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Breeding of the Regent Honeyeater in northern New South Wales in 1997

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The Regent Honeyeater *Anthochaera phrygia* is a critically endangered species and information on its breeding behaviour and success is valuable in relation to efforts to conserve the species. Nesting attempts by Regent Honeyeaters were documented at a single, well-known Regent Honeyeater site in the Bundarra-Barraba district, New South Wales, during August to November 1997. Of the 29 attempts, 15 reached the incubation stage and one produced fledglings. The success rate was low compared with that in studies conducted contemporaneously and since 1997. Vocal mimicry was exhibited by two individuals and was considered unusual because it had previously only been observed outside the context of breeding, and because one of the mimics mixed its own vocalisations with those of the model, an observation that has not been repeated.

Keywords: Regent Honeyeater; endangered species; breeding event; nesting success; vocal mimicry.

INTRODUCTION

The Regent Honeyeater *Anthochaera phrygia* is a critically endangered species and any information (even historical) on its reproductive success is therefore valuable in the context of attempts to conserve this iconic, native species. It also exhibits vocal mimicry, although the possible adaptive significance of this phenomenon in the species is unclear and requires further investigation. This study documents a Regent Honeyeater breeding event in the Bundarra-Barraba district, New South Wales (NSW) in 1997. This breeding event was partly discussed in a previous paper (Ley and Williams 1998), but the information is presented here with additional up-to-date commentary and now includes previously unpublished details of the 29 breeding attempts outlined in 1997. Twenty-five years later, with the national Regent Honeyeater population possibly as small as 350 individuals, a breeding event such as the one described here may not be witnessed again, and whether the Bundarra-Barraba district still deserves the description of a 'core breeding area' for the species (Crates *et al.* 2021) is arguable.

In his Regent Honeyeater study in the Bundarra-Barraba district, Oliver (1998) recorded that 21 of 41 breeding attempts (51%) that reached the incubation stage produced fledglings, whilst the equivalent figure from Geering and French (1998) working in the Capertee Valley, NSW was 66 of 116 nests (57%); these results may have led to the suggestion that the overall success rate for the 1990-2000 decade was one in two attempts (BirdLife 2021). The present observations document a breeding success rate radically different from that, and suggest that, those results notwithstanding, the species may have already had a low overall breeding success rate at the time of my investigation. The present results are more consistent with most records for various passerines in Australia, where 10-30% nesting success is common (Hugh Ford pers. comm.).

Veerman (1992, 1994) comprehensively discussed the subject of vocal mimicry by Regent Honeyeaters and suggested that in some cases it amounted to Batesian mimicry i.e. the mimic reduces aggression by using the vocalisations of another species, which promotes social cohesion with that model species. Given our observations on vocal mimicry by Regent Honeyeaters (Ley and Williams 1998), we questioned that interpretation. The use of mimicry by the species has been the subject of renewed interest after an apparent reported increase in the number of Regent Honeyeaters using other species' calls in a seriously declining population (Crates 2019; Crates *et al*. 2021). Accordingly, we re-visit the phenomenon of vocal mimicry in the Bundarra-Barraba population in the present study.

METHODS

The location of the investigation was near the Coonoor Road turnoff on the Bundarra to Woodsreef Road, about 35 km southwest of Bundarra at 30°37' S, 150°47' E, a now well-known Regent Honeyeater site where the birds' main food tree is Mugga Ironbark *Eucalyptus sideroxylon*. Observers visited the site regularly during the 1990s as part of an ongoing Regent Honeyeater survey in the wider Bundarra-Barraba district. After the discovery of the population at the site on 17 July 1997 and the commencement of nesting, the site was visited 30 times from 28 August to 9 November 1997, an average of one visit every 2.2 days. Most visits were for a full day, although field days were necessarily truncated because the site is a 3-4 hr round trip on some indifferent roads from the observers' Armidale base. On each visit, the Regent Honeyeater population was monitored, the birds' activities and behaviour were noted and details of every nesting attempt, eventually numbering 29, were documented. Regent Honeyeaters were trapped in mist-nets and colour-banded opportunistically, 26 individuals being processed.

RESULTS

Survey timeline

17 July 1997. One Regent Honeyeater was recorded at the site (M.B. Williams). The comprehensiveness of the survey was not recorded.

21 August. A flowering event was underway in the Mugga Ironbarks at the site. The Regent Honeyeater population was estimated at 20+ individuals and the birds were widely, but not evenly, dispersed through the site. They were very active, including displaying and calling, submissive behaviour by females while males called, vigorous chases, and fights involving up to four birds; the Regent Honeyeaters were strongly attacked by Fuscous Honeyeaters *Ptilotula fusca*, at least two nests of which were at the building stage.

25 August. Regents Honeyeaters were still present at the site.

28 August – 9 November inclusive. There were 30 visits to the site to monitor the birds and document the progress of the 29 nesting attempts (see details in Table 1).

11 November. At least nine birds were present; no nesting activity was observed.

16 November. Again at least nine birds were present, but no nesting activity was observed. Two marked pairs from known nests were still together.

19 November. At least seven birds were present; no nesting activity was observed. There was a noticeable difference in the behaviour of the birds from that early in the study period, with now little calling, chasing or fighting.

23 November. At least nine birds were present, including two well-advanced fledglings speculated to be from Nest 18, although the Nest 18 young had not been seen since 15 October.

28 November. Five marked birds were present, together with about seven unmarked adult birds and 'several' juveniles.

6 December. The site was 'notably quiet' compared to previous visits and only two birds were seen.

15 December. Two birds were present.

19 and 20 December. At least seven birds were present.

1 January 1998. No Regent Honeyeaters were recorded and no flowering was evident in the Mugga Ironbarks.

Nesting effort

Nest-building activity was first detected on 28 August and initiation of nest-building attempts was documented up to, but not beyond, 24 October; nest-building initiations were spaced more-or-less evenly throughout that period. The progress of the nesting attempts is shown in Table 1, which includes extrapolated starting dates for nesting attempts found later in the cycle based on a nest-building time of one week and incubation and nestling periods of two weeks each (Ley and Williams 1998).

Of the 29 nests documented, 25 were first detected at the building stage, two during incubation and two when nestlings were present. Fourteen nesting attempts were not known to have gone beyond the building stage and 15 reached the incubation stage, of which only one was successful, with two young fledging. The failure of one breeding attempt was observed when a Pied Currawong *Strepera graculina* took the nestlings on 9 November (Ley and Williams 1998).

'Several' fledglings or birds-of-the-year were present late in the observation period. Two were thought to be the young from Nest 18, and there may have been in total no more than one or two others, probably emanating from only one attempt that was not discovered before fledging. Due to uncertainty surrounding these birds, this otherwise undocumented nesting attempt is not included in Table 1. Fledglings were last recorded at the site on 28 November.

Multiple nesting attempts by a pair

Nests 2, 10, 14 and 21 were constructed by the same pair, Nests 4 and 20 were built by another pair, and Nests 16 and 28 were built by a third pair; all six birds involved were colour-banded. In all these examples, work on the replacement nests began essentially immediately after the preceding one had failed.

Nesting success rate

Only one of the 15 nesting attempts that reached at least the incubation stage produced fledged young. With an estimated commencement date of about 5 September (Table 1), this sole successful nesting attempt was one of the early ones to be started.

Vocal Mimicry

Two Regent Honeyeaters mimicked the vocalisations of other bird species. The first produced calls of the Grey Butcherbird *Cracticus torquatus* at two separate times on the same day. The quality of the reproduction of the model call appeared high and the identity unmistakable. The second bird was the male of the pair responsible for nests 2, 10, 14, and 21, which repeatedly produced Noisy Friarbird *Philemon corniculatus* calls interspersed, and seemingly interchangeably with, normal Regent Honeyeater vocalisations. This mimicry occurred throughout the study period; the identity of the model was unmistakable. Both the mimics were active in the main area of breeding activity i.e. they were in no way outliers or isolated individuals. Both model species were present in the bird community at the study site.

DISCUSSION

Timing of nesting

The timelines and summary (Table 1) of the progress of nesting attempts suggest a time-constrained breeding 'season' at Coonoor Road in 1997, probably linked to the timing and extent of Mugga Ironbark flowering. The earliest nest-building activity recorded was in late August and the latest nest commencement recorded was less than two months later, on 24 October. Regent Honeyeater activity and presence was reduced after that date, and by the start of 1998 no Regent Honeyeaters were present and flowering of the Mugga Ironbarks had finished. The time window available for commencement of nesting and for the

Table 1

Progress of Regent Honeyeater nests documented at Coonoor Road in Spring 1997. B = nest building, I = incubation, N = nestlings present, A = fledglings present, F = nest failed, ? = nest checked and apparently active but stage unclear. Nests reaching the incubation stage shaded yellow; for nests discovered late in the cycle a rough extrapolation back to nest building shaded orange. Repeat nestings by pairs shaded green, blue and red, respectively.

	Aug		Sep													Oct														Nov		
Nest	28	31	3	5	8	10	12	14	18	21	23	26	28.9	30	2	9	11	13	15	16	19	20	22	24	26	28	30	1	4	9
1	B		F																											
2		?	?	B	?	I	F																							
3		?	?	B	F	?	F																							
4			B	B	B	B	?	I	I	I	I	I	I	I	N	F														
5					B	B	?	I	I	I	I	I	?	N	N	F														
6							B	?	F	F	F																			
7							B	B	F	F	F																			
8								B	I	I	I	F																		
9									I	F	F																			
10									B	F	F																			
11										B		I		F	F															
12										B	F	F																		
13											B	I	I	I	I	I	I	I	N	N	N	N	N	?	F					
14											B	B	B	I	I	F														
15													B	F	F															
16													B	I	F															
17														B	?	F														
18														N	N	A	A	A	A											
19														B	?	I	I	I	I	I	I	I	N	N	N	N	N	N	N	F
20															B	B	B	B	I	I	I	I	I	I	I	F				
21																B	B	B	I	I	I	I	I	I	I	I	N	N	F	
22																B	F													
23																	B	F												
24																				B	B	B	?	?	?	F?				
25																						B	F							
26																						B	?	F						
27																							B	F						
28																							I	I	I	I	N	N	F	
29																											N	N	F	

breeding event overall was apparently short, which, if typical, may be a factor in the seeming haste with which the birds proceeded with the nesting cycle. It has been noted previously that both members of a Regent Honeyeater breeding pair feed their nestlings at a rate amongst the highest recorded for any passerine (Ley and Williams 1998); they may be under time as well as predation pressure to complete the cycle. Perhaps the explanation for what appears to be a particularly short period available for nesting may lie in the birds' use of rich patches of suitable habitat where the availability of resources may be time-limited (Geering and French 1998). In the Bundarra-Barraba district the occurrence and nesting of Regent Honeyeaters has been linked to irregular flowering events of Mugga Ironbark (pers. obs.); nectar is a major component of the diet of nestlings and fledglings (Ley and Williams 1994; Oliver 1998) and its availability may influence the timing of breeding of the species.

What this conjecture does not seem to explain is why the dates of nesting attempt initiations were quite evenly spaced throughout the study period: a clustering of nest commencements at the start of the period might be expected if time is a critical factor, even allowing for the fact that at least five and probably more of the nest initiations were repeats by a pair following a failed attempt. It is not known how many individuals were present at the breeding site, how many breeding or potentially breeding pairs there were, nor to what extent there may have been a turnover of individuals at the site which would have allowed an estimation of how many of the documented nesting attempts were repeat breeding attempts. Oliver (1998) noted a similar nesting pattern in breeding aggregations of Regent Honeyeaters and the lack of synchronisation of attempts during a breeding event.

In 1997, as noted for other breeding events (pers. obs.) and as was also the experience of Oliver (1998), dependent young were recorded for which no nest of origin was discovered. Nevertheless, the finding of most nests at the building stage, the frequency of observer visits relative to the time taken to build a nest (up to a week), the small number of nests found late in the breeding cycle, and despite the high nest failure rate, it is probable that a large proportion of all nests constructed was located. The behaviour of the adults, especially at the building and nestling stages, and the fact that the birds are neither secretive nor cryptic, made finding nests easy.

Nesting success

Of the 29 breeding attempts documented at Coonoor Road in 1997, just over half progressed to the incubation stage, but only one produced fledglings. This contrasts with the success rate observed by Oliver (1998) who, in the breeding seasons of 1993, 1995 and 1996 collectively, recorded that 21 of 41 attempts (51%) that reached the incubation stage yielded fledged young; the corresponding figure for the Capertee Valley was 66 of 116 nests (56.9%) being successful in the breeding seasons of 1995 and 1996 combined (Geering and French 1998). These figures may be one source of the later generalisation that in the 1990s Regent Honeyeater breeding success rate was roughly one in two nesting attempts producing fledglings (BirdLife Australia 2021). This generalization disregards nests that did not reach the incubation stage and, although the quoted success rate purports to cover a whole decade, does not account for the possibility that in some years the population breeding effort itself may have been severely limited, for example 1994 in the Bundarra-Barraba district (Oliver 1998). Over longer timespans than covered by these two studies, and taking into consideration the present study, the actual success rate may be much more variable and fluctuate among years; such a pattern has been shown for the Noisy Friarbird, another large honeyeater, which in one eight-year study achieved an overall rate of 38% of nesting attempts succeeding, but with an annual rate varying from zero in years of little breeding activity to more than 50% in one year (Ford 1998).

The observations above suggest that some nesting attempt initiations may be false starts: there was an example in the present study of a pair that alternately worked on two nests before laying in only one of them (Ley *et al*. 1997). Nevertheless, it is unclear why Oliver (1998) excluded from his calculation of breeding success all nesting attempts that did not reach (or were recorded as reaching) the incubation stage, but doing so obviously skews the figures in favour of greater nest success. It is obviously true that nest building is an investment of time and energy by the birds, and disruption of nesting through attacks on the nest itself at the building stage could be regarded as a form of nest predation; possibly this is an underestimated cause of nest failure and could even result in potentially breeding females never actually laying eggs. It at least constitutes a setback to breeding progress, and a loss of time and momentum in an already probably time-constrained period. Ley *et al.* (1997) documented the extent to which nest material piracy is rife during Regent Honeyeater breeding events, including during construction and after abandonment.

Vocal mimicry

Observations of Regent Honeyeater mimicry at Coonoor Road have been published previously (Ley and Williams 1998) and were subsequently extracted and included in *HANZAB* (Higgins *et al*. 2001), but were overlooked by Crates (2019) in his literature search on the subject. The present record of a Regent Honeyeater mimicking a Grey Butcherbird adds that species to his compilation of model species, and fits with the generalisation that the honeyeater limits its models to larger species, a suggestion that was made as long ago as Veerman's (1992) observations. Typical examples of model species listed by Crates (2019) are wattlebirds *Anthochaera* spp., friarbirds *Philemon* spp. and Spiny-cheeked Honeyeaters *Acanthagenys rufogularis*.

Crates (2019) and Crates *et al*. (2021) emphasise the absence in their experience of bilingual male Regent Honeyeaters (i.e. individuals mixing typical Regent Honeyeater vocalisations with the mimicked calls of another species). However, the example documented here and previously (Ley and Williams 1998; Higgins *et al.* 2001) was of exactly that phenomenon and the bird in question used both vocalisation types commonly over a long period of observation. How this fits with the Crates *et al.* (2021) discussion of the subject is unclear. I made no attempt to quantify the mimicking bird's use of the respective calls, although both types were common and were recorded as being used 'interchangeably'.

It is unclear what the basis was for the anecdotal assessment cited by Crates (2019) that vocal mimicry was 'rare' in the Bundarra-Barraba district in the 1990s, but the present observations give it substance: the incidents of mimicry described here were two of only three examples recorded by the author and co-workers in that decade, a period of high activity among Regent Honeyeater observers in the district. The third incidence was at a separate location in 1991, when possibly the same individual was recorded vocalising in the manner of a Noisy Friarbird over three weeks in July. There were only two other documented incidents of mimicry in the study district in the 1990s: at different sites, Regent Honeyeaters mimicked an Eastern Rosella *Platycercus eximius* and a Red Wattlebird *Anthochaera carunculata* (S. Debus pers. comm.).

Veerman (1994) suggested that the use of other species' calls by the Regent Honeyeater represents Batesian mimicry, where the mimic benefits from the resulting reduction of aggression by competitor species, part of the evidence for this being that the mimicry only occurs outside the breeding season. In his discussion of this issue, Crates (2019) presents as 'new evidence' his observations of mimicry occurring *during* breeding, although this was actually previously observed and documented during 1997 by Ley and Williams (1998) (see also Higgins *et al.* 2001). Not surprisingly, when faced with similar information, Crates (2019) comes to the same conclusion as Ley and Williams (1998) 20 years earlier, namely that the Batesian mimicry theory 'has limitations' to use his words or, as Ley and Williams (1998) put it, the observations 'cast doubt' on the Batesian mimicry theory.

Crates (2019) suggests that a second (although surely not an 'alternative', since both could be true for an individual) possible benefit to a mimic is to improve its chances of mate acquisition by increasing vocal repertoire complexity, but argues that this does not occur in the Regent Honeyeater because he has never heard a bird using both mimicry and its own songs. However, the latter phenomenon was documented at Coonooor Road in 1997 (Ley and Williams 1998; Higgins *et al*. 2001). Even if it is the case that mimicked vocalisations might not 'impress' a female Regent Honeyeater as Crates (2019) puts it, although the bilingual male in the present study did not produce any offspring in 1997 he was no less successful than almost all the other males involved in the breeding event; it would be a stretch of the imagination to attribute the lack of success in his case to the fact that he was sometimes courting his mate with non-typical vocalisations.

Crates (2019) also suggests that Regent Honeyeater mimics, or 'interspecific singers' as he styles them, are often individuals

that are somewhat removed from the main population; this was certainly not the case at Coonoor Road in 1997, where both mimics were amid the main Regent Honeyeater population and one of them was an active participant in the breeding event, being the male of the pair that made four nesting attempts.

Crates (2019) suggests that the use of other species' calls by Regent Honeyeaters is not 'true mimicry' because it does not convey a fitness advantage to the mimic. However, distinguishing mimicry as practised by the Regent Honeyeater from 'true mimicry' (rather arbitrarily defined) is perhaps a meaningless distinction; who can convincingly judge where or how selective advantage or disadvantage manifests itself? For an individual Regent Honeyeater without access to the species' usual processes of socialisation it could be that the alternative to mimicry, and potentially reduced reproductive success, is the complete absence of song preventing any breeding at all.

Conclusion

It has been suggested that the current population of Regent Honeyeaters comprises as few as 350-500 individuals (BirdLife Australia 2021), or, to put it another way, 100 pairs (Crates *et al*. 2021), representing a big decline in the last two decades. It may be that given the very high failure rate in the breeding event documented here (which may not be a rare occurrence), the possibility that the species may have come close to not breeding at all in some years (Oliver 1998) and the low overall success rate in the 1990s, the generalisation that one in two nests successfully produced offspring (BirdLife Australia 2021) is misleading and that the population was already so disastrously small as to make a precipitous decline inevitable.

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