

## Relationships between time since fire and honeyeater abundance in montane heathland

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**Abstract.** Montane heath communities in south-eastern Australia provide a valuable nectar resource for honeyeaters (Meliphagidae) but are subject to variable fire regimes that may influence the production of this resource and the abundance of honeyeaters. Little is known about changes in honeyeater communities through time after fire. We examined seasonal relationships between characteristics of the honeyeater community and time since fire in Blue Mountains Heath using regression analysis. Positive trends were expected, with possible eventual declines owing to senescence of the vegetation community. Twelve sites ranging from 2 to 39 years since fire were sampled in late winter–spring (cool season) and in late summer (warm season). In the warm season, abundance of all honeyeaters and abundance of New Holland Honeyeaters showed saturation relationships with time since fire. A steep rate of increase in abundance reached a plateau 10 years after fire for all honeyeaters and New Holland Honeyeaters. In the cool season, New Holland Honeyeater abundance was positively influenced by time since fire. This study showed that honeyeaters used heath across a broad range of post-fire intervals >10 years and there was no evidence of a decline as the heath matured (to 39 years post-fire). Our research has contributed to the understanding of the links between fire ecology and avian habitat use, which in turn provides a scientific basis for ecologically sustainable fire management of natural areas.

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### Introduction

Throughout the world, birds are influenced by the effects of fire on resource availability in natural landscapes. The abundance of a species may change immediately after fire (Smucker *et al.* 2005) and continue to change with time since fire (Jacquet and Prodon 2009; Pons and Clavero 2010). The resulting variations in avian community composition may be associated with post-fire successional changes in vegetation communities, and similar species might find a certain range of time since fire more useful in a habitat (Lowe *et al.* 2012; Pons *et al.* 2012). Australian studies, such as those by Loyn (1997) and Watson *et al.* (2012), have also found that some bird species may occur in higher numbers in habitat representing specific ranges of time after fire. Time since fire is thus an aspect of the fire regime that can play an important role in shaping avian diversity at the landscape scale.

Honeyeaters (Meliphagidae) are a diverse family of birds occurring predominately in Australia, New Guinea and the Pacific region. In Australia, their highest species richness and densities are found in dry sclerophyll eucalypt forest and heathland (Ford and Paton 1985). The ways in which honeyeaters respond to time since fire in heathland are not well understood. The few studies of honeyeaters and time since fire in heath have examined the varied responses of particular honeyeater species for up to 11 years after fire (McFarland 1988; Arnold *et al.* 1993).

Several studies of the ecological responses of plants to disturbances such as fire have considered species in functional

groups, according to their similarity of response (e.g. Gill 1981; Benson 1985). This understanding has facilitated fire management for plant biodiversity at a community scale. Efforts to evaluate and classify Australian fauna according to their similarity of response to fire are fairly recent (Tasker *et al.* 2006). We anticipated that sympatric honeyeater species may be somewhat similar in their response to time since fire owing to their common phylogenetic history, and the common but varying use of nectar as a food resource (Ford and Paton 1985). If so, perhaps individual species could be considered collectively, at least in some respects, for fire management purposes.

The temporal pattern of use of heath habitat by honeyeaters is at least in part related to the predictability of the food resources they provide. Honeyeaters consume a range of foods including nectar, fruit, manna, honeydew, lerp and insects, often depending on what is seasonally available (Ford and Paton 1985). Eastern Spinebills (*Acanthorhynchus tenuirostris*) may move into montane heath on a seasonal basis, possibly in response to higher levels of nectar (McFarland and Ford 1987). The New Holland Honeyeater (*Phylidonyris novaehollandiae*) is a frequently occurring, transient species in heath, although some individuals have been reported as residing for substantial periods throughout the year (Pyke *et al.* 1989).

In montane heath, flowering shrubs such as *Banksia ericifolia* are a major nectar resource for honeyeaters (Pyke 1988; Lloyd *et al.* 2002). Annual peaks in the mean number of *B. ericifolia*

inflorescences per plant can occur in June, July or August (Copland and Whelan 1989). This species has a juvenile period of 7–8 years before first flowering (Benson 1985). Other common nectar-producing shrubs, such as *Banksia serrata* and *Lambertia formosa*, produce flowers in the warmer months from 2–3 years since fire (Pyke 1983a; Bradstock and Myerscough 1988).

Heath community structure and flowering potential thus change through time after fire, with different plant species showing different temporal patterns of flowering, often associated with their means of persistence through fire (Benson 1985; Pyke *et al.* 1993). Obligate seeding species in heath, such as *B. ericifolia*, can decline and become extinct in a community if the interval between successive fires is too short to allow young plants to produce adequate seed (Bradstock *et al.* 1996). Frequent fire is limiting to resprouting shrubs, such as *L. formosa*, as plants direct resources to vegetative regrowth rather than reproduction (Knox and Morrison 2005). At the other end of the fire-frequency spectrum, senescence and local extinction of a serotinous heath species is possible when intervals between fires are long (Bradstock *et al.* 1996).

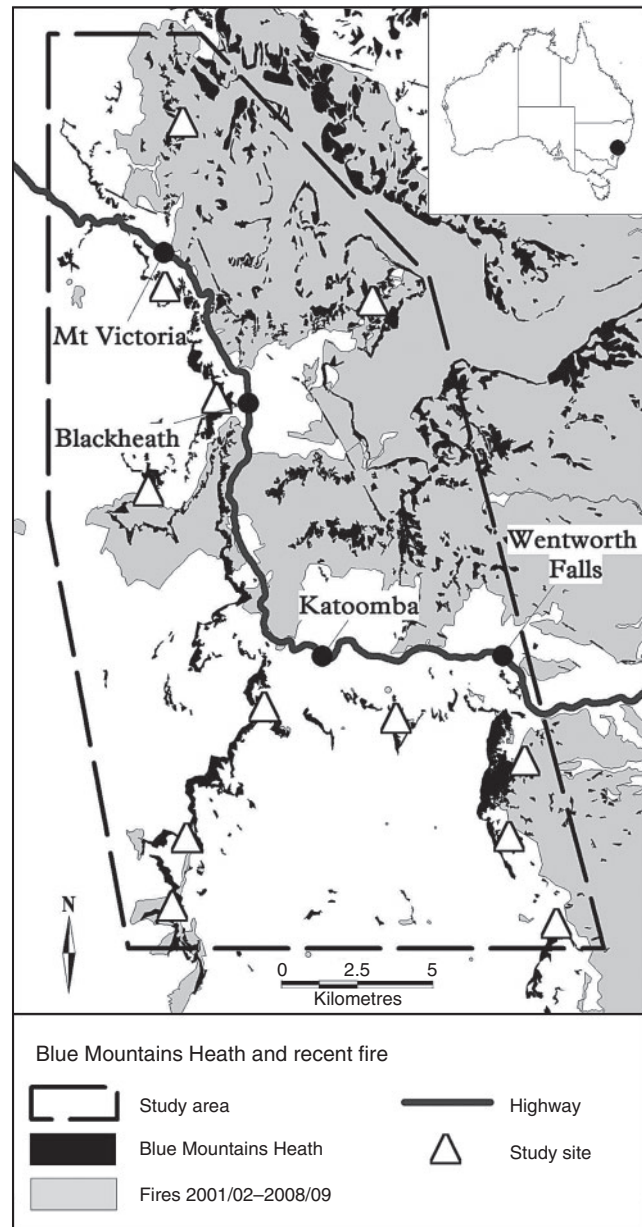
Although fire occurs naturally in the sclerophyllous heath vegetation of south-eastern Australia (Keith *et al.* 2002), fire regimes in these communities continue to change. Planned low-intensity fires have been used as a management tool to reduce the risk of wildfire affecting developed areas, and these practices have generally resulted in more frequent fires (Knox and Morrison 2005). In addition, large, high-intensity wildfires are expected to increase in frequency in south-eastern Australia with predicted changes in climatic conditions (Bradstock *et al.* 2009).

It is not known whether honeyeaters use montane heath from a narrow or broad range of time since fire. This study aimed to determine whether time since fire could explain seasonal honeyeater community composition and species abundance in montane heaths. These relationships were expected to vary seasonally owing to temporal variations in available food resources. It was expected that these relationships would initially exhibit positive trends, given that resources used by honeyeaters were likely to increase at certain rates after fire. One scenario was that resources would continue to support a steady increase in honeyeater numbers for decades after fire, with linear relationships expected. Alternatively, vegetation dynamics may contribute to a decline in honeyeater numbers in heath with a longer time since fire, so relationships may be represented by a quadratic curve. Furthermore, a saturation trend was possible, because at some point in time after fire, stabilised resource levels may preclude any further increase in honeyeater numbers.

## Materials and methods

### Study sites

The study was conducted in Blue Mountains Heath vegetation community (Tindall *et al.* 2004) on the western escarpment of the upper Blue Mountains, in central eastern New South Wales (Fig. 1). The Blue Mountains is an elevated, dissected sandstone plateau within the Great Dividing Range west of Sydney. Much of the area lies within conservation reserves and has a well documented history of fire management. Different types and seral stages of heath vegetation communities form a mosaic pattern in the landscape, largely as a result of the extent of



**Fig. 1.** The extent of Blue Mountains Heath within the study area and areas burned in fires between 2001 and 2009. The 12 study sites were widely distributed across the study area.

occurrence and frequency of fire (Keith 2004). Wildfires occurring since 2001 have burnt a major proportion of Blue Mountains Heath, so that heath with a fire-free interval of >10 years is not well represented in this landscape and patches of such age are often small (Fig. 1).

To understand how honeyeaters respond to processes of regeneration and senescence that occur over decades within heath vegetation communities after fire, it was necessary to use different study sites that spanned a wide range of time since fire, rather than following the same sites through time since fire. The identification of Blue Mountains Heath representing a broad range of time since fire was accomplished using geographical

information systems (GIS) software (MapInfo V9, Pitney Bowes, Troy, NY, USA) in conjunction with maps of the distribution of Blue Mountains Heath (DECCW 2004), the annual extent of wildfires and prescribed fires (National Parks and Wildlife Service 2009) and the region's towns and roads (Department of Lands 2006).

Mapping revealed numerous potential study sites, which led to the selection of a preliminary set of sites according to the criteria of patch-size, spatial distribution and accessibility. To be included, sites were required to (1) consist of an even-aged patch of heath greater than 5 ha, to accommodate random selection of replicate but separate bird survey points through time; (2) have a minimum spatial separation of 1 km, for honeyeater observations to be considered independent; (3) be distributed across the whole study area, rather than clustered near other sites with a similar time since fire; and (4) be within 500 m of a walking track or road so as to be able to carry sampling equipment through dense vegetation.

Because maps of fire history do not always indicate the intensity of fire or the potentially uneven distribution within their mapped boundaries (Wittkuhn *et al.* 2009), 24 potential sites were inspected in June and July 2010 from which we selected the 12 sites that best fitted the criteria. These sites had a time since fire of 2–39 years and were located at Kings Tableland, Narrowneck, Shipley Plateau and other scattered locations on the western escarpment (Table 1).

#### Surveys of honeyeaters

Surveys were conducted in two seasons to measure intra-annual variation in honeyeater occurrence (McFarland 2002; Mac Nally and Timewell 2005): cool season (August–September 2010) and warm season (February 2011). Each of the 12 sites was visited twice per season on different days. During visits, honeyeaters were surveyed in three circular sampling areas, each with a radius of 25 m (Pyke 1983b). The centre points of the circular sampling areas were randomly selected and different sampling areas within the site were selected for each visit. MapInfo GIS software (Pitney Bowes) was used to apply a 50-m grid to each of the sites and pairs of random numbers were used to identify grid squares within which sampling took place. At the centre of each sampling area, a 2.1-m step ladder was erected to give an observation

position above the top of the shrub canopy to increase the likelihood of detecting honeyeaters as they moved through and above the often dense shrub layer (Pyke 1983b). The ladder was erected and 3 min allowed to pass to allow birds to resume activity after being disturbed before the timed sampling period began.

Before sampling, a range finder (Bushnell, Yardage Pro, Japan) was used to determine distances to features, such as prominent plants and rock outcrops within the sampling area, to enable distances from the observation point to each bird to be estimated and recorded on a diagram while sampling was underway (Pyke 1983b). Frequency distributions of distances to observations for each site were compared to check for variation across the range of times since fire. There was no consistent evidence of honeyeater repulsion from the observer among sites with shorter fire-age, or reduction in the detection of honeyeaters among sites with longer time since fire (see Supplementary material). Regression analysis confirmed that there was no relationship between the mean distance to honeyeater observations and time since fire among the sites. Bird surveys took place in the 3 h after dawn as honeyeaters were more likely to be active at this time of day (Pyke *et al.* 1989).

Each sampling area was scanned for 10 min (Gibbons *et al.* 1996). Birds were recorded only if they were seen because it was not possible to determine whether individuals that were heard only were within the sampling area due to the density of the shrub layer (Pyke 1983b). Groups, pairs or individual birds were not recorded again if they reappeared in the same specific location during the survey (Gibbons *et al.* 1996). Records of honeyeaters alighting or foraging were combined and used for data analysis, whereas honeyeaters flying over were not considered to be using the site.

#### Data analysis

Relationships between time since fire and honeyeater variables (see below) were examined using regression analyses. The response variables used in the analysis were mean number of honeyeater species and mean honeyeater abundance (total and by species). The explanatory variable used was time since fire. Honeyeater variables consisted of a mean for each of the 12 sites with separate datasets representing the cool and warm seasons. Count data from the three honeyeater surveys per site visit were summed to give abundance data per visit for these variables. The number of honeyeater species per visit was established by counting all species present during surveys in each site visit. Seasonal means were calculated using the visit totals for each season ( $n = 2$ ).

Honeyeater abundance data required  $\log_{10}(x + 1)$  transformation to improve normality and homoscedasticity of these variables (Sokal and Rohlf 2012). In accordance with the range of anticipated trends, linear, quadratic and saturation ( $y = a + b/x^{0.5}$ ) regression models were systematically fitted to the data. The model form with the best fit for each relationship tested was determined through evaluation of Akaike's information criterion (AIC) values, AIC differences and Akaike weights (Burnham and Anderson 2002). The regression results of the best-fitting model forms for each relationship were then adopted for reporting (Appendix 1). The scatter plot of standardised residuals

**Table 1.** Location of study sites, area of sites, time since fire and type and year of fire

	Site code	Area (ha)	Time since fire (years)	Fire Season	Type of fire
Sublime Point	SU1	9.19	2	2008–09	prescribed fire
Darling Causeway	DC1	9.56	4	2006–07	wild fire
Narrowneck	NN1	23.21	7	2003–04	wild fire
Kings Tableland	KT1	15.99	8	2002–03	wild fire
Shipley Plateau	SP1	7.42	8	2002–03	wild fire
Kings Tableland	KT2	10.12	9	2001–02	wild fire
Narrowneck	NN2	9.79	15	1995–96	prescribed fire
Mount Piddington	MP1	7.15	16	1994–95	wild fire
Hat Hill Road	HH1	10.05	17	1993–94	wild fire
Shipley Plateau	SP2	14.35	25	1985–86	prescribed fire
Kings Tableland	KT3	7.82	33	1977–78	wild fire
Narrowneck	NN3	5.02	39	1971–72	prescribed fire



against standardised predicted values for the regression models presented in the results was checked against the assumptions of normality, linearity and homoscedasticity of residuals (Quinn and Keough 2002).

## Results

### Honeyeater species

Eight species of honeyeater were observed in surveys, with the New Holland Honeyeater being the most abundant species, accounting for 58% of all individuals recorded (Fig. 2). Honeyeater abundance and community composition varied between the sampling seasons, with the numbers that each species contributed to community composition being more evenly distributed in the cool season. New Holland Honeyeaters and Eastern Spinebills were more abundant in the warm season, and these two species in combination dominated community composition at this time. The largest honeyeater present, the Red Wattlebird (*Anthochaera carunculata*), was roughly equally abundant in both seasons. The White-eared Honeyeater (*Lichenostomus leucotis*) and the migratory Yellow-faced Honeyeater (*Lichenostomus chrysops*) were rarely observed during the warm season. The Little Wattlebird (*Anthochaera chrysoptera*), White-naped Honeyeater (*Meliphreptus lunatus*) and Noisy Friarbird (*Philemon corniculatus*) were each observed only once.

The mean number of species present in the 24 seasonal site-visits was  $1.1 \pm 0.2$  (s.e.) in the cool season and  $1.5 \pm 0.2$  in the warm season. Because the mean number of species was small, there was no apparent relationship between the number of honeyeater species present and time since fire in either the cool season (saturation regression model:  $F_{1,10} = 0.328$ ,  $P = 0.58$ ,  $R^2 = 0.032$ ) or warm season (saturation regression model:  $F_{1,10} = 1.588$ ,  $P = 0.236$ ,  $R^2 = 0.137$ ).

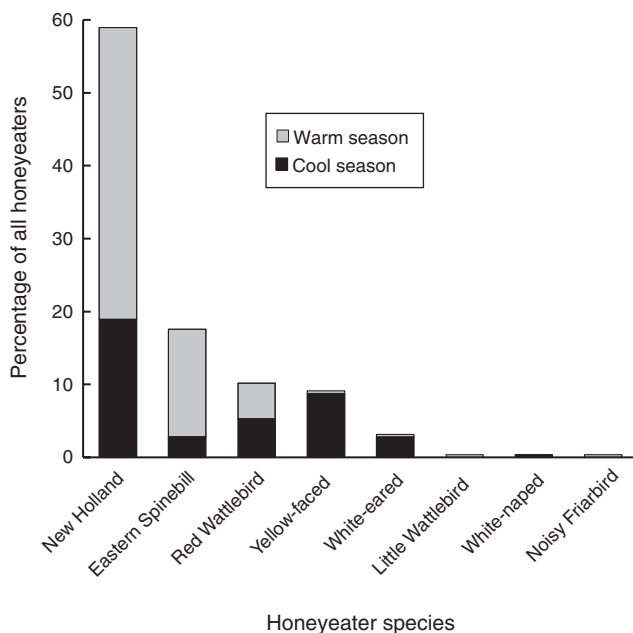


Fig. 2. The abundance of honeyeater species expressed as a percentage of all honeyeaters recorded ( $n = 285$ ).

### Honeyeater abundance and time since fire

The relationship between total honeyeater abundance and time since fire differed between the seasons. Total honeyeater abundance during the cool season was highly variable and showed no relationship with time since fire (Fig. 3a; saturation regression model:  $F_{1,10} = 1.096$ ,  $P = 0.32$ ,  $R^2 = 0.099$ ). During the warm season, total honeyeater abundance initially increased sharply and then levelled out across the range of time since fire assessed in this study (Fig. 3b). A substantial proportion of the variation in total honeyeater abundance was explained by time since fire using the saturation model ( $F_{1,10} = 8.034$ ,  $P = 0.018$ ,  $R^2 = 0.445$ ).

Abundance of New Holland Honeyeaters was related to time since fire in the cool and warm seasons. However, the relationships in each season showed different trends. During the cool season, New Holland Honeyeaters were not recorded in study sites with a time since fire of  $< 8$  years and were more abundant at sites with a longer time since fire (Fig. 3c). The linear regression model provided evidence of a relationship between abundance of New Holland Honeyeaters and time since fire in the cool season ( $F_{1,10} = 10.639$ ,  $P = 0.009$ ,  $R^2 = 0.515$ ). As was the case with total honeyeater abundance, the saturation model provided the best fit for New Holland Honeyeater abundance against time since fire in the warm season (Fig. 3d;  $F_{1,10} = 7.749$ ,  $P = 0.019$ ,  $R^2 = 0.437$ ).

Time since fire did not account for the variation in mean abundance of Eastern Spinebills at the study sites during the warm season (linear regression model:  $F_{1,10} = 0.028$ ,  $P = 0.87$ ,  $R^2 = 0.003$ ). Red Wattlebird, Yellow-faced Honeyeater and cool season Eastern Spinebill results did not meet the assumptions of regression analysis owing to low numbers and were not assessed on an individual species basis.

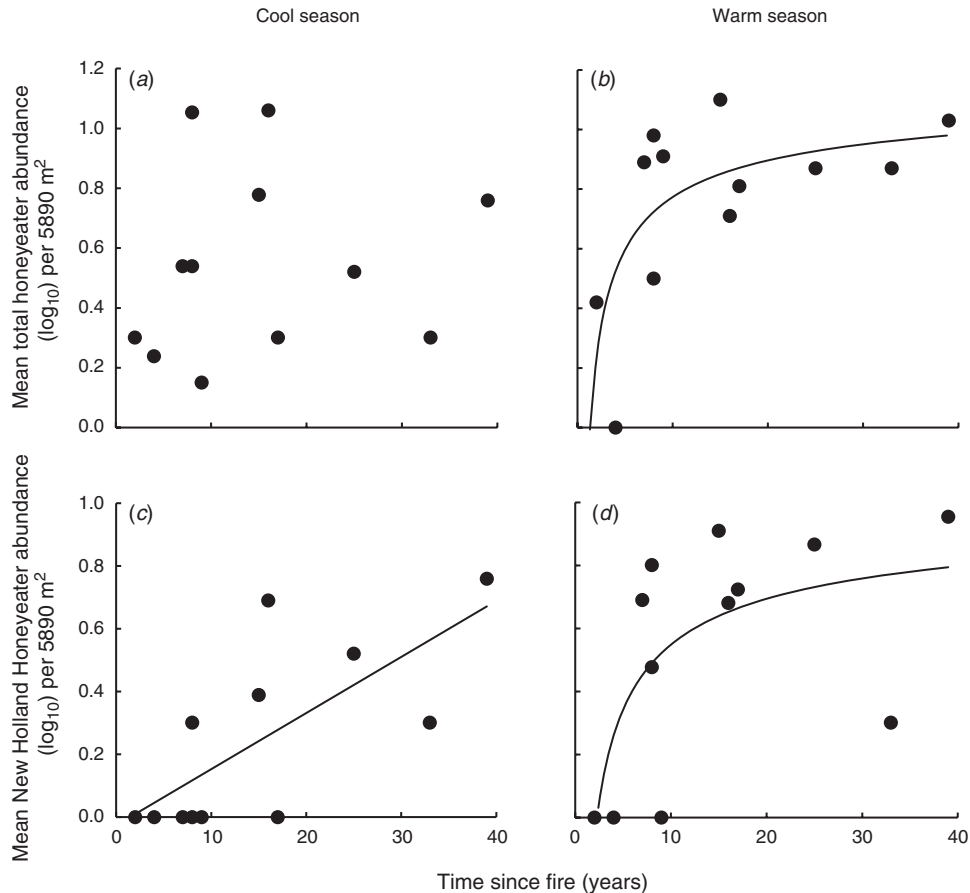
## Discussion

### Number of honeyeater species present

Although results varied on a seasonal basis, there was no evidence that time since fire influenced the number of honeyeater species in the sites during either the cool or warm seasons. Density of honeyeaters and total species present in this study were generally typical for heath vegetation in south-eastern Australia (Pyke 1983b; Ford and Paton 1985; Hardy and Farrell 1990; Pyke *et al.* 1993), but the low numbers of species present in each visit to the sites meant that any trends in the number of species were more difficult to detect. The numerical dominance of New Holland Honeyeaters may have contributed to the low numbers of species in the sites. New Holland Honeyeaters may have been territorial (McFarland 2002) and may have excluded other species from the sites (Pyke *et al.* 1996).

### Honeyeater abundance and time since fire

Several moderate-strength trends between abundance of honeyeaters and time since fire were detected, which varied with season and among all honeyeaters pooled and individual species. Total honeyeater abundance in the warm season increased rapidly up to 10 years since fire and then numbers appeared to reach saturation with little increase between 10 and 40 years since fire. The low level of total honeyeater abundance at study sites 2 and 4 years since fire is probably in large part a result of the loss of vegetative structure and food resources (Hardy and Farrell 1990).



**Fig. 3.** Abundance of all honeyeaters and New Holland Honeyeaters in relation to time since fire in cool and warm seasons. Honeyeater abundance variables are expressed as the mean of two surveys conducted on separate days, each consisting of the sum of three point surveys.

Movements of those honeyeaters able to escape a fire may result in an influx to neighbouring unburnt areas, such that the source of variation in numbers in a site might be a function of the state of its surroundings.

An absence of honeyeaters immediately after fire followed by a rapid increase in numbers then a slower rate of increase after a certain time has also been described by others. In a study in Victoria, honeyeaters were not present in heath during a survey conducted 3 weeks after a wildfire, with their absence attributed to the high mobility of honeyeaters and the lack of food resources (Loyn 1997). The reoccupation of Loyn's (1997) study sites by honeyeaters was non-linear, with the rate of increase slowing after ~2 years after fire. In the current study, the rate of increase in the warm season slowed at 10 years after fire. The differences between the two studies is probably a result of differences in habitat.

In heath communities after fire, ongoing renewal of food resources and habitat structure are likely to contribute to any increases in honeyeater numbers (Hardy and Farrell 1990). The rapid increase in numbers up to 10 years since fire can be partly explained by lower levels of competition and more available niche spaces making it easier for birds to colonise newly regenerating heath (Terborgh and Faaborg 1980). Competition and

associated territoriality is likely to have influenced the establishment of upper limits of bird density in sites more than 10 years since fire (Terborgh and Faaborg 1980; Pyke *et al.* 1996).

In the cool season, honeyeaters appeared to be widely distributed in Blue Mountains Heath, in so far as birds were recorded in every site, with varying species and numbers present. This may be due to an increase in the foraging range of individual honeyeaters seeking to meet increased energy demands at this time of year (Ford 1989). Lower levels of honeyeater abundance in August–September compared to February have also been recorded in several other studies (Pyke 1983b; Ford and Paton 1985; Hardy and Farrell 1990).

At the level of individual species, a positive linear relationship between abundance of New Holland Honeyeaters and time since fire was apparent during the cool season. *Banksia ericifolia* can be an important source of nectar in winter (Pyke 1988; Lloyd *et al.* 2002) but does not produce flowers until approximately 7 years after fire (Benson 1985), which may partly explain why no New Holland Honeyeaters were recorded at sites with a time since fire of <8 years. After this time, habitat factors within the heath appear to be of increasing value to New Holland Honeyeaters. One of these could be an increase in nectar supplied by *B. ericifolia*. The study sites 17 years (Site HH1) and 33 years (Site KT3) since fire

had low numbers of New Holland Honeyeaters, which added variability to the results. It would have been better to have had more sites of longer time since fire to establish whether these results were anomalous. However, there was a lack of suitable heath study sites in this age range owing to widespread recent wildfires across the Blue Mountains region.

During the warm season, the rate of increase in numbers of New Holland Honeyeaters slowed as saturation was reached at ~10 years since fire. As was the case with total honeyeater abundance, the steep increase in abundance of New Holland Honeyeaters at sites up to 9 years since fire may be attributed to increasing levels of food resources and habitat structure in the heath. Intraspecific competition was likely to be a factor in maintaining constant numbers through the range of 10–39 years since fire (Pyke *et al.* 1993; McFarland 2002). The difference in seasonal response forms for New Holland Honeyeater abundance could reflect the regeneration mode of the key nectar sources at these times. The post-fire abundance of New Holland Honeyeaters may recover more rapidly in the warm season because the nectar available in the warm season is produced by plants that resprout after fire, and they flower sooner and produce nectar sooner (Pyke 1983a; Bradstock and Myerscough 1988) than obligate-seeding plants (Benson 1985) that are used in winter.

Different types of relationships between certain honeyeater species and time since fire were also detected in Murray Mallee vegetation communities (Watson *et al.* 2012). Abundance of the Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*) and the Striped Honeyeater (*Plectorhyncha lanceolata*) after fire showed a linear trend that was comparable to that of the New Holland Honeyeater in the cool season in Blue Mountains Heath. Numbers of Yellow-plumed Honeyeater (*Lichenostomus ornatus*) reached a plateau over time since fire in a similar way to the New Holland Honeyeater in heath in the warm season, although the trends were analysed over different time periods. Numbers of White-eared Honeyeaters were seasonally low in Blue Mountains Heath. This species showed no response to time since fire in Chenopod Mallee and a bell-shaped response in Triodia Mallee over 100 years (Watson *et al.* 2012). Although relationships detected in both studies showed various trends, in all cases the abundance of these honeyeater species increased over the 40-year period following fire in these habitats.

## Conclusion

Honeyeaters appear to use Blue Mountains Heath across a broad range of times since fire with the exception of the years shortly after fire. Much Blue Mountains Heath in the landscape has been affected by several wildfires of large extent in the last 10 years, so there is little heath remaining in the range of time since fire in which honeyeaters have been shown to be more abundant (10–39 years). The landscape-scale reduction in optimal Blue Mountains Heath habitat for honeyeaters might have caused a slight increase in their density in surrounding heath with a time since fire >10 years.

For the maintenance of plant diversity in heath in New South Wales generally, fire intervals of 7–30 years are considered necessary, with some intervals >20 years (Kenny *et al.* 2003). This pattern of fire-ages in heath across a landscape may also suit honeyeaters, particularly if the lower end of the range was raised

from 7 to 10 years. It is possible that honeyeaters may respond to the effects of the frequency, intensity and seasonality of fire on their habitat and surrounding areas, but further investigations of these relationships is needed to yield greater understanding of their ecology.

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**Appendix 1. Values of Akaike's information criterion (AIC) for regression models used to analyse seasonal relationships between characteristics of the honeyeater community and time since fire in Blue Mountains Heath**

The model that best fitted the data is indicated with an asterisk (\*), and was determined by evaluating AIC values, AIC differences ( $\Delta_i$ ) and Akaike weights ( $w_i$ ) for each relationship tested (Burnham and Anderson 2002)

Response variable (mean) v. time since fire	Season	Model	Residual sum of squares	AIC	$\Delta_i$	$w_i$
Number of honeyeater species	Warm	$y = a + bx$	5.897	-4.526	0.601	0.367
		$y = a + bx + cx^2$	5.887	-2.546	2.580	0.137
		$y = a + b/x^{0.5}$	5.609	-5.126*	0.000	0.496
Number of honeyeater species	Cool	$y = a + bx$	6.031	-4.256	0.325	0.376
		$y = a + bx + cx^2$	5.761	-2.806	1.775	0.182
		$y = a + b/x^{0.5}$	5.87	-4.581*	0.000	0.442
Total honeyeater abundance $\log_{10}$	Warm	$y = a + bx$	0.778	-28.831	3.238	0.139
		$y = a + bx + cx^2$	0.644	-29.100	2.970	0.159
		$y = a + b/x^{0.5}$	0.594	-32.069*	0.000	0.702
Total honeyeater abundance $\log_{10}$	Cool	$y = a + bx$	1.029	-25.476	0.971	0.320
		$y = a + bx + cx^2$	0.979	-24.074	2.373	0.159
		$y = a + b/x^{0.5}$	0.949	-26.447*	0.000	0.521
New Holland Honeyeater abundance $\log_{10}$	Warm	$y = a + bx$	1.139	-24.257	3.640	0.116
		$y = a + bx + cx^2$	0.909	-24.964	2.933	0.166
		$y = a + b/x^{0.5}$	0.841	-27.897*	0.000	0.718
New Holland Honeyeater abundance $\log_{10}$	Cool	$y = a + bx$	0.448	-35.454*	0.000	0.601
		$y = a + bx + cx^2$	0.438	-33.725	1.729	0.253
		$y = a + b/x^{0.5}$	0.567	-32.628	2.827	0.146
Eastern Spinebill abundance $\log_{10}$	Warm	$y = a + bx$	1.122	-24.438*	0.000	0.411
		$y = a + bx + cx^2$	1.086	-22.829	1.609	0.184
		$y = a + b/x^{0.5}$	1.125	-24.405	0.032	0.405