Powerful Owl *Ninox strenua* Diet from Two Sites in the Australian Capital Territory

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Summary

The diet of three Powerful Owls *Ninox strenua* in the Australian Capital Territory was studied in 2007. A pair in Namadgi National Park took five Sugar Gliders *Petaurus breviceps*, a Greater Glider *Petauroides volans*, birds and a crustacean. Among avian prey, the Bassian Thrush *Zoothera lunulata* is a new record for Powerful Owls. An Owl at the Botanic Gardens took 41 Sugar Gliders, 10 Common Ringtail Possums *Pseudocheirus peregrinus* and two juvenile Common Brushtail Possums *Trichosurus vulpecula*, the last apparently off the females’ backs. This Owl was observed perching on prey items on 11.9% of the days it was seen: seven times on Sugar Gliders, twice on Ringtail Possums, and twice on Brushtail Possums. It was seen attacking Sugar Gliders and adult Brushtail Possums, but beak-clacking when attacking the Brushtail Possums (so apparently attacking them as competitors, not prey). It was agile while hunting. Its behaviour was affected by mobbing by diurnal birds.

Geometric Mean Prey Weight (GMPW) of Powerful Owl prey (including four items from a previous Namadgi analysis) in the ACT was 176.48 g, and the prey/predator weight ratio was 0.118. GMPW calculated from a previous study in Canberra of Southern Boobooks *Ninox novaseelandiae* was 2.11 g, and the prey/predator weight ratio was 0.008, much lower than for Powerful Owls. Standardised Food Niche Breadth for Powerful Owls was 0.115, and for Southern Boobooks 0.325; i.e. dietary evenness and richness were much higher for Boobooks. Powerful Owls took 95.2% arboreal marsupials, whereas Boobooks took a wider range of species including a large proportion of insects.

Introduction

The endemic Powerful Owl *Ninox strenua* is the largest owl in Australia. It ranges along the eastern coast from central Queensland south into western Victoria (Higgins 1999) and extreme south-eastern South Australia (Haywood 2010). Fleay (1968) said that its preferred prey was medium-sized arboreal marsupials, especially Common Ringtail Possums *Pseudocheirus peregrinus*, Common Brushtail Possums *Trichosurus vulpecula* and Greater Gliders *Petauroides volans*, as well as Sugar Gliders *Petaurus breviceps*. It takes fewer adult than juvenile Brushtail Possums, and more Possums in spring when young are riding on females’ backs (Lavazanian *et al.* 1994), or when young venture away and are climbing noisily near the females (Ed McNabb pers. comm.). It may take proportionally more Brushtail Possums at lower elevations and more Greater Gliders at higher elevations. It is also known to...
take juvenile Koalas *Phascolarctos cinereus* as well as Black-headed *Pteropus alecto* and Grey-headed *Pteropus poliocephalus* Flying-foxes, and birds such as White-faced Herons *Egretta novaehollandiae*, Brown Goshawks *Accipiter fasciatus*, Glossy Black-Cockatoos *Calyptrorhynchus lathami*, Sulphur-crested Cockatoos *Cacatua galerita*, Crimson Rosellas *Platycercus elegans*, Laughing Kookaburras *Dacelo novaeguineae*, Australian Magpies *Cracticus tibicen*, Pied Currawongs *Strepera graculina* and White-winged Choughs *Corcorax melanorhamphos*, and beetles and other invertebrates, but only occasionally comes to the ground to catch prey such as Brown Hares *Lepus capensis* or European Rabbits *Oryctolagus cuniculus* (Fleay 1968; Van Dyck & Gibbons 1980; Tilley 1982; Rose 1993; Lavazanian et al. 1994; Pavely et al. 1994; McNabb 1996; Higgins 1999; Kavanagh 2002; Bilney et al. 2006; Cooke et al. 2006; Hambling & Pavely 2008; Debus 2009).

Powerful Owls have nested in the Australian Capital Territory (ACT) at Tidbinbilla Nature Reserve and in Namadgi National Park (Olsen 1987; Olsen & Rehwinkel 1995), but the only published analysis of Powerful Owl prey for the ACT was collected from one active nest in 1991 located near Blundells Creek in the Namadgi National Park. Prey there included a Greater Glider, a Common Ringtail Possum and a Squirrel Glider *Petaurus norfolcensis*; one adult Owl was perched on an additional fresh Greater Glider (Olsen et al. 2006a). This paper describes the collection of prey remains and pellets from two other sites in the ACT: (1) Bendora Arboretum in Namadgi National Park, and (2) the Australian National Botanic gardens in Canberra where an Owl was reported by Overs (2007).

Given the close taxonomic relationship between Powerful Owls and Southern Boobooks *Ninox novaeseelandiae*, there is potential for studying interspecific competition between individuals. For example, adult (~125 g) and juvenile (~50 g) Sugar Gliders could be potential prey for both species. In this study we therefore compare the diet of Powerful Owls in the ACT with data already published for Southern Boobooks in the ACT (Trost et al. 2008).

**Methods**

**Study area**

Site 1: A pair of Powerful Owls was located at Bendora Arboretum in Namadgi National Park south of Canberra (35°25′S, 148°48′E; 1265 m above sea level), and prey remains and pellets were collected on 3 and 28 May 2005.

Site 2: An individual settled at the Australian National Botanic gardens (35°17′S, 149°6′E; 600 masl), and prey remains and pellets were regularly collected from 14 May to 24 November 2007.

**Observations**

Behavioural observations of the Powerful Owl at the Botanic Gardens were made by GF, JM, RL, JO and ST without a torch, beginning just before it left the roost at dusk. It was followed and all interactions with other fauna noted until it was lost from view. Occasional observations were made during daylight, and a Powerful Owl call recording was broadcast on four occasions to gauge the Owl’s response. The majority of the observations noted were: (a) if the Owl was present, and the roost-tree used, (b) if it was holding prey, and the type of prey, (c) whether pellets or prey remains were found below the roost-site, and (d) if the Owl was harassed by other birds.

**Prey**

We collected pellets and prey remains from under roost-trees used by the Owls. Pellets and prey remains were stored separately, and each pellet was placed in an individual sealed
plastic bag. We identified and counted body parts to estimate the minimum number of prey items (MNI) in a pooled sample of pellets, prey remains, and observations, in order to minimise biases in the food estimations (Collopy 1983; Simmons et al. 1991; Seguin et al. 1998). Feathers were identified through comparison with collections and museum specimens when necessary. Bones, hair, and scales were identified by microscopy (following Brunner & Coman 1974 for mammalian hair) and by comparison with museum reference material.

Statistical analyses

To estimate the MNI in the pooled sample of pellets and prey remains, we counted teeth, skulls, bones, feet, tails, beaks, primaries and rectrices, as in Olsen et al. (2006a,b). We did not assume that one pellet represented one prey item because Powerful Owls roost on prey, and take more than one meal from some large items or consume prey from more than one prey item in a day, so more than one species can be found in each pellet.

To estimate dietary biomass, we multiplied the MNI by the average mass for each prey species. The mean or median weights of most prey were taken from the literature (Pavey et al. 1994; Kavanagh 2002; Olsen et al. 2006a,b).

To compare the diets of the Powerful Owl and Southern Boobook in the ACT, we pooled the data from all three Owls in this study and included the two Greater Gliders, one Common Ringtail Possum and one Squirrel Glider reported by Olsen et al. (2006a), and used data for Boobooks in Canberra published by Trost et al. (2008).

(1) Geometric Mean Prey Weight. One straightforward method of estimating raptor prey size is to calculate the mean prey weight. The frequencies of prey weights of most raptor species, however, do not follow normal distributions, and are usually skewed to one side of the mean. This poses a problem for using traditional arithmetic mean prey weights, since this statistic is not representative of the central tendency of skewed populations and it is therefore unreliable as an estimator of the overall prey size. In an attempt to fix this problem, Jaksić & Braker (1983) proposed the use of Geometric Mean Prey Weight (GMPW), obtained by summing the products of the number of prey items in each category multiplied by its log-transformed weight and dividing it by the total number of prey individuals in all categories. Consequently, we used GMPW (Marti 1987) to compare Powerful Owl and Southern Boobook diet.

(2) Standardised Food Niche Breadth. To compare the dietary breadth (diversity) of Powerful Owls with Southern Boobooks in the ACT, we used Standardised Food Niche Breadth (SFNB: Colwell & Futuyma 1971). Dietary diversity has two components: (1) richness – i.e. the number of prey species, and (2) evenness – i.e. how uniformly represented the various prey species are. An owl’s diet has high diversity (broader food niche) if many prey species are included in nearly equal numbers, but low diversity (narrower food niche) if it contains few species in very different abundances (Marti 1987). To calculate SNFB, we used the formula: 

\[ \text{SNFB} = \frac{B_{\text{obs}} - B_{\text{min}}}{B_{\text{max}} - B_{\text{min}}} \]

where

- \( B_{\text{obs}} = 1 / \sum p_i^2 \) (\( p_i \) is the proportion of each prey species),
- \( B_{\text{max}} = \) total number of prey species, and
- \( B_{\text{min}} = 1 \) (minimum number of prey species).

Results

Botanic Gardens observations

The Owl was present in the Botanic Gardens from 13 May to 24 November 2007, seen by Gardens staff on 92 days, and not seen on 104 days. Its longest continual period of presence was 36 days; its longest continual period of absence was 17 days. Mostly it roosted in two paperbark trees, Prickly Paperbark *Melaleuca styphelioides* and White-feather Honey-myrtle *M. decora* (88.2%), and a tick bush *Kunzea* sp. (4.4%), but occasionally in two other paperbark trees (7.4%) in the same area.
The Owl was observed perching on prey items on 11 days (11.9%), on the following dates:
Sugar Glider: 15 and 21 June; 1, 3, 27, 28 and 29 August;
Common Brushtail Possum (juvenile): 28 September; 2 October;
Common Ringtail Possum: 20 and 25 September.

It was observed eating before leaving its day-roost on two occasions (15 June, 1 August); it dropped the remains of these Sugar Gliders. Before leaving the day-roost, it spent ~2 minutes preening, then another 2 minutes wing-stretching. It often defaecated. On average, it left the roost 20 minutes after sunset ($n = 4$).

The Owl was mobbed by Pied Currawongs, Crimson Rosellas, Australian Magpies, White-winged Choughs and other birds on five days. It sometimes became very unsettled when mobbed, and there were two instances when it was mobbed by Currawongs and then disappeared from that roost (on the first occasion for 17 days). After the second mobbing, by up to 100 Currawongs for a considerable part of the day, it left the Botanic Gardens and was not seen again, apart from one or two days in 2009 (Owl recognisable by a specific mark on its cere). During the more sustained and vigorous mobbing, it was swooped by 4–5 Currawongs in the paperbark roost while other Currawongs were carolling and calling nearby. It moved about on the branch with its feathers flattened, showing the typical compact head shape of _Ninox_ owls, and appeared distressed.

When flying, the Owl was very agile, and could briefly hover or turn 180°. It was observed attacking Sugar Gliders in midair, and against tree-trunks; all of these were misses. A typical set of behaviours was recorded on 25 May 2007:

Owl stretched, regurgitated pellet, then left roost, and flew to another perch.
Sugar glider leapt from large _E. mannifera_ [Brittle Gum]. Owl was observed gliding towards airborne Sugar Glider where it was nearly intercepted. It was clearly attempting to catch it with its talons. Upon missing its prey, the owl immediately halted its flight with an abrupt upward lift onto a small dead branch. Owl flew back in direction it had come from. Three Brushtail Possums in the immediate vicinity. One possum moved along a branch, and paused in the open sitting on top of the large branch 5–8 m from the owl. It was clear to us that the owl could see the possum. Some moments later the owl stealthily took flight and swooped in on the possum. The owl made contact with the possum as it swooped past it and the impact was clearly audible. It was obvious that the possum was physically moved by the brief impact. However, the owl failed to take the possum from the branch and as it flew to its next perch, the possum made a quick retreat to a large Casuarina. Immediately the owl made a second attempt, but this time was not in a position to get at all close to the prey. The owl perched near to the location where it launched its first attempt at the Brushtail. Some minutes later it was apparent that the possums were not moving from the Casuarina (there was more than one in this tree). The owl then took flight further up the rainforest gully. Shortly after it was lost by the observing group.

As the Owl was beak-clacking (making a popping or snapping noise with its mandibles) when it attacked these Brushtail Possums, it was likely attacking them as competitors rather than as prey. [Johnsgard (2002) described beak-clacking or ‘snapping’ behaviour in tytonid and strigid owls that were defending but not hunting.]

**Calling**

On 28 July a recorded Owl call was played at the Botanic Gardens, and the Owl responded, but it did not respond to a recording of its own call on 27 or
29 August or 1 September. Spontaneous calling was heard twice on 30 July, two calls after an attack on a Brushtail Possum and a single call 20 minutes later. One call was heard on 3 October, after the Owl attacked a Sugar glider.

Namadgi

JO, MM and ST surveyed Namadgi National Park and saw Powerful Owls only near Bendora dam and Bendora Arboretum (the pair in this study). There was no response to recorded calls. Although Olsen & Rehwinkel (1995) estimated eight pairs of Owls in Namadgi, there may now be only one pair, near Bendora dam and the Bendora Arboretum. Most pairs had apparently disappeared after major fires in 2003.

Prey analysis

The three Powerful Owls (pair at Namadgi and one at the Botanic Gardens) took prey consistent with prey found elsewhere: predominantly arboreal marsupials, especially Sugar Gliders, with some birds, and one crayfish. The Bassian Thrush Zoothera lunulata is a new prey species recorded for this species (Table 1).

Between 14 May and 11 September 2007, 37 of 38 prey items at the Botanic Gardens were Sugar Gliders. Between 13 September and 24 November, nine of the 15 prey items were Common Ringtail Possums, four were Sugar Gliders, and two were Common Brushtail Possums. The Brushtail Possums taken on 28 September and 2 October were juveniles, probably off the females’ backs.

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Table 1

Prey items of Powerful Owls by number (n) and biomass from the Australian National Botanic Gardens and Bendora Arboretum (Namadgi National Park), ACT.

<table>
<thead>
<tr>
<th>Prey species</th>
<th>Botanic Gardens</th>
<th>Namadgi</th>
<th>Mass (g)</th>
<th>% n</th>
<th>% biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td>mammals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar Glider Petaurus breviceps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>adult</td>
<td>38</td>
<td>5</td>
<td>125</td>
<td>69.4</td>
<td>41.1</td>
</tr>
<tr>
<td>subadult</td>
<td>2</td>
<td>65</td>
<td>3.2</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>juvenile</td>
<td>1</td>
<td>50</td>
<td>1.6</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Greater Glider Petauroides volans</td>
<td>1</td>
<td>1300</td>
<td>1.6</td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>Common Ringtail Possum Pseudocheirus peregrinus</td>
<td>1</td>
<td>846</td>
<td>1.6</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>adult</td>
<td>3</td>
<td>627</td>
<td>4.8</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>subadult</td>
<td>6</td>
<td>335</td>
<td>9.7</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>Common Brushtail Possum Trichosurus vulpecula</td>
<td>2</td>
<td>570</td>
<td>3.2</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>juvenile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>birds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crimson Rosella Platycercus elegans</td>
<td>1</td>
<td>131</td>
<td>1.6</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Bassian Thrush Zoothera lunulata</td>
<td>1</td>
<td>100</td>
<td>1.6</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>invertebrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crayfish Cherax sp.</td>
<td>1</td>
<td>115</td>
<td>1.6</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>53</td>
<td>9</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Table 2

Geometric mean prey weight (GMPW), predator mass, prey/predator weight ratio and standardised food niche breadth (SFNB) for Southern Boobooks and Powerful Owls in the ACT.

<table>
<thead>
<tr>
<th></th>
<th>Southern Boobook</th>
<th>Powerful Owl</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMPW (g)</td>
<td>2.11</td>
<td>176.48</td>
</tr>
<tr>
<td>Predator mass (g)</td>
<td>283</td>
<td>1500</td>
</tr>
<tr>
<td>Prey/predator ratio</td>
<td>0.008</td>
<td>0.118</td>
</tr>
<tr>
<td>SFNB</td>
<td>0.325</td>
<td>0.115</td>
</tr>
</tbody>
</table>

Geometric Mean Prey Weight of the ACT Powerful Owls’ diet (including four items from a previous Namadgi analysis: Olsen et al. 2006a) was 176.48 g. Assuming a mass of ~1500 g for Powerful Owls (Higgins 1999), this gives a prey/predator weight ratio of 0.118. GMPW calculated from a previous study of Southern Boobooks in the Canberra area (Trost et al. 2008) was 2.11 g. Assuming a mass of ~283 g for the Boobook (Higgins 1999), this gives a prey/predator weight ratio of 0.008, which is much lower than for the Powerful Owl. Standardised Food Niche Breadth for Powerful Owls in the ACT was 0.115, and for Southern Boobooks in the ACT was 0.325; that is, dietary evenness and richness were much higher for Boobooks (Table 2). This difference was largely because Powerful Owls took almost solely arboreal marsupials, whereas Boobooks took birds and ground mammals, and had a large proportion of insects in their diet (Table 3).

Discussion

The diet from both locations was similar to that reported for Powerful Owls elsewhere (Fleay 1968; Van Dyck & Gibbons 1980; Tilley 1982; Rose 1993; Lavazanian et al. 1994; Pavey et al. 1994; McNabb 1996; Higgins 1999; Kavanagh 2002; Bilney et al. 2006; Cooke et al. 2006; Hambling & Pavey 2008; Debus 2009).

Tilley (1982) said that Powerful Owls in her study took more Sugar Gliders in autumn, more Common Ringtail Possums in summer, and more juvenile Common Brushtail Possums in spring when the juveniles were riding on the females’ backs.

Table 3

Prey taken by non-breeding Southern Boobooks (Trost et al. 2008) and Powerful Owls (this study) in the ACT.

<table>
<thead>
<tr>
<th>Prey category</th>
<th>% by number</th>
<th>Southern Boobook</th>
<th>Powerful Owl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arboreal marsupials</td>
<td>0</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Ground mammals</td>
<td>33.4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Birds</td>
<td>6.7</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Invertebrates</td>
<td>59.7</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Bats</td>
<td>0.2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
In our study, the Botanic Gardens Owl took mainly Sugar Gliders in winter, and took Ringtail Possums on 13 and 14 September and between 1 October and 13 November. The only Brushtail Possums (juveniles) were taken on 28 September and 10 October, apparently off the females’ backs. Our Namadgi study adds one new dietary species, the Bassian Thrush. The only crayfish prey previously recorded for Powerful Owls was by Kavanagh (2002).

Southern Boobooks in the ACT specialised on ground mammals, especially introduced Black Rats *Rattus rattus* and House Mice *Mus musculus*, and birds and invertebrates, whereas Powerful Owls specialised on arboreal mammals (Table 3). The Southern Boobook dietary niche was therefore broader, with a much lower GMPW, and contained more invertebrates. This may be attributed to a larger sample of Boobook prey in the study, but Powerful Owls appear to be more specialised, from most dietary studies, and we believe that this trend would hold with large samples for both owl species. The GMPW for Powerful Owls in the present study is probably lower than that for some other studies because the Botanic Gardens Owl specialised in Sugar Gliders, smaller than average prey for Powerful Owls. For example, our study found, by number, 74.2% Sugar Gliders, 16.1% Ringtail Possums and 3.2% Brushtail Possums (Table 1), whereas Kavanagh (2002) found, in south-eastern New South Wales, 9.1% Sugar Gliders, 48.6% Ringtail Possums and 1.3% Brushtail Possums. On the central NSW coast, Kavanagh found 5.9% Sugar Gliders, 61.6% Ringtail Possums and 1.9% Brushtail Possums. In Victoria, Tilly (1982) found 17.1% Sugar Gliders, 47.5% Ringtail Possums and 6.5% juvenile Brushtail Possums; and McNabb (1996) found 88.5% Ringtail Possums and 5.5% Brushtail Possums at Ferntree Gully, and 77.5% Ringtail Possums and 10% Sugar Gliders at Olinda.

Sugar Gliders are small enough (125 g) to be within the Boobook’s prey range, and are common in the ACT study area, but Boobooks did not take them whereas Powerful Owls did. Although Rabbits and Rabbit kittens were common, especially in the Botanic Gardens, both Powerful Owls and Boobooks ignored them, apparently because they were too heavy for the latter, and Powerful Owls prefer arboreal prey to ground prey (Fleay 1968).

The Botanic Gardens Owl was very agile when hunting, and chased prey in midair, as reported by McNabb (1996). Its manoeuvrability and ability to hover in midair are similar to the closely related Southern Boobook, but different from the similar-sized Great Horned Owl *Bubo virginianus* (J. Olsen & S. Trost unpubl. data), which takes mainly ground prey (Johnsgard 2002).

The behaviour of both owl species was affected by mobbing birds. On average, the Botanic Gardens Owl left the roost 20 minutes after sunset, whereas Southern Boobooks in the same area left their roosts on average 28 minutes after sunset ($n = 17$; J. Olsen & S. Trost unpubl. data), perhaps because they were more at risk from harm when attacked by birds such as currawongs. Occasionally a Boobook was driven back into its roost-hollow or tree if it left earlier (Olsen & Trost unpubl. data). The Botanic Gardens Powerful Owl was also harassed by currawongs, and this mobbing may have caused it to leave the Gardens. Pavey & Smyth (1998) found that most mobbing of Powerful Owls was by single species between 4 and 26% of the Owl’s weight; Owls abandoned daytime roosts during 20% of these mobbing bouts.

The Botanic Gardens Powerful Owl ate before leaving its day-roost on two occasions. Southern Boobooks in the ACT did not roost on prey nor eat before leaving a day-roost, but they ate soon after leaving the day-roost. They retrieved
cached prey, often some distance from the nest, and brought it to the roost or nest to eat (Olsen & Trost 2009; Trost & Olsen unpubl. data). Olsen (1990a) argued that Powerful Owls perched on prey during the day because they caught prey proportionally large for their size, but could not evolve larger body size because of the limiting size of tree-hollows. In contrast, species such as the Southern Boobook, and Great Horned Owl, more often cache prey during the day and retrieve it at dusk. This difference may be because only in Powerful Owls, Rufous Owls *Ninox rufa* and Barking Owls *N. connivens* does the male control prey from its (smaller) mate (Olsen 1990b; McNabb 1996), and display this prey to the female.

Clusters of locations identified in telemetry studies are often said to be core foraging areas of owls (Soderquist & Gibbons 2007). However, Powerful Owls may consume prey before leaving the day-roost and drop the remains when they are no longer hungry. Clusters of point locations for satiated Owls could therefore represent Owls searching for mates, prospecting for breeding sites, or in territorial disputes (as in Southern Boobooks: Olsen et al. 2011), and not solely foraging sites.

The Botanic Gardens Powerful Owl responded once to call playback, but ignored playback on three other occasions. Surveys using playback may therefore underestimate the number of Owls in an area if some do not respond.

Further studies are needed with larger sample sizes, comparing the diet and behaviour of Powerful Owls and Southern Boobooks to determine whether the findings in this study apply to larger populations.

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**References**


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