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SURVIVAL, SEASONAL ABUNDANCE, SEX RATIO AND DIET OF EASTERN SPINEBILLS *Acanthorhynchus tenuirostris* IN THE BLUE MOUNTAINS, NEW SOUTH WALES

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Over 13 years (1977–1989) a total of 679 Eastern Spinebills was banded in a eucalypt forest at Blue Gum Swamp Creek, Winmalee, New South Wales. Compared with another population of Eastern Spinebills in the New England National Park, the one at Blue Gum Swamp Creek appeared to have a higher proportion of sedentary birds, had a higher survival rate and the birds that arrived during the 'winter influx' were less regular in their return to the site. There was a skewing of the sex ratio in favour of males, which was instigated during the birds' first year of life. The effect of fires in the surrounding area is examined in light of the yearly variations in capture rates. Major food sources during autumn, winter and spring, were determined from foraging observations and identification of pollen on the birds. The major food plants included *Banksia oblongifolia, B. spinulosa, Lambertia formosa, Grevillea mucronulata, Callistemon citrinus, Correa* sp., *Styphelia* sp., *Woollsia pungens* and *Amyema* sp. Capture rates showed a substantial rise during May, June and July. This influx is more likely a passage of birds through the site and not a response to the flowering of food plants at the site. Morphometrics for both males and females are also presented.

INTRODUCTION

The abundance of different species of honeyeaters varies seasonally at a particular site (Wilson 1964; Liddy 1965, 1966; Lamm and Wilson 1966; Bell 1966; Keast 1968; Morris 1974; Ford and Paton 1977; Ford and Pursey 1982; Ford 1983; Pyke 1985; McFarland and Ford 1987). Some individuals of a species appear to be sedentary and show high survivorship (Morris 1975; Paton 1985; Pyke *et al.* 1989), others appear to be transients (Keast 1968; Ford and Pursey 1982; Paton 1985). Several studies have shown that influx of honeyeaters to an area is correlated with peak nectar supply (Bell 1966; Keast 1968; Ford and Pursey 1982; Paton 1985; Pyke 1985). Others have shown that honeyeater abundance is independent of food availability (Pyke 1983). It has been hypothesised that many transients are young birds which are dispersing, and at times, sex ratios amongst such birds have been highly skewed (Liddy 1966; Paton 1985; McFarland and Ford 1987; Breitwisch 1989). Fire may also play a role in determining honeyeater abundance in a particular site (Recher *et al.* 1985; Christensen *et al.* 1985; Smith 1989).

TABLE 1

Summary of banding and retrap data by months and seasons (1977–1989) for Eastern Spinebills banded at Blue Gum Swamp Creek, New South Wales.

Month	Banding days	No. banded	No. indiv. retrapped	No. retrap records	% retrapped in same month but different year
Jan.	23	57	0	0	0
Feb.	15	62	4	10	10
March	14	83	4	4	0
April	18	59	8	17	6
May	13	91	17	13	62
June	12	88	6	25	4
July	11	54	6	12	17
Aug.	14	48	3	8	0
Sept.	16	55	4	11	0
Oct.	15	11	1	1	0
Nov.	19	43	5	12	8
Dec.	10	28	8	17	6

Season	% retrapped in same season but different year	% retrapped in different season and different year			
		Sum.	Aut.	Wint.	Spr.
Summer	26	—	22	30	22
Autumn	38	18	—	26	18
Winter	24	13	27	—	36
Spring	13	25	25	37	—

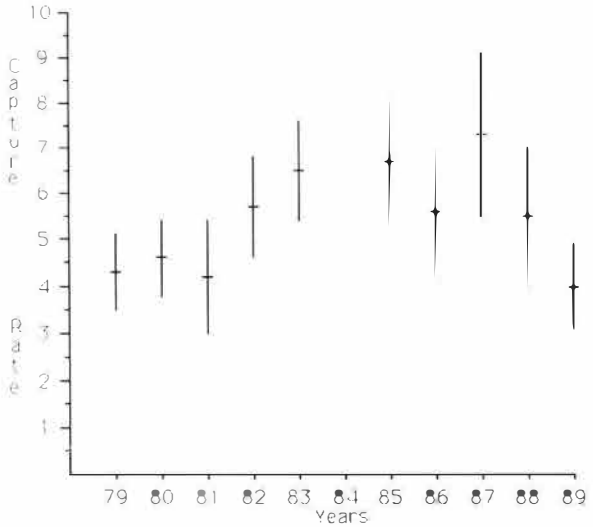

Figure 1. *Mean capture rate per banding day and standard error for each year.*

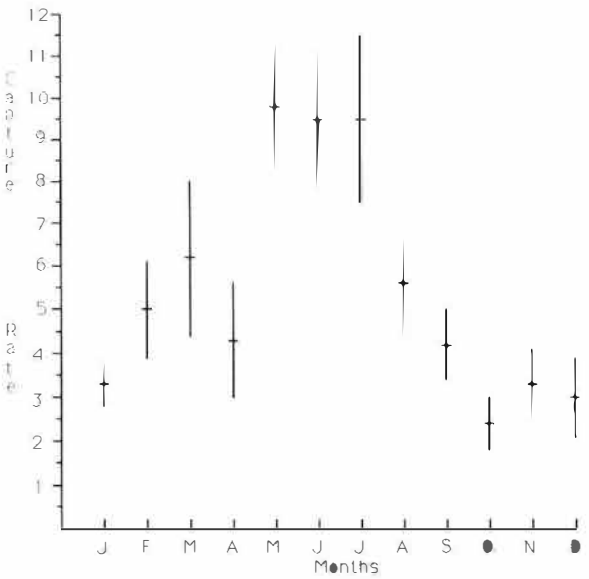

Figure 2. *Mean capture rate per banding day and standard error for each month from 1979–1989.*

In this paper, the second in a series, we analyse the banding data from 1977 to 1989 inclusive and data from pollen sampling during 1991, for the Eastern Spinebill *Acanthorhynchus tenuirostris*. The object of the study was to document population dynamics of the species and investigate factors with which abundance may have been correlated.

METHODS

This study was carried out in a eucalypt forest at Blue Gum Swamp Creek, Winmalee, NSW (33°39′48″S, 150°36′30″E). A description of the geography, vegetation and climate of the site is included in a previous paper (Hardy and Farrell 1990) which also presented an overview of the banding data (1977 to 1987) and broadly outlined the effects of both planned burns and wildfires.

Mist nets were used to capture birds monthly, weather permitting, using established net lanes within various habitat types. For a full description of the banding procedure, see Hardy and Farrell (1990). Nectar sources utilised by Eastern Spinebills were identified by direct observation and by collecting pollen from captured birds. Pollen samples were taken by rubbing a small cube of glycerine jelly around the birds' nares and foreheads (Wooller *et al.* 1983). Samples were collected after the birds had been removed from the mist net but before they were placed in holding bags. The jelly with its attached pollen was later melted and examined under a microscope. Pollen types collected from each bird were identified by comparison with known samples. Small pollen counts were not included as these might have been due to contamination from the mist net, or from flowers that had various species of pollen deposited on them by other birds or insects.

RESULTS

Capture and recapture rates

Eastern Spinebills are very common at Blue Gum Swamp Creek and have been either caught or seen on every visit (Hardy and Farrell 1990).

Mean capture rates for each year varied from 7.3 ± 1.8 SE per banding day in 1987 from mist nets totalling approximately 120 m to 4.0 ± 0.9 SE in 1989 (Fig. 1). Data for 1977–1978 have been omitted from Figure 1 because during that period only two nets were erected, and 1984 because of a low number of visits to the site due to inclement weather.

Two wildfires in December 1976 and December 1977 burned large tracts of bushland in the Lower Blue Mountains to the west and east of the study site, respectively. In addition, several areas adjacent to the study site were burnt during a hazard reduction programme in 1980, May 1985 and May 1987 (Hardy and Farrell 1990). In May 1981, one hazard reduction fire burnt approximately one-third of the study site. The Eastern Spinebills seemed to be less affected by the result of this fire than was the population of New Holland Honeyeaters, which took several years to build up their original numbers (unpub. data). Peak numbers of Eastern Spinebills were recorded in 1987 as the study site and surrounding areas slowly regenerated. After 1987 capture rates declined to a level comparable to those recorded at the start of this study.

Mean monthly capture rates for the period 1979–1989 are shown in Figure 2. These rates rose sharply during May, June and July and then declined in August. Rates of capture of juvenile birds (Fig. 3) were highly variable with the lowest rate being recorded in October and a maximum in March. The percentage of juveniles comprising the total number of Eastern Spinebills declined from a high in February through to a low in October (Fig. 4).

For the period 1977–1989 a total of 679 birds was banded; 229 retraps were recorded involving 105 individuals. This gives a total percentage retrap of 15.5 per cent. The total percentage of juvenile birds which were recaptured was very low at 4.2 per cent. Based on retrap data, the

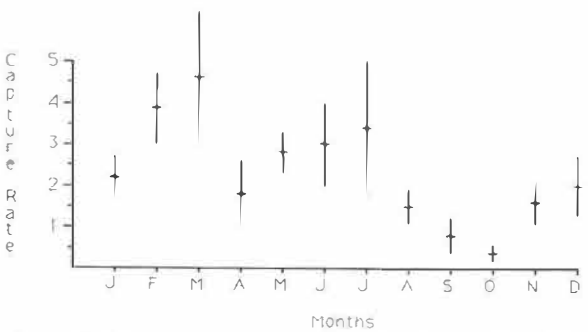

Figure 3. *Mean capture rate of juvenile Eastern Spinebills per banding day and standard error for each month from 1979–1989.*

TABLE 2

Banding and recapture data for Eastern Spinebills at Blue Gum Swamp Creek, New South Wales.

Year	Banding days	No. banded	Recaptures from: 77	78	79	80	81	82	83	84	85	86	87	88	89
1977	18	12	1												
1978	25	30	3	3											
1979	30	97	2	4	12										
1980	27	88	1	3	10	8									
1981	17	49	1	3	1	4	5								
1982	15	65	1	1	1	2	1	11							
1983	11	53	1	0	2	1	0	7	2						
1984	5	9	1	1	0	0	0	2	0	0					
1985	9	55	0	0	1	0	0	2	0	1	1				
1986	11	43	0	0	1	0	1	4	0	0	6	4			
1987	18	102	0	0	0	0	0	3	0	0	1	3	11		
1988	13	56	0	0	0	0	0	0	0	0	1	1	3	6	
1989	9	20	0	0	0	0	0	1	0	0	0	2	1	2	3

oldest bird to date is a resident male which was banded as an adult on 25 June 1977 and recaptured 12 times, the last occasion on 15 September 1984, giving a minimum age of 7 years 3 months. Retrap data (Table 1) for birds caught subsequent to the month in which they were banded indicated a very small or zero percentage recovery rate in all months except May.

No recoveries away from the site have been documented and no recoveries of birds banded elsewhere have been noted. The only movement recorded near the site was an adult female which was banded at Springwood (4 km SSW of Blue Gum Swamp Creek) and retrapped at Yellow Rock — a distance of 3.5 km.

Annual survival

All birds known to be alive for each age group were recorded for each year 1977–1989 (Table 2). Annual survival rates were calculated using the Fisher-Ford method outlined in McFarland and Ford (1987). The results produced by this method indicated an annual survival rate of 70 per cent.

Food sources

Direct observations and pollen sampling from March to November 1991 indicated that Eastern Spinebills at Blue Gum Swamp Creek fed on nectar from a variety of plants: *Banksia oblongifolia, B. spinulosa, Lambertia formosa, Grevillea mucronulata, Callistemon citrinus, Amyema* sp., *Correa* sp., *Styphelia* sp. and *Woollsia pungens* (Fig. 5). This is not a complete list as sampling and observations were not undertaken during summer.

During March and April the predominant food plants were *B. oblongifolia, B. spinulosa* and *L. formosa*. As the flowering of *B. oblongifolia* and *L. formosa* declined in May and June further utilisation was made of *B. spinulosa*. *G. mucronulata* gradually gained in importance as a food source from the end of May, when it entered into its maximum flowering period, to well into August.

Correa sp. and *Styphelia* sp. were discovered as food sources for the Eastern Spinebills during June. These plants had not previously been recorded as growing in our study site.

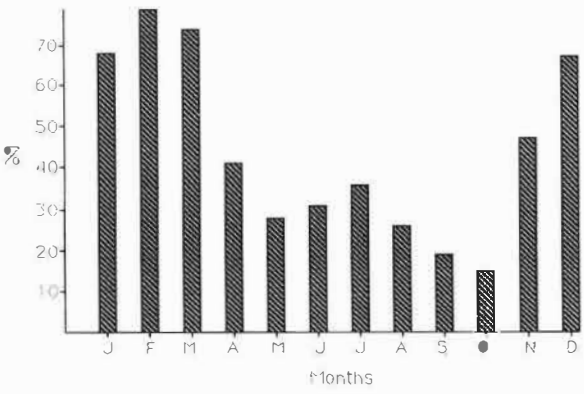

Figure 4. *Percentage of juvenile birds comprising the total number of Eastern Spinebills caught during each month from 1979–1989.*

During October and November the number of *L. formosa* blooms increased (a small number of blooms was present throughout June, July, August and September) and were visited by Eastern Spinebills as were *C. citrinus* and *Amyema* sp. These flowers were the major nectar source during this period.

Sex ratios

Male to female ratios for each month are presented in Figure 6. This ratio reaches a maximum in February but at no stage does it fall on or below unity. Only one banding day (6 July 1989) recorded any significant reversal of the male dominance pattern with 12 females and five males captured. The overall ratio was calculated at 2.2:1.0 males to females (n = 561).

In our study 309 juvenile birds were trapped. Males were sexed using plumage patterns and/or wing span measurement — a bird with a wing span over 202 mm was taken to be a male. This figure is the maximum wing span measurement for 95 per cent of the adult female population, i.e. mean female wing span measurement plus twice the standard deviation — see Table 3. Of the birds trapped 185 were deemed to be males, leaving a mixture of 124 females and small males. This gives a minimum male:female ratio of 1.5:1.

Morphometrics

Table 3 sets out measurements for wing span, wing length and tail length. The ranges of these three measurements vary slightly from those presented by Disney (1974) and Lane (1983)

DISCUSSION

Food sources

Both techniques (i.e. pollen samples and observations) were used to counteract the shortcomings of each. It was very difficult to observe many birds visiting flowers in the dense undergrowth but the pollen from those flowers could be collected from the birds that fed on them. Flowers that possess anthers that are short and are unable to spread their pollen onto parts of the bird where there is a likelihood of it remaining (i.e. the forehead and on the beak adjacent to the nares) have less chance of their pollen being collected by our sampling technique.

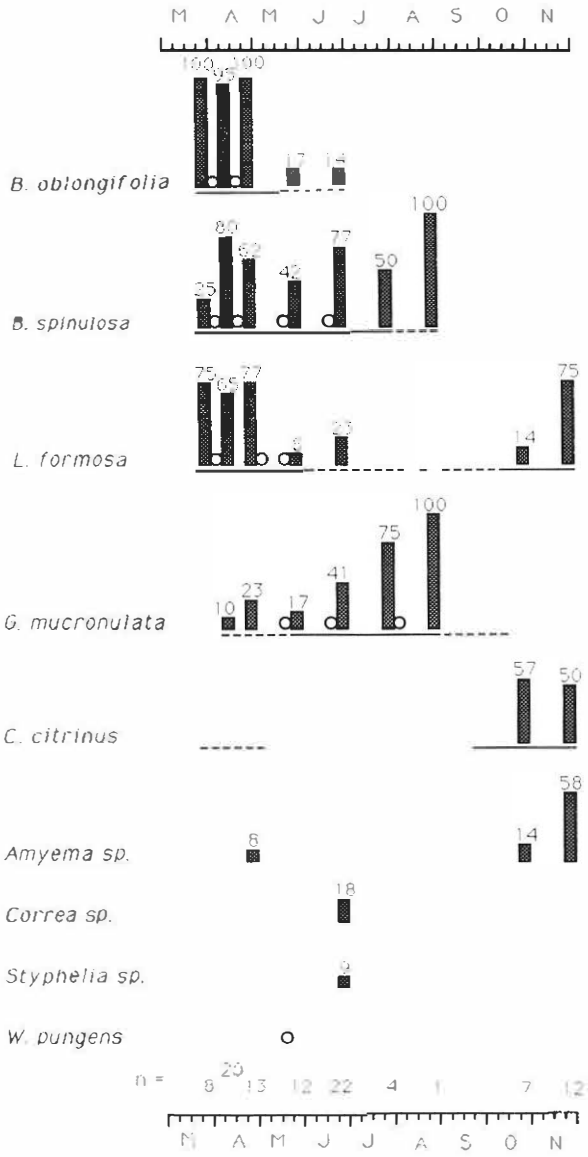

Figure 5. *Food plants utilised by Eastern Spinebills from March to November 1991, showing percentage of birds sampled per banding day which had a high pollen count. n = number of birds sampled each banding day; —— = major flowering period; – – – = extended intermittent flowering period; o = visual observation of feeding birds.*

We have several examples to highlight this. On numerous occasions we observed Eastern Spinebills feeding on *Woollsia pungens*. The corolla-tube of these flowers was only 10 mm long and even though pollen samples were taken from

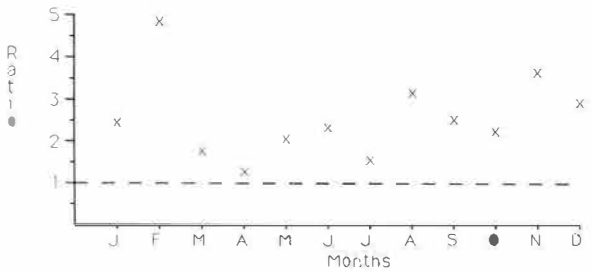

Figure 6. *Ratio of males to females per month from 1979–1989.*

the flower for reference none was ever recovered from a sampled bird. On the other hand no Eastern Spinebills were seen feeding on *Amyema, Correa* or *Styphelia* but many were caught with a high pollen count from these plants.

Capture and recapture rates

There was a dramatic rise in capture rates of Eastern Spinebills during May, June and July (Fig. 2). This peak coincided with the major flowering period of *B. spinulosa* and *G. mucronulata* and included the tail end of the flowering period of *B. oblongifolia* and *L. formosa* (Fig. 5). *L. formosa* continued to flower into June and July but the number of blooms had declined. These four species of plants formed the major nectar source of the Eastern Spinebills during this period and constantly brought the birds down into the capture zone.

Congregations of Eastern Spinebills during the autumn/winter period have also been noted at Canberra by Wilson (1964) and in the New England National Park by Ford and Pursey (1982) and McFarland and Ford (1987). All of these researchers noted that congregations coincided with the flowering of *Banksia* found in their district. Ford (1983) concluded that seasonal movements of several species of honeyeaters near Adelaide could generally be related to the flowering of nectar-bearing plants.

The major influx of Eastern Spinebills during May, June and July at Blue Gum Swamp Creek could be attributed to two major factors. First, it could simply be a congregation of birds in response to the flowering of their major nectar sources, or secondly, it might represent a passage of birds through our study site.

TABLE 3

Measurements of wing length, tail length, and wing span for adults Eastern Spinebills caught at Blue Gum Swamp Creek, New South Wales.

	Male	Female
WING (mm)		
n	173	91
range	62–74	57–66
mean	68.9	62.1
S.D.	±2.1	±1.8
WING SPAN (mm)		
n	201	107
range	200–226	182–205
mean	213.6	193.5
S.D.	±5.5	±4.4
TAIL (mm)		
n	166	94
range	55–70	50–59
mean	62.1	54.0
S.D.	±2.9	±2.3

The first suggestion appears not to be the case at Blue Gum Swamp Creek. *B. oblongifolia* grows in rather restricted areas in the region, mainly in gullies near water courses and along their adjacent slopes. It is found growing throughout the study area whilst *B. spinulosa* and *L. formosa* are widespread throughout the district and grow both in gullies and on ridgetops. Our data shows that nearly all Eastern Spinebills caught in March and April fed on *B. oblongifolia*, whereas *B. spinulosa* was utilised much less frequently. If the influx of Eastern Spinebills was in response to the flowering of these food plants the birds would have arrived in numbers during March to feed on *B. oblongifolia* or at least shown a gradual increase from March through to July. This did not occur.

We contend, therefore, that the winter influx is that of a passage of birds through our study site and possibly through the area. This is supported by the substantial increase in numbers during May, June and July which is not specifically linked to a food source restricted to our study site but may be linked to the widespread flowering of *B. spinulosa* and *G. mucronulata* throughout the Blue Mountains region. It is also supported by unpublished data supplied by Peter Smith. He has

calculated the mean density of Eastern Spinebills throughout the Blue Mountains using counts taken in 100 1 ha plots. His values of 1.3 ± 0.1 SE per ha for spring and 2.3 ± 0.2 SE per ha for winter show a significant rise during the winter period.

Most birds were trapped in May, June and July (Fig. 2) but the percentage recaptures during the same month in following years fell well below those tabled in McFarland and Ford (1987), who found that 'birds banded in June to September and recaptured in later years, had a greater than 50 per cent chance of being caught within one month of the banding date'. We found that the only month that recorded above 50 per cent return was May (Table 1) but this may simply be an artifact of the small sample size. When the retraps were tabulated for seasons (Table 1) the highest percentage recorded was only 38 per cent for autumn although the recapture figures do show that those birds banded in autumn had a higher chance of being caught during the autumn/winter influx in subsequent years. It would seem that Eastern Spinebills at Blue Gum Swamp Creek were less regular in the timing of their return to the site.

Total percentage of retrapped Eastern Spinebills was calculated as 15.5 per cent which is twice that recorded by McFarland and Ford (1987). This higher percentage probably indicates a higher proportion of sedentary birds at Blue Gum Swamp Creek.

Annual survival

The calculated annual survival rate of Eastern Spinebills from our study was 70 per cent. This is higher than the figure of 60 per cent reached by McFarland and Ford (1987) and could indicate a lower mortality of Eastern Spinebills at Blue Gum Swamp Creek. The milder climate experienced in the lower Blue Mountains, compared with that of the New England National Park site where overnight temperatures during winter usually drop below zero and snowfalls may occur, may be a contributing factor to the higher survivorship at Blue Gum Swamp Creek.

Sex ratios

The overall ratio of males to females found at Blue Gum Swamp Creek was 2.2:1.0 (n = 561). This value falls between the ratio calculated by McFarland and Ford (1987) for the New England National Park (1.6:1.0 males to females, n = 1 755) and that presented by Liddy (1966) for a population on the north coast of NSW (2.8:1.0 males to females, n = 864). McFarland and Ford (1987) showed this ratio peaking in August to just over 5:1 with a smaller peak in March, and the rest of the months approximating unity. A similar pattern is not evident in our study (Fig. 5).

The minimum male:female ratio was calculated as 1.5:1 amongst juveniles. It would appear then that the skewing of the sex ratio in Eastern Spinebills commences during their first year.

CONCLUSION

The results presented in this paper emanate from a broad study of the bird populations at Blue Gum Swamp Creek. From our data we were able to determine: (a) the food plants utilised by Eastern Spinebills; (b) morphometric details; (c) survival rates and longevity; (d) the skewing of the sex ratio in favour of males; (e) annual variations with reference to bu hfires in the area; and (f) seasonal variations with suggestions to explain the influx of Eastern Spinebills during the winter period.

Presenting our data in formats already established by other authors enabled us to compare our results with those from other areas of NSW and ACT and thus examine any trends and patterns that became evident. One major area that needs to be further investigated is the movement patterns of these birds. Major influxes of Eastern Spinebills have been recorded during winter at Canberra, the New England National Park and the Blue Mountains. It is known that some birds form a resident population but what happens to the majority of the winter 'migrants'? Where do they go during the other months of the year?

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