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Home-range, habitat use and diet of the Tasmanian Masked Owl *Tyto novaehollandiae castanops*

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Abstract. Estimates of home-range are reported for the Tasmanian Masked Owl *Tyto novaehollandiae castanops* using radio-telemetry in a modified agricultural land–forest landscape in south-eastern Tasmania. Home-range sizes for two female Owls were 1991 ha and 1896 ha using the Minimum Convex Polygon method, and 2507 ha and 2320 ha, respectively, using the Kernel Estimator method. The 50% isopleth Kernel estimated a core area of 174 ha and 309 ha for each Owl, respectively. Both Owls used two core areas within their home-range reflecting frequent foraging and roosting sites. The location and configuration of the home-ranges within the landscape, and areas of core use, suggest that Masked Owls are responding to geomorphology, heterogeneity of forest patches, forest structure and abundance and accessibility of prey. Both Owls preferentially foraged at forest edges, riparian zones and small forest patches. Frequently used foraging locations were in open forest with minimal understorey vegetation and a pasture groundcover, which probably reflects increased prey abundance, diversity and accessibility in this habitat type. The diet of both Owls was dominated by locally abundant native and introduced ground-dwelling eutherian mammals and marsupials. The strong association with riparian zones of both Owls in this study highlights the potential importance of retaining streamside vegetation to the conservation of the Tasmanian Masked Owl.

Introduction

Knowledge of home-range size, habitat requirements and diet is vital for effective conservation management of forest owls in Australia and internationally (e.g. Ganey & Balda 1989; Debus & Rose 1994; Kavanagh & Jackson 1996; Soderquist & Gibbons 2007). The Masked Owl *Tyto novaehollandiae* is now recognised as a high-priority species for conservation strategies in most forested landscapes throughout Australia (Commonwealth of Australia & State of Tasmania 1997; Commonwealth of Australia & State of New South Wales 2001) because it and some of its prey species are dependent on hollows and are potentially sensitive to reductions in the number of large hollow-bearing trees (Debus 2002; Cann *et al.* 2002; Kavanagh 2002).

Habitat selection by raptorial birds such as forest owls can be described as hierarchical, with four major levels. These include first-order selection of the geographical distribution of the species, second-order selection of home-ranges or territories within the geographical distribution, third-order selection of habitat components within the home-range, and fourth-order selection of food items within a foraging location (Johnson 1980). Studies of habitat selection generally measure and compare relative use versus availability of certain habitats within the chosen study area (Bias & Gutirrez 1992; Blakesley *et al.* 1992). When particular habitats are used disproportionately to their relative availability habitat use is described as selective or preferred (e.g. Johnson 1980; Carey *et al*. 1990). Data gathered in studies on habitat selection may be used to classify observations or locations into combined resource categories (e.g. ecotones) or measures of specific variables characteristic of those resources (e.g. percentage of canopy cover) (Thomas & Taylor 1990). For example, Kavanagh & Murray (1996) collected data on habitat use for a non-breeding female Southern Masked Owl *T. n. novaehollandiae* in New South Wales by classifying radio-telemetry locations in five habitat categories (ecotones) and comparing time spent in each habitat type.

Several studies on mainland Australia have demonstrated third-order selection by Southern Masked Owls for old-growth forests and mature trees for nesting and roosting, as well as forest edges, ecotones and open areas for foraging (Peake *et al*. 1993; Kavanagh & Murray 1996; McNabb *et al*. 2003). For example, drainage lines and small waterways in tall open forest with sparse understoreys appear to be targeted regularly by the species for foraging because of increased prey abundance, diversity and accessibility in these habitats (Kavanagh & Murray 1996). Fourth-order selection by this species for preferred prey items within specific foraging locations has also been reported by several researchers (Debus 1993; Mooney 1993; Kavanagh 1996).

In Tasmania, the Masked Owl *T. n. castanops* is the largest nocturnal forest owl, and is one of the largest in the family Tytonidae (Masked Owls) (Schodde & Mason 1980). It is widely distributed throughout the state, with the highest known densities occurring in low-elevation areas (<600 m) dominated by mature dry sclerophyll forests, open woodlands and modified forest–pasture mosaics (Bell *et al*. 1997; Bell & Mooney 2002; Todd *et al.* 2018). This endemic subspecies is currently listed as Endangered under the Tasmanian *Threatened Species Protection Act 1995* and Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. It is considered to be threatened by the loss of old-growth forests and trees from production forestry, agriculture, urban development and collection of firewood. Secondary poisoning from rodenticides and collisions with vehicles are also responsible for a significant number of mortalities (Bell *et al*. 1997; Mooney 2017).

Much of our knowledge of habitat selection and/or preferences for the Masked Owl in Tasmania is restricted to nesting and roost-sites, with no information currently available on home-range size, habitat utilisation and foraging ecology as no telemetry has been conducted. Two published radio-tracking studies have assessed home-range size and habitat use for the Southern Masked Owl in New South Wales (Kavanagh & Murray 1996) and Victoria (McNabb *et al*. 2003), with both of these reporting similar home-range sizes (and habitat use) for adult females in modified habitats of 1000–1300 ha.

We used radio-telemetry to investigate home-range size and habitat use of two female Tasmanian Masked Owls (one juvenile and one adult) to better inform the development of conservation management actions for this subspecies. We also describe the diet of the Owls by identifying prey species from undigested prey remains in regurgitated pellets collected from roost-sites.

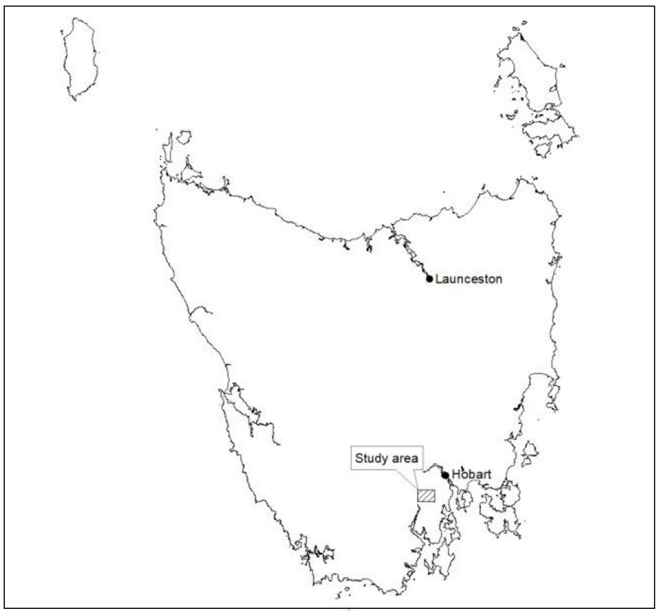

Figure 1. Location of study area ~20 km south-west of Hobart, Tasmania

Methods

Study area

The study area was located in Crabtree and Mountain River in the Huon Valley, ~20 km south-west of Hobart (Figure 1). The area comprises a modified agricultural–native forest mosaic with high primary productivity (i.e. highly fertile soils, mild temperatures and moderate rainfall supporting intensive grazing and large fruit-growing operations). Native vegetation consists of patchy eucalypt forest dominated primarily by Stringybark *Eucalyptus obliqua* and Manna Gum *E. viminalis* with extensive areas of exotic pasture and isolated paddock trees. Topography is diverse, with moderate-to-steep slopes and altitude ranging from 107 to 500 m above sea level. Numerous watercourses, including small rivers, creeks and drainage lines, dissect the study area. Average annual rainfall is 750–1500 mm and mean monthly annual temperatures range from 5 to 17°C.

Radio-tracking

One juvenile female Masked Owl (hereafter referred to as Owl 1), presumably independent of the parents, and one adult female (Owl 2) were captured using an Australian goshawk trap (1 m × 1 m) with adult laboratory rats *Rattus norvegicus* as lures (protected from physical harm). The captured Owls were presumably unrelated as they were trapped ~5 km apart and other adult Masked Owls were observed in the area where the juvenile was caught. Direct observations were also recorded for the (untracked) adult male breeding partner of Owl 2. Each captured Owl was weighed (Owl 1, 1025 g; Owl 2, 1000 g) and fitted with a two-stage radio-transmitter and lightweight harness constructed from soft nylon braid (Sirtrack Pty Ltd, New Zealand). The harness was attached with small (diameter 5 mm) brass crimps and included a weak link to enable harness detachment if entanglement occurred. The combined weight of the harness and transmitter was 20.8 g (<3% of the Owl's total body weight). Morphometric measurements [middle talon length (mm) and wing chord (cm)] were also taken.

Radio-transmitter signals were used to locate the Owls at the beginning of each tracking session and provided the majority of location records. Each transmitter had a unique frequency between 150.500 and 150.600 MHz that enabled individual birds to be recognised and located during the night. Radio signals were tracked by a single observer using a Communication Specialist R-1000 telemetry receiver and a three-element, hand-held Yagi antenna. Signals were received at distances >5 km on some occasions, but fixes were taken only at 0.2–1.0 km to minimise location error and potential disturbance to the Owls.

Locations of the Owls were calculated by triangulation of compass bearings (three-point triangulation method), which was possible for a single observer as there was a network of roads and vehicular tracks throughout the study area. With few exceptions, triangulation was easily obtained as both Owls were frequently stationary. Movement of the Owls was easily detected by fluctuating signals or rapid changes in signal direction. Fixes were recorded continuously when possible, but usually at least 15–30 minutes apart, so that a semi-continuous record of locations and movements could be obtained. Most recorded locations represent a number of fixes as the locations were recorded approximately every 15 minutes when the Owls were stationary. Fixes <15 minutes apart were removed from the home-range analysis to ensure partial independence of the sequential spatial locations (Kavanagh & Murray 1996).

The duration of tracking sessions ranged from 30 minutes to entire night sessions for each Owl. Thirty-two (Owl 1, n = 17; Owl 2, n = 15) combined pre-dusk visits to the study area were made to determine the time that the Owls left their roosts and to track their initial movements up until 2200 h (Eastern Standard Time). Fourteen (Owl 1, n = 7; Owl 2, n = 7) combined pre-dawn visits starting at 0300 h were made to determine the pre-dawn movements and the time that the Owls returned to their roosts. All other tracking was conducted between 2200 h and

0300 h. The sampling protocol consisted of locating each Owl at the commencement of a tracking session (six times a week) and then tracking Owl 1 on one night and Owl 2 the following night, and so on. Both Owls were tracked at different times of the night during each tracking session as the night was divided into three sampling segments (i.e. dusk–2200 h, 2201–0300 h, 0301 h–dawn). Owl 1 was tracked and observed for a total of 148 nocturnal hours from 25 April to 8 August 2006 and Owl 2 for a total of 119 nocturnal hours from 27 April to 8 August 2006 (*c*. 3.5 months).

Minimum Convex Polygons (MCP) and Kernel Estimator were used to estimate home-range size as these methods are convenient for comparisons of home-range with other similar studies and are conceptually simple. Analyses of home-range and habitat use were conducted using ArcView GIS v. 3.3 with Animal Movement Extension (Hooge & Eichenlaub 1997).

Habitat use

All radio-telemetry locations were plotted on 1:25,000 ortho-rectified colour aerial photographs and photo-interpretation forest-density layers obtained from Sustainable Timber Tasmania. These layers were used to map size of forest patch (ha) and the following broad habitat classes: low-density forest, 0–20% canopy cover; medium-density forest, 21–50% canopy cover; ecotone between forest and open pasture (100 m on each side); ecotone between a riparian zone and open pasture (100 m on each side); ecotone between forest and residential area (100 m on each side); and ecotone between medium-density forest and low-density forest (100 m on each side). Chi-squared Tests of Independence were used to test for significance of disproportionate habitat use relative to availability within the MCP for each radio-tagged Owl.

Diet

Regurgitated pellets were collected at regularly used diurnal roost-sites of the Masked Owls. Pellet material was soaked in soapy water, then broken apart and dried for identification of prey remains. Skeletal and dental remains were identified by comparison with collected reference material and use of the key to the skulls of the mammals in Tasmania (Green 1983). Hair samples were identified microscopically as described by Brunner & Coman (1974). To calculate prey biomass, predicted weights of adult prey items were estimated from Strahan (1983) and Mooney (1993). Immatures were recorded as 50% of adult weight.

Results

Home-range

In total, 108 telemetry locations and ten roost-sites were used for the home-range analysis of Owl 1 (juvenile). The estimated home-range for the non-breeding season for this Owl was 1991 ha using the MCP method (Figure 2) and 2507 ha using the 95% KE method. The 50% isopleth Kernel estimated a core area of 174 ha reflecting the frequent use of foraging and roosting locations. The MCP home-range was 7.53 km long × 4.55 km wide (at the widest

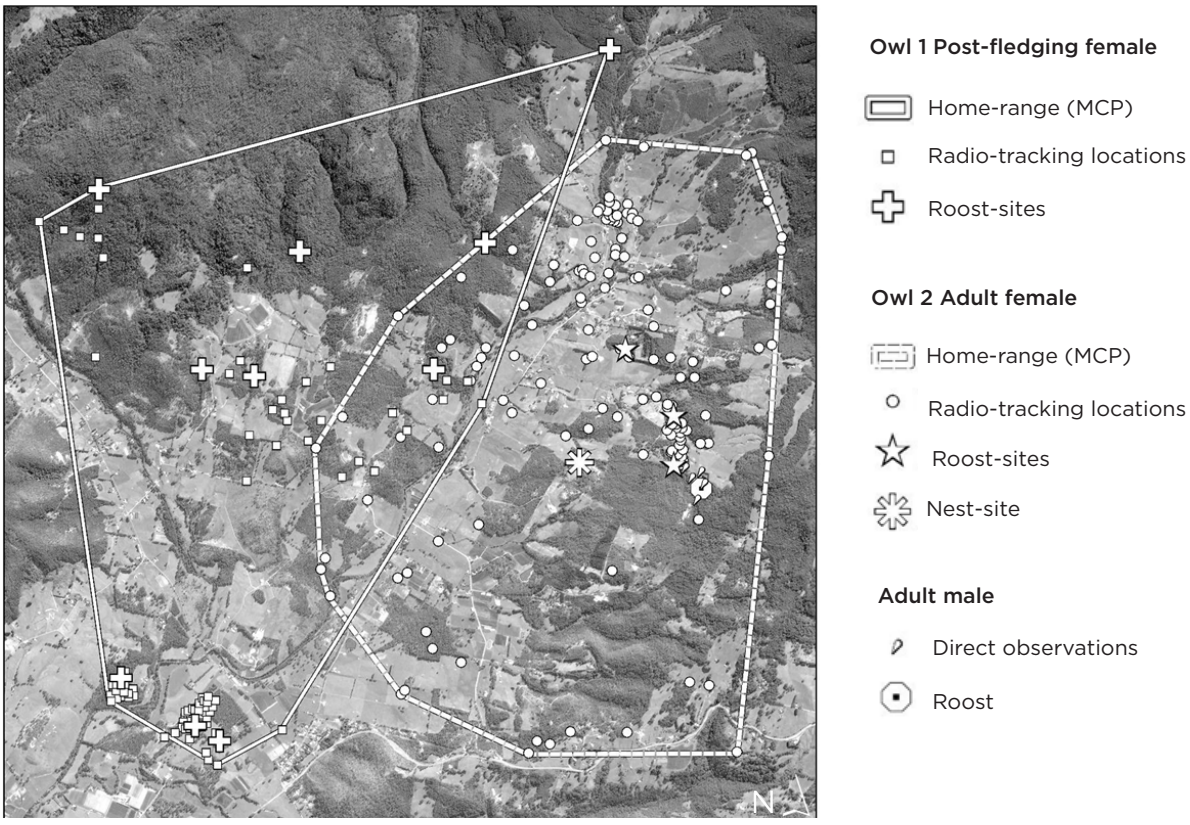

Figure 2. Home-range (MCP) and radio-tracking locations for Owl 1 (juvenile female) and Owl 2 (adult female). Direct observations and a roost-site of an adult male Tasmanian Masked Owl (breeding partner of Owl 2) are also presented. Scale is 1 : 45,000.

Table 1. Use of forest patches of different sizes in the home-range of a juvenile Tasmanian MaskedOwl (Owl 1) deduced from radio-tracked locations.

Patch size (ha)	*Coverage in home-range*		*Radio-tracked locations*	
	Area (ha)	*%*	*No.*	*%*
0–10	61	3.0	4	3.7
11–20	122	6.1	64	59.2
21–30	95	4.7	1	0.9
31–50	151	7.5	32	29.6
51–100	0	0	0	0
>100	782	39.2	7	6.4
Non-treed	780	39.1	0	0
Totals	**1991**	**99.6**	**108**	**99.8**

point) and consisted primarily of modified forest–pasture mosaic. The home-range was bordered to the north and east by the Wellington Range, which supported relatively continuous native eucalypt forest, although this part of the home-range was used relatively little. A small river and numerous small watercourses dissected the home-range, and adjacent forested areas were used often during nocturnal hours and for roosting. Most nocturnal activity was focused at the southern end of the home-range in a patch of Stringybark forest that had a low stem density with little or no understorey and exotic pasture groundcover.

For Owl 2 (adult), 154 telemetry locations and three roost-sites were used for the home-range analysis. The home-range estimate was 1896 ha using the MCP method (Figure 2) and 2320 ha using the KE method. The 50% isopleth Kernel estimated a core area of 309 ha reflecting the frequent use of two locations, one in the north of the home-range used primarily for foraging and the other around roost-sites. The home-range was 5.73 km long × 4.08 km wide (MCP method). It consisted of modified forest–pasture mosaic and was dissected by a small river that was frequently visited, presumably for foraging. The regular roost-sites of Owl 2 and of her male partner (breeding pair) were located on the eastern flanks of the female's home-range on the edges of relatively continuous forest. An active nest-tree was also located in mid July from radio-tracked locations of Owl 2. This was situated near the centre of the home-range and was ~960 m from the regular roost-tree of Owl 2. The home-range appeared to be constrained by topography in the north and east by the substantial mountain peaks of the Wellington Range and in the south by a large forested valley.

Both radio-tracked Owls in this study had home-ranges of similar shape and size, and both had two core areas of use, indicative of foraging and roosting sites. The MCP estimate for the area of overlap between the two radio-tagged Owls was ~321 ha, which equates to 16.5% of the average home-range size. The zone of overlap was situated along a significant topographical feature (small river) that was frequently used by both Owls (Figure 2).

Habitat use

Owl 1 showed a significant preference for small forest patches during nocturnal hours (χ^2 = 603.8, P <0.01). A disproportionate number of radio-tracked locations (59.2%, 64/108) were in forest patches of 11–20 ha, which contributed only 6.1% of the home-range area (Table 1). This Owl also disproportionately used forested patches of 31–50 ha, which represented only 7.5% of the home-range area. Nocturnal locations (presumably used for foraging) were mainly at the interface between forested and open areas as 72.2% of radio-tracked locations were in the ecotone between forest and open pasture. Eleven percent of radio-tracked locations were between a waterway such as a creek and open pasture, and only 9.2% of locations were >100 m from a forest edge or clearing. Foraging habitat of this Owl was typically at the edges of open forest that had 21–50% canopy cover, low stem density with little or no understorey and exotic pasture groundcover. During nocturnal hours, 60.8% of the radio-tracked time of Owl 1 was in ecotones between forest and open pasture, mostly at the frequently used patch of Stringybark forest at the southern end of the home-range. Twenty-three percent of foraging time was spent between a waterway, riparian zone and open pasture and 11.0% between forest and residential areas. Only 4.0% of the foraging time of Owl 1 was spent in medium-density forest >100 m from any edge.

Before and during radio-tracking, locations of Owl 1 were concentrated at two patches of Stringybark forest at the southern end of the home-range. Owl 1 left this area abruptly on 23 July after an interaction with another Masked Owl at the roost-site and subsequently ranged over a much wider area for the remainder of the radio-tracking period. This behaviour appeared to be dispersal from the natal territory.

Owl 2 also showed a significant preference for small patches of forest during the night (χ^2 = 535.8, P <0.01) as a disproportionate number of locations (44.1%, 68/154) were situated in forest patches of 0–10 ha that contributed only 5.5% of the home-range area (Table 2). Twenty-six percent of locations were in patches of 50–100 ha that were mainly in the vicinity of a regularly used roost-site. The majority of the locations in larger forest patches (>100 ha) were at the interface between the forest edge and open areas. A disproportionate number of locations (51.2%) were in an ecotone between a riparian zone and open pasture. A high proportion of locations (30.5%) were at forest edges between forest and open pasture and only 3.2% of locations were situated >100 m from a forest edge.

Table 2. Use of forest patches of different sizes in the home-range of an adult Tasmanian Masked Owl (Owl 2) deduced from radio-tracked locations.

Patch size (ha)	*Coverage in home-range*		*Radio-tracked locations*	
	Area (ha)	*%*	*No.*	*%*
0–10	105	5.5	68	44.1
11–20	109	5.7	14	9.0
21–30	124	6.5	0	0
31–50	196	10.3	15	9.7
51–100	112	5.9	41	26.6
>100	285	15.0	16	10.3
Non-treed	965	50.8	0	0
Totals	**1896**	**99.7**	**154**	**99.7**

Foraging habitat was similar to Owl 1 (i.e. forest with low stem density, 21–50% canopy cover, sparse or no understorey and groundcover of exotic pasture). Owl 2 spent almost half of her nocturnal hours (49.7%) in ecotones between a waterway–riparian zone and open pasture, 27.0% in ecotones between forest and open pasture, and 13.4% between forest and residential areas. Only 5.0% was spent between medium- and low-density forest, and 3.0% in forest >100 m from any edge or clearing. Diurnal roost-sites for both radio-tagged female owls (and the male partner of Owl 2) were in native forest patches of varying size within a large area of forest–pasture mosaic towards the centre of the respective home-ranges.

Roost-sites of both Owls (n = 13) were mostly situated in structurally diverse riparian vegetation adjacent to small watercourses. Tree species used frequently for roosting by both radio-tagged Owls (and the male, n = 1) were abundant in the study area, suggesting non-selectivity for floristics but this requires further research because of low sample sizes.

Diet

The diet of Owl 1 was assessed from 58 prey items with an estimated total biomass of 29.3 kg (Table 3). Native marsupials contributed the majority of identified prey items by both number (41.9%) and biomass (69.9%) (Figure 3). Introduced eutherian mammals were also a major component of pellets, representing 35.4% of prey items

Table 3. Diet of Owl 1 assessed from pellets collected in Study Area 1 from 26 April to 20 August 2006 by number (n; a slash separates the number of adults from immatures) and biomass (B). * denotes introduced species. Weights are averages obtained from Strahan (1983) and Mooney (1993), and immatures are presented as 50% of adult weight.

Prey species	*Weight (g)*	*Number*		*Biomass*	
		n	*%*	*B (g)*	*%*
Mammals					
Eastern Barred Bandicoot *Perameles gunnii*	950	6/11	29.3	10925	37.2
Southern Brown Bandicoot *Isoodon obesulus*	1200	1/0	1.7	1200	4.0
Tasmanian Pademelon *Thylogale billardierii*	4000	1/1	3.4	6000	20.5
Common Brushtail Possum *Trichosurus vulpecula*	4300	0/1	1.7	2150	7.3
Swamp Antechinus *Antechinus minimus*	65	2/0	3.4	130	0.4
Sugar Glider *Petaurus breviceps*	120	2/0	3.4	240	0.8
Australian Swamp Rat *Rattus lutreolus*	120	7/0	12.0	840	2.8
*Black Rat *Rattus rattus*	280	12/0	20.6	3360	11.4
*House Mouse *Mus musculus*	25	5/0	8.6	125	0.4
*European Rabbit *Oryctolagus cuniculus*	1200	3/1	6.8	4200	14.4
Unidentified mammals	–	2	3.4	–	0
Birds					
Grey Fantail *Rhipidura albiscapa*	9	1/0	1.7	9	0.03
*Common Starling *Sturnus vulgaris*	75	2/0	3.4	150	0.5
Totals		**58**		**29329**	

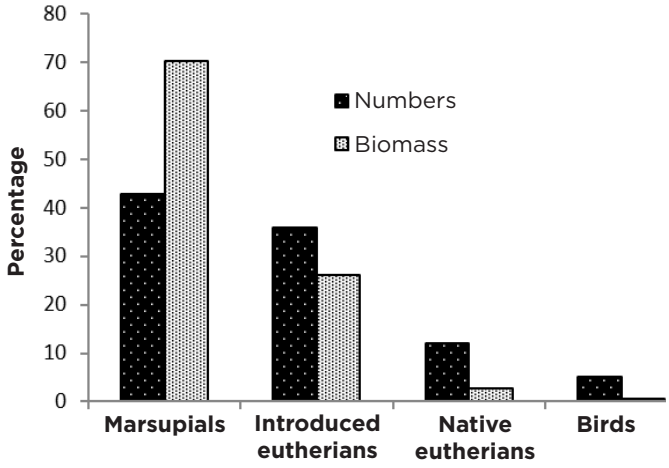

Figure 3. Percentage of prey groups represented (by number of individuals and by biomass) in pellets collected from Owl 1 (juvenile female Tasmanian Masked Owl) roost-sites.

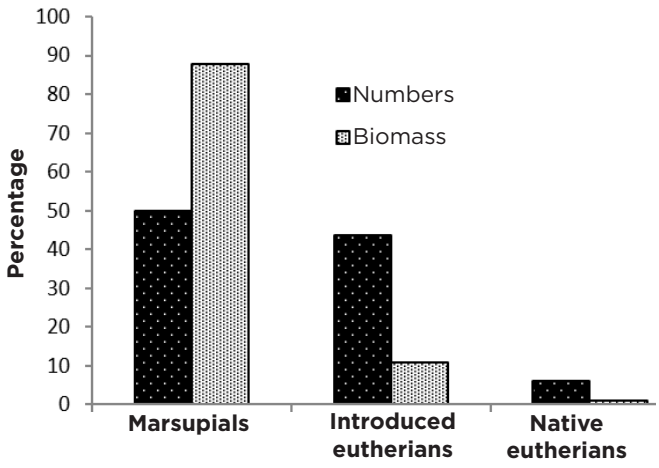

Figure 4. Percentage of prey groups represented (by number of individuals and by biomass) in pellets collected from Owl 2 (adult female Tasmanian Masked Owl) roost-sites.

by number and 26.3% of total biomass. Native eutherian mammals (Australian Swamp Rats *Rattus lutreolus*) were a minor component of pellets (11.8% by number and 2.8% of biomass), as were birds (5.0% by number and 0.5% of biomass). Eastern Barred Bandicoots *Perameles gunnii* and Black Rats *Rattus rattus* were the most abundant prey items. The former also contributed the majority of the biomass. Of the 17 Eastern Barred Bandicoots, six were adults and 11 were juveniles. Tasmanian Pademelons *Thylogale billardierii* and European Rabbits *Oryctolagus cuniculus* were also important components of the biomass. Prey items up to 200 g contributed the majority of prey by number (32.1%) whereas prey items of 400–600 g dominated the biomass (19.9%).

The diet of Owl 2 was assessed from only 16 prey items, with a total predicted biomass of 10.3 kg (Table 4). Only a few pellets were found at the primary roost-site although this was used continuously by this Owl during radio-tracking. Native marsupials constituted the majority of prey items recorded by both number (52.9%) and biomass (87.7%) (Figure 4), and were the most important prey group for this Owl. Introduced eutherian mammals (Black Rat, Brown Rat *Rattus norvegicus* and House Mouse *Mus musculus*) were also important components, representing 41.1% of prey items by number and 11.0% of total biomass. Native eutherian mammals (Australian Swamp Rat) constituted a minor part of the diet (5.8% by number and 1.1% biomass). Eastern Barred Bandicoots and House Mice were the most abundant prey items. Although introduced rodents such as Black and Brown Rats were an important component by number in the diet, the Tasmanian Pademelon *Thylogale billardierii* contributed the majority of the biomass in the diet of Owl 2. Of the four Eastern Barred Bandicoots, two were

Table 4. Diet of Owl 2, assessed from pellets collected in Study Area 2 from 28 April to 4 September 2006 by number (*n*; a slash separates the number of adults from immatures) and biomass (B). * denotes introduced species. Weights are averages obtained from Strahan (1983) and Mooney (1993), and immatures are presented as 50% of adult weight.

Prey species	*Weight (g)*	*Number*		*Biomass*	
		n	*%*	*B (g)*	*%*
Eastern Barred Bandicoot *Perameles gunnii*	950	2/2	25.0	2850	27.6
Tasmanian Pademelon *Thylogale billardierii*	4000	1/0	6.2	4000	38.7
Tasmanian Bettong *Bettongia gaimardi*	2000	1/0	6.2	2000	19.3
Sugar Glider *Petaurus breviceps*	120	2/0	12.5	240	2.3
Australian Swamp Rat *Rattus luttreolus*	120	1/0	6.2	120	1.1
*Black Rat *Rattus rattus*	280	2/0	12.5	560	5.4
*Brown Rat *Rattus norvegicus*	320	1/1	12.5	480	4.6
*House Mouse *Mus musculus*	25	3/0	18.7	75	0.7
Totals		**16**		**10325**	

adults and two were juveniles. Prey items up to 400 g contributed the majority of prey by number and prey items of 1000–4000 g dominated the biomass. These large prey items were presumably only partially consumed (e.g. head only found in pellets) so that estimates of total weight should be viewed with caution.

Discussion

Home-range

We provide the first Minimum Convex Polygon estimates of home-range size (~1800–2000 ha) for the Tasmanian Masked Owl based on radio-tracking data for two females prior to the breeding season in an agricultural land–native forest landscape. These MCP estimates are substantially larger than those that have been reported from radio-tracking studies of female Southern Masked Owls on mainland Australia (e.g. Kavanagh & Murray 1996; McNabb *et al*. 2003). This considerable difference in home-range size may be a consequence of the larger body size of the Tasmanian Masked Owl compared with the Southern Masked Owl or they may reflect differences in prey density and abundance or the low sample size. Interspecific competition may also influence home-range size of Southern Masked Owls on mainland Australia, where there are many more potentially competing owl species (Peery 2000; Kavanagh 2002).

The home-ranges in the present study contained a variety of patchy and continuous forest within large areas of modified pasture, which is similar to the habitat within the home-range reported previously for radio-tracked female Southern Masked Owls (Kavanagh & Murray 1996; McNabb *et al*. 2003). However, unlike the Southern Masked Owl on the Australian mainland, the home-range boundaries in this study coincided with distinct topographical features, suggesting that geomorphology may be important. Topography and vegetation were similar in the two home-ranges in the present study as they were located in neighbouring valleys. Both contained moderate numbers of old-growth trees and extensive amounts of immature and mature regrowth forest (50+ years), which is similar to home-ranges occupied by the Southern Masked Owl (Kavanagh & Murray 1996). Both radio-tracked Tasmanian Masked Owls used relatively small portions of their home-ranges intensively for roosting and foraging and other areas infrequently, which is consistent with comparable studies on Masked Owls in Australia (Kavanagh & Murray 1996; McNabb *et al.* 2003). In the present study, core areas of activity during the night were small open forest patches, forest edges and riparian zones in cleared agricultural land, and larger more continuous patches of old-growth/mature-regrowth riparian forest were generally used for roosting.

Habitat use

The adult female (Owl 2) occasionally patrolled the boundaries of her home-range, utilising watercourses and open patches of agricultural land as she travelled. This behaviour is strikingly similar to that reported by Kavanagh & Murray (1996) and McNabb *et al*. (2003) for the Southern Masked Owl in New South Wales and Victoria, respectively. On one occasion, Owl 2 was located in the early evening at the northern edge of her home-range and was subsequently tracked to the southern edge, travelling ~12 km during the night. In contrast, Owl 1 (presumably a juvenile reaching independence based on the intense 'begging' vocalisations) was quite sedentary during nocturnal hours, with most activity occurring within 1 km of the diurnal roost-site. Both Owls frequently used roads and tracks as flyways and for foraging. Such behaviour may explain the apparent high mortality of Masked Owls in Tasmania as a result of collisions with vehicles. Kavanagh & Murray (1996) and McNabb *et al*. (2003) also reported a preference of the Southern Masked Owl for roadsides and clearings for foraging.

Owl 2 frequently foraged in areas >2 km away from the primary roost-site despite abundant prey in the vicinity of this roost-site. Based on our observations (DY), we suggest that Tasmanian Masked Owls forage away from roost-sites in areas of higher prey abundance or species richness and/or where the canopy structure and understorey allow prey to be more accessible. In support of this, the Owls foraged mainly at the interface between forest edges, small watercourses or drainage lines and open pasture. These habitats are well documented as important foraging locations for forest owls and raptors in general as they support increased diversity, abundance and accessibility of prey (Kavanagh & Murray 1996; Cooke *et al.* 2006; DY pers. obs.). McNabb *et al*. (2003) suggested that this may be because the Masked Owl is an intrinsic edge hunter that has traditionally foraged in edge habitats or this behaviour might have arisen as a result of gross habitat modification, changes in prey assemblages and the presence of exotic predators throughout south-eastern Australia since European settlement.

Diet

Small native marsupials (especially Eastern Barred Bandicoots) were the most important prey group in the diet of the Masked Owls in our study. However, previous studies on mainland Australia and in Tasmania have shown that introduced prey species such as European Rabbits and rodents are increasingly important components of the diet in highly modified habitats (e.g. Mooney 1993; Kavanagh 1996; Kavanagh & Murray 1996). In unmodified environments, prey species are predominantly native ground-dwelling eutherian mammals, arboreal marsupials and birds (Kavanagh 1996). Interestingly, Tasmanian Bettongs *Bettongia gaimardi* were extremely abundant in the study area (DY pers. obs.) but only one individual was identified in the pellet remains. Mooney (1993) also recorded low numbers of Tasmanian Bettongs compared with other species in the diet of Tasmanian Masked Owls (although Bettongs were locally common), suggesting that factors other than abundance (e.g. manageability) may influence their presence in the diet.

Conservation management

The Masked Owl is one of the more controversial threatened species in Australia because of its rarity and

the high economic value of its habitat (Cann *et al*. 2002; Debus 2002; Kavanagh 2002). Yet, paradoxically, it often appears to prefer fragmented anthropogenic landscapes. This is possibly because of the extent of loss and modification of historically preferred habitat (woodland and open forests) combined with major changes to prey assemblages since European settlement (Cann *et al.* 2002). Given the current threatened status of the Tasmanian Masked Owl, further studies on its behavioural ecology, particularly spatial habitat requirements across various forest types, in Tasmania are urgently required to inform the development of effective conservation actions. Although our study involved only two female Tasmanian Owls in a single landscape unit, it has provided reliable local estimates of home-range size and habitat use at least for an agricultural land–forest landscape. Telemetry studies in more extensive native forest landscapes may show a different pattern of habitat use.

Both radio-tracked Owls in this study used two small core areas intensively within the home-range. Thus, it is suggested that conservation actions should target these core areas of use and would be best applied at different spatial scales to conserve foraging and nesting/roosting habitat. Characterisation of the habitats and forest types in these core areas may provide additional guidance on where conservation management actions should be targeted. The strong association of the Tasmanian Masked Owl with small watercourses in this study highlights the potential importance of retaining streamside vegetation for the conservation of this subspecies and its prey.

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