

Ecological adaptations for Large-billed, Yellow-throated and White-browed Scrubwrens

Robert McDonald
1/97 Decora Crescent, Warabrook

Large-billed Scrubwren, *Sericornis magnirostris*, White-browed Scrubwren, *S. frontalis*, and Yellow-throated Scrubwren, *S. citreogularis*, inhabit the same geographical range but do not appear to compete directly with each other. This led to the following hypotheses: firstly White-browed Scrubwrens will differ from Yellow-throated Scrubwrens in the type of vegetation they forage in; and secondly Large-billed Scrubwrens will differ from both Yellow-throated and White-browed Scrubwrens in their use of different foraging heights. Observations indicated that the foraging area of White-browed Scrubwren was significantly different to that of the Yellow-throated Scrubwren in the main type of vegetation used with White-browed using the edge vegetation along the roads (mainly exotic species) and Yellow-throated using the denser rainforest vegetation. The Large-billed Scrubwren was found to forage in a different layer of the forest (foraging mainly in the mid-storey) to that of both White-browed Scrubwrens and Yellow-throated Scrubwrens (which both forage mainly in the undergrowth). It was concluded that the three species of scrubwren have evolved different foraging adaptations to avoid competing with each other in the same geographical area.

INTRODUCTION

Three species of scrubwren in New South Wales often inhabit the same geographical range and habitat (Morcombe 2001). They are Large-billed, *Sericornis magnirostris*, White-browed, *S. frontalis*, and Yellow-throated Scrubwren, *S. citreogularis*. All are members of the Maluridae family, Order Passeriformes (Harrison 1978), and quite often inhabit areas in and around rainforest. They are not known to be difficult to observe and are generally active for most of the day (Christidis *et al.* 1988). They are active because their high metabolism requires them to feed continuously. In addition, they live in cool areas (rainforest) and do not need to reduce their activity during the hotter middle part of the day (Christidis *et al.* 1988).

Large-billed Scrubwrens are common rainforest birds, generally occurring in moist gullies in eucalypt forests (Morcombe 2001). They range throughout the east coast of Australia, along and to the east of the Great Dividing Range, up to an altitude of 1500m (Higgins & Peter 2002). Three subspecies have been described. The subspecies observed during this study, *magnirostris*, occurs from southeast Queensland, along the New South Wales coast and ranges to northeast Victoria, (Higgins & Peter 2002). Large-billed Scrubwrens tend to feed in the mid levels of the vegetation

(mid-storey) and are thus completely different to other species of scrubwren in the foraging zones (Christidis *et al.* 1988). Large-billed Scrubwrens feed mainly on insects, but will occasionally take fruit (Higgins & Peter 2002).

White-browed Scrubwrens are extremely common generalists in forest habitats occurring almost anywhere there is a dense under-storey with water not far away, but they tend not to frequent the densest parts of rainforests (Morcombe 2001). They range across most of the east coast of Australia, occurring in the ranges and the low lands along the Great Dividing Range, across the south coast of Australia and on the west coast as far north as Shark Bay (Higgins & Peter 2002). Four subspecies have been described. The subspecies observed for this study, *frontalis*, occurs from northeast New South Wales to southeast South Australia (Higgins & Peter 2002). White-browed Scrubwrens tend to feed in the under-storey and, occasionally, on the ground using both introduced and native vegetation (Christidis *et al.* 1988). White-browed Scrubwrens feed mainly on insects but will occasionally take fruit (Higgins & Peter 2002). Yellow-throated Scrubwrens are common rainforest birds, which can also inhabit wet gullies in eucalypt forests (Morcombe 2001). They range along the coast and ranges of eastern Australia

generally along and east of the Great Dividing Range (Higgins & Peter 2002). Two subspecies have been described. The subspecies observed for this study, *citreogularis*, occurs along the east coast of New South Wales to southeast Queensland (Higgins & Peter 2002). Yellow-throated Scrubwrens tend to feed on the ground in leaf litter, bare dirt or occasionally in low shrubs, generally preferring native vegetation (Christidis *et al.* 1988). Yellow-throated Scrubwrens feed mainly on insects but will occasionally take fruit (Higgins & Peter 2002).

For these three species to have evolved in the same area niche partitioning probably occurred to reduce competition with each other (Joseph & Moritz 1993). The aim of this report is to investigate adaptive differences in their foraging locations regarding the vegetation types and structures in which they forage. This led to the following two hypotheses: the White-browed Scrubwren will differ from the Yellow-throated Scrubwren in the type of vegetation it forages in; the Large-billed Scrubwren will differ from both Yellow-throated and White-browed Scrubwrens in their use of different foraging heights.

METHODS

To determine which behaviours to use in testing the two hypotheses an ethogram of the three species behaviours was conducted (Table 1), and to determine the appropriate time frame for the hypotheses tested a time budget was produced (Table 2). A plant field guide (Robinson 1994) was used to distinguish the difference between rainforest and non-rainforest vegetation and a plant expert (Chris MacLean pers. comm.) assisted in the field. Non-rainforest vegetation was observed only in disturbed areas along roads and on edges of rainforest that were mainly composed of non-native vegetation.

To test the two hypotheses three distinct locations were chosen with enough distance between them to ensure that, although all three species of scrubwren occurred in close proximity, they were separate populations. All locations were along the upper Allyn River, Barrington Tops. One location was along Peach Tree Walk on the eastern side of the river, another was through the gate at the northern end of the road on the west side of the river at White Rock Campsite and a third location was south from the gate along the road on the west side of the river. At each site four individual birds of each species of scrubwren were observed for a continuous five minutes and all foraging behaviour was recorded.

To avoid disturbance silence was maintained at all times and binoculars were used for observation. At the

time of observation, autumn 2006, the birds were active most of the day but particularly because of the overcast weather conditions, as this means it does not get too hot for the birds so they stay active. This allowed observations to be carried out between 9 and 11am on three consecutive days, 24th-26th March 2006, observing on only one day at each of the three sites. Individual birds were observed for five minutes recording (presence, percent time per foraging behaviour) behaviour at one minute intervals. Only the behaviours that involved foraging, (i.e. procuring and eating food) were recorded because they were required to compare the different foraging heights and vegetation used.

Bivariate correlation was used to compare the types/heights of vegetation foraged in by the scrubwren species. The correlation between Large-billed and Yellow-throated compared percent time spent at different foraging heights and this was the same between Large-billed and White-browed. The comparison between Yellow-throated and White-browed was in their preferred vegetation type for foraging.

RESULTS

The ethogram describes a variety of different activities (Table 1), which were categorized to construct the time budget (Table 2). A five minute observation period with one minute intervals is enough time to gather significant amount of data.

Large-billed Scrubwrens prefer to forage in the mid-storey of rainforest vegetation (Table 3).

Compared to the White-browed Scrubwrens that tend to forage in understorey and low shrubs of non-rainforest vegetation (Table 3), Yellow-throated Scrubwrens prefer to forage on the ground or in the understorey of rainforest vegetation (Table 3). Differences in the three species' foraging areas are shown in Figure 1.

There was a difference between the types of vegetation used for foraging between Yellow-throated and White-browed Scrubwrens. Yellow-throated Scrubwrens tend to use typical rainforest vegetation compared to the more disturbed, non-rainforest vegetation preferred by White-browed Scrubwrens. This result was supported by the strong negative correlation of the percent time

spent in the type of vegetation used for foraging by these two species (**Table 4**).

Results show that Large-billed Scrubwrens usually forage in the mid-storey of rainforest, occasionally using low shrubs (**Table 3**). This was

shown to be significantly different from the other two scrubwrens that prefer to use low shrubs, under-storey and the ground for foraging. This result was supported by strong negative correlations of percent time spent at different foraging heights (**Table 4**).

Table 1. Ethogram for three species of scrubwrens and their different behaviours.

Behavioural category	Behavioural definition and description
Preening	Sitting either on the ground or in vegetation cleaning feathers.
Roosting	Sitting inactive either on the ground or in vegetation.
Flying	Moving through the air with wings beating.
Feeding	Sitting on the ground or in vegetation consuming food collected while foraging.
Foraging on ground	Searching for food on the ground i.e. in leaf litter or in mud.
Foraging in understorey in rainforest vegetation	Searching for food in low understorey less than 50cm in height, in rainforest.
Foraging in understorey in non-rainforest vegetation	Searching for food in low understorey less than 50cm in height, in non-rainforest.
Foraging in low shrub in rainforest vegetation	Searching for food in low shrub and vines greater than 50cm in height to 2m in height, in rainforest.
Foraging in low shrub in non-rainforest vegetation	Searching for food in low shrub and vines greater than 50cm in height to 2m in height, in non-rainforest.
Foraging in mid-storey	Searching for food in mid-storey greater than 2m in height and less than 10m in height.

Table 2. Time budget for each scrubwren over a 20 minute period.

Category	Large-billed Scrubwren	White-browed Scrubwren	Yellow-throated Scrubwren
No. of 5 minute observation periods	4	4	4
No. of individuals observed	4	4	4
Total minutes of observation	20	20	20
Percent time preening	6.7	0	0
Percent time roosting	9.2	6.7	5.8
Percent time flying	7.5	3.3	0
Percent time feeding	12.5	15.0	13.3
Percent time foraging on ground	0	10	32.5
Percent time foraging in understorey in rainforest vegetation	0	5.8	37.5
Percent time foraging in understorey in non-rainforest vegetation	0	40	0
Percent time foraging in low shrub in rainforest vegetation	0	0	10.8
Percent time foraging in low shrub in non-rainforest vegetation	2.5	19.2	0
Percent time foraging in mid-storey	61.7	0	0

Table 3. Percentage of time spent foraging by each scrubwren.

Category	Large-billed Scrubwren	White-browed Scrubwren	Yellow-throated Scrubwren
No. of 5 minute observation periods	12	12	12
No. of individuals observed	15	15	15
Total minutes of observation	60	60	60
Percent time foraging on ground	0	14.5	46.7
Percent time foraging in understorey in rainforest vegetation	0	10.8	34.4
Percent time foraging in understorey in non-rainforest vegetation	0	38.6	7.8
Percent time foraging in low shrub in rainforest vegetation	4.8	1.2	11.1
Percent time foraging in low shrub in non-rainforest vegetation	0	34.9	0
Percent time foraging in mid-storey	95.2	0	0

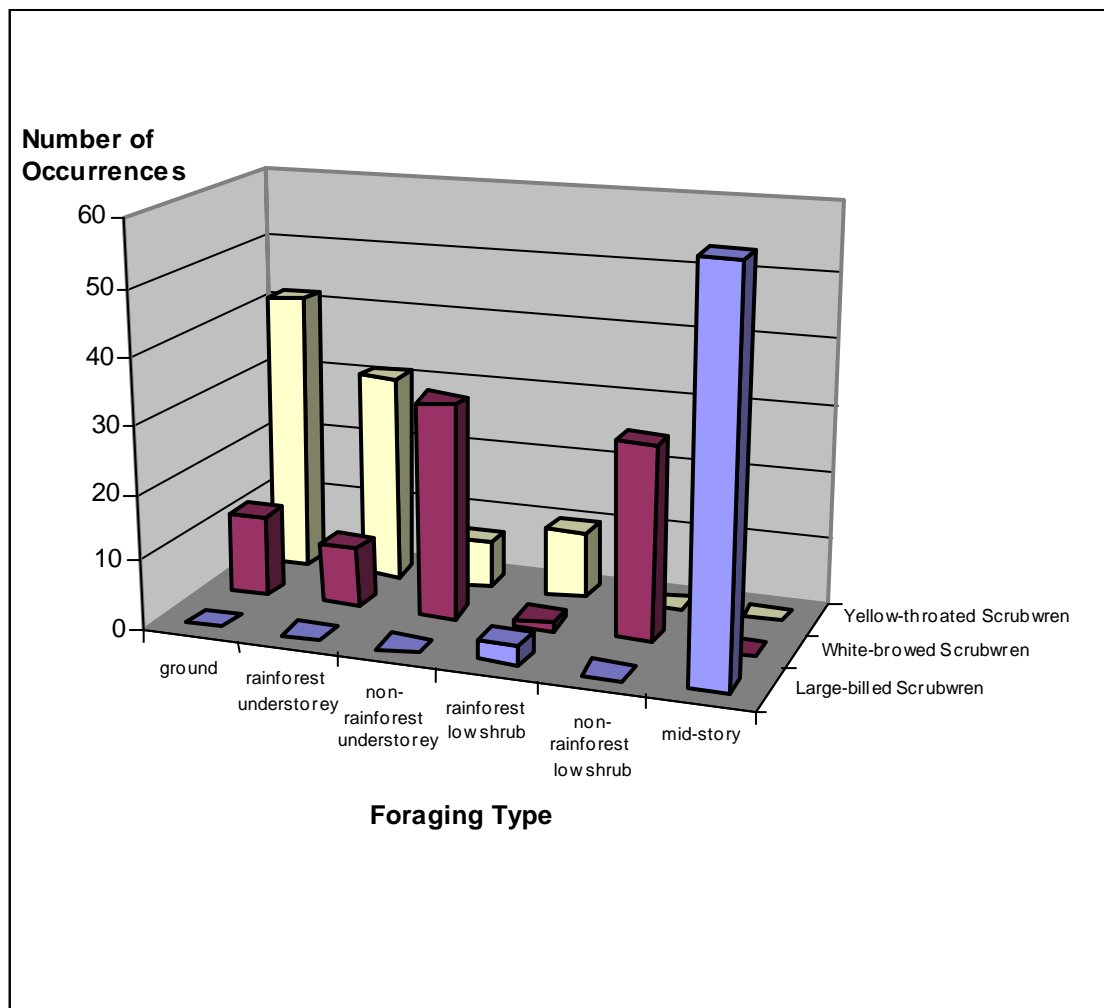


Figure 1. Number of times a different foraging area was used by Large-billed, White-browed and Yellow-throated Scrubwrens.

Table 4. Correlation between % time at foraging height for Large-billed and White-browed and for Large-billed and Yellow-throated. For White-browed and Yellow-throated the correlation is between % time in rainforest and non-rainforest vegetation. Two degrees of freedom was used.

Species 1	Species 2	Correlation
Large-billed Scrubwren	White-browed Scrubwren	-0.7573
Large-billed Scrubwren	Yellow-throated Scrubwren	-0.7519
White-browed Scrubwren	Yellow-throated Scrubwren	-0.6187

DISCUSSION

White-browed Scrubwrens were observed to forage in non-rainforest vegetation whereas Yellow-throated Scrubwrens showed a tendency to forage in rainforest vegetation and on the ground below. The first hypothesis, that White-browed Scrubwrens will differ from Yellow-throated Scrubwrens in the type of vegetation they forage in, was supported. It would be interesting to see more detail about the floristics of the different vegetation types, so that if this study is repeated in other parts of the species' range (see below), comparisons can be made regarding regional habitat preferences.

Large-billed Scrubwrens were observed to forage in the mid-storey of rainforest vegetation which is significantly different behaviour to both White-browed and Yellow-throated Scrubwrens which both forage in the under-storey or on the ground. These results supported the second hypothesis, that Large-billed Scrubwrens differ from both Yellow-throated and White-browed Scrubwrens in their use of different foraging heights.

These results suggest that Yellow-throated, Large-billed and White-browed Scrubwrens could have co-evolved without the necessity of geographical separation (Higgins & Peter 2002). The three species may have been in direct competition for food if the Large-billed Scrubwren had not adapted to feeding higher in the vegetation (Christidis *et al.* 1988), and if the White-browed Scrubwren had not adapted to feeding in habitats with dense ground cover adjacent to, but not within, rainforest (Joseph & Moritz 1993). Yellow-throated Scrubwrens exist in the rainforest by foraging in low vegetation and on the ground, without direct competition from the other scrubwrens (Joseph & Moritz 1993).

Observations for this project were carried out in the non-breeding season and, the birds were not very vocal. Therefore, the birds were often difficult to locate. All three days spent in the field were overcast, which allowed the birds to be active in the middle of the day, but they were quiet early in the morning. Because bird behaviour may change during different seasons and thus change the results (Joseph & Moritz 1993), data collection should be repeated in winter, spring and summer. This project also should be expanded to cover a wider geographic range where the three scrubwren species co-occur, to test whether the results can be generalized to other parts of the species' shared range (Christidis *et al.* 1988). Data could also be collected in similar habitats, but in locations where the species don't all co-occur. Niche expansion may then be demonstrated in one or more of the species (Christidis *et al.* 1988).

CONCLUSIONS

Observations indicate that Large-billed Scrubwrens are rainforest mid-storey specialists, White-browed Scrubwrens are non-rainforest ground and under-storey specialists and Yellow-throated Scrubwrens are rainforest ground and under-storey specialists (**Figure 1**). Thus, although the three species of scrubwrens occupy similar geographic areas they mostly forage at different heights within the same vegetation type or forage at similar heights but in different vegetation types, thereby avoiding direct competition for food resources.

REFERENCES

- Christidis, L., Schodde, R. and Baverstock, P. R. (1988). Genetic and morphological differentiation and phylogeny in the Australo-papuan scrubwrens Sericornis, Acanthizidae. *Auk* **105**: 616–629.
- Harrison, C.J. (1978). 'Bird Families of the World'. (Harry N. Abrams Inc: New York.)
- Higgins, P. J. and Peter, J. M. (2002). 'Handbook of Australian, New Zealand and Antarctic Birds Volume 6'. (Oxford University Press: South Melbourne VIC.)
- Joseph, L. and Moritz, C. (1993). Phylogeny and historical aspects of the ecology of eastern Australian scrubwrens Sericornis spp. evidence from mitochondrial DNA. *Mol. Ecol.* **2**: 161–170.
- Morcombe, M. (2001). 'Field Guide to Australian Birds'. (Steven Parish Publishing Pty Ltd: Archerfield QLD.)
- Robinson, L. (1994). 'Native Plants of Sydney'. (Kangaroo Press: East Roseville NSW.)