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Notes on the Breeding Behaviour of the Red-capped Robin *Petroica goodenovii*

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Summary

Three pairs of Red-capped Robins *Petroica goodenovii* were studied on the Southern Tablelands of New South Wales during a temporary invasion in 1981-1983, at the end of a drought. The birds arrived in spring, the males ahead of the females, and defended territories against Scarlet Robins *P. multicolor*. One male Red-capped Robin uttered the Scarlet Robin's song during territory advertisement. After raising one or two broods the birds dispersed for the winter, the adults either at the same time as or after the departure of juveniles. After breeding the adults moulted, the females starting before the males. Nests were built, by females only, at a height of 2-6 m (mean 3.6 m), and took 5-9 days (mean 8 days) to complete. Eggs were laid between mid October and late December. Mean clutch size was 1.9 eggs (1-2, mode 2), and mean brood size at fledging was 1.4 (1-2, mode 1). Incubation lasted 14 days (three clutches), the nestling period was 11-16 days (mean 12.5 days) and the post fledging dependence period lasted at least two weeks. The breeding success rate was 54% (7 fledglings from 13 eggs), and the nest success rate was 63% (5 nests successful out of 8 for which the outcome was known). Nest-building, courtship, parental behaviour and vocalisations are described.

Introduction

The biology of the Red-capped Robin *Petroica goodenovii* is reasonably well known in general terms, with descriptions of diet and feeding behaviour, breeding biology, nesting chronology, vocalisations, moult and plumages (e.g. Disney 1974, Hall 1974, Stewart 1976, Hobbs 1986, Schodde & Tidemann 1986). Notable observations include apparent mimicry of the song of the Scarlet Robin *Petroica multicolor* by a male Red-capped Robin (Chisholm 1960), separation by habitat where the breeding ranges of the two species overlap (Serventy & Whittell 1976), and hybridisation between Red-capped and Scarlet Robins (Cooper 1971).

This paper describes aspects of the behaviour, breeding biology, vocalisations and moult of Red-capped Robins on the Southern Tablelands of New South Wales during a temporary invasion of the species in 1981-1983, the end of a drought period; in this area the Scarlet Robin is the common breeding species of *Petroica*. Although some of the information obtained has been recorded previously, it seems worth reporting here as some of the results are sufficiently different from the literature to warrant comment or further study.

Study area and methods

The study site is located 8 km north-west of Cooma, N.S.W. (36°13'S, 149°05'E), 900 m above sea level. Rainfall is normally 450 mm per year, but there was a drought from 1977 to 1982. The habitat consists of White Cypress Pine *Callitris hugelii* and Ribbon Gum *Eucalyptus viminalis*, with an understorey of Golden Wattle *Acacia pycnantha*, on sandy soil with some granite outcrops. There is a 2 hectare clearing to the north and smaller clearings interspersed throughout.

Three pairs of robins were observed over a period of 18 months from August 1981 to January 1983: two pairs in the 1981-1982 breeding season and one in the 1982-1983 breeding season. In the breeding season daily visits were made, usually twice per

day (early morning and mid afternoon), sometimes once per day (morning). Observation periods were variable, not more than 90 minutes duration. Eight nests were watched for an entire cycle (building to fledging), and additional observations were made on a further three nests (total 11 nests observed). Observations were made using 8 x 40 binoculars. Behaviour and other aspects of biology were noted: arrival and territory establishment, nest construction, parental care, feeding, vocalisations, dispersal and moult. Six birds were mist-netted, banded* and colour-banded (three with individual combinations, three juveniles coded according to territory of origin: see Table 1). Photographs were taken to confirm plumage details and nest construction. Tape recordings of calls were made on a Sharp Autostop RD 465X cassette recorder.

Table 1
Details of Red-capped Robins banded at Cooma 1 December 1981 to 30 April 1982 (a=adult, i=immature, j=juvenile, p=pullus, m=male, f=female).

Band no.	*Date*	*Age/Sex*	*Weight (g)*	*Wing length (mm)*	*Colour bands*
014-24509	13.12.81	j			red/cream (Beta offspring)
014-24510*	20.12.81	im	7.0	63	red/red
014-24512	20.12.81	j			red/cream (Beta offspring)
014-24519	10. 1.82	p			black/yellow (Alpha offspring)
014-24520	17. 1.82	am	9.5	51	white/red (Beta)
014-24532	18. 4.82	af	8.0	66.5	blue/red (Beta's mate)

*Subsequent recovery, 14 km south on 9.5.82, proved it to be a male in full adult plumage.

Results

Arrival and territory establishment

In the spring of 1981, two adult males arrived and established territories adjacent to each other on an east-west axis. An immature male (banded, later retrapped as an adult) also established a territory to the north, adjoining the other two. The first male (colour-banded, designated Beta) arrived on 2 August and claimed the western territory, while the second (unbanded, designated Alpha) arrived on 22 August and claimed the eastern territory. The immature male arrived on 7 November, but he was unsuccessful in attracting a mate. The birds advertised their territories by singing from prominent perches around the boundaries. The two adult males (Alpha and Beta) defended 0.5 hectares each, and the immature male defended 0.25 hectares.

Both adult males started singing on 3 September. A female was first seen in Alpha's territory on 29 September, when both birds foraged loosely together and maintained contact by calling ('ticking'). Their first nest was started on 3 October and their first egg laid on 11 October. A female was first seen in Beta's territory on 26 October, when a nest was already under construction.

After breeding, the adults remained in their territories for varying periods then dispersed for the winter (see below). In 1982, a pair of unbanded birds arrived and bred in Alpha's territory. The male arrived on 3 October and started singing on 4 October. The female (a different bird from Alpha's mate in 1981) was first seen on 10 October when a nest was already under construction.

*bands supplied by the Australian Bird Banding Scheme, CSIRO

Nest site and construction

Nests observed were as described in the literature (e.g. Schodde & Tidemann 1986), i.e. a small, neat cup of shreds of bark, small rootlets and grass, lined with hair and small soft feathers, decorated externally with lichen, and bound together with cobweb. The external shape varied, apparently to merge with the substrate. Eggs were not visible from above when the female was absent, and small nestlings (up to five days old) were virtually invisible until they gaped for food.

All nests found were built in Cypress Pines, at an average height of 3.6 m above the ground (range 2-6 m, n=11). When a young slender tree was chosen, the nest was placed against the trunk and supported by a branch. In larger trees, the nests were built farther out in the forks of smaller branches where there was more shelter. In all cases but one, the nest had a northerly aspect. A new nest was invariably built for a new clutch, at least 20 m from the previous nest.

The time taken to complete a nest varied, and appeared to be affected by weather conditions. The average time taken was 8 days (n=3 nests), the shortest time (5 days) during a hot, dry spell and the longest time (9 days) during a cold, wet, windy period. Nests were sometimes left unattended for a few days before laying, if the weather was cold and wet.

The female was entirely responsible for nest building. Towards completion of a nest the male occasionally sat in the cup and shuffled around for c. 15 seconds. During the nest-building stage the male maintained territory against the neighbouring males of his species, and against Scarlet Robins. He also regularly fed the female, either at the nest, at a nearby feeding station on a branch (within 30 m) or on the ground while she was gathering nest material (usually within 25 m radius of the nest site). The female acted like a juvenile, quivering her wings, spreading her tail, crouching and begging excitedly with a call that sounded like a wet finger rubbing on a pane of glass. The male announced his arrival at the nest, or called the female away to be fed, with a shorter and quieter version of the territorial song.

The birds were observed mating on three occasions after a nest was completed. Copulation was preceded by an excited chase around the nest tree, the birds pausing to posture, alternately flicking and drooping the wings. After copulation, they departed and the female soon returned with a small downy feather and placed it in the nest cup.

Incubation and parental care

The first egg was usually laid two days after the nest was completed. First clutches for the season were started on 11 October in 1981 and 23 October in 1982, and last clutches for the season hatched in early to mid January (Figure 1).

Only females were seen incubating. Incubation periods were obtained for three clutches, each of which took 14 days to hatch. During early incubation the female frequently left the nest to forage and preen or to be fed by the male. As the hatching date approached, incubation spells became more prolonged (Figure 2) and the male then fed the female on the nest. The male's feeding visits to the nest averaged five per hour (35 feeds in 403 minutes, over 11 days). Incubation also appeared to be affected by weather conditions. Females incubated for longer periods during cold or wet conditions, whereas on very hot days they spent more time foraging.

At hatching, the nestlings were blind and near-naked with a thin covering of down. After four days the young became more active, and after seven days they were observed

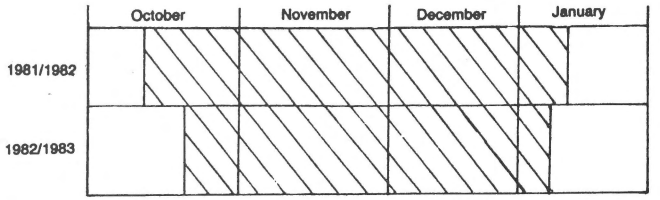

Figure 1. Breeding season of Red-capped Robins at Cooma 1981-1982 and 1982-1983, data from all pairs combined: period between first laying and last hatch of the season.

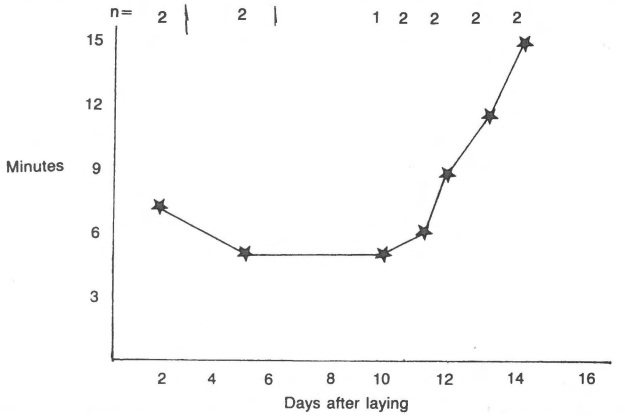

Figure 2. Average time (minutes) of incubating spells on successive days after laying (n=number of observations for each day of the incubation period).

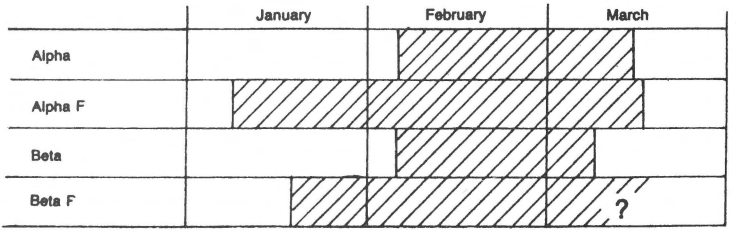

Figure 3. Periods of moult for two pairs of Red-capped Robins at Cooma, 1982 (head, body, wing and tail observed in active moult).

preening themselves, scratching and exercising by stretching and flapping their wings. Scratching was by the indirect method, and there was no sign of mutual preening. The chicks' calls were weak at first, but after four days they became vocal at feeding times or at any time they sensed movement. The nestling period averaged 12.5 days (range 11-16 days, n=5 broods).

The female brooded for long periods during the nestlings' first few days, and was mainly fed by the male. The food for the young was also provided by the male at this stage. The male passed food to the female, which stood up and gently offered morsels to the young. This action was in marked contrast to the vigorous competition between the young as they grew older.

When the female left the nest to forage, the nestlings were protected by the loose lining of feathers. At these times the male often perched on a nearby vantage point. The female was responsible for brooding and for repairs to the nest, but both parents shared feeding of young and disposal of faecal sacs. The sacs were usually dropped 20 metres or more away from the nest, or sometimes swallowed.

After leaving the nest, the fledglings were tended by the parents for at least two weeks. I observed one juvenile catching a moth seven days after leaving the nest. The female in particular defended the young once they left the nest, usually by flitting around in an agitated fashion and churring continually. If this did not work, she performed the broken-wing act. When a new nest was started after a previous successful attempt, the female deserted her previous brood. I saw a female spurn an offspring 13 days out of the nest with much scolding and chittering. The male then assumed two roles: care of the fledged brood and feeding of the incubating female.

Of the eight nests observed for a complete cycle, five (63%) were successful, producing 7 young fledged from three pairs in two years (1.2 young per pair per year). These young resulted from 13 eggs laid, which is a breeding success rate of 54%. Of the unsuccessful nests, the eggs were taken from one, the young were taken from another (nest also destroyed), and the third nest was found destroyed. Three other nests were abandoned before completion.

Dispersal

Adults were not territorial (i.e. did not sing) when not breeding, unlike local Scarlet Robins which sing all year (pers. obs.). The adult Red-capped Robins dispersed from their territories at varying times after breeding ceased, usually after their fledglings left. In 1981-1982, the fledglings left January-February and the adults left April-July. Beta brood 1 fledged on 13 December and were last seen on 16 January, a month later. Beta brood 2 fledged on 22 January and was last seen 2½ weeks later on 7 February. Beta himself was last seen on 18 July 1982, and his mate (colour-banded) on 23 April 1982. Alpha brood fledged on 10 January and was last seen on 21 February, 1½ months later; Alpha and his mate were last seen on 15 April 1982. The immature male (bachelor) was last seen on 7 February 1982, and was retrapped 14 km to the south on 9 May 1982, three months later.

It was not clear whether the same male returned to Alpha territory in 1982 as he was not banded, but the female was a different individual (lacking the rusty cap of Alpha's mate in 1981). In 1982-1983, the first brood (1 young) was last seen on 21 November, three days after fledging; the second brood fledged on 16 January (the last day the female was seen) and neither fledglings nor adult male were seen after 22 January. No other Red-capped Robins were seen in the study area until a grey bird appeared in July 1987, despite twice-weekly visits since the young fledged.

After breeding but before they dispersed, the Alpha and Beta pairs foraged in their territories, the respective partners maintaining association with each other. They did not forage outside their territories, in Scarlet Robin territories or in mixed-species feeding flocks.

Vocalisations

Seven different calls were recognised for Red-capped Robins.

1. The song. This was used by the male to advertise occupation of territory and to attract a mate. It was not heard after breeding finished, and in fact was heard only during the territory establishment phase and during nest-building (including second

nests for the season). It was not heard during the incubation or nestling period. Beta was unusual in that he uttered the Scarlet Robin's territorial song instead of the normal Red-capped Robin's song.

2. 'Scolding' aggressive call. This is a harsh churring, far-carrying for the size of the bird. It was used by both sexes — by the male when confronting other robins at territory borders, and by the female when defending young and to drive off young when a new nest was started.
3. 'Ticking'. This call sounds like two pebbles being struck together. It is probably a contact call, and was used by both sexes though I did hear it from Beta before the arrival of his mate.
4. Feeding calls used by adults. Three types of feeding calls were noted:
   (a) a shortened, subdued version of the territory song, used by the male when feeding the female during the nest-building stage
   (b) a series of 5-6 rapid clicks, used by the male to announce his arrival at the nest to feed the nestlings
   (c) the 'rubbing glass' call, used by both sexes on arrival at the nest with food, during feeding of the nestlings and also by the female when she was being fed by the male.
5. Juvenile begging calls. At hatching, these were weak and insect-like but became a distinct chirrup as the nestlings grew. Fledglings gave a thin piping whistle which may serve as a contact call as well as a begging call.

Plumage and moult

I have little to add to existing information on plumage, except to note that neither female in 1981-1982 had pink on the breast, and that the breeding female in 1982-1983 lacked the russet cap which is considered a feature of adult females. The immature (bachelor) male in 1981-1982 had no red on the breast, and was in fact identical in colour to the two adult females (i.e. he had a russet cap).

Details of moult were obtained in 1982 only, and then mainly from birds viewed through binoculars in the field. Beta was banded on 17 January, before he started moulting, and his mate on 10 April after she finished moulting. Unbanded birds were identified by association with partners or nests. Figure 3 shows the periods in which the four adult birds were observed to be in active head, body, wing and tail moult; the actual moulting period may be somewhat longer. Both females started moulting 4-5 days before their final broods fledged, considerably earlier than the males which started moulting on 7 February. The Beta pair started to build their first nest 23 days after the Alpha pair, which may account for the difference in the dates on which the females started moulting. The immature (bachelor) male was not observed to be in moult when last seen on 7 February, and three months later he was in full adult plumage.

Diet and foraging behaviour

The diet consisted of insects that the adults captured on the ground (pouncing), on the wing (hawking) or snatched from foliage, mostly near the ground. Prey positively identified included ants, blowflies, caterpillars, dragonflies, march flies and moths. While foraging on the ground, the birds frequently stopped with their head cocked, mantled their wings and shuffled one foot in the litter, perhaps to flush prey. This behaviour was often accompanied by wing waving — one wing and then the other was raised and lowered over 2-3 seconds.

Discussion

The Red-capped Robin's annual cycle at Cooma may be somewhat atypical, as the species does not normally occur there, but the data suggest the following sequence of events: arrival in the breeding area and establishment of territories in spring, the males ahead of females; rearing of 1-2 broods; moult after breeding; adults become non-territorial after breeding and disperse in autumn/winter, usually after juveniles (which disperse in summer); adults re-establish territories in the following spring. Before the post-breeding departure the adults forage in their territories, the members of a pair maintaining association with each other.

Red-capped Robins invaded and bred in Scarlet Robin habitat at Cooma, which brought into contact two species that do not normally breed sympatrically; they maintained interspecific territories. One male Red-capped Robin sang the Scarlet Robin's song, but attracted a Red-capped female. An immature male failed to obtain a conspecific mate, but did not attract a Scarlet female (cf. Cooper 1971, in which a male Red-capped sang his normal song but mated with a Scarlet female). I obtained no evidence of hybridisation at Cooma, despite apparently predisposing factors.

The data obtained in this study mostly corroborate previous data, with a few exceptions. The breeding season in the high country is said to be restricted to the spring months (Frith 1969), but eggs were found at Cooma from October to January. Birds at Cooma did not re-use nests for a second clutch, unlike birds observed elsewhere (Schodde & Tidemann 1986); this may be related to the survival of nests under different climatic conditions. The incubation period was longer (14 days) than earlier claims of 12 days (Frith 1969) but similar to other recent data (14 days: Schodde & Tidemann 1986). Cooper (1971) observed that a male shared the incubation of eggs, unlike the males at Cooma. Contrary to Schodde & Tidemann (1986), males' arrivals at the nest were not silent but were accompanied by the quiet food calls described above (cf. Cooper 1971 who also described the male's soft trilling food call). However, females' approaches to the nest were silent.

Published information on the immature plumage (presence or absence of a russet cap in either sex) seems somewhat confused, but my small sample supports the view that the russet cap is present in immature males but not in immature females. Further work is required to determine whether any red on the breast of immature males is the beginning of moult into adult plumage or a feature of 'grey' plumage; if the latter, then the song would identify them from adult females. Hall (1974) reported a post-moult transitional plumage (a mixture of 'grey' and adult plumage) for two young males, but the young male at Cooma went from grey (with no red on the breast) to full adult plumage in one moult.

Information was obtained at Cooma over a period of 18 months, and my account must therefore be incomplete. There are no other quantitative data on breeding biology for comparison with the Red-capped Robin elsewhere or with other species of *Petroica*. However, its breeding parameters and behaviour are generally similar to those of the Eastern Yellow Robin *Eopsaltria australis* (Marchant 1985). Further study is clearly warranted.

Acknowledgements

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The 20th International Ornithological Congress will take place in Christchurch, New Zealand, on 2-9 December 1990. The Congress programme will include 6 plenary lectures, 48 symposia, contributed papers (spoken and poster), workshops, discussion groups and films. There will be a mid-Congress excursion day. Longer excursions are planned to interesting ornithological sites in New Zealand before and after the Congress. In late 1990 New Zealand will also host the 20th World Conference of the International Council for Bird Preservation in Hamilton on 21-27 November 1990 and a Pacific Festival of Nature Films in Dunedin on 27 November-1 December 1990. Photographic and stamp exhibitions will be held in Christchurch in association with the International Ornithological Congress. Requests for the First Circular, which includes information on the above events, should be sent to:

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