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## SEDENTARINESS AND SURVIVAL OF WHITE-BROWED SCRUB-WRENS IN THE BRINDABELLA RANGE, AUSTRALIAN CAPITAL TERRITORY

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White-browed Scrub-wrens have been banded at New Chums Road in the Brindabella Range, Australian Capital Territory since 1961, as part of a larger bird-banding study. Adult White-browed Scrub-wrens were sedentary, and during the period 1961-82 their mean annual survival rate was 65 per cent. This compares with an annual survival of 77 per cent for adult White-browed Scrub-wrens in south-west Western Australia.

### INTRODUCTION

A banding study of bush birds in the Brindabella Range, Australian Capital Territory, was commenced in April 1961 in conjunction with a visual survey (Lamm and Wilson 1966). While the visual observations were discontinued in 1963, the banding work continued on a regular basis until 1982 (Horey and Wilson 1971; Tidemann *et al.* 1988). This paper examines the sedentary nature and survival of White-browed Scrub-wrens *Sericornis frontalis*, a common inhabitant of the study area.

### STUDY SITE AND METHODS

Birds were netted at New Chums Road in the Brindabella Range (35°24'S, 148°50'E). For a description of the study area see Lamm and Wilson (1966).

In October 1963 each site at which a net was erected was given a number and from then on the number of the net site was recorded for each bird that was caught. The locations of these sites are shown in Figure 1.

In calculating the estimates of survival in this paper, only birds recaptured at least once in the years following banding are used. The assumption is made that all losses in this group

are by mortality alone, however, factors such as emigration, band loss, and net shyness may also be responsible for the disappearance of some birds. Therefore the estimates of survival are a minimum figure.

The method of analysis is based on Lack (1954) and is similar to that used by other authors, e.g. Boehm (1974) and Morris (1975).

### RESULTS

During the 21 years up to 30 June 1982, 2 000 White-browed Scrub-wrens were banded of which 444 were known to be alive in the banding year following the original handling. The number of new birds banded each year (from 1 July to the following 30 June) varied from a minimum of 56 in 1968/69 to a maximum of 204 in 1973/74 (Table 1).

Adult plumage is acquired in about four to five months at New Chums Road (see also Rogers *et al.* (1986) who indicate that in the populations they examined, immature birds acquire full adult plumage by six to nine months). In contrast to the adult birds with territories, the younger birds were highly mobile.

TABLE 1

Calculation of survival rates. Number of birds surviving according to banding year.

Year Banded	Number Banded	Number surviving:																			
		62/3	63/4	64/5	65/6	66/7	67/8	68/9	69/0	70/1	71/2	72/3	73/4	74/5	75/6	76/7	77/8	78/9	79/0	80/1	81/2
1961/62	126	59	46	31	19	14	10	9	5	5	5	2	2	2	1						
1962/63	93		20	11	7	4	3														
1963/64	128			17	11	7	5	4	3	3	2	1	1	1							
1964/65	100				11	7	3	3	2	1	1										
1965/66	82					15	5	5	3	2	2	2	1	1	1	1	1				
1966/67	68						13	8	5	4	4	3	2	2	2	2	1				
1967/68	73							14	8	4	2										
1968/69	56								22	17	12	6	6	6	4	4	2	1			
1969/70	149									51	36	20	8	6	4	3					
1970/71	94										26	15	8	5	4	3	3	3	2	1	
1971/72	101											21	9	7	4	2	2	1	1	1	
1972/73	77												14	10	4	3	3				
1973/74	204													44	25	11	11	6	2		
1974/75	106														26	12	8	6	4	2	
1975/76	88															19	9	7	4		
1976/77	79																16	8	7	3	
1977/78	60																	13	7	4	
1978/79	68																		19	9	
1979/80	99																			12	
1980/81	78																			7	
1981/82	71																			12	
Total	2 000																				
Total number of birds present		59	66	59	38	47	39	43	48	87	90	70	51	81	75	60	Total = 913				
Total number of these birds present one year later		46	42	37	32	26	29	26	36	64	49	37	40	49	41	40	Total = 594				
Annual survival (%)		78	64	63	84	55	74	61	75	74	54	53	78	61	55	67	Total = 996				
Average annual survival = 594/913 = 0.651 (65%)																					

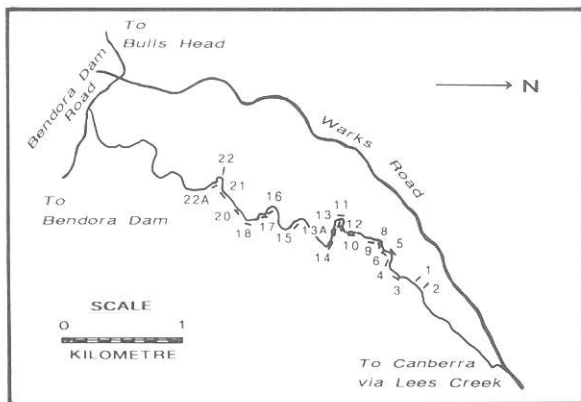


Figure 1. New Chums Road showing the location of the net sites.

Tidemann *et al.* (1988) noted that birds were banded at several other locations in the Brindabella Range. Thirteen White-browed Scrub-wrens were retrapped at locations different to those where they were banded. Seven of these were banded as juveniles and it is suspected the other six were also young birds. Eight were retrapped only once at the new location, two were retrapped twice, one three times, one four times and one six times, suggesting that the latter birds succeeded in establishing territories at the new sites. The movements of these birds were only of a few kilometres and the difference in altitude was a maximum of about 300 m (Tidemann *et al.* 1988). One bird (020-89249) banded on 17 April 1965 by M. Murn at Glendale Crossing on a tributary of the Murrumbidgee River, was retrapped by Wilson 21 days later and 31 km downstream at Pine Island beside the Murrumbidgee River.

TABLE 2

Dates on which two long-lived birds were banded and retrapped.

Band No. 020-27422			Band No. 020-33101		
Date	Recorded as	Net number	Date	Recorded as	Net number
19/10/61	Adult	—	1/6/62	Adult	—
2/12/61	Adult	—	28/10/62	Adult	—
28/7/62	Adult	—	20/1/63	A/F**	—
21/8/65	A/M*	13	5/5/64	A/F	21
11/9/65	A/M	13	8/2/65	A/F	22
14/11/65	A/M	11	16/9/70	A/F	21
27/2/66	A/M	13	7/8/71	A/F	21
11/4/66	A/M	10	13/11/71	A/F	22
4/2/67	A/M	13A	7/6/75	A/F	22
17/9/67	A/M	13			
22/11/69	A/M	13			
30/1/70	A/M	13			
4/7/70	A/M	13			
2/10/70	A/M	13A			
5/5/73	A/M	13			
27/9/75	A/M	13			
18/10/75	A/M	13			
23/3/76	A/M	12			

\* = Adult Male \*\* = Adult Female

Although this bird was banded as an 'adult' its exact age was unknown and the assumption is that it was a young bird. Recorded movements of this distance by White-browed Scrub-wrens are unusual.

#### *Sedentariness*

The banding and retrapping details of two long-lived and sedentary birds are shown in Table 2. The known life of 020-27422 was 14 years, 4 months and 4 days, and that of 020-33101 was 13 years and 3 days. These are the periods between first and last handling — the actual life spans would have been longer.

The five nets in which 020-27422 was caught (Table 2) were placed on the roadside on a hair-pin bend around a deep, densely vegetated gully with a small creek flowing through it (Fig. 1). In a direct line the greatest distance between the nets was about 70 m from net 10 to net 13A. The bird was caught 15 times in 11.5 years after the net sites were numbered, all within that small area, and on 12 of these times it was in net 13 or 13A. The two nets in which 020-33101 was caught six times over 11 years were located about 30 m apart at the end of the net run.

Another adult male 020-27168 was banded on 6 January 1962 and retrapped 25 times, the last being on 9 October 1971. Its 18 retraps in numbered net sites were: 11 times in net 9; five in net 8; once in net 7; and once in net 5; all within 75 m of each other. It seemed to have moved its territory slightly to the north as the early retraps were mostly in net 9 and the later ones in net 8.

While the three birds quoted are the longest lived male and female, and the bird most frequently retrapped, the examples are typical of all birds which were frequently retrapped and suggest the sedentary nature of the adult birds which manage to gain territories.

#### *Survival*

Several authors have published details of the survival rates of various Australian passerines based on bird-banding data e.g. Boehm (1974, 1977, 1978, 1982), Morris (1975), McFarland and Ford (1987), Farrell and Hardy (1993), Robertson and Woodall (1987) and Nicholls and Woinarski (1990). Other authors have published details of the survival rates of groups of passerines e.g. Fry (1980), Brown *et al.* (1990) and Yom Tov *et al.* (1992). Many of these have been summarized by Rowley and Russell (1991).

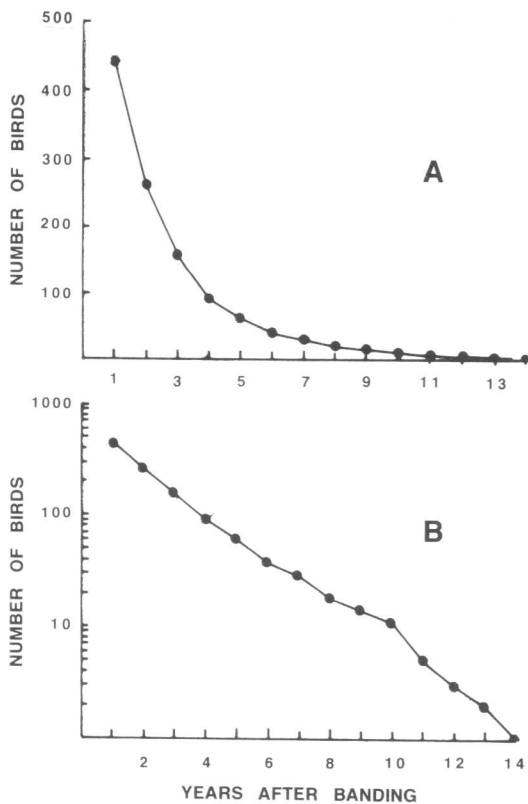


Figure 2. Survival curve for White-browed Scrub-wrens known to be alive at least one year after banding: (A) ordinary scale; (B) logarithmic scale.

The numbers of birds banded each year and the numbers of these known to be alive in subsequent years are given in Table 1. The age of these birds at banding was unknown, but by the subsequent year they would have been in adult plumage, therefore all survival figures are of birds in adult plumage. Survival curves prepared from these data on (a) an ordinary scale, and (b) a logarithmic scale indicate a fairly constant survival rate (Fig. 2).

Table 1 shows the survival of the population of banded birds from one year to the next. Some birds are not retrapped for several years, for example 020-33101 which was not retrapped for a period of 5.6 years (Table 2). To ensure all birds were given a good chance of being retrapped, only data from birds banded up to 1975/76 were used (because the study finished in 1981/82 this gave each bird the opportunity to be retrapped

during a period of at least six years). The estimate of average annual survival provided by this method is 65 per cent. Table 1 also shows the annual survival from year to year. This varies from 53 per cent (1971/72 to 1972/73) to 84 per cent (1964/65 to 1965/66).

The percentages of birds from the total banded population known to be alive (KTBA) one or more years after banding are given in Table 3.

## DISCUSSION

The causes of the variation between years in the number of White-browed Scrub-wrens banded were not obvious but there were many possible contributing causes such as fluctuations in rainfall, heavy persistent snowfalls in some winters and a bushfire which burnt out more than half of the net sites on 21 December 1972. There were also droughts lasting at least two years and similar periods of above average rainfall.

TABLE 3

The number of individuals from the banded population known to be alive (KTBA) each year after banding.

Years after banding	KTBA	Total banded population possible for age group	% KTBA
1	444	1 929	23.01
2	260	1 851	14.05
3	156	1 752	8.9
4	91	1 684	5.4
5	61	1 624	3.76
6	38	1 545	2.5
7	29	1 457	1.99
8	18	1 351	1.33
9	14	1 147	1.22
10	11	1 070	1.02
11	5	969	.52
12	3	875	.34
13	2	726	.28
14	1	670	.15
15		597	
16		529	
17		447	
18		347	
19		219	
20		126	

That 1 485 birds were banded but not retrapped in any of the years following their banding, is readily explained as the majority of these were birds in juvenile plumage or newly acquired adult plumage.

The survival of adult White-browed Scrub-wrens in this study is probably aided by their sedentary life style in small territories which provide them with adequate food, shelter and nest sites. For example, during the 14 years that adult male 020-27422 (Table 2) was encountered in this study he appears to have lived in a densely vegetated gully, moving within a well-defined territory and never venturing more than a few metres from the ground in an area virtually without predators. The Brown Goshawk *Accipiter fasciatus* and the Pied Currawong *Strepera glaculina* were the only avian predators recorded during the study which could pose a threat and the vegetation in the gully was probably too dense for them to fly through at the heights inhabited by the White-browed Scrub-wren.

By contrast, as they move about in search of a territory in which to settle, many young birds are probably taken by predators or become victims of the severe mountain climate.

The data used to calculate average annual survival in this and similar analyses have two major deficiencies: i) the ages of the birds at banding are not known; and ii) the calculations finish when the birds are last retrapped. We know that the birds were alive between the time they were banded and the time they were last retrapped, but what is not known is how long they had been alive before they were banded and how much longer they lived after they were last retrapped. Analysis of this type of data inevitably produces an underestimate of average annual survival.

Brown *et al.* (1990) studied the survival of White-browed Scrub-wrens in Karri forest at Smith's Brook in the south-west of Western Australia. In the first five years of their study, annual survival was 77 per cent for adult birds which is substantially different from the 65 per cent calculated for adult birds in this study.

To ensure that this comparison was not influenced by different methods of analyses, the data from Table 4 of Brown *et al.* were re-analysed according to the method used in Table 1

of this paper. To allow all birds captured to have a good chance of being recaptured (as in the New Chums Road analysis), only the first five years data were included. The result was an estimate of annual survival of 78 per cent for the first five years, which is similar to that calculated by them. The data from Table 1 of this paper were then analysed according to the method used by Brown *et al.* The result was an estimate of annual survival of 64 per cent, which is similar to that already calculated in this paper. These figures show that the difference between the estimated annual survival rates at these two places is not the result of the use of different methods of analysis.

It should be noted, however, that Brown *et al.* calculated survival based on the actual age of the bird in years from the time of banding. In this paper the age of the bird is calculated on its survival from one banding year (1 July to 30 June) to the next. The use of this method means that a number of birds would be shown as being one year older than they actually are, e.g. a bird banded on 15 May and recaptured on the next 15 August would be classed as being one year old whereas in fact the elapsed time is only three months. Therefore the use of banding years in calculating survival would result in the estimate of a slightly higher survival figure than would be calculated by using actual years elapsed.

It is tempting, therefore, to say that White-browed Scrub-wrens in the Karri forests of south-western Australia survive better than those in the wet sclerophyll forest of the Brindabella Range; although this is possible, the difference may also be the result of different sampling techniques. At New Chums Road, the aim was to make monthly visits to the area and use 21 nets (a total length of 253 m) at 20 fixed sites. On some visits up to a further 10 fixed sites were netted with up to an additional 113 m of mist-nets. The sites were situated along the edge of about 2 km of road (see Fig. 1). At Smith's Brook, an average of 71 visits were made each year and 100-125 m of mist-nets were used at 18 fixed sites (Brown *et al.* 1990). It is possible that these two different sampling regimes may have had an effect on the chances of birds being recaptured, so influencing the survival figures.

The chances of birds being recaptured may also have been influenced by the different habitats in which the studies took place. The study by Brown

*et al.* at Smith's Brook was in 72 ha of a 98 ha forest reserve which is surrounded by farmland, most of which is pasture (i.e. the study area was an 'island' of suitable habitat from which the dispersal of birds was probably restricted). On the other hand New Chums Road is surrounded by many kilometres of suitable habitat which allows easy dispersal. Therefore, it is possible there was greater mobility among the birds at New Chums Road than at Smith's Brook — although at both sites the movement of adult birds (which is the age group being analysed) would be restricted by territorial behaviour. Because the analyses in both studies were based on the recapture of live banded birds, birds which were not recaptured would be classed as having died — even if the reason for them not being recaptured was they had moved to areas not being sampled by mist-nets. In a territorial species like the White-browed Scrub-wren this movement need only be a few metres to place a bird out of the reach of a mist-net. A failure to recapture these birds would reduce the mean average annual survival calculated for all birds in the population.

White-browed Scrub-wrens have been banded and recaptured in long-term studies of bird populations in a number of sites in Australia. Undoubtedly the sampling methods used vary from study to study and therefore the analyses of survival data for White-browed Scrub-wrens from these studies may help to elucidate the extent to which sampling methods may or may not influence survival estimates.

#### ACKNOWLEDGMENTS

The project at New Chums Road was a remarkable one, chiefly in that it was carried on with a regular programme for 21 years by a large and dedicated group of amateur ornithologists. In the early days many local ornithologists helped the Wilson family with the banding. When educational commitments took Brendan and later Denis Wilson away from Canberra, S. J. Wilson was assisted by a number of high school lads, eight of whom went on to make careers in zoology. In total the number of people who assisted was large and it would be invidious to mention names for fear that some important contributors would be omitted. During the 21 years there were an average of 15 visits to the site each year, on each of which about six people were present. Thanks to all who were involved, Australian ornithology has benefited from this project.

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