32. Malleefowl activity at nesting sites increase fox and other feral animal visitation rates

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Abstract

The activity of foxes were monitored at Malleefowl nesting sites within the rangelands of western New South Wales during the Malleefowl breeding season of 2012 – 2013. Cameras were placed at 10 sites each for four treatments: active Malleefowl nests, inactive Malleefowl nests, artificial nests (created by the authors) and random sites. No differences in fox activity were found between random sites and artificial nests. However, active nests of Malleefowl recorded significantly higher levels (80%) of visitation by foxes throughout the egg laying period compared to all other treatments. Inactive nests recorded intermediate levels of disturbance by foxes, but were not significantly different to active nests. These results indicate that a factor associated with the presence of Malleefowl (possibly odour) attracts foxes to active nests rather than the disturbance of nest digging or random chance. Past baiting strategies for foxes within Malleefowl nesting areas have avoided placing baits in the vicinity of nests because of the fear of attracting these predators to nests and Malleefowl. Clearly, the presence of Malleefowl is already acting as an attractant and it might be that future baiting protocols should investigate placing baits at known active mounds as a more efficient method of removing foxes that are already accustomed to eating Malleefowl eggs and chicks.

Introduction

Malleefowl *Leipoa ocellata* were formerly distributed through much of western New South Wales from the slopes of the Great Dividing Range to the arid rangelands in the far west of the state and in particular the fertile mid-western plains referred to as the “wheat belt”. Although there are a variety of factors listed as contributing to this serious decline, including native vegetation clearing, one of the now recognised national key threatening processes has been the introduction of the European red fox *Vulpes vulpes*. Priddel and Wheeler (1996) during early attempts to reintroduce hatchling captive bred Malleefowl into western New South Wales documented mortality rates as high as possibly 92% and that was a key failure in their experiment. These authors had slightly greater success with the release of sub-adults (14 – 28 months) but even this age class suffered a loss of two thirds of the total birds released.

Monitoring of Malleefowl nests since 2009 by the senior author of this paper has consistently found the presence of fox tracks and scats at both active and non-active nests throughout the study area. Many of these mounds are several kilometres from vehicle tracks and for more than a dozen mounds the distance is over six kilometres. Current accepted fox control methods deploy 1080 impregnated baits along vehicle tracks and fence lines primarily because this allows the land owner to cover greater distances with limited effort (driving verses walking). There is good evidence to suggest that there are greater levels of fox activity along vehicular tracks (Towerton *et al.* 2011) however where there are no vehicle tracks it does not mean there are no foxes. In highly remote areas such as the western rangelands of New South Wales it is possible that some foxes never travel through the landscape using vehicle tracks and are therefore unlikely to encounter baits.

The nests of Malleefowl represent very important resource locations for predators and particularly species such as the fox that defend these resources over an extended period. Nest locations are scent marked by territory owners (foxes) and visited throughout the year but there is a lack specific knowledge about exactly how these foxes use and monitor the nests within their territories. In order to significantly control fox populations and their impact upon Malleefowl populations it is essential that we understand more fully the ecology of foxes where their territories overlap with the territories of Malleefowl. This paper represents as far as the authors can determine the first attempt to explore the detail of fox visitation rates at Malleefowl nest sites in relation to the seasonality of egg production and explores the possibility that foxes do not move randomly through the landscape but use resource sites (nests) for navigation.

Methods

The study area for the data reported in this paper was situated about 60 kilometres north of Hillston in western New South Wales (55 H 401546 6330022). Vegetation within the study area was typically characterised as mallee woodland with a canopy height of 3-5m and a sparse shrub layer averaging 1m in height. The dominant tree species were *Eucalyptus socialis* and the most common shrub species were *Melaleuca uncinata*, *Acacia colletioides*, *Vittadinia sulcata, Olearia pimelioides, Eremophila glabra*, and *Bossiaea walker*. This site is part of a much larger region that has been monitored for Malleefowl nesting activity by the authors since 2009.

Paired surveillance cameras were placed at 40 sites within mallee woodland vegetation for four treatments with 10 replicates in each treatment. Control treatments consisted of random points in the landscape chosen through random number generation and grid coordinates, however cameras were not placed to record movement on known animal paths or within non-mallee woodland vegetation. Disturbance sites replicated the appearance of active Malleefowl nesting mounds in which the authors constructed an artificial nest by digging and turning over soil in a 3m diameter circle. Inactive nest mounds for the third treatment were mounds constructed and used during previous three years by Malleefowl but were not being actively attended during the data collection period for this study. Active nests were those being used by Malleefowl during the period of the data collection reported in this paper.

All cameras were attached to steel pickets at a height of 1.5m, four metres from the edge of the nest and facing south to avoid reflective aberrations in the camera lens due to daily sun movement. Cameras were programmed to capture three medium resolution images in rapid succession with each triggered animal movement and a fixed delay between photo triggers of one minute. Two cameras per site were used to ensure that fox movements were not missed through camera failure and final data sets were combined to check validity of data. Cameras were downloaded every two weeks, batteries checked and replaced if necessary and jpeg photos stored in date labelled folders. Each photo was reviewed for the presence of foxes and Malleefowl and the date, time and animal activity recorded on a Microsoft excel spread sheet. Comparisons of fox and Malleefowl activity between treatments were analysed using ANOVA from the StatSoft programme Statistica version 10.

Results

Control sites within the four week period of the experiment reported within this paper received only four fox visits in 280 capture nights (4 weeks x 7 nights x 10 camera sites) (Figure 1). Disturbance treatments with artificial mounds received six fox visits, inactive nests recorded 250 visits and active mounds were visited by foxes on 242 separate occasions. During this period Malleefowl conducted 572 visits to their active nests. Malleefowl were not recorded at control sites but were recorded visiting artificial mounds on three occasions and at non-active nests on 29 occasions. No significant differences in fox sightings were recorded between control and disturbance treatments ($t_{78} = -1.38$, $p < 0.17$) however significant differences in total fox visits were found between controls, non-active and active nests ($t_{78} = -10.17$, $p < 0.0001$) ($t_{78} = -7.48$, $p < 0.0001$) (Figure 2). Significant differences in total visitation rates were found between disturbed sites and non-active sites ($t_{78} = -9.64$, $p < 0.0001$) and disturbed and active nests ($t_{78} = -6.84$, $p < 0.0001$). There were no significant differences in fox visitation between non-active and active nest. Malleefowl nest attendance was significantly greater than all other treatments ($t_{78} = -7.68$, $p < 0.0001$).

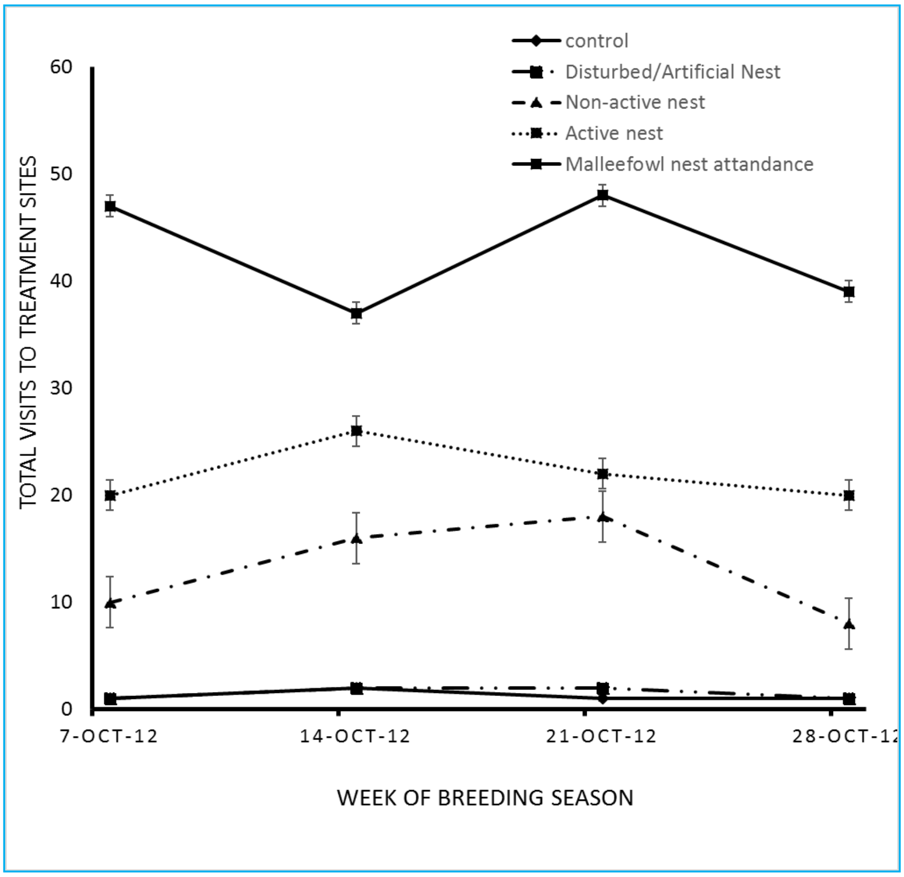

Figure 1. Weekly total treatment site visits by foxes and Malleefowl during the peak egg production period of the 2012 nesting season.

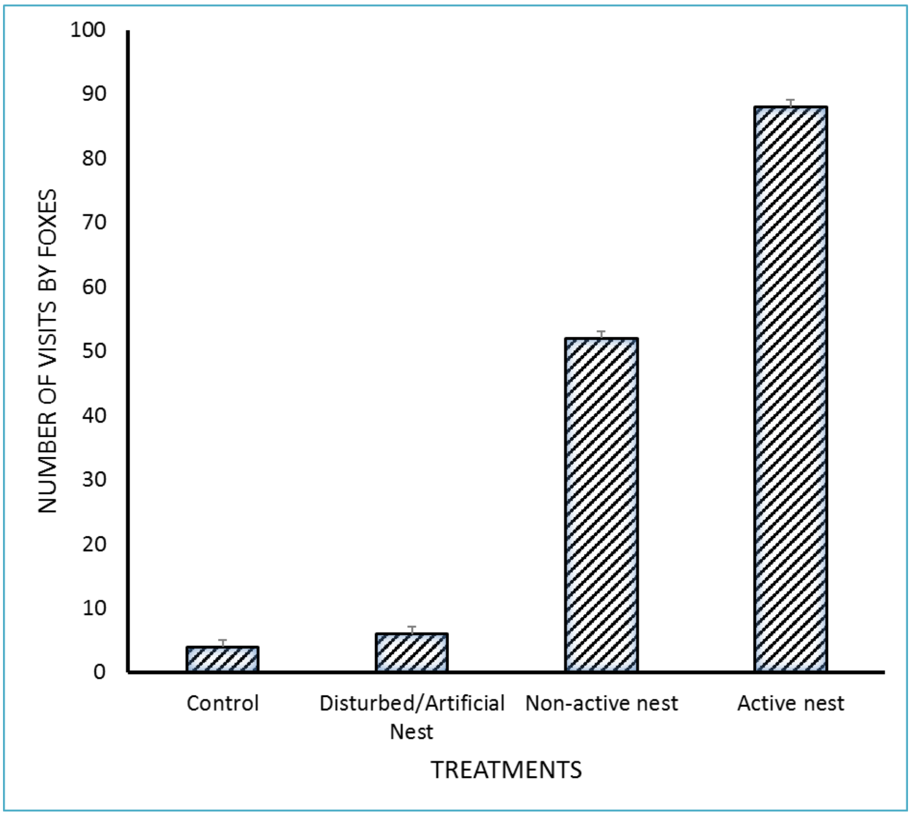

Figure 2. Total number of fox visits at control, disturbed and Malleefowl nest sites during October 2012.

Discussion

Fox predation is recognised as a key threatening process in the decline and recovery of Malleefowl. Data from this study exemplifies the ongoing threat posed by this predator through the frequent visits by foxes at active nests. We have long been aware of the presence of foxes at nesting sites but we can now show that the visitation frequencies of foxes to the resource rich nests containing firstly eggs and later nestlings is tuned to the breeding cycle of the birds. Egg laying by Malleefowl in western mallee rangelands of New South Wales occurs between August and October and during this period the frequency of both attending Malleefowl and foxes increases compared to other periods of the nesting cycle and territory occupation. This project investigated the visitation frequencies of foxes at active nest sites, inactive nests (active in previous five years), control random sites and disturbance sites simulating nest digging activity.

Foxes were observed infrequently at control sites and artificial disturbance nesting simulations. There were no significant differences between these sites, but there were noted differences in the behavioural responses of foxes. At control sites foxes were observed walking across the camera field of view but did not stop at the location. Foxes at the disturbance sites investigated the artificial nests for several minutes and in all cases marked these areas with both urine and faeces. Foxes visited inactive nest sites at a significantly higher rate than either of the previously mentioned treatments. Visits consisted of mound investigation and as with the previous disturbance sites the areas were scent marked. Active nesting sites were frequently attended by multiple fox individuals (recognised by pelage pattern and sex from multiple photographs). This visitation rate was significantly higher than other treatments but less than Malleefowl attendance levels. In most cases foxes were seen at nests during the early morning between 12:00 – 03:00 and around dawn (05:00 – 06:00), but there were occasional daylight visits. During these visits predation events removing eggs (often multiple eggs per visit) and capturing emerging chicks were recorded. These nests were again scent marked suggesting that nests may be an important asset within a territory as a food resource. It was also observed that female foxes with attendant cubs regularly visited these nests (Figure 3).

Figure 3. Female fox with attendant cub attending an active Malleefowl nest.

The continuum of fox visitation frequency between the treatments of this experimental investigation would suggest that foxes are targeting sites that are regularly visited by Malleefowl in a non-random pattern. Photography revealed that individual foxes repeatedly visited the same nests in successive nights and removed eggs. Malleefowl would return to these nests in the morning, cover the egg chamber and continue nesting activity. In many instances evidence of the fox visit was obliterated by the activity of the Malleefowl pair. The authors have been concerned that human activity checking nests may increase the success of foxes also finding nests but the lack of fox visits to disturbed treatment sites would suggest that foxes have not associated human scent with Malleefowl activity. Some suggestions have also been made in the past that it would not be appropriate to place fox baits at Malleefowl nests because this activity and the odour of the bait may increase fox activity around nests. Our data clearly shows that foxes are regularly visiting nests at very high rates without attractants other than the Malleefowl themselves. Foxes with Malleefowl nests in their territories have habituated their foraging behaviours to incorporate nightly nest checks during the breeding season. This learned behaviour is then passed to following generations with female foxes teaching their young where these nests are located and how to collect eggs (Figures 3 and 4). Baiting foxes at nest sites within these large rangeland locations may be the only option in successfully controlling the loss of Malleefowl eggs through fox predation.

Figure 4. Sub-adult foxes continuing their learned behaviour of visiting Malleefowl nests.

Acknowledgements

The authors would like to thank the community of Mount Hope for their exceptional support, allowing us on their properties and coming to our rescue whenever required. Throughout the project many staff members of the former Lachlan Catchment Management Authority assisted in field work, but in particular we would like to acknowledge Lyndal Hasselman, Angus Arnott, Angela Higgins, and Jasmine Wells. Additional highly valued field staff included Ted and Kerry Davenport, Elizabeth Langdon, Kevin Solomon and Andrea Lewis. The work reported in this paper was financially supported by the Australian Federal Government through Caring for Our Country and additional funding was supplied by the Lachlan Catchment Management Authority.

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