pastoral	s52	Gluepot 3	23	200
Pastoral	s54	Gluepot 5	16	200
Pastoral	s56	Gluepot 7	15	200
Pastoral	s57	Gluepot 8	11	200
Pastoral	s76	Oak Bore 3	21	400
Pastoral	s41	Oakbore 1	20	400
Pastoral	s42	Oakbore 2	15	400
Pastoral	s06	Pooginook CP	33	400
Pastoral	s19	Taylorville	37	430
Pastoral	s36	Taylorville East	18	400
Pastoral	s74	Taylorville North West	6	400
Pastoral	s35	Taylorville West	9	400
		Total	**326**	**5,230**
		(Average density) 0.062 mounds/ha		
		Grand total	**683**	**8,244**

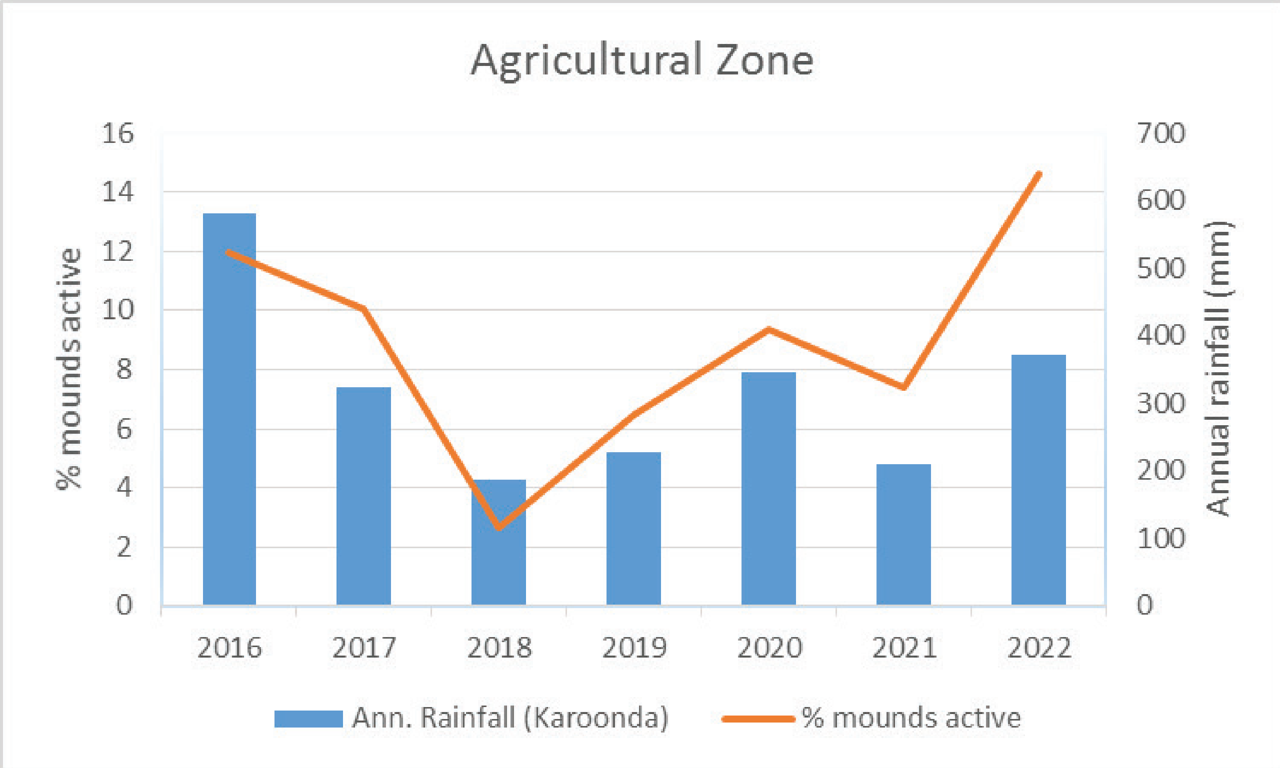

Figure 2: *Percentage of active mounds per year in the agricultural zone plotted against annual rainfall.*

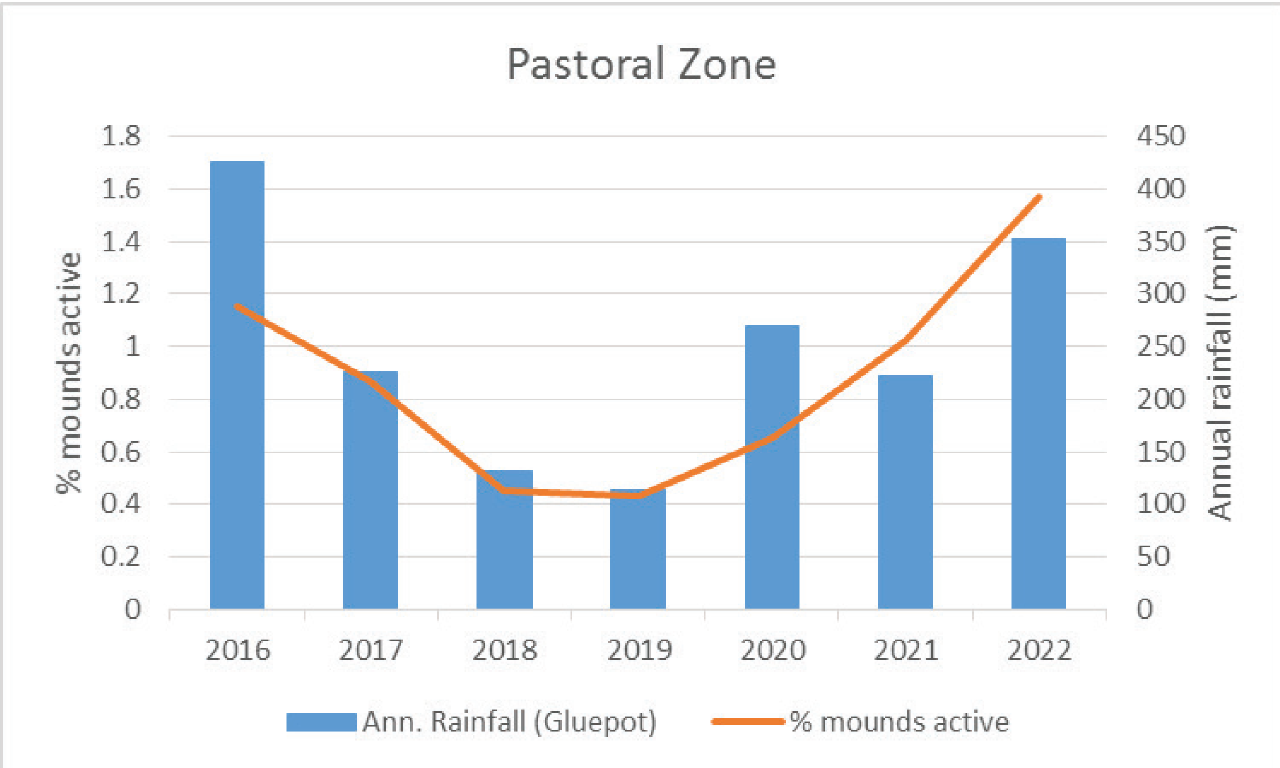

Figure 3: *Percentage of active mounds per year in the pastoral zone plotted against annual rainfall.*

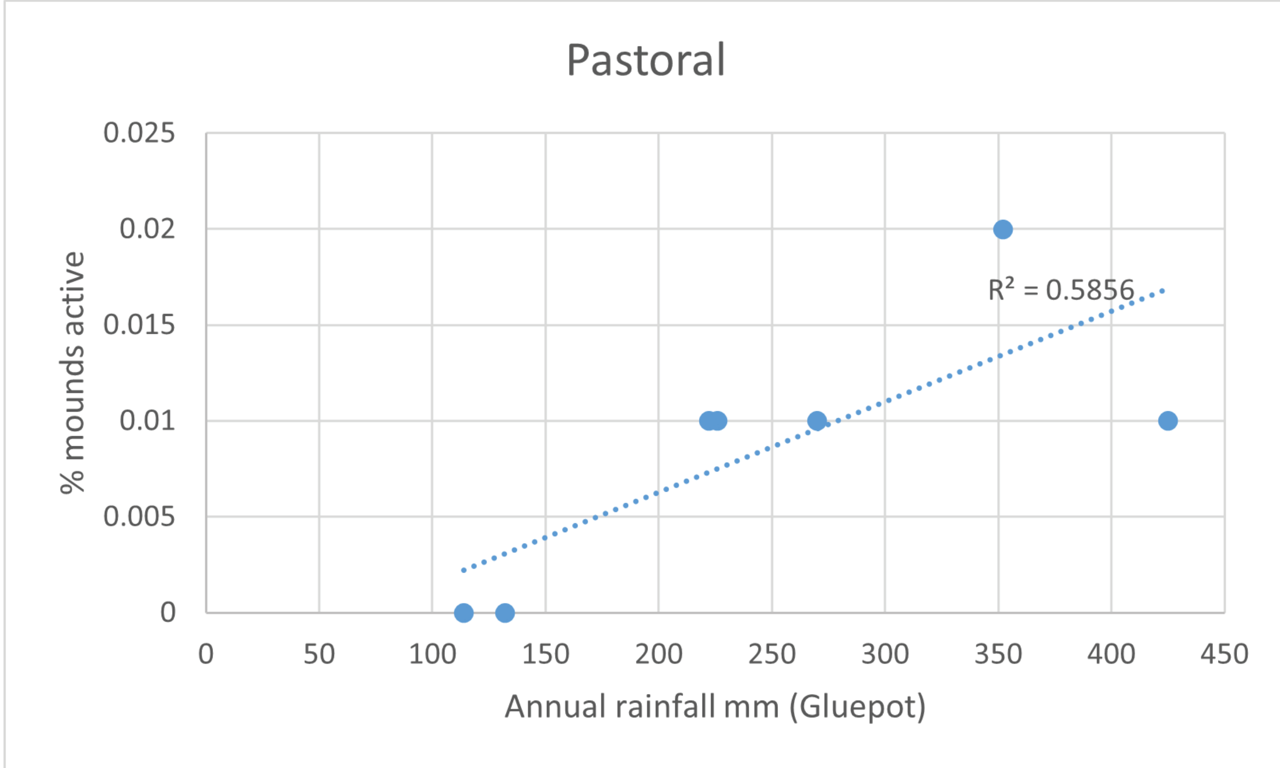

Figure 4: *Regression of percent of active Malleefowl mounds against annual rainfall in the pastoral zone.*

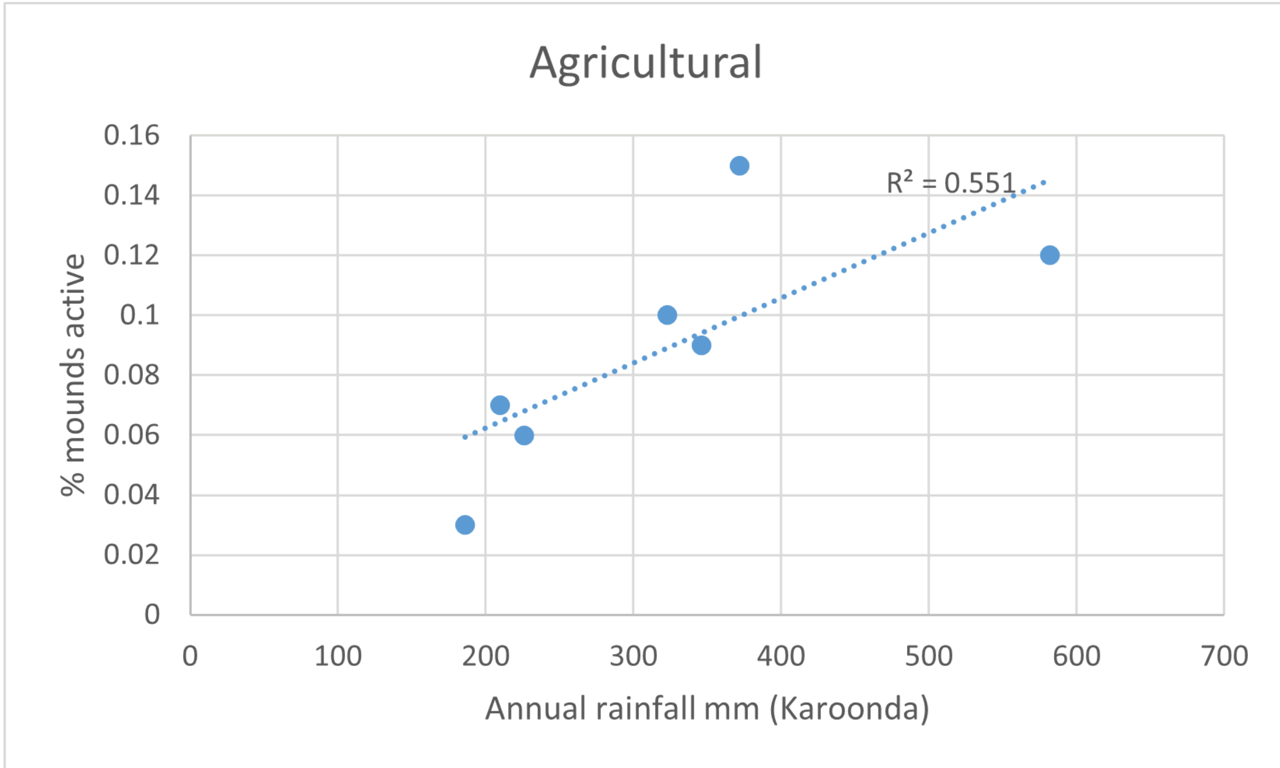

Figure 5: *Percentage of active mounds per year in the pastoral zone plotted against annual rainfall.*

In the agricultural zone, 11.96% of mounds visited in the breeding season of 2016 were active. This figure declined to 2.65% by 2018 which was the lowest percentage of the 7 seasons presented here. Percent of mounds active increased again over the subsequent two seasons to another peak at 9.33% in 2020 before dipping to 7.38% in 2021 and then rose again to the best season of the study at 14.6% active (Figure 2).

In the pastoral zone, 1.15% of mounds visited in the 2016 breeding season were active. This figure declined to 0.43% by 2019 which was the lowest percentage of the 7 seasons presented here. Percent of mounds active increased every year from then, also reaching the highest level over the 7 seasons at 1.57% in 2022 (Figure 3). In both the agricultural and pastoral zones, breeding effort correlated quite well with total annual rainfall R^2 = 0.551 and R^2 = 0.5856 respectively (Figures 4 and 5).

New mound monitoring sites

Methods

During the life of the Threatened Mallee Bird project, 3 additional mound monitoring sites were established in the region. The first of these (Danggali 3, s88) was established by New South Wales Department of Planning and Environment in partnership with Local Land Services Western Region as a control plot (no fox baiting) to compare with a corresponding treatment plot in neighbouring Tarawi Reserve across the NSW border. The landscape board contributed local knowledge of malleefowl habitat to assist in selecting site, which was established using an airborne LiDAR scan delivered by contractors to the NSW government. The landscape board later provided logistical support for volunteer driven ground-truthing and baseline monitoring operations.

LiDAR (Light Detection and Ranging) uses laser light reflected from the substrate of interest to build a 3D model of surface topography which can then be interpreted, in this case to predict the locations of malleefowl mounds. Currently LiDAR can be deployed using manned aircraft or drones.

Another site (s89) was established using LiDAR by the Australian Department of Defence at the Murray Bridge Army Range to better characterise the risk posed to malleefowl by training activities. This site was established adjacent to an existing site (s69) which was calibrated using the same LiDAR method (see site calibration section below). In this case, the LiDAR was deployed using an unmanned remote-controlled aircraft (drone).

A third additional site (Sandalwood Dam, s87) was established using traditional on-ground search methods by volunteers at Taylorville Station, a property managed by in the Australian Landscape Trust. This site was added to the existing sample size within the Taylorville area, where historically very low breeding activity rates were recorded. The landscape board provided support for the resultant data to be entered and established in the National Malleefowl Database including baseline monitoring.

Results

At Danggali 3, (s88) a 100 km^2 area near the centre of the Danggali Wilderness Protection Area was scanned using airborne LiDAR. The resultant data was interpreted digitally to produce over 3,500 predicted mound locations (Table 2). These predictions were categorised by confidence level from 1 (highly confident) to 4 (least confident). All locations in categories 1-3, along with a selection of category 4, were ground-truthed in 2022 by contractors, landscape board staff, and volunteers from the Scientific Expedition Group in. The same group returned to do baseline monitoring in the 2022-23 breeding season. The LiDAR method proved highly accurate, 75 actual mounds located and included in the mound monitoring program. Of these, 4 were found to be active, and a further 2 were classed as “Ambiguous Active”.

Confidence of prediction	Count of rating
1	22
2	42
3	23
4	3,418
Grand total	3,505

Table 2: *The number of malleefowl locations predicted for each of four degrees of confidence, identified at site Danggali 3 from airborne LiDAR.*

At the Murray Bridge Army Range (s89), 29 mounds were added to the mound monitoring program using a drone-mounted LiDAR system. This method was also quite accurate with less than a handful of predictions proving incorrect. However, this method was more time-intensive, requiring dozens of hours of drone flight over several days to scan an area of approximately 836 hectares. In contrast, the manned aircraft at Danggali 3 scanned the 100 km^2 in a matter of hours. In the subsequent baseline monitoring for this site, 12 of the 29 mounds were found to be active and a further 2 were classed as “Ambiguous Active”.

At the Sandalwood Dam (s87) site in Taylorville Station, 17 new nest mounds were added to the monitoring program which were located by systematic on-foot search. In subsequent baseline monitoring, in 2021 and 2022, none of these mounds were found to be active.

Mound monitoring site calibration

Malleefowl are known to periodically build new nest mounds from scratch. This may be a response to a number of environmental cues including availability of food or compostable plant material used for incubating eggs or both. If these new mounds are established without the knowledge to monitors, then the results of the monitoring programs may underestimate breeding activity. To maintain the accuracy of long-term data, it is therefore prudent to periodically conduct a systematic search for new mounds. Prior to the commencement of the current Threatened Mallee Bird project, this had not been done for any monitoring sites in the region since they were established up to 30 years ago.

Methods

There are several ways to conduct a systematic search for new malleefowl mounds. The traditional method involves walking a series of parallel transects across the study area, spaced no more than about 40 or 50 metres apart. Participants visually search either site of each transect for mounds, recording all detections using GPS. The results are subsequently analysed to determine whether any new mounds have been detected, after which they can be added to the monitoring program. The interval between transects can be adjusted based on the density of vegetation and resulting visibility. While this method can be undertaken by a single, it is time consuming and arguably greater accuracy can be achieved if done by a team. This method was used to calibrate 3 mound monitoring sites in the region as part of the Threatened Mallee Birds project. Priority was given to the most reliably productive sites since they stood to have the largest impact on monitoring results for any proportion of inaccuracy. These sites were Bakara CP (s07), Karte CP (s45) and Peebinga CP (s44).

Another method is to use LiDAR as described above. In 2020, the landscape board partnered with the University of Adelaide’s Unmanned Research Aircraft Facility (URAF) to trial the LiDAR method along with other remote sensing techniques using drones.

At the time this method proved capable of detecting a high proportion of the known mounds in the study area in Peebinga CP (s44) However, the method was severely limited by the battery life, and subsequent flying time of the drones, as well as by regulatory requirements to fly the aircraft only within line of sight of the operator.

Only a year later, the method was successfully used by the Department of Defence at the Murray Bridge Army Range thanks to improvements in technology and CASA regulation. However, the process did still take several days to complete.

Results

At Bakara CP (s07), 4 new mounds were found during the on-foot search, an increase of 7% in sample size. At Peebinga CP (s44), 4 new mounds (7%) were also added and at Karte CP (s45) 3 new mounds were added (10%). No new mounds were detected in the LiDAR search of the Murray Bridge Army Range site s69.

Adaptive Management Predator Experiment (AMPE)

The Malleefowl Adaptive Management Predator Experiment is a national (NSW, Vic, SA and WA) initiative of the National Malleefowl Recovery Team and the National Environmental Science Programme's Threatened Species Recovery Hub.

This citizen science project is aimed at conservation of nationally vulnerable malleefowl and addresses a deceptively simple question: *Does malleefowl breeding effort increase when predators are suppressed?*

For over 30 years, malleefowl breeding activities has been monitored by dedicated volunteers across Australia. This new experiment incorporates predator activity data captured by camera traps at selected mound monitoring sites, along with information on predator control activities provided by land managers around the monitoring sites.

In the Murraylands and Riverland region, 6 monitoring sites have been set up, with a total of 48 surveillance cameras to participate in the experiment. The cameras also provide valuable data on other environmental issues as well, particularly the presence and impact of pest and overabundant herbivore species.

Methods

Wildlife surveillance cameras have been deployed across the region as part of the AMPE since 2016. Six malleefowl mound monitoring sites are included in the experiment: Bakara Conservation Park (CP) (s07), Karte CP (s45) and Peebinga CP (s44) in the agricultural zone and Gluepot, Calperum (Oak Bore 3 s76), and Danggali CP (s15) in the pastoral zone. At each site, 8 cameras operate continuously and are spaced at regular intervals across the landscape, with each camera located at least 50 metres from the nearest nest mound. Cameras are serviced approximately every 90 days to ensure they are operational, check settings and power supply, and retrieve data. These tasks, along with data processing, are primarily carried out by volunteers.

The data is processed using the DigiVol website, which allows volunteers to contribute to the project by identifying and recording the animals observed. Animals are categorised broadly, based on relevance to malleefowl ecology, to optimise efficiency while maintaining ecological relevance to the project.

The sites have been selected to allow comparison of predator activity and malleefowl breeding responses in similar landscapes (in this case either pastoral or agricultural) that differ in the intensity of fox control. In the agricultural landscape, Karte CP and Bakara CP are surrounded by farming properties that run sheep and consequently, these farmers lay fox baits annually in the spring only in an effort to protect their lambs from predation by foxes. The areas surrounding these 2 sites are baited at a rate of 0.6 and 0.4 baits per km^2 per annum respectively. Meanwhile, the properties surrounding Peebinga CP do not bait foxes at a measurable rate. While there is no fox baiting undertaken on the Conservation Parks themselves, they are small parks, and the baiting of surrounding farms provides a measurable treatment.

In the pastoral zone, all AMPE sites are contained within large conservation reserves.

- Calperum Station (Oak Bore 3), landholder Australian Landscape Trust lays ground baits for foxes twice annually (spring and autumn) with the area surrounding the monitoring site s76 baited at a rate of approximately 0.6 baits per km^2 per annum.
- In Gluepot Reserve, landholder BirdLife Australia maintains a mixture of ground laid 1080 fresh meat baits and 1080-armed canid pest ejectors almost constantly throughout the year resulting in an intensity of up to 0.8 baits per km^2 around the monitoring site (s63).
- No fox baiting is undertaken by Department for Environment and Water in Danggali CP, the location of monitoring site s15.

Fox baiting is reported annually through direct contact with farmers, and monitoring 1080 distribution registers for a 100 km^2 area surrounding the centroid of each mound monitoring site (approximately a 6 km radius).

Results

To date, more than 437,000 surveillance camera images have been processed. The top 8 species categories detected across all sites, in descending order, were kangaroo (with 3 times more detections than any other group), birds (excluding malleefowl or emu), fox, emu, hare, malleefowl, feral goat and echidna. If grouped together, reptiles (including goannas) would be the ninth, followed by feral cats in tenth place, and rabbits in eleventh (Figure 6).

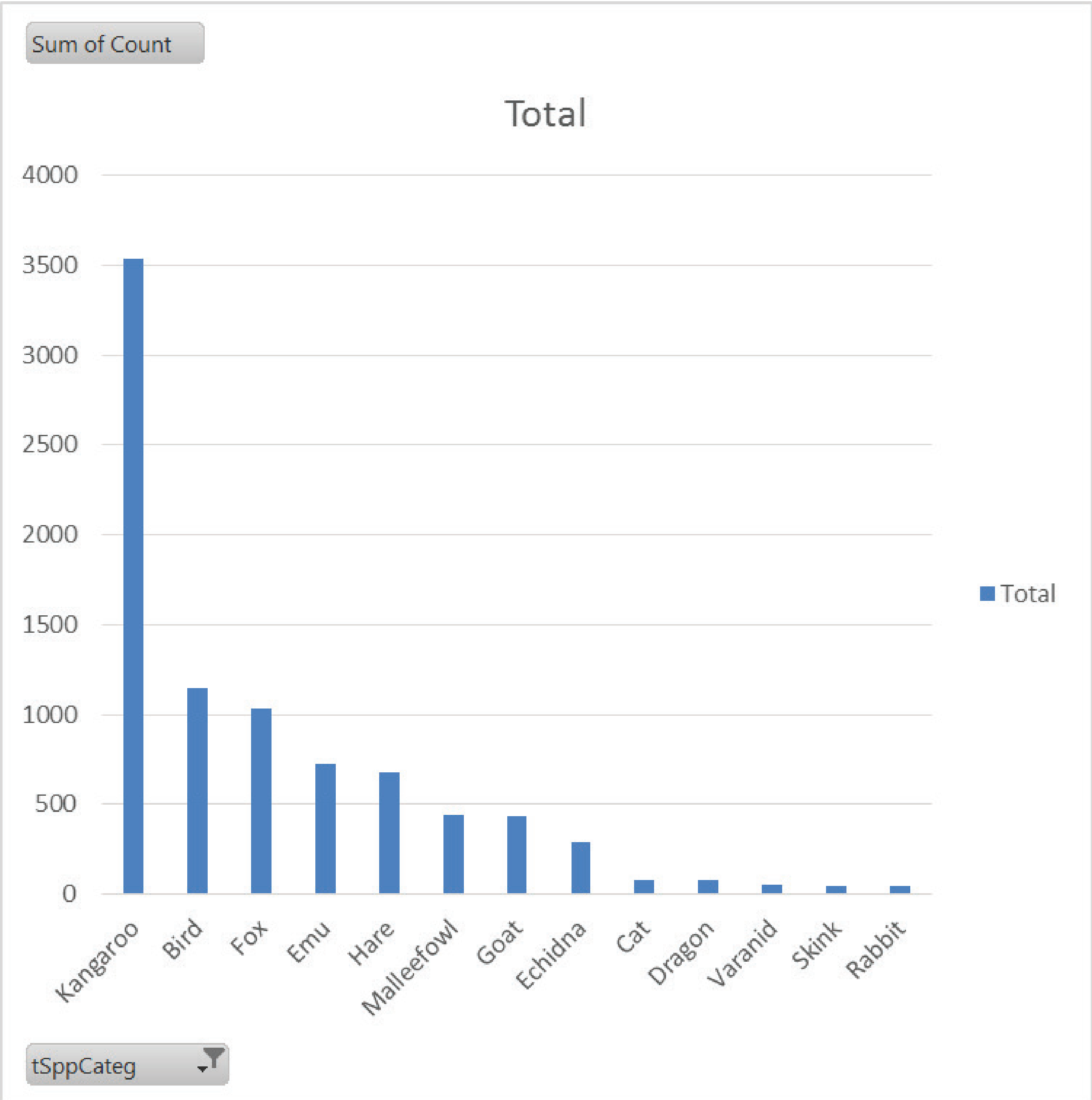

Figure 6: *The number of images detected for each species group across 437,000 surveillance camera images recorded*

This varied somewhat between sites; however, kangaroos were consistently the most commonly detected, especially in Bakara CP. In the agricultural zone, malleefowl remained at fifth or sixth position. Feral goats were the second most commonly detected in Karte CP but were far less common in Peebinga and Bakara CPs. Hares were the second most common detection in Bakara CP and foxes were fifth in Bakara CP, third in Karte CP and second most commonly detected in Peebinga CP (Figure 7).

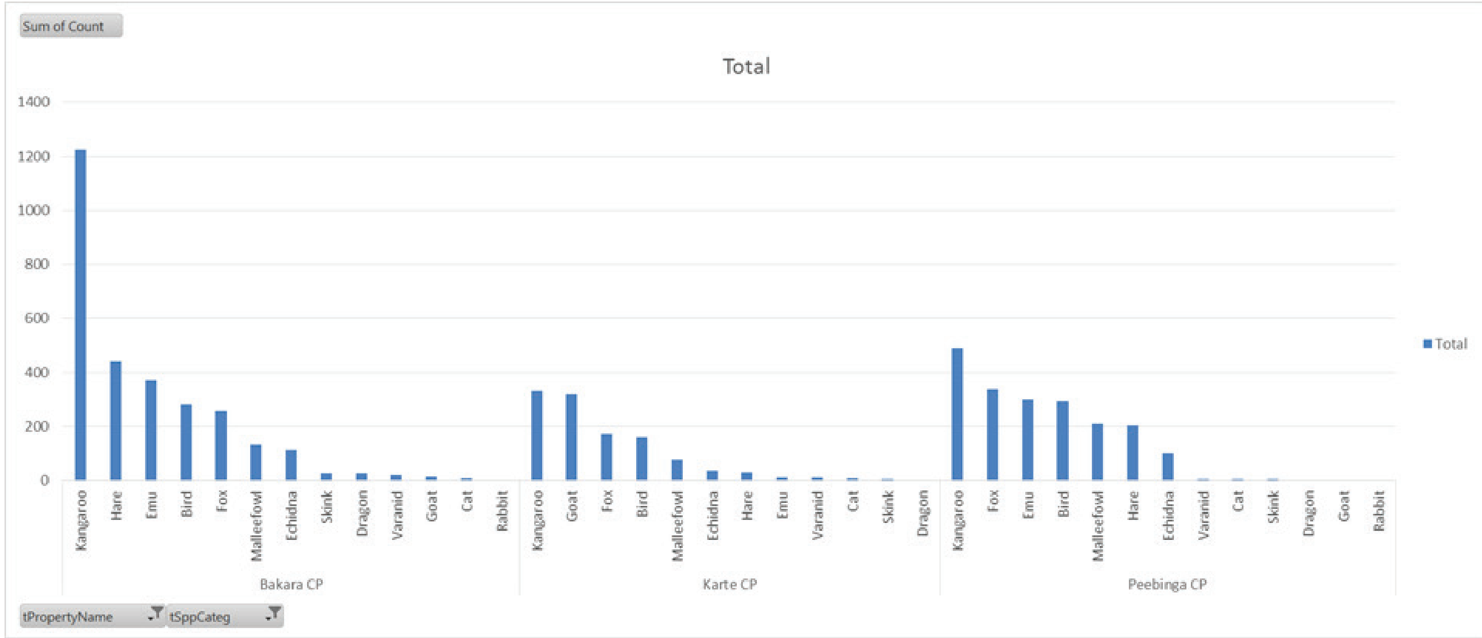

Figure 7: *The number of images detected for each species group for the surveillance camera images recorded from the agricultural zone.*

In the pastoral zone, kangaroos were still the most detected animal across all sites. Birds consistently ranked second, followed by foxes in third place at all sites. The fourth most common detection varied: feral goats held this position at both Danggali and Gluepot, while at Calperum, feral cats ranked fourth and goats dropped to fifth. Feral cats came in eighth in Danggali, and seventh in Gluepot. Malleefowl were ranked eighth most commonly detected in Calperum, and ninth in Danggali and Gluepot (Figure 8).

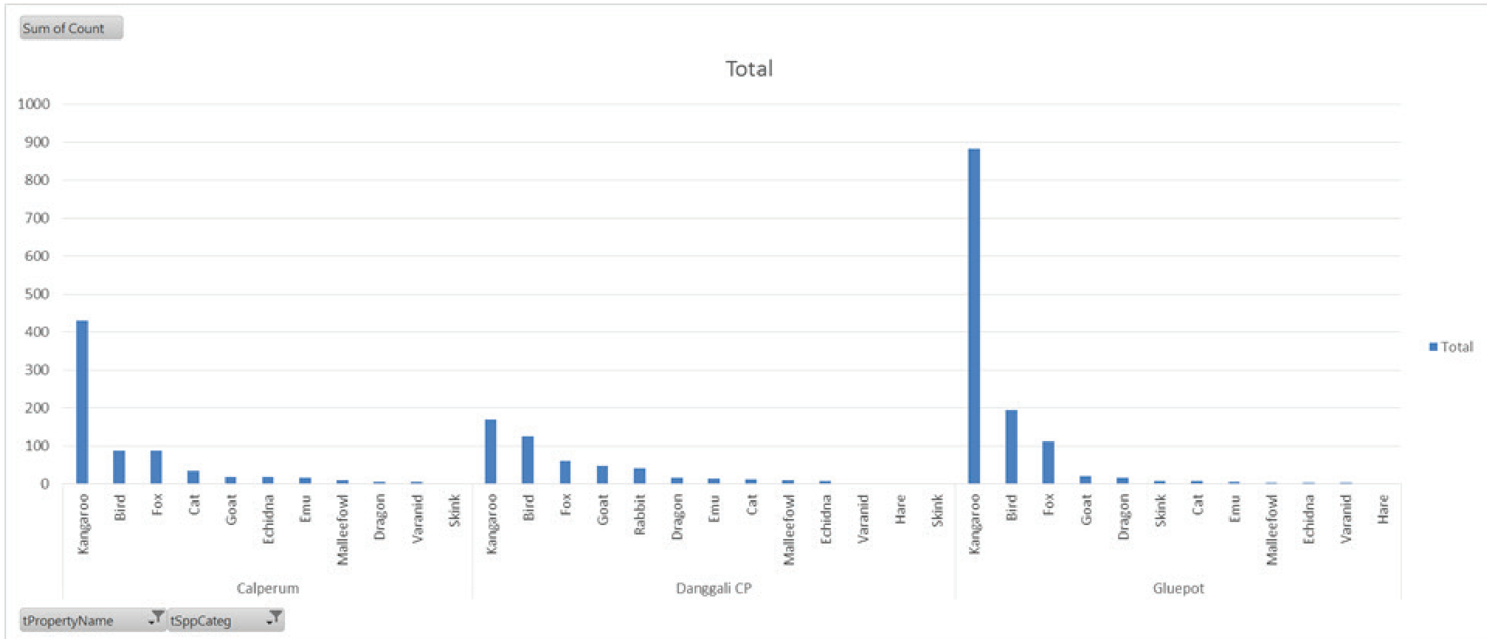

Figure 8: *The number of images detected for each species group for the surveillance camera images recorded in the pastoral zone.*

A simple index of activity level is the number of detections at a site (summed across all 8 cameras) per month. Using this measure, foxes were most active at Peebinga CP where fox baiting intensity is the lowest of all sites measured. However, the site also recorded the highest level of malleefowl activity, by the factor of three compared to other agricultural zone sites. Elsewhere in the agricultural zone, fox activity was slightly higher in Karte CP where baiting is slightly more concentrated than in Bakara CP (Figure 9).

In the pastoral zone, foxes were most active in Gluepot where baiting is also most intensive, followed by Calperum, with the lowest measured fox activity was in Danggali where no baiting occurs. Conversely, malleefowl activity was highest in the pastoral zone at Danggali, followed by Calperum and then Gluepot where fox baiting intensity is highest (Figure 9).

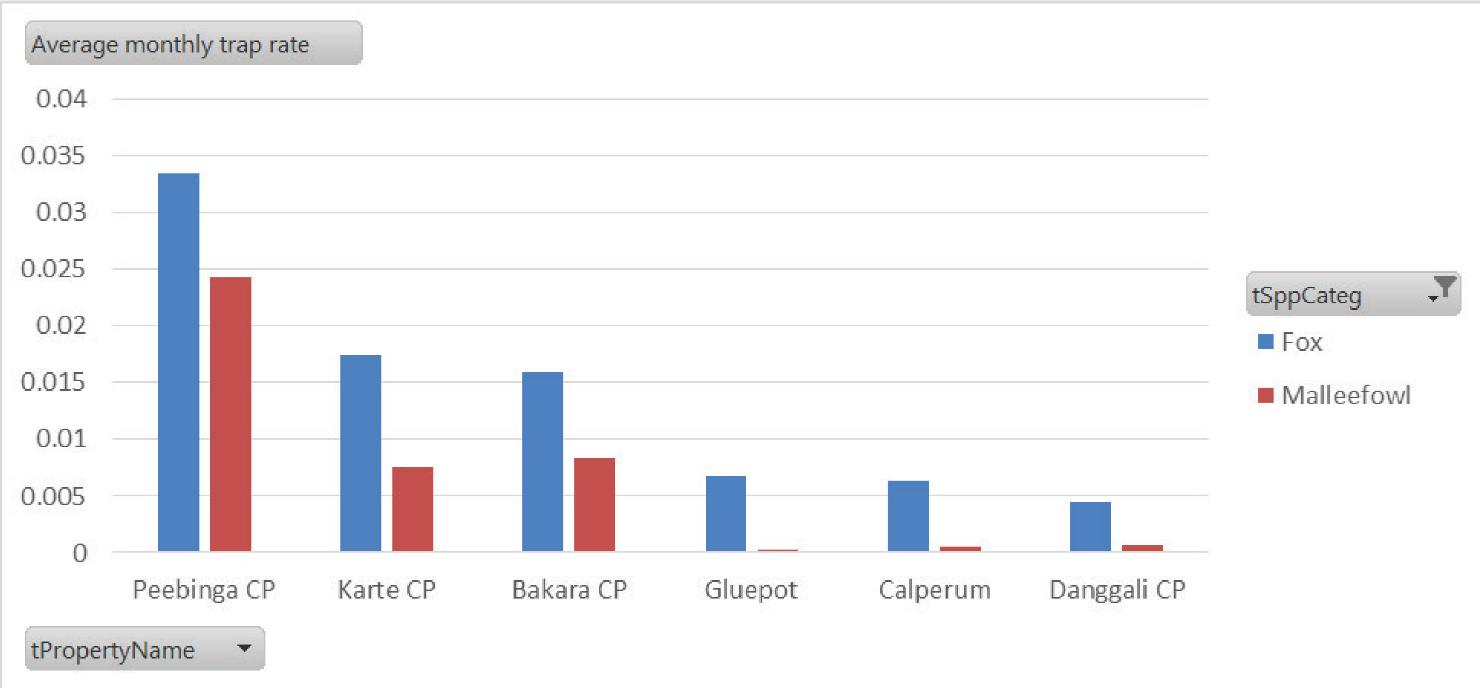

Figure 9: *Average monthly trap rates for fox and malleefowl across the 6 sites*

In the agricultural zone, fox activity showed no obvious pattern over time other than a peak in activity at Karte CP and Peebinga CP around the spring of 2019 (Figure 10). However, in the pastoral zone, fox activity may be showing a loose positive correlation with annual rainfall (Figure 11).

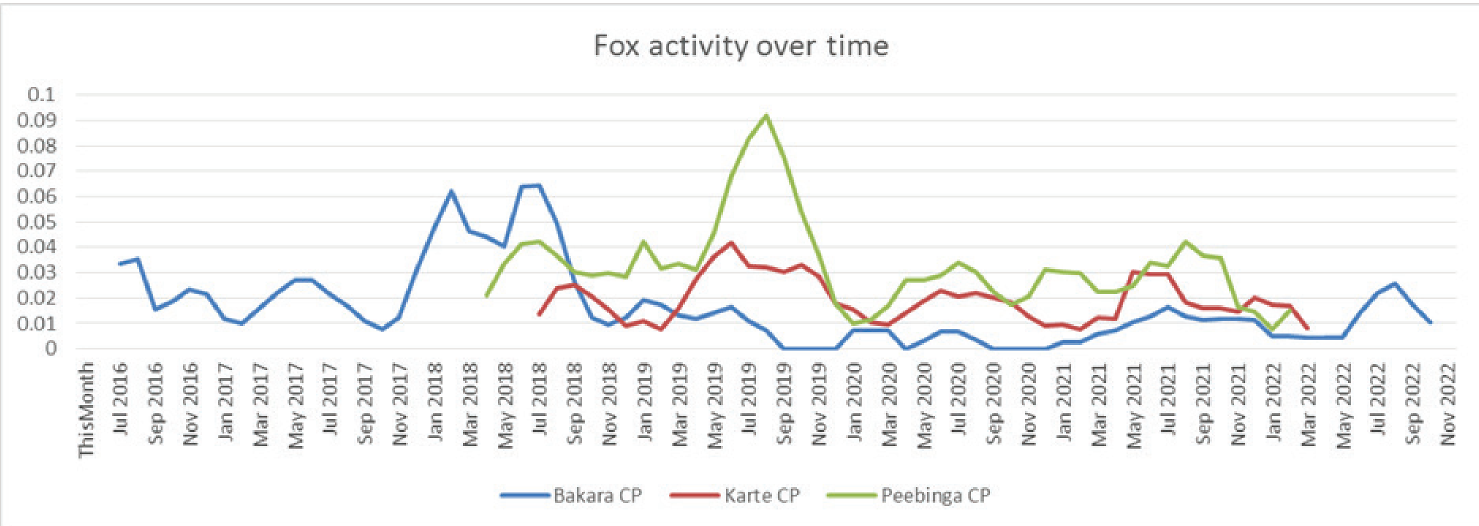

Figure 10: *Fox activity over time in the agricultural zone.*

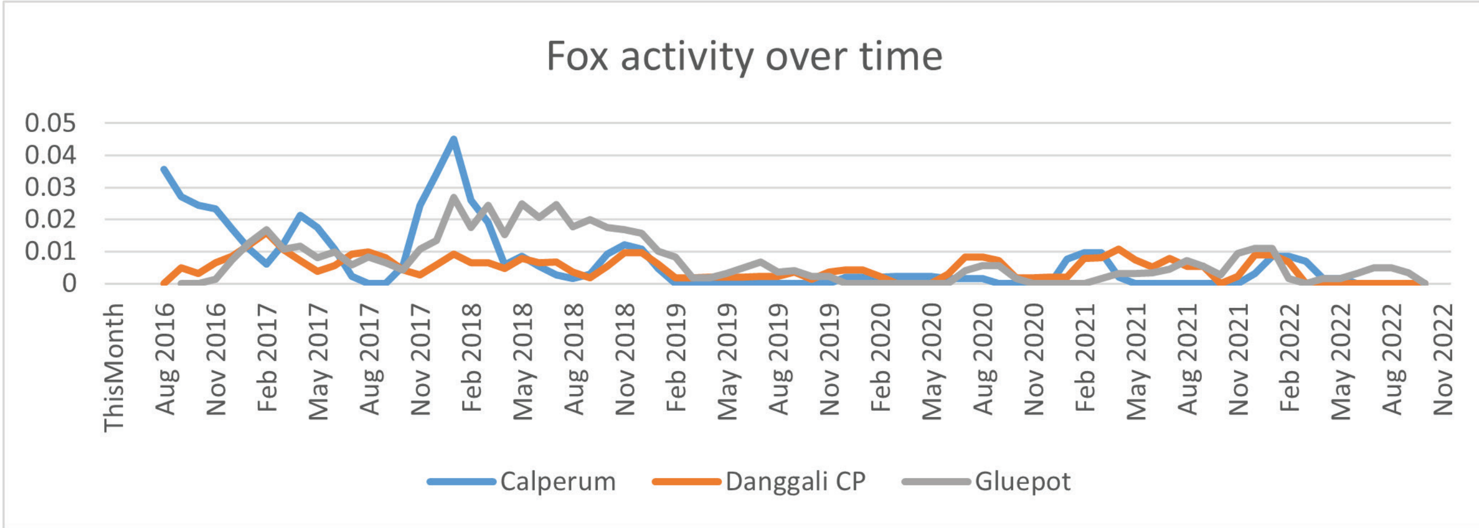

Figure 11: *Fox activity over time in the pastoral zone.*

Discussion

Malleefowl breeding activity across the Murraylands and Riverland region has shown an overall increase since 2016, and since the beginning of the Threatened Mallee Bird project in 2018-19. However, this should be considered within the context of recent climatic conditions and the long-term, national-scale declines in malleefowl populations. We should also remember that breeding activity is a real time measure and is presumably an influential factor in population recruitment. However, an improving trajectory in population size cannot be inferred from this and would need to be demonstrated in part by a much longer term and consistent increasing trajectory in breeding activity.

The positive correlation between annual rainfall and breeding activity is consistent with recent research findings, providing optimism for the impact of closing redundant dams in the pastoral zone to reduce grazing pressure. Preliminary results of grazing impact monitoring (not presented here) show an improving trend in plant growth, and a reduction in the impacts of feral goats, particularly in this landscape. If this continues as the climate shifts back into a drier phase over coming years, it may give malleefowl an advantage over herbivores that require standing water to survive in the landscape. The next wetting phase will be a critical time then for recruitment in malleefowl populations which are well adapted to boom and bust climate cycles.

The relationship between rainfall and breeding activity also holds for the agricultural landscape, with competition – both direct and indirect - from mammalian herbivores, both native and introduced is presumably involved. However, managing herbivores and their impacts presents a different challenge, given the mixed land-use, smaller property sizes, requirement of drinking water for livestock on mixed cropping and grazing properties, the fragmentation of remaining native vegetation, and food subsidies afforded by cropping activities.

While the agricultural zone remains the more productive area for malleefowl, it still shows a long-term decline in their populations, suggesting that these factors therefore warrant careful consideration when it comes to protecting malleefowl.

The addition of new mound monitoring sites has had mixed results across the region in recent years, providing useful insights, particularly with the emergence of new technologies such as LiDAR and drones. The new site s89 near Murray Bridge has reinforced the status of the agricultural zone as a productive area for malleefowl breeding effort and therefore an important area for their conservation. Meanwhile, the addition of another similar sized site in Taylorville (s87) shows consistent results of low breeding density as elsewhere in the pastoral zone. However, the establishment of a much larger site (s88) in Danggali seems to demonstrate that malleefowl mound monitoring in the pastoral zone may be much more informative with a smaller number of much larger sites. S88 alone has the equivalent of approximately 25 percent of the mounds already monitored in the pastoral zone across 17 other sites. Also, in 2022, s88 had more active mounds than the rest of the pastoral zone monitoring sites combined.

While LiDAR has proven to be a very reliable way of detecting malleefowl mounds, it is also very expensive whether deployed using manned or unmanned aircraft. However, it is highly effective and efficient when used on a large scale, which is ideal for large, continuous habitat areas where malleefowl breeding populations are relatively widespread but scarce, such as in the pastoral zone. If future monitoring of malleefowl in the pastoral zone is going to reliably determine the effectiveness of management efforts, such as closing dams, it appears that a small number (3-4) of large LiDAR scans that incorporate clumps of existing monitoring sites would be a good way to calibrate existing monitoring while optimising sample sizes and monitoring effort.

Meanwhile, on-ground searching by foot seems the best solution to the calibration question in the agricultural zone, especially while there is plenty of community participation in volunteering, however, drone-deployed LiDAR is quickly becoming an affordable and effective option.

The AMPE brings into question both the importance of exotic predators, particularly foxes in malleefowl decline and the effectiveness of fox-baiting as a predator control. The results seem to suggest that both malleefowl and foxes respond more reliably and positively to the presence of available resources, primarily rainfall driven, than to each other. Also, there appears to be more fox activity in areas that are more intensively baited than in areas that are not baited at all. While this association would not be expected to be a linear one, and in fact would be expected to reverse at baiting intensities orders of magnitude greater than what is undertaken in our region, it sheds valuable insight into what the financial cost of what "effective" baiting might be and whether that is sustainable or even necessary. Nonetheless, AMPE is a national scale experiment and future analyses of the full dataset will provide more certainty.

Overall, the future of malleefowl seems strong in the Murraylands and Riverland region thanks to the efforts of project partners and the dedicated volunteer community alike. The monitoring program is unique in its longevity amongst Australian datasets which is why it has been able to produce such valuable and informative research for malleefowl conservation. In recent years it has improved greatly which, along with learnings from the work documented here will enable it to benefit malleefowl well into the future.


Photo: Tom Hunt


Photo: Tom Hunt

More information

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