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FORAGING ECOLOGY AND HABITAT USE OF THE SWIFT PARROT ON THE SOUTH-WESTERN SLOPES OF NEW SOUTH WALES

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The foraging ecology and habitat use of the Swift Parrot *Lathamus discolor* was investigated in the south-western slopes region of New South Wales in May 1999. An extensive search of known and potential habitats was conducted in the study area.

A total of six Swift Parrot sites was located during the study period, all of which were in open forest and woodland dominated by Mugga Ironbark *Eucalyptus sideroxylon* or Mugga Ironbark-Grey Box *E. microcarpa* association. Both eucalypt species were used by Swift Parrots for foraging resources. Swift Parrots were mainly observed foraging on the nectar of Mugga Ironbarks. They also foraged on other carbohydrates on Grey Box. Swift Parrots foraged in the largest trees in the landscape. Swift Parrot records from the study area in other years indicate that woodlands dominated by White Box *E. albens* are also of importance.

The Swift Parrot is capable of locating small patches of suitable habitat in a highly fragmented landscape. A significant proportion of the non-breeding Swift Parrot population is reliant on the south-western slopes of New South Wales in some years. The results here demonstrate that appropriate management of Mugga Ironbark-Grey Box communities is a priority for Swift Parrot conservation in this region but further work is needed to ascertain the possible importance of other vegetation communities such as White Box woodland.

INTRODUCTION

The Swift Parrot is a nationally endangered species (Brereton 1998), which breeds in Tasmania before migrating to the Australian mainland in autumn. The Swift Parrot is predominantly a nectarivore and is attracted to areas of extensive eucalypt flowering or abundant production of carbohydrate-rich resources such as lerp and honeydew. Abundant food resources exist in the box-ironbark forests and woodlands in the cooler months of the year, as several species of eucalypt come into flower at this time (McGoldrick and Mac Nally 1998; Wilson and Bennett 1999). As a result, the inland slopes of the Great Dividing Range in Victoria and New South Wales support a large percentage of the wintering Swift Parrot population (Tzaros and Davidson 1996; Tzaros 1997; Tzaros 1998).

The national Recovery Plan for the Swift Parrot outlined the need for more information on foraging ecology and habitat use (Brereton 1996). A study on the foraging ecology of the species commenced in the Victorian box-ironbark region in July 1997 and continued in 1998 and 1999. This study found that Swift Parrots foraged in box-ironbark woodlands with a higher number of medium-sized (Diameter at Breast Height Over Bark 40–60 cm) and large trees (Diameter at Breast Height Over Bark 60 cm or more) and a higher level of flowering than randomly chosen sites (Kennedy and Tzaros, in prep.). Swift Parrots were also found to select larger trees within foraging sites (Kennedy and Tzaros, in prep.).

A study was required to determine the distribution and resource use of the species on the New South Wales south-western slopes. Box-ironbark forests and woodlands are considered to be one of the principal habitat types for wintering Swift Parrots in New South Wales. Other important habitat types are the Swamp Mahogany *Eucalyptus robusta* forests on poorly drained sites on the coast, and open forest dominated by Spotted Gum *Corymbia maculata* which occurs on the coastal foothills (Kennedy 2000).

The south-western slopes of New South Wales are extensively cleared, with relatively small, highly fragmented patches remaining in a predominantly agricultural landscape (Fig. 1). Larger areas of open forest and woodland exist on ranges and outcrops that are unsuitable for agriculture and winter-flowering box and ironbark stands often occur only as pockets in blocks dominated by other habitats. A number of State Forests in the study area have had most or all ironbark and box eucalypts removed to enable the production of cypress-pine for commercial use in the 1940s and 1950s (A. Deane, pers. comm., pers. obs.).

The objective of this study was to investigate habitat characteristics, foraging behaviour and bird community structure at Swift Parrot foraging sites in box-ironbark woodlands of the New South Wales south-western slopes.

STUDY AREA AND METHODS

The study area encompassed the box-ironbark forests and woodlands of the inland slopes of southern and central New South Wales (Fig. 1), which is characterized by a relatively low altitude (200 m–500 m asl for vegetation types relevant to this study) and a rainfall of between 400 and 600 millimetres per year. The vegetation was largely open

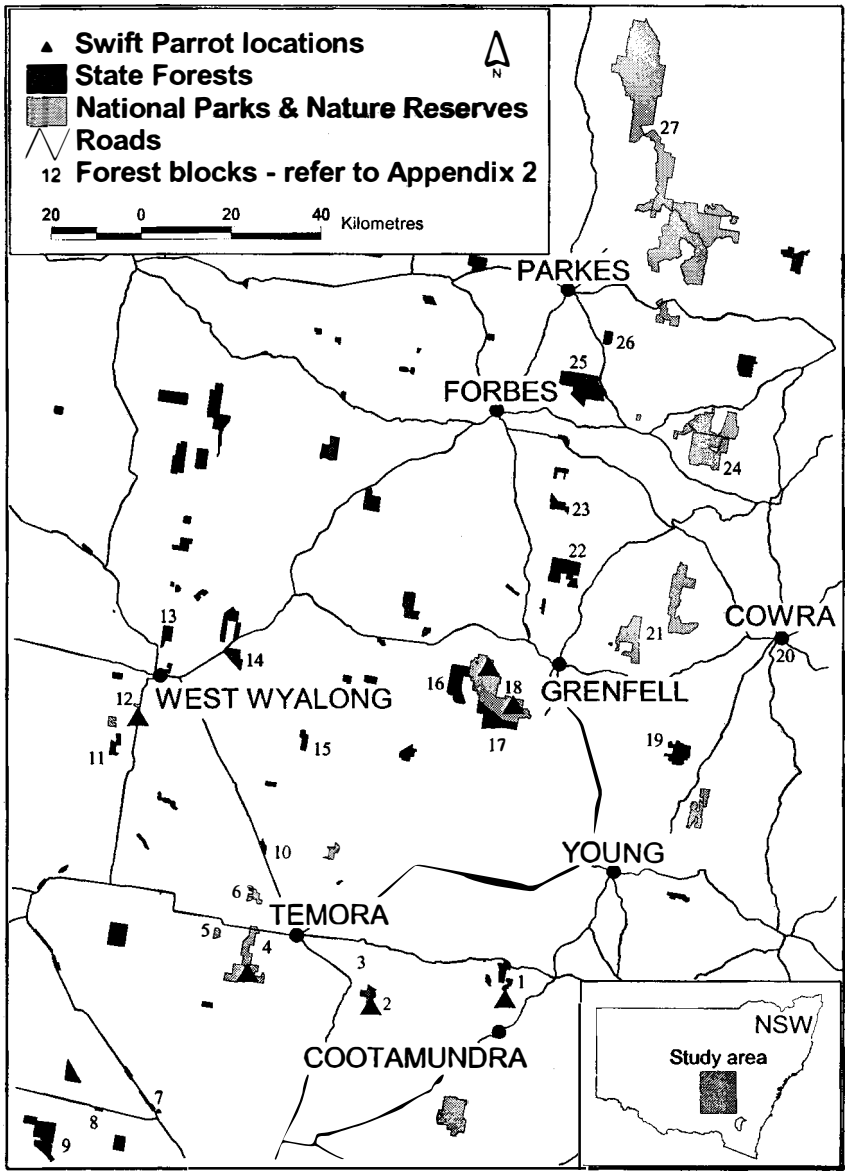

Figure 1. *Study area and locations of Swift Parrot sightings.*

forest and woodland and the dominant eucalypts were Mugga Ironbark *Eucalyptus sideroxylon*, Grey Box *E. microcarpa*, White Box *E. albens* and Red Stringybark *E. macrorhyncha*. Twenty-seven public forest blocks supporting box-ironbark and box woodland habitats within the study area were surveyed for Swift Parrots in May 1999 (Appendix 1). See Figure 1 for approximate size and location of the forest blocks in the context of the study area. A winter survey for Swift Parrots on the Australian mainland has been conducted annually since 1995 (Tzaros 1998) and these surveys have provided most of the information used as a basis for selection of the sites studied here. Most locations of Swift Parrot records as reported by volunteers or in the Atlas of New South Wales Wildlife were investigated (NSW NPWS). The study area also encompassed forest blocks within the region with no previous Swift Parrot records. Information regarding forest and woodland type was gained from a number of sources (S. Campbell, pers. comm.; A. Deane, pers. comm.; P. Myler, pers. comm.). Woodlands managed for production of White Cypress-pine *Callitris glaucophylla* were generally avoided where few or no eucalypts remained. The topography at each site was arbitrarily categorized as a ridge, midslope, drainage line or a flat.

Study plots

The Swift Parrot has a distinctive 'clinking' call that can be heard above the engine noise of a slowly moving vehicle. We drove slowly through each forest block, listening for calls and stopping regularly. If a Swift Parrot was heard, or an area supported large numbers of nectar or lerp feeding birds, we would leave the vehicle and attempt to locate Swift Parrots. When Swift Parrots were found, they were observed until a foraging manoeuvre by an individual bird was observed. The tree in which the first Swift Parrot was observed foraging was designated as the central point for a bird census at the site. This tree was also the starting point for measurement of tree size distribution and flowering intensity. A rectangular plot (0.1 ha) was established at each site to sample tree species composition, tree size distribution and flowering intensity. The plot began at the centre tree, and the orientation of the plot from the centre tree was selected using a random number table. The Diameter at Breast Height Over Bark (DBHOB), species and flowering intensity of every tree in the 0.1 hectare plot was recorded.

Foraging observations

At foraging sites, a single-point observation was made for each individual foraging Swift Parrot encountered. The type of food taken (e.g. nectar, lerp), tree species and DBHOB were recorded to determine food resource use and whether Swift Parrots exhibit a preference for the largest trees present.

Bird censuses

One 10-minute bird census was carried out over 0.8 hectares at each foraging site. All birds seen or heard within the census area were recorded and their abundance was recorded. Birds flying over or through the transect were not included in the analysis. Birds that were initially observed in the air and later alighted in the census area were included in the census.

Tree size distribution

The availability of stems in each size class in forest patches was sampled by measuring the diameter of all stems greater than 10 centimetres DBHOB on the 0.1 hectare tree study plot. The stems were placed into size class categories (very small: 10–19 cm DBHOB, small: 20–39 cm DBHOB, medium: 40–59 cm DBHOB, large: 60 cm + DBHOB) for analysis. The use of different tree size categories by Swift Parrots for foraging was then compared with tree availability using Chi-squared analysis (Zar 1984).

Flowering frequency

The frequency of flowering of trees in each tree size class was assessed to determine whether tree size had an effect on the likelihood of flowering. Flowering frequency (percentage of trees in flower in each size class) was chosen as a unit for measurement of the influence of tree size on magnitude of flowering. A categorical scale for flowering intensity was recorded but is not analysed here as a similar value for flowering intensity was obtained for most trees. The relationship between DBHOB and the percentage of trees in flower was determined by using Chi-squared analysis (Zar 1984).

It should be noted that the diameter of each stem (a 'stem' being a separate trunk of a coppice tree) was measured on the study plots, but only one flowering value was obtained for each tree, which may have had several stems. This flowering value was assigned to the largest stem of the tree for analysis.

RESULTS

Swift Parrots were recorded foraging at six locations in four forest blocks (Table 1). Approximately 150 Swift Parrots were located during the study. The birds were located in Combaning State Forest, Charcoal Tank Nature Reserve, Ingalba Nature Reserve, and Weddin Mountains National Park, with additional records in Jindalee State Forest where no foraging was observed (Fig. 1).

Description of forest blocks where Swift Parrots were observed

Combaning State Forest (741 ha)

This forest is predominantly a Mugga Ironbark-Grey Box open forest, with ridges supporting cypress-pine, Red Stringybark and White Gum *Eucalyptus rossii*. This forest supported the largest number of Swift Parrots found in the study, with at least 70 thought to be present. The birds were largely in the southern part of the forest, in Mugga Ironbark-Grey Box communities. There are no previous records from this forest. Large numbers of birds were observed flying south in the early evening, presumably to a roost. The roost was not located and was suspected to be outside the State Forest boundary.

Ingalba Nature Reserve (3 200 ha)

About 30 Swift Parrots were present in Mugga Ironbark-Grey Box-Black Cypress-pine *Callitris endlicheri* habitat in the southern section of the reserve. This part of Ingalba Nature Reserve has a number of Swift Parrot records dating back to the 1960s (NSW NPWS Wildlife Atlas database).

Charcoal Tank Nature Reserve (86 ha)

About 30 Swift Parrots were present in this Reserve, about 60 hectares of which is Mugga Ironbark-Grey Box habitat. This was the third annual visit in four years by Swift Parrots. The regularity of usage at this small, isolated remnant by Swift Parrots provides evidence that the species displays some site fidelity.

Weddin Mountains National Park (8 360 ha)

More than 20 Swift Parrots were present here at the time of the study and 80 were reported in early June 1999 (Richard Allen, pers. comm.). The lower slopes of the Weddin Mountains, particularly on the eastern side, support communities of Mugga Ironbark and Grey Box and stands of White Box. There is a particularly large area of Mugga Ironbark-Grey Box habitat on the northern slopes of Black

TABLE 1

Vegetation associations at Swift Parrot foraging sites, and the tree species used by the birds for foraging at these sites.

Foraging Sites	Grid References Easting	Northing	Tree species association*	Tree species used by Swift Parrots
Combaning State Forest	565280	6175909	Mugga Ironbark/Grey Box	Mugga Ironbark/Grey Box
Combaning State Forest	566628	6174858	Mugga Ironbark/Grey Box	Mugga Ironbark/Grey Box
Charcoal Tank Nature Reserve	514074	6239858	Mugga Ironbark/Grey Box	Grey Box
Ingalba Nature Reserve	537974	6183619	Mugga Ironbark/Grey Box/Red Stringybark	Mugga Ironbark/Grey Box
Weddin Mountains National Park	592700	6248835	Mugga Ironbark	Mugga Ironbark
Weddin Mountains National Park	597877	6240636	Mugga Ironbark/Grey Box/White Box	Mugga Ironbark/Grey Box
Incidental records				
Jindalee State Forest (West block)	596796	6177048		
Jindalee State Forest (East block)	594276	6177955		
Combaning State Forest	565305	6175680		

* Mugga Ironbark *E. sideroxylon*, Grey Box *E. microcarpa*, Red Stringybark *E. macrorhyncha*, White Box *E. albens*.

Springs Mountain in the southern part of the National Park and one foraging site was in this area.

Swift Parrots seen at the northern end of the Park were observed flying along a well-treed habitat corridor, which passes through agricultural land. Swift Parrots visited the foraging site at the northern end of the Park in 1998 and this area was also the location of the 80 birds seen in June 1999. Two State Forests, covering about 1 500 hectares, adjoin this National Park but were found to be managed primarily to produce cypress-pine and were therefore considered likely to be unsuitable for Swift Parrots.

Jindalee State Forest (1 080 ha)

A small number of Swift Parrots were found here. No foraging observations were made despite considerable searching for foraging birds. This forest, which is divided into two separate blocks, consists primarily of Mugga Ironbark-Grey Box open forest, and features some of the largest ironbarks (1.2–1.6 m DBHOB) remaining on public land anywhere in the box-ironbark forests and woodlands of south-eastern Australia (Kennedy, pers. obs.).

Foraging ecology and habitat characteristics

Mugga Ironbark and Grey Box were the dominant eucalypts at foraging sites. Mugga Ironbark was present at all six foraging sites, and Grey Box was present at five sites. Single White Box and Red Stringybark trees occurred at one site each (Table 1).

Large trees (60 cm + DBHOB) were scarce at foraging sites and most stems (88.5%) were less than 40 centimetres DBHOB (Fig. 2). Swift Parrots actively selected larger trees within foraging patches, utilizing trees in larger size categories more often than expected on the basis of the abundance of such trees ($\chi^2 = 55.6$, df = 3, $p < 0.01$) (Fig. 2). The mean DBHOB of trees used by Swift Parrots for foraging (40 cm DBHOB) was significantly greater than the mean DBHOB for trees available on the 0.1 hectare plots at foraging sites (25 cm DBHOB) (Table 2).

Mugga Ironbark was the only species observed flowering and this event was widespread with Mugga Ironbarks in flower at all six foraging sites. Tree size did not appear to affect flowering frequency, as there was no significant difference in flowering frequency between the <40 centimetres and ≥40 centimetres DBHOB categories ($\chi^2 = 0.05$, df = 1, $p > 0.05$) (Fig. 3).

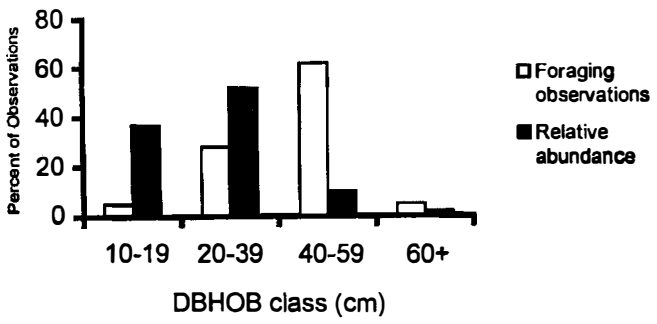

Figure 2. *Distribution of Swift Parrot foraging observations in tree size classes, and the relative abundance of stems in each size class. (DBHOB = Diameter at Breast Height Over Bark).*

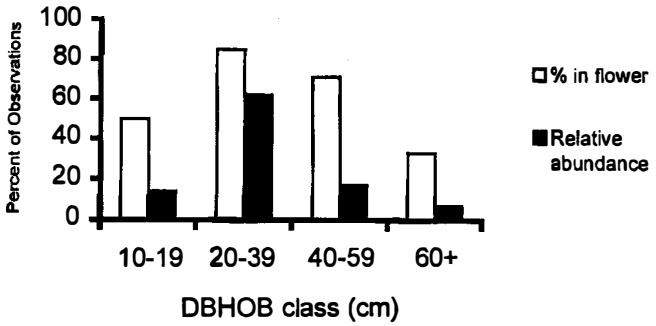

Figure 3. *Percentage of Mugga Ironbarks in flower at foraging sites in each size class.*

Swift Parrots were observed foraging on both Mugga Ironbark and Grey Box at four foraging sites (Table 1). Of the 40 foraging observations of Swift Parrots, 24 were of nectar-feeding on Mugga Ironbark, 15 were of gleaning on Grey Box leaves and one was of gleaning on Mugga Ironbark leaves (Fig. 4).

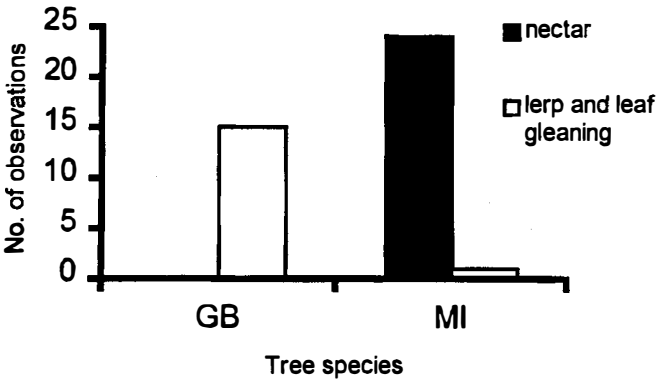

Figure 4. *Food resources used by the Swift Parrot at foraging sites (GB = Grey Box, MI = Mugga Ironbark).*

A total of 33 other bird species was recorded at Swift Parrot foraging sites (Appendix 2). The Dusky Woodswallow *Artamus cyanopterus* was the only species to occur at all sites. Species that occurred on at least three sites were the Noisy Friarbird *Philemon corniculatus*, Little Friarbird *P. citreogularis*, Red Wattlebird *Anthochaera carunculata*, White-plumed Honeyeater *Lichenostomus penicillatus*, Fuscous Honeyeater *L. fuscus*, Brown-headed Honeyeater *Melithreptus brevirostris*, Black-chinned Honeyeater *M. gularis*, Spotted Pardalote *Pardalotus punctatus*, Striated Pardalote *P. striatus* and White-browed Babbler *Pomatostomus superciliosus*. An average of 13 species and 39 individuals were recorded per census. Honeyeaters were abundant, accounting for 49 per cent of all individuals. The Little Lorikeet was the only lorikeet present and did not appear to be closely associated with the Swift Parrot in site selection (pers. obs.).

DISCUSSION

The number of birds found in the study area make up a significant proportion of the total population of the Swift Parrot, which is thought to be less than 2 500 mature individuals (Brereton 1998). The quantity of suitable habitat is small, with the total area of all the blocks that were found to have Swift Parrots in this study less than that of Victoria's largest box-ironbark forest block, the

TABLE 2
Comparison of mean DBHOB* (cm) of Swift Parrot foraging trees with mean DBHOB of all stems at foraging sites using Mann-Whitney U-test.

	All trees at foraging sites	SD	Foraging trees	SD	U	P
Grey Box	**22.1**	10.6	**35.3**	14.7	309.0	<0.01 **
Eucalyptus microcarpa	(n = 86)		(n = 15)			
Mugga Ironbark	**27.8**	12.7	**42.8**	9.4	260.5	<0.01 **
E. sideroxylon	(n = 86)		(n = 25)			
White Box	**47.0**	—	—	—	—	—
E. albens	(n = 1)					
Red Stringybark	**33.0**	—	—	—	—	—
E. macrohyncha	(n = 1)					
Mean	**25.0**	11.9	**40.0**	12.1	1 129.0	<0.01 **
	(n = 157)		(n = 40)			

*DBHOB = Diameter at Breast Height Over Bark.

Rushworth forest (24 300 ha). The largest remnant with Swift Parrots in this study (the Weddin Mountains National Park) only had suitable habitat on the lower slopes of the ranges. Therefore it could be argued that the density of Swift Parrots in suitable habitats in the study area compares favourably with Victorian box-ironbark habitats.

Habitat selection and foraging resources

The tree selection by Swift Parrots in this study suggest that the largest trees remaining within box-ironbark forests and woodlands are of great importance as a food resource for the Swift Parrot. The utilization of foraging trees in larger size classes more often than expected given their abundance is consistent with results from Victoria (Kennedy and Tzaros, in prep.). Large trees were scarce at foraging sites (3 of the 114 measured were 60 cm + DBHOB) but appeared to be at a greater density than in equivalent Victorian habitats, perhaps due to less intense silvicultural treatment (Kennedy, pers. obs.). There is evidence in Victoria that box-ironbark habitats probably supported a greater number of large trees prior to European settlement (Soderquist and Rowley 1995), and it is likely that the density of large trees has also been reduced at the study sites in New South Wales.

There is considerable evidence that larger trees in box-ironbark habitats in Victoria flower more reliably and with a greater intensity (Kennedy and Tzaros, in prep.; Wilson and Bennett 1999). There was no apparent relationship between tree size and flowering frequency in this study and flowering intensity was not investigated. The extensive nature of Mugga Ironbark flowering in the year of this study may have negated a pattern that might occur in years when flowering is generally poorer. The selection of larger trees by Swift Parrots in light of the lack of an apparent relationship between flowering frequency and tree size suggests that larger trees may have been more attractive to the birds as a result of greater flowering intensity or even nectar production per flower. The likelihood of this scenario would require more detailed study of the flowering phenology of Mugga Ironbark.

The bird communities at foraging sites were species-rich, with the result here (13 species and 39 individuals per count) indicating a higher density of birds than in Victorian habitats with Swift Parrots, where an average of 6–8 species and 20–25 individuals per count was recorded in each of three years of study (Kennedy and Tzaros, in prep.). Honeyeaters were numerous at all Swift Parrot foraging sites. Small honeyeaters such as Fuscous and White-plumed Honeyeaters were the most numerous species, but large honeyeaters such as Noisy and Little Friarbirds and Red Wattlebirds were also frequently recorded. Exclusion of Swift Parrots from potential feeding areas by large honeyeaters has been inferred in Victoria (C. Tzaros, pers. comm.). In this study the absence of Swift Parrots from many potential sites with a high density of large honeyeaters may be a result of competitive exclusion, though Swift Parrots appear to be capable of co-existing with large honeyeaters under suitable conditions. Interspecific aggression is probably a localized and temporal phenomenon, which would be very hard to actually quantify (D. Oliver, pers. comm.).

Flowering Mugga Ironbarks were present on every site and the species is well-known for its capacity to produce large quantities of nectar (Oliver 1998, 2000). The level of flowering observed in this study was similar to the highest flowering levels recorded in Swift Parrot sites dominated by Mugga and Red Ironbarks *E. tricarpa* in Victorian box-ironbark habitat (Kennedy and Tzaros, in prep.). Winter-flowering events of the Red Ironbark have been shown to drive influxes of large numbers of nectarivores into box-ironbark habitats (McGoldrick and Mac Nally 1998) and it is likely that widespread winter Mugga Ironbark flowering events result in a similar influx of non-breeding nectarivores, including Swift Parrots.

Grey Box was used widely by the Swift Parrot although it was not flowering at any site, suggesting it has food resources which Swift Parrots will use even if Mugga Ironbark nectar is also available. There were no obvious lerp infestations, but the birds were gleaning food from the leaves of this species. Swift Parrots were also observed using non-flowering Grey Box widely in Mugga Ironbark-Grey Box communities in north-east Victoria in May and June 1999 (Kennedy, pers. obs.; D. Geering, pers. comm.). Grey Box is the most widely used species for foraging resources other than nectar in Victoria (Kennedy and Tzaros, in prep.).

Collection of foraging data

Single-point foraging observations are preferable to sequential observations of individual Swift Parrots in terms

of the independence of the data (Hejl *et al.* 1990). However, by recording the first foraging manoeuvre of a bird, a bias may be created towards conspicuous activities (Oliver 1998, 2000). The bias created by recording the initial bird was probably mitigated to a degree by observing the activities of a species that was very cryptic when not calling.

Observation of several individuals within a flock was made here as in other foraging studies (Recher and Gebski 1990; Oliver 1998, 2000). This approach has some limitations but this must be reconciled with the scarcity of the species in question and the hypotheses being tested. Hejl *et al.* (1990) sought to counter this problem by setting time limits between observations of individuals of the same species but they were studying common, resident birds. This approach would not have been feasible in this study given the species' high mobility, even over a short time frame.

Conclusion

The box-ironbark woodlands on the south-western slopes of New South Wales are important for the wintering population of the Swift Parrot. Mugga Ironbark-Grey Box communities are of particular importance, although any area which may produce large quantities of nectar or lerp could be of importance to Swift Parrots (White Box woodland for example). The foraging sites in this study also supported a diverse community of other nectarivorous birds. The Swift Parrot selected larger trees within foraging sites which is important given the scarcity of large trees in the temperate woodlands of Victoria and New South Wales.

The Swift Parrot has visited small and isolated forest blocks (Charcoal Tank Nature Reserve and Reefton State Forest are examples) in the south-western slopes region of New South Wales in recent years. These records demonstrate that the Swift Parrot is capable of locating small fragments of suitable habitat in a highly-fragmented landscape.

The extent of suitable habitat in this area has been greatly reduced by clearing and the alteration of box-ironbark habitat to cypress-pine habitat for silviculture. The species can locate suitable patches in largely cleared areas, so patches of suitable habitat of any size must be considered important. The site fidelity displayed at some of these patches between years emphasizes their importance. This study concentrated on public land and located some 150 Swift Parrots. Future studies should include a focus on private land, which may reveal more important foraging sites in the region. Future surveys in the locations we visited may reveal that areas recently found to support Swift Parrots (such as Combaning State Forest) may be visited by the species on a regular basis. It is also likely that some of the forests in which no birds were found in this study will support Swift Parrots in the future given the mobility of the species and the well-known temporal fluctuations in flowering of the key eucalypt species. Further study of site selection and foraging ecology of the Swift Parrot both in this area (as future years are likely to uncover a different distribution of Swift Parrots across the landscape) and in similar habitats to the north is necessary. Future study of Swift Parrot foraging ecology on the inland slopes of New South Wales over a period of years is likely to add significantly to the initial findings here.

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APPENDIX 1

Forest blocks visited in 1999 foraging ecology study of Swift Parrots *Lathamus discolor* on the New South Wales western slopes.

State Forest, National Park or Nature Reserve	Number of Swift Parrots	Previous record?	Tree species present	Forest block number (see Figure 1)
Jindalee State Forest	3	yes	Mugga Ironbark-Grey Box	1
Combaning State Forest	70	no	Mugga Ironbark-Grey Box	2
Springdale Hills area	0	yes	Mugga Ironbark-Grey Box	3
Ingalba Nature Reserve	30	yes	Mugga Ironbark-Grey Box	4
Pucawan Nature Reserve	0	no	Mugga Ironbark-Grey Box	5
Big Bush Nature Reserve	0	yes	Mugga Ironbark-Grey Box	6
Kindra State Forest	0	no	Grey Box, mainly pine	7
Ganmain State Forest	0	no	Grey Box, mainly pine	8
Matong State Forest	0	no	Grey Box, mainly pine	9
Reefton State Forest	0	yes	Mugga Ironbark-Grey Box	10
Buddigower State Forest	0	yes	Mugga Ironbark-Grey Box	11
Charcoal Tank Nature Reserve	30	yes	Mugga Ironbark-Grey Box	12
Hiawatha State Forest	0	no	Mainly Grey Box, some Mugga Ironbark	13
Back Creek State Forest	0	yes	Mugga Ironbark-Grey Box, mainly pine	14
Curraburrama State Forest	0	no	pine	15
Bimbi State Forest	0	no	pine	16
Weddin State Forest	0	no	Mugga Ironbark-Grey Box	17
Weddin Mountains National Park	21	yes	Mugga Ironbark-Grey Box	18
Bendick Murrell State Forest	0	no	Mugga Ironbark	19
Cowra Japanese Gardens	0	yes	White Box	20
Conimbla National Park	0	no	Mugga Ironbark	21
Warraderry State Forest	0	no	Mugga Ironbark-Grey Box, mainly pine	22
Mulyandry State Forest	0	no	White Box, mainly pine	23
Nangar National Park	0	no	Mugga Ironbark	24
Back Yamma State Forest	0	yes	Grey Box-White Box, mainly pine	25
Cookamidgera State Forest	0	yes	Mugga Ironbark-Grey Box	26
Goobang National Park	0	yes	Mugga Ironbark-Grey Box	27

APPENDIX 2

Number of sites and density of all birds recorded during bird censuses.

		No. of sites present (n = 6)	Individuals per hectare
Galah	*Cacatua roseicapilla*	1	0.8
Little Lorikeet	*Glossopsitta pusilla*	1	1.3
Red-rumped Parrot	*Psephotus haematonotus*	2	0.6
White-throated Treecreeper	*Cormobates leucophaeus*	1	0.2
Brown Treecreeper	*Climacteris picumnus*	1	0.2
Superb Fairy-wren	*Malurus cyaneus*	1	0.2
Spotted Pardalote	*Pardalotus punctatus*	3	1.5
Striated Pardalote	*P. striatus*	5	2.3
Red Wattlebird	*Anthochaera carrunculata*	4	1.0
Noisy Friarbird	*Philemon corniculatus*	4	3.8
Little Friarbird	*P. citreogularis*	3	3.3
Noisy Miner	*Manorina melanocephala*	1	0.4
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	1	0.4
Yellow-faced Honeyeater	*Lichenostomus chrysops*	1	0.4
Yellow-tufted Honeyeater	*L. melanops*	1	0.6
Yellow-plumed Honeyeater	*L. ornatus*	1	0.2
Fuscous Honeyeater	*L. fuscus*	5	4.6
White-plumed Honeyeater	*L. penicillatus*	5	6.3
Black-chinned Honeyeater	*Melithreptus gularis*	3	1.0
Brown-headed Honeyeater	*M. brevirostris*	4	1.7
Eastern Yellow Robin	*Eopsaltria australis*	1	0.2
White-browed Babbler	*Pomatostomus superciliosus*	4	1.9
Grey Shrike-thrush	*Colluricincla harmonica*	2	0.4
Restless Flycatcher	*Myiagra inquieta*	1	0.2
Magpie-lark	*Grallina cyanoleuca*	1	0.2
Willie Wagtail	*Rhipidura leucophrys*	2	0.4
White-bellied Cuckoo-shrike	*Coracina papuensis*	1	0.2
Olive-backed Oriole	*Oriolus sagittatus*	2	0.6
Dusky Woodswallow	*Artamus cyanopterus*	6	4.6
White-winged Chough	*Corcorax melanorhamphos*	1	0.4
Diamond Firetail	*Stagonopleura guttata*	1	0.2
Mistletoebird	*Dicaeum hirundinaceum*	1	0.4
Common Starling	*Sturnus vulgaris*	1	0.8