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RESURVEYS OF THE EASTERN BRISTLEBIRD *Dasyornis brachypterus* IN CENTRAL-EASTERN NEW SOUTH WALES 1999–2001: THEIR RELATIONSHIP WITH FIRE AND OBSERVER COMPETENCE

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The endangered Eastern Bristlebird *Dasyornis brachypterus* is found in a number of small isolated populations along the east coast of Australia. Presently little is known about the status and viability of many of these populations. Surveys for Eastern Bristlebirds were conducted at Red Rocks Nature Reserve, around Jervis Bay near Huskisson and on Beecroft Peninsula, and at Ku-ring-gai Chase National Park in south-eastern New South Wales to compare these data with historical records and to investigate more recent unconfirmed sightings of the species. Eastern Bristlebirds were resurveyed at Barren Grounds Nature Reserve, using the same sites as a previous long-term study from 1992 to 1998, to improve understanding of population density changes following fire. Among the sites of historical or unconfirmed records, ten Eastern Bristlebirds were found at Red Rocks Nature Reserve and four near Huskisson. None were found at either Beecroft Peninsula or Ku-ring-gai Chase National Park. At Barren Grounds Nature Reserve densities varied among sites of different post-fire age, ranging from 0.67 birds per 5 hectare in vegetation with the youngest fire-age of seven years to 1.6 birds per 5 hectare in vegetation with a fire-age of 19 years. For each site, the density was from 24 per cent to 60 per cent lower than in the 1992–98 study. We conclude that the consistency of these differences indicates differences in observer experience and training rather than a real decline in bird densities in these sites, and suggest that this factor should be taken into account in interpreting the results of long-term bird studies that rely on data from different observers.

INTRODUCTION

Evidence that fire has been present in Australia since the Tertiary Period was presented by Kemp (1981) and much of the flora has evolved characteristics that allow survival after this disturbance (Gill 1981). Although adaptations relating to fire are not as obvious in animals, many species, including some bird species, clearly take advantage of post-fire conditions. Loyn (1997) found that birds that feed in open ground, such as the Flame Robin *Petroica phoenicea*, Scarlet Robin *P. multicolor*, Buff-rumped Thornbill *Acanthiza reguloides* and Superb Fairy-wren *Malurus cyaneus*, thrived for three years post-fire to levels greater than before fire by exploiting low shrub regrowth. Aerial insectivores and raptors may also benefit from fire by following it and hunting disturbed insects or vertebrates (Woinarski and Recher 1997).

By contrast, there is a range of species that would be viewed as sensitive to fire because they depend on dense vegetation, species such as the Western Bristlebird *Dasyornis longirostris* (Smith 1987), Western Whipbird *Psophodes nigrogularis* (Smith 1991), and Noisy Scrub-bird *Atrichornis clamosus* (Danks 1997). The Eastern Bristlebird *D. brachypterus* has been described as fire-sensitive, based primarily on the work of Baker (1997, 2000, 2003). Currently, fire is identified as the main threat to this species (NPWS 1997; Garnett and Crowley 2000) as fire removes the dense understorey vegetation, which is the birds' preferred habitat. At Barren Grounds Nature Reserve and Booderee National Park, Jervis Bay, Eastern Bristlebird densities have been shown to increase with increasing time since last fire (Pyke *et al.* 1995; Baker 1997, 2003).

The Eastern Bristlebird is a cryptic, ground-dwelling, semi-flightless passerine. It occurs in a few disjunct populations on the east coast of Australia, inhabiting low, dense, fire-prone vegetation (Baker 2000). Within the last few centuries the species is assumed to have had a continuous distribution from Ku-ring-gai, north of Sydney Harbour, south to Ulladulla (Baker 1997) and populations common throughout suitable habitats along the east coast from Victoria to southern Queensland (North 1904). Currently, there are estimated to be 10 to 14 isolated populations, with only two of these exceeding 500 individuals (Baker 1997). The species is listed nationally as endangered under the Commonwealth 'Environment Protection and Biodiversity Conservation Act 1999'.

Barren Grounds Nature Reserve, the adjacent Budderoo National Park and Bherwerre Peninsula at Jervis Bay are currently the largest populations of the Eastern Bristlebird, with Nadgee Nature Reserve on the Victorian border the

next largest with an estimated 120 individuals (Baker 1997; NPWS 1997). Besides these populations there are historic or unconfirmed reports from the following areas in central eastern New South Wales: Ku-ring-gai Chase National Park where the species was apparently common before 1904 (North 1904) but from which there has only been a single record in the last three decades (Saunders 1986); Red Rocks Nature Reserve where a single Eastern Bristlebird was detected in 1995 (NPWS 1999); Beecroft Peninsula where their presence remains unconfirmed despite three recent records between 1984 and 1995 (NPWS 1997) and their high density on Bherwerre Peninsula on the opposite side of the Jervis Bay (Fig. 1).

Confirmed sightings of Eastern Bristlebirds are not common, as the bird is rarely seen, cryptically coloured and lives in dense vegetation not conducive to bird surveys. The Eastern Bristlebird is usually detected by its characteristic call, but this technique also poses problems. The Eastern Bristlebird has a repertoire of calls, many of which sound very similar to co-occurring species such as the New Holland Honeyeater *Phylidonyris novaehollandiae*. This can pose a problem for inexperienced observers leading to either over- or under-estimates of population density.

The aims of this study were to survey areas in the Sydney and Shoalhaven regions from which there have been historic or unconfirmed sightings of Eastern Bristlebirds, to resurvey sites at Barren Grounds Nature Reserve to determine trends since 1997 and to continue long-term monitoring and data collection.

STUDY AREAS AND METHODS

Historic locations

Surveys for the Eastern Bristlebird were carried out during January–March 1999 at Red Rocks Nature Reserve, Beecroft Peninsula, near the Huskisson township, and in Ku-ring-gai Chase National Park (Fig. 1). A follow up survey was conducted near Huskisson in October 2001. Surveys followed the methods outlined in Baker (1997), which incorporated slowly walking transects at 0.5 to 4 kilometres per hour. All Eastern Bristlebirds detected by sight or from their call were recorded. Eastern Bristlebirds can be reliably surveyed and mapped by their calls up to approximately 250 metres away in still, clear weather. This was verified by Baker (2001) who calculated similar densities using both aural surveys and radio-tracking studies. Surveys were not conducted when the weather was excessively hot or windy. Two Eastern Bristlebirds were often detected calling together, commonly termed duetting. Where duetting was heard, the two birds were recorded as a 'pair'. In circumstances when the presence of Eastern Bristlebirds in the area was uncertain a tape of Eastern Bristlebird calls was played in sites of suitable habitat in an attempt to elicit a response from any birds in the area.

At Red Rocks Nature Reserve, one observer walked a total of 12 kilometres of tracks in 14 hours over two days. Tracks were selected based on the location of past detection (NPWS 1999) and the presence of suitable habitat. Tracks were walked twice, once in the early morning and once in the late afternoon. Where birds were detected at a site on both surveys, the total number of birds was counted.

In 1999, one observer walked a total of seven kilometres in four hours during one day at Huskisson. At Beecroft Peninsula the survey consisted of a combination of walking and driving to cover a total of 16 kilometres in 12 hours over two days. Sites of previous and unconfirmed detections west of Huskisson (NPWS 1999) and at Beecroft Peninsula (Baker 1997) were targeted for surveys and transects were selected based on the presence of suitable habitat. Transects were walked either in the

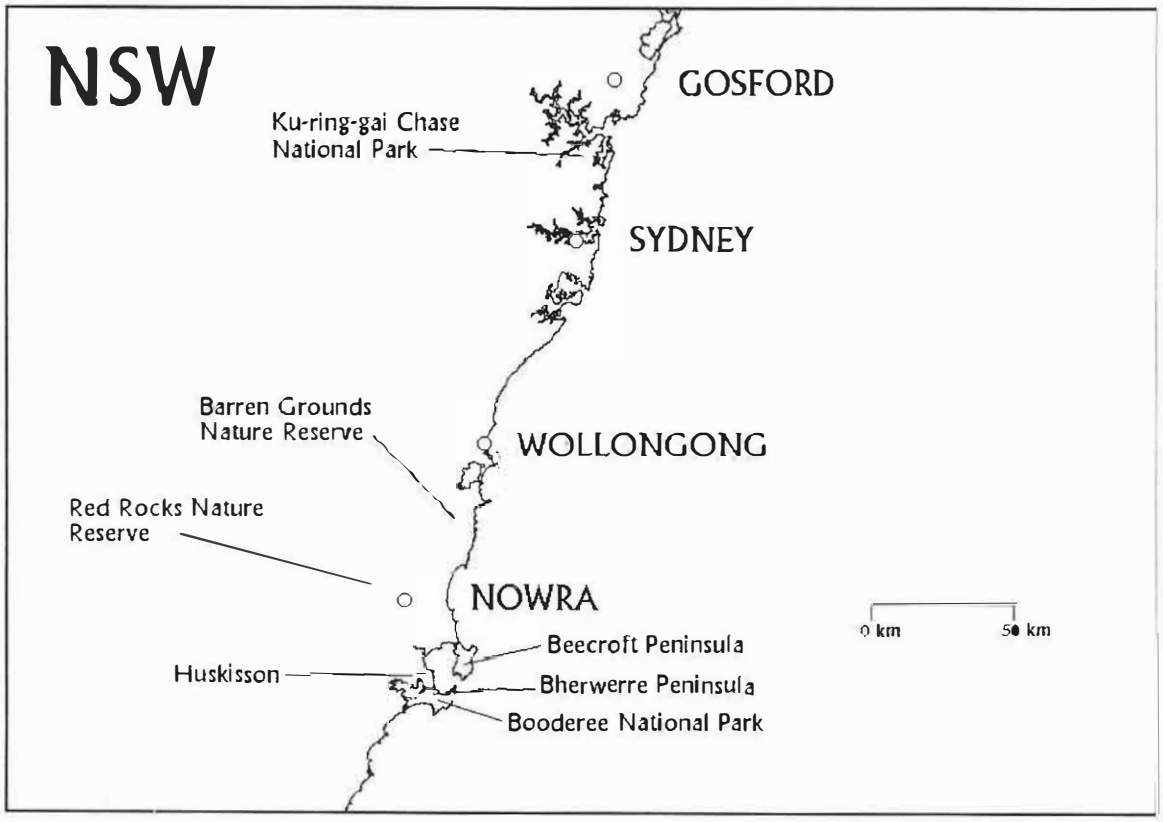

Figure 1: *Map of study areas in central-eastern New South Wales.*

early morning or in the late afternoon and a tape of Eastern Bristlebird calls was played for approximately two minutes at 16 sites at Huskisson and 20 sites on Beecroft Peninsula where suitable habitat occurred. In 2001, ten kilometres of transects near Huskisson were again surveyed in five hours over two days by one observer, without the use of call playback. Transects were extended from that walked in 1999 and they were each only walked once, within three hours of sunrise.

In the south-west of Ku-ring-gai Chase National Park, one observer walked a total of 11.5 kilometres in ten hours over two days. The Mt. Ku-ring-gai Track was surveyed because Saunders (1986) detected an Eastern Bristlebird in that vicinity. Other tracks were selected on the basis of the occurrence of suitable habitat. Tracks were walked either in the morning or the afternoon and a tape of Eastern Bristlebird calls was played for approximately two minutes at 19 sites.

Barren Grounds Nature Reserve

At Barren Grounds Nature Reserve, two observers walked 19 kilometres of pre-selected tracks (Baker 1997) in a total of 19 hours over three days. Each track was walked twice, once by each observer within four hours of sunrise. In the past, these tracks have been used as fire breaks and the 19 kilometres of tracks traversed five different fire-ages of vegetation. The tracks were divided into 500 metre sections and all Eastern Bristlebirds detected within 100 metres of the track were mapped so that the densities of birds per five hectares could be calculated for each of five different fire-ages of habitat: 7, 10, 16, 18 and 19 years post-fire. These tracks were previously monitored during 1992 to 1998.

RESULTS

Historic locations

At Red Rocks Nature Reserve, ten Eastern Bristlebirds were detected. Two duetting pairs were found at the western end of the Reserve. One of these pairs was located in a gully of dense *Melaleuca* shrubland, the other in *Eucalyptus* woodland with a clumpy shrub understorey and dense ground cover. Both these habitats had a fire-age at the time of only three years, being last burnt in late 1995. The remaining six birds, including one pair, were found at the south-eastern end of the Reserve. The vegetation in this area was open *Eucalyptus* forest with a dense, shrubby understorey and dense ground cover. Much of this area was also burnt in late 1995. Two of the six remaining birds were found within the fire boundary and the other four birds in longer unburnt habitat (>13 yrs). These two fires in 1995 were not large wildfires and burnt a combined total of just under 200 hectares, approximately 130 hectares within the reserve boundary.

At Jervis Bay, two pairs of Eastern Bristlebirds were detected in 1999. One pair within 0.5 kilometres south-west of Huskisson in closed heathland dominated by *Hakea teretifolia*, just within the boundary of a fire from 4.5 years earlier. The second pair was found in closed shrubland dominated by *Leptospermum grandifolium* within 2.5 kilometres south-west of Huskisson, with a fire-age of only 1.5 years. In 2001, four birds were again detected 1 to 2.5 kilometres south-west of Huskisson, two as individuals and two birds as a duetting pair. The two individuals were found in the same vicinity as the pair found previously in 1999 in *Hakea* heathland, although within the boundary of a more recent fire in 1996. The duetting pair of Eastern Bristlebirds was detected in thick *Melaleuca ericifolia* dominated shrubland, approximately one kilometre further west than other previous records of Eastern Bristlebirds in the area (NPWS 1999). This area of *Melaleuca ericifolia* had a fire-age of 3.5 years.

No Eastern Bristlebirds were detected at either Beecroft Peninsula or Ku-ring-gai Chase National Park. All survey routes and locations where Eastern Bristlebird were detected at Red Rocks Nature Reserve, near Huskisson on Jervis Bay, Beecroft Peninsula and Ku-ring-gai Chase National Park can be found in Bain and McPhee (1999) and Bain (2001).

Barren Grounds Nature Reserve

At Barren Grounds Nature Reserve, the density of Eastern Bristlebirds looked to be positively correlated with the increasing fire-age of vegetation (Fig. 2). This relationship, however, was not significant ($r = 0.67$, $df = 4$, $P = 0.22$) due to a lower than expected density of birds in vegetation with a fire-age of 18 years. Bristlebird densities averaged 1.1 birds per 5 hectare and increased from 0.67 ± 0.17 birds per 5 hectares (mean ± SE) in vegetation with a fire-age of seven years to 1.6 ± 0.70 birds per 5 hectares (mean ± SE) in vegetation with a fire age of nineteen years (Fig. 2).

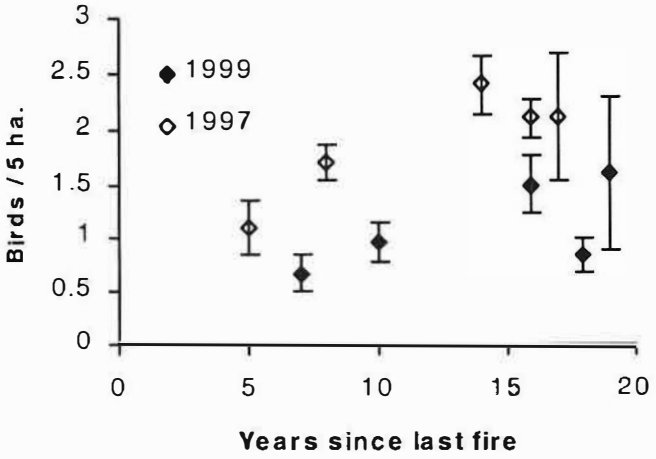

Figure 2: *Eastern Bristlebird densities in habitat with varying fire-age at Barren Grounds Nature Reserve. 1999 observations are from this study, 1997 observations are from Baker (2003). Error bars represent standard error.*

DISCUSSION

Historic locations

The presence of ten Eastern Bristlebirds at Red Rocks Nature Reserve suggests that the area may support a viable population of the species. The fact that Eastern Bristlebirds have survived relatively recent (1995) fires here and were present in habitat ranging from older than 13 years to 3 years since the last fire, may add weight to this conclusion. Additional weight may be added by the presence of duetting Eastern Bristlebirds, as duetting is believed to indicate the presence of breeding pairs of bristlebirds. Further surveys of this area are needed to accurately estimate the size of the Red Rocks' population, its status and connectivity to other nearby reserves. Morton National Park, Budderoo National Park and Barren Grounds Nature Reserve are 2.7, 5.6 and 13.5 kilometres respectively from Red Rocks Nature Reserve and are separated by agricultural land that is considered unsuitable for the dispersal of Eastern Bristlebirds. Despite the fact that some

Eastern Bristlebirds are surviving at Red Rocks Nature Reserve, the status and security of the Eastern Bristlebird population is uncertain.

Given the circumstances at Red Rocks Nature Reserve it would be valuable to obtain a broad estimate of the potential population size in this area. We assume a total of 500 hectares of Eastern Bristlebird habitat (400 hectares within the reserve and 100 hectares surrounding the reserve), based on topographic maps and field notes taken during surveys. The majority of this habitat falls outside the boundaries of the most recent fires in 1995. An average Eastern Bristlebird density of 1.7 birds per 5 hectares for habitat with a fire-age of greater than 13 years can be inferred utilizing the 1997 and 1999 results from Barren Grounds Nature Reserve. Using this figure, a potential estimate of 170 Eastern Bristlebirds could inhabit Red Rocks Nature Reserve. The long-term viability of this population at Red Rocks Nature Reserve, given its estimated size, will require continued monitoring and the combined management of nearby reserves and potential habitat corridors between them. Another aspect to consider is the isolation and small population size of Eastern Bristlebirds at Red Rocks Nature Reserve with regards to fire. Isolation within an agricultural matrix will reduce the risk of wildfire spreading into the reserve from the outside, however, this isolation may play a role in the complete loss of the population if a large fire burnt through the reserve.

Surveys for the Eastern Bristlebird throughout the Jervis Bay region from 1992 to 1996 (Baker 1997) recorded the species in substantial numbers only on Bherwerre Peninsula. The four Eastern Bristlebirds detected south-west of Huskisson during the 1999 survey suggests that some dispersal is occurring away from the main population area. These Eastern Bristlebird detections have been considered recent dispersals, as bristlebirds were not detected in these areas before the most recent fires in 1994, 1996 and 1997. The presence of duetting pairs of Eastern Bristlebirds at these sites may indicate that the two sites are now breeding areas. When transects were surveyed again in 2001, Eastern Bristlebirds were still detected in the area. This again supports the suggestion that the area is significant as a potential breeding or dispersal site for bristlebirds. These Eastern Bristlebirds are distant from core bristlebird habitat around Jervis Bay and their habitat is only tenuously connected (Bain 2001). Maintaining this connection is vital to the viability of this outlying area of habitat for the Eastern Bristlebird.

No Eastern Bristlebirds were detected at Beecroft Peninsula. However, the possibility that the species occurs in the area cannot be excluded. Much of Beecroft Peninsula has ideal Eastern Bristlebird habitat, some of it unburnt for over 20 years (Bushfire and Environmental Services 2001). Three Eastern Bristlebirds were recorded at Beecroft Peninsula between 1984 and 1995 (NPWS 1997) but subsequent surveys have failed to confirm their presence in the vicinity.

No Eastern Bristlebirds were detected during the present study at Ku-ring-gai Chase National Park. Before 1904 the Eastern Bristlebird was commonly recorded around the Park (North 1904) with the most recent record being an unconfirmed sighting 17 years ago (Saunders 1986). Chaffer (1954) and Baker (1997) suggested that, in the Sydney area, direct loss of habitat to urban land-use was the ultimate factor in the presumed local extinction of the species.

Barren Grounds Nature Reserve

At Barren Grounds Nature Reserve, the results continue to show increasing Eastern Bristlebird densities with the increasing fire-age of habitat to at least 13 years post-fire (Fig. 2). This is consistent with the trends described by Baker (2003) for surveys carried out there from 1992–1998 and by Bramwell *et al.* (1992) up until nine years post-fire. For Eastern Bristlebirds at Jervis Bay, densities also increased up until at least nine years post-fire (Pyke *et al.* 1995). The low relative density of Eastern Bristlebirds in vegetation with a fire-age of 18 years compared to vegetation with a fire-age of 16 or 19 years is consistent with those areas from 1992 to 1997 (Baker 2003).

Implications

A comparison of densities calculated for 1997 with those from 1999 (41 ± 5% : mean ± SE) suggests that there may have been a consistent decline in Eastern Bristlebirds across habitats of all fire-ages (Fig. 2). There are three plausible explanations for this unexpected result: the population really has declined, previous estimates were too high, or there was a systematic bias in the current study.

The difference may represent a real decline in Eastern Bristlebird density. The population at Barren Grounds Nature Reserve may have suffered some environmental perturbation or stress during the period 1997–1999. This seems unlikely as monthly average temperatures during both the 1997 and 1999 surveys did not vary significantly from long-term averages and across the whole period January 1997 to March 1999, the rainfall total was only 6 millimetres (0.2%) above the long-term average (Bureau of Meteorology 1997, 1998, 1999). During the survey period in 1999, the calling behaviour of Eastern Bristlebirds at Barren Grounds was commented on as being typical for that time of the year (J. Baker, pers. comm.). This comment, the consistent size of the decline in the density of Eastern Bristlebirds right across Barren Grounds in all fire-ages and the similarity in climatic factors between 1997 and 1999, suggests that the results may not represent a real decline in Eastern Bristlebird density. Ongoing monitoring will assist in determining if this is the case.

Baker (2003) might have over estimated Eastern Bristlebird densities in 1997, although this is unlikely due to the consistency of his estimates when compared with radio-tracking results (Baker 2001).

The difference between the 1999 and 1997 results may be a consequence of differences in observer skill leading to a decrease in the numbers of birds detected rather than a decrease in the density of the species. The present work was undertaken by surveyors competent in recognising the distinctive Eastern Bristlebird calls but with as little as eight days experience. The 1997 data were collected by a surveyor with nine years experience with the species (J. Baker, pers. comm.). A review of census procedures for terrestrial Australian birds (Recher 1989), highlighted the importance

of considering observer error when analysing data, particularly when utilizing transect counts. Kavanagh and Recher (1984) also emphasized the importance of using experienced observers or ensuring that adequate observer training is conducted. We consider that this is the most likely explanation for the results, although ongoing monitoring of these Eastern Bristlebird populations will give a clearer indication of the current situation.

This issue of observer competence raises some important implications for the management of reserves that support cryptic endangered species. The continual monitoring of populations is critical in informing management and establishing conservation goals. However, it is vital that managers only use experienced and competent field officers, or provide adequate training to officers when conducting monitoring of cryptic endangered species. In the light of these Barren Grounds results it is likely that not all Eastern Bristlebirds were detected at Red Rocks Nature Reserve or at Huskisson. Ongoing surveys at Red Rocks and Huskisson will help to more accurately estimate the size of populations in these areas. Further surveys of Beecroft Peninsula and Ku-ring-gai Chase National Park are required to determine whether the species is indeed absent from these areas.

The observed rise in Eastern Bristlebird density with the increasing fire-age of habitat at Barren Grounds Nature Reserve is slower in sites with a fire-age of over 14 years, than in sites less than ten years since last fire. This may suggest that these areas are reaching carrying capacity for the Eastern Bristlebird. Baker (2001) found that Eastern Bristlebirds survive in overlapping home ranges between about four and eleven hectares in size, which would correspond to bristlebird densities of between 0.5 birds per 5 hectare to 2 birds per 5 hectare, similar to densities of birds recorded in past studies (Bramwell *et al.* 1992; Pyke *et al.* 1995; Baker 1997). Further examination of this, however, will require continued long-term monitoring.

If the density of Eastern Bristlebirds is beginning to plateau at Barren Grounds Nature Reserve after about 10 to 14 years post-fire, it does not mean a decline in density is following. In 1996 for example, there was, and still is, a population of Eastern Bristlebirds surviving in habitat unburnt for over 20 years in Nadgee Nature Reserve (Baker 1997). Dispersing Eastern Bristlebirds may be moving out into surrounding habitat, including those areas that have been burnt more recently. Eastern Bristlebirds may take up to ten years post-fire to completely recolonise areas of burnt habitat (Baker 2003) and subsequently survive at stable densities in much longer unburnt habitat. The implications for management are that not all Eastern Bristlebird habitat needs to be constantly maintained as greater than 14 years unburnt, as long as large, adjacent and long (>20 years) unburnt areas are protected for emigration from and recolonization of more recently burnt areas. Continued monitoring of the density of Eastern Bristlebirds in long unburnt habitat is essential to illustrate the intimate long-term habitat requirements of the species. Replication of the Barren Grounds study would be useful to test the generality of this relationship between Eastern Bristlebird density and the fire-age of its habitat. A similar study could be attempted at Booderee National Park as Pyke *et al.* (1995) have collected Eastern Bristlebird density data from a range of habitats of different fire-ages within the Park.

CONCLUSION

The conservation of the Eastern Bristlebird will continue to involve long-term monitoring of all populations. This monitoring is vital to understanding the relationship between Eastern Bristlebirds and fire, their current distribution and the status and viability of all populations. However, as ongoing long-term studies invariably involve data collected by various observers, this factor must be taken into account when interpreting the results of such studies.

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BOOK REVIEW

Kookaburra King of the Bush

Sarah Legge 2004. Australian Natural History Series, CSIRO Publishing $34.95

Kookaburra King of the Bush is the result of research for her PhD by the author, Sarah Legge. It sets out clearly and in great detail the life cycle of this best-known of Australian birds, the Laughing Kookaburra *Dacelo novaeguineae*. Of the four kookaburra species, three are in New Guinea, which shares one with us, the Blue-winged Kookaburra *D. leachii*. The other two are the Rufous-bellied *D. gaudichaud* and the Spangled *D. tyro* Kookaburras. Laughing Kookaburras were introduced to New Zealand, Western Australia, Kangaroo Island and Tasmania where, apart from unsubstantiated anecdotal reports, they have not had any adverse effect.

The Blue-winged Kookaburra is mainly a northern bird but territories overlap those of Laughing Kookaburras in Queensland. They do not interbreed. This study deals mainly with Laughing Kookaburras, whose breeding regime appears little different from that of its congener. Both species are hereinafter referred to as kookaburras.

Briefly, kookaburras are sedentary and territorial, needing hollow trees or termite mounds or even a haystack for nesting, sites for perching and enough food to carry them throughout the year. Females are larger than males, and blue on the rump is not a sure indicator of the sex of the bird. Breeding is co-operative and the peak is in September and October. It takes up to 19 weeks from the first egg to eventual independence of the young. Helpers all take turns to incubate, each developing a brood patch to do so, and to feed the young.

Larger group size does not mean greater success but often the contrary, birds eager to incubate or brood crush eggs and nestlings. Females are larger than males and require more food for themselves. They are not such good providers as are male helpers.

None of this is so remarkable but there is much behaviour that is unusual. The poet who wrote 'Little birdies in their nests agree' obviously knew nothing of siblicide, a practice relatively rare in birds apart from raptors [check] but practised by kookaburras, the only known co-operatively breeding bird to do so.

The reason for siblicide is explored in detail with extraordinary results. Simply stated, it amounts to a third egg being laid as insurance in case either of the first two does not hatch. A third chick may compromise the provisioning to the other two so they get rid of it. But it is much more complex than that. In some mysterious way, not yet unravelled by researchers, the female is able to manipulate the sex of the eggs with the view to successful provisioning of her young by her helpers and their eventual fledging. Neither parent does anything to prevent siblicide which in the long term appears to be necessary for the health of the species.

The book is amply illustrated with figures, tables, b/w photographs and drawings. Excellent colour shots illustrate well the kookaburra's life cycle, especially those showing progress of the growing young in the highly inaccessible nests for all but the intrepid researchers.

I have a few quibbles, mainly editorial. References are given for each chapter but not for which part of the chapter. I remember being castigated for such an omission in one of my books. Nor is there an index to *Kookaburra*, though the contents page does separate the component parts to make for easy reference. There are several omissions in numbering. On page 19 the family tree of the Coraciiformes is not numbered and one has to search for it without an index. A caption would have been welcome for the DNA sequencing on page 54, where the printing is minute and difficult for this reviewer unversed in the mysteries of this technique. Figure 6.2 on page 80 surely refers to mass of food though the legend reads 'food delivered per hour (cm)'. On page 84, The word 'pair' appears with both plural and singular verbs and page 93 begins mid sentence ('as' missing?)

All these minor quibbles aside, this is an excellent book. If you wish to experience the mystery and wonder of the natural world in which this signature Australian bird lives, you won't be disappointed with *Kookaburra, King of the Bush*.

I cannot help reflecting that far too many people worldwide behave like kookaburras. Their behaviour is innate. Our desire for dominance is probably also innate but we have history and comprehension with which we ought to moderate our behaviour but, far too often, don't.

Pauline Reilly
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