

# Further dietary samples for Eastern Barn Owls *Tyto javanica* near Tamworth, New South Wales, revealed by habitat clearance

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**Abstract.** The diet of the Eastern Barn Owl *Tyto javanica* was investigated by examination of two samples of pellets ( $n = 11$  and 39), pellet debris and prey remains from: (1) an occupied nest with fledgling in May 2009, and (2) an Owl's winter roost in August 2009 near Tamworth in the grain belt of New South Wales. The breeding diet consisted, by number, of 91% mammals (90% rodents, including 87% House Mice *Mus musculus*) and 9% common farmland birds ( $n = 116$  food items). The winter diet consisted of 99% House Mice and 1% bird ( $n = 188$  food items). The fledgling Owl was killed when it failed to flush from its nest hollow as the tree was being felled, during approved clearing of the now Critically Endangered White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Given the dependence of the Barn Owl on House Mice, and the ongoing clearing of hollow trees, we note the potential for (a) secondary poisoning of owls by rodenticides, especially during plagues of the invasive House Mouse in the grain belt, and (b) the Barn Owl's long-term decline in abundance in New South Wales.

## Introduction

As reviewed by Olsen *et al.* (2020), the Asian–Australasian populations of the global Barn Owl *Tyto [alba]* complex should, on DNA evidence, be known as *Tyto javanica*, with the Australian population as subspecies *delicatula*. In Australia, as elsewhere globally where prey populations permit, members of the complex usually specialise on small terrestrial mammals, although their diet can be diverse (e.g. Higgins 1999; Debus 2009; Roulin 2020).

The diet of the Eastern Barn Owl (hereafter Barn Owl) has been studied extensively in Australia, though mainly in the arid zone, with few studies in the south-eastern agricultural belt (e.g. Higgins 1999; Fitzsimons *et al.* 2008; Pavey *et al.* 2008; Debus 2009; Debus *et al.* 2010; Woolley 2010; Kutt *et al.* 2021). Debus & Rose (2004) described the diet of a pair of Barn Owls occupying a hollow tree ~30 km north-west of Tamworth (31°05'S, 150°55'E), in the New South Wales sheep–wheat belt in 2004. Here we describe the diet of a pair of Barn Owls and their fledgling at the city sewage works on the western fringe of Tamworth, adjoining agricultural land in May 2009, and that of another Owl roosting in the surrounding rural zone in August of that year. Both 2009 samples were obtained when land-clearing operations exposed the samples in felled hollow trees of an endangered woodland community, in which the Owls were roosting.

## Study area and methods

The area of the Barn Owls' nest (pellet samples #1,  $n = 11$ ) was Yellow Box *Eucalyptus melliodora*–Blakely's Red Gum *E. blakelyi* floodplain grassy woodland adjoining the existing sewage works along the Peel River, and a cattle-grazing paddock with remnant eucalypts. The nest tree was a live, emergent old-growth Yellow Box with a large trunk-hollow in the crown. The later roost site (pellet samples #2,  $n = 39$ ) was a hollow located in a live old-

growth White Box *E. albens* in mature White Box grassy open woodland in a grazing paddock, ~5 km west of the nest site. The general area also supported a mosaic of grain-cropping fields.

The Barn Owl nest and fledgling were initially located during daytime bird surveys and nocturnal spotlighting by SJSD in April 2009, as part of pre-clearing faunal surveys for the expansion of the sewage works. A dietary sample (pellet samples #1: pellets, fragments and remains) from the nest was collected during ecological supervision of the daytime clearing operation (18 May), when the nest tree was felled, broke open on impact and killed the fledgling Owl that had remained in the hollow. The Owl specimen was lodged with the Australian Museum (registration no. AM O.73145). A pellet sample (pellet samples #2) was collected from another Owl's roost hollow on 12 August 2009 when the tree was 'soft-felled' (slowly), during ancillary work to create a storage dam and irrigated field (from reuse of treated wastewater). A Barn Owl safely vacated the hollow, though under mobbing by Australian Magpies *Gymnorhina tibicen*, as the tree was falling. The pellets at both sites appeared fairly fresh, from their typical 'glazed' *Tyto* mucous coating, and probably dated from the weeks or months immediately preceding the respective collection dates.

It is noted that the woodland clearing operations were officially approved despite the mature tree communities involved being, at the time, listed both state and federally as an Endangered Ecological Community (White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland: *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the New South Wales *Threatened Species Conservation Act 1995*). They have since been uplisted as a Critically Endangered Ecological Community under the *EBPC Act* and the replacement New South Wales *Biodiversity Conservation Act 2016* – reflecting the ongoing clearing that has occurred despite the previous listings.

The pellets (11 from the nest, 39 from the roost), pellet fragments and orts (remains and fragments of prey) were analysed by LRT by comparison with reference material in the Australian Museum and a rodent identification guide (Watts & Aslin 1981). For each sample (nest vs roost), the minimum number of individuals as prey (MNI) per whole pellet was inferred from the number of whole skulls, paired or odd jaws, and other skeletal elements or fragments. The MNI in the remaining pellet fragments and orts was then calculated from the number of additional whole or partial skulls, jaws and post-cranial body parts, for each sample. For each sample (nest vs roost), the whole pellets and other items were then combined for a conservative total MNI for each site.

We have no information on how long the nest hollow and roost hollow were in use over years or seasons, or on mouse populations around the collection sites in 2009.

## Results

### Diet

Rodents, and especially House Mice *Mus musculus*, were the major prey for both nesting and roosting Barn Owls (Table 1). The nest prey remains ( $n = 116$  items) consisted of 91% mammals (90% rodents, including 87% House Mice) and 9% birds, regardless of whether the Galah *Eolophus roseicapilla* wing represented a genuine Barn Owl prey item; it might have been brought there by a prior occupant of the hollow. The parrot skeletons might have represented stored uneaten prey, or perhaps dead prior occupants of the hollow. The Common Starling *Sturnus vulgaris*/Common Myna *Acridotheres tristis* remains were mostly just skulls among the pellet debris, i.e. eaten by the Owls, with only one complete skeleton. All these bird species were abundant at the sewage works (SJSD pers. obs.), and most of those taken (i.e. Starling and/or Myna) are exotic, invasive pests. Prey items at the Owl's roost ( $n = 188$ ) consisted of 99% House Mice and 1% bird.

At the nest site, 11 intact pellets contained the remains of 36 House Mice (range 2–6, mean 3.3 per pellet). At the roost, 39 intact pellets contained the remains of 162 House Mice (range 1–8, mean 4.2 per pellet); one containing six mice also contained the feet of an unidentified small bird.

### The fledgling owl

The dead fledgling, weighing 379 g, appeared to be the only juvenile successfully raised by the pair of Barn Owls at the sewage works in April–May 2009. A male by dissection at the Museum, it had fine horizontal vermiculations on its neck where the grey dorsal plumage met the white ventral plumage – apparently a feature of juvenile plumage in some individuals, though not described in the literature (e.g. Higgins 1999). It was the sole begging juvenile at night during the nocturnal survey. The fledgling had been mobile at night, visiting different hollow trees, but appeared insufficiently confident to flush from its falling hollow tree by day, despite mechanical attempts to flush hollow occupants before each tree-fall. The intended 'soft fall' of the nest tree failed, resulting in a rapid, uncontrolled and destructive fall.

**Table 1.** Minimum number of prey individuals in Eastern Barn Owl dietary samples (pellets, pellet debris and orts) from a nest hollow with fledgling (May) and an individual's roost hollow (August), Tamworth, NSW, in 2009.

Prey species	Nest	Roost	Total
<b>Mammals</b>			
House Mouse <i>Mus musculus</i>	101	187	288
Rat <i>Rattus</i> sp. <sup>a</sup>	3		3
Larger mammal <sup>b</sup>	1		1
<b>Subtotal</b>	<b>105</b>	<b>187</b>	<b>292</b>
<b>Birds</b>			
Galah <i>Eolophus roseicapilla</i> <sup>c</sup>	1		1
Parrot Psittaculidae <sup>d</sup>	2		2
Starling/myna Sturnidae <sup>e</sup>	6		6
Small bird	1	1	2
Medium bird	1		1
<b>Total</b>	<b>116</b>	<b>188</b>	<b>304</b>

<sup>a</sup>Probably Black Rat *R. rattus*

<sup>b</sup>Probably juvenile European Rabbit *Oryctolagus cuniculus*

<sup>c</sup>Wing only; uncertain if caught/consumed by Owl(s)

<sup>d</sup>Whole skeletons: Red-rumped Parrot *Psephotus haematonotus*/Eastern Rosella *Platycercus eximius*; uncertain if caught/consumed by Owl(s)

<sup>e</sup>Common Starling *Sturnus vulgaris*/Common Myna *Acridotheres tristis*

## Discussion

### Diet

The slightly higher average number of mice per pellet in the August 2009 roost sample might reflect a higher food intake during colder weather in winter, or perhaps an increase in mouse numbers, or an effect of sample sizes.

The Barn Owls' diet at both the nest site and roost site was dominated by House Mice and similar to that in a previous sample from the district, collected from a hollow where a pair of Owls was active (Debus & Rose 2004). The diet of the breeding pair with a fledgling was slightly more diverse, with more birds (even if some remains were not Owl prey) and some larger mammal species (Table 1). The Owls' diet in the Tamworth district was also similar to that elsewhere in the south-eastern Australian grain belt, where the diet is dominated by House Mice, by biomass if not always by number (Hutton & Brickhill 1985; Rose 1996; Higgins 1999; Fitzsimons *et al.* 2008; McLaughlin in prep.).

### Implications for mouse plagues

The introduced House Mouse is abundant in the grain belt, is targeted by poison baits, and is the major prey of the Barn Owl in agricultural districts. Rodents affected by poisons are attractive and easy prey for owls and other raptors (e.g. Mooney 2017). Given recurrent plagues of the House Mouse in the grain belt, there is therefore potential for significant, and counterproductive, mortality of various avian predators of mice, via secondary poisoning by rodenticides. The worst are the second-generation

anticoagulants (SGARs) based on brodifacoum, bromadiolone and difenacoum, which require only a single dose to kill a rodent; they are also highly toxic and persistent (Mooney 2017; Lohr 2018; Lohr & Davis 2018). The population impact of such avian mortality is unknown, but the Barn Owl declined substantially in New South Wales during 1986–2006, by ~50% in atlas reporting rate (Cooper *et al.* 2016). Given the dependence of Barn Owls on House Mice in the agricultural belt, we recommend avoidance of SGARs and adoption of alternatives to anticoagulant rodenticides where feasible, or the use of first-generation rodenticides based on warfarin or coumatetralyl that are less toxic to owls and other raptors (see Mooney 2017). Properly constructed nest boxes for Barn Owls could also be usefully deployed around grain crops, to encourage both predation on rodents, and owl reproduction in the face of declining tree hollows on farms (Meaney *et al.* 2021).

### Impact on habitat

This episode, of clearing a threatened woodland community that supported a mouse predator, exemplifies the animal-welfare issue (death and other trauma) caused by land clearing (Finn & Stephens 2017). It also exemplifies the failure of legislation, and of assessment and approval procedures, to protect species or ecological communities that are gazetted as Endangered or Critically Endangered (e.g. Ward *et al.* 2019). In winter 2010, following clearing of all scattered eucalypts in ~100 ha at the August roost site, SJSD found a Barn Owl roosting in foliage of dense roadside Yellow Box–Red Gum regrowth ~5 km away, perhaps reflecting the local loss of hollow trees. The roosting Owl was being mobbed by a Grey Butcherbird *Cracticus torquatus*, which betrayed the apparently distressed Owl's presence.

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