

Roosting and Awakening of some Inland Australian Birds

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A five-day study of the time of roosting and awakening of 13 species of birds was made near Booligal, N.S.W. in May 1975. It is probable that the time of roosting and awakening varies as a function of light intensity, and evidence was found of an anticipatory period between awakening and leaving the roost in the Black-faced Woodswallow. In general smaller birds, insectivores and partly or solitary roosting species left the roost earlier at dawn and entered the roost later at dusk than larger birds, graminivores and social or partly-social roosting species.

Introduction

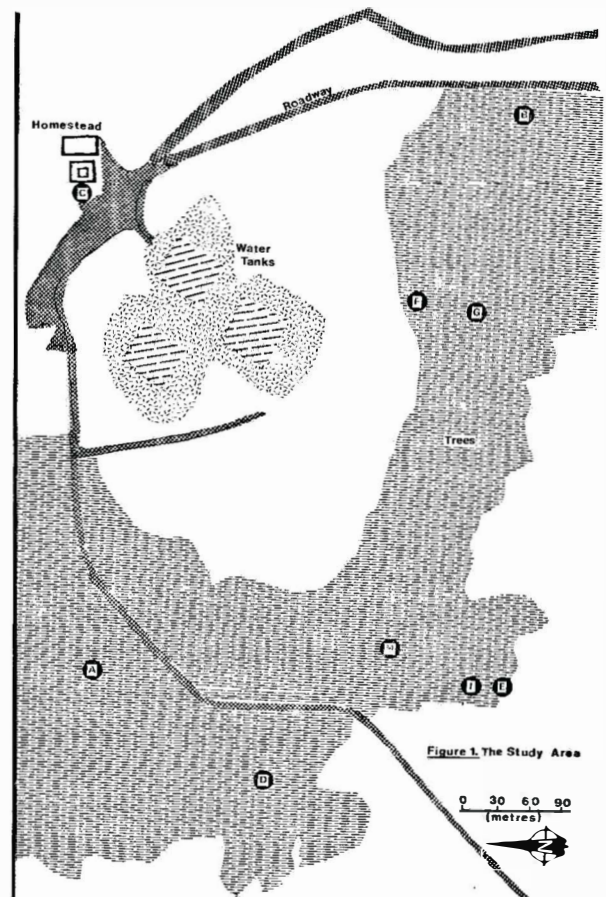
Many overseas studies have focused on the roosting and awakening of birds, in particular the relation between the onset and cessation of such activity and light intensity (e.g. Leopold and Eynon 1961, Davis and Lussenhop 1970, Councilman 1974, Calder 1975). It seems each species roosts at dusk and awakens at dawn within a light intensity range in which there is both group and individual variation. However, there have been few quantitative studies of this aspect of Australian bird behaviour.

From 5 to 10 May 1975 a comparative study was made of the time of roosting and awakening of 13 species roosting in a discrete grove of Black Box *Eucalyptus largiflorens* near the homestead on Woorandara Station (33°40' S., 144°50' E.) near Booligal in south-western New South Wales.

Method

The study area is shown in Figure 1. The procedure used was similar at both dawn and dusk. Two teams, each of two people, walked slowly in different directions through the area noting the time, the species calling and their behaviour. After some days many regular roosts and roosting areas were known, and the time at which birds entered and left were also recorded.

The observation periods ran from 06:25 to 07:25 and 17:25 to 18:08, Eastern Standard Time. These times roughly spanned the inter-twilight zone, between civil twilight and sunrise



● Figure 1. Map of study area showing roosting areas of four species. A, B; Crested Pigeon roosting areas: C, D, E, F; Australian Magpie-lark roosting trees: G; Flock Australian Magpie's roosting area: H, I; Black-faced Woodswallow roosting trees.

TABLE 1

Time* of roosting and awakening of birds near Booligal, N.S.W.
(Species are shown in general order of time of awakening)

Species	5 May		6 May		7 May		8 May		9 May		10 May	
	Dawn	Dusk	Dawn	Dusk	Dawn	Dusk	Dawn	Dusk	Dawn	Dusk	Dawn	Dusk
White-plumed Honeyeater <i>Lichenostomus penicillatus</i>	06:29	17:50	06:25	18:00		18:00	06:35	17:59	06:29	17:59	06:31	
<i>Malurus</i> wren	06:35	17:58					06:36	18:08	06:30	18:01	06:31	
Yellow-throated Miner <i>Manorina flavigula</i>			06:46		06:47		06:42	17:54	06:38	17:58	06:38	
Australian Magpie <i>Gymnorhina tibicen</i>	06:40	17:53 fly					06:48	17:52 etr	06:40	17:59 fly		
Australian Magpie-lark <i>Grallina cyanoleuca</i>	06:47	17:43 fly	06:47	17:47 etr	06:42		06:55	17:47	06:45		06:46	
Black-faced Woodswallow <i>Artamus cinereus</i>		17:45 etr	06:59 lve	17:47 etr	06:57 lve	17:47 etr	07:15 lve			17:41 etr	06:56 lve	
Galah <i>Cacatua roseicapilla</i>	06:49 lve		06:47 lve		06:53 lve		07:05 lve				06:58 lve	
Blue Bonnet <i>Northiella haematogaster</i>	07:03 lve	17:29 etr	07:01 lve				07:15 lve	17:40 etr	06:56 lve	17:43 etr	07:01 lve	
Australian Raven <i>Corvus coronoides</i>		17:55 fly			06:52		07:08		06:42 fly	17:59 fly	06:40	
Pied Butcherbird <i>Cracticus torquatus</i>					06:55				06:41		06:41	
Crested Pigeon <i>Ocyphaps lophotes</i>					07:00 lve		07:10 lve	17:41	07:07 lve	17:49	07:05 lve	
Australian Kestrel <i>Falco cenchroides</i>		17:43 etr		17:52 etr	06:45 fsh	17:26 etr	07:10 fsh	18:00 etr	06:40 fsh	17:30 etr	06:49 fsh	
Australian Owllet-nightjar <i>Aegotheles cristatus</i>							06:56 etr	17:58 lve				

*Eastern Standard Time

Symbol key: The first (dawn) or last (dusk) birds seen to:—
 leave the roost = lve
 enter the roost = etr
 flush from roost = fsh
 be seen flying = fly
 be calling = unmarked time

and sunset (cf. Department of Civil Aviation "Visual Flight Guide — 1975"). Readings of light intensity were taken every minute on an EEL portable photo-electric photometer calibrated in 1973 by the CSIRO Division of Atmospheric Physics. These confirmed the exponential relationship between time and light level at this period of the day (Leopold and Eynon 1961).

Results

The results are given in Tables 1 and 2, and Figure 2. Not surprisingly they are most complete, and probably most accurate, for dawn. Then all birds were roosting, a predictable stationary activity, and thus it was a simple matter to observe the vacating of the roosts or time of first call. At dusk there was a bewildering

TABLE 2
Weather details during the study

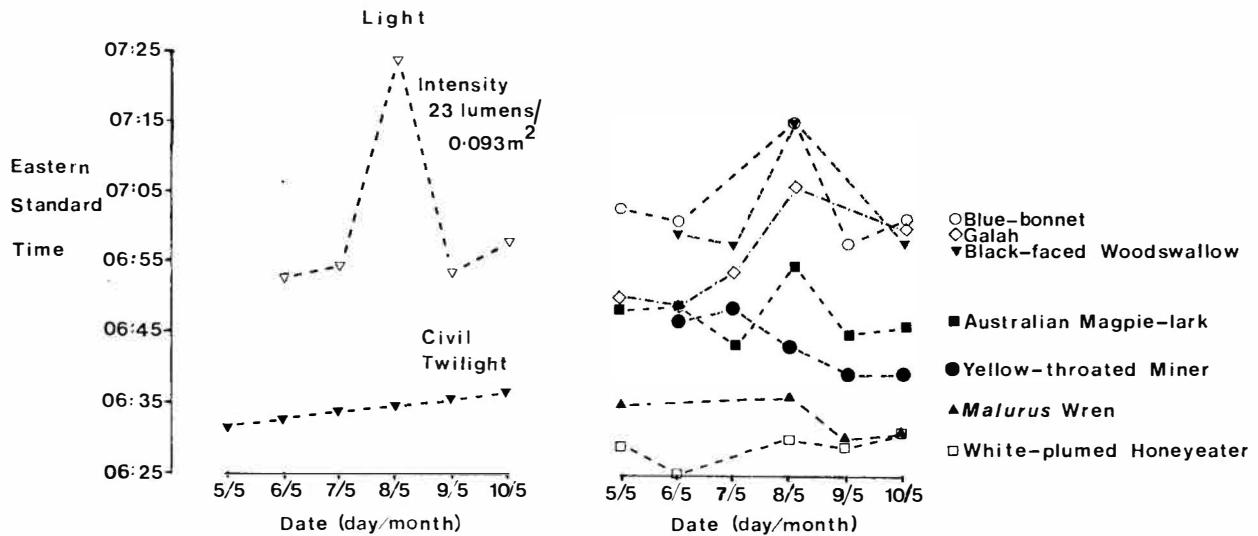
Date 1975	Dawn	Dusk
5 May		Fine. 4/8 Cloud cover.
6 May	Fine. 4/8 Cloud cover overhead; heavy cloud on eastern horizon.	Fine. 3/8 Cloud cover.
7 May	Fine. 2/8 Cloud cover.	Fine. 8/8 Thin cloud cover.
8 May	Continuous light to medium rain. 8/8 Cloud.	Fine. 1/8 Cloud cover.
9 May	Fine. No cloud.	Fine. No cloud cover.
10 May	Fine. No cloud except on eastern horizon.	

array of activities which made the species difficult to follow. These results refer to the first bird to awaken and the last to roost.

Figure 2 uses the more complete results to show a serial arrangement of species awakening in the total bird population. The arrangement seemed similar at dusk, that is, the earliest species to awaken tended to be the last to roost. The results also seemed to concur with overseas findings that species tend to roost in higher light intensities at dusk than they awaken in at dawn (Dunnett and Hinde 1953).

Behaviour

The Blue Bonnet *Northiella haematogaster* was commonly seen in a flock of from 19 to 23 birds, the movements of which centred around the dams and surrounding saltbush, and the homestead. Most roosted as a flock in the planted avenue of trees alongside the homestead. They silently entered the trees in loose groups of from two to eight individuals at dusk. At dawn there was little calling prior to the birds flying, as a flock, to emergent branches of a willow near the dam to preen in the rising sun. They



● Figure 2. Dawn awakening of birds at Booligal, N.S.W. — 1975.

then flew to the dam rims, where some drank and most fed on the flowers of *Inula graveolens*.

Most Galahs *Cacatua roseicapilla* roosted together in a large Black Box tree north-west of the homestead. However, a few were found in scattered pairs and foursomes in other trees. The main roosting flock comprised 50 to 60 birds. At dawn a few individuals left the roosting tree and began wheeling over the grove calling raucously. They then were followed by the flock, which circled for up to 10 minutes, some occasionally landing to preen in the rising sun. All then headed off in a broad arc from south-west to north-west. In the evening pairs and bands of up to 10 individuals returned and assembled in the roosting tree. The return of all birds often spread over 30 minutes, so that some were at roost long before others.

The Crested Pigeon *Ocyphaps lophotes* seemed to concentrate in particular areas to roost, though they roosted in pairs rather than flocks. Two such concentrations of pairs are shown in Figure 1 ('A' and 'B').

The discovery of an Australian Owllet-nightjar *Aegotheles cristatus* going to roost on the morning of 8 May provided an interesting comparison between nocturnal and diurnal species. The bird was observed for 25 minutes before roosting in a hollow spout. Initially it made three flights from the entrance of the hollow, where it perched, to gather food on the trunk of a nearby tree but, as dawn advanced, it stayed at the entrance, finally entering it at a higher light intensity than that at which it left the following evening. After emerging at dusk, just before the end of daylight, it hopped onto a nearby branch and remained there for at least five minutes. The dim light made further observation impossible.

At least 10 Australian Kestrels *Falco cenchroides* roosted in the grove. The pre-roosting behaviour was variable with a common factor of fast flights at canopy level around the tree in which the bird eventually settled. These were accompanied by loud calling and, often, a brief perch at predictable sites on nearby trees. Eventually the bird entered the roosting tree and hopped to the roosting position.

White-plumed Honeyeaters *Lichenostomus penicillatus* were active in lower light levels than

other diurnal species (Figure 2). At dusk there was a general increase in calling and movement within the population. Typically a bird flew back and forth between five or more trees within a radius of 60 metres, and did not forage. It perched for less than 60 seconds, looked around, then flew on. This activity may have helped choose the safest roosting site. It was always chosen in dim light, insufficient to allow us to follow a particular bird to its roost.

Four pairs of Australian Magpie-larks *Grallina cyanoleuca* roosted in the area. They were not breeding and territorial disputes were rare. However, we did witness one between pairs 'D' and 'E' (Figure 1) which allowed the territorial boundary to be estimated. It was precipitated by the presence of a lone male which roosted on the boundary and was often chased by the 'D' pair, especially the male bird. On one occasion, soon after dawn, a fierce physical fight occurred on the ground between these two birds near the boundary of pair 'E'. The 'E' birds briefly participated and thus the boundary was assumed to be in that area. The foraging of the 'D' pair and the lone male, which often followed them, extended to the shearing shed 300 metres south-west of Figure 1.

The Australian Magpies *Gymnorhina tibicen* were distributed in pairs around the Black Box ring. However, a loose roosting flock of up to 20 birds roosted in area 'G' each night (Figure 1). These entered the area from the saltbush plains surrounding the grove about 20 minutes before daylight ended each day. They came in groups of two or four, flew rather higher than the territorial birds, and silently roosted in the outer leafy foliage of the trees, either alone or with up to seven birds sharing the tree. At dawn they left in a loose flock flying high over the plain in a southern direction. The territorial birds foraged on the plains within 300 metres of the Black Box grove.

Seven Black-faced Woodswallows *Artamus cinereus* formed a roosting cluster on particular trees near 'H' and 'I' (Figure 1) (Stokes and Hermes 1979).

Discussion

It is apparent that this technique does not pinpoint the exact time of sleeping and awakening. Even in species comparison using similar

criteria it is suspect, for some species call before leaving the roost at dawn (e.g. Australian Magpie-larks, pers. obs.), while others do not (e.g. Black-faced Woodswallows, pers. obs.). The use of different criteria of alertness may therefore provide results even more suspect. Nevertheless, some conclusions can be drawn from this brief study.

The roosting and awakening of all species was probably a function of light intensity. On the heavily overcast and rainy morning of 8 May all species, except the Yellow-throated Miner *Manorina flavigula*, seemed to adjust their activity to the delay in the increase in light intensity. Though wind and temperature may inhibit or modify the effects of light intensity (Calder 1975) they were not measured in this study.

It is probable that there is an endogenous rhythm of daily activity and rest in birds (Palmgren 1949, Leopold and Eynon 1961). Many observers have found that birds awaken long before they leave the roost (e.g. Counsilman 1974) and Leopold and Eynon suggest that they test their environment during an anticipatory period and sing when the light reaches a certain intensity. The observations of the Black-faced Woodswallows provide further evidence for this rhythm (Stokes and Hermes 1979). At dawn on 7, 8, 10 May all heads appeared from the woodswallow clusters at 06:53, 06:55 and 06:54 hours respectively, a range of two minutes. Yet on those days the time of leaving the cluster correlated with similar light intensities (Figure 2). This was emphasised on 8 May, when the overcast sky delayed their departure.

The rhythm of sleep in birds is influenced by their need to obtain enough food to maintain energy reserves (Calder 1975, Dunnett and Hinde 1953). The birds with the highest surface area to volume ratio in this study, *Malurus* and *Lichenostomus*, required proportionately more food than the others to maintain body temperature and, significantly, had the longest active day-length. The graminivorous species, the parrot, galah and pigeon, were all late risers in comparison with the insectivores. This may have been related to food energy content and foraging efficiency. Social and partly-social roosting species also seemed to leave the roost at later times than solitary or paired roosters.

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