

THE EFFECT OF WILDFIRE ON BUSH BIRD POPULATIONS IN SIX VICTORIAN COASTAL HABITATS

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In an area severely burned by wildfire on 16 February 1983, a study was carried out at six different sites at six-monthly intervals from autumn 1984 (14 months post-fire) to spring 1987 (56 months post-fire) to record the time taken for birds to re-establish populations. At 26 months post-fire, 84 per cent of the eventual total of 69 species had been recorded. No specific bird lists were available for the six sites, nor were there unburnt areas to act as controls. Comparison of population re-establishment is made between three sites: two in this present study that most resembled a third in a more intensive study carried out in the same district. The danger of fire is most acute for ground-dwelling species restricted in habitat and distribution, such as Rufous Bristlebirds and Southern Emu-wrens. Their numbers declined and their populations were slow to become re-established.

INTRODUCTION

The widespread bushfires of Ash Wednesday (16 February 1983) razed 40 000 ha in the north-eastern Otway Ranges in coastal south-western Victoria. The present study investigates relative changes in the number and type of species in six different habitats (see below) near Anglesea (38° 25'S, 144°11'E) and Aireys Inlet (38°28'S, 144°06'E) in the four years subsequent to the fires (1984–87). Figure 1 shows the extent of the fires and the

sites involved. These sites were selected by Angair Inc. (Anglesea and Aireys Inlet Society for the Protection of Flora and Fauna) for the study of plant regeneration. Information on post-fire regeneration of vegetation and invertebrates in this same general area, is given by Dedman (1983a,b), King and King (1983), Wark *et al.* (1987) and was also obtained from Wark (pers. comm.).

Some comparison will be made with another more intensive study (Reilly 1991), especially between sites E and F and that study, all of which are in Angahook State Park.

The numbers and species of beach-washed birds collected following the fire are detailed in Pescott (1983a).

METHODS

Sites

Six sites, representative of different major plant communities, were selected by Angair Inc. and are described in Wark *et al.* (1987). These were: A. Point Addis, coastal heath/woodland; B. Harrison Track, heath/woodland and swamp thicket; C. Coalmine Road, heath woodland; D. Ocean Road Dune, coastal scrub; E. Bambra Road, ironbark forest; and F. Fern Gully, riparian forest with tree fern grove (Fig. 1). Sites varied in size from 0.75 to 1 km in length and width varied from a strip along a sand dune to a wider more circular area.

Few areas were left unburnt and no area was large enough to act as a control. Site A was close to cleared unburnt pasture on one side and on the other to the extreme eastern edge of

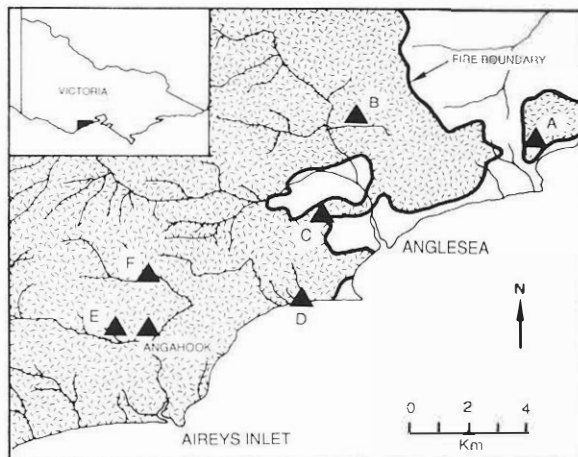


Figure 1. Map of bushfire area and all study sites. Burnt area indicated by stippling.

the burnt area. Site C lay between the partly unburnt township of Anglesea and an open cut coalmine. At the coalmine site, any unburnt vegetation remained only in small pockets which were probably incapable of supporting a reservoir of flora and fauna from which regeneration could proceed. At Site D, on the ocean side of the coastal dune, a strip about 150 m long and 15 m wide was unburnt.

Sites E and F were 600 m and 2 km distant respectively from the Angahook study area (designated Angahook and fully documented in Reilly 1991). Site E crossed a dry east-west ridge and did not include any area of permanent water as did the other two.

For Sites E and F in Angahook Forest Park, refuges may have been available in the township of Aireys Inlet, which was not totally burnt, and in a 2 km narrow strip of vegetated coastal dune between Fairhaven and Moggs Creek, a few km west of Aireys Inlet.

Survey

From 1984 to 1987, each site was visited once only at six-monthly intervals in April (autumn) and October (spring). Different teams visited the six sites, either strip counting and retracing their steps to the start or else moving randomly through the sites. The time taken (often not recorded) varied from half an hour to two and a quarter hours, depending on the ease of recording: that is, regeneration of vegetation increased the difficulty of observations. The membership and individual birdwatching expertise of the teams differed, both between sites and, in some instances, between survey periods. As far as possible, the time of day and the weather conditions most favourable to birdwatching were chosen and were similar for each visit, though all team visits were not made on the same day.

Birds either seen or heard have been given the same value. Nocturnal birds, waterbirds, seabirds and migratory waders were excluded as irrelevant to the study. Brush and Common Bronzings (*Phaps elegans* and *P. chalcoptera*) were more often heard than seen and, though both were observed, participants were unsure of identity by sound and they have been combined as bronzing species. Similarly, Australian, Forest and Little Ravens (*Corvus coronoides*, *C. tasmanicus* and *C. mellori*), all of which were identified at different times, have been listed as raven species.

The shortcomings of the survey are recognized: sampling was constrained by opportunity and occurred once only at six-monthly intervals. This permitted only sparse coverage and, because teams differed, their quantitative assessments of bird numbers could be only roughly compared and have therefore been omitted.

RESULTS

Numbers of species

Species and the periods and sites at which they were recorded are given in Appendix 1. Of the species listed by Pescott (1983b) for the eastern Otway Ranges, 89 (48 common and 41 uncommon) could reasonably be expected, on the basis of habitats, to be present at one or more of the six sites. Of these, 66 (74%) were recorded by the end of the study. Three other species, two listed as rare (Peregrine Falcon, Chestnut-rumped Hylacola) and one (White-throated Gerygone) listed only for two other parts of the Geelong area and then as rare, made the total species recorded 69.

TABLE 1

Number of species recorded at all sites, both seasonally and totally, showing the size of each community and the rate of recovery.

	Sites						Combined
	A	B	C	D	E	F	
<i>Community size</i>							
Total number of species	39	47	37	21	38	38	69
Mean number of species							
spring	12.8	18.8	17.5	8.0	20.3	17.3	42.8
autumn	17.0	15.3	13.8	6.3	12.8	13.0	38.3
Total number of records	119	136	125	57	132	121	690
Mean number of records per species	3.1	2.9	3.4	2.7	3.5	3.2	10.0
<i>Recovery rate</i>							
Number of species recorded by spring 1985 (32 months post-fire)	31	31	29	14	28	30	61
Percentage of final total	80	66	79	67	74	79	88

Five species (Gang-gang, Eastern Rosella, Satin Flycatcher, Willie Wagtail and White-winged Chough) listed as 'common' by Pescott (1983b) were not recorded.

Within the first year of the study, (to autumn 1985 — 26 months post-fire), 84 per cent of the total of 69 species had been recorded. The size of the bird community at individual sites is shown in Table 1. There was little difference between the final number of species at Sites A, C, E and F (39, 37, 38, 38 respectively). Site D recorded the smallest number (21) and Site B the greatest (47). By spring 1985 (32 months post-fire), 88 per cent of the total number of species had been recorded and the percentage of the totals at individual sites was between 66 per cent and 80 per cent (Table 1). The mean number of species at all sites combined in each six-month period was 40.5 (range 35–44).

The total number of species at individual sites in each six-month period showed different patterns of increase. After the initial unsettled period to autumn 1985 (26 months post-fire), the general pattern was decreased numbers in autumn and increased numbers in spring, except for Site A, where the pattern was reversed (Table 1), especially in autumn 1985 when the number of species recorded was 65 per cent higher than at any other time.

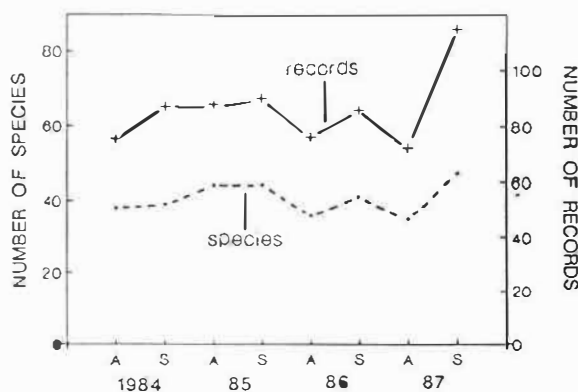


Figure 2. Total number of records (-----) and species (- - -) recorded at all sites combined, autumn and spring 1984 to 1987.

At all sites in each season, the number of species followed the same pattern as the total number of records (Fig. 2) ('records' includes a repetition of species recorded at individual sites, e.g. one species recorded at six sites equals six records). There was little difference in the mean number of records per species (range 2.7 to 3.5).

While Appendix 1 details the return of all species, some species seem worthy of discussion and, where relevant, some comparison will be made with the Angahook study (Reilly 1991).

Thirty-eight species were recorded at sites E and F, of which 29 were common to both. Of the total of 47 species at these two sites, 46 were common to Angahook; the Blue-winged Parrot was recorded only at site F.

The percentage of the total species recorded to autumn 1985 (84) was similar to the 86 per cent recorded in the Angair study for the same period.

Individual species

Eight species only (Crimson Rosella, Grey Shrike-thrush, Grey Fantail, Superb Fairy-wren, Brown Thornbill, White-eared Honeyeater, Silver-eye and raven species) were found at all sites.

Fan-tailed, Pallid, and Shining Bronze and Horsfield's Bronze-Cuckoos were present at Angair sites in spring 1984. All but the Horsfield's Bronze-Cuckoo had been recorded at Angahook in spring 1983.

Eastern Yellow Robins were not recorded at Site E, but they appeared from autumn 1984 onwards at Site F, deeper in the forest, and not until a year later at Angahook.

Migrant Rufous Whistlers did not initially appear to be greatly affected by the fires (this study and at Angahook) but from spring 1985 to spring 1987 there was only one record (at Site C). A similar reduction was noted at Angahook, where there were only ten records between spring 1984 (21 records) and spring 1988 (28 records) (pers. obs.).

Superb Fairy-wrens were well established at Angahook by autumn 1984 but did not appear at Sites E and F until 18 months later in spring 1985. Conversely, White-browed Scrubwrens were consistently recorded at Site F from autumn 1984 but were infrequently recorded at Angahook until autumn 1986, and they did not appear at Site E until spring 1987.

Southern Emu-wrens appeared at Site B in autumn 1986 (38 months post-fire), but were not recorded at Site C until spring 1987 (56 months post-fire). North-west of Anglesea at five weeks post-fire, M. Cameron (pers. comm.) recorded an unexpectedly dense population of emu-wrens in about 1 ha of short heath, burned a year earlier but missed by the Ash Wednesday fires. This population was still present at eight weeks post-fire, but was absent at 15 weeks and in subsequent visits until late 1985 when regular observations ceased. Emu-wrens were again recorded there in 1989.

Rufous Bristlebirds were recorded fairly regularly from 14 months after the fire at Site D. At Site A, at the extreme eastern limit of this species' range, they were recorded once only. At Angahook, bristlebirds returned after two years. In another adjacent area, where two pairs had resided before the fire and where daily counts were now made, their return had not occurred seven and a half years post-fire (Reilly, pers. obs.).

A White-throated Gerygone was first recorded at Site E in spring 1987 and at Angahook in spring 1988. White-throated Treecreepers were recorded at Site F in autumn 1984 but not at Angahook until a year later and a year later again at Site E.

Tawny-crowned Honeyeaters were recorded at Sites C and D only in spring 1987 (56 months post-fire).

Fire mortality

Mortality of birds was documented by Hemsley (1967) for the 1967 fires in south-eastern Tasmania (931 individuals) and by Fox (1978) for the 1972 fires in the Nadgee Nature Reserve (609 individuals). Pescott (1983a) documented mortality after the Ash Wednesday fires, when 2 210 dead but unburnt specimens of 66 species (plus two unidentified taxa) were collected 3–5 days post-fire along 60 km of coastline from Point Lonsdale (at the entrance to Port Phillip Bay) westward to Eastern View (6 km west of Aireys Inlet). No seabirds were included. Although the fire had swept from inland to the sea from about 8 km westward of Eastern View, few birds were collected along the beaches at Eastern View. On the other hand, birds were collected at Collendina

TABLE 2

The most numerous species of dead birds (2 210 individuals) collected along a 60 km stretch of coastline in southern Victoria 19–21 February 1983 (taken from Pescott 1983a).

Species	Number	%
Crimson Rosella	984	44.5
New Holland Honeyeater	282	12.8
Currawong spp.	179	8.1
Red Wattlebird	104	4.7
Raven spp.	86	3.9
Sulphur-crested Cockatoo	78	3.5
Australian Magpie	66	3.0
Other species (61)	431	19.5

25 km beyond the eastern extremity of the fire near Bell's Beach, with a few at Point Lonsdale, even farther east. Table 2 shows the numbers of the most numerous species collected.

McClure (1981) noted birds with singed wings, damaged mandibles and burnt feet following fire in southern California, but few injured live birds were found in Victoria following the Ash Wednesday fires.

DISCUSSION

The reverse seasonal pattern in species numbers at Site A may be accounted for because it was situated on the clifftops, which mostly lacked shelter from ocean winds, perhaps inhibiting breeding, and where birds involved in seasonal movements were more evident. For example, there were an estimated 800 Yellow-faced Honeyeaters in autumn 1984 and 262 Red Wattlebirds in autumn 1986 (M. White and pers. obs.).

This irregularity of seasonal patterns is reflected in Figure 2, where there was a drop in the total number of species in the autumns of 1986 and 1987 and a similar drop in the total number of records (i.e. the total of species recorded at individual sites). Contributing to this were marked decreases from spring 1985 to autumn 1987 at Site F in the fern gully, where heavy undergrowth limited access and visibility, and in autumn 1987 at Site C in heath/woodland.

Because adverse weather was avoided for surveys as far as possible, weather conditions did not appear to affect the numbers of species

recorded. It is difficult to account for the drop in numbers of species and records mentioned above, but the numbers were highest in spring 1987.

The distribution of birds recovered dead well beyond the limits of the fire may be accounted for by westerly winds of cyclonic strength that accompanied the fire.

Gang-gang Cockatoo *Callocephalon fimbriatum*, Eastern Rosella *Platycercus eximius*, Satin Flycatcher *Myiagra cyanoleuca*, Willie Wagtail *Rhipidura leucophrys* and White-winged Chough *Corcorax melanorhamphos* listed by Pescott (1983b) as 'common', were not recorded at any of the study sites following the fire, almost certainly through lack of coverage as all were recorded elsewhere in the district.

Because the six sites covered a variety of different habitats, it is not surprising that eight species only (Crimson Rosella, Grey Shrike-thrush, Grey Fantail, Superb Fairy-wren, Brown Thornbill, White-eared Honeyeater, Silvereye and raven species) were found at all sites. Also not unexpected was that the fewest species were recorded on a strip of sand dune where regeneration was concentrated on dense ground cover and not on trees or tall shrubs. What is surprising is the apparent lack of effect on numbers of Crimson Rosellas, despite their constituting by far the greatest number of any single species found dead (984 or 46% of the total) (Pescott 1983a). The mobility of Crimson Rosellas from other areas and their conspicuousness and noisy calling may account for the apparent stability of the population.

The presence of cuckoos in the spring following the fire suggests that either their host species were breeding in sufficient numbers to attract them, or else that migrant cuckoos return to the same area irrespective of the state of the habitat.

Several reasons may account for the absence of Rufous Whistlers during both this and the Angahook study. Rufous Whistlers feed on invertebrates in the canopy (Ford 1985; Loyn 1985), which was slow to regenerate. Conspicuousness of these birds may have led to increased predation; insufficient invertebrates may have

caused the birds to move to a more accessible food source in another region; and unsuitable nesting habitat may have resulted in lowered reproduction.

A nucleus of Southern Emu-wrens may have remained at the site north-west of Anglesea and it, or other small pockets that survived in Anglesea, may have eventually re-established the populations at Sites B and C. The delayed return of Southern Emu-wrens was also noted by McFarland (1988), who found that in sub-tropical heathland they did not become abundant until more than five years post-fire. This slow return was unlike that shown at Barren Grounds Bird Observatory in south-eastern New South Wales by Jordan (1987). He noted rapid repopulation a year after wildfire by birds presumably moving from a nearby reservoir of unburnt heath.

The strip of unburnt coastal scrub near site D was apparently sufficient to support a small population of Rufous Bristlebirds. At Site A, at the extreme eastern limit of this species' range, it is understandable that they were recorded once only, even though the adjoining cliff-top heath had not been burnt. At Angahook, bristlebirds returned after two years. In Aireys Inlet the birds were conspicuous after the fire, but in an adjacent area, where two pairs had resided and where daily counts were now made, their return had not occurred seven and a half years post-fire (Reilly, pers. obs.). (For further discussion on Rufous Bristlebirds, see Reilly (1991)).

A White-throated Gerygone was recorded in 1987 and 1988. In December 1988, this species was recorded on King Island, the first record for Tasmania (Mitchell 1989) but these sightings may not be related to post-fire recovery.

At Angahook, ants were obvious immediately post-fire. Ants, mainly nectarivorous species, figure largely in the stomach contents of White-throated Treecreepers (Noske 1985) that forage by pecking and excavating on rough-barked eucalypts, which are plentiful in Angahook State Park. Because the young are evicted early from parental territory, their dispersal is widespread (Noske 1982). The re-establishment of populations at Site E and in the Angahook study area was not as rapid as that recorded

by Hewish (1983). In an inland Victorian forest, Hewish recorded this species three weeks after the forest had been severely burnt in January 1983.

Tawny-crowned Honeyeaters not recorded until spring 1987 (56 months post-fire), were unlike those of Jordan (1987), who recorded a population explosion following an absence of nearly two years after fire.

The source of immigration of bird species into all sites, especially the three Angahook State Park sites, is not known. It was expected that immigrants from population reservoirs in unburnt areas would have become re-established near the forest edges and then moved deeper into the forest, but the reverse appears to have been the case for Eastern Yellow Robins, White-browed Scrubwrens and White-throated Treecreepers; the Superb Fairy-wren was the only one to conform to expectations.

CONCLUSIONS

There are insufficient pre-fire data to determine the period necessary for complete re-establishment of bird populations in the six different sites. The danger of fire is most acute for ground-dwelling birds, especially for those restricted in habitat and distribution, such as Rufous Bristlebirds and Southern Emu-wrens (Blakers *et al.* 1984). Like many rare birds, they are 'incapable of strong sustained flight' (Bamford 1988). For these reasons, the Rufous Bristlebird, in view of its probable extinction in south-western Australia (Smith 1977; Bamford 1988), gives cause for concern for its future throughout its restricted range.

Re-establishment of bird populations is dependent on the regeneration of vegetation and recovery by its associated invertebrates. Too-frequent fires retard regeneration and alter the nature of the vegetation, thus altering the habitat for bird-species. Provided vegetation is allowed to regenerate and reproduce, and there are adequate reservoirs for the recolonization of bird species, fire does not appear to present an insuperable barrier. If fire is used as a management tool, pockets of unburnt country are vital, as well as avoidance of the main breeding period (spring in the Anglesea/Aireys Inlet district).

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APPENDIX 1

Species list for sites A-F autumn 1984 to spring 1987.

Species Name Scientific Name	Autumn 84	Spring 84	Autumn 85	Spring 85	Autumn 86	Spring 86	Autumn 87	Spring 87
Black-shouldered Kite <i>Elanus notatus</i>				. D . .				A . . D . .
Brown Goshawk <i>Accipiter fasciatus</i>			A . . . E .		. . . . . F			
Marsh Harrier <i>Circus aeruginosus</i>						. B . . . . .		. B
Peregrine Falcon <i>Falco peregrinus</i>	A		A	A				
Australian Kestrel <i>F. cochlearius</i>				. . . . D . .				
Painted Button-quail <i>Turnix varia</i>			. . C . . . .	. . C				
Bronzewing species <i>Phaps</i> sp.		. . . . E .	A . . . . .	. . . . E .		. . . . E .		. . . . E .
Yellow-tailed Black-Cockatoo <i>Calyptorhynchus funereus</i>					. . . . . F	. B . . . . .		. B
Galah <i>Cacatua roseicapilla</i>						. B		
Sulphur-crested Cockatoo <i>C. galerita</i>	. . . . EF	. . C . E .	. . . . E .		. . . . EF	. . C . EF	. . . . E .	. B . DEF
Crimson Rosella <i>Platycercus elegans</i>	ABC . EF	AB . . EF	A B C D E F	. B C . EF	A B . . E .	. . C . EF	ABC . E .	AB . . EF
Blue-winged Parrot <i>Neophema chrysostoma</i>					. B		A . . . . .	. B C . . F
Pallid Cuckoo <i>Cuculus pallidus</i>		. B C . E .		. B C . E .		. . C . E .		AB . . EF
Fan-tailed Cuckoo <i>C. pyrrhophanus</i>	. . . . F	. B . . EF		. B . . E .		A . . . EF		AB . . EF
Horsfield's Bronze-Cuckoo <i>Chrysococcyx basalys</i>		. B C . EF	. B . . . . .	. . C . . . .		. . C . . . .		. B C
Shining Bronze-Cuckoo <i>C. lucidus</i>		. . . . EF		. . . . F		. B . . . . .		. . . . EF
White-throated Needle-tail <i>Hirundapus caudacutus</i>			A					
Laughing Kookaburra <i>Dacelo novaeguineae</i>	. . . . E .		. . . . E .	. B . . . . .	. . C . . . .			. B
Sacred Kingfisher <i>Halcyon sancta</i>				. . . . F				
Skylark <i>Alauda arvensis</i>	. . . D . .	A . . D . .		. . . D . .	. . . . D . .			. . . D . .
Welcome Swallow <i>Hirundo neoxena</i>	AB	A . C . . .	A . C . . .	AB	A	A . CD . . .	A	A . CD . . .
Richard's Pipit <i>Anthus novaeseelandiae</i>		A		A		A		

Species Name Scientific Name	Autumn 84	Spring 84	Autumn 85	Spring 85	Autumn 86	Spring 86	Autumn 87	Spring 87
Eastern Spinebill <i>Acanthorhynchus tenuirostris</i>		F	A	F	BC, EF	F	C	E
Spotted Pardalote <i>Pardalotus punctatus</i>		F	C, F	B, F	ABC, F	B, F	B, E	B, E
Striated Pardalote <i>P. striatus</i>		C, E	E	B, E	B, F	C, EF	B	B, E
Silvereye <i>Zosterops lateralis</i>	B, D, F	A, D, F	A, C	D	A	B, DEF	DE	D
European Goldfinch <i>Carduelis carduelis</i>		A						
Red-browed Firetail <i>Emblema temporalis</i>	F	F	A				F	
Common Starling <i>Sturnus vulgaris</i>		A			A	D		
Olive-backed Oriole <i>Oriolus sagittatus</i>		E	E					
Australian Magpie-lark <i>Grallina cyatholeuca</i>		C						
Dusky Woodswallow <i>Artamus cyanopterus</i>								B
Australian Magpie <i>Gymnorhina tibicen</i>	ABC, E	A, C	A, C, E	BC, E	A, C, E	A, C, E	A, E	C, E
Pied Currawong <i>Srepera graculina</i>		B, EF		B, EF	A, C	BC	E	BC, EF
Grey Currawong <i>S. versicolor</i>		B	ABC, F	A, E	A, F	C	A	AB, F
Raven sp. <i>Corvus sp.</i>		C	A, CDE	C	ABC, E	BC, E	A, E	ABCDEF

BOOK REVIEW

Whistling Wings.

H. Elliott McClure, 1991. The Boxwood Press, Pacific Grove, California.
Paperback, 99 pp., b/w chap. illus., 5 b/w plates, 215 × 140 mm, US\$9.95.

The title refers to one of the diagnostic features of the Mourning Dove *Zenaidura macroura*, native to North America and similar to, though less robust, than the introduced Spotted Dove *Streptopelia chinensis*.

For many years, I have sympathized with Dr McClure as he has tried to translate his vast array of field notes into published books, books that would attract and lead the uninformed public into an understanding of the diversity of nature and thence to a recognition of the need for conservation.

Dr McClure writes from a wealth of experience covering 50 years of observing doves in North America and Asia and from studies of 5 000 Mourning Dove nestlings. Those of us who have been lucky enough to accompany him in the field will remember his inexhaustible energy, unflagging from well before dawn until after the entry of field notes at night.

This book reflects his meticulous attention to detail as he tells the story of Mourning Doves, not in dry scientific fashion but with obvious love of the birds. He skillfully weaves full details of their life history into the correct ecological setting throughout all seasons, following one pair mated for five years and, after the death of the female, the subsequent fate of the male shot on his seventeenth migration to Mexico.

He deplores the annual slaughter of 40 million doves and tells the story of the extraordinary survival of one dove despite the loss of all its bill and tongue to a shotgun blast.

He warns that a decline already shows in dove populations and recalls the extinction of the Passenger Pigeon, once in vast numbers.

Dr McClure identifies individuals by name rather than band number, which makes reading easy, although at one place he gives two band numbers, no doubt an oversight when translating numbers to names. Most of the names are those given to doves by Indians. He assumes the birds' ability to communicate by sound and posture by translating it into anthropomorphic terms, thus saving long and tedious explanations. Most of the time I found this quite acceptable, though there were times when I could not do so (the italics are mine): 'Interrupting his breakfast *irritated* Zee . . .'; 'He *felt like crying out* but was *afraid to*'; 'How could this be?' *though* Zee, 'no dove would want to risk the dangers on the soil when hazards in trees are bad enough! The stranger was *surlly* about it . . .' But this is not a major fault and points to the great difficulty in conveying to a wide audience a complex story in simple language.

The repetition of breeding dates within seasons and years would be more of interest to the ornithologist than to the general reader but it has been included, I imagine, to show changes from year to year and the devotion to breeding shown by the species.

An appendix explains nomenclature, of value to the proposed readership which is likely to have little ornithological background. This is not to say that the initiated are precluded. Anyone interested in the life histories of any taxa must gain from reading this easily digested book, with its pleasant b/w drawings adorning the chapter headings.

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