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Notes on the Bassian Thrush *Zoothera lunulata* in the Illawarra region, south-eastern Australia

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Abstract. Observations of the Bassian Thrush *Zoothera lunulata*, a poorly studied species, were recorded opportunistically in the Illawarra region, New South Wales, over a 5-year period between January 1988 and December 1992. At this location, this species mainly fed on earthworms, mostly foraging on cropped lawns and deposits of leaf-litter. Cup-shaped nests composed of moss were observed from September to December, and foraging Thrushes gathered up to eight worms at a time to feed nestlings. The Thrushes were seen mostly singly or in pairs, and some had apparently dispersed from the study sites during autumn and early winter.

Introduction

An inhabitant of moist forests, the Bassian Thrush *Zoothera lunulata* is endemic to the eastern coast and ranges of Australia, including the Atherton region, Queensland, and Tasmania. Populations have been adversely impacted by clearing of densely vegetated habitats (Dickison 1929). The Thrush forages on the ground, feeding mainly on earthworms (Annelida), beetles (Coleoptera) and fruits. It is generally considered to be sedentary, though some seasonal dispersal between habitats is thought to occur (Gibson 1977; Dabb 1992; Griffioen & Clarke 2002). This cryptic species has been the focus of few detailed studies (Edington 1983; Recher *et al.* 1985), so many aspects of its ecology are either poorly understood or known only from scant observations (Higgins *et al.* 2006). Its separation from the similar Russet-tailed Thrush *Z. heinei* is relatively recent (Ford 1983).

The prominent presence of Bassian Thrushes at two study sites in the Illawarra region, New South Wales, provided an opportunity to record notes on the species' behaviour during a 5-year study of frugivorous birds in the rainforests south of Sydney (Mo & Waterhouse 2015, 2016). As in much of its distribution, suitable habitat in the Illawarra region has become severely fragmented (Dunstan & Fox 1996; Stork *et al.* 2008). This paper reports on observations of diet and foraging, nesting and parental care in the Bassian Thrush.

Methods

The wider study was carried out at six sites along the Illawarra Escarpment between January 1988 and December 1992. Two sites, Mount Keira (34°24′S, 150°51′E) and Bulli Mountain (34°20′S, 150°54′E), were visited for 5 hours over 1 day each fortnight. Observations on the Bassian Thrush were made on an *ad hoc* basis for 10–30 minutes at a time. A further four sites were visited sporadically, at least once per season: Bola Creek in the Royal National Park (34°9′S, 151°1′E), Minnamurra Falls in Budderoo National Park (34°38′S, 150°43′E), Foxground (34°43′S, 150°46′E) and Saddleback Mountain (34°41′S, 150°47′E). Typical habitat types at these sites were a mosaic of subtropical and temperate rainforest. The canopy was made up of a diverse variety of tree species, including 42 species that produced fruit during the study period, such as Cabbage Tree Palm *Livistona australis*, Sweet Pittosporum *Pittosporum undulatum* and Sandpaper Fig *Ficus coronata*. Bassian Thrushes were readily encountered only at Mount Keira, particularly around the scout camp, and Bola Creek. Notes relating to foraging, prey selection and nesting were recorded.

Results and discussion

Feeding

In total, 53 observations of the Bassian Thrush were made in this study, 36 of them involving foraging. We found the Thrush to be mainly a specialist predator of earthworms, which comprised 91% of the 288 prey items observed. This was similar to observations in the Mount Lofty Ranges, South Australia, by Edington (1983), who found 95% of prey items were earthworms. Foraging was observed in several settings, most frequently on cropped lawns (28% of foraging observations), leaf-litter over sandstone surfaces (25%) and leaf-litter on the ground (22%). Foraging was also observed on bare ground (17%) and over leaf-litter in ditches (8%). Thrushes appeared to hunt effectively in all these settings, able to locate and extract each worm within 30 seconds to 2 minutes of searching.

Although generally inconspicuous, Bassian Thrushes became particularly noticeable as they searched for worms by tossing leaf-litter aside or behind them with the beak. They also probed the ground, penetrating the entire beak beneath the soil surface. This technique was used in 81% of foraging observations in our study, and 76% of foraging observations in a study near Bombala, NSW (Recher *et al.* 1985). Other authors have speculated that listening for prey is an important aspect of foraging (Edington 1983; Dabb 1992). In our study, Bassian Thrushes walked or ran along their feeding areas and then paused suddenly, cocking the head in a similar manner to the true thrushes *Turdus* spp. (Heppner 1965). Larger worms often resisted, but the Bassian Thrushes maintained steady pressure and pulled a worm farther when it relaxed. Yellow-throated Scrubwrens *Sericornis citreogularis* were sometimes attracted to

foraging Thrushes, possibly scavenging for leftover prey or other potential prey disturbed by the foraging activity, although this was not observed. Worms were consumed by the Thrushes upon capture, except when Thrushes were collecting prey for nestlings (described below).

Predation on other invertebrates, ranging in size from small beetle larvae to larger prey such as cicadas (Hemiptera), represented ~10% of observations on foraging Bassian Thrushes. One Thrush subdued a cicada by pecking at it until it became still, then proceeded to consume it in small portions. We also recorded a Thrush feeding on unidentified invertebrates along a walking track: it foraged by taking three–four steps at a time, and then darting forward to capture any prey located. Edington (1983) determined that invertebrates other than worms comprise ~5% of the Thrush's diet.

Gathering of plant material for food was seen only once. In December 1989, Bassian Thrushes were observed foraging on the ground for kernels of Jackwood *Cryptocarya glaucescens* fruits (Jackwood had produced a crop 6 months earlier: Waterhouse 2001). Although fruit is a known dietary component, Jackwood has not previously been recorded in the diet of the Bassian Thrush (Higgins *et al.* 2006).

Nesting and parental care

Nesting of the Bassian Thrush was recorded from early September to December (three active nests). Other authors have located nests with eggs in New South Wales as early as July (Marchant 1981; Ford 1983). Two active nests were situated in forks of Common Lilly Pilly *Acmena smithii*, 8 m above the ground. The third nest was situated on the convergence of branches in a Moreton Bay Fig *Ficus macrophylla*, ~30 m from the first nest and at a height of 10 m above the ground. The nests were cup-shaped and composed entirely of moss, typical of those described by Beruldsen (2004), except lacking alternative structural components such as grass and bark strips. In December 1989, a Thrush returned to the nest with a piece of root material from a Moreton Bay Fig, just a few weeks before fledging, suggesting that nest structures were replenished throughout the nesting period.

Each nest contained two nestlings. The mean clutch-size for the Bassian Thrush is two, and the range is one to four (Dove 1916; Ey 1944; Berry 2001). These nestlings were fed almost entirely on earthworms (n = 19 visits by an adult to a nest). No exchanges of brooding roles were observed at any of the nests, so it is not known if both the male and the female forage for food. Foraging occurred within 80 m of the nest-site. In most observations, the adult carried up to eight worms in the bill (cf. Edington 1983). After capturing the first three worms, a Thrush dropped its catch to obtain successive worms, swiftly retrieving them afterward. Foraging duration ranged from 5 to 15 minutes to obtain a bill full (6–8 worms). The Thrush sometimes interrupted its foraging to feed itself, usually when the prey was a beetle or grub. In the present study, the foraging bird always fed nestlings itself; the brooding bird stood up to allow access to the nest. Elsewhere, food exchanges between adults have been recorded so that the brooding bird fed the nestlings (Cooper 1959).

Before departing, the foraging adult removed a faecal sac from the nest in ~94% of cases (n = 19 visits by an adult to the nest). This was always dropped in mid-flight, such that regular flight-paths could be determined by examining the concentrated locations of deposited faecal sacs. Elsewhere, Thrushes have also been observed to ingest the faecal sacs (Edington 1983).

Table 1. Total number of observations on the Bassian Thrush per month in the Illawarra region, NSW, 1998–1992.

	Month											
	J	*F*	*M*	*A*	*M*	*J*	*J*	*A*	*S*	*O*	*N*	*D*
No. observations	6	7	5	2	1	1	4	7	5	6	5	4

Fledglings were dependent on adult Bassian Thrushes for food provision, as also observed by other authors (Campbell 1906; McGill & Lane 1955). The time taken for fledglings to become independent has not been studied previously; however, in our study, fledglings were recorded begging for food as late as February. Based on these observations, it appears that the period between fledging and independence may last more than 40 days.

Social organisation

Bassian Thrushes were seen mainly singly (59% of observations) or in pairs (34%) (cf. Legge 1935; Bourke & Austin 1947; Edington 1983). Groups of three or more were encountered on only four occasions (7.5%). In late September 1989, three Thrushes feeding within an area of 5 m^2 momentarily displaced one another, either by flying or running at a conspecific.

Movements

Movements are poorly understood in the Bassian Thrush, which is often considered to be resident or seasonally dispersive throughout its distribution (Higgins *et al.* 2006). There was strong evidence from atlas data for no large-scale movements (Griffioen & Clarke 2002). Some authors have suggested that some local dispersal occurs to lowland or open areas during autumn and winter (Dabb 1992; Whiter 1994). In the present study, Thrushes were seen in all months of the year, though observations were fewer in April, May and June (Table 1). Similarly, Gibson (1977) noted that Thrushes in the Illawarra region moved into gardens and other open areas during these months. Seasonal dispersal may provide a possible explanation for declines in the abundance of Thrushes in our sites from April to June.

Responses to human disturbance and interspecific interactions

Upon being disturbed by an observer, a Bassian Thrush usually ran a few metres and took up a motionless posture, as described by other authors (Barrett 1915, 1919; Legge 1928). If the intruder showed no interest, the Thrush soon resumed foraging. The Thrushes that were disturbed while gathering worms for nestlings could remain motionless with prey held in the beak for periods of up to 30 minutes. Elsewhere, this behaviour has been recorded in response to a Red Fox *Vulpes vulpes* passing through (Cooper 1959). Thrushes responded by flying away only when they were disturbed suddenly.

An Australian Raven *Corvus coronoides* was observed diving at a Bassian Thrush that was foraging on the lawns at the Mount Keira Scout Camp. The Thrush responded by retreating to the forest before another Thrush swooped at the Raven, successfully displacing it. We speculate that Ravens are either predators or displace Thrushes from their prey, but we did not observe them seeking dropped prey.

Conclusion

As one of few detailed studies on the Bassian Thrush (cf. Edington 1983; Recher *et al.* 1985), this paper helps contextualise aspects of the species' behavioural biology, previously known only from incidental observations. Our observations provide further insight on invertebrate prey selection and foraging in the Thrush over a 5-year study period, including during the breeding season. In addition, notes on post-fledging events provide a preliminary basis for understanding the period from fledging to independence in this species. Further work is necessary for understanding precise timings in the development of independent skills in the Australian thrushes.

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