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NOTES ON THE BREEDING BIOLOGY OF THE REGENT HONEYEATER

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Two Regent Honeyeater *Xanthomyza phrygia* nests were watched for six days before both nests disappeared. Observations on nest building, copulation, incubation, feeding, vocalization and aggressive interactions with other avian species are presented. There was frequent aggression between the Regent Honeyeaters and other species of honeyeaters. It is possible that habitat fragmentation coupled with frequent and intense interspecific aggression during breeding are contributing factors in the decline of Regent Honeyeater populations.

INTRODUCTION

The Regent Honeyeater *Xanthomyza phrygia* has declined in abundance in the last 30 years (Peters 1979; Blakers *et al.* 1984; Franklin and Menkhorst 1988) and is considered endangered (Brouwer and Garnett 1990) with an estimated population of only 500 to 1500 individuals (Webster and Menkhorst 1991). The reasons for the decline of the Regent Honeyeater are mostly associated with the clearing and fragmentation of its habitat for agriculture (Franklin *et al.* 1989), but why this species should be especially affected is not understood.

Keast (1968) considered the Regent Honeyeater to be nomadic, moving among patches of flowering eucalypts over a wide geographic range. More recent information suggests that Regent Honeyeaters move seasonally with patterns of abundance and nesting correlated with regional and annual differences in the blossoming of eucalypts (Waterhouse 1938; Franklin *et al.* 1989; Ley 1990). However, details of the breeding behaviour of Regent Honeyeaters are poorly known and largely qualitative (Collison 1959; Franklin *et al.* 1989; Ley 1990), but will become increasingly difficult to obtain as the species continues to decline in abundance. Yet such information is fundamental to an understanding of the response of this bird to the effects of habitat fragmentation and for the development of a recovery plan. In this paper we describe the behaviour of two nesting pairs of Regent Honeyeaters including their interactions with other species of honeyeaters.

METHODS

On 25 October 1990, two active Regent Honeyeater nests were located in a mixed stand of eucalypts dominated by Red Ironbark *Eucalyptus*

sideroxylon and White Box *E. albens* along Bundarra Road west of Armidale, New South Wales. Regent Honeyeaters have nested in this area since at least 1984 (Ley 1990; Ley, pers. comm.). Nest 1 was under construction on the end of an exposed dead stub of mistletoe in a White Box, 8 m above the ground. Nest 2 was in a clump of live mistletoe 7 m above the ground in a White Box. Nest 1 was 40 m, and Nest 2 was 52 m from a large, flowering ironbark where both pairs foraged for nectar. The nests were 20 m apart. Nest 2 was complete and the female was incubating. Sexes were distinguished by behaviour on the assumption that, as with other honeyeaters, females constructed the nest and incubated the eggs (Ley 1990; H. A. Ford, pers. comm; Recher, pers. obs.).

Between October 25 and 29, 577 minutes of observation were made at Nest 1 and 338 minutes at Nest 2. No observations were made on the 26th. The following information was recorded for each pair: nesting behaviour, foraging behaviour, and interactions with other birds.

Each interaction was recorded separately, regardless of whether it was a single event (e.g. a simple displacement) or part of series (e.g. a sequence of displacements and chases). On October 29, at 30-minute intervals, we counted the birds using the large ironbark where the Regent Honeyeaters foraged for nectar.

RESULTS

Nest building

Only Nest 1 was observed during nest building. Nest construction occurred in bouts of activity of 1 to 15 minutes duration during which the female gathered nest material and added it to the nest. During 210 minutes of continuous observation from 0630 to 1000 h on October 25, 44 building bouts were recorded. Building was frequently interrupted by aggressive interactions with Noisy Friarbirds *Philemon corniculatus* and the honeyeaters from Nest 2. By October 27 the nest was nearly complete and only eight bouts of nest building were recorded in 158 minutes of observation.

The nest was constructed of strips of eucalypt bark woven together with spider web and lined with fine grass. The male perched nearby as the female gathered nest material. Most often the male returned first and perched at the nest, peering into and sometimes probing and picking at the nest before leaving. He did not bring or add material. The female then went to the nest and added the nesting material she was carrying. She then settled on the nest and formed it with her body, flipping her tail up and down as she rotated through approximately 180°. Nest material was worked into the nest with her bill as the nest was shaped.

Copulation

Copulation was not observed for the pair from Nest 2 where the female was already incubating eggs. Initially, the male from Nest 1 remained close to the female, but copulation was not observed until October 27 when five copulations were recorded. A single copulation was observed on the 28th, but none were recorded on the 29th when the female began to incubate. By this time the male had become less attentive to the female and occasionally foraged alone.

Copulation occurred in the nest tree, once adjacent to the nest and once on the nest. Twice copulations were interrupted by friarbirds. The majority of copulations followed aggressive interactions with other honeyeaters and were preceded by wing fluttering. On four occasions the female preened after copulating.

Incubation

During 178 minutes of continuous observation beginning at 0918 on October 28, the female at Nest 2 incubated for periods ranging from 8 to 38 minutes ($\bar{x}$ = 16 min., n = 8). Periods off the nest ranged from 2 to 9 minutes ($\bar{x}$ = 6 min., n = 9). The male did not incubate, but initiated nest relief by perching near the nest and fluttering his wings. After the female left, usually to forage, the male hopped to the nest, peered in and probed with his bill, probably turning the eggs. On occasion, incubation or the nest relief ceremony was interrupted by aggressive interactions with other honeyeaters.

The female on Nest 1 commenced incubation on October 29, sitting on the nest for periods of up to three minutes.

Between our departure on the afternoon of October 29 and our return in the morning of the 30th, both nests had disappeared and only one Regent Honeyeater could be found in the vicinity.

Foraging behaviour

The honeyeaters from both nests fed on insects and nectar. Insects were taken mainly by hawking (38 observations), snatching (7), gleaning (4) and hovering (3). Prey were taken from the air (38 observations), foliage (12) and bark (2). The pair from Nest 1 foraged together, while those from Nest 2 foraged separately. Both pairs foraged predominantly in the large ironbark near their nests and were not seen to take nectar from other trees.

Aggressive interactions

At both nests, both male and female defended the nest and nest tree against other birds (Table 1).

The birds from Nest 1 were frequently involved in aggressive interactions with the other pair of Regent Honeyeaters (Table 1), which were not tolerated in or near the nest tree. Other interactions with honeyeaters in or near the nest tree involved Noisy Friarbirds, Red Wattlebirds *Anthochaera carunculata,* and Noisy Miners *Manorina melanocephala* (Table 1). Friarbirds and wattlebirds attempted to remove material from the nest while it was unattended. Rufous Whistlers *Pachycephala rufiventris,* Weebills *Smicrornis brevirostris,* and Fuscous Honeyeaters *Meliphaga fuscus* were also chased from the nest tree. Interactions were often protracted and intense. In one instance the pair attacked two friarbirds 24 times in a two-minute period. On 12 occasions friarbirds were struck by the Regent Honeyeaters. Wattlebirds were struck three times. Aggressive interactions were most frequent on October 25. By the 27th friarbirds were occasionally tolerated in the nest tree so long as they were on the side farthest from the nest.

The pair from Nest 2 appeared to be more tolerant of birds in the nest tree than those from Nest 1, but they were also frequently involved in aggression with other honeyeaters (Table 1). Interactions occurred with Noisy Miners, Noisy Friarbirds and Red Wattlebirds. Encounters were often prolonged. In one instance involving three friarbirds there was a sequence of 36 attacks including nine chases. In a second instance involving four Noisy Miners the nesting birds made 117 attacks including chases in five minutes. One miner was chased over 100 m.

Aggressive interactions were less frequent when the birds were foraging. More than 30 individuals of 13 species of birds foraged in the ironbark frequented by the Regent Honeyeaters with as many as 18 individuals present at one time. Ten of the species were nectar-feeders: two species of lorikeet and eight species of honeyeaters. We recorded 11 instances of aggression involving Regent Honeyeaters in this tree. Nine of these involved the birds from the other nest. Twice friarbirds were attacked. There were nine instances of intraspecific aggression among miners and three among friarbirds. Friarbirds twice attacked Fuscous Honeyeaters and once a Noisy Miner.

DISCUSSION

The nest building, incubation and foraging behaviour of the Regent Honeyeaters observed is similar to that of other species. Franklin *et al.* (1989) reported more gleaning (50%) and less hawking (23%) for insects than we recorded, but such differences often occur between birds feeding at different localities and in different seasons (Recher, unpubl. data). What separates the

TABLE 1

Defence of nest trees by Regent Honeyeaters against other birds.

Species attacked	Number of attacks by Regent Honeyeaters at Nest 1	at Nest 2
Regent Honeyeater	31	0
Noisy Friarbird	416	192
Red Wattlebird	50	2
Noisy Miner	20	257
Other Species	10	3
Total attacks	527	454
Mins of observation	577	388
Attacks per min.	0.9	1.2

behaviour of these Regent Honeyeaters from that of any other bird with which we are familiar is the frequency and intensity of aggressive interactions with other birds, and in particular with other honeyeaters.

The aggressiveness of Regent Honeyeaters in defence of nests and nectar sources has been reported previously (Mathews 1924; Franklin and Robinson 1989; Franklin *et al.* 1989). The frequency and intensity of aggression we recorded may be exceptional. The proximity of the nests to a flowering ironbark that attracted many other nectar-feeders may have created a situation in which frequent aggression was inevitable. Regardless of the precise causes, the events we observed may illustrate one of the consequences of habitat fragmentation in which the nesting and foraging opportunities for nectarivorous birds are increasingly being restricted. That is, as a result of habitat fragmentation, there is an increase in interspecific interactions and competition for resources. For a species like the Regent Honeyeater that may be particularly aggressive the heightened level of interspecific interactions may be a significant factor in nest failure and the decline in the population.

We do not know why the nests failed. They may have been predated with the predator removing the nests. Possibly the nests were abandoned and the nest material pirated by other birds. The nests may have been abandoned because of the frequent aggression with other birds in the nest trees. Alternatively the reliance of the Regent Honeyeaters on a single tree as a source of nectar that was also attractive to many other nectar-feeders may have led to a situation in which the nesting birds had inadequate food resources near the nest. That is, the other birds depleted the nectar resources to a level below that required by the Regent Honeyeaters causing them to abandon the nests. Evidence that there may be competition for resources is shown by the attempts by other honeyeaters to pirate nest material during nest building.

Frequent aggression, nest failure and competition for resources are predictable consequences of habitat fragmentation. Resolution of these problems and the development of a recovery plan for Regent Honeyeaters will require more than the protection and management of existing vegetation fragments. It may also be necessary to manage the populations of the more abundant honeyeaters so as to reduce the frequency and intensity of aggressive and competitive interactions with Regent Honeyeaters.

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