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SOME ASPECTS OF THE BIOLOGY AND CONSERVATION OF THE THICK-BILLED GRASSWREN *Amytornis textilis* IN THE SHARK BAY AREA, WESTERN AUSTRALIA

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Colour-banded populations of Thick-billed Grasswrens *Amytornis textilis* were studied over three years at two sites in the Shark Bay region, Western Australia. The estimated density (2-3/ha) for the site on Peron Peninsula was surprisingly high and it is likely that the northern two-thirds of the Peninsula is the major stronghold of this species in Western Australia. They are also widespread in several habitats in pastoral country east of Shark Bay. Their preferred habitat is characterized by the presence of chenopod species and tall recumbant shrubs. Other aspects of their biology and conservation are presented.

INTRODUCTION

"Grasswrens have the fascination of the lost, the elusive and the unknown" is how Schodde (1982) introduced the genus *Amytornis* in his monograph on the Maluridae. This fascination has attracted the attention of birdwatchers, photographers and egg-collectors but, to date, few biologists have examined in detail any of the eight species of this endemic Australian genus. Six species have small geographic ranges and show narrow habitat specificity while two (*Amytornis striatus* and *A. textilis*) have extensive, but fragmented distributions, and relatively broad habitat requirements. Schodde (1982), in reviewing potential hazards for survival of the eight species, considered three (*A. barbatus, A. dorotheae* and *A. textilis*) were in danger and suggested that the western population of *A. textilis* "may be on the edge of extinction". More recently, however, Storr (1985) and Curry (1986a) have reported that the Western Australian populations of *A. textilis* are being maintained, at least in the Shark Bay region. Populations of grasswrens were colour-banded on the Peron Peninsula and on Hamelin Station in 1985, and this paper gives some preliminary results of this work.

STUDY AREAS

Two sites were selected mainly on the basis of accessibility. The Monkey Mia site on eastern Peron Peninsula (Fig. 1) was about 40 ha in area

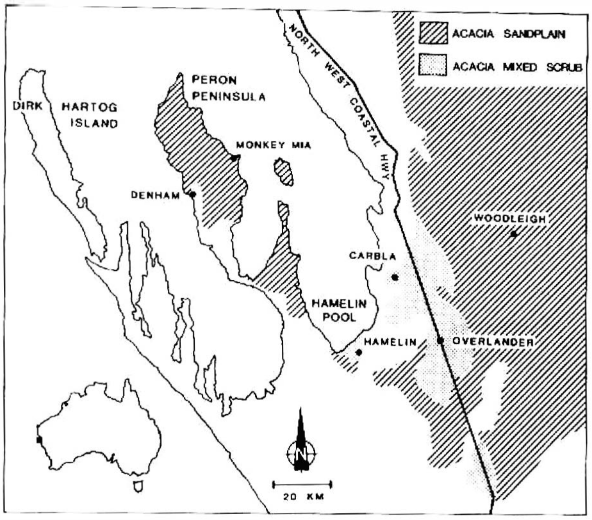

Figure 1. *Shark Bay Region showing locations used in the text and the extent of vegetation types frequented by grasswrens (after Payne* et al. *(1987): Acacia Sandplain =Peron and Sandplain land systems; Acacia Mixed Scrub=Toolonga land system).*

and included three landform elements; the coastal dune, the coastal sandplain and the red sandplain (Fig. 2). The vegetation on the coastal dune element was mainly *Acacia sclerosperma, Spinifex longifolius, Halosarcia* spp. and *Sporobolus virginicus*. The coastal sandplain was dominated by *Acacia sclerosperma, Scholtzia* spp. and *Rhagodia preissii*. This element included several small swamps vegetated by *Halosarcia* spp., *Frankenia pauciflora* and *Sporobolus virginicus*. The vegetation on the red sandplain was typical of most on northern Peron Peninsula with *Acacia ramulosa* dominating together with some *Acacia tetragonophylla* and *Heterodendrum oleaefolium*. The red sandplain vegetation had a considerably higher species richness than the coastal sandplains on the margins of the peninsula. The Hamelin site on Hamelin Station was a small (2 ha) depression in a plain of outcropping calcrete. It was thickly vegetated by *Muehlenbeckia cunninghamii* and *Atriplex amnicola*, with some *Acacia victoriae, Eremophila maculata* and *Melaleuca uncinata*.

Both sites were grazed by sheep, Monkey Mia being five kilometres and Hamelin three kilometres from a stock-watering point. Monkey Mia was also disturbed by off-road vehicle and wood-gathering activities.

Rainfall records for Denham and the monthly medians for Denham and Hamelin Station (Fig. 1) are shown in Table 1. This area has a low but reliable winter rainfall, with occasional but heavy falls in summer.

METHODS

The coastal and red sandplain areas on the Monkey Mia site were systematically mist-netted in April and July 1985. In all, 19 east-west net lines each 80 to 130 m in length were set (Fig. 2). Little clearing was required because of the extent of antecedent human disturbance. The coastal sandplain areas adjacent to the caravan park and the coastal dunes were not netted. All grasswrens and most other sedentary species captured were colour-banded, measured and released. Subsequent sightings of colour-banded birds were plotted (the area had been gridded at 100 m intervals) and some additional mist-netting was undertaken. Occupied nests, especially those with eggs, were difficult to find at first, though the two observers had extensive experience with other species of malurids. In August 1986, it took two and a half days to find the first nest, but a further 11 active nests were located in the next five days.

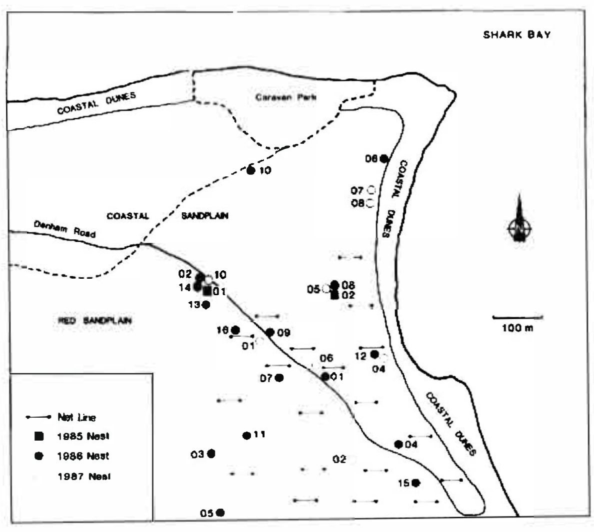

Figure 2. *Monkey Mia study area showing vegetation and the locations of net-lines and nests.*

TABLE 1

Monthly rainfall records at Denham (1976, 1982-1986) and monthly and year median rainfall for Denham and Hamelin, Western Australia.

	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Monthly rainfall (mm) at Denham	1976	6.0	22.0	0	0	45.0	13.0	24.0	19.0	18.0	9.0	0	0	156.0
	1982	37.2	1.0	34.4	0	3.5	40.4	0.8	0.4	0.8	0.4	0	0	118.9
	1983	0	0	11.4	9.0	4.4	47.9	35.1	34.0	6.0	0	44.6	2.8	195.2
	1984	0	20.5	22.8	31.4	84.0	28.6	34.8	23.8	11.2	73.3	1.8	0	332.2
	1985	0	0.9	0.8	0	1.8	30.8	43.4	29.8	7.4	0.4	12.6	0	127.9
	1986	0	76.4	0.2	0	11.6	89.8	29.2	8.2	18.6	10.0	0	0	244.0
	1987	0	0	4.0	58.0	0	37.4	13.0	8.0	3.0	0	2.0	—	—
Median rainfall (mm)														
Denham (85 years)		0	1	3	3	26	46	32	18	5	3	0	0	209
Hamelin (95 years)		0	2	2	3	22	42	33	17	6	2	0	0	192

Grasswrens at the Hamelin site were netted during two brief visits in September 1984 and August 1985 but the area was not searched for nests.

RESULTS AND DISCUSSION

Dimensions

The mean bodyweights for all birds, including retraps, at Monkey Mia are given in Table 2. Males were significantly heavier (+2.2 g) than females (t33=5.17, P<0.001) for the April 1985 samples, and, while still heavier (+0.9 g) in July 1985, this difference was not significant. The ranges of bodyweight (males 21.6-27.6 g; females 19.6-25.6 g) suggest that those given by Schodde (1982) from museum specimens (males 18-23 g; females 16-21 g) are less than for the species as a whole. Wing length (males 66.0±2.5 mm, n=26; females 64.2±1.8 mm, n=32) and tail length (males 89.2±2.7 mm, n=20; females 85.1±2.5 mm, n=18) agree with Schodde (1982) for *A. t. textilis,* the subspecies in this region. Males had significantly longer wings (+1.7 mm, t56=2.99, P<0.01) and tails (+4.1 mm, t36=4.89, P<0.001) than females. Males captured in 1985 had significantly lower body mass than those captured in 1986, probably due to the drier conditions (Table 1) in 1985 (April 1985 versus May 1986, t21=3.0, P<0.01; July 1985 versus May 1986, t10=2.95, P<0.05).

TABLE 2

Mass (g) of Thick-billed Grasswrens mist-netted at Monkey Mia.

	Males			Females		
Date	Mean	SD	n	Mean	SD	n
Apr. 1985	23.8	1.3	17	21.6	1.2	18
July 1985	23.5	0.5	6	22.6	1.4	11
Oct. 1985	25.0	—	1	22.9	—	1
May 1986	25.2	0.8	6	23.4	—	1
Aug. 1986	25.8	—	2	22.8	1.6	4
Jan. 1987	—	—	—	21.8	—	2

The measurements for the five adults (3 males, 2 females) netted on Hamelin were within the observed range recorded for the Monkey Mia birds.

Moult and Plumage

All adults captured were sexed according to the presence (females) or absence (males) of a rufous

TABLE 3
The extent and distribution of moult on Thick-billed Grasswrens mist-netted at Monkey Mia.

					Feather Tract		
		Body*			Retrices	Primaries	Secondaries
	n	Slight	Moderate	Heavy			
Apr. 85	35	12	5	0	11	0	2
May 86	7	2	5	0	7	2	6
July 85	17	2	4	10	14	1	6
Aug. 86	6	0	0	0	1	0	0
Oct. 85	2	0	1	1	2	1	0
Jan. 86	2	1	0	0	2	0	1

*Slight: a few feathers in sheath or in pin, usually confined to one tract;
Moderate: as for Slight, but present in several tracts.
Heavy: numerous feathers in moult in most tracts.

patch of feathers on the lower breast. This patch is acquired by females at an early age (1-2 months, Schodde 1982), and although it is partly covered by the wing, all banded birds were subsequently correctly sexed when identified in the field. At least two of the older nestlings which we handled had some rufous feathers on their sides. A neonatal nestling is described by Brooker and Brooker (1987).

Adult moult seemed to occur mainly in winter (Table 3) somewhat later than suggested by Carter (1917) and Schodde (1982). The extensive and late moult recorded in July 1985 may have been due to the dry conditions (Table 1). The two birds moulting in October 1985 were attending an occupied nest (No. 85-1). Tail feathers were being replaced throughout the year, a common trait with *Amytornis* (Schodde 1982).

Density

This was estimated for Monkey Mia from the number of adults caught on the initial net lines set in April and July 1985. Fifty birds were captured on an area of about 18 ha giving a density of 2.8 grasswrens per hectare. If the three unbanded pairs known to frequent the eight hectares on the northern end of the study area are added, the density on 26 ha could be extrapolated to 2.2 birds per hectare. These are probably minimum estimates of density because unbanded birds were subsequently seen on the netted area and at least two of the males at 1986 nests were unbanded.

The density estimate for *A. textilis* on the Monkey Mia study area (2-3 birds/ha) was surprisingly high — much higher than the two per four to five hectares estimated by Schodde (1982) for populations in the Lake Torrens basin, South Australia. It also exceeds the density estimate for another malurid the Splendid Wren, *Malurus splendens* (0.60±0.20 adults/ha, range 0.38-0.99, on 45 ha over 12 years) in a more mesic environment (average annual rainfall c. 800 mm) near Perth, Western Australia (Rowley and Brooker 1987). The census followed a year (1984) of above average rainfall (Table 1), so the 1985 estimate could represent a peak figure. However, the three years prior to 1984 were relatively dry and, though the area was not netted in 1986 and 1987, there was no subjective indication that numbers were lower than in 1985. Habitat disturbance due to human activity is especially high at Monkey Mia, where there is soil and vegetation damage caused by off-road vehicles and firewood gatherers, in addition to the effects of three introduced herbivores: sheep, goats and rabbits. *Amytornis textilis* has been reliably reported on most of the northern half of Peron Peninsula in recent times (N. Kolichis pers. comm., G. Chapman pers. comm., R. Wells pers. comm., P. Curry pers. comm.).

There is no obvious factor which would explain the persistence of high numbers of grasswrens at Monkey Mia and presumably on most of northern Peron Peninsula. Their distribution on the peninsula is insular with the sea on three sides and unsuitable habitat to the south (Fig. 1). The population of Singing Honeyeaters *Lichenostomus* *virescens* on this peninsula shows the increase in body size which is common in the island forms of many bird species (Wooller *et al.* 1985). This 'island' effect can reduce species diversity and enhance the survival of some animal populations by reducing competition and/or predation. However, Peron Peninsula has no shortage of potential predators or competitors. There are at least 15 species of birds which forage mostly on the ground and which eat invertebrates, seeds or vegetable matter. This number is probably similar to or greater than the number of potential competitors found elsewhere in the range of *A. textilis.* Most of the potential predators of adults, nestlings and eggs are present, for example, varanids and snakes (Storr and Harold 1978), *Accipiter* spp., *Corvus bennetti,* feral cats and foxes (pers. obs.).

On the first visit to the Hamelin site (May 1984) there appeared to be three groups of grasswrens but subsequent visits and netting showed that only two groups were present. The dense vegetation made netting difficult. The Hamelin birds were also much more inclined to flight and several flew over the nets. The immediate surrounds of the swamp were searched but no grasswrens were found. However, a group was located in a thicket of *Acacia tetragonophylla* about one kilometre from the site in May 1986.

Home Range

The re-sighting of colour-banded individuals proved difficult even at occupied nests. While birds were easy to locate on call, they moved away quickly after contact with an observer and rarely remained stationary except in the centre of shrubs or in deep shadow. They often perched on exposed branches in trees and shrubs (to 3 m high) as an observer approached (especially in the more densely vegetated Hamelin site) but usually not long enough for colour-combinations to be identified. Twenty individuals were re-sighted or re-netted one or more times at Monkey Mia. The median distance 'travelled' by the birds was 90 m (range 0-250) and 19 out of 27 re-sightings (70%) were 100 m or less from the banding site. The confines of the study area would have allowed movements of up to 500 m.

Breeding at Monkey Mia

(a) 1985. Three experienced observers searched the study area for occupied nests between 24 and 30 July. None were found, and there were no brood patches on 11 females mist-netted. In three days in late August, two nests were found (Fig. 2).

(b) 1986. Twelve nests (details of breeding data in Appendix) and a pair with a young fledgling were located between 5 and 13 August (Fig. 2). Another occupied nest (86-14) was found on 31 August near nest 86-2 that had failed on 11 August. Another three nests found August 1987 were attributed to this season by reason of their condition when compared with nests of known age. All females but no males that were netted at nests had brood patches. Males are thought to share incubation duties (Whitlock 1910, Schodde 1982) and I had two records where males appeared to come off nests, one with eggs, the other with nestlings. At three nests, a third bird was seen nearby but on only one occasion did it (in this case a male, Nest 86-8) carry food to the nest and perform a 'rodent-run' behaviour (Rowley 1962) when the nestlings were handled. There are insufficient data to estimate incubation or fledgling periods or growth curves of nestlings. A nestling aged not more than 20 hours (Nest 86-10) weighed 2.5 g.

(c) 1987. The search this year (10 to 13 August) was concentrated on the Coastal Sandplain and adjacent Red Sandplain portions of the study area. Four occupied nests were located (see Appendix), together with one group with a fledgling and four nests which were confidently aged to this season.

Seven occupied nests were found in 1986 on the 18 ha area on which 50 individuals had been previously mist-netted. It is most probable that not all nests were found especially since the vacant areas (Fig. 2) had suitable habitat and known occupants. On the other hand, if *A. textilis* live in large groups each with only one breeding pair, as is the case in the related genus *Malurus* (Rowley 1965, 1981, Tidemann 1986), then this may explain the apparently low nesting density. However, little evidence of a communal way of life by *A. textilis* was found; groups containing more than two individuals were rare and only one instance of three birds feeding nestlings was observed. Four pairs of 1986 nests (nest 1 and 7, 7 and 9, 9 and 8, 3 and 11) were within 100 m of each other suggesting that, in a good season, there could be a breeding pair per hectare.

Nesting appeared to be less widespread and later in 1985, which was much drier (Table 1) than 1986. This difference in seasonal conditions between years was reflected in the bodyweights of the birds (see Dimensions). However, in 1976 (a relatively dry year, Table 1), N. Kolichis (pers. comm.) found 13 nests with eggs between 24 July and 26 August on an area west of Monkey Mia.

Nests were placed 0.02-1.10 m (median 0.30 m, n=25) above ground. They were situated in the centre of the substrate with 0.15-1.10 m of foliage above them. The aspect of the entrance tended to be southerly (17 out of 24 faced between 90° and 270°). The entrance was invariably towards the thickest and tallest vegetation in the vicinity of the nest. The nesting substrate varied considerably and usually consisted of more than one species of plant. In all, at least eight species of plants supported nests, with a further five species growing beside or above the nest. The nests were solid structures composed of dry grass with some narrow strips of bark and the lining was entirely of plant origin. All had incomplete hoods.

Distribution

(a) *Peron Peninsula*

Grasswrens are widespread on the northern two-thirds of the Peninsula (Storr 1985, R. Wells pers. comm., N. Kolichis pers. comm., G. Chapman pers. comm., P. Curry pers. comm.), and their range evidently includes most of the Sandplain and Peron land systems of Payne *et al.* (1987) and are shown as 'Acacia Sandplain' in Figure 1. I do not have records for the spinifex country south of these systems (but see Storr 1985).

(b) *Inland from Shark Bay*

Post-1970 sightings of grasswrens on the plains east of Shark Bay (Storr 1985, Curry 1986a, this study) were mostly in the area bounded by Woodleigh to Overlander on the east and Hamelin Pool on the west, and all were located within the Sandplain and Toolonga land systems of Payne *et al.* (1987) as illustrated in Figure 1. The Sandplain system is characterized by acacia-dominated scrublands on flat to gently undulating red sandplains; Toolonga by acacia mixed scrub on limestone outcrop plains.

Habitat Preferences

Grasswrens are known to occur in the following landforms within the area shown in Figures 1 and 2.

(a) Coastal dunes (Monkey Mia).

(b) Coastal sandplain (Monkey Mia).

(c) Red sandplain (Northern Peron Peninsula).

(d) Drainage depressions in acacia scrubland (Hamelin).

(e) Regenerating burnt acacia scrubland (Carbla, Woodleigh).

(f) Acacia scrubland on limestone (Overlander).

The common vegetative factors in all these habitats were:

(i) some chenopod species

(ii) shrubs 1-3 m tall which are recumbent in their normal growth form, as a response to persistent wind action or due to senescence. This structure protects grass, herb and other shrub species from grazing by large mammalian herbivores, as well as providing support for twining species, such as *Leichardtia australis*, *Porana sericea* and *Commicarpus australis*.

Conservation

Schodde (1982) did not have recent information from Shark Bay when he considered that only two populations of *A. textilis* were holding their own, those on the northern Eyre Peninsula and those through the Lake Eyre basin, both in South Australia. It is now clear from these results and Curry (1986a) that nominate *A. textilis* is not merely widespread in the arid plains around Shark Bay but remains abundant on at least part of Peron Peninsula. The northern two-thirds of the Peninsula are probably the species' major stronghold.

Grasswrens have been found in at least three scrubland types (Curry 1986a) on the mainland adjacent to Shark Bay. They are not confined to the almost pure chenopodiaceous steppes occupied by this species elsewhere throughout its range (Schodde 1982). In fact they are not usually encountered in the saltbush/bluebush land systems as mapped for this region by Payne *et al.* (1987). There have been no recent records for Dirk Hartog Island or for the pastoral and wheatbelt country east and south of Shark Bay which were previously inhabited. However, because of their low detectability, a thorough search may yet show their continued existence on at least parts of their previous range.

It is unlikely that the results of a three-year part-time study of an arid zone species will identify all the factors important for its conservation. However, the two features of the vegetation, which usually characterize the habitat of Thick-billed Grasswrens (some chenopod species, tall recumbent shrubs) are probably important for their survival and should be considered if any changes in land use are contemplated in this region, especially at Peron Peninsula. For example, a land use change such as de-stocking and increased tourism could alter the fire regime by increasing the intensity, frequency and extent of burning. There is evidence of large fire scars in the Sandplain land system on Peron Peninsula, though the present fire frequency is low (P. Curry pers. comm.). It is known that *A. textilis* occurs in fire successional vegetation at least after a few years (Curry 1986a,b). However, repeated burning of the same area appears to have an adverse effect on the survival of a closely related species, *Malurus splendens* (Rowley and Brooker 1987), and thus this factor must not be overlooked when considering the survival of *A. textilis*.

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APPENDIX

Summary of breeding data for 21 nests of Thick-billed Grasswrens at Monkey Mia. HBC=Horsfield's Bronze-Cuckoo; b=banded, colours not read; ub=unbanded; ?=no band sighted; M=male; F=female.

Year	Nest No.	Date	
1985	85-1	28 Aug.	Nest half-built. F(ub) carrying feather.
		2 Oct.	1 nestling banded. M(ub) and F(ub) netted.
	85-2	29 Aug.	2 eggs fresh M(?), F(?)
		2 Oct.	Empty, nest undamaged.
1986	86-1	7 Aug.	2 nestlings. M(17) and F(39) carrying food.
		8 Aug.	M(17) and F(39) feed chicks.
		12 Aug.	2 nestlings banded.
	86-2	7 Aug.	2 eggs. M(b) and F(b) at nest.
		10 Aug.	2 eggs.
		11 Aug.	Empty. Hood torn, twigs above nest, broken.
	86-3	10 Aug.	2 *Amytornis* eggs and a HBC egg (fresh).
		13 Aug.	3 eggs. M(ub) and F(ub) at nest.
		28 Aug.	1 HBC nestling 12-13 days old.
		1 Sept.	1 HBC banded.
	86-4	10 Aug.	2 eggs. M(ub) and F(49) at nest.
		13 Aug.	2 eggs. (?M came off).
		22 Aug.	2 nestlings.
		28 Aug.	2 nestlings banded.
		1 Sept.	1 nestling.
	86-5	11 Aug.	2 nestlings. M(ub) and F(ub) at nest.
		12 Aug.	2 nestlings banded, M(ub) comes off nest.
	86-6	12 Aug.	3 eggs. M(ub) and F(ub) at nest.
		13 Aug.	3 eggs.
		22 Aug.	3 nestlings.
		28 Aug.	3 nestlings.
		30 Aug.	Empty.
	86-7	12 Aug.	Ready for eggs.
		13 Aug.	0 eggs.
		28 Aug.	2 eggs. M(?) and F(?) at nest.
		2 Sept.	2 eggs.
	86-8	12 Aug.	3 eggs.
		22 Aug.	3 nestlings.
		28 Aug.	1 nestling. M(21) and F(20) feeding. A third bird M(ub) nearby.
		2 Sept.	1 nestling banded. Three adults at nest.
1986	86-9	12 Aug.	2 eggs. M(?), F(42) at nest.
		22 Aug.	2 eggs.
		28 Aug.	2 nestlings.
		30 Aug.	Empty. Nest disturbed.
	86-10	12 Aug.	2 eggs, 1 HBC nestling. M(ub) and F(ub) at nest.
		13 Aug.	1 egg, 1 nestling, 1 HBC nestling.
		22 Aug.	1 HBC nestling.
		28 Aug.	1 HBC fledgling.
	86-11	13 Aug.	1 egg. M(ub) and F(?) at nest.
		29 Aug.	1 egg, warm.
		2 Sept.	1 egg. Bird sitting.
	86-12	13 Aug.	2 eggs. M(b) and F(?) at nest.
		22 Aug.	1 nestling, 1 egg (damaged).
		28 Aug.	1 nestling banded.
		30 Aug.	1 nestling.
		2 Sept.	Empty — ? fledged. Nest undamaged.
	86-13	13 Aug.	1 fledgling with M(ub) and F(ub).
	86-14	31 Aug.	2 eggs. M(?) and F(?) at nest.
		3 Sept.	2 eggs.
1987	87-1	12 Aug.	2 nestlings banded. M(ub), F(?).
	87-2	13 Aug.	2 nestlings banded. M(44), F(53).
	87-3	10 Aug.	M(ub) and F(ub) "rodent-run".
		11 Aug.	Find one short-tailed fledgling.
	87-4	10 Aug.	1 naked nestling.
		12 Aug.	Nest empty, not disturbed.
	87-5	10 Aug.	1 cool egg, 1230 hrs.
		11 Aug.	2 eggs, F(?) on, 0900 hrs.
		12 Aug.	2 warm Grasswren eggs, 0930 hrs.