Short Communications

Activity Budget of Non-breeding Helmeted Honeyeaters

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The Helmeted Honeyeater *Lichenostomus melanops cassidix* is a rare meliphagid found at only one location, the Yellingbo State Nature Reserve and immediate environs in southern Victoria (Blackney & Menkhorst 1993). In 1987 it was estimated that the entire population numbered less than 50 individuals, prompting the initiation of an intensive recovery program in July 1989 (Menkhorst & Middleton 1991). By March 1993 the population had recovered to around 84 individuals. As part of the recovery program, some birds were radio-tracked over the autumn and winter months of 1992 to investigate dispersal patterns (Runciman et al. 1995). As an adjunct to that study, individually recognisable birds were observed to determine activity budgets and to quantify the effects of time of day, sex and transmitter load on individuals that did not disperse.

Methods

Yellingbo State Nature Reserve covers 526 ha of mostly riparian habitat adjoining the township of Yellingbo, Victoria (37°49′S, 145°31′E) and is described in detail in McMahon & Franklin (1993).

Helmeted Honeyeaters are territorial, with groups of territories forming clearly distinguishable breeding sites at several locations within the reserve. Over the non-breeding season most territories remain intact. During this study Helmeted Honeyeaters were present at five sites but the majority of birds were resident at only two of these, 'green' and 'mauve' sites, where observations were made.

All birds observed were readily identifiable in the field from a unique combination of three coloured leg-bands plus a numbered aluminium leg-band; in addition, most carried radio transmitters. Due to the nature of the radiotelemetry study only birds less than one year old (first years) and unpaired adults (floaters) were observed; sex was determined by morphology and behaviour.

Three birds not carrying transmitters were observed. Transmitter-free birds were either floaters or first years and were chosen according to the ease with which observations could be made in their territories. Ten birds always carried a transmitter while being observed, two birds were observed with and without transmitters and one bird never carried a transmitter. Observations on transmitter-free birds were only included in the comparison of birds with and without transmitters.

Subjects were observed at various times between 0800 and 1800 h. To reduce the probability that activity budget results were biased by handling and transmitter attachment, observations were made only after transmitters had been attached for at least five days.

Individuals were located by radiotelemetry or by sight and once located, focal-animal sampling (Altmann 1974) was used to sample their activities. While the focal bird was visible, descriptions of behaviour were recorded continuously using a portable cassette recorder. Activities were categorised as: (a) Feeding (gleaning, bark-probing, feeding from blossom, feeding on manna and hawking); (b) Moving (movement not involving prolonged flight, such as moving from branch to branch of a single tree); (c) Resting (sitting immobile, including sitting alert) (d) Flying; and (e) Preening (body maintenance and bill-wiping). Social activity, including aggressive interactions with other species, was also recorded but since its incidence was too low for a statistical comparison to be made it was combined with the flying activity category (all social activity observed involved flying).

When analysing the effects of carrying a radio-transmitter, each activity category was classified as either 'high' or 'low' energy according to its presumed energetic cost. Activities characterised by body movement (flying and moving) were regarded as 'high energy' and those characterised by immobility (feeding, resting and preening) were regarded as 'low energy' (Hooge 1991). For this comparison, hawking behaviour was included in the flying category rather than the feeding category.

Descriptions of behaviour were later transcribed using a variation of the instantaneous sampling technique (Altmann 1974); cassette recordings of behaviour descriptions were played back and every ten seconds

Table 1 Comparison of number of observations (Obs), samples, individuals sampled (*n*), and mean percentages of time (± *s.e.*) spent in five activities by Helmeted Honeyeaters. Means followed by an asterisk are significantly greater ($P <$ 0.05) than those with which they are being compared; all other differences are non-significant.

				Percentage of time spent in activity (Mean ± *s.e.*)				
Comparison	Obs	Samples	*n*	Feeding	Resting	Preening	Moving	Flying
(a) Temporal								
Morning	1206	11	8	21.0 ± 3.7	32.9 ± 4.3	12.2 ± 4.3	23.5 ± 2.0	10.4 ± 1.0
Afternoon	1412	15	8	22.6 ± 4.4	30.8 ± 4.8	5.9 ± 1.8	30.3 ± 2.0	10.4 ± 3.7
(b) Sex								
Male	1641	15	5	13.6 ± 3.5	39.1 ± 4.2	12.2 ± 3.2	26.8 ± 3.1	8.3 ± 1.8
Female	1360	16	6	23.3 ± 3.2	27.7 ± 3.8	8.3 ± 3.0	32.0 ± 2.8	8.7 ± 1.6
(c) Transmitter[1]								
Transmitter	2425	26	9	19.3 ± 2.8	29.1 ± 2.2	9.7 ± 2.7	30.6 ± 2.3*	11.3 ± 0.9
No transmitter	482	6	3	13.6 ± 4.8	39.4 ± 3.9	8.5 ± 4.6	18.8 ± 4.0	19.7 ± 1.6*

[1] Hawking is included in the flying category for this comparison. For all other comparisons hawking is included in the feeding category.

the activity of an individual at that instant (termed an observation) was recorded. The proportion of time spent in each activity was calculated by dividing the number of observations for each category by the total number of observations. Statistical tests were computed using JMP version 2.04 (SAS Institute Inc. 1991).

Results

Twelve birds (31% of the unpaired population) were observed between April and August 1992. A total of 37 samples comprising 3483 observations were taken; each bird was sampled one to six times ($\bar{X}$ = 3.1, *s.d.* ± 1.25) and samples lasted from 2 min 50 s to 25 min 40 s ($\bar{X}$ = 14 min ± 6 min 15 s). Only those of 2 min 50 s duration or greater were included in the analysis because on average, all activities had occurred by this time.

Diurnal effect

Eight individuals were observed during morning (before 1300) and afternoon (after 1300). A comparison between morning and afternoon activity budgets, using matched pairs analysis (Wilcoxon signed ranks test) showed no significant differences for any of the five activities (Table 1) and samples were pooled for further analysis.

Effect of sex

Five males and six females were observed; no significant differences were found between the sexes for any of the five activities (Wilcoxon-Mann-Whitney test; Table 1).

Effects of radio-transmitters

Eleven radio-tagged individuals were observed, two of which were subsequently observed without transmitters. One individual observed never carried a transmitter. The two individuals observed both with and without transmitters were only included in the transmitter-free category for this analysis. This was considered to be acceptable because observations were made on these birds at least 51 days after the loss of their transmitters. It is highly unlikely that any potential transmitter effect was still operating at that time.

Significant differences between radio-tagged and transmitter-free birds were found for the two high energy activities, moving and flying (Table 1). Birds without transmitters spent 8.4% more time flying than those carrying transmitters (Wilcoxon-Mann-Whitney test: $S = 32$, $P = 0.027$). Conversely, radio-tagged birds spent 11.8% more time moving than transmitter-free birds (Wilcoxon-Mann-Whitney test: $S = 8$, $P = 0.042$). There were no significant differences between radio-tagged and transmitter-free birds for low energy activities.

Discussion

Helmeted Honeyeaters showed no significant diurnal variation in activity pattern during the non-breeding season. In contrast, Collins & Briffa (1983) found that Brown Honeyeaters *Lichmera indistincta* spent more time flying in the morning than the afternoon at all times of the year. This behaviour appeared to be associated with nectar availability, standing crop volumes being significantly higher in the morning than the afternoon. The lack of diurnal variation in activity for Helmeted Honeyeaters during this study suggests that the availability of food resources throughout the day may not have varied significantly.

No significant difference in activity budget between the sexes was detected. Helmeted Honeyeaters are not obviously sexually dimorphic. Males are larger and around 10% heavier than females (Helmeted Honeyeater Recovery Team unpubl. data) and appear to be more aggressive towards female than towards male conspecifics (DR pers. obs.), but these differences would be unlikely to cause a significant difference in activity between the sexes.

Radiotelemetry studies can provide an insight into movements of birds that would not be possible by any other means but radio-transmitters may have adverse effects on behaviour and body condition (Boag 1972; Gessaman & Nagy 1988; Massey et al. 1988). Klaassen (1992) showed that daily energy expenditure of nesting Common Terns *Sterna hirundo* was unaffected by a transmitter load of 6.2% of mean body weight. In contrast, Hooge (1991) demonstrated that Acorn Woodpeckers *Melanerpes formicivorus* carrying transmitters weighing 5.1-5.9% of body weight spent less time engaged in high energy activities (flying and moving) than controls, whereas birds carrying transmitters weighing 3.5-3.9% of body weight did not differ from controls.

Helmeted Honeyeaters during this study carried transmitters weighing only 4.5-8% of body weight at time of attachment, yet they appeared to spend less time flying and more time moving than transmitter-free birds. They may have modified their foraging strategies in order to conserve energy; time that would normally have been spent flying was partitioned towards an increase in moving.

There may be a nutritional cost associated with carrying a transmitter because the likelihood of obtaining flying insects through hawking is reduced. However, moving is a less energetic activity than flying but one that still provides an opportunity for foraging, particularly for high-energy food resources such as manna. Manna, a sugary plant exudate, appears to be an important component of the diet of many species of honeyeater (Paton 1980) and has been implicated as being particularly important for the Helmeted Honeyeater (McMahon & Franklin 1993; Pearce et al. 1994). Feeding on manna accounted for the majority of feeding observations during this study (35.2 ± 5.7% compared to 32.0 ± 5.2%, 20.3 ± 6.6%, 12.2 ± 2.7% and 0.3 ± 0.3% for gleaning, bark-probing, hawking and feeding from blossom respectively; 644 observations, n = 12). This further highlights the significance of manna as a carbohydrate source for Helmeted Honeyeaters. The nutritional cost of carrying a transmitter may be higher during the breeding season when flying insects provide an important source of protein.

Although Helmeted Honeyeaters appeared to modify their behaviour whilst carrying transmitters, there was no significant difference between the weight of radio-tagged birds at transmitter attachment and at their subsequent recapture (Wilcoxon signed ranks test: T = 5, P = 0.523, n = 8). Also, radio-tagged birds were just as likely to move long distances from their territories as were transmitter-free birds (Runciman et al. 1995). In view of this, and considering that the sample size of transmitter-free birds was low, the evidence that transmitter load had an adverse effect on Helmeted Honeyeaters should be treated with caution. However, because the Helmeted Honeyeater is highly endangered, it is recommended that the future use of radio-tracking be limited until such time as radio-transmitters weighing less and lasting longer than those used during this study are available.

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Differences in Social Behaviour Between Populations of the Australian Magpie *Gymnorhina tibicen*

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The phenomenon of cooperative breeding, or in particular helping behaviour, has been recorded in a number of species of Australian birds (Rowley 1975). 'Helping' is the feeding of nestlings and/or fledglings by individuals other than the genetic parents (Jamieson 1989). In most published cases, helping behaviour is characteristic of a species, although helping may not occur in all groups in all years (e.g. Russell & Rowley 1988).

The Australian Magpie *Gymnorhina tibicen*, although listed amongst communal breeders by Rowley (1975) and Gaston (1978), was not seen to exhibit helping behaviour, even when a study was specifically designed to search for evidence of it in a New Zealand population (Veltman 1989a). Later observations by Brown & Farabaugh (1991) on the same population observed feeding of nestlings by second year birds but only rarely. Helping has not been reported in any mainland Australian populations of the species, although Thomas (1974) reported auxilliaries at nests of Tasmanian magpies. However, cooperative defence is a characteristic of the species and is seen in all populations in mainland Australia, Tasmania (Hughes & Mather 1991; Farabaugh et al. 1992) and New Zealand (Veltman 1989a).

The Australian Magpie has a distribution covering most of Australia, with a number of distinct colour forms (Slater et al. 1990). In northern Australia, birds are black-backed (sub-species *Gymnorhina tibicen tibicen*), in the south-east birds are white-backed (*G. tibicen hypoleuca*) and in south-western Australia males are white-backed and females are black-backed (*G. tibicen dorsalis*). In all areas, they defend year-round territories (Farabaugh et al. 1992). There is significant variation in sizes of territorial groups among populations