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A RELIC POPULATION OF BLUE-BREASTED WRENS *MALURUS PULCHERRIMUS*, IN THE CENTRAL WHEATBELT

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ABSTRACT

A small isolated population of *Malurus pulcherrimus* living in a 47.6 hectare heathland Water Reserve near Manmanning, W.A. were colour banded and censused (N=21). Eight territorial groups contained twice as many males as females and communal nesting was observed.

INTRODUCTION

Of all the nine species of wren in the genus *Malurus*, I have found *M. pulcherrimus* the hardest to locate and to watch. Not only do they seem to call at a higher frequency than the other wrens, which eludes my ageing hearing, but they live in heathland and manage to keep low and well hidden unless one can provoke their curiosity by squeaking or by playing-back a recording of their territorial reel.

For seven years the Division of Wildlife Research of the CSIRO studied the ways of the Galah, *Cacatua roseicapilla*, at Manmanning, in the Western Australian wheatbelt. Occasionally, as we searched for nests or followed tagged birds, we encountered parties of *pulcherrimus* briefly; this happened so seldom that I thought there were only a few birds around — too few to study. In 1976, when the end of our stay at Manmanning was in sight, I discovered that there were more wrens than I had previously thought in one particular uncleared block that we knew as the Water Reserve. I, therefore, decided to spend a few weekends at Manmanning in order to colour band and census the wrens on this block.

This paper reports a one year study of a small, colour-banded population of *M. pulcherrimus*.

MATERIALS, STUDY AREA AND METHODS

The Blue-breasted Wren, *M. pulcherrimus*, is one of three *Malurus* species that are grouped together under the heading "Chestnut-shouldered Wrens", the other two species are *M. elegans* and *M. lamberti* (the latter now includes the forms previously recognised as separate species:— *assimilis*, *dulcis*, *rogersi*, and *amabilis* [Schodde, 1975]).

In Western Australia these three Chestnut-shouldered Wrens meet and overlap without any apparent inbreeding which means that they are good species (Ford, 1966). Serventy and Whittell (1976) describe the distribution of *pulcherrimus* in detail and give its north-eastern boundary as Mingenew, Bunjil, Wongan Hills and Norseman. Recent observations show that the species has a wider range and may even be continuous with the South Australian population: it has been seen 40 km N.E. of Mukinbudin (Chapman and Bradley, pers. comm.), and is thriving around the R.A.O.U. Observatory at Eyre (Martindale, 1980).

Manmanning, where this study was carried out, is a railway siding 23 km east of Wongan Hills and 170 km north-east of Perth. The climate is Mediterranean with a wet winter and a hot dry summer. Rainfall records have been kept at Cadoux, a township 9 km to the north, for 42 years giving an average rainfall of 362 mm (Bureau of Meteorology, 1977). Manmanning rainfall† over the period of this study was:— 1973 — 329 mm; 1974 — 439 mm; 1975 — 377mm; 1976 — 307mm.

† Measured by Mr. B. Smith, who lived 2 km south-west of the siding.

Until 1926 Manmanning was part of the large area of sand-plain heath or kwongan (Beard, 1979) that is characteristic of south-west Western Australia. After that date clearing was rapid and cereal cropping with sheep grazing wrought a complete change in the landscape. Before the Goldfields and Agricultural Water Supply pipeline reached Manmanning those few places where it was possible to create a water holding dam or tank were vital to existence. Such areas and their surrounding catchment remained Crown property amidst the Conditional Purchase or the Freehold farms, and tended to remain ungrazed and therefore in their native state largely due to the presence of legumes that were poisonous to stock.

The site of this study, the Water Reserve, Avon Location 20109 (Reserve A25984, for the Conservation of Flora and Fauna) was such an area. A small dam to the south centre of the 47.6 hectares still holds water for most of the winter months. The nearest other heathland was 4 km to the south-west-Dingo Rock (Location 20167, Flora and Fauna Reserve No. ↑13494); I never saw any wrens there but Graeme Chapman did. Seven kilometres to the east the Railway Water Reserve (Location 25363, Reserve No. ↑20571) supported a small population of *pulcherrimus*, but only 36.68 ha of this area was heathland; it held at least two groups of wrens in 1973. Another area of taller heath (11 ha) in Avery's timber held one group of wrens (1973), and a similar area of tall heath near the Railway siding (36.6 ha) also held at least one other group; this latter area is part of Manmanning townsite. The locations of these areas are shown in Figure 1.

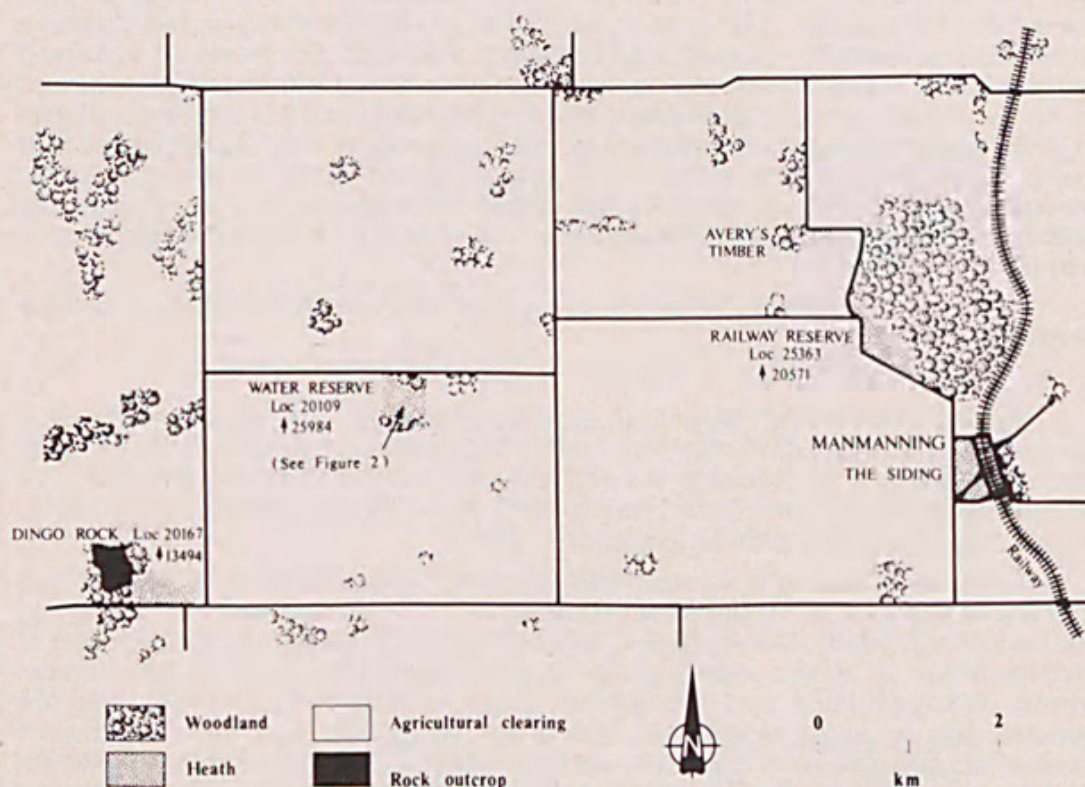


Fig. 1.—The location of remnant patches of heathland near Manmanning.

The north and south parts of the Water Reserve were wooded with Wandoo *Eucalyptus wandoo* and Salmon Gum *E. salmonophloia*, underneath which the shrub-layer tended to be sparse and tall, (Fig. 2). This scrub, which was dominated by *Casuarina campestris*, merged into a floristically much richer open-scrub with a heathy under-storey characteristic of yellow sandy soils — *Banksia* — *Xylomelum* alliance (see Kenneally, 1977, p. 16 and Pl. 5B; George *et al.*, 1979, example 13 and Fig. 7.10). I marked several tall dead trees conspicuously and registered their positions on a map of the area. Sightings of banded *pulcherrimus* and of nest sites were plotted on this map from compass bearings of the three most suitable markers.

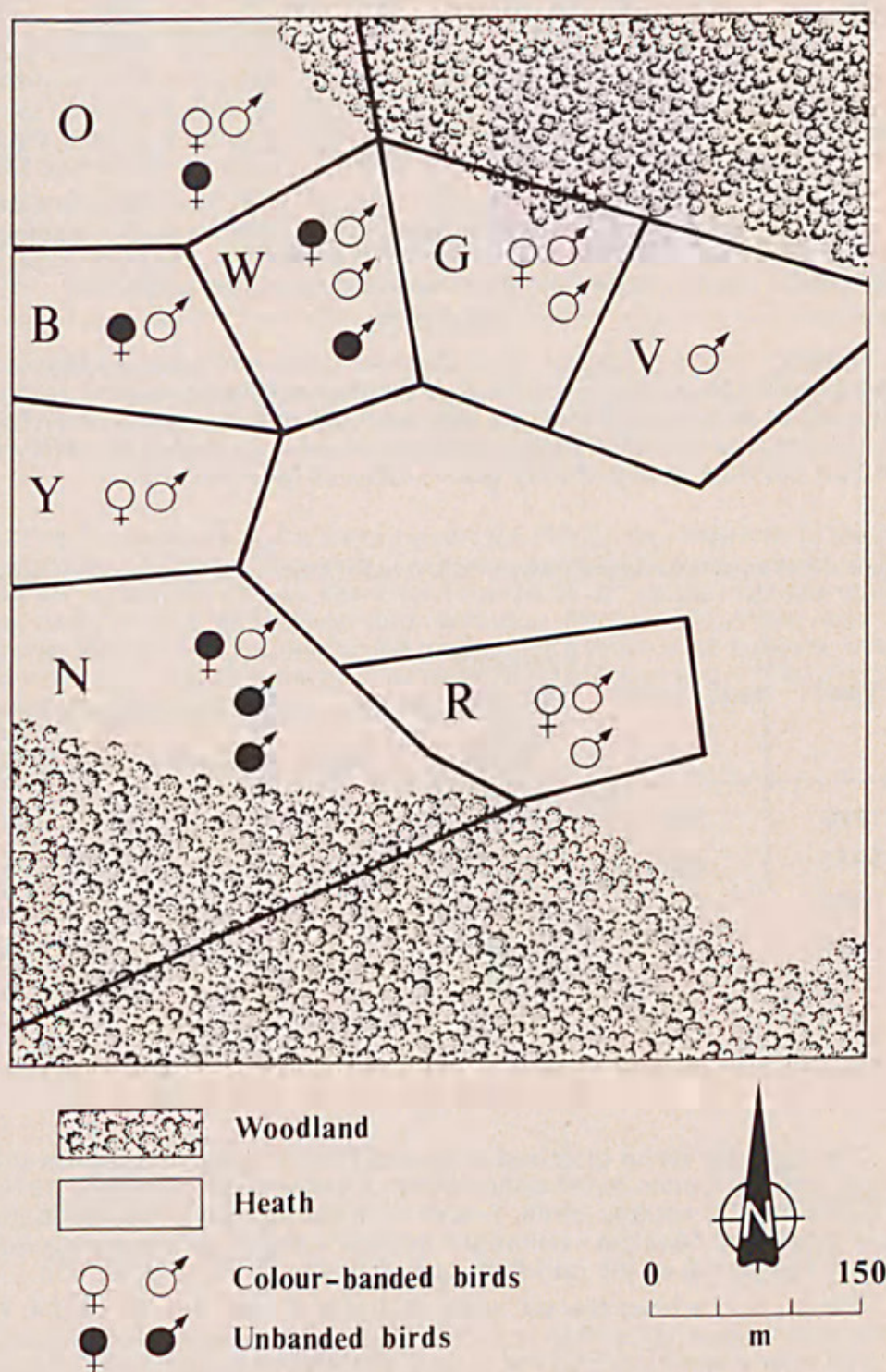


Fig. 2.—Map of Water Reserve (A25984) showing approximate areas occupied by groups of *Malurus pulcherrimus*.

At first I quartered the area systematically, stopping every 50 m and playing a recording of *pulcherrimus* song. This consisted of what I recognise as the territorial reel that is usually sung by a male proclaiming his ownership. The wrens usually first responded by answering me, then approaching and finally by showing themselves atop a bush taller than its neighbours. After I had roughly located the areas frequented by wrens, I set up mist-nets and attempted to draw the birds into the nets by re-play. All wrens that were caught were given two celluloid colour bands on one leg and a metal numbered band of the Australian Bird Banding Scheme on the opposite leg.

The first *pulcherrimus* that I caught and banded was found next day, tethered to a clump of restiads (Fam. Restionaceae) by a stalk that had slipped inside a colour band that I had sealed shut with acetone; he was released unhurt. This is the first and only such accident I have had in twenty years of banding wrens (N=400+!). I nearly gave up the project, but compromised by cutting 1mm off each colour band before sealing it shut; this made banding much slower but no more trouble was experienced and the smaller diameter band was quite large enough to allow it to move freely up and down the leg.

Throughout the spring and early summer of 1976, five nests were located and I banded three clutches of nestlings. Besides these seven nestlings, 15 adults were also banded making a total of 22 banded *M. pulcherrimus*, in the study area; 7 adults eluded my mist-nets and remained unbanded.

RESULTS

Nesting. In the spring of 1973 Graeme Chapman and Les Moore each found a nest of *M. pulcherrimus* (both in the Railway Reserve) and during 1976 we found five active nests, four of which were laid in and three of which fledged seven young; the details of these nestings are given in Table 1. In 1976 we also found an old nest in sufficiently good repair to be measured.

TABLE 1.— DETAILS OF SIX NESTS USED BY *MALURUS PULCHERRIMUS* AT MANMANNING, W.A.

Year	Nest number	Estimated date first egg was laid	Number of		
			eggs	nestlings	Young fledged
1973	301	5.ix	3	3	3
1973	302	28.viii	3	0	0
1976	601	30.viii	3	0	0
1976	602	15.ix	3	3	3
1976	603	3.ix	3	3	3
1976	604	6.ix	3	2	1

The eggs are white blotched or spotted with reddish brown towards the blunter end. My limited data confirms that of Serventy and Whittell (1976) that the clutch size is usually three. I have no data for either the incubation or nestling periods, because I visited the nests as seldom as was consistent with banding the young at the optimum age (7 days), to avoid desertion.

The evidence from the six nests in Table 1 and from two other family parties encountered (7.x.1973 and 27.ix.1977) all suggest that egg-laying only occurred over a relatively short time from the end of August to early October. Compared with other wrens that I have studied in detail (Rowley, 1965, 1981), this is a very brief breeding season, and is probably limited by the rapid onset of the hot dry summer, at least in the years 1973-1977 at Manmanning. This is in contrast to *M. splendens* in similar heathland near Perth where egg-laying continues into January.

TABLE 2.— DIMENSIONS OF EIGHT NESTS OF *MALURUS PULCHERRIMUS* AT MANMANNING, W.A.

Nest Number	Measurement in mm					(see Fig. 3)
	A	B	C	D	E	Aspect
301	90	160	220	70	35	112°
302	230	300	365	70	45	090°
601	100	150	210	70	35	285°
602	130	180	250	70	40	090°
603	110	160	230	70	50	010°
604	430	460	520	65	50	105°
605	130	170	220	70	30	345°
606	130	160	210	70	30	080°

Substrate

nests 302, 604 and 605 were in a restiad, Family Restionaceae.
 nests 301, 601, 602 and 603 were in *Melaleuca cordata*.
 nest 606 was in a *Hakea incrassata*.

The dimensions of the eight nests (see Fig. 3) are shown in Table 2; they do not differ significantly from those of *M. splendens* (Rowley, unpubl.). All the nests were domed with an entrance two-thirds of the way up one side, and were lined with plant fibres and feathers. Nests of *pulcherrimus* were, however, placed much closer to the ground than those of *M. splendens* built in heathland near Perth and which were, on average nearly 0.5 m higher (av. 64 cm: range 20-240 cm: N=103: Rowley unpubl.).

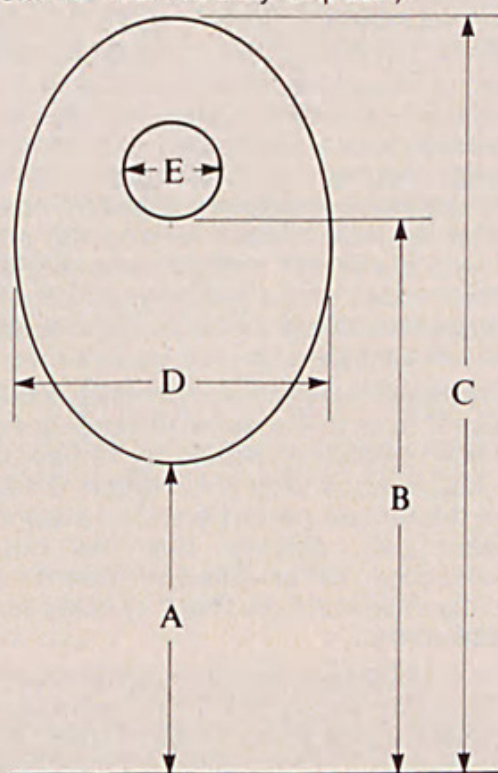


Fig. 3.—The measurements taken at nests of *Malurus pulcherrimus* given in Table 2.

Group composition. The number and sex of the adult birds that were present on each territory in September 1976 are shown in Fig. 2. The population consisted of 22 adult birds, 15 of whom were banded; there were twice as many males as females. The distribution of group composition is shown in Table 3, and includes a group encountered near the railway siding on 15 July, 1974. In 1973 two other groups were seen and each was noted as having more than one female but since these sightings were made in November in time for an early brood of young to have grown to adult female appearance, I have disregarded those sightings (one at the Water Reserve and one at Manmanning Siding).

TABLE 3.— ADULT MEMBERSHIP OF ELEVEN GROUPS OF *MALURUS PULCHERRIMUS*

Year	← Group membership →					
	♂ alone	♂♀	♂♂♀	♂♂♂♀	♂♀♀	♂♂♀♀♀
1973	—	1	1	—	—	—
1974	—	—	—	—	—	1
1976	1	2	2	2	1	—
1977	2	1	—	—	—	—

Helping. At nest 301 Graeme Chapman saw and photographed two males feeding the nestlings. In 1976 both males at 602 (G territory, Fig. 2) attended the nestlings; 601 was robbed and can provide no data on helping, whilst 603 and 604 had only a pair to tend the young by the time the eggs hatched (the second female in O territory had disappeared). No attempt to quantify the division of labour was made in the limited time available.

Territory. Blue-breasted Wrens live in territories which they defend against conspecifics as was shown by the rapid and intense response to my play-back of the territorial advertising call. The approximate configuration of these territories is given in Figure 2 and shows that most territories had one or more boundaries which did not need defending. The area in the centre and towards the east appeared to be unoccupied by wrens in 1976 although the central area was where I sighted a family of *pulcherrimus* in 1973 and the eastern edge was a stronghold of White-winged Wrens *M. leuconotus* that year. The size of these territories averaged 3.2 hectares and ranged from 2.0 ha to 7.6 ha although the largest (N) was really an undisputed Home Range. This large territory size and the fact that quite large areas of apparently suitable habitat were unused suggests that in 1976 the density of *pulcherrimus* in the Water Reserve was not at a maximum.

Behaviour. As mentioned earlier *pulcherrimus* is the most difficult of the wrens to watch because it lives in dense heathland where it keeps low to the ground, and is rarely seen unless provoked by replay, in which case all one sees is the defensive reaction towards an invader. On one occasion whilst I was banding nestlings the female parent scuttled around like a small mouse, performing the "rodent run" display; this has not been recorded in *pulcherrimus* before (Rowley, 1962). Besides rodent running *pulcherrimus* frequently ran under my mist-nets so that I quickly learnt to peg down or weight the bottom shelf-string.

I can distinguish four different calls for *pulcherrimus* but I would not be surprised if younger ears can recognise more. As is usual for Malurid wrens the group keeps in contact by uttering a soft single note; in alarm the birds keep up a near continuous churring (it was this that drew my attention to the male tethered by his leg band) and, as already mentioned, I used a recording of the territorial advertising reel to provoke resident owners into showing themselves.

A display that I have not seen from any other wren was given by a male (the territory owner) at intervals as he chased a strange female in his territory (10.xii.76). The male held his tail cocked right up over his back and gave a 'churring call' as he faced her; I have called this the Rattle Display.

Later History. I had hoped to continue this study for a few years, but the extreme difficulty of locating the birds and, as it turned out, the drastic fluctuations in numbers made this impracticable.

In 1977 we paid seven visits to the area, but we never managed to see more than 4 adults in a day (1, 4, 0, 4, 3, 3, 0). Graeme Chapman saw a pair with flying young (27.ix) whose tails were about 3 cm long; this suggests a first egg laid towards the end of August. Of the fifteen adults and seven nestlings that we had colour banded only two were sighted in 1977.

DISCUSSION

In comparison with the other Chestnut-shouldered Wrens (*M. lamberti* and *M. elegans*), *M. pulcherrimus* is very secretive and hard to observe. This species appears to have adapted to the dense heathland by travelling mainly on foot at ground level. Nests are built very close to the ground and none of the eight that I measured had the entrance more than 52 cm above ground level (see Table 2).

As with most populations of Malurid wrens that have been studied there appears to be a predominance of males with a consequent development of territorial groups and communal nesting where all group members help feed and tend the nestlings. This study was too short to provide the demographic details necessary to understand how such an imbalance between the sexes came about.

The difficulties of separating the three Chestnut-shouldered Wrens, *M. assimilis*, *M. pulcherrimus* and *M. elegans* have thwarted bird watchers for a long time, depending as it does on that rather ephemeral character the relative blue-ness of the breast and the blue or white saddle on the back. These features are often hard to pick up in the field where, especially with *pulcherrimus*, glimpses are brief. Graeme Chapman, whose hearing is much better than mine, and who has an excellent memory for bird calls, regards the characteristic reel of song from *pulcherrimus* to be absolutely unmistakable. I agree with him and consider this to be the best field character for separating these similar species. It also emphasises, along with the secretive ground-loving habits, the genuineness of the taxonomic separation of these three species.

It appears from this very superficial study that *M. pulcherrimus* can persist in refuges as small as 47.6 hectares for at least thirty years after most of the heathland has been converted into grassed or cultivated paddocks — both unsuitable habitat for these birds. In woodland where stock have been allowed to graze and camp the under-storey vegetation tends to be depauperate and generally inadequate to support wrens. The few patches of heathland that do remain largely owe their preservation to past needs for local water-catchment which ensured that these reserves remained Crown property. Their continuing survival in relatively undamaged natural state has frequently been due to the presence of poisonous legumes. Their future depends on the farming community appreciating these areas not only for their beauty and importance as refuges for flora and fauna but as valuable reminders of the efforts made by their forebears to create the farms on which they now live.

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The assistance of Craig Bradley, Graeme Chapman and Les Moore of the CSIRO Division of Wildlife Research, early in the morning and during their lunch breaks is gratefully acknowledged. Also that of my wife Eleanor, whose ears are younger than mine and her patience greater. The drawings were made by C.P.S. de Rebeira, also of the Division.

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FORAGING BEHAVIOUR OF MEGACHILID BEES ON SWAINSONA CANESCENS (FABACEAE) AND ITS COEVOLUTIONARY IMPLICATIONS

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ABSTRACT

Females of the Megachilid bee *Chalicodoma semiluctuosa* were observed foraging on the vertical inflorescences of *Swainsona canescens* on Cooloomia Nature Reserve 70 km north of Kalbarri in Western Australia. The bees tended to start foraging on each inflorescence below the uppermost flowers, they moved upwards between flowers more frequently than downwards, and they missed a lot of open flowers on each inflorescence. These behavioural patterns concur with those adopted by North American bumblebees feeding on plants with vertical inflorescences. Further work may show that *S. canescens* possesses a number of floral characteristics that have coevolved with the foraging behaviours of its Megachilid pollinators to reduce pollen wastage, to maximize outcrossing in environmentally unfavourable years and to increase self-pollination in favourable years.

INTRODUCTION

Interest in the foraging behaviour of bees and coevolved features of their plants was recently stimulated by Pyke (1978). He studied the behaviour of three North American bumblebees (*Bombus* spp.) that fed on the nectar of five plant species all characterized by flowers on vertical inflorescences (*Delphinium nelsoni*, *D. barbeyi*, *Aconitum columbianum*, *Epilobium angustifolium* and *Penstemon strictus*). Pyke found that the bumblebees consistently commenced foraging at the bottom of inflorescences, they tended to move vertically up each inflorescence, they tended to leave each inflorescence before reaching the top and they missed flowers as they moved upwards. In four of the five plants studied, nectar abundance per flower decreased with flower height on an inflorescence, flowers with receptive stigmas were restricted to the bottoms of the inflorescences while flowers shedding pollen occurred above them, and flowers were arranged approximately in spirals on the inflorescences. Pyke proposed that these



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