IS THE BEHAVIOUR OF MALLEEFOWL *Leipoa ocellata* SIGNIFICANTLY AFFECTED BY THE ATTACHMENT OF RADIO TELEMETRY EQUIPMENT?

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The decline of Malleefowl *Leipoa ocellata* populations across Australia has necessitated field research dependent upon bird identification and location using radiotelemetry equipment. To investigate the effect of radio transmitter attachment this study analysed foraging, moving, preening and resting behaviour of captive Malleefowl with and without radio transmitters attached. Six juvenile Malleefowl were randomly allocated to the transmitter group and six allocated to the control group. Control birds were captured, anaesthetised, weighed, leg-banded and blood sampled in an identical manner to the transmitter group, but did not have telemetry equipment attached. The results showed that there were no statistically significant differences between the transmitter and control groups in the percentage of time spent engaged in each behaviour.

INTRODUCTION

The Malleefowl *Leipoa ocellata* was once widely distributed throughout much of the southern half of mainland Australia, but is presently classified as nationally vulnerable (Benshemesh 2000). Significant population declines have been caused by the clearing and grazing of mallee habitat, altered fire regimes and the introduction of exotic predators (foxes and feral cats) and competitors (goats and rabbits) (Benshemesh 2000). Given the seriousness of the Malleefowl's decline, a captive-breeding program has been established at Western Plains Zoo (WPZ) in New South Wales to supply chicks for release into the wild. While the breeding program has been successful in producing young Malleefowl, early studies of post-release survival indicated that most birds died within the first few weeks (Priddel and Wheeler 1994, 1996, 1997). The cause of death was often predation by foxes. In a bid to increase the survival of newly released Malleefowl NSW National Parks and Wildlife Service (NPWS) has undertaken wide-scale fox baiting to reduce fox numbers within Nombinnie Nature Reserve.

In order to quantify the survival of captive-bred Malleefowl after release a radio tracking study in Nombinnie Nature Reserve was established. However, the welfare of Malleefowl included in such a study was of paramount importance and the attachment of telemetry equipment has the potential to significantly stress birds (Marcström *et al.* 1989; Guthery and Lusk 2004). Current literature suggests radio transmitter attachment can potentially alter animal behaviour and survival (e.g. Guthery and Lusk 2004; Mattsson *et al.* 2006). Therefore, it was necessary to establish the safety of the radio telemetry attachment procedure to ensure that birds would not be adversely affected. A pilot study was conducted to investigate the effectiveness of the attachment technique and the impact of the procedure on captive Malleefowl behaviour.

METHODS

Dummy radio transmitters were used to avoid the loss of expensive radio telemetry gear. These dummy radio transmitters were constructed by Sirtrack Ltd as exact replicas but did not contain the functional elements. The weight of the telemetry package was 12 grams and the length of the antennae was 220 millimetres.

Selection of Study Animals

The twelve Malleefowl (average age approximately 32 weeks) included in the radio transmitter attachment pilot study were chosen by WPZ keepers to be healthy representatives of the cohort to eventually be released into Nombinnie Nature Reserve. Six of the selected Malleefowl were randomly allocated to the transmitter group (dummy radio transmitter attached) and six allocated to the control group (no transmitter attached). The six control birds were captured, anaesthetised, weighed, leg-banded and blood sampled in an identical manner to the transmitter group, but did not have dummy radio transmitters attached.

Radio Transmitter Attachment Procedure

The dummy radio transmitters were prepared for attachment prior to Malleefowl capture by gluing each one on to an oval-shaped piece of cotton gauze (approximately 2 cm x 3 cm) with Araldite® glue. The gauze extended past the transmitter by about five millimetres on all sides and was included to enhance the adhesion of the transmitter to the bird. The whip antenna for each dummy radio transmitter emerged from the back of the transmitter at its centre. The tips of the antennae were painted red with nail polish to assist in observations within the aviary after attachment.

After anaesthesia, feathers from each bird were trimmed over a 5 cm x 5 cm area in the interscapular region (Fig. 1).

Figure 1. *Radiotelemetry package attached to Malleefowl.* Photo: C. Coombes

The bare skin and any feather remnants were covered with a layer of non-irritant adhesive eyelash glue (Manicare®, Impco International, Mordialloc, Australia). A 5 cm x 5 cm patch of chiffon material was then placed onto the eyelash glue, and additional eyelash glue was smeared on top of the chiffon. The eyelash glue, combined with the chiffon, provided a protective and flexible layer to be used for the attachment of the radio telemetry package.

Araldite® glue was used to attach the pre-prepared dummy transmitter/gauze package to the chiffon layer. A heat lamp was used to reduce glue-drying time in order to minimise the period that each bird spent under anaesthetic. Feathers surrounding the attachment site were stroked aside to minimise contact with the glue. Veterinary staff also collected blood samples and applied leg bands to each bird. The entire procedure, including anaesthetising, weighing, blood collection, feather removal and gluing of dummy radio transmitters took 25–35 minutes per bird.

Once the bird had recovered sufficiently from the anaesthetic each individual was returned to the transport box and placed in a dark, quiet location until all attachments were complete. When all birds had been processed, they were returned to the aviary complex. As the Malleefowl aviaries at WPZ can only accommodate six birds each, it was necessary to split the study animals into two groups. The six control birds were randomly split into two groups of three, as were the transmitter birds, so that there were three transmitter and three control birds in each of two adjacent aviaries.

Observation of Malleefowl Behaviour

Differences in the behaviour of transmitter and control birds were investigated using daily observations of four major activities, after Göth and Jones (2001). The major activity types recorded were:

- Foraging – pecking at grains/pellets/mealworms provided or scratching through leaf litter
- Moving – walking, running, flying
- Preening – grooming feathers, pecking at telemetry package
- Resting – no movement

Collection of behavioural data commenced approximately 24 hours after the radio transmitter attachment to allow birds sufficient time to recover from the capture and anaesthetic procedures, as recommended by Göth and Jones (2001). One fifteen-minute observation period was recorded daily for each individual between 8 am and 4 pm.

Due to the construction, size and furnishing of the aviaries, and cryptic habits of the Malleefowl, it was necessary to sit inside the aviaries to take observations. This was done from the same location each day to facilitate the observation of as many birds as possible regardless of where they were situated in the aviary. Upon entering the aviary the Malleefowl generally became mildly agitated and so they were given time to settle before observations commenced. Observations did not commence until the birds being studied had ceased fence running and were not noticeably disturbed by the observer's presence. Behaviour types were recorded from time zero to fifteen minutes using a stopwatch. The blocks of behaviour time were then converted into number of seconds of exhibited behaviour. For each individual bird the data for each day were pooled to produce a percentage of total time spent in each behaviour type.

Observations of Malleefowl behaviour were undertaken in random order each day until the dummy radio transmitters detached. This was anticipated to occur within 14 days due to glue deterioration and gradual feather moulting. The longest retention time recorded for similar attachment methods by Rohweder (1999) was 49 days, by Göth and Jones (2001) was 34 days, and by Raim (1978) was 24 days. This type of unaided transmitter detachment was chosen as it avoids the stress associated with birds having to be recaptured to remove telemetry equipment. Examination of the instrument package after detachment was undertaken to investigate any evidence of broken skin, blood or damaged feathers.

Data Analysis

The data collected from Malleefowl behaviour observations were not expected to have a normal distribution (e.g. Göth and Jones 2001). Therefore the non-parametric Mann-Whitney Ranked U test was used to identify any difference between transmitter and control birds for each behaviour (foraging, moving, resting and preening) (Freund and Simon 1992).

RESULTS

Retention time for the radio telemetry equipment during this study was low. Of the six Malleefowl included in the transmitter group, three lost their dummy transmitters within 48 hours of the attachment procedure. One of the dummy transmitters remained attached for approximately three days. The remaining two radio transmitters remained attached for eleven and thirteen days, giving a mean retention time of 5.5 days.

Data collected on the percent time spent by each bird foraging, moving, resting and preening were highly variable. All birds spent the majority of their time either foraging (control mean = 27%; transmitter mean = 37%), moving (29%; 32%) or resting (40%; 25%), with relatively little time spent preening (4%; 6%) (Fig. 2). Substantial overlap between control and transmitter birds was evident across all four recorded behaviours (Fig. 2).

Time spent foraging by transmitter birds was not significantly different (Mann-Whitney U = 12, P > 0.05) from control birds, but the range of values for transmitter birds was large (26% to 57%). Similarly, there were no significant differences between control and transmitter birds in the percent time spent preening (Mann-Whitney U = 10, P > 0.05) moving (Mann-Whitney U = 9, P > 0.05) or resting (Mann-Whitney U = 2, P > 0.05).

DISCUSSION

The method of attachment of radio transmitters to Malleefowl used in this study follows the procedures outlined initially by Raim (1978), further trialled by Rappole and Tipton (1990), and by Rohweder (1999). The technique has most recently been refined and successfully used for megapodes by Göth and Jones (2001) on the Australian Brush-turkey, *Alectura lathami*. These researchers fitted 2-day-old Australian Brush-turkeys with radio transmitters by gluing with a combination of eyelash glue and superglue. Although information from Göth and Jones (2001) offers valuable insights into the likely success and low impacts of transmitter attachment to Malleefowl using glue, that study was conducted on a different bird species and on very young individuals. Additionally, accurate estimates of retention time of transmitters were difficult to ascertain because the majority of brush-turkeys studied after release into the wild died due to predation.

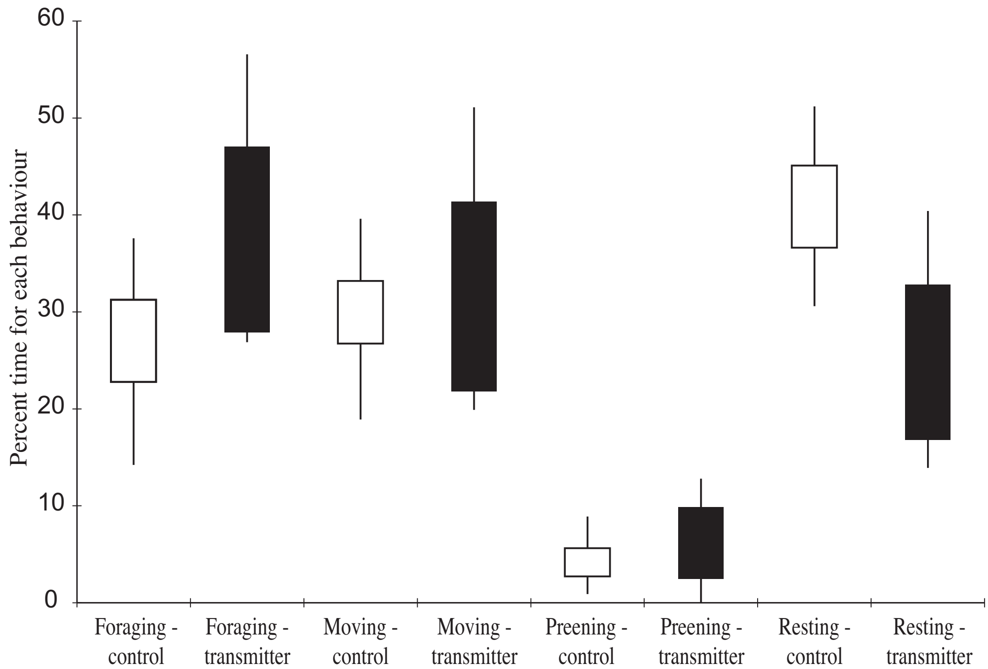

Figure 2. *Hi-Low plot of percent time spent undertaking each behaviour by control (open boxes) and transmitter birds (closed boxes) based on 15 minute observation periods (Control n = 33; Transmitter n = 20). Boxes represent mean (±1 SE), error bars show highest and lowest values. No significant differences between groups (Mann-Whitney U-test; P > 0.05).*

Previous studies by Priddel and Wheeler (1994, 1996, 1997) have investigated the survival of captive-bred Malleefowl after release into the mallee regions of western New South Wales using radio tracking techniques. Priddel and Wheeler mounted radio transmitters on juvenile and sub-adult Malleefowl using a cotton (1994) or synthetic harness (1996, 1997) with straps passing under each wing. Current NSW Agriculture animal ethics guidelines caution against the use of harnesses where other modes of attachment are available. Particularly in the case of the juvenile Malleefowl being studied for this project, potential risks exist for these ground-dwelling birds to become entangled in undergrowth while foraging or to outgrow attachment apparatus (White and Garrott 1990). In this study, none of the radio transmitter detachments caused any apparent injury to the Malleefowl. The detached telemetry packages were examined for traces of blood and skin but no such traces were evident. Only feathers adhered to the chiffon.

The data collected from this study suggest that use of the glue-on technique for the attachment of radiotelemetry equipment to captive-bred Malleefowl juveniles has no statistically significant effects on foraging, moving, resting and preening behaviour in the aviary. However, it should be noted that these results should be interpreted cautiously due to the low replication achieved during the study. For this analysis all observation days have been pooled together and averaged and no unhandled control birds were examined. Additionally, the retention times recorded during this captive study were lower than that required for satisfactory data collection in the field.

To improve retention times subsequent attachment procedures were modified to include a more durable attachment mounting by replacing Araldite® glue with SupaGlue® gel (Ann Göth, pers. comm.). Subsequent field studies of post-release survival of captive-bred Malleefowl into Nombinnie Nature Reserve recorded transmitter retention times up to a maximum of 137 days, with a mean of 42 days (Coombes 2006).

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