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TERRITORIAL AND BREEDING BEHAVIOUR OF THE RUFOUS TREECREEPER (*Climacteris rufa*) IN THE STIRLING RANGES, WESTERN AUSTRALIA

ALLAN M. ROSE

C/- Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983

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A population of colour-banded Rufous Treecreepers *Climacteris rufa* was studied in wandoo woodland in the Stirling Range National Park, 89 kilometres north of Albany, Western Australia, from June 1990 to January 1994. Five territories were studied and consisted of at least one adult female, one, two or three adult males and one to two juvenile birds. Breeding commenced in August and finished in February. Females layed up to two eggs per clutch and were capable of three broods per breeding season. Juveniles assisted in feeding young of the next brood. Only two of the juveniles banded in 93/94 stayed in the study area. Tree hollows only were used for nesting, while hollows in logs and trees were important sheltering areas for fledglings.

INTRODUCTION

Long-term studies of the White-throated Treecreeper *Climacteris leucophaea,* Red-browed Treecreeper *Climacteris erythrops* and Brown Treecreeper *Climacteris picumnus* have been undertaken by Noske (1980, 1984, 1985, 1991). However, no studies have been undertaken on the Rufous Treecreeper.

The Rufous Treecreeper is the only member of the family Climacteridae confined to the southern part of Australia from Eyre Peninsula to the south west of Western Australia. It lives in various habitats from wandoo *Eucalyptus wandoo,* salmon gum *E. salmonophloia,* savannah woodland *E. gongylocarpa,* to the jarrah *E. marginata* and karri forest *E. diversicolor* of Western Australia (Seventy and Whittell 1976).

With no studies of the Rufous Treecreeper having been undertaken, the aims of this study were to determine the territorial and breeding behaviour of the Rufous Treecreeper. In particular, given the superficial similarity between Brown and Rufous Treecreepers, I was interested in identifying similarities in co-operative breeding, group size, territory fidelity, clutch size, multi-broodedness and the length of incubation and nestling periods.

METHODS

The study area was located at the northern boundary of the Stirling Range National Park in open wandoo *E. wandoo* woodland, and the neighbouring Stirling Range Caravan Park. Mean average rainfall was 512 mm (1976–93) for the Ranger's residence adjoining the study site.

The dominant tree at the study site within the national park was *E. wandoo* with individual and patches of *E. occidentalis* var. *occidentalis,* small pockets of mallee *E. tetragona* and *E. decipiens* also occurring. The understorey consisted mainly of small (to 0.5 m) plants of *Gahnia ancistrophylla, Lepidosperma tenue* (sedges); *Bossiaea eriocarpa, Harperia lateriflora* and *Dodonaea* species (woody shrubs). The Stirling Range Caravan Park consisted of partly cleared areas of *E. wandoo, E. occidentalis* var. *occidentalis*, also uncleared patches of *E. wandoo, E. occidentalis* var. *occidentalis* and *E. decipiens,* and mallee scrub, with some natural understorey as for the national park. Permanent buildings as well as transient people and vehicles used the caravan park and its facilities throughout the year.

Metal bands were applied to 41 individual Rufous Treecreepers (24 males, 17 females), of which 26 were also colour banded. Upon commencing the study in June 1990 metal bands only were applied. From May 1992 onwards, celluloid bands of seven colours (red, orange, purple, yellow, light green, dark blue and black, abbreviated in this paper as R, O, U, Y, P, B, N respectively) were applied to the right tarsus in combinations of two colours, e.g. red-red (RR), yellow-purple (YU), etc.

Territory boundaries were determined by observing the range of individual birds and the locations of conflict with other Rufous Treecreepers. During the three and half year study, I banded birds in five of the seven Rufous Treecreeper territories under observation. Observations of the two remaining neighbouring territories were also undertaken to determine any movement of Rufous Treecreepers into and from the territories in which birds were banded.

Mists nets were the only means of capturing birds. Observations were carried out either daily, weekly or monthly over the study period, and mist netting occurred mostly during and after the breeding seasons. A ladder was used to inspect tree hollows during nest building, incubation and nestling period.

RESULTS

Territoriality

The average area of the five study territories was 7.8 ± 1.65 (sd) ha. Four territories ranged from 8.0 ha (territory D) to 9.2 ha (territory B), but one territory was only 4.6 ha (territory E). Territory boundaries appeared to stay the same during the study although an eighth territory was briefly established on two occasions by young male birds within territory F.

Three of the seven territories were in the caravan park; one in *E. occidentalis* woodland, the other two *E. wandoo–E. occidentalis* woodland, which was partly disturbed by buildings and associated human activities throughout the year (Fig. 2). Birds in only one of these caravan park territories (territory C) were banded. The main area used by these birds was located near the caravan parks office, toilet block, powered caravan sites and on-site vans. Young were successfully raised from nests in trees from 5 to 25 metres from these buildings. At least half of this territory had no understorey and the ground was bare. Birds obtained food from trees, logs, the ground and the eaves, verandahs and roofs of buildings. The eaves and verandah rafters provided shelter for both adults and juveniles during the day.

Males out numbered females in the study area, with 16 males and 10 females banded. Territory A and C had a subordinate adult male in each territory, with no subordinate adult females observed in any territory. Subordinate birds are referred to as those birds that reside but do not breed within the territory.

Of the nine juveniles banded prior to the 1993/94 breeding season, YR♀ stayed the longest (259 days) in its territory of birth. Length of stay for the other six juveniles were 9, 18, 30, 34, 45 and 188 days respectively. Only two (PU♂, RP* — both from natal territory A) of the nine juveniles remained in the study area, both moving into

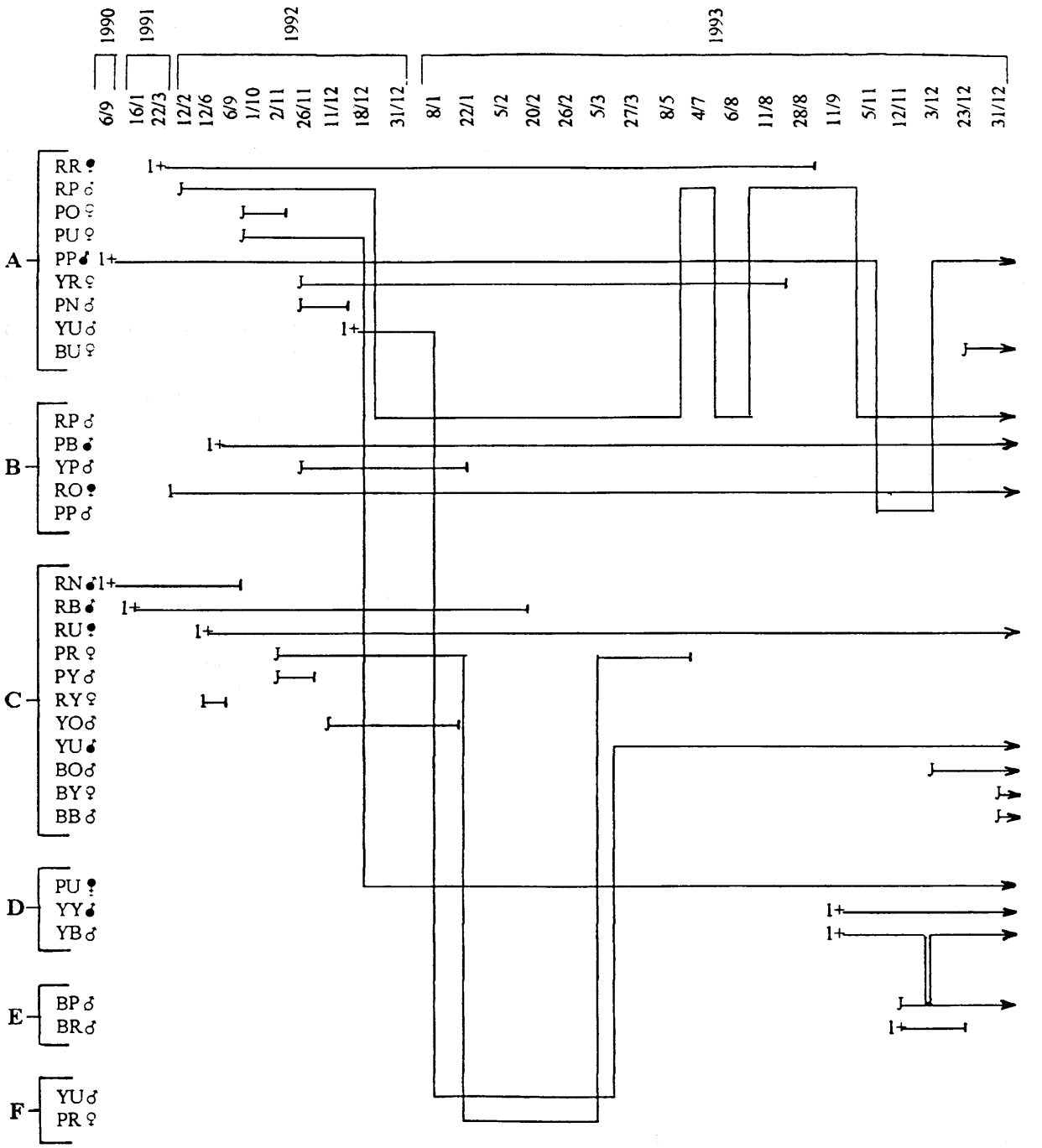

Figure 1. *History of individual Rufous Treecreepers at the Stirling Range National Park. Symbols at the beginning of each line represent age when bird banded. Lines that end are for birds not seen in the study area after that date. J = juveniles. Closed circles are breeding birds. Some individuals appear more than once.*

adjoining territories (B and D, Fig. 1). The other seven juveniles either died or moved out of the study area. The nearest territory of the species to the study area was 2.5 km away. No banded Rufous Treecreepers were seen in this or more distant territories. Four of the five juveniles banded during the 1993/94 breeding season were still in their natal territories when the study ended in January 1994. The fifth, a female (BU in territory A, approximately three months of age when banded), probably came from one of the two territories at the study site at which birds were not banded.

Five weeks after the disappearance of RR♂ in territory A, midway during the 1993/94 breeding season, her partner PP ♂ was seen feeding the adult female (RO) and a nestling in the neighbouring territory B. At the time of RR's disappearance, PP was the only other treecreeper in territory A, who then fluctuated between territory A and B up to the end of this study. The juvenile female (BU), possibly from the unbanded territories, was observed in territory A in early December 1993, 14 weeks after the disappearance of RR. Due to the study ending in January, I am uncertain if this juvenile bird became the breeding female. RP ♂, hatched in territory A (son of PP) in the 91/92 breeding season, fluctuated between territories A and B for the duration of the study (or since 10 months old — see Fig. 1).

On two occasions during the study, unoccupied territory F was occupied briefly by birds. YU♂ (territory A) aged 2–, moved into the unoccupied territory F on 8 January 1993. Seven days later PR♂ (14 months old) from territory C, was seen with YU in territory F. However, by 27 March 1993, both YU and PR had taken up residence in territory C, and by 8 May 1993, PR♂ had disappeared from the site, though YU ♂ stayed in territory C until the end of the study.

On 13 November 1993, an unbanded adult male moved into the unoccupied territory F. RP ♂ (ex territory A) was seen in territory F later on the same day chasing the unbanded male with both acting aggressively towards each other. PP ♂ had also moved into this territory and combined with RP in attack on the unbanded male. However, by the 22 November 1993, territory F was vacant and the unbanded male was not seen in any of the other study territories, with PP and RP moving back to territory B. On both occasions that territory F was occupied, birds from the neighbouring territories showed interest in the new birds by calling at the territory boundary.

During the non-breeding season (March–July) birds from within each territory encroached slightly into neighbouring territories and tolerated each other. However, during the breeding season, activity was concentrated around a smaller core area where the nest tree was located within the larger, defended territory.

Nesting

The breeding season, defined as the months in which egg laying occurred commenced in August and finished in January (n = 12 nests). Females were capable of raising three broods in a season. In the 1992/93 breeding season RR♀ (territory A) had three clutches. Two of the three clutches were successful with eggs of the third clutch preyed upon two days before due to hatch. If this clutch had been successful then young would have fledged from the nest in early February.

Nests were located in dead and live hollow limbs, or tree trunk hollows, only in *E. wandoo* and *E. occidentalis*. They ranged in height from 2.4 m to 13 m above the ground ($\bar{x} = 5.9 \pm 2.8$ (sd), n = 12). The entrance hollows of four nests measured 125 × 125 mm, 70 × 50 mm, 60 × 30 mm and 60 × 40 mm. The distance, for the four same nests, from the nest hollow entrance to the nest itself was 625 mm, 300 mm, 260 mm and 300 mm respectively. The greater depth of the first nest may have been attributable to cracks in the dead limb in which the nest was placed, with one narrow crack going past the nest chamber.

At four nests, the breeding female was observed performing the majority of the nest building, with the breeding male only undertaking minor building. Helpers and juveniles within a territory were not observed assisting in nest building. Noske (1991) found that members within a territory of Red-browed and Brown Treecreeper assisted in nest building. Nest building from the beginning was seen on three occasions. Large amounts of bark strips were first placed in the hollow, then feathers, bark fibre and occasionally kangaroo droppings (n = 2 nests) were placed on top of the bark strips producing a shallow cup. After the eggs were laid, more feathers, particularly downy ones, were added to the nest by both sexes. This addition of feathers made eggs and

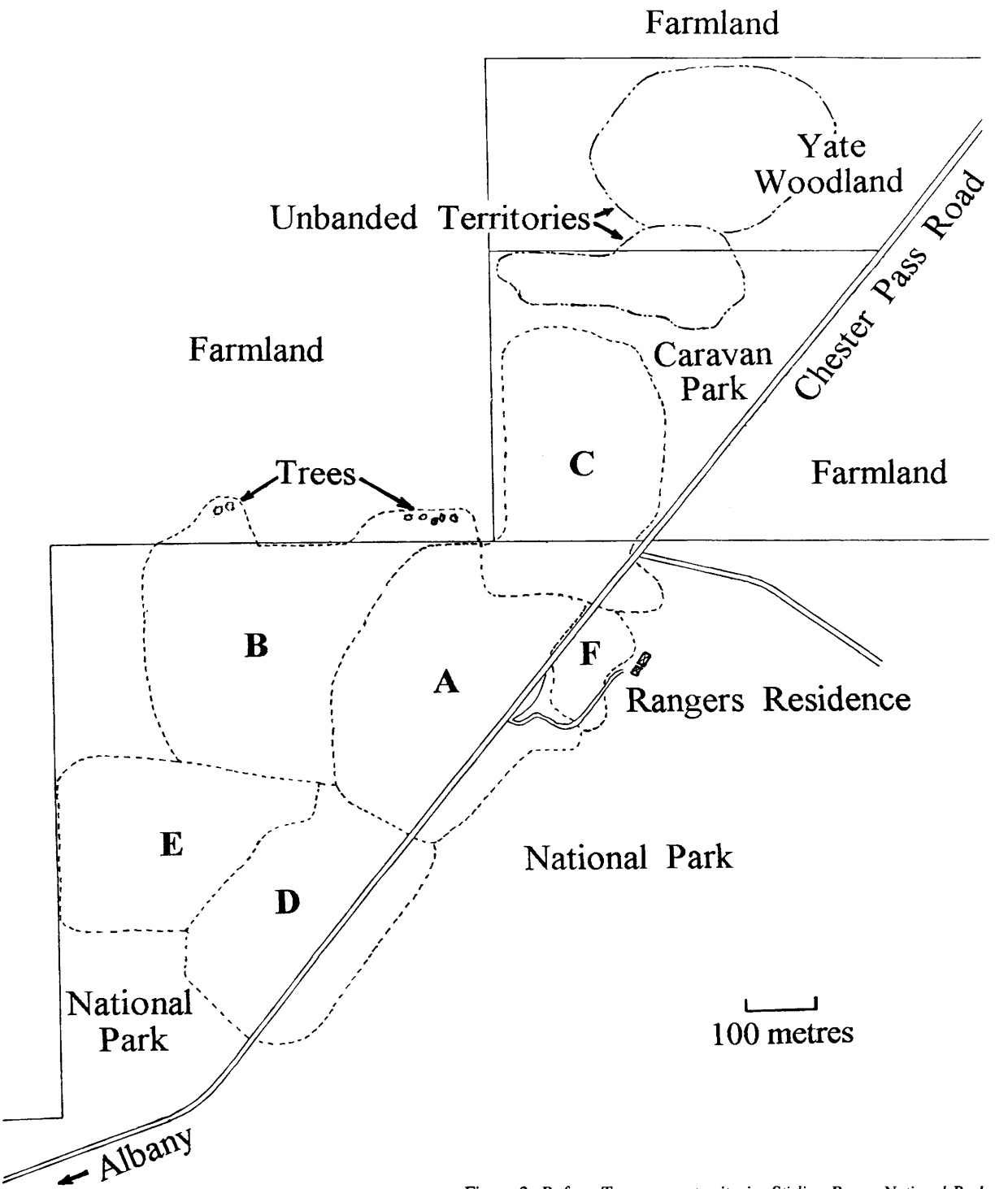

Figure 2. *Rufous Treecreeper territories Stirling Range National Park.*

newly hatched young difficult, and at times impossible, to see. If the hollow in which the nest was placed was too deep, bark strips were jammed into the hollow at the desired depth. Harrison (1969) also found that *Climacteris* spp. appear to have this as a specialized nest-building habit, i.e. building up the cavity in which the nest is placed.

Copulation was seen twice only, and only between members of territory C on 11 December 1992. RB ♂ and RU♀ were seen facing each other, 10–15 cm apart, on a large log. Both birds were flicking their wings quickly and moving around on the log. The male had, in its beak, either food or a small stick, which he dropped after some 10 seconds. The male came closer to the female, both still flicking wings, lifted his head up, then mounted the female. The procedure was repeated within 1 to 2 minutes.

Only the female incubated the eggs, 1 (n = 1) to 2 (n = 5) per clutch. Incubation was for 17 days (n = 2) and the nestling period 28 days (n = 2). Incubation and nestling period for the similar Brown Treecreeper is one and two days shorter respectively (Noske 1991). PU was in her first year of age when she laid one egg only for her first clutch. Her second and last clutch for that breeding season consisted of two eggs.

The breeding male fed the incubating female at the hollow entrance and away from the nest. The female also searched for food on trees and the ground for short periods during incubation. Juveniles from the previous brood assisted in feeding juveniles of the next brood, both at the nest and after fledging, but did not feed the brooding female.

The period for a breeding female between young fledging from one brood to eggs being laid of the next brood may be as short as seven days. Young from RR's first brood fledged between 26 and 29 September 1992 and 51–56 days later her second brood fledged from the same nest hollow. Allowing 44 days from egg laying to fledging, this leaves 7–12 days between broods.

For up to five days after fledging, hollow logs and, to a lesser extent large tree hollows, were important refuges for fledged young which did not venture far from these hollows. On many occasions I witnessed fledged young take refuge in hollows after alarm calls were made by Yellow-plumed Honeyeaters *Lichenostomus ornatus*. Older birds feeding fledged young would fly into the hollow enticing the recently fledged young into the hollow and not feeding them until they were in the hollow. Fledged young did not shelter together in hollows, preferring to shelter in separate hollows (n = 10). On one occasion after banding two recently fledged young, I placed both in the same hollow log; one bird was seen shortly after in another hollow log 15 m away.

DISCUSSION

RR was the only female to have had three broods in a breeding season. This was only possible when nesting started at the beginning of the breeding season and if the same nest was used for the entire breeding season. Although Readers Digest (1976) states that clutches consist of one, two and three eggs, two eggs per clutch was the maximum number seen in this study (n = 5).

Subordinate males occupied some territories within the territories of the breeding males, but no subordinate females were seen in any of the studied territories. However, the two juveniles that stayed the longest in their natal territory, (YR 262 days and PR 188 days) were both females. On one occasion the subordinate male YD (territory D) was seen feeding a juvenile male BP in the neighbouring territory E. The subordinate male RP in territory A, moved between territories A and B during most of this survey. Noske (1991) found that breeding and non-breeding Brown Treecreepers attended two nests in different territories on the same day.

It is clear from this study that Rufous Treecreepers have a requirement for hollows for breeding purposes and probably also for roosting. Noske (1985) found the Brown and Red-browed Treecreeper required tree holes for roosting and nesting. The requirement of tree hollows for both nesting and roosting, may be part of the explanation for why the Rufous Treecreeper has disappeared from the wheatbelt region of Western Australia (Perry de Rebeira, pers. comm.) where small natural bush reserves, with suitable foraging habitat but few hollows are all that remain. In addition, it appears that young birds cannot remain indefinitely on their natal territories and as areas of suitable habitat are widely separated, it is likely that many dispersing birds die before they are able to find suitable habitat.

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CHANGES IN THE ABUNDANCE OF SILVEREYES IN A CENTRAL VICTORIAN VINEYARD DURING THE GRAPE RIPENING PERIOD

THOMAS C. BURTON

Division of Biological and Chemical Science, La Trobe University, Bendigo, P.O. Box 199, Bendigo, Victoria 3550

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Population parameters of Silvereyes in Chateau Leamon, a vineyard in central Victoria, were estimated on the basis of capture-recapture methods employed during the grape ripening seasons 1988–1993, using the Jolly-Seber model, the Peterson model and a model of Seber. In the context of low survival rates, results from the Jolly-Seber model were erratic, and as short seasons yielded few data, the Jolly-Seber model was too wasteful. Populations generally rose during a season, despite the loss of many Silvereyes from the population, indicating that birds moved into the vineyard during the season. Annual survival rates were very low (mean 25% p.a.). The Tasmanian subspecies typically arrived between late March and early April, and formed up to 26% of the total Silvereye population. Few Silvereyes banded in the vineyard were recovered elsewhere.

INTRODUCTION

The Silvereye *Zosterops lateralis* is one of several bird species known to cause damage to soft fruits (Rooke 1984). Between 1988 and 1993, as part of a larger study of bird damage to grapes in the Central Victorian region, I studied the population dynamics of the Silvereye in one vineyard, Chateau Leamon, at Big Hill near Bendigo, using a trapping-retrapping method.

The subspecies of Silvereye that predominates and breeds in Central Victoria is *Zosterops l. halmaturina* (Simpson and Day 1989). However,