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# Relation Between Number of Honeyeaters and Intensity of Flowering near Adelaide, South Australia


HUGH A. FORD



The relation between number of honeyeaters and intensity of flowering was studied in sixteen sites near Adelaide in South Australia. Numbers of honeyeaters were highest in late autumn and winter for all species and lowest in summer. Numbers of honeyeaters of all species or of each species were correlated with flowering index of major species of plants.


Keast (1968) summarized the available information on seasonal movements of Australian honeyeaters and concluded that flowering of nectar-bearing plants was the all important factor. Probably all species of honeyeaters consume nectar from flowers to some degree (Pyke 1981) but it is more important to some species than others. Around Adelaide the longer-beaked Eastern Spinebill *Acanthorhynchus tenuirostris*, New Holland and Crescent Honeyeaters *Phylidonyris novaehollandiae* and *P. pyrrhoptera* and Red Wattlebird *Anthochaera carunculata* appear more nectarivorous than the shorter-beaked Yellow-faced and White-plumed *Lichenostomus chrysops* and *L. penicillatus* and White-naped and Brown-headed Honeyeaters *Melithreptus lunatus* and *M. brevirostris* (Ford and Paton 1977). Insects and other sources of carbohydrate such as manna, honeydew and lerp compose the rest of the diet (Paton 1981). One would expect the seasonal movements of the more nectarivorous species to most closely follow flowering intensity and indeed those of the Red Wattlebird and New Holland Honeyeater do so (Keast 1968) However both White-naped and Yellow-faced Honeyeaters show regular seasonal movements in eastern Australia and around Adelaide (Hindwood 1956; Liddy 1966; Ford 1977).

Few studies have attempted to relate abundance of honeyeaters to abundance of flowers through the year in one area (see e.g. Bell 1966). In this paper I present data on numbers of honeyeaters counted at 16 sites near Adelaide and test for correlations between numbers of honeyeaters and intensity of flowering.

I ask the following questions:

Are numbers of each species and all species of honeyeaters related to:

i) flowering intensity at all sites pooled,
ii) flowering intensity at each site,
iii) flowering intenity of each species of plant, pooled for all sites where it is important?

### Study Areas

Sixteen study areas were chosen in the Mount Lofty Ranges, South Australia, one at Cleland Conservation Park (10 km south-east of Adelaide) two at Waterfall Gully (8 km south-east of Adelaide), one at Horsnell Gully (8 km east of Adelaide), eight at Para Wirra Recreation Park, two at Hale Conservation Park and two at Sandy Creek Conservation Park (all 35-42 km north-east of Adelaide). Table 1 gives location, dominant trees and main nectar-sources for each site. Most sites had either a rather stunted dry sclerophyll forest with a dense understorey or woodland with scattered shrubs and grass. The major tree species in forest were *Eucalyptus obliqua*, *E. goniocalyx* and *E. fasciculosa*, and in the woodland *E leucoxylon*, *E. camaldulensis* and *E. odorata* though most species occurred in both habitats. Shrubs were diverse in the forest and mostly belonged to the families Mimosaceae, Myrtaceae, Epacridaceae and Proteaceae. Wattles, especially *Acacia pycnantha*, were common in woodland and forest. One site at Para Wirra (No. 14) had been cleared and had very few trees but had dense *Xanthorrhoea semiplana* One site at Sandy Creek (No. 16) had mallee-form eucalypts (mostly *E. fasciculosa*) and cypress-pines *Callitris preissii*, with a dense understorey.

Of the trees, *E. leucoxylon* provided the major nectar source to the birds; *Eucalyptus cosmophylla* was also visited frequently. *Eucalyptus odorata*, *E. fasciculosa*, *E. obliqua*, *E. goniocalyx*, *E. camaldulensis* and *E. baxteri* also flowered but were rarely visited by birds. The major nectar-sources among the shrubs were: *Astroloma conostephioides*, *Epacris impressa* (both Epacridaceae), *Correa schlechtendallii* (Rutaceae), *Banksia marginata* and *Grevillea lavandulacea* (both Proteaceae). The mistletoe *Amyema miquelii* (Loranthaceae) was also frequently visited. *Xanthorrhoea semiplana* provided nectar in one site.

## TABLE 1

Location, habitat (DSF — dry sclerophyll forest, SW — savanna woodland, G — grassland, MH — mallee heath), dominant tree species and major sources of nectar at each site.

| Site | Location | Habitat | Dominant Tree(s) | Nectar Sources |
|---|---|---|---|---|
| 1. | Cleland | DSF | *E. obliqua*, *E. baxteri* | *Epacris* |
| 2. | Waterfall Gully | DSF | *E. cosmophylla*, *E. obliqua* | *E. cosmophylla*, *Epacris* |
| 3. | Waterfall Gully | DSF | *E. obliqua* | *B. marginata* |
| 4. | Horsnell Gully | DSF | *E. leucoxylon*, *E. obliqua* | *E. leucoxylon* |
| 5. | Hale | DSF | *E. goniocalyx*, *E. fasciculosa* | *Astroloma* |
| 6. | Para Wirra | DSF | *E. goniocalyx*, *E. fasciculosa* | *Astroloma*, *Amyema*, *Grevillea* |
| 7. | Para Wirra | DSF | *E. goniocalyx*, *E. fasciculosa* | *Astroloma*, *Amyema*, *E. leucoxylon* |
| 8. | Hale | SW | *E. goniocalyx*, *E. leucoxylon* | *Astroloma*, *Amyema*, *E. leucoxylon* |
| 9. | Para Wirra | SW | *E. leucoxylon*, *E. fasciculosa* | *E. leucoxylon*, *Amyema*, *E. fasciculosa* |
| 10. | Para Wirra | SW | *E. leucoxylon*, *E. fasciculosa* | *E. leucoxylon* |
| 11. | Para Wirra | SW | *E. camaldulensis*, *E. fasciculosa* | *Correa*, *Astroloma* |
| 12. | Para Wirra | SW | *E leucoxylon*, *E. odorata* | *E. leucoxylon* |
| 13. | Para Wirra | SW | *E. leucoxylon*, *E. odorata* | *E. leucoxylon*, *Amyema*, *E. fasciculosa* |
| 14. | Para Wirra | G | — | *Xanthorrhoea*, *E. leucoxylon*, *Amyema* |
| 15. | Sandy Creek | SW | *E. leucoxylon* | *B. marginata*, *E. leucoxylon*, *Astroloma* |
| 16. | Sandy Creek | MH | *E. fasciculosa*, *Callitris* | *B. marginata*, *Astroloma*, *Amyema*, *Grevillea* |

## Methods

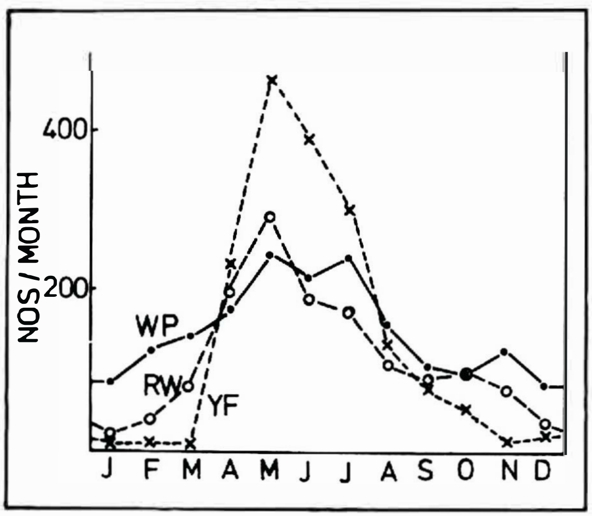
Each site was visited on two days each month from November 1973 to October 1974. One visit was within four hours of sunrise, the other less than four hours before sunset. I walked a fixed transect of *c.* 600 m for 45 minutes and recorded each honeyeater seen or heard. Observations were not restricted to any particular distance from the transect hence numbers cannot be converted to density. However they should give a measure of relative density from which changes in abundance through the year can be inferred.

I noted species of plants whose flowers were visited by birds and at each visit estimated the intensity of flowering on a scale of 0-5, where 0 = no flowers, 1 = up to 10% of peak, 2 = 10%-25% of peak, 3 = 25-50% of peak, 4 = 50-75% of peak, 5 = >75% peak bloom. Peak bloom was taken as the intensity of flowering in the site in which the plant was most common, so that in sites where it was scarce it would score only 1 or 2 when in full flower.

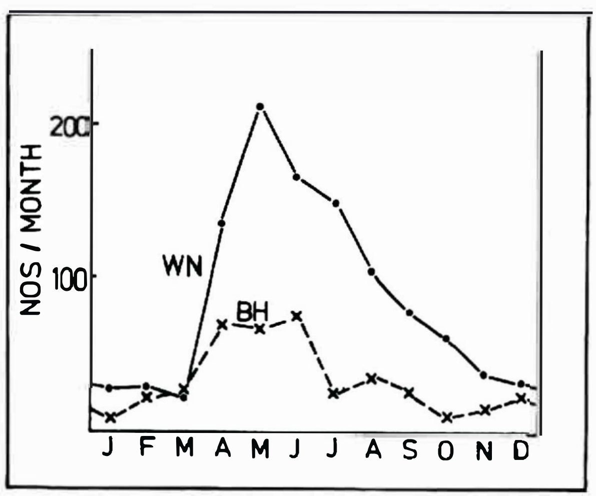
Numbers of birds and flowering indexes were added for the two visits each month and Spearman's Rank Correlations were applied to the twelve sets of data to answer the questions asked in the introduction. Tests were carried out on: all honeyeaters pooled and all flowering indexes pooled, each species of honeyeater and all flowering indexes, all honeyeaters and each flower species, and each honeyeater species against each flower species. The last two were done for data from only those sites where the flower species was common (total of five or more for best month). Finally numbers of each species and all species of honeyeater were tested against total flowering index for each site. Data for each honeyeater species were only tested if there were 20 or more records of that species from the site(s) and it was recorded in at least six months.

## Results

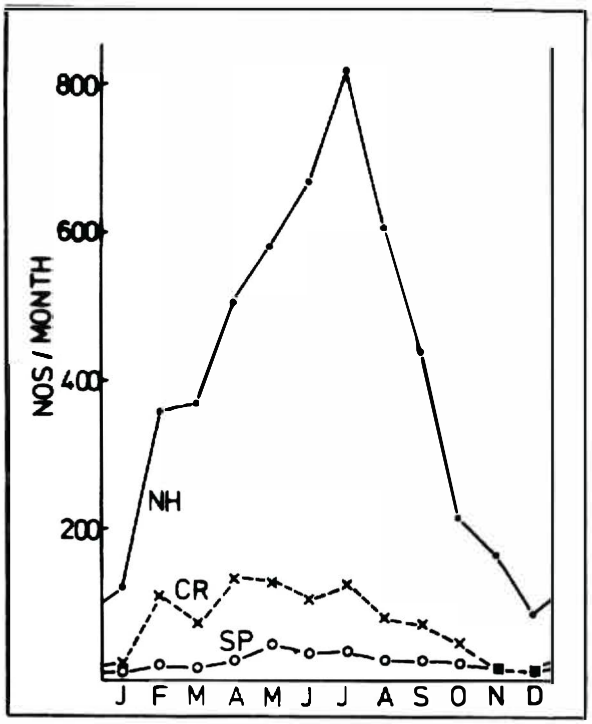
The total numbers of eight species of honeyeaters recorded in each month are shown in Figures 1, 2 and 3. Numbers are highest in late autumn and winter for all species (May to July peak) and lowest in summer. The increase during autumn (March to May) is especially marked for White-naped and Yellow-faced Honeyeaters, but also substantial for Red Wattlebird and New Holland Honeyeater.



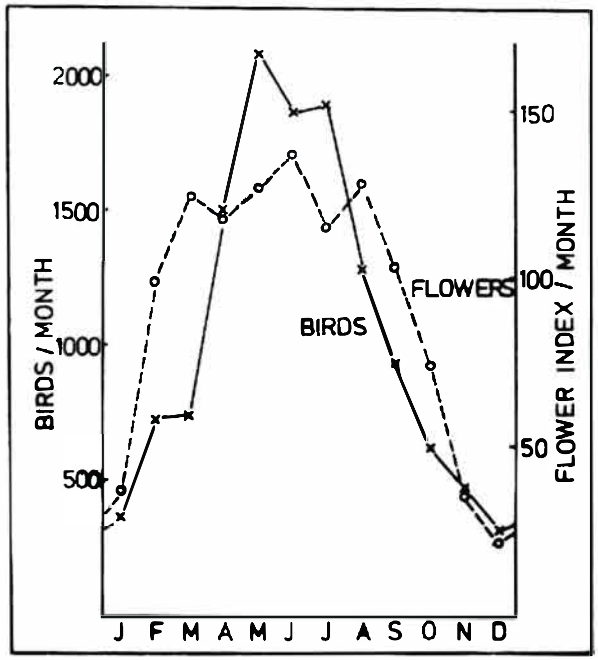

• Figure 1. *Total numbers of White-plumed (WP), and Yellow-faced (YF) Honeyeaters and Red Wattlebirds (RW) each month; all sites combined.*




• Figure 2. *Total numbers of White-naped (WN) and Brown-headed (BH) Honeyeaters each month; all sites combined.*




● Figure 3. *Total numbers of New Holland (NH) and Crescent (CR) Honeyeaters, and Eastern Spinebills (SP) each month; all sites combined.*




● Figure 4. *Total numbers of all species of honeyeaters and flowering index of all plants each month; all sites combined.*

## TABLE 2

Total flowering indexes for each species, all sites combined, each month. Plants in chronological order of peak flowering time.

| Plant Species | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Eucalyptus obliqua* | 15 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 |
| *Amyema miquelii* | 6 | 46 | 27 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| *E. fasciculosa* | 0 | 8 | 48 | 19 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Correa schlechtendalii* | 3 | 8 | 7 | 6 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Banksia marginata* | 3 | 8 | 13 | 17 | 13 | 7 | 4 | 3 | 0 | 0 | 1 | 5 |
| *E. cosmophylla* | 0 | 0 | 6 | 9 | 8 | 8 | 5 | 4 | 3 | 1 | 0 | 0 |
| *Epacris impressa* | 0 | 5 | 6 | 6 | 13 | 13 | 7 | 9 | 2 | 2 | 0 | 0 |
| *E. leucoxylon* | 5 | 1 | 10 | 33 | 36 | 49 | 48 | 41 | 43 | 44 | 21 | 6 |
| *Astroloma conostephioides* | 0 | 3 | 1 | 25 | 45 | 52 | 42 | 44 | 31 | 7 | 0 | 0 |
| *Grevillea lavandulacea* | 0 | 0 | 1 | 0 | 2 | 4 | 5 | 16 | 10 | 13 | 6 | 0 |
| *Xanthorrhoea semiplana* | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 3 | 5 | 5 | 6 | 5 |

Smaller numbers of Black-chinned Honeyeater *Melithreptus gularis*, Tawny-crowned Honeyeaters *Phylidonyris melanops* and Little Wattlebirds *Anthochaera chrysoptera* were also recorded, rather more often in winter.

The monthly flowering indexes (all sites pooled) for each species of plant are shown in Table 2. *Eucalyptus leucoxylon* has flowers throughout the year though fewer in summer, *Astroloma, Epacris* and *E. cosmophylla* flower mainly in winter, *Grevillea* and *Xanthorrhoea* in spring, *Amyema* in late summer and *E. fasciculosa, Banksia marginata* and *Correa* in autumn. There are flowers available throughout the year but the period November-January appears to be a time of relative scarcity, March-September one of abundance. The abundance of honeyeaters fairly closely matches the pooled flowering index (all sites, all species, Figure 4, $r_s = 0.84$, $p < 0.001$). Each species of honeyeater is also positively correlated with total flower index for each month (Table 3, $p < 0.05$ in all cases).

The abundance of each species of honeyeater tested against the flowering index for each plant species in appropriate sites is shown in Table 3. Generally numbers of honeyeaters are significantly related to flowering index in *Astroloma, E. leucoxylon, Epacris*, and *E. cosmophylla*. The relation is weaker for *Correa* and absent in *Amyema, Banksia* and *Xanthorrhoea*.

Honeyeater abundance and flowering index for each site are compared in Table 4. In most cases (11 out of 16) there are significant correlations between all honeyeaters and flowering index. In about two thirds of the cases (43 out of 69) individual species are correlated with flowering index.

## Discussion

Generally, numbers of honeyeaters of all species or of each species are correlated with flowering index of the major species of plant. Before considering whether the abundance of flowers determines the abundance of birds, several sources of bias and alternative explanations need to be considered.

TABLE 3

**Relations between numbers of birds of each species per month and flower index for chosen sites. Flowers in approximate order of importance.**

| Sites | Flowers | All honeyeaters | White-plumed | Yellow-faced | White-naped | Brown-headed | Crescent | ew Holland | Spinebill | Red Wattlebird |
|---|---|---|---|---|---|---|---|---|---|---|
| All | All flowers | *** | ** | * | * | ** | ** | *** | ** | ** |
| 4, 7, 8, 9, 10, 11, 12, 13, 14, 15 | *E. leucoxylon* | ** | * | ** | ** | ns | ns | * | * | ** |
| 5, 6, 7, 8, 11, 15, 16 | *Astroloma* | *** | ** | *** | *** | * | ** | ** | ** | ** |
| 2 | *E. cosmophylla* | ** | — | * | ** | — | ns | ** | — | — |
| 5, 6, 7, 8, 9, 13, 14 | *Amyema* | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| 15, 16 | *Banksia* | ns | ns | — | — | — | — | ns | ns | ns |
| 14 | *Xanthorrhoea* | ns | — | ns | — | ns | — | ns | — | ns |
| 11 | *Correa* | * | ns | ns | — | — | ** | * | * | ns |
| 1, 2 | *Epacris* | ** | — | * | ** | — | ** | * | ns | — |

ns — not significant, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, — insufficient data.

## TABLE 4

Relations between flowering index and numbers of honeyeaters in each month at each site, using Spearman's Rank Correlation. ns — not significant, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, — insufficient data.

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All species | ns | *** | ns | * | * | ns | *** | ** | ns | ** | *** | ** | ** | ns | *** | ** |
| Red Wattlebird | — | — | — | — | — | ns | ** | — | — | * | * | ns | * | ns | ** | * |
| Spinebill | ns | — | — | — | — | — | — | ns | ns | — | — | ** | ** | — | — | ns |
| New Holland | ns | ** | ns | * | ** | ns | ** | ** | ns | — | * | — | * | ns | ** | ** |
| Crescent | ** | ns | ** | ns | ** | * | ** | * | ns | — | — | * | ** | ns | — | — |
| Brown-headed | — | — | — | — | — | — | — | ns | — | — | — | * | ** | ns | — | — |
| White-naped | ns | *** | ns | ns | *** | — | — | — | — | — | — | * | * | — | — | — |
| Yellow-faced | ns | * | ns | * | * | * | ** | * | — | — | ns | * | — | — | — | — |
| White-plumed | — | — | — | — | — | — | — | * | * | * | * | ns | ns | — | ** | — |
| Site No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

Part of the reason for more birds being seen in winter than summer may be that birds are more active at lower temperatures. Also in summer honeyeaters are moulting (Ford 1980) and may be less conspicuous. Perhaps in the species that show small seasonal changes these result from differences in activity rather than in numbers. These species include White-plumed, Brown-headed, and Crescent Honeyeaters and Eastern Spinebill. June to August figures for these species average about twice those for December to February. For White-naped, Yellow-faced and New Holland Honeyeaters and Red Wattlebird winter counts averaged five to twenty times those of summer. It seems unlikely that changes of this magnitude can be explained merely by changes in level of activity.

Breeding could also contribute to an increase in numbers. However honeyeaters breed between July and December near Adelaide, with a minor autumn peak in some years (Ford 1980). A summer peak in birds counted would then be expected, contrary to what is found.

Seasonal changes in abundance could result from either local movements within the Mount Lofty Ranges or from long-distance migration from outside the Mount Lofty Ranges.

White-naped and Yellow-faced Honeyeaters are well known migrants in south-eastern Australia (Hindwood 1956, Keast 1968, Liddy 1966). They are primarily winter visitors to the northern parts of the Mount Lofty Ranges, east of Adelaide (Ford 1977). Their abundance in late autumn and winter may be due to the unsuitability of their breeding areas at this time, rather than to the abundance of flowers in the Mount Lofty Ranges. The remaining two species, the New Holland Honeyeater and Red Wattlebird, are known to move around but the extent to which this is local or true migration is unclear (Keast 1968).

The flowering index for sites shows a peak between late autumn and spring but interpretations from this should be cautious as the index is crude and not based on number of flowers or nectar production. Also values from different species have been simply added whereas they are unlikely to be equivalent. Taking flowering indexes from single species in only the sites in which they are common may be more reliable. However where two species of plant co-occur and flower at different times flowering of one may interfere with any correlation between flowering of the other and honeyeater numbers. For example *Banksia marginata* occurs with *Astroloma conostephioides*, which greatly outnumbers it and flowers at a somewhat different time. Likewise *Amyema miquelii* flowers when *E. leucoxylon* flowers are scarce. Not surprisingly neither *Banksia* nor *Amyema* is correlated with honeyeater numbers.

This study generally supports Keast's (1968) contention that seasonal movements of honeyeaters are related to the flowering of nectar-bearing plants, however there are several sources of bias and the correlations may only be coincidental. Perhaps surprisingly there does not appear to be a closer relationship between the more nectarivorous species (*Phylidonyris, Anthochaera, Acanthorhynchus*) and flowers than between the more "insectivorous" genera (sensu Ford and Paton 1977 — *Melithreptus* and *Lichenostomus*) and flowers. The latter two genera show as many positive correlations in Tables 3 and 4 as do the first three genera. This may be because these latter genera become more nectarivorous in winter when most of the flowers are available and move into areas where flowers are abundant.

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Hugh A. Ford,
University of New England,
Department of Zoology,
Armidale, N.S.W. 2351.