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POST-NESTING HOME RANGE, HABITAT USE AND DIET OF A FEMALE MASKED OWL *Tyto novaehollandiae* IN WESTERN VICTORIA

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A female mainland Masked Owl *Tyto novaehollandiae novaehollandiae* nested in a dead tree which was standing in pasture and was supporting two recently fledged young when radio-tagged on 17 December 1999. She was tracked until the tag became detached four weeks later. Her home range was estimated to be 1 125–1 310 hectares. Foraging activity was focused in dense/medium tree cover with a high proportion of fixes within 100 m of the forest/pasture edge. The European Rabbit comprised 89 per cent of the prey biomass from 277 individual prey items. The owl displayed an apparent aversion to light by remaining inside her roost hollow until well after sunset on moonlit nights as well as flying away when spotlit.

INTRODUCTION

Little is known of the diet, nesting biology and home range of the Masked Owl *Tyto novaehollandiae*. Debus (1993) regarded it as 'arguably the least known owl species in mainland Australia'. It is listed as rare in Australia (Garnett and Crowley 2000) and the southern nominate subspecies *novaehollandiae* is classified as endangered in Victoria (NRE 2000). Its major stronghold in the state is in the heathy coastal forests of east Gippsland (Peake *et al.* 1993), with other scattered populations across the central and western Gippsland foothills and in the Otway Ranges and nearby coastal forests extending to the south-west (Atlas of Victorian Wildlife). Because of the Masked Owl's cryptic nocturnal habits it is difficult to detect during standard faunal surveys and many records in Victoria are of Masked Owls killed on roadsides. This has perhaps given rise to the general perception that the species is an 'edge hunter'. Limited evidence to support this view has been presented by Hollands (1991), Peake *et al.* (1993), Bell and Mooney (2002) and Liddelow *et al.* (2002).

Recent surveys of large forest owls at approximately 2 000 sites throughout public forested lands in Victoria have failed to detect Masked Owls north of the Great Dividing Range and detected them mainly in the southern lowlands at 11 sites (Loyn *et al.* 2002; Arthur Rylah Institute, unpubl. data). The species has seldom been recorded breeding in Victoria with only eight records from five sites to date.

A recent study near Newcastle, New South Wales described a pair breeding during winter, preying heavily on small native terrestrial and scansorial mammals in a forest environment (Kavanagh 1996). Another study near Newcastle reported a radio-tagged, non-breeding female in fragmented semi-urban habitat, favouring the bushland edge and preying predominantly on introduced small terrestrial mammals. The home range of this bird was estimated to be 1 178 hectares using the minimum convex polygon method (Mohr 1947) and 1 017 hectares using the more accurate (95%) harmonic mean method (Dixon and Chapman 1980; Kavanagh and Murray 1996).

This study in south-western Victoria, documents the immediate post-nesting movements and behaviour of a female Masked Owl in highly modified rural habitat, that generally concur with Kavanagh (1996) and Kavanagh and Murray (1996). Analysis of regurgitated pellets from the nest suggests an apparent change in the diet associated with the reduction of native habitat and prey species and the corresponding resultant encroachment of the European Rabbit *Oryctolagus cuniculus*.

STUDY AREA

The study area was at Corndale (37°33'S, 141°17'E) in south-western Victoria. Topography is flat with altitude ranging between 130 and 140 metres above sea level. Habitat consists of extensive areas of privately-owned pasture with scattered mature, senescent or dead River Red Gums *Eucalyptus camaldulensis* with abundant large hollows. The area is bordered to the north-west by softwood plantations and the south-west by damp sands herb-rich woodland of Drajurk State Forest dominated by Brown Stringybark *E. baxteri* and Scent-bark *E. aromaphloia*. Manna Gum *E. viminalis* and River Red Gum occur along a shallow drainage line flowing westward into the forest from the adjacent pasture. Damp sands, herb-rich woodland also borders the northern edge of the area and two isolated patches of approximately 50 hectares each occur in the pasture-land. Middle storey in forest areas is generally sparse to absent with ground cover either heathy or grassy. Low numbers of large tree hollows occur in these forests and large areas of pastureland within the study area have undergone conversion to plantations of Tasmanian Blue Gum *E. globulus* since this study was conducted.

METHODS

Locating nest and roost sites

An active Masked Owl nest was discovered during October 1999, by researchers searching tree hollows for nests of Red-tailed Black-Cockatoos *Calyptorhynchus banksii*. The nest contained two downy owlets and an adult female. The nest was monitored with the intention to fit a radio tag to the adult female when the chicks were no longer in need of brooding, i.e. shortly before she ceased roosting in the nest tree and was therefore, still relatively easy to capture. However, by the

Figure 1. *Radio tracking points and home range of a female Masked Owl* Tyto novaehollandiae *supporting two dependent fledglings in relation to mapped tree cover classes at Corndale, Victoria. NT nest tree; R1, R2, R3 roost trees.*

time the nest tree was climbed on 24 October 1999, the female had vacated the cavity and was roosting elsewhere.

After the chicks had fledged (23 November 1999), all accessible tree hollows within 500 metres of the nest were systematically inspected for daytime roosting adult owls by means of a miniature television camera mounted on a 10 metre extendable pole. The owl was subsequently captured in a mist net (7 m high × 10 m wide × 100 mm mesh) as she exited the roost at 2200 hours that evening.

Home range, habitat use and behaviour

The 810 gram adult female was fitted with a 6 gram 'Biotrack' transmitter (0.7% of the owls' weight) attached ventrally to the right-central retrix close to the base, by using an epoxy glue *(Five Minute Araldite®)* and two bindings of medical suture. The whip aerial was tied with dental floss at 30 millimetre intervals along the shaft. Because Tyto owls have relatively soft feather shafts (P. Olsen, pers. comm.), the suture was not threaded through the shaft (see also Soderquist 2002). A length of floss was also loosely looped around the adjacent right retrix with enough slack to enable normal fanning of the tail. The owl was banded and released within 60 minutes of capture.

Radio signals were ground-tracked at night by two observers, each equipped with a Telonics TR2 receiver and three element Yagi antenna. Signals were received at distances of up to 3 kilometres but to minimise error, fixes were taken by triangulation at distances of 0.5–1.5 kilometres. Both observers used portable two-way radios to enable them to synchronize the fixes. Thereafter, roost sites were located during daytime and monitored at dusk to (1) establish the time the owl left the roost and (2) to enable us to track the owl's movements immediately after it left the roost.

The owl was tracked for four weeks (18 December 1999 — 18 January 2000) until the transmitter became detached. Fixes were recorded at least 15 minutes apart to facilitate independence of the locations. The recording of fixes was often interrupted when the owl moved a long distance, changed position too frequently, or was too far away for an accurate fix. Night sessions lasted between 30 minutes (two fixes) and 8 hours (10 fixes) with 15 sessions during the first four hours after sunset, one during the last three hours before sunrise and one from sunset to sunrise. Estimates of home range were made using Calhome software (U.S. Forest Service Pacific Southwest Research Station and California Department of Fish and Game) by three methods: minimum convex polygon (MCP: Mohr 1947), harmonic mean distance minimum (HM: Dixon and Chapman 1980), and Adaptive Kernel (AK: Worton 1989).

The site where the owl was observed and subsequently captured prior to the radio fitting was also included in the data for analysis. Mapped digital Geographical Information Systems (GIS) data were used in analysis of the owl's foraging patterns in relation to tree cover densities and the forest/woodland edge.

The radio tracking fixes were plotted on to a 1:25 000 tree cover map (source: NRE Corporate Library; Fig. 1) to:

(a) determine the proportion of points (excluding the nest and roost sites) within each of two broad tree cover classes: Dense/medium and Sparse/non-treed

(b) determine the proportion of points (excluding the nest and roost sites) inside, inside less than 10 metres from the edge, outside and outside less than 100 metres from the edge of the dense/medium tree cover areas compared with the proportion of each class in the owl's estimated home range as estimated from a computer raster data layer using MapInfo® software (MapInfo Corporation).

These mapped tree density classes are based on canopy cover and therefore tend to under-estimate the actual number of tree stems. For example, areas with scattered single trees are often mapped as 'non-treed'.

During the study, a time lag was noticed between sunset and the owl's egress from the roost, particularly on nights when ambient light levels were high. Accordingly, on the ten occasions when the time the owl left its roost was recorded, the brightness of night light one hour after sunset was assigned an index value between 0 and 2 based on moon phase, and rise and set times. Genstat 5® software was used to investigate any relationship between the owl's activity period and the ambient light. Because the sky was cloudless on each occasion, the light index was solely a function of moonlight intensity. To avoid distracting the owl, spotlighting was kept to a minimum and observations were usually made at least 200 metres away from the owl. A spotlight fitted with an infra red filter (ICI black perspex 962), in conjunction with infra red night vision goggles (M972, Litton Electron Devices, USA) was trialed but was discontinued when the owl appeared to be distracted by it.

Diet

The nest hollow contained a layer of pellet material approximately 10 centimetres deep. After the chicks had fledged and were roosting elsewhere, this material was scooped out in two layers by means of a small spade and sent for analysis. Pellets in the top (5 cm) layer were generally less fragmented and were assumed to have been cast by the Masked Owl. The lower layer contained material that had been completely fragmented over time and could have come from another species, e.g. Barn Owl *T. alba*. Seven fresh pellets were also collected from one of the three recently used roost hollows. Of the other two roost trees, one was unstable and therefore unsafe to climb, the other became infested with feral Honey Bees *Apis mellifera* after the study and was not climbed until several months later. No pellets were found.

Prey skeletal and dental materials in the pellets were identified by comparison with reference material. Hairs were identified microscopically as described by Brunner and Coman (1974). It was not possible to quantify the number of pellets but by pairing major limb bones and cranial bones including dentaries, an estimate of the approximate minimum number of each prey species was made. An estimate of the biomass of prey was based on mean weights of mammals (Strahan 1983) and unidentified birds were assigned the mean weight of the Common Starling *(Sturnus vulgaris)*, (Source, Australian Bird and Bat Banding Scheme).

Abundance of prey species

No formal assessment of prey species abundance was conducted but Atlas of Victorian Wildlife, spotlighting data collected during the concurrent Red-tailed Black-Cockatoo study (see above) and general opportunistic observations were used to make approximate estimates of prey abundance.

Nest and roost tree characteristics

Measurements were taken of nest and roost tree diameters at breast height (DBH), tree height, nest or roost entrance aspect and height above ground level, status (living or dead) and quality of canopy cover on a scale of 0 (no canopy) — 5 (full canopy). The distance between each roost tree and the nest was estimated from a 1:25 000 topographical map and land use noted.

RESULTS

Fledglings

The owlets fledged on 23 November 1999, and appeared to roost within the nest tree on an undetermined number of occasions. They were not sighted within the nest tree on 24 October and because our efforts were concentrated on finding an adult roost, the nest site was monitored only a few times thereafter. However, both fledglings were observed emerging from the nest entrance on 26 November and one emerged on 27 November 1999. On a few occasions, the fledglings appeared on a branch of the nest tree after dark, and may have emerged but this was not confirmed.

Home range

A total of 134 owl locations were recorded between 15 December 1999 and 18 January 2000 (Fig. 1). Radio tracking fixes were collected during 17 nights and daytime roosts were located on 28 days between 18 December 1999 and 18 January 2000 when the transmitter became detached

from the feather shaft and was found on the ground with a small piece of feather still tied to the aerial.

The MCP (minimum convex polygon) for all 134 points was 1 310 hectares compared with the 95 per cent HM (harmonic mean distance minimum) and 95 per cent AK (Adaptive Kernal) estimates which were 1322 ha and 1032 ha respectively. To ensure independence (see Goldingay and Kavanagh 1993), all fixes less than 60 minutes apart were omitted and the reduced set of 68 points provided MCP, 95 per cent HM and 95 per cent AK estimates of 1 280 hectares, 935 hectares and 913 hectares respectively. Omission of the nest area and roost site fixes from the home range analysis made little difference with an estimate of 1 125 hectares for the 95 per cent HM based on 94 locations.

The 50 per cent MCP, 50 per cent HM and 50 per cent AK methods estimated a core area of 176 hectares, 61 hectares and 53 hectares respectively, reflecting the strong influence of the owl's regular visits to the nest tree and its surrounds, where her dependent young remained throughout the study. She often visited the young soon after leaving her roost and delivered prey later.

Habitat use

All points shown in 'non-treed areas' were in fact, at a tree except for one where the owl came to ground in a paddock. The owl showed a preference for the mapped dense/medium tree cover habitat with a disproportionate 10 per cent of points falling within 5 per cent of the MCP that the dense/medium tree cover provided. Conversely, 21 per cent of points fell within the 51 per cent formed by sparse/non-treed areas (Table 1).

The owl's foraging activity was focused strongly along the interface between the dense/medium and sparse/non-treed tree cover classes. Sixty-nine per cent of radio fixes fell at or within 100 metres either side of the edge of the dense/medium tree cover habitat. Further analysis showed that the owl spent an almost equal proportion of its time less than 100 metres inside the edge as it did less than 100 metres outside the edge. However, the owl again showed a preference for the dense/medium tree cover by spending 10 per cent of its time in the 5 per cent of the MCP that this class provided (Fig. 2). When detected inside the dense/medium area, the owl was always within 250 metres of the edge.

TABLE 1

Broad tree cover classes within the home range of a post-nesting female Masked Owl *Tyto novaehollandiae* supporting two dependent fledglings at Corndale, Victoria. Proportion of fixes (excluding nest and roosts) within each class (n = 94). Dense/medium, Sparse/non-treed (Note: 'Non-treed' areas contained scattered single live and dead stems). ($X^2 = 39.08$; $pr < 0.001$).

Tree cover class	Coverage (ha) in home range	Proportion of coverage in home range (%)	No. of fixes	Proportion of fixes (%)
Dense/medium	65	5	9	10
Dense/medium <100 metres from edge	211	16	33	35
Sparse/non-treed <100 metres from edge	362	28	32	34
Non-treed	672	51	20	21
Total	1 310	100.0	94	100.0

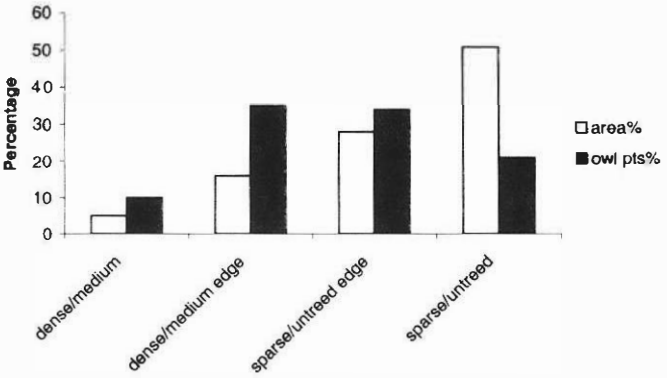

Figure 2. *Radio tracking locations (n = 94) of a post-nesting female Masked Owl* Tyto novachollandiae *supporting two dependent fledglings at Corndale, in relation to the availability of each broad tree cover class within the estimated home range (1 310 ha MCP):Dense/medium; dense/medium <100 from edge; spares/untreed <100 m from edge; sparse/untreed. Data excludes owl locations at daytime roosts and nest tree.*

There were clusters of points in three mapped dense areas (Fig. 1). The greatest was along the edges of a triangular block (6 ha) of stringybark forest 300 metres north of roost No. 2, directly between the roost and the fledglings (in the nest tree area). Although open to grazing, this block was only lightly grazed around the edges. The owl often paused to perch at this edge (<15 minutes) after exiting her roost en route to the fledglings, but on one occasion remained within this area for 90 minutes. Another smaller cluster fell one kilometre east of roost No. 2, in a larger patch of stringybark (~25 ha) that was fenced off to exclude grazing. The owl spent one session of 60 minutes within this patch. The third, more widely-spread cluster fell along the edge of the Drajurk State Forest. On one occasion, the owl perched in this area in a forest edge tree for 85 minutes. (The only distinct drainage line in the study area flowed through this area).

Behaviour

The radio-tagged owl showed a distinct aversion to light and fled on each of the few times it was spotlit, even when the infra-red light was used. The owl tended to remain inside its roost hollow until well after sunset, particularly on bright evenings (Table 2). For example, on 23 December 1999, one night after the full moon had passed its perigee (closest point to the earth (Source: Astrolab for Windows)), night light was extremely bright and our radio tracking fixes showed that the owl was still in its roost tree, apparently in the hollow, at 2356 hours (fixes were taken from >200 metres away to avoid inhibiting the owl's normal egress). Unfortunately, radio tracking was discontinued until 0700 hours (after sunrise) the following morning when the owl was located in the same hollow. The owl may not have left its roost at all due to the brightness of the night light. A positive relationship (Kruskal-Wallis one-way analysis of variance, $H = 7.364$; $p = 0.008$) was found between the ambient light and the delay between sunset and the owl's egress from its roost.

TABLE 2

Variations in the time (Eastern Summer Time) that a female Masked Owl departed from daytime roost in relation to ambient light.

Date	Ambient light index one hour after sunset (0–2)	Sunset time	Time roost vacated	Difference (minutes)
17/12/1999	1	2052	2200	68
19/12/1999	1	2054	2212	78
23/12/1999	2	2056	2356	180
24/12/1999	1	2056	2315	139
27/12/1999	0	2058	2139	41
28/12/1999	0	2058	2145	47
29/12/1999	0	2058	2136	38
5/01/2000	0	2100	2140	40
12/01/2000	1	2059	2150	51
13/01/2000	1	2059	2148	49

Diet

The estimated minimum number of prey individuals from the nest hollow was 277 comprising 214 individuals from the top layer and 63 from the lower layer of pellet material. The introduced European Rabbit (n = 123) and House Mouse *Mus musculus* (n = 75) were predominant with a broad range of native species occurring in small numbers. Traces of an unidentified micro-bat Nyctophilus sp., unidentified rodents and birds were also found (Table 3). Seven pellets from roost No. 2 contained the remains of one European Rabbit in each (Table 3). Thus, the main proportion of biomass from the nest was provided by rabbits (89%) followed by juvenile Common Ringtail Possums *Pseudocheirus peregrinus* (3%). Although the House Mouse provided a relatively high proportion of the total number of individuals, it only provided 1 per cent of the estimated biomass. Unidentified rodents (2%) were the only other prey to provide more than 1 per cent.

TABLE 3

Estimated minimum number of individuals identified from two layers of regurgitated pellet material collected from a Masked Owl *Tyto novaehollandiae* nest hollow and from a separate roost tree at Corndale, Victoria, January 2000. (Note: Lower layer could contain prey from a different species e.g. Barn Owl *T. alba*). * Introduced species.

Species	Nest top layer	Nest lower layer	Roost 2
Common Dunnart *Sminthopsis murina murina*	1	0	0
Sminthopsis sp.	1	1	0
Yellow-footed Antechinus *Antechinus flavipes*	0	3	0
Agile Antechinus *Antechinus agilis*	1	0	0
Antechinus sp.	9	1	0
Southern Brown Bandicoot *Isoodon obesulus*	1	0	0
Isoodon sp.	1	0	0
Common Ringtail Possum *Pseudocheirus peregrinus* (juvenile)	5	2	0
Sugar Glider *Petaurus breviceps*	5	2	0
Unidentified micro bat	2	0	0
Heath Rat *Pseudomys shortridgei*	10	0	0
Pseudomys sp.	0	2	0
Bush Rat *Rattus fuscipes*	2	2	0
Swamp Rat *Rattus lutreolus*	1	0	0
Unidentified Rat	2	0	0
House Mouse *Mus musculus**	52	23	0
Unidentified rodent (probable *Rattus* or *Pseudomys*)	17	7	0
European Rabbit *Oryctolagus cuniculus**	103	0	7
European Rabbit *Oryctolagus cuniculus* (juvenile)*	0	20	0
Unidentified bird	1	0	0
Total individuals	214	63	7

The European Rabbit was by far the most abundant prey item in the area (Table 4). High numbers were observed along the road near the drainage line near the north-east boundary of Drajurk State Forest (Fig. 1) where the owl was often tracked and to a lesser degree, along most roadsides. Large numbers of microbats were observed flying near roost 2 when night vision goggles were used. Several of the small native prey species had not previously been recorded in the immediate vicinity. They were Common Dunnart *Sminthopsis murina*, Yellow-footed Antechinus *Antechinus flavipes*, Agile Antechinus *A. agilis*, Heath Rat *Pseudomys shortridgei*, Bush Rat *Rattus fuscipes* and Swamp Rat *R. lutreolus*. These species have all been recorded in the wider region (Atlas of Victorian Wildlife) but were not detected during recent fauna surveys in the Drajurk or other nearby state forests (ARI unpubl. data).

TABLE 4

Potential prey species recorded in the 5° block centred on the Masked Owl *Tyto novaehollandiae* nest site at Corndale, Victoria since 1995 (source Atlas of Victorian Wildlife) and assessment of their abundance during this study. (Source B. Jarmin and pers. obs.).* Introduced species.

Species	Status during this study
Southern Brown Bandicoot *Isoodon obesulus*	Not observed
Common Ringtail Possum *Pseudocheirus peregrinus*	Common
Sugar Glider *Petaurus breviceps*	Uncommon
Common Brushtail Possum *Trichosurus vulpecula*	Common
European Rabbit *Oryctolagus cuniculus**	Abundant
European Hare *Lepus capensis**	Uncommon
White-striped Freetail Bat *Tadarida australis*	Unknown, unidentified bats common

Terrestrial species provided the majority (89%) of prey captures with arboreal (5%), scansorial (5%) and flying species (1%) providing only minor proportions of the captures (Table 5).

Nest and roost sites

On 15 December 1999, the adult female was flushed during television inspection of hollows, from its roost (roost 1, Figs 1 and 5) in a dead River Red Gum standing amongst pasture, 300 metres north-west of the nest tree. It flew 100 metres and landed in a living Red Gum and did not return to the same roost until the morning of 17 December 1999 where she was detected at 0730 hours.

TABLE 5

Prey of a Masked Owl *Tyto novaehollandiae* at Corndale and proportion of catches per foraging strata.

Foraging strata	No. of species	No. of individuals	%
Aerial	2	3	1
Scansorial	2	10	5
Arboreal	2	10	5
Terrestrial	11	191	89

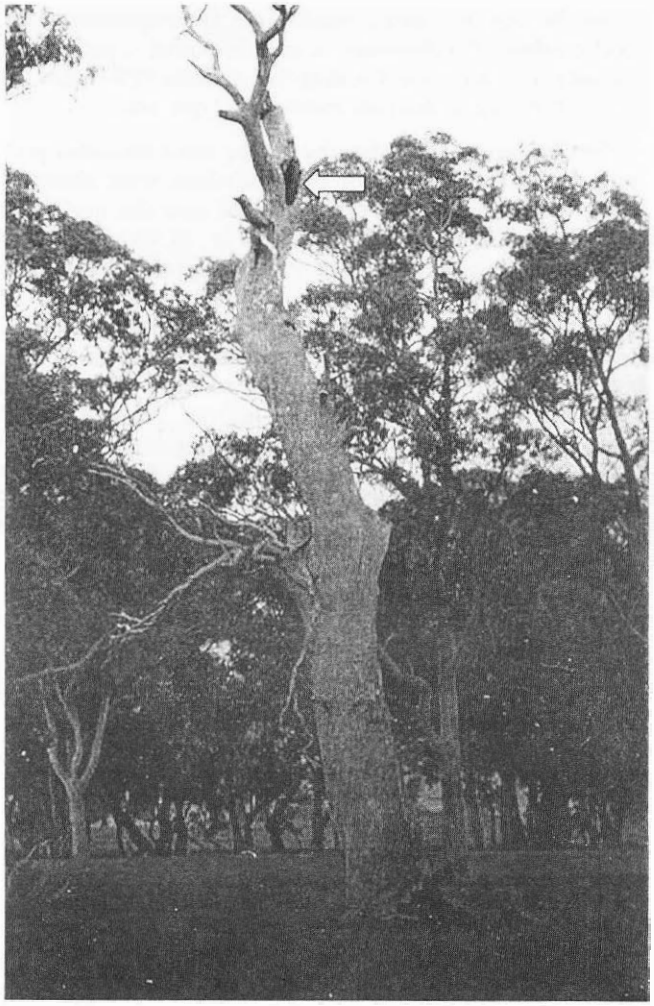

Figure 3. *Masked Owl* Tyto novaehollandiae *nest tree at Corndale, 1999. Arrow indicates nest hollow entrance.*

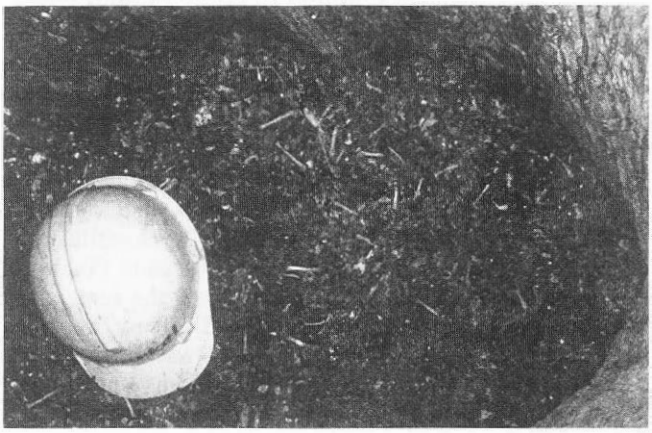

Figure 4. *Masked Owl* Tyto novaehollandiae *nest chamber (with climber's helmet for scale). Corndale 1999–2000*

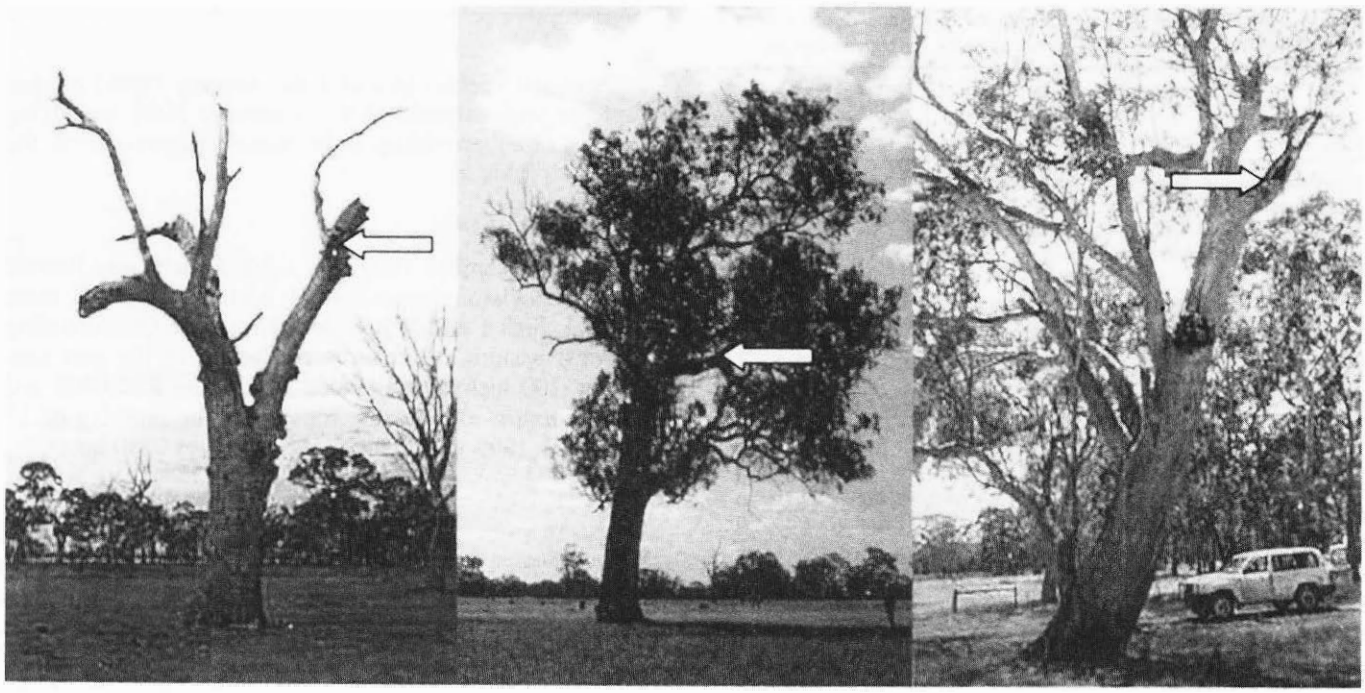

Figure 5. *Masked Owl* Tyto novaehollandiae *roosts, Corndale 1999–2000. From left to right: Roost 1 (site where female was captured); Roost 2; Roost 3. Arrows indicate hollow entrance.*

The nest tree (Figs 1 and 3; Table 6) was a large, dead eucalypt (assumed to have been a River Red Gum), standing 50 metres from a patch of living River Red Gums on the edge of cleared pasture paddocks. The nest entrance was situated 14 metres above ground level and faced west. The roughly cylindrical nest chamber was approximately 1 metre deep and 90 centimetres wide and the layer of pellet material formed a flat floor (Fig. 4).

Roost No. 1 (Figs 1 and 5; Table 6) was also a dead eucalypt (assumed to be a River Red Gum) standing in pasture, 50 metres from a farm dam. This tree was extensively decayed and unstable, therefore unsafe to climb so no hollow measurements were taken although television inspection showed the hollow to be at least 100 centimetres deep and 30 centimetres wide. The roost hollow had three entrances located near the top of a primary branch. The owl was not visible in the hollow when it was scanned with the television camera, but was heard scrambling up to the entrance where she sat looking out shortly after the camera was removed. The owl used only the west-facing aperture on the two occasions it was observed at this roost and it was not recorded using this roost again after being captured nearby.

Roost No. 2 (Figs 1 and 5; Table 6) was one of six living River Red Gums scattered through a 32 hectare cleared pasture paddock. The owl was recorded roosting in this hollow (Fig. 6) for 24 days – the most frequently used roost in the study period. There were also five dead trees scattered through the paddock. All of these trees were hollow-bearing and large (>100 cm diameter at breast height).

Roost No. 3 (Figs 1 and 5; Table 6) was a living River Red Gum standing in a roadside reserve 2.9 kilometres north of the nest site. This site was used only once by the owl during the study. As reported above, we visited the tree with a view to climb it but found it had become infested with feral Honey Bees. Climbing was therefore postponed for several months but the period of bee occupancy was not determined. No pellets were found.

DISCUSSION

The results of this study generally concur with those of the only previous radio tracking study of *Tyto novaehollandiae novaehollandiae* by Kavanagh and Murray (1996). The estimated home range size for both studies is similar, and both comprised a mosaic of disturbed and undisturbed habitats, interspersed with large open areas.

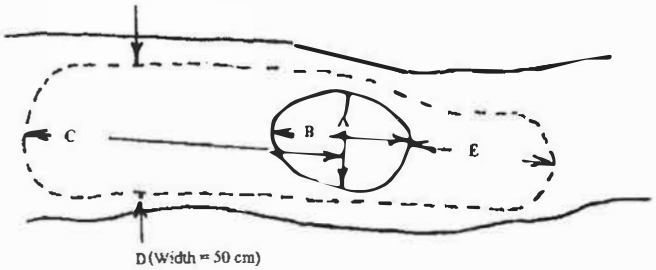

Figure 6. *Dimensions (cm) of Masked Owl* Tyto novaehollandiae *roost hollow in horizontal branch in roost tree No. 2 A = 27; B = 28; C = 145; D = 35; E = >50.*

The main difference was that a major proportion of the Newcastle owl's home range comprised residential areas, the study was over three months and that owl was apparently not breeding at the time (although a possible breeding area was identified). However, our study comprised 17 nights of radio tracking and this is comparable with the 18 nights of the previous study.

The spread of the radio tracking fixes in the Corndale home range shows clearly that this Masked Owl favoured habitats on the forest/farmland edge. This could be because:

(1) The Masked Owl is an intrinsic 'edge forager' and has traditionally foraged along the interface between forest and sparse woodland. This notion is supported by earlier dietary studies by Kavanagh and Murray (1996) and Kavanagh and McCray (2000), and by recent survey work in Tasmania and Western Australia (Bell and Mooney 2002; Liddelow *et al.* 2002).

(2) The favoured prey species (currently the European Rabbit) is most abundant in edge habitats.

(3) Favoured forest habitats have been fragmented and hence predominantly occur close to forest farmland edges. If this is the case, the so-called 'edge' foraging theory may be an aberration brought about by the gross habitat modification across its range.

The above interpretations do not explain why this Masked Owl (or others studied elsewhere) chose to roost and nest in farmland rather than within the forest. This could be due to the distribution of suitable large old trees, which in this case were mainly River Red Gums. River Red Gums tend to grow in open woodland that is easy to clear and has been favoured for agricultural use. Several forest birds and bats use hollows in these old trees in farmland for roosting and nesting, and feed mainly within nearby

TABLE 6

Female Masked Owl *Tyto novaehollandiae* at Corndale. Nest and roost site parameters.

Roost No.	Nest	1	2	3
Eucalyptus species	probable *camaldulensis*	probable *camaldulensis*	*camaldulensis*	*camaldulensis*
DBH (cm)	184	164	185	148
Distance from nest (m)	—	300	1 375	2 900
Living or Dead	D	D	L	L
Land use	Pasture	Pasture	Pasture	Roadside reserve
Tree height (m)	18	c14	31	29
Entrance height (m)	14	10	13	12
Entrance aspect	W	W	E	SW
Canopy cover (0–5)	0	0	1	2

forests (Saunders 1979; Bennett *et al.* 1994; Lumsden *et al.* 1994), including the Red-tailed Black-Cockatoo which indirectly led the authors to this site.

The Masked Owl occurs in a diverse range of habitat types in Victoria, ranging from the highly modified forest/farmland mosaics described in this paper to relatively unmodified, contiguous forests (Higgins 1999). For this reason, we should not assume that the owls occupy similar home ranges across all habitat types. This paper gives one example of home range size at one time of the year, but further radio tracking studies are needed to investigate the home range size in contiguous forest.

The Masked Owl is now well-known to prey heavily on small terrestrial mammals and to a small extent, arboreal species such as possums and gliders (e.g. Schodde and Mason 1980, Beardsell 1991, Hollands 1991, Debus 1993, Kavanagh 1996, Kavanagh and Murray 1996; Higgins 1999). However, this study, and that of Kavanagh and Murray (1996), demonstrates that the species is versatile and opportunistic enough to respond to some of the changes in prey brought about by European colonisation. The diet of the Corndale Masked Owls comprised a broad range of native species, but nevertheless showed a strong reliance on the introduced rabbit as the major source of biomass. Pest species such as European Rabbit and Black Rat can obviously supply a major component of the owls' prey at some sites, but because eradication programs often seriously deplete these species, it may be important to consider the possible unintended negative impact on native predators such as the Masked Owl.

We assume that the top layer of pellets collected at the nest were from the same species or possibly, the smaller male. It is recognized that another species such as the Barn Owl *Tyto alba* may have used the same hollow previously, but there are few records of Barn Owls eating rabbits (P. Peake, pers. comm; Higgins 1999). Nevertheless, the data from the lower layer are included here because there was no distinct variation between the two layers. It is likely that rabbit numbers were high at the time of our study due to spring breeding. For example, Hill (1955) reported an increased role of rabbit in the diet of Masked Owls in Tasmania during spring. Further study of the diet at Corndale when rabbits are less abundant, may reveal an increase in the proportion of native prey.

The time lag between sunset and the owl's egress from its roost on brightly moonlit nights observed in the present study has not been recorded previously (e.g. Kavanagh and Murray 1996). The owl's apparent aversion to light may help explain its notoriously cryptic reputation and suggests that future research should be focused on dark nights and avoid use of artificial light.

A recent strategy adopted by the Victorian Department of Natural Resources and Environment is aimed at conserving core habitat in public forests. This strategy includes delineation of special protection zones (SPZ) of 500 hectares of suitable habitat around Masked Owl detection sites where logging and other disturbance is excluded (Loyn *et al.* 2002; McIntyre and Henry 2002; DNRE in prep). These SPZs are to be reviewed, as aspects of the habitat needs and breeding biology of the Masked Owl become better known.

The extensive large-scale conversion of the Corndale study area from pasture to plantations may have a major impact on the Masked Owl. Although large living or dead hollow trees are protected by an Environmental Significance Overlay because of their potential as nest sites for Red-tailed Black-Cockatoos (R. Hill, pers. comm.), it is not known whether the owls will utilize them when they have become surrounded by dense stands of plantation trees. The effects of plantations on an 'edge-forager' need to be investigated.

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