

THE VERTEBRATE FAUNA OF NORTHERN YENGO NATIONAL PARK

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Central Branch Parks and Wildlife Division
Biodiversity Survey Priorities Program

Information and Assessment Section
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Cover Photos

Front cover
Feature Photo (Helen Achurch)
Mormopterus sp. 3 (short penis form) (Narawan Williams)
Spotted Gum (Elizabeth Magarey)
Nobbi Lashtail (Narawan Williams)
Grey Gum (Daniel Connolly)
Squirrel Glider (Narawan Williams)

Back cover
Red-crowned Toadlet (Dave Hunter)
Woodland in Yengo National Park (Narawan Williams)
Tawny Frogmouth (Narawan Williams)
Escarpment Slopes Woodland in North-east Wollemi National Park (Elizabeth Magarey)

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OVERVIEW

Northern Yengo National Park comprises 46 000 hectares of a prominent dissected sandstone plateau on the southern escarpment of the Hunter Valley. It lies at the convergence of a number of environmental and climatic influences from the north, west and east and as a result the reserve supports a highly diverse assemblage of fauna. There are at least 256 native terrestrial vertebrate fauna species known to use the reserve, of which 28 are listed as either vulnerable or endangered on the NSW Threatened Species Conservation Act (1995). There are ten species of introduced fauna recorded including the Fox and Wild Dog. The faunal diversity is typical of large sandstone reserves in the Sydney Basin, and northern Yengo NP supports the fifth highest number of fauna species in the Central Branch Parks and Wildlife Division.

This report compiles and reviews background information on the fauna of northern Yengo NP. This has been supplemented by extensive new data generated by surveys conducted during the spring-summer period in 2004-5, in order to provide a more accurate inventory of fauna across the range of habitats present. A total of 161 systematic sites were established to sample birds, frogs, bats, reptiles and arboreal mammals in the reserve. Terrestrial mammals have been sampled opportunistically, while fish have not been included in this study. These data can be further used for analysing habitat use, faunal assemblages, impact assessments and abundance estimates for species of interest.

Our findings confirm that northern Yengo National Park is characterised by the suite of birds, reptiles, frogs and mammals typical of hinterland sandstone environments of the Sydney Basin. A number of species that are endemic to the Sydney sandstone environments are present in the reserve, including the Rockwarbler, Large-eared Pied Bat, Southern Leaf-tailed Gecko and Red-crowned Toadlet. Northern Yengo National Park is surrounded by the open Hunter Valley to the north, the Wollombi Valley to the east and Howes Valley to the west. These areas are fertile, dry rainshadow valleys that prior to clearing supported a complex of grassy woodlands. These woodlands provided habitat for a range of fauna species typical of the central western slopes and plains. Due to extensive clearing over the last 200 years many of these species are now recognised as either endangered or vulnerable under state threatened species legislation. With their preferred habitat much reduced in area, these species are largely restricted to small remnants of dry woodland. This pattern is apparent in northern Yengo National Park with a number of bird species in particular occupying dry grassy woodland remnants and dry ironbark forests on the margins of the reserve, including the Black-chinned Honeyeater, Grey-crowned Babbler, Diamond Firetail, Speckled Warbler, Turquoise Parrot, Brown Treecreeper and Regent Honeyeater. Other species that occupy these habitats include the Squirrel Glider and Barking Owl.

Surveys revealed that northern Yengo National Park supports significant populations of several threatened species including the Glossy Black-cockatoo, Large-eared Pied Bat, Brush-tailed Rock-wallaby, Koala, Eastern Cave Bat and Yellow-bellied Glider. In contrast, other threatened species were recorded more sporadically and are likely to have a patchy distribution or be in low numbers, including the Rosenberg's Goanna, Squirrel Glider, Powerful Owl, Sooty Owl and Greater Broad-nosed Bat. Numbers of the threatened amphibians, the Red-crowned Toadlet and Giant Burrowing Frog, are likely to have been underestimated in the reserve due to the drought of the last few years. The Eastern Pygmy-possum and Spotted-tailed Quoll remain poorly understood in the reserve, as intensive ground mammal surveys have not been implemented.

At present the largest threats to species viability within the park are likely to emerge from the impact of fire and from feral predation and competition. Managing impacts of fire on fauna requires an understanding of the distribution and intensity of fires as well as the delineation of significant fauna habitats. Currently, these information layers are not available for the reserve. We recommend that fire intensity mapping be carried out after future fire events. Furthermore, vegetation community mapping currently available for northern Yengo National Park is too coarse to delineate many important habitat features. It is therefore recommended that a detailed vegetation mapping program be implemented for the reserve and adjoining lands so that fire sensitive fauna habitats can be more successfully identified and monitored. Wild Dogs, Foxes and Cats present a significant threat through predation and competition for resources. Initiatives that prevent the expansion of these predators are warranted, together with research into the effects of predator control. Control should be focussed on sites identified as being of high conservation significance. The Threat Abatement Plan for the Fox currently includes Brush-tailed Rock-wallaby sites, to help gain a better understanding of the impact of Fox control.

The report concludes that the reservation status of several threatened species could be improved by directly targeting specific habitats for future acquisitions and voluntary conservation agreements. Proposed additions that include confirmed records and habitat for the suite of Declining Woodland Birds, Squirrel Gliders, Masked and Barking Owl and Brush-tail Rock-wallaby should be given high priority.

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1 INTRODUCTION

1.1 PROJECT AIMS

The Central Branch Parks and Wildlife Division (PWD) of the NSW Department of Environment and Conservation (DEC, formerly NSW National Parks and Wildlife Service (NPWS)) has established a biodiversity survey priorities (BSP) program for DEC managed estate within the Branch. This program recognises that information that documents the range of biodiversity values held within reserves is fundamental to successful reserve management and to generating an improved understanding of the contribution reserves make to the protection of vegetation communities, plant and animal populations and their habitats. Currently there is only sparse and incomplete information that describes the role reserves play in ensuring the viability of fauna species across large regions and local areas.

Typically the largest reserves, which potentially offer a significant contribution to biodiversity conservation, are the most poorly understood and the most deficient in data quality and quantity. The BSP program goes some way towards addressing this information shortfall by addressing the most poorly known reserves first and combining this work with larger regional conservation assessment projects.

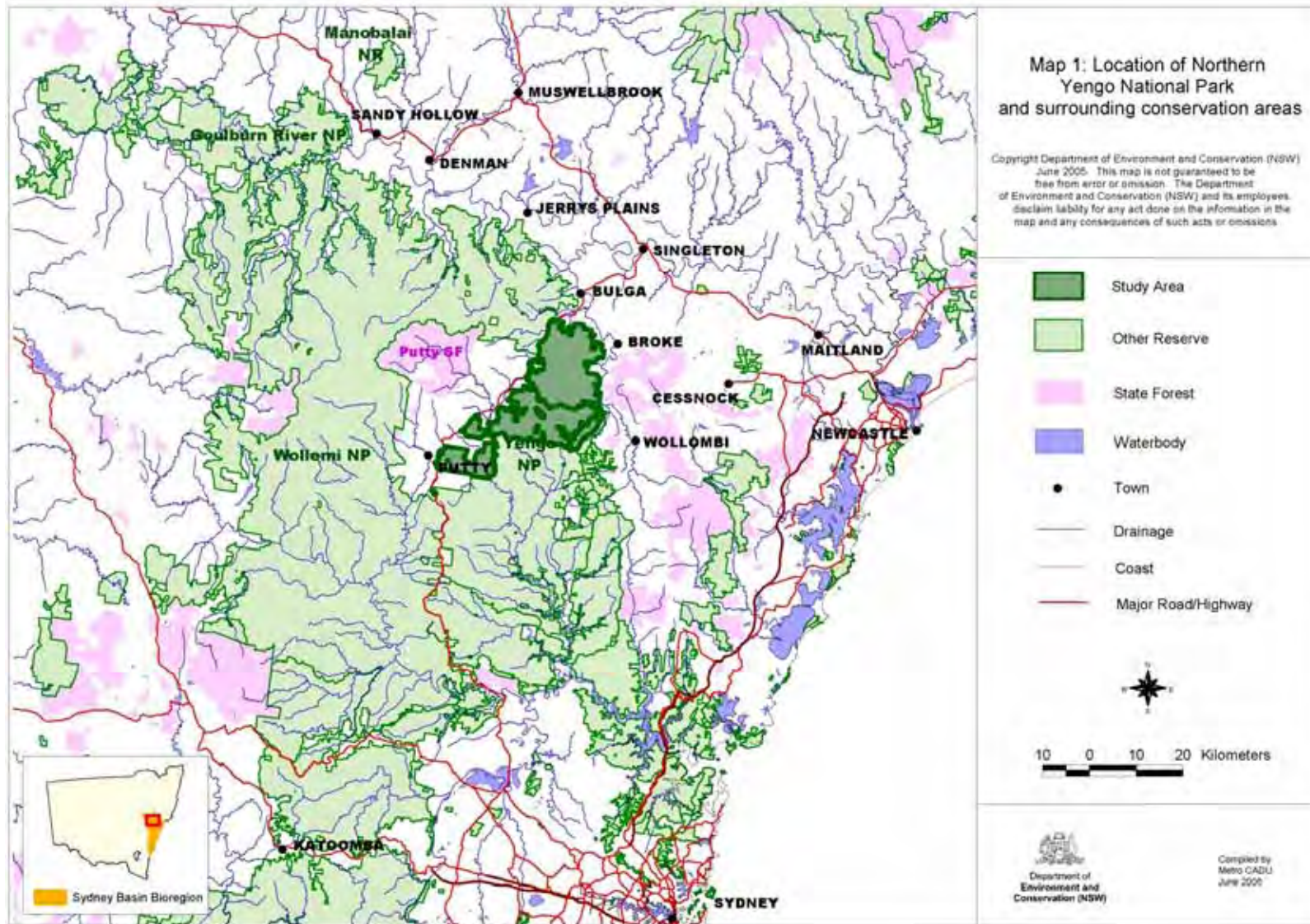
Currently the Hunter region is the focus of considerable biodiversity assessment and environmental planning investigation. In terms of human population it represents one of the fastest growing regions in the state and extreme pressures are being placed on many of the habitats of the Central Coast and Lower Hunter as a result of urban expansion. Knowledge of the values of the large sandstone reserves that fringe the southern Hunter Valley is fundamental to understanding the conservation priorities for many species in the region. The Hunter Range Area of Yengo National Park (NP) is characterised by low levels of information on its fauna values (NPWS 2003b). Consequently, the northern portion of this large reserve was identified as a survey priority. The specific objectives of this project are to:

1. Document, review and collate existing terrestrial vertebrate fauna data.
2. Carry out systematic field sampling of all terrestrial vertebrate fauna groups to establish baseline data for future conservation assessment and monitoring works.
3. Identify and profile threatened fauna species and other regionally significant fauna that are known or likely to occur.
4. Identify broad-scale patterns in fauna occurrence and habitat use across the study area and identify habitats of particular conservation significance.

1.2 BACKGROUND

Northern Yengo NP is located within the catchment of the Hunter River approximately 21 kilometres south-west of Singleton and 100 kilometres north-west of Sydney (Map 1). Yengo National Park was dedicated in 1989 and covers an area of approximately 165 500 hectares (NPWS 2001a). This project focuses on the northern third of the park, which lies within the DEC Hunter Range Area (the study area, Map 1). The study area, covering 46 711 hectares, is bound by the Putty Road and Darkey Creek in the west and private lands adjoining Wollombi Brook to the north and east (Map 2). The catchments of Bulga Creek, Drews Creek and Werong Creek all start within this section of the Park and flow east into Wollombi Brook which then flows northwards to join the Hunter River (Map 2). The steep sandstone escarpment marks the northern boundary and makes a striking contrast to the surrounding cleared farmlands of the Hunter Valley floor. Wollemi National Park and private land in Howes Valley abut the study area on its western side and the greater part of Yengo National Park joins to the south (Map 1). A later addition of 502 hectares on the western side of the study area, known as "The Little Darkey Addition" was gazetted as part of the Park in October 2001.

Yengo NP forms part of The Greater Blue Mountains World Heritage Area inscribed by the International Union of Conservation of Nature and Natural Resources in 2000. Yengo NP, Parr State Conservation Area and other nearby areas of crown, lease and freehold land were nominated as a wilderness area under the Wilderness Act, 1987. An assessment carried out under the Act identified an area of 105 400 hectares as meeting wilderness criteria (NPWS 2001b). However, no declaration has yet been made.



Map 1: Location of northern Yengo National Park and surrounding conservation areas

1.3 HISTORY OF LAND USE

There is a long history of Aboriginal habitation in the region and within the area now defined as Yengo NP (NPWS 2001a). The MacDonal River area including Wollombi and Putty formed a part of the territory of the Darkinjung people and the northern section of the park comprised some of the territory of the Wonnarua people (Sim 1966). The “Kamilroi tribe”, one of the groups belonging to the Darkinjung people, inhabited the Wollombi area in their hundreds in 1800 but were largely gone by the 1830s. Disease, dispossession and migration are thought to be the reasons for decline (Slater undated).

The Hawkesbury Sandstone plateau of the region is rich in Aboriginal sites, a number of which are conserved within the reserve. Mount Yengo, which is located just south of the study area, is of particular significance to Aboriginal people. It is a sacred site of ethnographic and cultural significance and it is believed Aboriginal sites in the surrounding region are connected to it in some way (NPWS 2001a). The location of the sites and the information they contain offers valuable clues to past land use. However, the remote and rugged nature of the area means that many parts of the study area have not yet been documented.

Remnants of early European settlement are also evident in the region. Early transport routes between Sydney and the Hunter Valley run through the area, most notably Putty Road on the western side (a section of which included the Old Bulga Road) and the Great North Road on the East (Map 2). Cattle were driven along these early routes between the Hawkesbury and Hunter Valley. Settlers Road, sometimes referred to as the Convicts Road, cuts across the study area from east to west (Map 2). Built in the late 1800s, this road was constructed to provide a transport route between Howes Valley and the Wollombi district (NPWS 2001a).

The limited amount of standing water and the rugged nature of the region restricted European settlement and agricultural landuses. The fertile valleys to the north and east of the reserve were cleared and settled early and the less fertile country in between was subjected to free-range grazing of Cattle and frequent burning to induce green feed (Sanders *et al.* 1988). Early settlers lodged applications for land title in some of the smaller valleys in the area, and these constitute the freehold blocks within the park today (NPWS 2001a). Elsewhere the area remained as vacant crown land. Early timber operations also started up in the area supplying Sydney Blue Gum (*Eucalyptus saligna*), Narrow-leaved Ironbark (*E. crebra*) and Turpentine (*Syncarpia glomulifera*) for general use as fencing and building materials. The army constructed a system of fire trails soon after World War Two. This facilitated increased access for timber-getting and other landuses. Logging activities continued in the area until the park's gazettal in 1989.

1.4 ENVIRONMENT

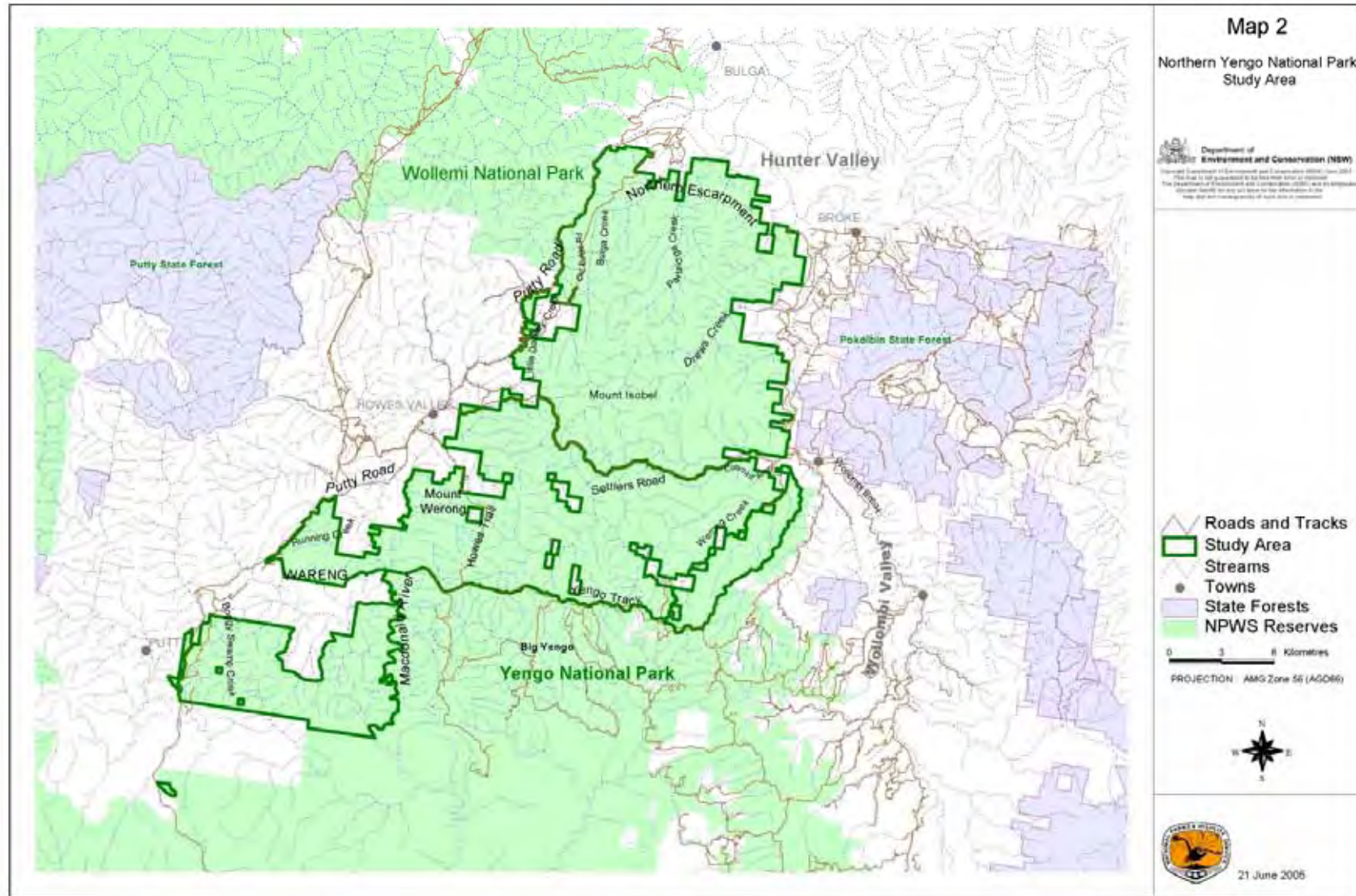
1.4.1 Biogeography

Northern Yengo National Park lies within the Sydney Basin Bioregion just below the northern boundary (Thackway and Cresswell 1995). This bioregion extends from just north of Batemans Bay to Nelson Bay near Newcastle, and west toward Mudgee (Map 1). It is characterised by a temperate climate with warm summers and no dry season. Approximately 40 percent of the Bioregion is reserved for conservation, largely as National Parks and Nature Reserves (NPWS 2003b).

1.4.2 Geology and geomorphology

Yengo National Park forms part of a series of sandstone plateaux that connect the coastal hinterland with the Blue Mountains. It encompasses part of the Hornsby Plateau, a large sandstone landscape that supports sequences of incised gullies and ridges. The sandstone formed during the Tertiary period, with the Narrabeen series slightly older and the Hawkesbury series the younger of these depositional periods (NPWS 2001a). Both form siliceous soils of very low fertility. The Narrabeen series is mostly exposed in the lower gullies and incised gorges. Networks of rugged rolling hills, sandstone benches and narrow gullies are common across the study area.

Weathering or tilting has exposed small bands of fertile shale rock within the sandstone strata. Other soils of higher fertility are associated with volcanic activity during the Tertiary Period. Basalt extrusions and diatremes are restricted to the peaks of Mount Yengo and Mount Wareng and as plugs at the base of a few open gullies and valleys.



Map 2: Northern Yengo National Park Study Area

The northern perimeter of Yengo NP forms a dramatic escarpment that marks the descent into the low-lying Hunter Valley. Soils derived from the older Permian Age are exposed at low elevations beneath the sandstones on mid to lower slopes of the escarpment. Layers of finer sedimentary material, including mudstone, siltstone and conglomerate, are present and erode to form a soil of higher fertility than the surrounding sandstone. These Permian substrates are the dominant feature of the Hunter Valley Floor.

Sandy alluvium is associated with the larger creek systems. These are indicative of the active erosion of the sandstone plateau.

1.4.3 Elevation

The elevation of the study area primarily falls between 150 and 400 metres above sea level, with the lowest areas found on the northern and eastern perimeter of the reserve, particularly along the deeper gorges such as Drews Creek. Mount Murwin and Mount Wareng are the highest points of northern Yengo NP and lie at over 550 metres.

1.4.4 Climate

The climate of Yengo NP is typical of the Sydney Basin hinterlands at moderate to low elevations. There is however some variation in rainfall patterns given the size of the study area. Rainshadow effects are prominent in the north eastern and northern escarpment where mean annual rainfall is at its driest, receiving just 650 millimetres per year at Broke. In the centre of Yengo NP at Big Yango Station rainfall reaches 826 millimetres per year before falling again in the Howes Valley to 737 millimetres. Temperatures are hottest on the escarpment and footslopes that fall into the Hunter Valley, while south-eastern areas are tempered by a coastal influence. Mean annual temperatures do not vary greatly with the highest elevations experiencing mean annual temperatures of around 14 degrees to above 17 degrees in lower valleys and plains (Bureau of Meteorology 2001).

1.5 VEGETATION

Northern Yengo National Park spans a large dry sandstone plateau that is covered in eucalypt forests and woodlands. This sclerophyllous vegetation is dominant and extensive across the sandstone, with only small areas of tall moist eucalypt forest and rainforest present in narrow protected gullies and gorges. The floristic composition of the vegetation varies primarily with aspect, although climate and soil fertility appear to exert influence along the northern escarpment. Northern Yengo National Park spans two botanical divisions, the North Coast and the Central Coast. The following discussion is sourced from Bell *et al.* (1993) and Sanders *et al.* (1988).

The northern escarpment is characterised by very dry open woodlands on steep exposed slopes (Plate 1). The vegetation that grows in these environments is comparable to the dry open woodlands found on the northern Wollemi NP escarpment and dry woodlands of Goulburn River NP and Manobalai Nature Reserve. The soils on these steep slopes are a combination of Permian sediments with colluvial movement of sandstone material falling from the retreating sandstone cliffs. The vegetation forms open woodland with Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*E. molucanna*) and Grey Gum (*E. punctata*) the dominant eucalypts. Black Cypress Pine (*Callitris endlicheri*) occurs sporadically amongst the small tree layer. The understorey is generally shrubby with a sparse grassy ground cover. Sheltered gullies support taller forest with a similar canopy composition, however, moisture loving herbs such as Kidney Weed (*Dichondra repens*) and Slender Tick-trefoil (*Desmodium varians*) are abundant. Forest Oak (*Allocasuarina torulosa*) and Kurrajong (*Brachycton populeneus*) may be locally common amongst the small tree layer.

The geology of the northern plateau is characterised by the Triassic sandstones from the Narrabeen Group. Soils



Plate 1: Northern Escarpment woodland on slope east of Partridge Creek © DEC

derived from this sandstone are marginally more fertile than those from the Hawkesbury Series. They support a combination of dry shrubby eucalypt forests and woodlands. Low growing Grey Gums and Narrow-leaved Stringybark (*Eucalyptus sparsifolia*), Smooth-barked Apple (*Angophora costata*) and less frequently Yellow Bloodwood (*Corymbia eximia*) form the dominant canopy species. A dense shrub layer is sometimes present though more often the cover is sparse given the frequency of fire in these environments. This community forms a mosaic with taller forests and woodlands that feature Ironbark species (*Eucalyptus fibrosa*, *E. crebra*, *E. beyeriana*, *E. fergusonii*). Many of the floristic characteristics of the understorey are shared between these two communities. This vegetation is also common in far north-eastern Wollemi National Park and Pokolbin State Forest. Residual shale caps are scattered through the northern half of the reserve on top of the Narrabeen Sandstones, forming patches of higher fertility soils. These areas, prevalent along Old Bulga Road, support grassy Box woodlands and are more extensive than currently indicated in the vegetation map for the reserve.



Plate 2: Exposed Hawkesbury Woodland along Settlers Road © DEC

Further south toward the Settlers Road, Hawkesbury sandstone is the prominent bedrock - a geological formation found throughout the Sydney Basin. The vegetation supported by this sandstone conforms to other coastal hinterland sandstone environments found in the region (Plate 2). Rocky crests and slopes support an open to very open cover of Yellow and/or Red Bloodwood (*Corymbia gummifera*) and Narrow-leaved Apple (*Angophora bakeri*). Typical sandstone heath and shrub species are abundant including tea trees (*Leptospermum* spp.), Geebung (*Persoonia* spp.) and Wattles (*Acacia* spp.). On sheltered slopes a taller forest develops and the canopy species comprise Smooth-barked Apple, Sydney Peppermint (*Eucalyptus piperata*) and Turpentine. The small tree layer may feature tall Forest Oak and some mesic species such as Christmas Bush (*Ceratopetalum gummiferum*) though mostly the shrub layer is

xeromorphic. Small vines and twiners gain prominence on the lower slopes near the gully bottoms. These two vegetation communities are the most extensive, covering large areas of the central and southern reserve.

Tall eucalypt forest with a mesic understorey or rainforest communities are restricted to very protected gullies or on sites of higher soil fertility. Tall forests generally comprise Blue Gums (*Eucalyptus saligna/ E. deanii*) and Turpentine, sometimes with Rough-barked Apple (*Angophora floribunda*). A sparse to dense mid layer of Grey Myrtle (*Backhousia myrtifolia*) is often present. The ground cover invariably has a good cover of ferns and scrambling vines. In the most protected locations, a mesophyllic canopy of Grey Myrtle replaces eucalypt forest. The gullies of the northern plateau have a number of pioneering dry rainforest species included amongst the mesic shrub layer. Species such as Red Ash (*Alphitonia excelsa*), Port Jackson Fig (*Ficus rubiginosa*) and Brittlewood (*Claoxylon australe*) are examples. Some broad floristic similarities are found between these forests and those of the sheltered slopes of the Hunter Valley floor and Barrington foothills.

Small areas of forest persist on fertile alluvial soils although extensive clearing of this community has occurred throughout the Howes Valley. The forest includes Rough-barked Apple, Forest Red Gum (*Eucalyptus tereticornis*) and Narrow-leaved Ironbark. The forest is generally open, though dense clusters of regenerating Wattles are often present. A good cover of grasses and herbs is common on the deep soil. The vegetation here is likely to provide insights as to the habitat present prior to clearing along the alluvial flats of the Putty, Wollombi and Central Hunter Valleys.



Plate 3: Woodland on Perched Sands in Wareng © DEC

Small areas of woodland growing on perched sands are present along the Putty Road, some distance from their primary location at the Mellong Swamps (Plate 3). These sand

swamps are flat swales and depressions that feature a deep cover of tertiary sand material. The soil is very infertile, resulting in a very open woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*) and Parramatta Red Gum (*E. parramattensis* subsp. *parramattensis*) above a heathy understorey typical of sandstone ridges including tall Old Man Banksias (*Banksia serrata*), Tea Trees and Geebungs.

Downslope movement of fertile basalt soil has enriched small areas of sandstone at a small number of sites. These basalt soils are associated with remnant cappings found on some of the higher peaks. Grey Box and Grey Gum are the distinctive canopy species, sometimes in combination with Narrow-leaved Stringybark and Forest Red Gum. Shrubs and herbs common to richer soils are present, as is a good cover of grass on the forest floor. These forests, though small in area, are significant as they are floristically aligned to communities that were once extensive across the Hunter Valley.

1.6 FIRE

Little is known about traditional Aboriginal and early European burning practices in northern Yengo NP, but there is no doubt that humans have influenced fire regimes and the resulting vegetation composition for thousands of years. Traditional Aboriginal burning practices would have ceased in the mid-1800s when the impact of European settlement devastated the local Aboriginal population (NPWS 2001a).

Much of the reserve has been burnt at least once since 1993-94 and fire has burnt areas between two and five times since the keeping of records in the late 1950's. This indicates that fire is an integral component of the ecosystem although the frequency and intensity of fire may have been altered by modern human occupation. In more recent times high intensity wildfires have burnt through large sections of the study area. These fires generally occur between late spring and the end of summer when high temperatures and dry north-westerly winds create conditions that aid the rapid spread of fire.

Two major wildfires have burnt the area since 2001. In the summer of 2001/02 a fire that affected a large area of Wollemi NP to the west jumped the Putty Road and continued across the northern section of Yengo NP. The top third of the study area from west to east, some sections to the north and south of Howes Valley/Yengo Trail and the section of park around Running Creek in the south-west were burnt during this fire. The vegetation cover still displays impacts from the fire intensity. A later wildfire in the summer of 2002/03 burnt through much of the area in the south-west of the study area around Boggy Swamp Creek and east to the MacDonald River. This was also an intense fire with a high degree of canopy burn and complete consumption of the understorey. These wildfires started in the west of the park and ran unhindered to the east where back burning prevented them from continuing onto private properties. The most intensely burnt areas occur on the north and west facing slopes and ridges. Gullies on the eastern side of the study area appear to have been spared from the worst impacts of the fire.

A small hazard reduction fire was put through the very north-west of the park between Old Bulga Road and Putty Road in the 2001/02 season. There are few areas that are long unburnt in this part of the reserve. The largest section that has not burnt for fifteen years lies to the north-west of Settlers Trail.

2 METHODS

2.1 EXISTING FAUNA DATA

Yengo National Park has a fragmented history of data collection programs that have been undertaken to assist in identifying the fauna values of the reserve. Since the establishment of the reserve in 1989 fauna surveys have been directed toward endangered species such as the Koala (Curtin and Lunney 1995) and the Brush-tailed Rock-wallaby (Rummary *et al.* 1995) or fauna groups such as reptiles (Phillips 1987), bats and herpetofauna (Hoye 1999, Kendall and Kendall 1995). Most of these studies were focused on accessible areas in the central and southern portions of the reserve, with the area falling within the Hunter Catchment receiving little survey effort. The Comprehensive Regional Assessment (CRA) program first employed systematic survey methods in the reserve as means to provide a broad overview of the fauna conservation values of public land in the forests of eastern NSW. Between 1997 and 1998 systematic fauna sites sampling a range of broad environmental strata were located within northern Yengo NP along the Old Bulga Road, Northern Link and Yengo Trails in gully, midslope and ridge locations. Birds, reptiles, frogs, bats and arboreal mammals were surveyed at these sites. A small systematic survey was also completed in the Little Darkey Additions to Yengo in 2002 (Browne 2002).

The Atlas of NSW Wildlife stores a number of records associated with incidental observations, the Australian Museum specimen register and licensed data from Birds Australia, as well as the recent systematic survey data. The licensed data from Birds Australia was collected during two recording periods when data was gathered for the first and second Atlas of Australian Birds published by the Royal Australasian Ornithologists Union (Blakers *et al.* 1984 and Barrett *et al.* 2003). During the first period, 1977 to 1981, bird data was recorded across ten-minute spatial grids that were based on easting and northing lines. All birds recorded within each grid were assigned the AMG coordinates at the centre of the grid. The allocation of the central AMG has resulted in spatially inaccurate data, and birds recorded during these surveys may or may not have been detected in the study area. The second period of collection recorded bird data from 1998 to 2002. The data recorded during this time related to smaller search areas, so the point localities are more accurate and can be used to determine whether species have actually been recorded within the reserve.

The Australian Museum data derive from specimens submitted to the museum by members of the public, as well as from field trips undertaken by Museum staff specifically to collect fauna specimens. Records collected soon after European settlement have been entered into the Museum database with a low level of spatial and temporal reliability. For this reason, records from the Australian Museum prior to 1950 have been excluded from discussion in this report.

Remaining records within the Atlas come from observations made by park rangers and field officers, bushwalkers and naturalists, scientific researchers working in the area, and other visitors to the park. These records have various levels of reliability depending on the type of observation, as well as the certainty and identification experience of the observer.

2.2 SURVEY STRATIFICATION AND SITE SELECTION

The aim of the survey stratification and site selection process was to proportionately sample the range of habitat types contained within northern Yengo NP. The initial step undertaken was a gap analysis to identify the previous systematic fauna survey effort undertaken within each modelled vegetation community within northern Yengo National Park. Broad vegetation mapping of Yengo NP (Bell *et al.* 1993) formed the primary data layer for reviewing existing sampling adequacy. The northern Yengo study area contains eleven mapped vegetation communities (Table 1). Existing systematic survey effort (CRA sites) were overlaid on vegetation mapping in ARCVIEW Geographic Information System (GIS), in order to determine the level of sampling that had been undertaken within each community. Vegetation communities that had not previously been sampled or had been under-sampled (where the amount of previous survey effort was less than that predicted by the proportional size of the community) were prioritised for sampling during the 04-05 surveys.

Major sampling gaps were identified in Northern Escarpment Woodland, Exposed Narrabeen Woodland and Narrabeen Hawkesbury Ironbark Forest, as well as the suite of tall forests on sheltered or rich soils. New survey effort was allocated to three broad regions, the north and north-east, the middle along Settlers Road and the south and south-west. Sites were initially selected using a GIS, based on vegetation type and proximity to access trails. Attention was given to the allocation of sites across the distribution of the vegetation communities and at different aspects and positions on the slope. Where possible, survey sites, each two hectares in area, were spaced at least one kilometre from each other to ensure spatial independence (two kilometres for nocturnal call playback surveys). The majority of sites were placed in close proximity to access trails to allow for night spotlighting and harp trapping surveys and to maximise the

number of sites that could be accessed during the limited survey period. An effort was also made to select sites at remote locations up to five kilometres from access points. Not all survey techniques were conducted at these locations given access constraints for cumbersome fauna equipment. All sites were ground-truthed to ensure they were accessible, representative of mapped vegetation communities, had not been significantly affected by recent burning or other habitat modification, and comprised a single vegetation community. If these criteria were not met, an alternative site was selected.

Map 3 shows the location of fauna survey sites and the distribution of vegetation communities within the study area. The location of access trails and the large amount of travelling time between areas (especially when walking in difficult terrain) limited selection of survey sites. Consequently, considerable difficulties were met in locating survey sites that proportionately sampled the full range of strata, maintained sufficient distance between sites to ensure they were independent from one another, and could be accessed with a reasonable degree of efficiency. For these reasons Hawkesbury Narrabeen Sheltered Forest, Grey Box Open Forest and Swamp Woodland on Perched Sands were under-sampled. Appendix A provides details, including vegetation community, for all systematic survey sites in the study area.

2.3 SURVEY METHODS

The systematic fauna survey methods used in this study were based on those developed by the NPWS Biodiversity Survey Coordination Unit (NPWS 1997). The systematic techniques described below were used to sample the following vertebrate fauna groups: diurnal and nocturnal birds, diurnal and nocturnal reptiles, bats, arboreal mammals, amphibians, and terrestrial mammals. Consistency in the use of these techniques allows comparison between fauna species detected across different vegetation types and environments within the study area. Furthermore, it will allow future comparisons with consistent surveys of environments elsewhere.

Field survey teams were supplied with field proformas to facilitate comprehensive, consistent recording of field data and to increase accuracy and efficiency of data entry into the DEC Biodiversity Subsystem (BSS) of the NSW Wildlife Atlas computer database. The names of observers and recorders were noted on every data sheet to aid data verification and entry.

2.3.1 Systematic site-based methods

Site attributes

A site attribute form, aiming to characterise fauna habitat, was filled out at every systematic site where survey techniques were conducted. A 20 by 20 metre quadrat typical of the overall 100 by 200 metre site was used for the assessment. The site attribute locates and describes the site in a format that is comparable to other sites. Data relating to physio-geographic, disturbance, structural and floristic, microhabitat and stream categories were recorded for the site. Standard codes provided by the Australian Soil and Land Survey Handbook (McDonald *et al.* 1990), particularly for vegetation (ie Walker and Hopkins 1990) were used wherever possible.

Diurnal bird survey

Diurnal bird censuses comprised a twenty-minute observation and listening search within a two-hectare (100 by 200 metre) area, conducted by an experienced bird surveyor. Censuses were only conducted during periods of relatively high bird activity (in the early morning) and reasonable detectability (e.g. low wind and loud cicada activity). All bird species and abundance of individuals seen or heard were recorded. Individuals were scored as on-site if they were detected within the one-hectare plot. Individuals recorded outside the plot, in adjacent vegetation types were recorded as off-site.

Diurnal herpetofauna search

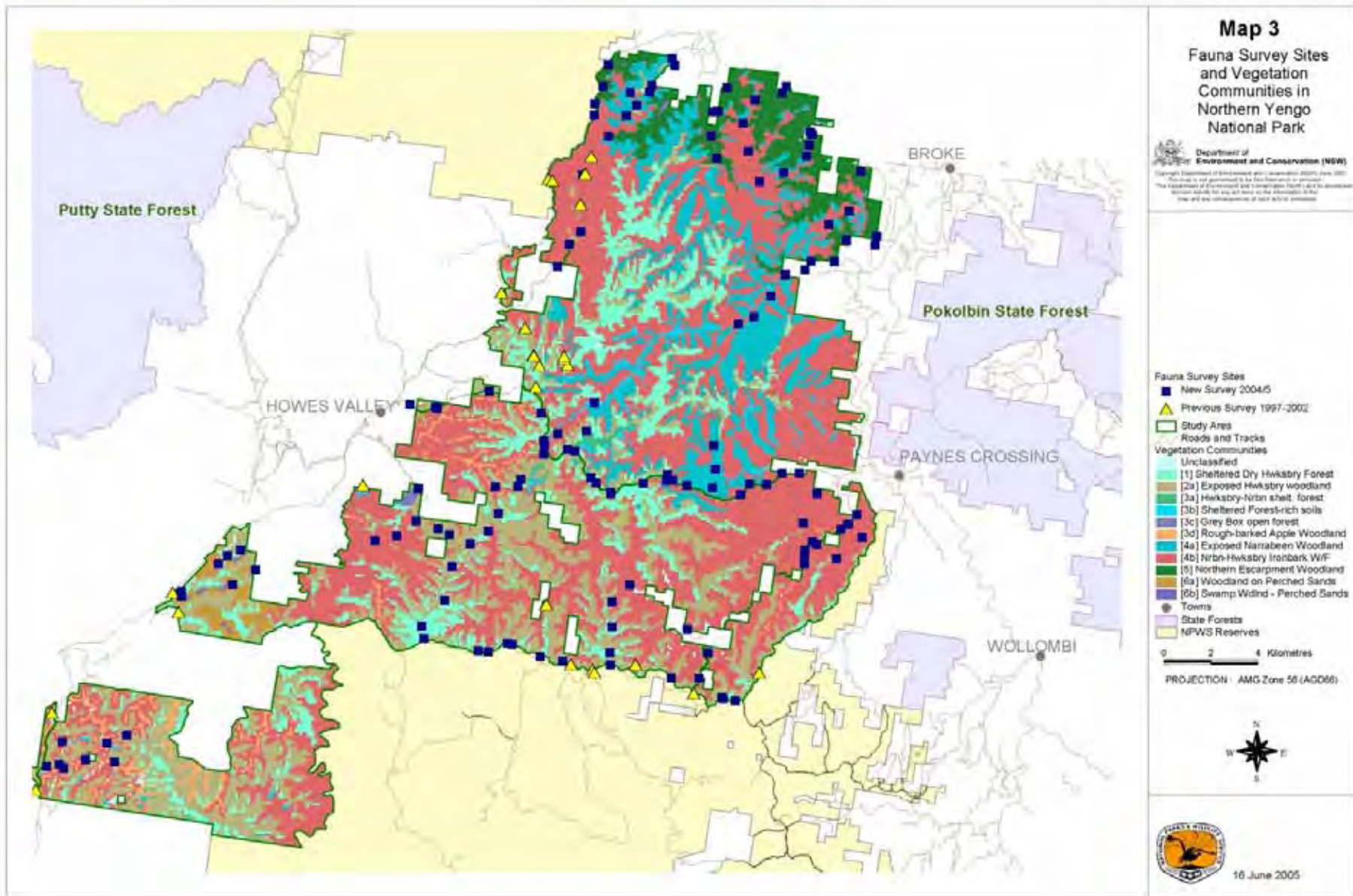
A standard half-hectare area (50 by 100 metres) was searched for one person-hour at each site (standardised regardless of the number of surveyors). Censuses were restricted to the period between mid-morning to late afternoon, when temperature and insolation are sufficient to ensure maximum reptile activity. Surveys were not conducted on overcast, rainy or extremely windy days or in extreme heat.

This census technique entailed active searching of potential reptile and frog microhabitats within the half-hectare area. Active or basking reptiles were identified by sight or captured and identified by the use of keys. Sheltering or cryptic species were detected by searching around, under and within fallen logs, litter, decorticated and fallen bark, rock outcrops and other likely shelter sites. Species identified by shed skin, found during the search, were also recorded on the census sheet. Incidental observations of other fauna were also recorded on opportunistic forms.

Vegetation community ¹	Mapped area of vegetation community in study area	Proportion of study area occupied by vegetation community (%)	No. of diurnal bird surveys	No. of diurnal reptile surveys	No. of site spotlight surveys	No. of harp trapping bat sites	No. of ultrasonic bat detector sites	No. of nocturnal streamside searches for frogs	No. of owl call broadcast sites	No. of hairtube transects	No. of Elliott trap sites
Narrabeen-Hawkesbury Ironbark Woodland/Forest	21680	46.6	24	22	10	7	10	1	14	2	0
Exposed Hawkesbury Woodland	9774	21	37	21	21	17	8	1	13	1	3
Sheltered Dry Hawkesbury Forest	5423	11.7	7	8	6	4	3	1	6	1	0
Exposed Narrabeen Woodland	5265	11.3	6	7	3	2	0	0	0	0	0
Northern Escarpment Woodland	2428	5.2	12	10	7	2	1	4	6	4	1
Rough-barked Apple Woodland	767	1.7	4	3	2	2	0	0	0	0	0
Woodland on Perched Sands	488	1.1	3	3	3	0	0	0	0	0	1
Sheltered Forest-rich soils	397	0.9	4	3	1	0	2	0	0	0	0
Hawkesbury-Narrabeen Sheltered Forest	157	0.3	2	1	0	0	0	0	0	0	0
Grey Box open forest	74	0.2	2	1	1	0	0	0	0	0	0
Swamp Woodland - Perched Sands	35	0.1	1	1	0	1	0	0	0	0	0
Unclassified			2	1	0	2	0	0	0	0	0
Total	46489	100	104	81	50	35	27	7	39	8	5

¹ Note that the Vegetation Mapping regularly overlooks fine scale vegetation features. Taller forests of gullies and Grey Box forests were specifically targeted. Sampling of map units is misleading for these fine scale units.

Table 1: Areas of mapped vegetation communities within northern Yengo National Park and corresponding allocation of systematic survey sites. Includes sites established during Comprehensive Regional Assessment and Biodiversity Survey Priorities surveys. Vegetation communities derived from Bell *et al.* (1993)



Map 3: Fauna survey sites and vegetation communities in northern Yengo National Park

Nocturnal site spotlighting survey

This census comprised searching for arboreal mammals along a 200 metre transect within a site for half a person hour. Fifty-watt spotlights were used to scan the vegetation for animals and enable detection of reflected eye shine. Surveyors also listened intently for fauna calls during the survey period. The ground and rock overhangs were also searched for nocturnal reptiles. All animals observed or heard within the census period were recorded, noting whether they were on or off site.

Harp trapping

While ultrasonic recorders were used principally to detect high flying bat species, collapsible bat traps, known as harp traps (Tidemann and Woodside 1978), captured low flying species. Two nights of trapping were conducted at each bat trap site. Sites were selected for their perceived potential to interrupt bats along their flight paths, and were usually placed along tracks, next to dams or in gaps between trees where adjacent vegetation might force bats to fly.

Traps were checked during the night and each morning. Captured bats were identified by external morphology, forearm measurement and body weight, and keyed out where necessary using Parnaby (1992a) and Churchill (1998). Animals were released during the night or on the following night at the point of capture.

Bat ultrasonic ('Anabat') call recording

Ultrasonic recorders (Corben 1989) are particularly useful for detection of high-flying species, which often comprise more than one third of an area's bat species (Parnaby 1992b), and yet are under sampled by harp trapping (Richards 1992). The method requires the recording and identification of high frequency, echo-location "calls" made by bats, which, except for one or two species, are ultrasonic and inaudible to humans.

The recording equipment for the surveys consisted of an Anabat II[®] detector and digital flash card recorder, housed within a tupperware box for weather protection. The box was set up in locations where bats were expected to fly, such as over water bodies, at cave entrances and along tracks. The Anabat was set to commence detection at dusk and turn off at dawn. During the night, a delay switch operated to turn on the recording device when bat activity was detected and then de-activate the device while no bat activity was occurring. The equipment was left in each location for one night only, then moved elsewhere.

Anabat recordings were transferred onto computer and analysed using Analook Software (Corben 2000). Narawan Williams, a recognised expert in the field, identified calls. Identification was designated as definite, probable or possible, following the methodology of Parnaby (1992b) and Pennay *et al.* (2004).

Nocturnal streamside search

Streamside searches for frogs were undertaken for half a person hour in one of two ways: in stream or gully habitats a 200 metre stretch was searched; at standing water bodies a half-hectare (50 by 100 metre) area was surveyed. The searches were only conducted on warm, dark, humid and wet nights within two days of rain. All frogs, and other animals, identified visually or by call within the time period were recorded, together with the weather conditions at the time of the survey.

Nocturnal call playback

Nocturnal birds and mammals are often detected only when they vocalise for territory or social contact, behaviour which can be elicited by broadcasting specific calls. A standard survey census involved broadcasting the calls of each of the four large forest owls - Powerful Owl (*Ninox strenua*), Masked Owl (*Tyto novaehollandiae*), Sooty Owl (*T. tenebricosa*) and Barking Owl (*N. connivens*) - from the centre of a site. Prior to call broadcasts, on arrival at the site, the surrounding area was searched by spotlight for five minutes to detect any fauna in the immediate vicinity and then a ten minute period of listening was undertaken.

A pre-recorded compact disc of each species' call series was played, amplified through a megaphone. Calls of each species were played for five minutes, followed by a five minute listening period. The surrounding area was again searched by spotlight after a final ten minute listening period. After the census, the response or presence of any fauna, date and time that response occurred, and weather details such as amount of cloud cover was recorded. Very windy and rainy periods were avoided where possible. Censuses conducted in poor weather were noted.

Elliott trapping

This technique involved setting ten Elliott B traps at twenty metre intervals along a 200 metre transect through a site. Traps were baited with a mixture of peanut butter, oats and honey. Traps were left in place for four nights, checked and emptied every morning soon after dawn. Any animals captured within the traps were identified, sexed if possible, and released.

Hair tube sampling

Ten hair-sampling funnels (Faunatech and Austbat 2003) were placed at 20 metre intervals along a ground transect bisecting selected sites. Transects were aligned parallel to contours of the site (that is across the face of any slope and not up and down the slope). Alternate tubes were baited with raw chicken or a mixture of peanut butter, oats and honey. Each tube is fitted with a sticky wafer that collects hairs of small and medium sized mammals investigating the bait.

Tubes were left on the site for at least ten nights. Hair samples were identified by Barbara Triggs, a specialist in the field, using the techniques described by Brunner and Coman (1974). Identifications were divided into three levels of reliability: definite, probable and possible. Only the first two categories being entered into the Atlas of NSW Wildlife.

2.3.2 Opportunistic methods

Predator and herbivore scat and owl pellet collection

The large numbers of hairs, and occasionally skeletal remains, in predator scats and owl pellets results in a high level of confidence in identifications of prey species and is hence an efficient sampling technique for prey animals. In addition, the recording of predator or non-predator scats constitutes records for the species that deposits the scat, providing locality records for species such as the Spotted-tailed Quoll (*Dasyurus maculatus*), Fox (*Vulpes vulpes*), Dingo (*Canis lupus dingo*), Dog (*C. lupus familiaris*) and Pig (*Sus scrofa*). Due to the unmeasurable time delay between prey ingestion and defecation, the location in which the prey animals lived cannot be accurately known, so this technique is useful only for detecting the species presence within a general area. Lunney *et al.* (2002) have shown, however, that predators defecate an average of two kilometres from the point of prey ingestion.

Predator scats were collected, placed in paper envelopes, labelled and sent to specialist, Barbara Triggs, for analysis. Hair samples were identified using the techniques described by Brunner and Coman (1974). Identifications were classified into three levels of reliability: definite, probable and possible.

The location of herbivore scats was also noted on an opportunistic basis to indicate the presence of an animal. If there was any doubt in herbivore scat identification in the field, samples were brought back for identification by an expert.

Searches of caves and overhangs

When come across, caves and overhangs were thoroughly searched with a headtorch for animals such as cave-roosting bats, geckos and nesting birds.

Incidental records

Surveyors driving or walking through the study area recorded the location of interesting fauna when it was seen or heard. Particular animals targeted by this technique were those undersampled by systematic surveys, including large ground mammals, non-vocalising birds, and secretive, shy and/or rare animals. The date, time, rough location, AMG (usually obtained from a GPS) and microhabitat of the animal were recorded on a data sheet.

2.4 SURVEY TIMING

As discussed, systematic field surveys were undertaken within northern Yengo NP during both the CRA and the Biodiversity Survey Priorities programs. Table 2 summarises the timing of these systematic surveys, along with the techniques that were undertaken in each season.

Survey program	Timing	Techniques employed
Comprehensive Regional Assessment (CRA)	January - March 1997 November 1997	Diurnal bird census, reptile search, site spotlighting, call playback, harp trapping, bat call detection, nocturnal streamside search, opportunistic methods
Biodiversity Survey Priorities (BSP)	August 2004	Nocturnal call playback, site spotlighting
	September 2004 – March 2005	Diurnal bird census, reptile search, site spotlighting, harp trapping, bat call detection, nocturnal streamside search, elliot trapping, opportunistic methods
	April – June 2005	Nocturnal call playback, hair tube trapping, site spotlighting, opportunistic methods

Table 2: Timing of DEC systematic fauna surveys within northern Yengo National Park

3 RESULTS AND DISCUSSION

3.1 OVERVIEW

Since 1997, 161 systematic fauna survey sites, with one or more techniques employed at each site, have been assessed within northern Yengo NP. These are comprised of 137 from the 2004-05 BSP surveys, seventeen from the CRA surveys and eight from the "Little Darkey Addition" survey. These sites sample a broad range of environments in the study area, but due to its size and accessibility the coverage is not thoroughly comprehensive. Systematic surveys have occurred over different years and seasons (Table 2) but the majority of the work was completed during the 2004-05 spring/summer season.

Following an extensive review of all data we consider that 256 native species of vertebrate fauna are known to occur in northern Yengo NP. Twenty-eight of these species are listed as threatened on the NSW Threatened Species Conservation Act (1995) and two are also listed on the commonwealth Environmental Protection and Biodiversity Conservation Act (1999). A complete list of fauna recorded in the study area is provided in Appendix B. The number of species known to occur is commensurate with other hinterland sandstone reserves of this size. The finding indicates that despite frequent fires, infertile soils and inhospitable landscape it is the fifth most diverse reserve in the Branch. There have been ten introduced fauna species recorded within northern Yengo NP.

The diversity of the region is reinforced by the fact that there are 71 additional species recorded within five kilometres of the boundary of this part of the reserve (see Appendix C). Of these, five are listed as threatened on the NSW Threatened Species Conservation Act (1995).

Systematic fauna surveys since 1997 have added a considerable number of new species to the list of those known to occur in the reserve. Figure 1 details the increase in the number of species known to occur as a result of the survey effort between 1997 and 2005. The most recent surveys identified 31 species that had not previously been recorded in the reserve and added over 4500 new records, including many new locations for threatened species. Map 4 illustrates the change in density of fauna survey records following the 2004-05 survey effort.

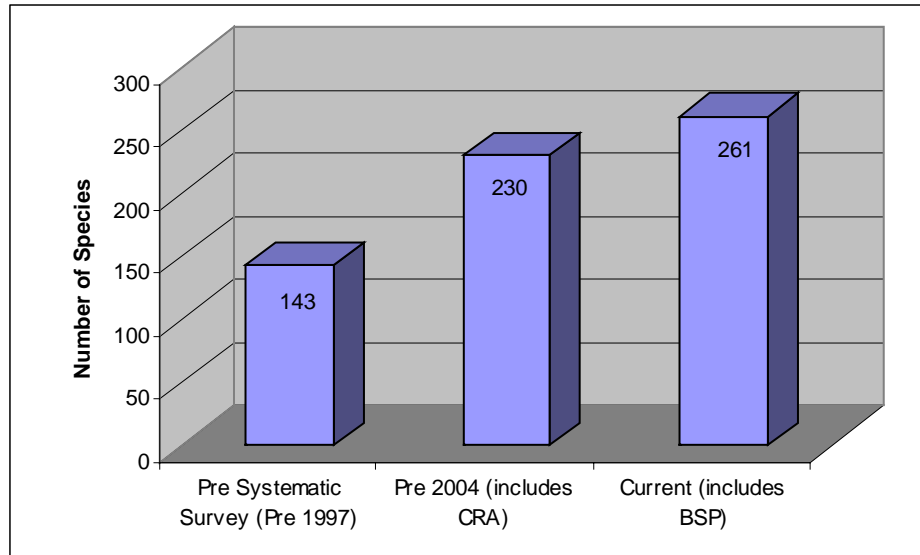
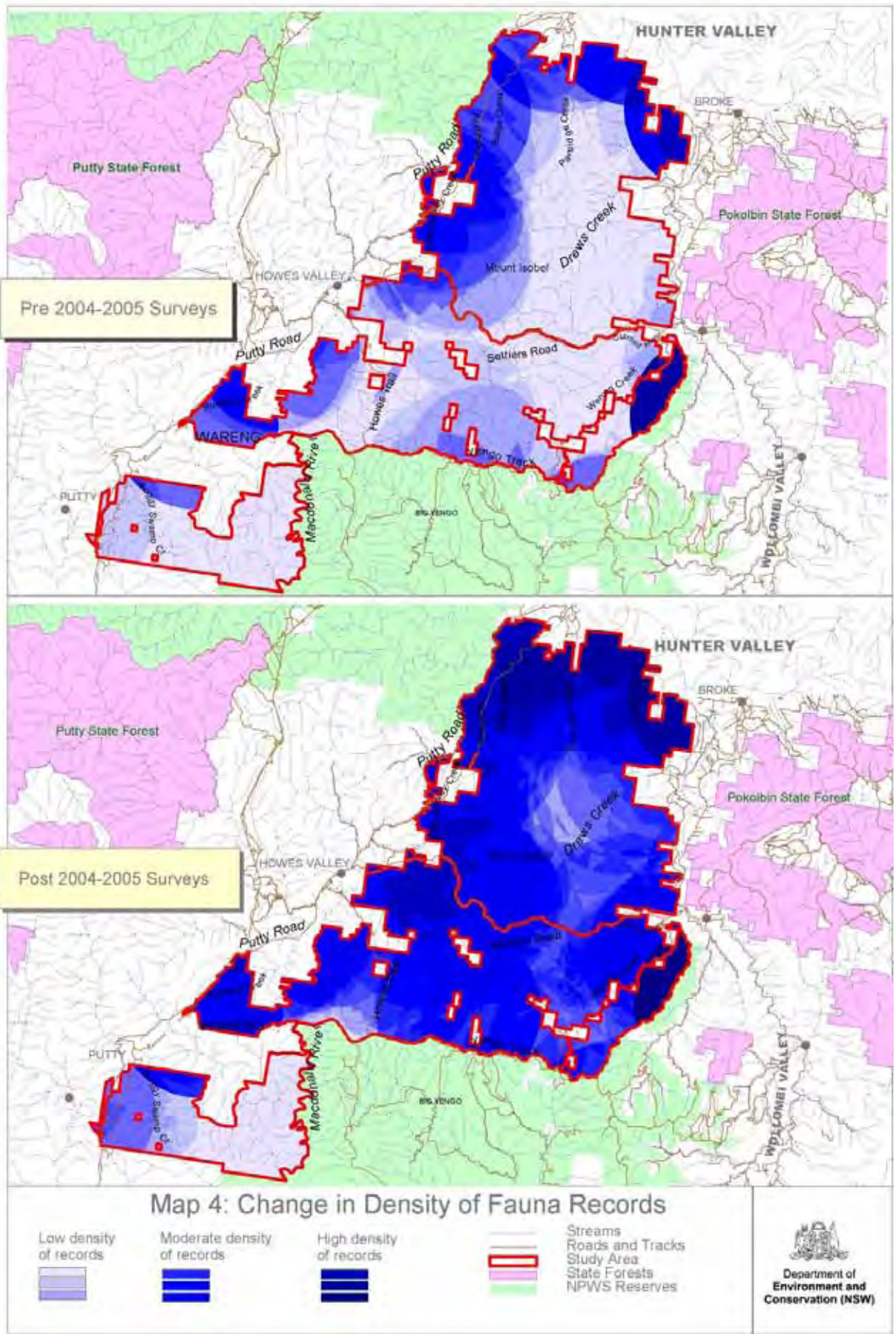


Figure 1: Number of species recorded within northern Yengo National Park following systematic fauna survey



Map 4: Change in density of fauna records due to 2004-05 systematic surveys in northern Yengo National Park

3.2 NATIVE DIURNAL BIRDS

Northern Yengo NP provides a range of habitats that support a high richness of native diurnal bird species. One hundred and forty one (141) species have been recorded within the reserve. This richness is typical of sandstone environments, with a similar number of bird species found in the Nattai reserves (146), North-eastern Wollemi NP (152), Kanangra-Boyd NP (124), and Goulburn River NP (160) (DEC 2004a; DEC 2005b; DEC 2004b; NPWS 2001c). Within northern Yengo NP there are ten diurnal bird species listed on the NSW Threatened Species Conservation Act (TSC Act) (1995). Most of them are associated with dry open Box-Ironbark woodlands, a vegetation community that has been heavily cleared throughout the state. These include the Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), Black-chinned Honeyeater (eastern subsp.) (*Meliphaga gularis gularis*), Turquoise Parrot (*Neophema pulchella*), Grey-crowned Babbler (eastern subsp.) (*Pomatostomus temporalis temporalis*), Speckled Warbler (*Pyrrholaemus sagittatus*) and Diamond Firetail (*Stagonopleura guttata*). The Regent Honeyeater (*Xanthomyza phrygia*) is listed as Endangered under the TSC Act (1995) and is also a nationally recognised threatened species under the commonwealth Environmental Protection and Biodiversity Conservation Act (EPBC Act) (1999). Other threatened species are the Glossy Black-cockatoo (*Calyptorhynchus lathami*), Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Black Bittern (*Ixobrychus flavicollis*). Each of these threatened species is discussed in more detail in Section 5.

Other species listed under the TSC Act (1995), the Painted Honeyeater (*Grantiella picta*) and Hooded Robin (south-eastern subsp.) (*Melanodryas cucullata cucullata*), have been recorded in a number of locations within ten kilometres of the park boundary, but not within the reserve itself. Painted Honeyeaters are known to frequent habitat containing Weeping Acacia (*Acacia pendula*), which exists in restricted areas of the Hunter Valley floor but is not known in the reserve itself. Both of these threatened species are not included in our definitive list of bird species for the reserve, although it is recognised that they may be present near the reserve boundary.

There have been 104 systematic diurnal bird censuses completed by DEC in northern Yengo NP, which have recorded 107 bird species. The results provide valuable data on the relative abundance of species across the reserve as well as a means of comparing bird assemblages between different environments of the region.

The composition of the bird assemblage found in the reserve reflects the dominance of dry shrubby sandstone environments. The most commonly encountered species are the active, visible and loud calling species such as the White-throated Treecreeper (*Cornobates leucophaeus*), Yellow-faced Honeyeater (*Lichenostomus chrysops*), Spotted Pardalote (*Pardalotus punctatus*), Noisy Friarbird (*Philemon corniculatus*), Eastern Spinebill (*Acanthorhynchus tenuirostris*) and Grey Shrike-thrush (*Colluricincla harmonica*). Other common species of these dry forests and woodlands include the Brown Thornbill (*Acanthiza pusilla*), Cicadabird (*Coracina tenuirostris*), Silvereye (*Zosterops lateralis*), Grey Fantail (*Rhipidura albiscapa*), Red-browed Finch (*Neochmia temporalis*), Eastern Yellow Robin (*Eopsaltria australis*) and Rufous Whistler (*Pachycephala rufiventris*). Moist gully environments provide habitat for a different suite of birds. Yellow-throated Scrubwren (*Sericornis citreogularis*), Large-billed Scrubwren (*S. magnirostris*), Bassian Thrush (*Zoothera lunulata*), Brown Cuckoo-dove (*Macropygia amboinensis*) and Brown Gerygone (*Gerygone mouki*) in particular, are restricted to these habitats and were recorded in wetter forests such as Partridge and Drews Creeks in the north and east of the park. These species are infrequently recorded, alongside more common gully forest birds such as Eastern Whipbird (*Psophodes olivaceus*), Lewins' Honeyeater (*Meliphaga lewinii*), Golden Whistler (*Pachycephala pectoralis*), Satin Bowerbird (*Ptilonorhynchus violaceus*), White-browed Scrubwren (*Sericornis frontalis*), Black-faced Monarch (*Monarcha melanopsis*) and Superb Lyrebird (*Menura novaehollandiae*).

Twenty-one species of honeyeater were recorded across the range of vegetation communities sampled. Many honeyeater species were making use of flowering Ironbarks that occurred across much of the reserve during the recent survey season. The Yellow-faced Honeyeater and Noisy Friarbird are the most abundant of this group of birds and both occurred in the majority of systematic survey sites. Other species such as the Black-chinned Honeyeater and Brown-



Plate 4: Mistletoebird © DEC

headed Honeyeater (*Melithreptus brevirostris*) are far less frequently encountered and were only recorded at small numbers of sites. While the Black-chinned Honeyeater is already recognised as a threatened species, the Brown-headed Honeyeater is one of four honeyeater species noted in Barrett *et al.* (2003) to have declined in the Sydney Basin Bioregion since the 1980s. Two species of these four, the White-eared Honeyeater (*Lichenostomus leucotis*) and White-cheeked Honeyeater (*Phylidonyris nigra*) have been recorded in reasonable numbers in the reserve. The fourth species, Brown Honeyeater (*Lichmera indistincta*) is known from a single historical record on the park boundary. The record is unusual as within the Sydney Basin this species is generally found in coastal areas. It is possible that this bird was mis-identified or a vagrant to the area attracted by flowering bottlebrush planted in nearby farm gardens.

The most frequently recorded bird of prey in the reserve was the Wedge-tailed Eagle (*Aquila audax*) which was noted at eleven locations. Other species detected less frequently include Brown Falcon (*Falco berigora*), Brown Goshawk (*Accipiter fasciatus*), Nankeen Kestrel (*Falco cenchroides*), Black-shouldered Kite (*Elanus axillaris*), Australian Hobby (*Falco longipennis*), Collared Sparrowhawk (*Accipiter cirrocephalus*), Grey Goshawk (*Accipiter novaehollandiae*), Pacific Baza (*Aviceda subcristata*), Peregrine Falcon (*Falco peregrinus*) and Swamp Harrier (*Circus approximans*). In general, birds of prey occur in low densities and many species were detected close to the perimeter of the park where the escarpment gives way to open woodland and cleared farmlands.

A greater number of ground foraging birds, such as the Superb Lyrebird, Australian Brush Turkey (*Alectura lathamii*) and Bassian Thrush were noted at sites where substantial amounts of leaf litter have been able to build up in between fires. These areas included the protected gullies and lower slopes on the northern and eastern sides of the study area, as well as lower and south facing slopes in the vicinity of Settlers Road.

Australian King-parrots (*Alisterus scapularis*) are more common in the reserve than other parrots. The Crimson Rosella (*Platycercus elegans*), Eastern Rosella (*Platycercus adscitus eximius*) and Little Lorikeet (*Glossopsitta pusilla*) were recorded at half the number of sites, while the Musk Lorikeet (*Glossopsitta concinna*) and Turquoise Parrot were recorded at only a few locations.

Other widely recognised birds are the pigeons and doves, of which a number are commonly encountered in northern Yengo National Park. Common Bronzewing (*Phaps chalcoptera*) are occasionally flushed while driving or walking, while the presence of the much rarer Brush Bronzewing (*Phaps elegans*) has been recorded only once in north-eastern Yengo NP in 2003, and requires further validation. Wonga Pigeons (*Leucosarcia melanoleuca*) are regularly heard calling from gullies while the Brown Cuckoo-dove is a resident of the wettest forests only. Crested Pigeons (*Ocyphaps lophotes*) and Peaceful Doves (*Geopelia placida*) are found near cleared and fragmented country in or near the edges of the reserve. The Bar-shouldered Dove (*Geopelia humeralis*) has also been recorded at several sites.

Four species known to occur in the reserve are of conservation concern because they have declined across their range: Rockwarbler (*Origma solitaria*), Spotted Quail-thrush (*Cinclosoma punctatum*), Red-browed Treecreeper (*Climacteris erythroptera*) and White-winged Chough (*Corcorax melanorhamphos*). Barrett *et al.* (2003) identified these species as declining based on trends apparent in the data between the first and second Bird Atlas censuses. The Rockwarbler is of interest because it is endemic to NSW and its distribution pattern is closely tied to the Sydney Sandstone environments. This small ground-dwelling bird is moderately common amongst the rocks and boulders of the gullies and slopes of northern Yengo NP. White-winged Choughs were not often recorded, and where they were found it tended to be amongst the drier woodlands of the northern escarpment. Red-browed Treecreepers were not common and were restricted to narrow moister habitats where tall Blue Gums dominated gullies and sheltered slopes.

There are a substantial number of records held within the Atlas of NSW Wildlife that suggest that an additional 30 species of bird occur within the reserve. These data have been reviewed and discounted based on the reliability of the records and the lack of suitable habitat. Many of these records are sourced from the first Bird Atlas published by the Royal Australasian Ornithologists Union (RAOU) (Blakers *et al.* 1984). The limitations of the data are that locations of species have been assigned to the central point of a ten-minute grid square covering the area. As such, species that have been recorded some distance from the reserve may have been given a location point that may lie within the reserve boundary, suggesting that the reserve provides habitat for species that are realistically unlikely to occur. Table 3 lists species that were sourced from the RAOU surveys and have not been detected in the study area since. Most are associated with farm dams common to agricultural and grazing landuses that adjoin the reserve. An additional 42 species of bird have been recorded within five kilometres of the boundary of the study area, but not within the area itself (Appendix C).

Common name	Conservation status	Comment
Grey Teal	P	Unlikely to occur
Australasian Grebe	P	Likely in farm dams in adjoining private lands
Intermediate Egret	P	Unlikely to occur
Yellow-billed Spoonbill	P	Likely in farm dams in adjoining private lands
Australian Hobby	P	Likely adjoining private lands
Baillon's Crane	P	Likely in farm dams in adjoining private lands
Dusky Moorhen	P	Likely in farm dams in adjoining private lands
Sharp-tailed Sandpiper	P	Likely in farm dams in adjoining private lands
Latham's Snipe	P	Likely in farm dams in adjoining private lands
Black-winged Stilt	P	Likely in farm dams in adjoining private lands
Australian Pelican	P	Flying overhead or farm dams
Straw-necked Ibis	V	Likely in farm dams in adjoining private lands
Royal Spoonbill	P	Likely in farm dams in adjoining private lands
Little Pied Cormorant	P	Likely in farm dams in adjoining private lands
Pacific Black Duck	P	Likely in farm dams in adjoining private lands. May utilise creeklines near the boundary of the park.
White-necked Heron	P	Likely in farm dams in adjoining private lands
White-faced Heron	P	Likely in farm dams in adjoining private lands. May utilise creeklines near the boundary of the park.

Table 3: Native bird species recorded only with low spatial accuracy and/or considered unlikely to occur within northern Yengo National Park. Scientific names are presented in Appendix B.

3.3 NOCTURNAL BIRDS

Eight nocturnal bird species have been recorded within northern Yengo NP including five species of Owl: Barking Owl, Powerful Owl, Masked Owl, Sooty Owl and Southern Boobook (*Ninox boobook*). The first four of these owls are listed as Vulnerable under the TSC Act (1995). Forty nocturnal call playback sites specifically targeting these threatened owls have been conducted throughout the study area. The Barking Owl has been recorded a number of times along Yengo track, as well as at Boggy Swamp near Putty. Powerful Owls have been heard within gullylines containing taller forests, although they are not common. Only one response from both the Masked Owl and Sooty Owl was achieved. The response rate to the playback censuses for Powerful, Sooty and Masked Owls are lower than those achieved during surveys conducted in other reserves of the southern Blue Mountains (DEC 2005a). This suggests that the large forest owls occur in lower densities in the drier reserves. The lower abundance of arboreal mammals across the area may be a contributing factor to these lower densities. The response rate of the Barking Owl, however, is higher than that achieved in the southern Blue Mountains. All four threatened owl species are discussed in more detail in Section 5.

The Southern Boobook was the most frequently recorded owl species in the study area. The species has been recorded at 54 locations across a broad range of habitats. This small owl is common across its range and is widespread across Australia (Higgins 1999). The Southern Boobook is a versatile predator known to eat insects, small birds, and mammals up to 13 per cent of their body mass (McNabb 2002). On one occasion during these surveys, an individual was found roosting during the day in a shady gully on the eastern side of the park.

The other species of nocturnal birds detected include the Australian Owlet-nightjar (*Aegotheles cristatus*), Tawny Frogmouth (*Podargus strigoides*) (Plate 5) and White-throated Nightjar (*Eurostopodus mystacalis*). Prior to 1997 these three species had not been recorded in northern Yengo NP. Systematic surveys provided some insight into their abundance and habitat preferences. The Owlet-nightjar, mostly detected by its

assortment of calls, was found to be common throughout the study area. It was recorded at 64 sites during night surveys in both summer and winter months. Tawny Frogmouths were also found to be widespread and relatively abundant. They were recorded within a variety of vegetation types and were frequently detected opportunistically when driving along trails or by their soft humming call. In contrast the White-throated Nightjar was relatively uncommon. It was only recorded at seven locations and only during the summer months as they migrate north for winter (Pizzey and Knight 1999). Its distinct call and hawk-shaped silhouette swooping around ridge tops at dusk or dawn make it relatively easy to detect when present.

One species of owl that has not been detected in the study area was the Barn Owl (*Tyto alba*). This species is commonly observed or heard in open forests, woodlands and farmlands or perched on a roadside fence posts (Morcombe 2004). They have been noted, during surveys in adjoining reserves, to nest in large tree hollows, but they may also roost in caves and buildings. Although records for this species are absent from the reserve, it has been recorded at two locations within five kilometres of the boundary and therefore may be an occasional visitor.



Plate 5: Tawny Frogmouth © Narawan Williams

3.4 ARBOREAL MAMMALS

Nine species of arboreal mammal have been recorded within the reserve: Yellow-bellied Glider (*Petaurus australis*), Koala (*Phascolarctos cinereus*), Squirrel Glider (*Petaurus norfolcensis*), Eastern Pygmy-possum (*Cercartetus nanus*), Sugar Glider (*Petaurus breviceps*), Common Ringtail Possum (*Pseudocheirus peregrinus*), Greater Glider (*Petauroides volans*), Feathertail Glider (*Acrobates pygmaeus*) and Common Brushtail Possum (*Trichosurus vulpecula*). The first four of these species are listed as Vulnerable under the TSC Act (1995). The recent survey of 50 sites confirmed that these species are still present in the reserve despite extensive fires since 1997 and in the case of the Yellow-bellied Glider, results indicate that the species is more common than previously thought. Each of the four threatened arboreal mammal species is discussed in greater detail in Section 5.

By far the most commonly recorded arboreal mammal in the reserve was the Common Brushtail Possum (Plate 6). Their large size, bright eye shine and hissing vocalisation makes them relatively easy to detect. They were found to inhabit a mix of vegetation and terrain types, from ridgetop woodlands to tall gully forests. The Common Brushtail Possum is the most widespread possum in NSW and it is regarded as common throughout most of its range (Kavanagh 2004). It is a very adaptable species and is known to forage extensively both in the canopy and on the ground in forest and woodland environments.



Plate 6: Common Brushtail Possum © Narawan Williams/DEC

The Sugar Glider was also found to be reasonably common and widespread. This small agile glider was most frequently detected by its shrill and repetitive yapping. Its distribution in NSW extends west beyond Dubbo and north and south to the borders with Queensland and Victoria and within this range it is considered common particularly in the eastern forest and woodlands (Kavanagh 2004). Within the study area it was detected in a range of habitats in wet and dry sclerophyll forest as well as open woodlands. The species' diverse diet includes nectar, pollen sap and insects and allows a large number of foraging opportunities in the reserve.

The Greater Glider, as its name implies, is the largest of the gliders known to occur in the reserve. Easily detected during spotlight surveys by their large size, long tail and bright staring eyeshine, they were found in only a few locations. The majority of records were located in tall to very tall forest in gullies or creeklines where tree hollows are present. These forests are restricted to narrow ribbons, with many accessible forests being regrowth stands from previous logging. The Greater Glider has been shown to be very sensitive to extensive habitat disturbance. This is suspected to be related to their dependence on tall canopy trees for food and shelter in combination with small home range size, slow recovery rate following disturbance and poor dispersal ability (Kavanagh 2004). These affects can be compounded by fire that burns the canopy, with numbers known to be drastically reduced by severe wildfire (DEC 2004c). Given the

low numbers of the species in the reserve, an understanding of the effects of fire will reduce the risk of local species extinction in the study area.

The Common Ringtail Possum was also only detected at a few locations. Not recorded at all until 2001, it has since been detected at five locations in the northern and middle sections of the study area. This species shows a preference for foraging in the sub-canopy and tall shrubs of open and closed forests (Kavanagh 2004; Menkhorst and Knight 2001). This type of habitat is not abundant in northern Yengo NP. The low number of records is consistent with surrounding reserves, so it seems that this species is not common in the region.

Small and cryptic arboreal mammals such as the Feathertail Glider and Eastern Pygmy-possum are difficult to detect during spotlighting surveys. Consequently there are only a small number of records for these species, which is unlikely to reflect their true abundance or distribution. Low detection rates for these species are common, although it is predicted that they are still widespread throughout NSW and even suspected of being relatively common within their range (Kavanagh 2004). Two Feathertail Gliders were observed during the recent surveys, foraging amongst the upper canopy foliage of flowering Ironbarks. These flowering events are an important food resource for this species and Ironbarks are commonly featured as a preferred feeding species when in flower in the region. The species has also been observed feeding on flowering Ironbarks in Wollemi and Goulburn River National Parks (DEC 2005b; NPWS 2001c). Feathertail Gliders are known to eat nectar, pollen, sap, insects and honeydew (Kavanagh 2004), and are reliant on a high diversity of trees and shrubs to provide year-round foraging opportunities (Menkhorst and Knight 2001).

3.5 BATS

Eighteen species of bats have been recorded in northern Yengo NP. One of these species, the Grey-headed Flying-fox (*Pteropus poliocephalus*), belongs to the suborder Megachiroptera (megabats). The other seventeen belong to the suborder Microchiroptera (microbats).

Megabats, commonly known as fruit bats, feed on a diet of fruit, blossom and nectar and are social animals that rest during the day in large colonies or camps (Churchill 1998). The nearest known colony to the study area is located in Burdekin Park at Singleton, approximately 24 kilometres to the north-east of the park boundary. It is highly likely that the bats observed feeding in flowering Ironbarks in the reserve have come from this colony. The Grey-headed Flying-fox is listed as Vulnerable under the TSC Act (1995) and will be discussed in more detail in Section 5. Although not yet recorded in the study area, a small number of breeding Little Red Flying-foxes (*Pteropus scapulatus*) were observed over summer 2004/05 in the Grey-headed Flying-fox colony at Singleton (A. Williams pers. comm.). It is possible that these nomadic Flying-foxes also use the nearby flowering blossoms in northern Yengo NP when in the region.

Of the seventeen species of microbat recorded in the study area, six are listed as Vulnerable under the TSC Act (1995). These species are the Eastern Cave Bat (*Vespadelus troughtoni*), Large-eared Pied Bat (*Chalinolobus dwyeri*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) (Plate 7), Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), East-coast Freetail-bat (*Mormopterus norfolkensis*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*). These species will be discussed in more detail in Section 5.

Microbats are generally small, feed on insects and navigate using echolocation (Churchill 1998). Microbats were surveyed using two methods, harp trapping and ultrasonic ('Anabat') call identification. Both systematic survey methods have limitations in their ability to sample all species known in the area. Placement of harp traps is generally limited to areas with road access and suitable flyways, which tend to occupy ridgelines, and consequently bias sampling. Secondly harp traps only sample bats that fly under the canopy and thus the chance of capturing species that predominantly fly above the canopy is low. Ultrasound detection techniques overcome some of these problems, as they do not restrict sampling effort to flyways. However analysis of ultrasound calls does not resolve identification for all species with the same reliability. Some call signals present difficulties in distinguishing between different species, with the calls of some species overlapping in frequency with others. The call of the White-striped Freetail-bat (*Nyctinomus australis*) is audible to humans and was often heard during nocturnal surveys. A small number of bats were also observed in their cave roosts.



Plate 7: Greater Broad-nosed Bat © Narawan Williams/DEC

Of the seventeen species of microbat, four are cave-roosting bats: the Eastern Cave Bat, Large-eared Pied Bat, Eastern Bent-wing Bat and the Eastern Horseshoe-bat (*Rhinolophus megaphyllus*). Cave-roosting bats

are often particular about the type of cave and microclimate they roost in, especially when raising their young (Churchill 1998). The abundance of caves throughout the sandstone landscapes of the Sydney Basin Bioregion is an important shelter resource for these species. The remaining thirteen species of microbat generally rely on tree hollows and exfoliating bark for roosting sites. Tree-roosting bats are generally more tolerant of fluctuations in temperature and humidity at roosting sites and therefore have a broader range of homes available to them (Churchill 1998). This may account for the greater number of species and higher number of records for this group.

The most frequently detected species in the reserve was the Little Forest Bat (*Vespadelus vulturnus*). This result is typical of the forest and woodlands of the Sydney Basin. This tiny bat, weighing as little as three grams, is also common across south-eastern Australia. Its congener the Large Forest Bat (*Vespadelus darlingtoni*) was captured at only one site. Gould's Long-eared Bat (*Nyctophilus gouldi*) and Lesser Long-eared Bat (*Nyctophilus geoffroyi*) were both commonly captured in harp traps within all vegetation communities. Both of these species forage below the canopy, predominantly on moths, and can orientate without using echolocation (Churchill 1998). Bats of this genus cannot be distinguished by their ultrasonic call and very short, soft calls are often all that is recorded by ultrasound recording devices (Pennay *et al.* 2004).

Three species of wattled bats were recorded; the Large-eared Pied Bat, Chocolate Wattled Bat (*Chalinolobus morio*) and Gould's Wattled Bat (*C. gouldii*). The Chocolate Wattled Bat is common and found in most vegetation communities. Gould's Wattled Bat, larger than the other two species, is highly adaptable and is found in virtually all habitats throughout Australia (Churchill 1998). It was trapped less frequently than the Chocolate Wattle Bat, but is still commonly encountered. The Large-eared Pied Bat, discussed in more detail in Section 5, was trapped at over ten sites, confirming the role that sandstone reserves play in protecting this species.

Four species of Freetail-bat have been recorded. The most common of these, the White-striped Freetail-bat is a large fast flying bat that forages primarily above the canopy (Menkhorst and Knight 2001). For this reason it is unusual to catch this species in harp traps. However, its echolocation calls are audible to the human ear, making it easy to identify during nocturnal survey work. Three other species of Freetail-bat are far less commonly recorded: the Eastern Freetail-bat (*Mormopterus* sp. 2) (Adams *et al.* 1988) and Southern Freetail-bat (long penis form, *Mormopterus* sp. 4) (Adams *et al.* 1988), and the East-coast Freetail-bat (*Mormopterus norfolkensis*). The Eastern Freetail-bat was detected at eight locations within the study area. It has a widespread distribution from northern Queensland to Victoria, generally on the eastern side of the Great Divide (Churchill 1998). The Southern Freetail-bat is known from one anabat site along Settlers Road. This species is commonly found in western NSW and was detected by DEC surveys at fourteen locations in North-eastern Wollemi NP. The absence of other records for this species in the reserve suggests that it is only an occasional visitor. The threatened East-coast Freetail-bat has been recorded at only a few locations in the reserve and will be discussed further in Section 5.

Some bat species that are typical of central-western NSW and have been recorded in the adjoining Wollemi NP have not been detected within northern Yengo. These include the Inland Freetail-bat (short penis form *Mormopterus* sp. 3), the Inland Broad-nosed Bat (*Scotorepens balstoni*) and the vulnerable Greater Long-eared Bat (*Nyctophilus timoriensis*).

3.6 NATIVE GROUND MAMMALS

Despite the difficulties of surveying this fauna group, twelve species of native ground mammal have been recorded in the study area.

Larger ground mammals are not targeted by particular systematic survey techniques but are recorded opportunistically during surveys. There are six species of macropod known to occur in the study area: the Brush-tailed Rock-wallaby (*Petrogale penicillata*), Parma Wallaby (*Macropus parma*), Swamp Wallaby (*Wallabia bicolor*), Red-necked Wallaby (*M. rufogriseus*), Common Wallaroo (*Macropus robustus*) and the Eastern Grey Kangaroo (*M. giganteus*). The most frequently encountered of these within the reserve is the Swamp Wallaby (Plate 8). This characteristic dark wallaby is primarily a browser on small shrubs and grasses and lives in dense undergrowth in forests and woodlands (Merchant 1995). The Red-necked Wallaby is also reasonably abundant in the study area, the majority of sightings being opportunistic records of animals along the edge of the forest, near open grassy areas.



Plate 8: Swamp Wallaby © Ray Williams

Common Wallaroos were frequently recorded on steep rocky slopes, with the majority of sightings in the south-eastern corner of the study area, namely in the Cody and Werong Creek valleys. These solidly built macropods often use overhanging rocks and ledges to shelter from high temperatures and graze during cooler parts of the day on lower slopes or valley floors (Poole 1995). The Eastern Grey Kangaroo is not common in the study area, with only six records located near cleared land at the edge of the park. These kangaroos prefer open grassy habitats for foraging and are therefore a common sight in the surrounding farmland, though when disturbed retreat to the protection of denser vegetation.

Both the Brush-tailed Rock-wallaby and Parma Wallaby are listed under the TSC Act (1995). The populations of the Brush-tailed Rock-wallaby in the north-west and east of the reserve are of state-wide conservation significance for the species. Further discussion of this species is presented in Section 5. The Parma Wallaby is an unusual record. Identification of the species has come from a hair sample collected during the survey of the Little Darkey Creek Additions. The location lies well outside the known range for the species, primarily wet sclerophyll forests and rainforests along the coastal ranges north from the Hawkesbury River. While the identification of the species through the use of hair samples is reliable (B. Triggs pers. comm.), the habitat present in and around the site of the sample is not of the kind commonly associated with the species. While Darkey Creek supports tall Blue Gum gully forest it does not match the tall wet layered forests of the Watagan Ranges and Barrington footslopes known to be representative habitat of the Parma Wallaby. At this stage we remain uncertain of the species presence, and hence have not generated a species profile. If an individual is eventually observed it should trigger serious review of habitat occupancy across the sandstone reserves of the Sydney Basin.

Small ground mammals, such as native rodents, have been sampled using hair tubes and Elliott traps. There has not been intensive sampling for this group of animals across the reserve, although local areas have received considerable effort (Browne 2002). Recorded in low numbers were the Bush Rat (*Rattus fuscipes*) and Brown Antechinus (*Antechinus stuartii*). Although it is likely other Dasyurid species occur, analysis of hair samples rarely resolves these genera to species level. Nests of Brown Antechinus were found at two locations in sheltered forests. One record for Dusky Antechinus (*Antechinus swainsonii*) occurs in the north-east of the study area. This species is generally found in moist gullies or moist heath with dense ground cover. As this type of vegetation is not present in the vicinity of this record and it is the only record within a radius of more than ten kilometres, it is possible that this species has been mis-identified. Overall density of this group of small mammals appears low, particularly in areas that have been recently or repeatedly burnt. This is to be expected due to the fact that small populations are repressed after fire and recover only at the rate at which vegetation cover regenerates (Monamy and Fox 2000).

With the exception of macropods, which are recorded through opportunistic sightings, medium sized ground mammals were poorly surveyed, as cage trapping was not extensively used during recent DEC surveys. Two records of the Long-nosed Bandicoot (*Perameles nasuta*) exist, one being a road kill near the Putty Road and the other a Dog kill near private property in the north-east. This species was not recorded during systematic surveys, but is difficult to detect without targeted survey techniques. It is known to range in habitat from rainforest through to dry woodland and leaves behind conical diggings after foraging (Stodart 1995). We expect the species to occur in low densities throughout the reserve. Similarly, the Spotted-tail Quoll was not recorded during these surveys, although there is likely to be suitable habitat in the network of gullies that span the reserve. It is a wide-ranging and cryptic species, more frequently encountered on the north coast of NSW. Section 5 provides more detail on this animal.

Common Wombats (*Vombatus ursinus*) are found throughout the reserve. They have been recorded at 103 locations by direct observation, burrow entrances, or by their prominently placed scats (Triggs 1996). These large burrowing herbivores were recorded in all areas where systematic surveys have been undertaken, across a variety of vegetation and terrain types. Their diet mainly consists of native grasses but also includes sedges, rushes and the roots of shrubs and trees (McIlroy 1995).

One species of monotreme, the Short-beaked Echidna (*Tachyglossus aculeatus*) has been recorded infrequently. This easily recognised ground mammal survives on a diet of ants and termites and is found in almost all terrestrial environments across Australia (Menkhorst and Knight 2001). Records have been collected during recent surveys by opportunistic observation, scats or by its characteristic diggings around ant nests.

Northern Yengo NP holds numerous records of sightings of Canids, which includes both Dingo and Wild Dog. Testing for the purity of the Dingo has been undertaken in southern Yengo NP, in conjunction with Dog trapping programs (T. Horwood pers. comm.). Tests have revealed that some animals trapped in the more remote areas of Yengo, including Mount Yengo and off the Yengo Track, appear to preserve at least 90 per cent purity, while those on the periphery of farmlands are primarily derived from Domestic Dog gene pools.

3.7 REPTILES

Forty-seven species of reptile are known to occur within northern Yengo NP. This is a highly rich assemblage of species that reflects the position of the reserve, linking drier western habitats to central and northern coastal environments. The reserve contains a number of reptile species that are at or approaching the edge of their range. This extensive list of reptiles is comprised of one species of turtle, five species of gecko, three species of legless lizards, four species of dragons, two species of monitor, twenty-one species of skinks and eleven species of snake. In addition, it is likely that Blind-snakes occur, though they have not been recorded in recent years. One of these reptile species, the Rosenberg's Goanna (*Varanus rosenbergi*) is listed as vulnerable under the TSC Act (1995) and will be discussed further in Section 5. Other species are very rarely recorded in the region, as will be discussed below. Data collected during over 81 systematic reptile search sites provides an overview of species distribution across the landscape.

Skinks are the most diverse group of reptiles in the study area, with 21 species recorded. The most abundant and frequently detected species include the Copper-tailed Ctenotus (*Ctenotus taeniolatus*) and White's Rock-skink (*Egernia whitii*), found on rocky exposed ridgetops and rocky outcrops. Two litter-dwelling skinks were also commonly encountered, the Dark-flecked Garden Sunskink (*Lampropholis delicata*) and the Tree-base Litter-skink (*Carlia foliorum*, previously *Lygisaurus foliorum*), the latter clearly more common in the northern two thirds of the reserve. Numerous sites have recorded the Punctate Worm-skink (*Anomalopus swansoni*), a burrowing skink often found under rocks in areas with sandy soil. The findings of recent DEC surveys across the Hunter Range indicate that this region is a core area for the species.

The Southern Rainbow-skink (*Carlia tetradactyla*) and Tussock Rainbow-skink (*C. vivax*) are surface-active skinks that prefer dry forests and woodland habitats. These species exhibited signs of habitat partitioning. The Tussock Rainbow-skink was restricted to the northern edge of the reserve while the Southern Rainbow-skink was only found in the southern regions. The records obtained from these surveys for the Tussock Rainbow-skink are a first for Yengo NP and along with locations in Werakata NP are some of the most southerly records for the species. These locations are a considerable distance south of the nearest populations in Dorrigo NP and Plagyan State Forest on the North Coast. This disjunct population may vary genetically from these northern populations and should be further investigated.

A number of tree-dwelling skinks were also recorded. One of the exciting discoveries during the recent surveys was that of the partially arboreal Pink-tongued Skink (*Cyclodomorphus gerrardii*). This cryptic reptile is known to inhabit rainforest and wet sclerophyll forest of the North Coast (Swan *et al.* 2004). It is most active following rain on warm nights when it forages along the ground for slugs and snails (Wilson and Swan 2003). It was found along two unnamed tributaries of Werong Creek in the east, and Watts Creek in the north, as well as on Putty Road. In contrast, the Tree-crevice Skink (*Egernia striolata*) is a common lizard of western NSW. In Yengo NP it was recorded several times and appeared to be restricted to the dry forests and woodlands in the very north-eastern section of the reserve. Other tree-dwelling skinks recorded were the Bar-sided Forest-skink (*Eulamprus tenuis*) and the Cream-striped Shinning-skink (*Cryptoblepharus virgatus*).

Eastern Water-skinks (*Eulamprus quoyii*) are often seen basking on rocks at the edge of water courses, but can also be found around rock outcrops in moist forest high up on sheltered slopes. Less frequently encountered skinks were the Robust Ctenotus (*Ctenotus robustus*), the Red-throated Cool-skink (*Bassiana platynota*), the Weasel Shadeskink (*Saproscincus mustelinus*), Cunningham's Spiny-tailed Skink (*Egernia cunninghami* subsp. *krefti*), the Pale-flecked Garden Sunskink (*Lampropholis guichenoti*), the Yellow-bellied Three-toed Skink (*Saiphos equalis*), the South-eastern Morethia Skink (*Morethia boulengeri*) and the South-eastern Slider (*Lerista bougainvillii*). The latter two species are indicative of the dry western NSW environments that are found in the northern portions of Yengo NP. A well-known species of skink, the Common Bluetongue (*Tiliqua scincoides*), was only located near the park boundary in the north and west of the study area.

Five species of gecko have been found to occur within the study area. Most interesting was the identification of the Robust Velvet Gecko (*Oedura robusta*) at a single location in the north-east of the park. This record approaches the southern limit for the species and as such is an important sighting. Lesueur's Velvet Gecko (*Oedura lesueurii*) was the most frequently recorded gecko, often found around rocky outcrops and exposed sandstone ridgetops. Although easily detected during the day sheltering under exfoliating rock and bark, it was not recorded in the study area south of Settlers Road. The Broad-tailed Gecko (*Phyllurus platurus*) and Thick-tailed Gecko (*Underwoodisaurus milii*) are also common within northern Yengo NP. The Broad-tailed Gecko, also called the Southern Leaf-tailed Gecko, is restricted to sandstone outcropping within the Sydney Basin Bioregion (Wilson and Swan 2003). Although northern Yengo NP is close to this species northern extent, it can be found in reasonable densities where exfoliating rock, crevices, caves and overhangs are

available for shelter. The species is often detected by its eye shine, reflected in surveyors head torches. The Thick-tailed or Barking Gecko was commonly observed opportunistically, crossing trails at night or under logs or rocks on sites. This attractively coloured gecko was noticeably absent from the sites surveyed in the eastern part of the study area.

Legless lizards are rarely recorded as they are very cryptic, however three species are known to occur within the reserve. Legless lizards resemble small snakes but can be distinguished by the occurrence of external ear openings and/or residual hindlimb flaps. The Burton's Snake-lizard (*Lialis burtonis*) has been recorded near the edge of the reserve. It has a distinctly angular snout but ranges greatly in colouration and pattern. This species is the most widely distributed member of its family and occurs in a variety of habitat types, often found in low vegetation or in ground debris (Cogger 1996). The Leaden Delma (*Delma plebeia*) has also been recorded in the north of the park in Ironbark woodland with a low dense *Leptospermum* shrub layer and grass/herb ground cover. This animal is more commonly associated with environments of the central west slopes and plains. The Southern Scaly-foot (*Pygopus lepidopodus*) was recorded in the reserve for the first time during recent surveys, but is expected to occur more widely throughout the region than records currently indicate.

Of the four species of dragon known from the reserve, the Mountain Heath Dragon (*Tympanocryptis diemensis* now known as *Rankinia diemensis*) was the most commonly recorded. Not recorded in the study area until the recent surveys, the Eastern Water Dragon (*Physignathus lesueurii*) was found at nine locations, including Bulga, Partridge and Drews Creeks. As its name suggests, this large dragon occurs along drainage lines and is usually seen during the day, basking on rocks or logs adjoining pools of water. The Jacky Lashtail (*Amphibolurus muricatus*) was only recorded at three locations along the western edge of the study area. This dragon generally prefers open forest or coastal heath habitat (Swan *et al.* 2004). It has been recorded more frequently to the south and west of the study area in Wollemi and Yengo NPs and was the most commonly recorded dragon in Werakata NP to the east. The Eastern Bearded Dragon (*Pogona barbata*) was recorded at four locations near the western edge of the study area.



Plate 9: Fighting Lace Monitors © Doug Beckers/DEC

The Lace Monitor (*Varanus varius*) is common across the reserve. This goanna is a habitat generalist that forages across a large home range. It was found in a range of habitats, and were most often recorded opportunistically near trails. The survey team came across two large Lace Monitors fighting over a dead carcass by the side of a dam when working near Werong Creek (Plate 9). The animals were unaware that they were being watched and continued to struggle for over half an hour until both were exhausted. The Sand Monitor (*Varanus gouldii*) may also occur within the drier part of the reserve, though it has not yet been detected. This species has recently been observed in northern Wollemi NP (DEC 2005b).

The Eastern Snake-necked Turtle (*Chelodina longicollis*) was recorded at four locations including within rockpools along Partridge and Drews Creeks. This species was also frequently observed on roads outside the study area, moving between farm dams and watercourses.

Eleven species of snake have been recorded in this part of Yengo NP, most of which belong to the family Elapidae, the family to which most of Australia's venomous snakes belong. The Red-bellied Black Snake (*Pseudechis porphyriacus*) is often seen in close proximity to water and was recorded along Werong, Watts, Little Darkey and Boggy Swamp Creeks. The Eastern Brown Snake (*Pseudonaja textilis*) is a versatile species and can take advantage of a range of habitat types. Likely to occur anywhere in the reserve, it was detected near the boundary of the park in the north and west. The Yellow-faced Whipsnake (*Demansia psammophis*) is a small snake, typically found in dry forests and open woodlands (Swan *et al.* 2004), but was also found in gully lines and upper slopes during the surveys. The Red-naped Snake (*Furina diadema*) (Plate 10) is a small colourful snake that can be found in a range of environments. During recent surveys, they were found under logs or foraging along the ground at night. The Mainland Tiger Snake (*Notechis scutatus*) was seen twice along Settlers Road and once on the trail west of Boggy Swamp Creek in the very south-west of the study area. The Southern Death Adder (*Acanthophis antarcticus*) is known to occur in dry sclerophyll forests, woodlands and heathy environments (Swan *et al.* 2004). The species is often overlooked because their colouration is effective at camouflaging their presence. It is likely to occur in the study area in greater numbers than is currently recorded. A burrowing snake, the Eastern Bandy-bandy (*Vermicella annulata*) was recorded at three locations along Putty Road on one humid night. The Variable Black-naped



Plate 10: Red-naped Snake © Narawan Williams /DEC

Snake (*Suta spectabilis dwyeri*) was found during recent surveys sheltering during the day under a rock on a sandstone ridge off the Old Bulga Road and on Putty Road at night near Howes Valley.

Diamond Pythons (*Morelia spilota spilota*) are occasionally encountered. Surveyors have recorded this species in sheltered and gully forests including twice crossing the Putty Road. Other tree-dwelling snakes include two species from the Colubrid family. The Eastern Brown Tree Snake (*Boiga irregularis*) was recorded twice during recent surveys, once on Putty Road and once in a warm cave on the side of Settlers Road, while the Green Tree Snake (*Dendrelaphis punctulata*) has been observed during previous surveys near the northern boundary of the reserve.

Blind snakes have not been recorded in the study area for many years. Phillips (1987) recorded the Blackish Blind Snake (*Ramphotyphlops nigrescens*) further south in Yengo NP, although there is no precise location information for this sighting. The Brown-snouted Blind Snake (*Ramphotyphlops wiedii*) was recorded somewhere in the Putty Road area in 1975. The absence of recent records of Blind Snakes is unusual given the extent of suitable habitat, although drought and fires over the last few years may have had an impact on population numbers. Blind Snakes are cryptic and very difficult to detect, such that they may be more widespread than records indicate. The presence of Eastern Bandy-bandy suggests that some Blind Snakes occur, as they usually make up a significant component of the Bandy-bandy's diet.

A number of sightings of reptile species from within the reserve require further confirmation. These records are associated with a single observer and the presence of these species conflicts with findings of multiple surveyors over several years. The Trunk-climbing Cool-skink (*Pseudemoia spenceri*) is a species of cool montane environments with the closest records found over 1000 metres above sea level in Kanangra-Boyd National Park. Records of the Warm-temperate Water-skink (*Eulamprus heatwolei*) have been made by a single observer during surveys for the Little Darkey Addition on the western side of the reserve. The DEC surveys have been unable to confirm the presence of this species in either northern Yengo or north-eastern Wollemi National Parks. Surveys during the CRA in 1997 and by Kendall *et al.* (1995) did not record the water-skink species either. The Friendly Sunskink (*Lampropholis amicula*) is an interesting record that warrants further investigation. Primarily a species of the far north coast of NSW, a number of surveyors have noted that some specimens of *Lampropholis* appear closely related to this species at sites in Pokolbin State Forest, immediately to the east of the reserve (Wellington and Wells 1995). Our recent surveys noted these similarities, although identified the species as *Lampropholis delicata* based on the number of superciliary scales on the head (Cogger 1996).

3.8 FROGS

Conducting systematic surveys for frogs is restricted by the availability of suitable habitat, seasonal conditions and recent and immediate weather conditions. During the recent surveys, surveyors were fortunate to encounter some periods of warm humid weather with storms and downpours, but they were limited in number and duration. These conditions enabled the discovery of two species listed as Vulnerable under the TSC Act (1995), the Giant Burrowing Frog (*Heleioporus australiacus*) and the Red-crowned Toadlet (*Pseudophryne australis*). These two species were recorded at a few locations in the northern half of the study area. They will be discussed in more detail in Section 5.

Sixteen species of frog are known to occur within northern Yengo National Park. Of these six are of the genus *Litoria*, commonly known as tree frogs. These species are (in order of abundance) Peron's Tree Frog (*Litoria peronii*), Broad-palmed Frog (*Litoria latopalmata*), Lesueur's Frog (*Litoria lesueurii*), Green Tree Frog (*Litoria caerulea*), Keferstein's Tree Frog (*Litoria dentata*) and Eastern Dwarf Tree Frog (*Litoria fallax*). Occurring in a range of environments, they may be distinguished from other genera by the adhesive discs on their fingers and toes, webbing between their toes or by their horizontal pupils (Robinson 1993). Although a number of these species can be found long distances from water, the majority of observations are made in close proximity to permanent water sources.

By far the most frequently recorded frog is the Common Eastern Froglet (*Crinia signifera*), mostly heard calling from creeklines, swamps and roadside pools after rain. Although heard calling year round and thus easily detected, their small size and camouflaged appearance means that it is difficult to see. Another

common frog is the Banjo Frog or Bullfrog (*Limnodynastes dumerilii*). This large frog was frequently seen dispersing along trails, notably Old Bulga Road and Putty Road on humid nights after rain (Plate 11). Its distinct “banjo” like call was also heard from larger streams such as Darkey and Partridge Creeks. Both subspecies, *Limnodynastes dumerilii dumerilii* and *Limnodynastes dumerilii greyii*, were recorded along Old Bulga Road during recent DEC surveys.

Other ground frogs were recorded at much lower frequency. These include the Smooth Toadlet (*Uperoleia laevigata*), Dusky Toadlet (*U. fusca*), Bibron’s Toadlet (*Pseudophryne bibronii*), Ornate Burrowing Frog (*Limnodynastes ornatus*) and the Striped Marsh Frog (*L. peronii*). The latter species was only recorded on the eastern side of the reserve along Werong, Cody and Drews Creeks. Bibron’s Toadlets are considered to be declining in the Sydney Basin and are a species of conservation concern. A number of gullies in the central plateau support the species. It is difficult to resolve the identification of the *Uperoleia* species, yet both species continue to be recorded in the reserve.



Plate 11: Banjo Frog © Narawan Williams/DEC

One of the more interesting discoveries was that of the Great Barred Frog (*Mixophyes fasciolatus*) which was heard calling late at night in January 2005 along Darkey Creek. This species is a common resident of wet sclerophyll forests of the coastal ranges and had not previously been recorded in northern Yengo or north-eastern Wollemi National Parks. This record is one of only a few in the south-western part of the species range. The Great Barred Frog belongs to the *Mixophyes* genus, which is a group of large frogs characterised by banded legs, strongly webbed feet and vertical pupils (Robinson 1993). They are typically found in rainforest, antarctic beech or wet sclerophyll forests (Cogger 1996) and require permanent ponds or streams for breeding (Anstis 2002). The presence of the species in the reserve indicates that Putty and Howes Valleys provide significant habitat for the species, which is more typical of northern and central coastal environments. These moister habitats are likely to approach their westerly limit within Yengo as rainfall levels are lower across northern Wollemi National Park.

Although not observed during these surveys, the Littlejohn’s Tree Frog (*Litoria littlejohni*), has been recorded near Putty Creek just over one kilometre west of the reserve boundary. This species is listed as Vulnerable under the TSC Act (1995) and could possibly occur within the reserve.

3.9 INTRODUCED SPECIES

3.9.1 Introduced mammals

Ten species of introduced mammal have been recorded in northern Yengo NP. The distribution of record is shown in Map 5. Introduced predators are of particular concern because of their potential impact on native wildlife. The most frequently observed feral carnivores were the Wild Dog (*Canis lupus*) and Fox (*Vulpes vulpes*). Both animals were often recorded by scats collected along trails and tracks. Evidence of Wild Dogs was also found in more remote parts of the park when surveyors walked in to sites some distance from access roads. However, it is the perimeter of the park where these animals appear most active. Recent Dog-trapping programs in Yengo NP have been examining the level of purity of native Dingo strains in captured animals (T. Horwood pers. comm.). Preliminary results suggest that animals in remote parts of the reserve are more likely to retain higher levels of Dingo purity than animals found on the perimeter.

Predation by the Fox is listed as a Key Threatening Process under the TSC Act (1995) and as a result a Threat Abatement Plan (TAP) has been prepared to aid in managing its impacts. Predation by the Fox is a major threat to the survival of native Australian fauna, with non-flying mammals weighing between 35 and 5500 grams and ground-nesting birds at greatest risk. Fox predation has been implicated in limiting habitat choice and population size of a number of medium-sized marsupials (NSW Scientific Committee 1998a). The fact that Foxes prey upon native animals within the study area is evident from scat analysis, as summarised in Section 3.10 below. It is worth noting however that the Feral Rabbit (*Oryctolagus cuniculus*) also forms a component of Fox diet.

The Feral Cat (*Felis catus*) is extremely cryptic and very rarely recorded even where present in high numbers. Though there have been only four observations of this species, it is considered that the species is more widespread in the reserve. Feral Cats threaten native fauna by predation and are recognised as a Key Threatening Process under the TSC Act (1995). The Cat is carnivorous and capable of killing vertebrates up

to three kilograms. Preference is shown for mammals weighing less than 220 grams and birds less than 200 grams, but reptiles and amphibians are also eaten (NSW Scientific Committee 2000).

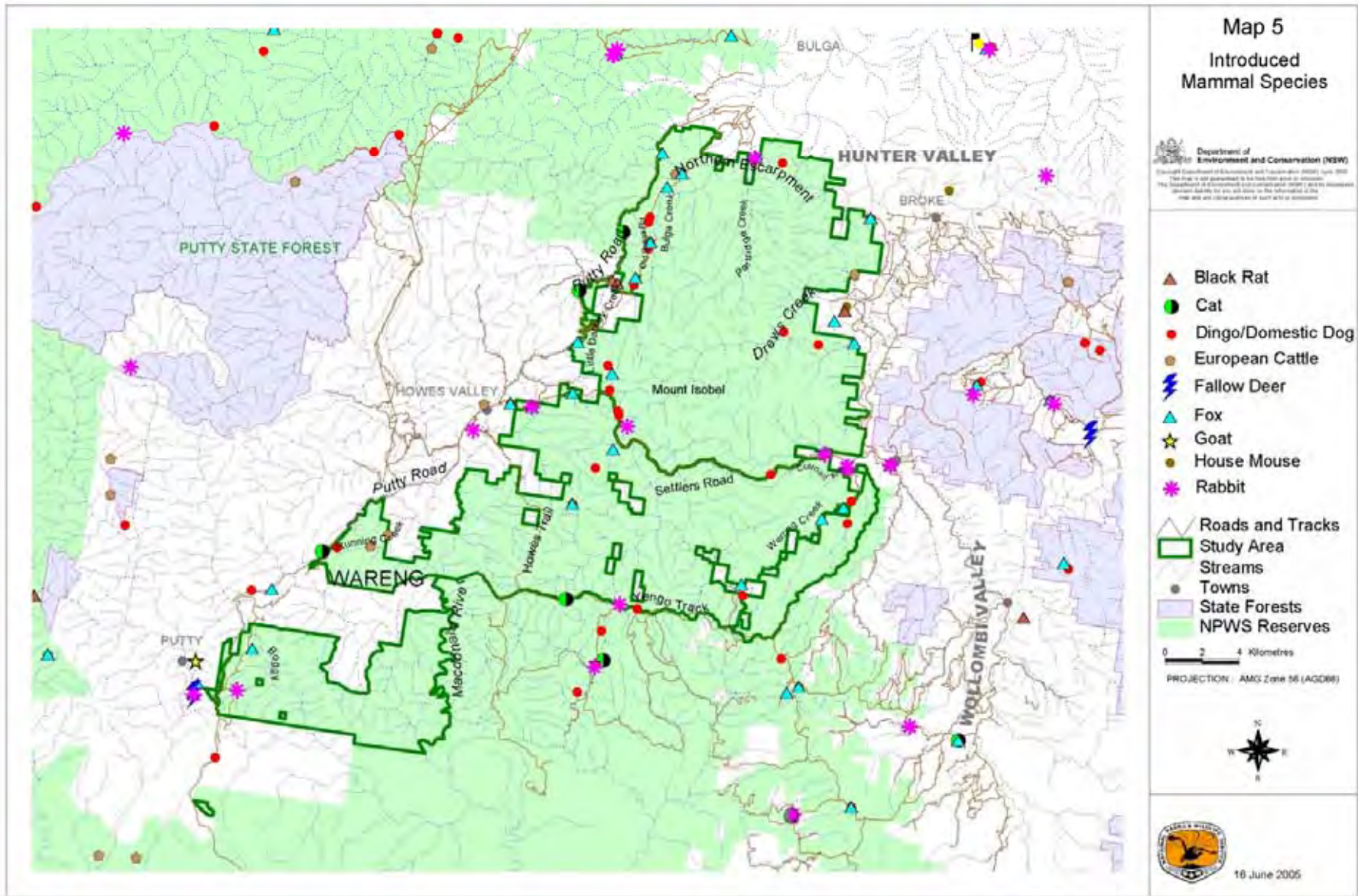
Herbivorous and omnivorous introduced mammals that have been recorded are the Feral Rabbit, European Cattle (*Bos taurus*), Black Rat (*Rattus rattus*) and House Mouse (*Mus musculus*). Feral Rabbits are prevalent in well-grassed habitats associated with farming lands, alluvial forests and richer clay soils where food sources are plentiful and soils are deep enough for burrowing. Feral Rabbits impact negatively on indigenous species via competition for resources, alteration of the structure and composition of vegetation and land degradation (NSW Scientific Committee 2002a). Competition and land degradation by Feral Rabbits is listed as a Key Threatening Process under the TSC Act (1995) as well as the federal EPBC Act (1999).

Evidence of grazing Cattle was found near Running Creek east of Putty Road, in northern Werong Creek and along Old Bulga Road. These large herbivores are capable of disturbing sensitive environments, with impacts dependent on their numbers, duration and intensity of grazing. Goats (*Capra hircus*) were not seen during recent surveys, which is a significant result, as the species competes with the endangered Brush-tailed Rock-wallaby (NSW Scientific Committee 2003a, 2004a).

3.9.2 Introduced birds

Seven introduced bird species have been recorded within or in close proximity to the boundary of northern Yengo NP. These include the Rock Dove (*Columba livia*), Eurasian Skylark (*Alauda arvensis*), House Sparrow (*Passer domesticus*), Nutmeg Mannikin (*Lonchura punctulata*), Common Myna (*Acridotheres tristis*) and Common Starling (*Sturnus vulgaris*). None of these species however have been recorded during systematic sites in the native vegetation of the reserve. They are restricted to clearings and fragmented vegetation within inholdings and adjoining valleys. However these same locations also support the suite of Declining Woodland Birds listed as threatened under the TSC Act (1995). Competition for nesting resources, predation and other forms of aggressive behaviour from introduced species are a recognised threat to many of these woodland birds (NSW Scientific Committee 2001a, 2001b, 2001c, 2001d, 2001e).

The Rock Dove and House Sparrow were noted to have increased in numbers in the Sydney Basin Bioregion between the first and second Bird Australia Atlases (Barrett *et al.* 2003). Due to their association with human settlement this increase is likely to be related to the expansion of urban development in the region. The Spotted Turtle-Dove (*Streptopelia chinensis*) was recorded at two locations at the edge of the study area in the north and south-west. This species is also commonly found around human settlement and cleared areas. As these species are restricted in their occurrence and abundance in the study area, it is considered unlikely that they impact significantly on native fauna at this stage.



Map 5: Introduced mammal records within five kilometres of northern Yengo National Park

3.10 PREDATOR SCAT ANALYSIS

The analysis of Fox and Dingo/Dog scats yields interesting information about the vertebrate prey composition of the predator's diet. In order to increase sample size and yield greater information about the predators diets, Dog and Fox scats collected from the Hunter Range area of both Wollemi and Yengo National Parks have been pooled and analysed together (Figure 2). Only limited conclusions can be drawn from these results due to the low number of scats analysed and the different length of time it takes to digest different-sized prey animals. Swamp Wallabies, for example, may be over-represented in the sample due to their large size. It is clear, however that a mix of native and introduced ground and arboreal mammals are taken.

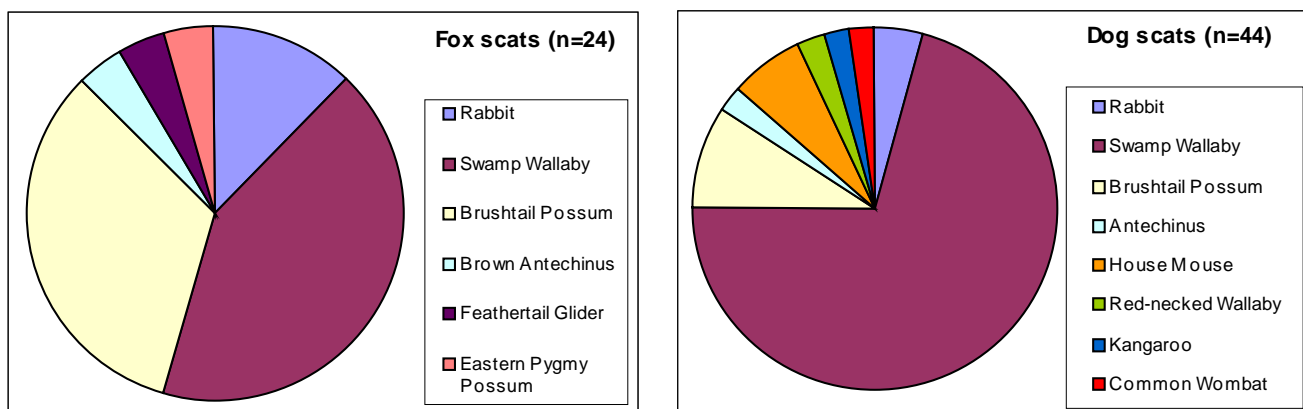


Figure 2: Vertebrate prey items (hair and skeletal remains) identified from predator scats collected in Wollemi and Yengo National Parks (Hunter Range Area)

3.11 LANDSCAPE SCALE PATTERNS IN FAUNA DISTRIBUTION

Yengo National Park is bordered to the north by the broad undulating expanse of the Hunter Valley, which is characterised by grassy woodlands and sclerophyll forests. The valley exerts considerable influence on the fauna composition of northern Yengo NP, as it marks a convergence between the drier environments of the western slopes of NSW and the moister east coast. Northern Yengo NP, like Wollemi and Goulburn River National Parks, straddles these gradual changes and as a result reveals an interesting mix of species. The bird assemblages illustrate these trends. On the perimeter of the park, in the network of remnant and contiguous vegetation cover that forms the lower escarpment footslopes and major valley floors, as well as on residual shale caps along Old Bulga Road, a suite of threatened bird species known as the Declining Woodland Birds are often observed. Species such as the Speckled Warbler, Diamond Firetail, Brown Treecreeper and Black-chinned Honeyeater are birds that are closely tied to these habitats and are more often found in central western NSW.

Some species of reptile also share this pattern. The Leaden Delma, South-eastern Morethia Skink, the South-eastern Slider and Tree-crevice Skink are species that are more common and abundant in western NSW. These reptiles are sparse or not present further east in the hinterland environments of the southern Hunter region, as the climate is likely to be too moist and warm. Some reptile and frog species also indicate that some of the habitats in northern Yengo NP are suitable for species that prefer the warmer moister climates of the north coast. The Pink-tongued Skink and Robust Velvet Gecko are two species that approach their southern limit in the reserve. Complimenting these findings was the discovery of the Great-Barred Frog along the Putty Road, a species best known from the wet sclerophyll forests and rainforests of north-eastern NSW.

Interestingly the bat fauna found in Yengo NP did not include species typical of western environments such as the Inland Broad-nosed bat and the Greater Long-eared Bat. This was unusual as similar vegetation in adjoining northern Wollemi NP supported reasonable numbers of these species (DEC 2005b).

These patterns illustrate that the Hunter Valley and adjoining tributaries facilitate movement between eastern and western environments during seasonal migrations. They are also likely to promote less immediate movement patterns for species that are either expanding or contracting in range. It may be that the major valley systems that are traced by the Putty Road and adjoining creek systems are pathways for movement between regions, both in the evolutionary history of species and in current habitat occupation.

To the south, the sandstone geology characterises the landscape of northern Yengo NP. The sandstone has eroded to form a complex mosaic of crests, hills, gullies and benches. Impoverished skeletal sandstone soils found on ridges and slopes support sclerophyllous woodlands and forests that fall within the Sydney Hinterland Dry Sclerophyll Forests statewide vegetation classification (Keith 2004). These communities are low forests and woodlands between ten to twenty-five metres in height with a shrubby understorey, and are often marked by outcrops and benches of sandstone rock. Fauna species found in these environments are closely tied to the profusely flowering shrubs and shelter provided by the rock outcropping. Honeyeater species are common, such as the Yellow-faced Honeyeater, Eastern Spinebill, Noisy Friarbird and White-cheeked Honeyeater. Other common birds include the White-throated Treecreeper and Grey Fantail. Reptile species vary dependent on the type of microhabitat present at a site. Rocky outcrops on slopes and ridgetops are home to the Copper-tailed Skink, Lesueur's Velvet Gecko and White's Rock Skink. The Common Brushtail Possum is the only arboreal mammal that is regularly found on ridgetops.

Gully systems are narrow and regularly show evidence that they are affected by fire. When combined with low rainfall and infertile soils, mesic shrubs and rainforests find it difficult to tolerate such conditions, and only hardy species such as Grey Myrtle survive. As a result, fauna species that are dependent on a complex mesic habitat for cover and food resources are sparsely distributed and uncommon. The single record for the Sooty Owl is evidence of the absence of this moist habitat, and as this species is a top-order predator, it is likely to reflect similar abundance for its moist forest and rainforest prey species. The fauna of the gullies is mostly typical of sandstone hinterland gully forests. Bird species such as the Lewin's Honeyeater, Eastern Whipbird, Golden Whistler and Black-faced Monarch are often present, with Yellow-throated Scrubwren and Bassian Thrush occasionally recorded in rainforest sites. Tall eucalypt gully forests support Yellow-bellied Gliders wherever Grey Gums are included in the canopy, and Greater Gliders are more common in unlogged tall forests. Reptile fauna is of low diversity and abundance as gully forests present few basking opportunities. Only the Eastern Water-skink and Eastern Water Dragon are encountered. At night, frogs dependent on flowing water are sometimes heard and observed. Species such as Lesueur's Tree Frog, Broad-palmed Frog and Peron's Tree Frog are common in the gullies of the Sydney region.

4 MANAGEMENT RECOMMENDATIONS

4.1 AREAS OF HIGH CONSERVATION SIGNIFICANCE

4.1.1 Known localities of the Barking Owl

Surveys completed for this project have indicated that the dry woodlands of the Hunter Valley Escarpment are of considerable regional importance for this rare owl. As the majority of preferred habitat for this species is not currently reserved or protected, it is paramount that where territories are known on reserves, caution be exercised to ensure that they are not inadvertently modified in a manner that negatively impacts on the owl. There are five records of Barking Owl in northern Yengo National Park, three in relatively close vicinity to each other on the Yengo Track, one near Boggy Swamp Creek and one on the Southern Link Trail (Map 8). The territories of these owls are likely to be complex, probably extending linearly along creeklines (where prey availability is high) or along park boundaries where preferred habitat occurs. Since the exact territories cannot be determined without detailed study, a simplified approach for management purposes may be adopted, consisting of delineating a two kilometre radius around known records. Though this distance is somewhat nominal, it is likely to include the core habitat areas of these individual owls.

- Any park management activities conducted within a two kilometre radius of a known Barking Owl location should critically appraise potential impacts on the species roosting and nesting requirements.
- In the case of hazard reduction burning, creeklines within the designated burn area should be traversed to identify potential nest or roost sites, often indicated by wash on ground, litter or tree trunks. If nest or roost sites are located, the fire boundaries should be amended accordingly to exclude these sites. Hollow-bearing trees should be carefully protected from hot fires. Alternatively, hazard reduction burns should be excluded from known Barking Owl territories altogether.

4.1.2 Brush-tailed Rock-wallaby colonies

Northern Yengo National Park is well known for the significance of its Brush-tailed Rock-wallaby population(s) and habitat. The two largest colonies in the northern part of the reserve are 'Drews Creek' and 'Portion 78' in the very north-west. These locations, together with records of the species elsewhere in the park hold very high conservation significance and should continue to be the subject of research into Fox control as part of the statewide Fox Threat Abatement Plan, as well as further monitoring and research. It is noteworthy that during a visit to northern Yengo NP in February 2006, two Foxes were seen during the daytime in the Drews Creek area, one in Vault Creek and one in an un-named creek to the south. This suggests that Foxes remain abundant in the area, despite the ongoing Fox control program.

4.1.3 Permian escarpment and residual shale caps on Old Bulga Road

The northern escarpment slopes are comprised of Permian sediments that erode to higher fertility soil than the sandstone plateau. The vegetation here is an open woodland, with Narrow-leaved Ironbark, Grey Box and Grey Gum being the dominant eucalypts. Patches of higher fertility soils are also scattered through the northern half of the reserve where shale capping occurs on top of the Narrabeen Sandstone. These areas, prevalent along Old Bulga Road, support grassy Box woodlands. Both of these habitat types have conservation significance, as they remain poorly reserved within the Hunter Range area. A large number of threatened species depend upon such habitats, including Turquoise Parrot, Brown Treecreeper, Speckled Warbler, Black-chinned Honeyeater and Grey-crowned Babbler. Similar habitats also occur just outside the boundary of the reserve on lower slopes of the northern escarpment and in gully lines such as Bulga, Partridge and Drews Creeks. These latter areas are of high conservation priority, yet remain unreserved and subject to a number of threatening processes.

4.2 RECOVERY PLAN ACTIONS

There are a number of recovery plans for species that occur within the study area that have been approved by the Minister or are in final draft stages. The threats and recovery actions outlined in these plans that are relevant to the study area are discussed below.

4.2.1 Large Forest Owls

None of the recovery actions outlined in the Draft Recovery Plan for Large Forest Owls provide specific management recommendations for immediate on ground implementation in Wollemi National Park. Of the

listed threats to the species, fire is the most relevant to north-eastern Wollemi National Park, together with previous logging activities along some creeklines. In light of this, it is recommended that:

- Too frequent hazard reduction burning, using low intensity fire with short burn intervals, not be undertaken within known Powerful Owl or Sooty Owl territories.
- A mosaic pattern be used when fuel reduction burns are undertaken. This will ensure that sufficient refugia are left unburnt, particularly along creek lines and gorges for Powerful and Sooty Owls, while a mix of burnt-unburnt patches contributes to the vegetation structural diversity required for Masked Owls.
- Hollow-bearing trees, both living and dead, be retained, even in semi-cleared country at the park boundary. Furthermore, mature trees should be allowed to develop along creeklines that have previously been logged, in order to provide further nesting and roosting opportunities for the Large Forest Owls in the long term, as well as den sites for prey species.

4.2.2 Barking Owl

Of the threats listed to the Barking Owl in the Draft Recovery Plan, the most relevant are likely to be predation on fledglings by Cats and Foxes, and potentially occupation of hollows by feral Honey Bees (NPWS 2003a). These threats are poorly understood, however, and further research is required before specific management recommendations can be made. The recommended management of threats posed by fire is outlined in section 4.1.1 above.

4.2.3 Koala

The Draft Recovery Plan for the Koala (NPWS 2003d) indicates that many remaining Koala populations on the ranges of the Sydney Basin occupy secondary class habitat. Available data indicate that the Koala occurs in very low densities in the northern escarpment, with higher levels of activity in the vicinity of Yengo Track in the Werong Creek area. In Yengo NP the key habitats are those where Grey Gum is in abundance in the canopy, particularly in areas enriched by shale lenses in the sandstone bedrock. Research into Koala populations in the Greater Southern Sydney Region has revealed the species to be most common in forests on higher fertility soils (DEC 2005a). The pattern of Koala occurrence in Yengo NP indicates a similar trend. Areas of richer soils often support Forest Red Gum, another preferred feed tree for the Koala. Of the threats listed to the Koala in the Draft Recovery Plan, the most relevant to Yengo NP is related to fire. Predation by Dogs may also be a threat, however Koala remains were not located in any of the 44 Dog scats collected in the region during the DEC surveys. Koalas are known to survive extensive and intense wildfires (K. Madden pers. obs. in DEC 2004b), but are threatened in areas where no refugia persist. In Yengo National Park there are considerable refuge areas in the gullies, which Koalas may retreat to.

The Draft Recovery Plan highlights a number of generic recommendations to managing threats to the Koala on reserved lands. In summary these are:

- That fire be excluded, where possible, from areas known to contain Koalas.
- That mosaic patterns be used in fuel reduction burns to ensure refuges of unburnt habitat are always available. Such burns should be carried out outside the spring-summer period when Koalas are breeding and most likely to be on the ground and therefore vulnerable to fire. Burns should avoid crown scorch and crown burns.
- Preferred feed trees not be felled during mop-up operations in areas known to be used by Koalas, or during the construction of fire breaks and fire trails.

4.2.4 Yellow-bellied Glider

Recent surveys for the Yellow-bellied Glider have significantly expanded knowledge on the species distribution in the Sydney Basin reserve system, indicating it is more common than once considered. Surveys in Wollemi and Yengo National Parks have indicated that the tall forests in sandstone gullies and gorges represent high quality habitat for the Yellow-bellied Glider. These distribution trends are not recognised by the current Recovery Plan for the species (NPWS 2003e). The preferred sap feed tree across the Sydney Basin is the Grey Gum (*E. punctata*), which is widespread in northern Yengo National Park.

Of the threats listed to the Yellow-bellied Glider in the Recovery Plan, the most relevant to northern Yengo National Park is related to fire. The recovery plan indicates that there are no known studies on the impact of wildfire on the Yellow-bellied Glider. It is likely that as long as wildfire and hazard reduction burning events leave a natural mosaic of varying burn intensities across the landscape, with unburnt refugia in incised gorges, the Yellow-bellied Glider is unlikely to be threatened on a landscape scale.

4.2.5 Brush-tailed Rock-wallaby

Of the threats listed to the Brush-tailed Rock-wallaby in the Draft Recovery Plan, the most relevant to northern Yengo National Park are likely to be predation by the Red Fox and aspects relating to fire regimes (DEC 2005j). Very hot widespread fires may adversely affect the species by preventing their escape, while frequent burning may change vegetation structure and characteristics at refuge and foraging sites (DEC 2005j). The plan acknowledges, however that the threatening processes affecting Brush-tailed Rock-wallabies are poorly understood, multi-level, usually inter-related and the inter-relationships are often complex. Until a better understanding of the threatening processes of the Brush-tailed Rock-wallaby is gained, the control of threatening processes will continue to be problematic.

Specific on-ground management recommendations for the Brush-tailed Rock-wallaby cannot be provided at this stage. Instead, the following guidelines should be followed:

- That management of the Brush-tailed Rock-wallaby sites is coordinated with management of the species across the state. The key to this will be to maintain regular communications with the NSW Brush-tailed Rock-wallaby recovery team.
- That the Fox TAP program continues to be implemented and eventually guides Fox control programs.
- That hot wildfires be prevented from entering known Brush-tailed Rock-wallaby colonies when possible.
- That monitoring of known locations and further investigation into recently discovered locations be continued, as outlined below.

4.3 FIRE AND BIODIVERSITY

4.3.1 Lessons so far from the Woronora Plateau post-fire fauna study

The impact of controlled burning and wildfire on fauna is poorly understood. Research currently being undertaken by DEC (2004c) is one of very few studies to offer a comparison of fauna composition between long unburnt vegetation and vegetation that has undergone an extensive and severe wildfire. Even fewer studies have examined the impacts of frequent burning on the suite of fauna in an ecosystem; more often fire impact studies have been species specific.

The study (DEC 2004c) on the Woronora Plateau in the south of Sydney is the most relevant guide to the impact of extensive and severe wildfire on fauna in northern Yengo National Park. Both areas are characterised by dry sandstone woodlands and forests and while rainfall levels differ substantially, there is considerable species overlap for many of the fauna groups. It is not unreasonable to hypothesise that the fauna of Yengo National Park would respond to fire in similar as that on the Woronora Plateau. The following discussion summarises current findings of the Woronora Plateau study.

The Woronora Plateau study has found that the impacts of wildfire depend on the intensity of the fire. High intensity fire has had a much more dramatic impact on species abundance than has low or moderate intensity fire. Arboreal mammal abundance was found to be greatly reduced in areas of high intensity fire. In northern Yengo NP, the Squirrel Glider, Yellow-bellied Glider, Eastern Pygmy-possum and Koala are threatened species at risk from high intensity fires. Results are unambiguous for arboreal mammals with small home ranges such as the Greater Glider. Unburnt forests were shown to have ten times the number of Greater Gliders than forests burnt by high intensity fire. Squirrel Gliders and Eastern Pygmy-possums have similarly small home ranges and are therefore vulnerable to extirpation during such fire events. Koalas are more mobile and while high intensity fire is recognised as a major threat they are known to have survived such conflagrations. Such is the case in Avon Catchment (DEC 2004c), Nattai National Park (DEC 2004a), Campbelltown and Yengo (NPWS 2003d).

The richness and diversity of bird assemblages are significantly reduced in sandstone woodlands following high intensity fire. Honeyeaters are one group of birds that were shown to suffer greatly reduced numbers in the Woronora study. The consumption of the shrub layer during fire removes the primary source of food and cover. Composition of post fire environments was shown to preference canopy-using bird species.

Loss of key habitat resulted in similar downturns in the richness and diversity of reptile species in sandstone woodlands. Most affected were litter-dwelling skinks while those associated with rocky habitats were less affected though still suffered reduced numbers.

The study is also showing that the recovery of fauna populations to pre-fire levels takes considerable time. There is evidence of only slow increases in abundance of some species even at three years after fire. Such a trend reinforces that subsequent fires within this time are likely to suppress an already reduced fauna population.

The study reveals that while the impacts of the high intensity of fire have been catastrophic in the short term and at a small scale, there has been no recorded loss of species from the Woronora Plateau as a result. This is because there is a mosaic of burn intensities within the study area, with some areas remaining lightly burnt or unburnt. These areas are most likely to act as refugia in which species will survive and from which species will in time recolonise the intensely burnt environments. Subsequent fires that burn unburnt areas after only short fire intervals are likely to severely affect local population numbers.

Research into the impacts of fire on fauna on the Woronora Plateau will continue until five years after the wildfire event (summer 2006-7). A final report detailing findings will then be produced. This report is likely to include key findings that are directly relevant to northern Yengo National Park and may assist in the formation of fire management strategies that maximise fauna diversity in the park.

4.3.2 Recommendations for fire management

Understanding and managing the impacts of fire in high fire frequency environments such as Yengo NP would be aided by fire intensity mapping and the delineation of sensitive fauna habitats. At present there is no information to guide reserve managers as to the degree to which vegetation cover has been burnt. Additionally there is no way of defining the impacts of fire intensity on particular habitats. Currently available vegetation community mapping (Bell 1998) is too coarse and inaccurate for this purpose. As a result we recommend that:

- Fire intensity mapping be carried out following all major wildfire events.
- Detailed vegetation mapping be undertaken across north-eastern Wollemi National Park to enable clearer delineation of fire sensitive fauna habitats and vegetation communities.

In the mean time, the following generic recommendations for fire management in relation to fauna are made:

- Fire management should aim for a mosaic of fire regimes.
- Mosaic burning should retain examples of all fauna habitats in a long unburnt state.
- Fire planning should recognise the immensely important role of unburnt refugia in the recolonisation of burnt landscapes, particularly after extensive and intense wildfire.
- Unburnt refugia should remain completely unburnt for more than four years following extensive and intense wildfire.

A number of threatened species warrant particular consideration when planning hazard reduction burns and when attempting to control wildfires. These species include the Brush-tailed Rock-wallaby, Barking Owl and Koala.

4.4 PEST SPECIES AND BIODIVERSITY

Three of the introduced species known to occur within northern Yengo National Park are listed as a Key Threatening Process as follows: predation by the Red Fox; predation by the Feral Cat; competition and grazing by Feral Rabbits. Of these, predation by the Red Fox is likely to be having the most significant impact on threatened species in the study area. The impact of Feral Cats is largely unknown, as though the species has only been observed on four occasions, its elusive nature may simply mean that it goes largely undetected. The preferred habitat of Rabbits is highly localised and there is little potential for expansion of the species current locations in the park. They are no threatened fauna species populations that appear to be threatened by this pest, and thus control of Rabbits is currently of low priority. Though not listed as a Key Threatening Process, Wild Dogs pose a significant threat to native fauna through predation and are listed as a pest under the Rural Lands Protection Act (1998). Control of Wild Dogs is currently considered second in priority to Fox control in the study area.

In order to help guide feral animal control programs, the following is noted:

- The threatened species considered most sensitive to Fox predation are the Brush-tailed Rock-wallaby and Spotted-tailed Quoll and to a lesser extent the Speckled Warbler, Diamond Firetail, Koala, Squirrel Glider and Yellow-bellied Glider. Impacts of Foxes on other threatened species are considered to be low (NPWS 2001a).
- It is unlikely that Foxes can be removed from the study area entirely, so control programs should be centred around priority sites or habitats that will achieve the maximum benefit for biodiversity. Control of Foxes, with regards to their impacts on biodiversity, should be focussed on the areas of high

conservation significance listed in section 4.1 as well as known locations of the above threatened species.

- Control of Foxes is most important in the first few years following fire when the ground layer is open providing little refuge for ground-dwelling mammals and birds.
- The foraging efficiency of Foxes seems to be maximal in open habitats where they are able to range widely and freely (Environment Australia 1999). They readily use roads, tracks and other cleared access ways through denser vegetation or complex topography. One option to minimise Fox impacts on threatened species is to reduce such access points to a minimum and to maintain bait stations along those access paths which are retained (Environment Australia 1999).
- Priorities for Wild Dog control, with regards to their impacts on biodiversity, are known locations of Koala and Brush-tailed Rock-wallaby.
- Control of Cats is very difficult and at present there are no particular sites that require attention. Further survey into the abundance and distribution of Cats in the area is recommended. Following this, if deemed necessary, control should be considered in the vicinity of records and habitat of Giant Burrowing Frog, Hooded Robin, Grey-crowned Babbler, Diamond Firetail, Speckled Warbler, Spotted-tailed Quoll, Eastern Pygmy-possum and Squirrel Glider.
- Any control programs must consider the impacts that baiting or removal of feral animals from the system are likely to have, and take this into account before going ahead with broad-scale control measures. For example, Dog baiting can have an adverse impact by serving to increase Fox populations and endangering Dingo populations, while evidence collected elsewhere suggests that both Fox and Dog baiting can have an adverse impact on Quoll populations (Belcher 2004).
- The use of 1080 baiting in areas where Quolls are known should be very carefully considered. Burying baits deeper than seven centimetres below the ground surface (rather than burying them in raised mounds) will decrease the number of baits removed by Quolls (Glen and Dickman 2003).
- The impact of Fox or Dog removal should be monitored and used to guide further management actions. Baiting (particularly aerial baiting) within the remote sections of the centre of the park should be avoided until research on the heritage of Dogs/Dingoes is completed. Findings of the research within Yengo National Park to date has indicated that hybrid Dogs are most concentrated around the perimeter of the park while dogs in the core of the park have a very high degree of Dingo heritage (T. Horwood pers. comm.).

4.5 TREE HOLLOW MANAGEMENT

A large proportion of the fauna species known to occur within northern Yengo NP utilise tree hollows for shelter, roosting, nesting and/or breeding. As the park comprises a massive area of multi-aged forests and woodlands, suitable tree hollows are widespread and abundant throughout the large majority of the park. A complex mosaic of tree ages occurs across the landscape, due to the activity of numerous processes, such as fire and erosion, over hundreds of years. Due to the nature of the landscape, much of the park has avoided the impacts of modern human disturbance, and where human disturbance has occurred, it is highly localised and has usually affected particular communities rather than the park as a whole. In addition, the geomorphology of the region provides a complex array of caves, rock fissures and outcrops, which provide an alternative sheltering resource for numerous fauna species. Consequently, sheltering resources are not limited throughout most of the park, and hence do not require any specific management actions, provided that a mosaic approach to forest management is retained, as described in previous sections of this report.

The majority of human disturbance to northern Yengo NP has occurred near the periphery of the park within vegetation communities closely associated with past or present agricultural activities or timber extraction. There are three main habitat types that have been disturbed by clearing, logging or thinning: the Red Gum dominated woodlands on flats at the western boundary of the park; the Box and Box-Grey Gum-Ironbark woodlands along the northern escarpment and on enriched soils such as around Mount Wareng and on Old Bulga Road; and the Blue Gum forests in accessible gully systems, particularly in Drews Creek Catchment and off Settlers Road. This logging has reduced the diversity of tree ages and the number of large trees, and hence limited the number of tree hollows available to fauna, in these habitats. The first two of these habitat types are of high conservation significance as they provide habitat to numerous threatened fauna species. Hollow-dependent species occurring within these habitats include the Squirrel Glider, Powerful Owl, Barking Owl, Masked Owl, Turquoise Parrot and Brown Treecreeper. The Blue Gum forests are a lower priority as in most cases only Sydney Blue Gum has been logged and large remnant Mountain Blue Gum trees remain. Furthermore, large tracts of Blue Gum forest remain unlogged within inaccessible gully

systems in more remote sections of the park. Never-the-less all three of these habitat types would benefit from being allowed to mature and develop a complexity of tree age classes over the coming decades.

The restricted availability of sheltering resources within the Red Gum and Box-Ironbark woodlands on both sides of the northern and western boundaries of the park necessitates the implementation of management actions that ensure the re-development of tree-hollow resources over the long term. In light of this it should be recognised that:

- Large remnant hollow bearing trees are vitally important in the disturbed forests and woodlands on the northern and north-western boundaries of the park and on Old Bulga Road, as they often provide the only shelter resource available to hollow-dependent threatened species in these habitats. Hence these large remnant trees should be retained at all costs, whether they occur alone or in a remnant patch, and whether on or off park.
- Retention of tree hollow resources in the above areas will require a cooperative approach between DEC and private land owners, as much of the high conservation value habitat occurs off reserve.
- Fire is an important contributor to hollow formation. While the perpetuity of hollows is dependent on a disturbance regime that promotes mortality and regeneration, too frequent fires can cause an area to be depleted of hollows, particularly when the area has previously been logged (Gibbons and Lindenmeyer, 2002). The mosaic burning pattern that occurs across the majority of the park preserves unburnt refugia and enables a balance between hollow destruction, preservation and formation. However the situation in the disturbed woodlands on the northern and western boundaries of the park is more fragile, and the area is more prone to hollow reduction by frequent fire. Measures that reduce the frequency of high intensity fires over short time intervals within these areas are therefore warranted.

4.6 OFF-RESERVE CONSERVATION AND LAND ACQUISITIONS

4.6.1 Additions to northern Yengo National Park

Opportunities for additions to northern Yengo National Park arise as in-holdings and parcels of land adjoining the park become available on an opportunistic basis. Choosing which areas to add to the reserve requires a consideration of operational issues (such as maintenance costs, access and fire management) as well as the biodiversity values of the land.

Data collected during recent DEC surveys in the Hunter Range area indicate that there are a number of threatened species that remain poorly conserved in the region, and whose habitats continue to be exposed to threatening processes such as land clearance. The study has shown that a number of threatened species occur on either side of the margins of Yengo National Park, in areas of higher fertility along the northern and western escarpment slopes and lower footslopes adjoining valley flats. In particular, such areas support good numbers of Declining Woodland Bird species. Protection of these habitats through acquisition or negotiated conservation agreements with private landowners should be a priority. Given limited resources reservation of these fauna habitats would provide far greater benefit to threatened species and vertebrate diversity in the study area than the acquisition of additional sandstone areas. Examples of high value sites lie on the northern perimeter, along the escarpments and gullies that include Bulga, Partridge and Drews Creeks.

Reserve additions and conservation agreements should also be prioritised to areas that include confirmed populations of the Squirrel Glider, Barking Owl, Masked Owl or Brush-tailed Rock-wallaby.

4.6.2 Conservation on private lands adjacent to the park

Private lands adjacent to the northern escarpment that support Box-Grey Gum-Ironbark vegetation, or creek flats and riparian systems with intact vegetation, play an important role in the ongoing conservation of threatened species in the area. For this reason, landholders should be encouraged to minimise the undertaking of activities that would decrease the value of these habitats to native fauna. It is recommended that a program be launched across the Hunter Range area to educate neighbours of the importance of these habitats and encourage them to undertake the following.

- Prevent the progress of relevant Key Threatening Processes. This entails in situ retention of fallen wood, dead trees and bushrock, as well as the avoidance of any clearance of native vegetation. In particular, all large trees, whether living or dead, isolated or connected to other vegetation, should be retained as they are likely to provide vital hollow resources. Key feed tree species should also be retained where possible, such as Mugga Ironbark and Yellow Box for the Regent Honeyeater.
- Avoid activities that alter the structure of the vegetation, such as frequent burning and over-grazing.

- Avoid the plantation of invasive exotic plant species, particularly exotic grasses. These have the potential to invade key habitats and reduce their value to numerous threatened species, particularly the Diamond Firetail and the Speckled Warbler.

4.6.3 Co-operative pest management

Control of pests in the study area will not be successful without the adoption of a cooperative landscape-based approach. Baiting on individual tenures will only provide short-term success due to the high mobility of Foxes and the potential of rapid re-invasion. It is strongly recommended that a cooperative targeted pest management program be developed for the catchments that feed into the study area, across all land tenures including private lands, Crown Lands, State Forests and National Parks.

4.7 FURTHER SURVEY

There is now comprehensive documentation of the fauna characteristics of northern Yengo National Park. While additional survey is warranted for some fauna groups and in inaccessible parts of the northern plateau, priority lies in developing information systems that help guide the assessment of wildfire on sensitive fauna habitats.

Fire intensity and detailed vegetation mapping

We recommend that fire intensity mapping be included as a fundamental information resource for park managers. This data should be supplemented by detailed and accurate delineation of vegetation communities from which fauna habitat maps can be derived. Without this information there is no method through which to transparently estimate the impacts of fire on threatened fauna. Nor is it possible to make reliable estimates of populations of the most sensitive species.

Further frog and small terrestrial mammal surveys

The drought of recent years has precluded an understanding of the distribution and abundance of both the Giant Burrowing Frog and the Red-crowned Toadlet. Small terrestrial mammals are not well surveyed, as survey for them is labour intensive, costly and often yields few valuable data from which to guide management planning. However, the absence of such survey means species such as the Spotted-tailed Quoll, Long-nosed Potoroo and Eastern Pygmy-possum may be overlooked.

Fauna survey of remote sections of the park

The ridges and gullies of the ranges north of Settlers Road are inaccessible to fauna survey teams without the use of helicopters. This is a significant gap in the coverage of fauna survey effort in northern Yengo NP. Additional surveys in this area are likely to assist in providing an improved understanding of distribution trends for some threatened fauna species that are associated with sandstone habitats.

5 THREATENED SPECIES PROFILES

Thirty-one threatened fauna species are known to occur in northern Yengo NP. This section provides a profile of each of these threatened fauna species, together with one additional threatened species recorded within five kilometres of the park and considered likely to occur in the study area. The aim of these profiles is to provide: a background on the species biology; a summary of threats to the species; an assessment of how well the species is protected in the region; a map of known records of the species in the study area and the surrounding five kilometres; and an appraisal of the distribution and status of the species in northern Yengo NP and the surrounding area.

The list of threatened vertebrate fauna for the study area contains records of various levels of reliability. For this reason, a species profile has not been generated for all of the threatened species listed on the DEC Atlas of NSW Wildlife as occurring within the area (DEC 2005d). Only species that have been directly and reliably observed within the study area since 1950, or have been recorded on the Atlas of NSW Wildlife within two kilometres and considered likely to occur within the area, have been afforded a species profile. Table 4 presents all of the threatened species recorded on the Atlas of NSW Wildlife within five kilometres of northern Yengo NP, together with annotation for each species regarding the latest record, reliability of identification and a rationale for the generation of a species profile.

Scientific name	Common name	Status in NSW (TSC Act 1995)	Status in Australia (EPBC Act 1999)	No. of locations within study area ¹		No. of locations within a five kilometre radius of study area	Notes on reliability and date of last record	Species profile generated?
				DEC ²	Other ³			
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	2	0	1	Observed during recent DEC surveys in November 2004 on Old Bulga Road and Partridge Creek	Y
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V		4	0	0	Recorded January 2005, Old Bulga Rd during recent DEC surveys	Y
<i>Litoria littlejohnii</i>	Littlejohn's Tree Frog	V		0	0	1	Heard during CRA surveys in 1997 west of the park near Putty	N
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V		1	0	0	Seen during DEC vegetation surveys in February 2006	Y
<i>Ixobrychus flavicollis</i>	Black Bittern	V		1	1	0	Observed by DEC in February 2005 in Drews Creek	Y
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V		45	6	28	Regularly observed within the study area, most recently by DEC in May 2005	Y
<i>Calyptorhynchus lathamii</i>	Glossy Black-cockatoo	V		23	6	20	Regularly observed in the study area most recently during DEC surveys	Y
<i>Neophema pulchella</i>	Turquoise Parrot	V		1	3	2	Observed by DEC in January 2005 along Old Bulga Road	Y
<i>Ninox connivens</i>	Barking Owl	V		6	0	4	Most recently observed by DEC in February 2006	Y
<i>Ninox strenua</i>	Powerful Owl	V		6	1	3	Three locations during recent DEC surveys in April/May 2005	Y
<i>Tyto novaehollandiae</i>	Masked Owl	V		1	0	1	Heard only once in study area during CRA surveys in 1997	Y
<i>Tyto tenebricosa</i>	Sooty Owl	V		1	0	0	Only one record in study area, heard in March 1997, during CRA surveys	Y
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subsp.)	V		1	2	4	Most recent record near Running Creek in south-west, January 2005	Y
<i>Pyrholaemus sagittatus</i>	Speckled Warbler	V		7	4	21	Mostly located near edge of reserve, recorded at nine locations during recent DEC surveys 2005	Y

Scientific name	Common name	Status in NSW (TSC Act 1995)	Status in Australia (EPBC Act 1999)	No. of locations within study area ¹		No. of locations within a five kilometre radius of study area	Notes on reliability and date of last record	Species profile generated?
				DEC ²	Other ³			
<i>Grantiella picta</i>	Painted Honeyeater	V		0	0	3	Not recorded in the reserve, most recent record in 1992 on Milbrodale Rd five kilometres to the north	N
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subsp.)	V		5	0	0	Only recorded during recent DEC Surveys in 2005, Old Bulga Road and Partridge Creek	Y
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E	E	0	2	10	Last recorded in July 1999 near Putty	Y
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern subsp.)	V		0	1	0	Record not spatially accurate (Birds Atlas 1). Not likely to be found within the reserve although likely on adjoining cleared lands	N
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subsp.)	V		1	5	12	One individual recorded during recent surveys in January 2005 near Werong Creek, though mostly known from Hunter Valley	Y
<i>Stagonopleura guttata</i>	Diamond Firetail	V		0	2	3	Recent DEC surveys recorded this species in January 2005, near Partridge creek	Y
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	0	0	2	Probable hair sample taken from Cutroad Arm Creek during recent DEC survey though no individual has been observed in the reserve. Most recent observation has been in 2005 near Thompsons Road near Bulga in 2005	Y
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V		0	0	1	Recorded near Broke in 2001 not recorded during current surveys. Habitat unlikely.	N
<i>Phascolarctos cinereus</i>	Koala	V		6	6	14	Well known from northern Yengo NP. Recently recorded during DEC surveys in 2005 along Old Bulga Road and Yengo Track	Y
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V		1	0	0	Single record from predator scat during recent DEC surveys	Y
<i>Petaurus australis</i>	Yellow-bellied Glider	V		30	0	15	Regularly observed and heard. Extensively recorded during recent DEC surveys	Y
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		4	1	0	Found on western side of the reserve during recent DEC surveys in 2005	Y

Scientific name	Common name	Status in NSW (TSC Act 1995)	Status in Australia (EPBC Act 1999)	No. of locations within study area ¹		No. of locations within a five kilometre radius of study area	Notes on reliability and date of last record	Species profile generated?
				DEC ²	Other ³			
<i>Macropus parma</i>	Parma Wallaby	V		0	1	0	Definite identification of hair by Barbara Triggs, found in Little Darkey Addition March 2002. Habitat seems unlikely and record is significantly outside range of known distribution.	N
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	0	9	5	Two well known colonies on the northern escarpment. Actively managed under Fox TAP.	Y
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	7	0	2	First recorded by recent DEC surveys 2005.	Y
<i>Mormopterus norfolkensis</i>	East-coast Freetail-bat	V		2	1	2	Two records from ultrasonic call during recent DEC surveys. Has been caught in harp traps during CRA in 1997.	Y
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	14	2	0	Numerous new locations during recent DEC Surveys	Y
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		5	0	1	Status uncertain. Has only been recorded on anabat with varying degrees of call identification reliability	Y
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V		2	0	2	Recorded on anabat in the reserve at two locations.	Y
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		2	0	1	Captured in harp trap along Howes Valley Trail during recent DEC surveys in 2005.	Y
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V		25	0	0	Observed twenty-five bats in two different caves during recent DEC surveys	Y
<i>Kerivoula papuensis</i>	Golden-tipped Bat	V		0	0	1	Not recorded in the study area, most recent record in 2002 trapped in Pokolbin SF to the east. Habitat unlikely.	N

E Endangered

V Vulnerable

¹ Numbers indicate the number of locations for the species, rather than the number of individuals

² Includes all records collected during CRA and Biodiversity Survey Priorities fauna surveys

³ Includes records on the NSW Wildlife Atlas obtained from sources other than DEC systematic survey

Table 4: Threatened fauna species recorded within and around northern Yengo National Park

GIANT BURROWING FROG

Species Profile

The Giant Burrowing Frog (*Heleioporus australiacus*) is a rotund ground-dwelling frog that can attain a maximum length of over ten centimetres. Its powerful limbs are used to excavate burrows where they can aestivate for long periods of time during unfavourable conditions. This species has a large black tadpole with a purple ventral surface that takes up to eleven months to metamorphose (Anstis 2002). The species has two disjunct populations, with one restricted to sandstone geology of the Sydney Basin as far south as Jervis Bay, and the other to the south between Narooma and eastern Victoria (NPWS 2001d).

Threats

The primary threat to the Giant Burrowing Frog is development of the sandy ridgetops that are its preferred habitat (NPWS 2001d). Other threats to this species are not well known. Some threats that might be relevant within the study area include frequent fire, road mortality and infection with chytrid fungus. As a large, slow moving species, it is also likely to be vulnerable to predation by Foxes and Cats.



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Local and Regional Conservation Status

The Giant Burrowing Frog is listed as a Vulnerable species under the TSC Act (1995) and Vulnerable under the EPBC Act (1999). The Sydney Basin population is thought to have declined considerably, with tadpoles being encountered far less frequently than in the past (Anstis 2002). There is suitable habitat for the species across a large number of Sydney Sandstone reserves including Royal, Ku-ring-gai Chase and Brisbane Waters National Parks with fewer records obtained in Blue Mountains and Wollemi National Parks (DEC 2005d). They have also been recorded in the Woronora and Cataract, Cordeaux and Avon Catchments on the Woronora Plateau (DEC 2005d). However, despite extensive areas of habitat and sustained survey effort over the last few years in the Sydney Basin, the species is rarely recorded.

The species was recorded for the first time in northern Yengo NP when two adult frogs were located in during DEC surveys in November 2004. The first observation was made on the Old Bulga Road near the northern end of the park and the second was identified by the distinctive owl-like hooting call from Partridge Creek near the northern boundary (See Map 6). Surveys completed since 1997 have extended the range of this species across the western sandstone hinterlands and into Wollemi National Park. These recent discoveries in Yengo point to an unbroken chain of habitat from Brisbane Water National Park to Wollemi National Park. Surveys conducted following heavy rains of the spring summer months are likely to yield further locations in the reserve, with the sandy creeklines of the northern and western catchments providing areas of likely habitat.

RED-CROWNED TOADLET

Species Profile

The Red-crowned Toadlet (*Pseudophryne australis*) is a small (20 to 25 millimetres), strikingly coloured litter-dwelling frog. It is fairly restricted in its distribution, only occurring on the sandstone geologies of the Sydney Basin, and within this range some morphological and genetic variation exists. The Red-crowned Toadlet lays its eggs in moist leaf litter, relying on rain to wash the eggs into a temporal pond where they can complete their development (NPWS 2001e).

Threats

Development of ridgetop land and creek headwaters is the primary threat to the Red-crowned Toadlet. Other threats may include habitat alteration due to fire, bush rock removal, water pollution and Chytrid fungus (NPWS 2001e). Due to their size and morphology, this species has only a limited ability to disperse. This probably makes them vulnerable to local extinction.



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Local and Regional Conservation Status

The Red-crowned Toadlet is listed as Vulnerable under the TSC Act (1995). Suitable habitat for this species is widespread across the sandstone plateaux of the Sydney Basin Bioregion, with the major populations occurring in the upper Blue Mountains, around the mouth of the Hawkesbury River and the Woronora Plateau extending to Royal National Park (DEC 2005d). Throughout its range it has been recorded in numerous National Parks, including a number within the Sydney urban area (DEC 2005d). DEC surveys in the Sydney Basin Bioregion during the last five years have revealed that the species is perhaps more common in the region than previously thought (DEC 2005d).

The Red-crowned Toadlet has been recorded during recent surveys and is now known from four locations in northern Yengo NP. These localities are at the northern limits of the species range. All of the sightings have been located on the western side of the reserve off Old Bulga Road and the Northern Link Track (Map 6). Both Hawkesbury and Narrabeen Sandstones appear to provide suitable habitat in the reserve, with locations closely associated with dry upper gullies and gully heads that retain small microhabitats of mesic vegetation such as Coral Fern (*Gleichenia* spp.). There are areas of this habitat present throughout northern Yengo NP and it is anticipated that with further surveys carried out under suitable weather conditions, the species will be found to be more widely distributed than is currently recorded.

ROSENBERG'S GOANNA

Species Profile

Rosenberg's Goanna (*Varanus rosenbergi*) (also known as Heath Monitor) is a large, powerful lizard with an unusual distribution. It is superficially similar to the commonly encountered Lace Monitor (*V. varius*) though morphologically and taxonomically it is closer to the Sand Monitor (*V. gouldii*). It can be distinguished from the Lace Monitor by the fine barring on its lips and tail and the spots on its legs. Within NSW it occurs in the Greater Sydney Basin and in the Southern Highlands, but then occurs discontinuously through Victoria, South Australia and south western Western Australia (King and Green 1999). The population in the Sydney Basin may or may not be genetically distinct. This goanna is known to associate with sandstone environments, and is usually found in heath and woodlands where it shelters in burrows, hollow logs and rock crevices (Cogger 1996).

Threats

Rosenberg's Goanna is particularly threatened in urban fringes, where the species is subject to pressure from development of the flat sandstone ridgetops that are its preferred habitat. Road mortality is also of concern (NPWS 2002a). Goannas have been identified as taking baits placed for Foxes (*Vulpes vulpes*) (Thomson and Kok 2002) and this species may consume baits placed during Fox and Dog (*Canis lupus*) eradication programs. Nests and juveniles of the species may be vulnerable to predation by Foxes and Dogs (M. Schulz pers. comm.).

Local and Regional Conservation Status

Rosenberg's Goanna is listed as Vulnerable under the NSW TSC Act (1995). It is a poorly understood species and there is still much to be learnt about its distribution. Previously the NSW population was thought to be restricted to the Hawkesbury and Narrabeen sandstones and coastal areas such as Dharug and Kuring-gai Chase NPs, with the Woronora Plateau and Morton NP known to contain good habitat. Notwithstanding this, survey work over the last few years has confirmed it to be present outside of these geologies, with confirmed sightings now from Abercrombie River and Turon NPs and for north-western Wollemi NP, as well as from around Braidwood. In addition, there are anecdotal records of this species from the south-western slopes for as far west as Bathurst and for the region around Goulburn (R. Wells pers. comm.) and it is likely the species is under-recorded off reserve.

Rosenberg's Goanna was recorded for the first time within northern Yengo National Park in February 2006, during DEC vegetation surveys being undertaken along the Yengo Track (Map 6). The animal was seen in woodland habitat of the type that is typical of sandstone ridgetops throughout the centre of the study area. Although much survey work has been conducted under suitable conditions for the detection of this species, a high level of visitation is required to pick up this cryptic species and it can easily go undetected. It is likely that the goanna occurs in similar habitat at other locations on the sandstone plateau particularly in the centre and south of the study area.



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BLACK BITTERN

Species Profile

The Black Bittern (*Ixobrychus flavicollis*) is a medium-sized, dark grey-black heron, with a distinctive yellow stripe on the head and neck. It is usually found singly or in pairs in thick vegetation at the margins of freshwater and estuarine wetlands, with breeding occurring in thick leafy trees overhanging water (Marchant and Higgins 1990). It is usually recorded in or near watercourses and poorly drained sites with either Swamp (*Casuarina glauca*) or River Oak (*C. cunninghamiana* subsp. *cunninghamiana*) (Chafer *et al.* 1999). Within Australia, it is widespread coastally between the Kimberleys, Western Australia and extreme north-eastern Victoria, though rare south of Sydney, with an isolated declining population in south-western Western Australia (Garnett and Crowley 2000). The subspecies *australis* is also found in New Guinea and surrounding islands, while two other subspecies occur in the Solomon Islands, and between northern Indonesia and India (Marchant and Higgins 1990).

Threats

Habitat alteration would seem to be the greatest threat to the Black Bittern. Practices that have affected the species in Western Australia and are likely to have similar effects in New South Wales include clearing of riparian vegetation for agriculture and urbanisation, and the resultant increase in salinity and sedimentation (Marchant and Higgins 1990; Garnett and Crowley 2000). The NSW Scientific Committee (2004b) listed this species as one that is likely to have habitat effected by subsidence due to longwall mining.

Local and Regional Conservation Status

The Black Bittern is listed as Vulnerable under the NSW TSC Act (1995). The majority of records in NSW come from the three coastal Bioregions, with the occasional historic record west of the Divide (DEC 2005d). Within the Sydney Basin Bioregion, most records are immediately adjoining the coast or along major rivers, such as the Hawkesbury, and though these areas are often poorly protected in reserves, a number of records occur in Dharug and Scheyville National Parks.

The observation of a Black Bittern on Drews Creek during recent DEC surveys was unpredicted. The habitat present at the site was not typical for the species with sheltered sandstone forest dominating a relatively narrow valley, although standing water was present. This observation supports a historical record of the Black Bittern in Werong Creek area in 1977. It is likely that the Black Bittern is an infrequent visitor to the area. It may make use of other low lying valleys around the north-eastern boundary of the reserve.

GANG-GANG COCKATOO

Species Profile

The Gang-gang Cockatoo (*Callocephalon fimbriatum*) is a small, stocky cockatoo with dark grey feathers on its body, narrowly margined with pale grey, orange and red (Pizzey and Knight 1999). Both sexes have a wispy crest that is curved forward and twisted, but the males crest and head is a bright fiery red. The species is endemic to south eastern Australia, ranging from the mid north coast and central tablelands of NSW to far south west Victoria and occasionally into South Australia (Higgins 1999). Gang-gangs are seasonally nomadic, inhabiting tall mountain forests and woodlands in the summer then moving to lower altitudes to drier, open eucalypt forests and woodlands in the winter (Higgins 1999) when they may also be found in urban areas and farmlands. It is gregarious in nature and primarily arboreal, roosting in tall trees and foraging in pairs or family groups for seeds, berries, fruits, nuts and insects in the canopy or occasionally in the upper understorey (Higgins 1999). The Gang-gang Cockatoo requires hollows in large trees for breeding, which occurs between October and January (Pizzey and Knight 1999).



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Threats

Threats to the Gang-gang Cockatoo are poorly known but are thought to include habitat destruction and degradation; in particular the loss of food trees and large old trees required for roosting and breeding (NSW Scientific Committee 2001g; 2005). Perhaps important is that a large amount of winter habitat has been cleared for agricultural and urban development. Competition for nest hollows with other species may also be problematic (NSW Scientific Committee 2001g), while Psittacine Circoviral (Beak and Feather) Disease may threaten small populations that are already stressed (DEH 2004a). Climate change may alter the extent and nature of the cool temperate vegetation that the species utilises (Olsen *et al.* 2003, NSW Scientific Committee 2005).

Local and Regional Conservation Status

The Gang-gang Cockatoo has recently been listed as a Vulnerable Species under the NSW TSC Act (1995). The listing was made on the basis of a decline in the reporting of this species across its distribution between 1984 and 2002, though the reliability of this trend was low (Barrett *et al.* 2003). In the Sydney Basin Bioregion it is abundant south of the Hunter River, though there are fewer records in the Sydney and Wollongong urban areas. Numerous records of the species occur within many reserves, including (in addition to Yengo NP) Kanangra-Boyd, Blue Mountains, Nattai and Yengo National Parks.

Within northern Yengo NP the species has been recorded at over 50 locations (Map 7). These records are scattered throughout the park, individuals or family groups of these distinctive birds having been regularly sited in a variety of habitats from sandstone ridgetop woodland along Yengo Track and Settlers Road, to moist gully forest along Drew's Creek and the sandy country in the Garland Valley. Of particular importance to the species are the grassy Box and Ironbark woodlands along the northern escarpment and Old Bulga Road, which provide potential winter habitat for the species. Such habitat has been extensively cleared for agricultural and urban development, while much remaining habitat outside reserves is under ongoing pressure. Conservation of the species within the study area is important to the continued conservation of species towards the northern edge of its range.

GLOSSY BLACK-COCKATOO

Species Profile

The Glossy Black-cockatoo (*Calyptorhynchus lathami*) is a medium to large black cockatoo, which has a diagnostic black-brown head, with yellow patches in the female, and red tail panels. It is usually seen in pairs or trios (with dependant young) in eucalypt woodland or forest, where it nests in hollows. This species feeds almost exclusively on Sheoaks (*Allocasuarina* species including *A. verticillata*, *A. torulosa* and *A. littoralis*) (Higgins 1999). Two subspecies are restricted to eastern Australia between Queensland (Eungella) and eastern Victoria, with the nominate *lathami* found in NSW, and a third, isolated, endangered subspecies on Kangaroo Island (South Australia) (Higgins 1999).

Threats

Habitat destruction for agriculture or residential development appears to be one of the main threats, due to both removal of nesting and feeding sites, and also from competition from more open habitat species such as Galahs (*Eolophus roseicapillus*). Because many *Allocasuarina* species are fire sensitive, inappropriate burning regimes may affect food supplies and this species has been listed by the NSW Scientific Committee (2000b) as being affected by inappropriate fire regimes. Illegal trapping for aviculture may be a localised, minor threat (Garnett and Crowley 2000). DEH (2004a) lists the Glossy Black-cockatoo as a species that has exhibited symptoms of Psittacine Circoviral (beak and feather) Disease.

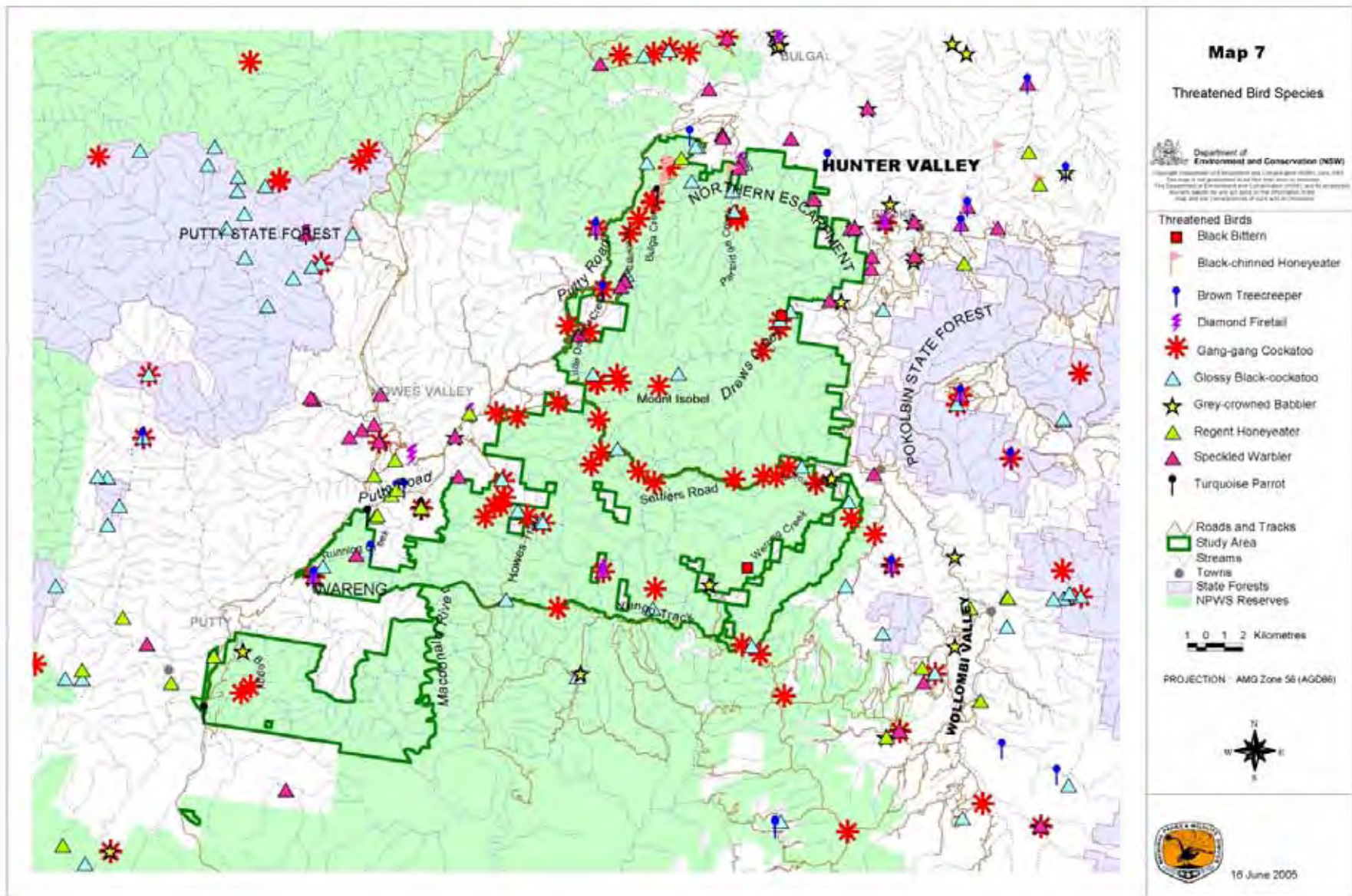
Local and Regional Conservation Status

The Glossy Black-cockatoo is listed as Vulnerable under the NSW TSC Act (1995). Relatively large areas of the Sydney Basin provide suitable habitat for Glossy Black-cockatoos and there are a large number of records for this species throughout the Sydney Basin Bioregion (DEC 2005d). Their habitat is well protected, occurring in numerous NPWS reserves, including Morton, Blue Mountains, Ku-ring-gai Chase and Wollemi National Parks (DEC 2004d, 2005b).

Northern Yengo NP provides an extensive area of high quality habitat for Glossy Black-cockatoos. Many gullies and sheltered slopes on Narrabeen sandstone support an abundance Forest Oak (*Allocasuarina torulosa*). Vegetation communities of Bell *et al.* (1993) that include this tree species are Hawkesbury – Narrabeen Sheltered Forest, Hawkesbury-Narrabeen Ironbark Forest and Exposed Narrabeen Woodland. There are 31 records of the Glossy Black-cockatoo in the reserve (Map 7), many derived from chewed *Allocasuarina* cones lying on the forest floor following feeding. Yengo National Park represents an important component of habitat across the southern Hunter Catchment between Goulburn River NP to the Watagan Ranges.



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Map 7: Threatened diurnal bird records within five kilometres of northern Yengo National Park

TURQUOISE PARROT

Species Profile

The Turquoise Parrot (*Neophema pulchella*) is a small, brightly coloured parrot, distinguished by its bright green upper parts, yellow under parts and blue face and shoulder patch. The male is considerably brighter than the female, and also has a red shoulder band. The bird usually occurs in pairs or small family parties in eucalypt woodlands and open forests that have a ground cover of grasses. It nests in tree hollows, and has a usual clutch size of two to five eggs (Higgins 1999). It is restricted to eastern Australia, where its range has contracted by over 50 percent since the 1890s (Garnett and Crowley 2000).

Threats

Garnett and Crowley (2000) summarise the main threats as: past clearing for agriculture, which has greatly reduced the overall distribution of the species; predation by Cats and Foxes; loss of hollows that are used for nesting in managed forests; and inappropriate burning regimes that may favour a shrubby rather than a grassy understorey. Beak and Feather (Psittacine Circoviral Disease (PCD)) is not known from this species, but has been recorded in the congeneric Orange-bellied Parrot (*N. chrysogaster*) (DEH 2004a). The species may also be threatened by competition for nesting sites with introduced birds, such as the Common Myna (*Acridotheres tristis*), as well as feral Honeybees (*Apis mellifera*).



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Local and Regional Conservation Status

The Turquoise Parrot is listed as Vulnerable under the NSW TSC Act (1995). Record numbers are highest in the Sydney Basin Bioregion and along the western slopes (Nandewar, Brigalow Belt South and NSW South West Slopes Bioregions) (DEC 2005d). In the Sydney Basin Bioregion, the species is most commonly found within dry grassy woodland environments that are prominent in the Hunter and Capertee Valleys and to a lesser extent on the Cumberland Plain. Important conservation reserves for this species in this Bioregion include Yengo and Goulburn River National Parks, Wollemi National Park, Munghorn Gap Nature Reserve and Yerranderie State Conservation Area.

Within northern Yengo NP the species is likely to be a rare nomad. Only one bird was sighted along the Old Bulga Road during recent surveys. This area had been extensively burnt in the 2002 fires and was noted to have seeding grasses. Historical records suggest that the species may frequent the Garland Valley and Putty area. In the reserve it may occasionally use the dry Ironbark woodlands found along the northern escarpment and Narrabeen sandstone ridges. This species was found quite frequently in these habitat types in north-eastern Wollemi NP.

BROWN TREECREEPER (EASTERN SUBSPECIES)

Species Profile

The Brown Treecreeper (*Climacteris picumnus*) is a medium-sized brown bird that is superficially similar in appearance to the Red-browed (*C. erythroptus*) and White-throated (*Cormobates leucophaeus*) Treecreepers. It is distinguished from both by its slightly larger size, distinctive pale supercilium (eyebrow stripe) and by its call. Typically a bird of eucalypt woodlands with a grassy or open shrub understorey, and abundant fallen timber and/or dead trees. Unlike most treecreepers, they spend approximately half of the time on the ground where they feed on insects, particularly ants and beetles, taken from live and dead trees, fallen branches and off the ground. They occur in pairs or small groups in permanent territories where tree hollows are utilised for breeding (Higgins *et al.* 2001). The eastern subspecies (*victoriae*) occurs along the coast and ranges in Victoria, New South Wales and south-east Queensland, with the other two subspecies occurring either west (*picumnus*) or north (*melanotus*) (Schodde and Mason 1999).



Threats

The eastern subspecies of the Brown Treecreeper is one of a suite of woodland birds that have declined throughout their range due to habitat clearance (Reid 1999). Traill and Duncan (2000) stated that the population was estimated to have declined by at least twenty percent in the last fifteen years. Studies have shown that populations can not persist in habitat fragments smaller than 300 hectares, mostly because females either disperse or suffer from preferential mortality. As with most treecreepers, once extinction occurs in a remnant, natural recolonisation is unlikely (Garnett and Crowley 2000). The lack of hollows may also be the limiting factor as known to compete with introduced species like the Common Starling (*Sturnus vulgaris*) (Higgins *et al.* 2001) and European Honeybees (*Apis mellifera*) (NSW Scientific Committee 2001a). Grazing also has impacts by decreasing the diversity of ground-dwelling invertebrates which reduces the levels of food availability (NSW Scientific Committee 2001a).

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Local and Regional Conservation Status

The eastern subspecies of the Brown Treecreeper is listed as Vulnerable under the NSW TSC Act (1995). Though it is found through all the eastern Bioregions in New South Wales, it is least common in the South East Coast and Australian Alps, and has declined significantly within the Sydney Basin and NSW North Coast. Within the Sydney Basin Bioregion, the species is restricted to open woodlands of the central tablelands and open coastal plains and valleys such as the Cumberland Plain and Hunter Valley (DEC 2005d). The species has virtually disappeared from the Cumberland Plain in the last 30 years (NSW Scientific Committee 2001a, DEC 2005d). These environments are all characterised by agricultural and urban clearing with small isolated fragments of native vegetation common.

Brown Treecreepers have been recorded twice within northern Yengo over the last eight years (See Map 7). An individual has been recorded near Running Creek in the south-west and another just north of the "Little Darkey Addition" off Putty Road. Individuals have also been recorded on private property in Howes Valley. The vegetation on the perimeter of the reserve offers the best habitat for the species as it is here that the dry grassy woodlands of the Hunter Valley floor blend with the sandstone escarpment and plateau. The grassy Box woodlands along Old Bulga Road may also provide habitat. Primarily a species associated with the Hunter Valley itself, the species also persists in suitable dry woodland remnants in alluvial valleys, including along the Putty Road and Wollombi Valley. The species has not been recorded far inside the reserve boundary indicating that the sandstone vegetation is of marginal habitat value. This is contrary to the dry Ironbark woodlands on sandstone in Wollombi and Goulburn River NP's which support far greater numbers of the species (DEC 2005b; NPWS 2001c).

SPECKLED WARBLER

Species Profile

The Speckled Warbler (*Pyrrholaemus sagittata*) is a small, primarily ground-dwelling bird. It is similar in size and shape to the Buff-rumped Thornbill (*Acanthiza reguloides*) but can be identified by its boldly streaked underbody, distinctive facial pattern, noticeably longer tail and distinctive call. The female differs from the male by having a chestnut, rather than black, streak in the eyebrow. It usually occurs in the grassy understorey or low shrubs of dry sclerophyll forests and woodlands dominated by eucalypts. It feeds on insects and seeds with most foraging occurring on the ground. Pairs, and occasionally trios, live permanently in large (up to twelve hectares) territories where a well-concealed domed nest is built on the ground in grass tussocks. Two to four (usually three) eggs are laid, though breeding success can be low. The Speckled Warbler is endemic to south-eastern Australia, being found between Maryborough (Queensland) and the Grampians (Victoria) (Higgins and Peter 2002).



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Threats

The Speckled Warbler is one of a number of woodland birds that has declined in density throughout its range due mainly to agricultural land clearing (Reid 1999). Speckled Warbler populations are estimated to have declined by at least twenty percent in the last fifteen years (Traill and Duncan 2000). Small isolated patches may result in local extinction due to natural fluctuations (Garnett and Crowley 2000) with extinction occurring in areas with no patches over 100 hectares (NSW Scientific Committee 2001e). The species nests and forages on the ground and hence is susceptible to predation by exotic mammalian predators, loss of ground cover by stock and rabbit grazing, weed invasion (NSW Scientific Committee 2001e, Garnett and Crowley 2000) and inappropriate fire regimes.

Local and Regional Conservation Status

The Speckled Warbler is listed as Vulnerable under the NSW TSC Act (1995). It is widespread in the eastern Bioregions of the state, extending as far west as the Cobar Peneplain, but is scarce or absent from the South East Coast and Australian Alps. Within the Sydney Basin Bioregion most records are in areas of drier woodlands, including the Burratorang, Capertee, Hunter and Goulburn River Valleys (DEC 2005d). Speckled Warbler habitat is poorly reserved in the region in Wollemi, Goulburn River and Gardens of Stone NPs.

The Speckled Warbler has been the most commonly observed species of the Declining Woodland Birds in northern Yengo NP. It has been recorded at 14 fourteen locations (Map 7). As is the case for other Declining Woodland Birds, Speckled Warblers have a preference for the dry Box-Ironbark woodlands in the region. However, the species is dependent on a reasonably dense shrub layer for cover and consequently marginal farming lands that support regenerating shrubs on the slopes behind cleared alluvial flats and plains are often utilised. Such vegetation is present on the northern escarpment of Yengo NP and along the Putty Road, as well as on residual shale caps on Old Bulga Road. Similar trends in species habitat use are apparent along the Wollemi NP escarpment. The Speckled Warbler is unlikely to use habitat on the sandstone plateau, though may occasionally use open or broken vegetation associated with private inholdings along Werong Creek and Settlers Road.

REGENT HONEYEATER

Species Profile

The Regent Honeyeater (*Xanthomyza phrygia*) is a medium-sized honeyeater with a striking black and yellow plumage. It typically favours box-ironbark woodland, though it also utilises River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) forests and coastal habitats such as Swamp Mahogany (*Eucalyptus robusta*) or Spotted Gum (*Corymbia maculata*) dominated forest. The species is semi-nomadic and seems to undertake complex movements, generally dependent on where flowering food trees are available. It feeds mainly on nectar, and nests in the crown of eucalypts where it usually lays two or three eggs. It is endemic to south-eastern Australia, formerly between Rockhampton (Queensland) and Adelaide, though it is now rare in Queensland and probably extinct in South Australia, with a general contraction of range in the other two states (Higgins *et al.* 2001). There is thought to be only a single population of approximately 1,500 individuals of this species remaining, with numbers considered to be still decreasing (Garnett and Crowley 2000).



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Threats

Land clearance for agriculture has removed about three-quarters of the suitable habitat of the Regent Honeyeater. The remaining vegetation is fragmented, and is still being affected by the removal of larger trees. Grazing by domestic stock and rabbits prevents habitat regeneration (NPWS 1999e). Habitat alteration may also advantage more aggressive honeyeaters, such as miners (*Manorina* spp.) and friarbirds (*Philemon* spp.) with resulting competition.

Local and Regional Conservation Status

The Regent Honeyeater is listed as Endangered on the NSW TSC Act (1995) and as Endangered under the Commonwealth EPBC Act (1999). Compiling records was one of the priorities of the Draft Regent Honeyeater Recovery Plan (Menkhorst *et al.* 1999) and so a number of records are included in the Atlas of NSW Wildlife. Records are concentrated in the coastal third of the state, with the greatest number in the Sydney Basin, Nandewar and New England Tableland Bioregions (DEC 2005d). The most important area in the region is the Capertee Valley as each year the species returns to breed. Other areas such as the the Lower Hunter Valley, the northern Cumberland Plain, Burragorang Valley and the Central Coast are frequently visited for feeding at different times of the year. Breeding habitat is poorly conserved although habitat is used in Goulburn River, Wollemi and Nattai National Parks and Cockle Bay and Munghorn Gap Nature Reserves.

The Regent Honeyeater has not been recorded within northern Yengo NP however the species has been observed roosting and feeding in the adjoining Howes Valley over extended periods (DEC 2005d). In the Howes Valley, tree species such as Narrow-leaved Ironbark (*Eucalyptus crebra*), Forest Red Gum (*E. tereticornis*) and Rough-barked Apple (*Angophora floribunda*) were preferentially used over several months in 1994 and 1999 (Oliver 1998). These tree species are found on the alluvial and colluvial sediments in the Howes Valley and at Putty. The combination of these species is not associated with the sandstone habitats of the reserve, although some small areas are present near cleared valleys and on basalt at Mount Wareng and Mount Yengo. While Narrow-leaved Ironbark is widespread in northern Yengo NP, surveys have failed to detect these rare honeyeaters, even during profuse flowering periods during the 2004/05 surveys. Potential habitat value for this species within northern Yengo NP is likely to decline with distance from fertile valley floors.

BLACK-CHINNED HONEYEATER (EASTERN SUBSPECIES)

Species Profile

The Black-chinned Honeyeater (*Melithreptus gularis*) is a small, rather stocky and short-tailed honeyeater. It is distinguished from other *Melithreptus* honeyeaters by its relatively larger size, bright blue or jade green eye-wattle and distinctive call. It occupies dry eucalypt woodlands that feature Ironbark and/or Box species with low to moderate rainfall levels, where they are usually found in pairs or small groups of up to twelve. They feed on insects, nectar and lerp usually in the upper canopy and outermost flowers and leaves. There are two subspecies, which have in the past been named as two separate species. The eastern, nominate subspecies (*gularis*) is found along the inland slopes of the Great Dividing Range, extending to the coast in the Sydney Basin and Clarence River Valley of NSW, and again between Brisbane and Rockhampton, Qld, as well as westward into south-eastern South Australia. The 'Golden-backed Honeyeater' (*laetior*) is widespread across northern Australia (Higgins *et al.* 2001).

Threats

The eastern subspecies of the Black-chinned Honeyeater is one of a suite of woodland birds that have declined throughout their range due to habitat clearance (Reid 1999). They are threatened by clearance and the fragmentation of woodland habitat and don't appear to survive in remnants less than 200 hectares (NSW Scientific Committee 2001b). The species appears to occur naturally at low densities (NSW Scientific Committee 2001b) and is relatively mobile, so the reason for this absence in small fragments is unknown (Garnett and Crowley 2000). They are also likely to experience high levels of competition from aggressive honeyeater species associated with smaller fragments and may suffer increased nest predation from such species as Pied Currawongs (*Strepera graculina*) (NSW Scientific Committee 2001b).

Local and Regional Conservation Status

The eastern subspecies of the Black-chinned Honeyeater is listed as Vulnerable under the NSW TSC Act (1995). Scattered records for this species occur in the eastern half of the state, though the highest number of records are in the Nandewar, Sydney Basin and NSW South West Slopes Bioregions with very few in the South Eastern Highlands. In the Sydney Basin bioregion, most records come from drier areas such as western Sydney, the Capertee and Hunter Valleys (DEC 2005d). All of these areas have been heavily cleared in the past and remain subject to ongoing threatening processes. Most of the records are also outside DEC reserves, though it has been recorded in a number of parks, notably Wollemi, Goulburn River and Werakata National Parks and Munghorn Gap Nature Reserve (DEC 2005d).

Recent DEC surveys recorded Black-chinned Honeyeaters in the reserve for the first time along Old Bulga Road and along Partridge Creek on private property (Map 7). The greatest numbers were found foraging in a stand of flowering Ironbarks on a west facing ridge. While the Ironbarks were flowering across the escarpment face the species was not widespread and was restricted to these two locations. The species is highly nomadic and the pattern of use indicates that the species is likely to be an infrequent visitor to the reserve. However this reinforces the importance that the interface habitats between the northern escarpment and the Hunter Valley provide for this and other woodland birds.

GREY-CROWNED BABBLER (EASTERN SUBSPECIES)

Species Profile

The Grey-crowned Babbler (*Pomatostomus temporalis*) is the largest of the four Australian babbler species, and the only one with a light-coloured crown. Other distinctive features are a long, decurved bill and a dark band that passes from the bill through the eye, giving it a “masked” appearance (Higgins and Peter 2002). There are two subspecies in Australia, the nominate being *temporalis*, which occurs in eastern Australia from Cape York to north-east NSW then south and west through central NSW and Victoria to south-eastern South Australia (Higgins and Peter 2002). It is widespread on the inland slopes of the Great Dividing Range in NSW and on the western plains. Grey-crowned Babblers live in open forest and woodland, *Acacia* shrubland and adjoining farmland, preferring Box-Gum woodlands on slopes and Box-Cypress and open Box woodlands on alluvial plains (DEC 2005e, Garnett and Crowley 2000). They feed on invertebrates gleaned from vegetation or the ground (Garnett and Crowley 2000). The birds form family parties, consisting of a breeding pair and offspring from prior breeding years, which are thought to be vital for predator avoidance and cooperative feeding of the young (King 1980).

Threats

The Grey-crowned Babbler has been identified as one of a number of birds that have declined significantly in range and population in the sheep-wheat belt of central west NSW due to the degradation and fragmentation of woodland habitats. (Reid 1999). Remaining Babbler habitat occurs in isolated fragments throughout its range, from which they gradually disappear (Garnett and Crowley 2000). This disappearance has been attributed to the consequences of habitat fragmentation on family-group sizes and the resulting reduction in breeding success and higher rates of nest predation (Garnett and Crowley 2000, NSW Scientific Committee 2004c). Once lost from a habitat fragment, natural recolonisation is unlikely (Robinson and Traill 1996). Agricultural practices, such as grazing and associated weed invasion also pose a threat, as does increased competitor abundance in disturbed habitats, removal of important feeding sites such as logs and fallen timber from habitat remnants, as well as Cat predation.

Local and Regional Conservation Status

The eastern subspecies (*temporalis*) of the Grey-crowned Babbler is listed as Vulnerable under the NSW TSC Act (1995). It is most common in the central western regions of NSW, particularly the NSW South Western Slopes and Brigalow Belt South, but also occurs in the NSW North Coast Bioregion in the Clarence River Valley (DEC 2005d). Within the Sydney Basin Bioregion the species is virtually restricted to the Hunter Valley, with a few records also in the Capertee Valley, where it is closely tied to the drier grassy woodland habitats. Within the Bioregion it is poorly represented in reserves, having been recorded in only small areas in Wollemi, Goulburn River, Yengo and Werakata National Parks and Munghorn Gap Nature Reserve (DEC 2005d).

The Grey-crowned Babbler has been recorded on the Atlas of NSW Wildlife four times in northern Yengo NP since 2001 (see Map 7). This species is most often recorded where cleared open farmland meets woodland vegetation on the lower slopes of the northern escarpment or in the Howes and Wollombi Valleys. It is frequently observed at Paynes Crossing and Werong Creek, near the eastern boundary of the park (P. Ewin pers. comm.). It was recorded only once during recent DEC surveys at the start of Howes Valley Trail. It is expected to occur within the reserve around inholdings that support cleared and lightly timbered country on fertile soils, such as Big Yengo Station. Other locations within northern Yengo NP are similarly small in area and patchily distributed. Primary habitat for this species is located on the surrounding valley floor where the dominant threats of clearing are still active. Consequently, the protection of any habitat is currently of value to the species in the region.

DIAMOND FIRETAIL

Species Profile

The Diamond Firetail (*Stagonopleura guttata*) is an attractive finch, which is distinguished by its bold black breast band and white-spotted black flanks. The eye, beak and rump are red, with the latter contrasting strongly with the black tail in flight (Pizzey and Knight 1999). It is most frequently encountered in Eucalypt dominated communities that have a grassy understorey, where it feeds mainly on grass seeds (Garnett and Crowley 2000). They are usually encountered in pairs, though are known to form small flocks in autumn, winter and early spring. They build bottle-shaped nests in trees or sometimes mistletoe and usually produce four to six eggs (Pizzey and Knight 1999). The species is endemic to south-eastern Australia, with records extending from Rockhampton (Queensland) to the Eyre Peninsula and Kangaroo Island (South Australia) (Pizzey and Knight 1999). Most populations occur on the inland slopes of the Great Dividing Range with only small pockets near the coast (Blakers *et al.* 1984).

Threats

Much of the Diamond Firetail's habitat has been cleared and it is therefore included in the suite of woodland birds that have declined in south-eastern Australia (Reid 1999). It appears unable to survive in areas that lack remnants larger than 200 hectares (NSW Scientific Committee 2001c). Clearing and habitat degradation by over-grazing and the spread of exotic grasses may also result in the loss of key food plants and possibly competition from flock-foraging Red-browed Finches (*Neochmia temporalis*) (Garnett and Crowley 2000). Predation by Foxes and feral Cats may be another threat as the species forages on the ground (Smith *et al.* 1995).

Local and Regional Conservation Status

The Diamond Firetail is listed as Vulnerable under the NSW TSC Act (1995). It is widely recorded in the eastern two thirds of the state, with scattered records in the far west, although it is less widely recorded in the three coastal Bioregions and in the high country of the Australian Alps. Within the Sydney Basin Bioregion the species is closely associated with grassy box woodlands found on the more fertile soils on the inland valleys, including the Capertee, upper Hunter and Burratorang, and occasionally on the Cumberland Plain. These environments are generally poorly conserved throughout the region, though records are known from Goulburn River and Wollemi National Parks and Munghorn Gap Nature Reserve (DEC 2005d).

Diamond Firetails have not been recorded reliably in the reserve, though they do occur at the edge of contiguous vegetation and cleared lands around the northern perimeter (see Map 7). This species is closely associated with dry grassy woodlands of fertile inland valleys and plains. These environments have been heavily cleared and much of what remains is a mosaic of cleared country, scattered trees and remnant vegetation. This mosaic supports the most suitable habitat for the species and it is only present in the study area in Howes Valley and near major flats and lower slopes of Partridge, Bulga and Drews Creeks. There is also potential for the species to occur within the grassy woodlands on residual shale caps along Old Bulga Road.

BARKING OWL

Species Profile

The Barking Owl (*Ninox connivens*) is an owl of intermediate size between the larger Powerful Owl (*N. strenua*) and the Southern Boobook (*N. boobook*). It has dark brown upper-parts and a white underbody with coarse brown streaking (Higgins 1999). It is often identified by its call, which is a distinctive, dog-like barking that can be confused with Fox (*Vulpes vulpes*) or Dog (*Canis lupus*) barks. It usually inhabits dry open eucalypt forests and woodlands, where it is associated with hydrological features such as rivers and swamps (Taylor *et al.* 2002a). It nests in hollows, usually of large eucalypts, where it lays one to three eggs. It is an opportunistic feeder, eating more insects than other large forest owls, but consumes small terrestrial and arboreal mammals and birds during the breeding season. The race *connivens* occurs east of a line connecting Cooktown (Queensland) and the Flinders Ranges (South Australia) with an isolated population in the south west of Western Australia. Other races occur across northern Australia, in New Guinea and the Moluccas (Indonesia) (Higgins 1999).

Threats

The main identified threat to the species is habitat destruction, particularly the removal of woodlands and forests from more low-lying fertile areas for agriculture (Taylor *et al.* 2002b). Remaining habitat is also subject to further degradation through forestry and collection of firewood, which often involves the removal of large hollows. However, the owl is frequently located at the edge of forest blocks adjacent to cleared land, possibly due to increased prey availability at such locations (Taylor *et al.* 2002b). The owl may also suffer some competition for nest sites from feral Honeybees (*Apis mellifera*) (Garnett and Crowley 2000). The long generation time (ten years) means that the species may take a long time to recover after suffering a decline (NSW Scientific Committee 1998b). NPWS (2003c) also lists predation (particularly of fledglings), mortality from collisions with fences and vehicles, and secondary poisoning from rodenticides as threats.

Local and Regional Conservation Status

The Barking Owl is listed as Vulnerable under the NSW TSC Act (1995). Records occur throughout NSW, though it is more rare in the far west and at higher altitudes in the south-east (DEC 2005a). It is the rarest owl species in the Sydney Basin Bioregion. Recent surveys in the southern Sydney region have found the species to respond to less than one per cent of the 500 call playback surveys undertaken in the region (DEC 2005a). Important locations in the Sydney Basin appear to be the Capertee and Hunter Valleys and to a lesser extent the Cumberland Plain. Very few records occur within the Sydney sandstone reserves (DEC 2005a), with most records on private lands.

Playback surveys conducted across Wollemi and Yengo NPs confirm the species rarity. Map 8 shows the species distribution within the study area. In northern Yengo an individual responded from a deep gully east of the Southern Link Trail. At Boggy Swamp Creek a pair of owls were heard and during the CRA surveys, a pair were also recorded off the eastern end of the Yengo Track. An individual was discovered roosting in a thicket of Grey Myrtle (*Backhousia myrtifolia*) along Back Creek (south of the Yengo Trail) during vegetation surveys in February 2006. There are also five records of this species within five kilometres of the reserve boundary, two in the vicinity of Putty, one in Howes Valley, one to the north of the study area towards Bulga and another to the east in the area of Wollombi Brook. The drier environments found on the sandstone reserves of the southern Hunter are achieving greater response rates for the species than other more temperate environments associated with the Blue Mountains reserves (DEC 2005d). Consequently, the records within northern Yengo NP are of high state and regional significance and territories occupied by the species warrant special management attention. Management suggestions are presented in Section 4.2.



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POWERFUL OWL

Species Profile

The Powerful Owl (*Ninox strenua*) is the largest owl in Australia and is distinguished by its relatively small, round head and long tail. It is dark brown above with prominent off-white barring, and paler underneath with diagnostic dark chevrons. It inhabits various forest habitats, though it usually breeds and roosts in dense forest types, including rainforest and wet sclerophyll forest. It hunts in more open forests, where it feeds mainly on arboreal mammals, particularly Common Ringtail Possums (*Pseudocheirus peregrinus*) and Greater Gliders (*Petauroides volans*) (Kavanagh 2002). This owl usually nests in a hollow in eucalypts within or below the canopy, and normally lays two eggs. They usually maintain a territory of between 300 and 1500 hectares, with size dependent on habitat quality and prey density. The species is endemic to eastern Australia, being recorded between Eungella (Queensland) to near the South Australia-Victoria border (Higgins 1999).



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Threats

Past land clearance for agriculture has reduced the area of habitat available for the Powerful Owl (Garnett and Crowley 2000), particularly the availability of nest sites. The owl can, however, survive in areas with some levels of disturbance, such as in selectively logged forests (Kavanagh 1997) and suburban areas of Brisbane, Sydney and Melbourne (Garnett and Crowley 2000, DEC 2004e). Two of the determining factors for the species persistence in disturbed areas is the presence and suitable abundance of prey species (Chafer 1992) and nesting/roosting sites (Debus and Chafer 1994). The foliage roosts of the Powerful Owl are vulnerable to regular hazard reduction burning (DEC 2005h).

Local and Regional Conservation Status

The Powerful Owl is listed as Vulnerable under the NSW TSC Act (1995). It is a habitat generalist and as a result is widespread throughout the region. Extensive survey for the species has revealed that it is more common across the southern Sydney region than previously thought (DEC 2005a). High quality habitat is associated with tall open forests on richer soils and tall moist gully forests from the coast to the Central Tablelands. There are a large number of territories protected throughout the region in reserves such as Nattai, Blue Mountains, Kanangra-Boyd, Illawarra Escarpment, Royal as well as the Woronora Plateau water Catchments (DEC 2005d).

Within northern Yengo NP the species is present but is not as common when compared to reserves supporting higher rainfall and taller forests. Powerful Owls have been recorded at six locations (Map 8), three of these are sourced from recent surveys. Owls were heard in the north near Sentry Box Point, south-east of Watts Creek and north of Howes Valley Trail. An adult and immature were also discovered roosting together during the day in a Turpentine (*Syncarpia glomulifera*) along Partridge Creek. These creeklines represent the most important habitat for the species, as this is where nesting and roosting takes place. The lower density of owls in northern Yengo is likely to reflect the lower quality of habitat present for preferred prey items such as the Common Ringtail Possum and Greater Glider. Management of the owl should be undertaken in accordance with the state-wide recovery plan (currently in draft form, DEC 2005c).

SOOTY OWL

Species Profile

The Sooty Owl (*Tyto tenebricosa*) is a medium to large 'barn' owl, with sooty grey plumage that is finely spotted and flecked with white. It is found in tall wet forests, including wet sclerophyll and rainforest, where it is often first detected by its distinctive 'falling bomb' call. It roosts and breeds in hollows, often located in emergent trees which may be greater than 100 years of age, as well as in sandstone overhangs (Kavanagh 1997). Pairs probably maintain permanent territories that are between 200 and 800 hectares in area (Higgins 1999). It feeds on a wide range of arboreal and terrestrial mammals (Kavanagh 2002). In Australia the subspecies *tenebricosa* is distributed along the east coast between the Conondale Ranges (Queensland) to north east of Melbourne (Victoria). A smaller subspecies (*arfaki*) occurs in New Guinea (Higgins 1999).

Threats

Garnett and Crowley (2000) list the main threat as habitat clearance for agriculture and urban development, with additional fragmentation or degradation caused by logging, burning, dieback and urbanisation. The exact impacts of logging are not entirely clear (Higgins 1999). Where the species is at the margins of its ecological tolerance, frequent fire may threaten its occurrence when it results in the replacement of mesic plants with fire tolerant species and impacts on nest and roost sites.

Local and Regional Conservation Status

The Sooty Owl is listed as Vulnerable under the NSW TSC Act (1995). It is restricted to the three coastal Bioregions, with a few records in the extreme east of the South Eastern Highlands Bioregion. The distribution of this species in the Sydney Basin Bioregion is strongly tied to the presence of wet sclerophyll forests and rainforests. The Illawarra escarpment behind Wollongong and the Watagan Ranges between the Central Coast and Newcastle support the largest areas of high quality habitat (NPWS 2002a). In these areas it has been most often recorded in the Illawarra Escarpment and Jiliby State Conservation Areas, with other records in Royal, Blue Mountains and Bouddi National Parks (DEC 2005d).

Northern Yengo NP is a dry environment and habitat for the Sooty Owl is highly restricted to major drainage lines and areas of sheltered forest located on south facing and lower slopes of deep valleys. Results from over 40 playback sites confirm that the species is rare and that habitat is poor to marginal. Only one positive response was recorded for this species off Old Bulga Road (see Map 8). Few gully forests in the reserve support well developed mesic and rainforest shrub and small tree layers. Areas of potential habitat include Little Darkey, Werong and Drews Creeks, as well other creeklines in the eastern side of the reserve where more mesic vegetation occurs. These areas offer a small contribution to the protection of the species in the region. Far greater areas of suitable habitat present in the reserves of the coastal ranges such as Watagans National Park and Jiliby SCA.

MASKED OWL

Species Profile

The Masked Owl (*Tyto novaehollandiae*) is a large 'barn' owl, which has three colour morphs (with intermediates), but is distinguished from the similar Barn Owl (*T. alba*) by its larger size, more thickset and hunchbacked appearance, fully feathered legs and larger feet (Higgins 1999). It inhabits a wide range of woodland habitats with large hollows for roosting and open areas for hunting. It feeds mostly on ground-dwelling mammals such as rats (*Rattus*) and Antechinus (*Antechinus*), and occasionally on diurnal birds, Sugar Gliders (*Petaurus breviceps*) and insects (Kavanagh 2002). It appears to forage near ecotones, either at the boundary of forests of different structural composition or at the forest edge, and may this benefit from the mosaic of burnt-unburnt patches in the landscape after fire (DEC 2005c). The owl has a home range of 800 to 1200 hectares (Kavanagh 2002). It nests in hollow trees, usually eucalypts, where two to three eggs are the normal clutch (Higgins 1999). The nominate subspecies *novaehollandiae* was formerly found around the southern coast of Australia between Fraser Island (Queensland) and Carnarvon (Western Australia), though its range has contracted, particularly in Western Australia (Garnett and Crowley 2000). Other subspecies occur in Tasmania, northern Australia and in New Guinea and adjoining islands, some of which are sometimes considered separate species (Higgins 1999).

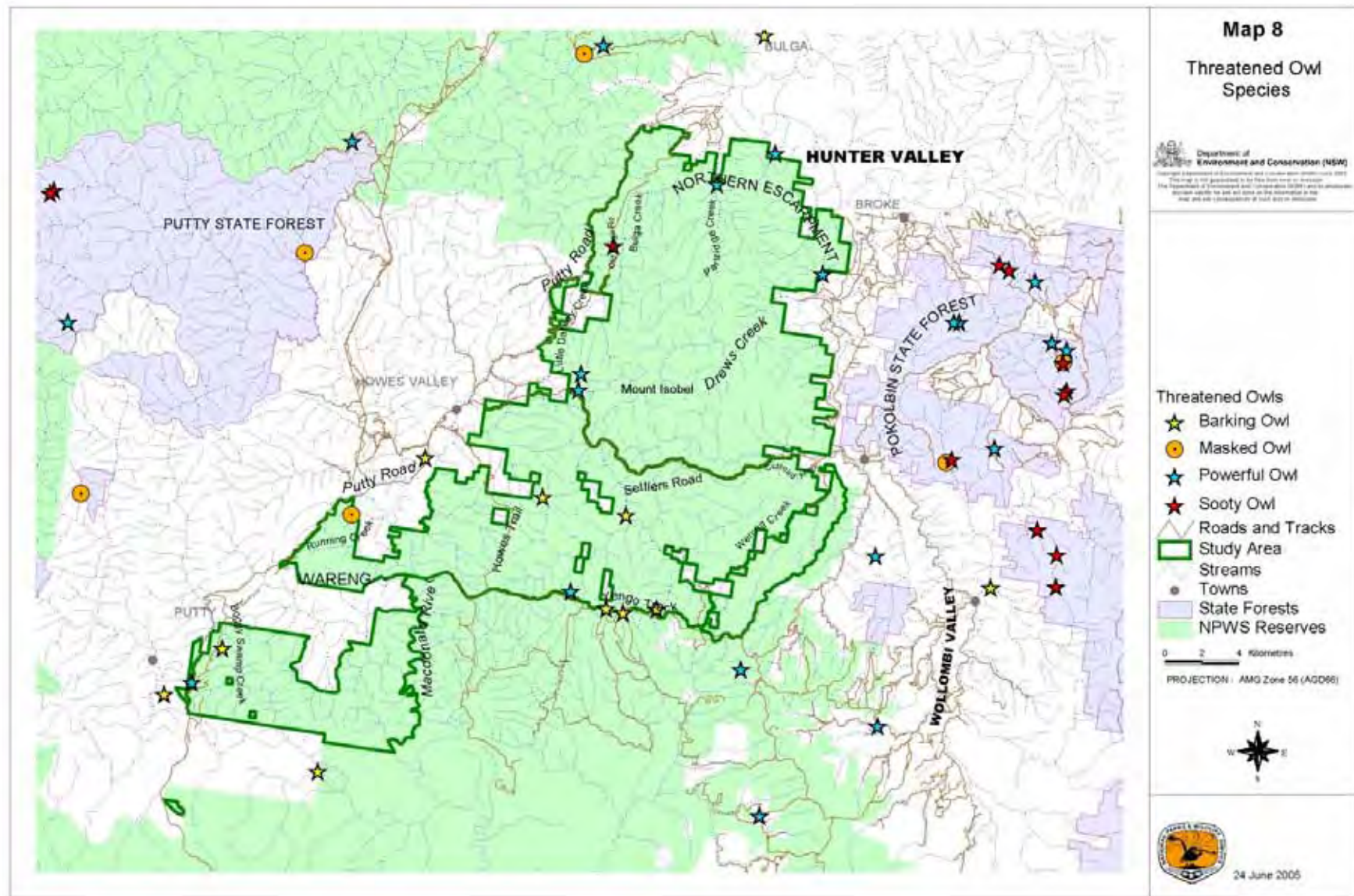
Threats

Clearance of native forest for agriculture and urban development, and the resulting fragmentation of habitat, has negatively affected the abundance of Masked Owls (Kavanagh 2002, Garnett and Crowley 2000). The species does not persist within fragments of forest less than 200 hectares (Kavanagh 2002). The owl may be affected by logging, through removal of hollows or reduction in foraging habitat due to vigorous regrowth (Garnett and Crowley 2000), though it has been suggested that modern mosaic logging operations do not cause major changes to the abundance of the species (Kavanagh 2002).

Local and Regional Conservation Status

The Masked Owl is listed as Vulnerable under the NSW TSC Act (1995). Most records for the species in NSW are located in the NSW North Coast, Sydney Basin and South Coast regions, with a few scattered records west of the Divide (DEC 2005d). The Lower Hunter and Central Coastal Plains between Wyong and Port Stephens support high numbers of the species and the dry woodlands represent the highest quality habitat in the Bioregion.

The Masked Owl has been recorded in low numbers throughout the Sydney sandstone reserves despite extensive surveys (DEC 2005a). This pattern is replicated in northern Yengo NP where recent surveys failed to record the species. A single record exists near Putty Road at Reedy Creek obtained during CRA surveys in 1997 (Map 8). While the dry forests of the coastal plain are well recognised as primary habitat the species is known to occupy a range of other habitats in low densities. This includes both sandstone gully forests and ridgetop woodlands (D. Connolly pers. obs.) as well as transitional vegetation near cleared environments (N. Williams pers. comm.). Within northern Yengo, suitable secondary quality habitat is present and numbers of territories are likely to be very low. Further confirmed observations of the species within Yengo NP would add significantly to the conservation security of the species in the region.



Map 8 Threatened nocturnal bird records within five kilometres of northern Yengo National Park

SPOTTED-TAILED QUOLL

Species Profile

The Spotted-tailed or Tiger Quoll (*Dasyurus maculatus*) is a medium-sized marsupial carnivore that is identifiable by its rufous to dark brown fur and white spots which are present on the body and tail. It is essentially terrestrial, but is also an agile climber. It feeds on a wide variety of birds, reptiles, mammals and invertebrates and will also take carrion and domestic poultry (NPWS 1999b). It uses several 'latrines' within its territory for defecation (NPWS 1999b). Two subspecies of Spotted-tailed Quolls have been recognised: *D. maculatus gracilis* from north Queensland and *D. m. maculatus* from south-eastern Queensland, New South Wales, Victoria and Tasmania (Edgar and Belcher 1995). However, genetic work has shown that the true genetic split occurs between Tasmania and the rest of the mainland (Firestone *et al.* 1999). Within NSW the species utilises a variety of habitats on both sides of the Great Dividing Range, including sclerophyll forest and woodlands, coastal heath and rainforest (NPWS 1999b). Habitat requirements include suitable den sites, an abundance of food and large areas of intact vegetation (NPWS 1999b).



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Threats

The main problems confronting the Spotted-tailed Quoll are believed to be habitat loss, degradation and fragmentation (Belcher 2004). Other threats include: predation and competition by introduced predators such as Cat (*Felis catus*), Fox (*Vulpes vulpes*) and Dog (*Canis lupis*); disease such as toxoplasmosis; road mortality; and direct mortality at the hands of humans (Mansergh 1984). Quolls were heavily persecuted as killers of domestic fowl, and have been hunted and trapped to extinction in many parts of the country. In more recent years evidence has been collected to suggest that aerial, ground and mound baiting using 1080 (sodium monofluoroacetate) has significant negative impacts on Quoll populations (Belcher 2004), while Dingo control has the potential to impact on Quolls through the competitive release of Foxes and Cats (Glen & Dickman 2005). Inappropriate fire regimes and the removal of dead wood and dead trees may also impact on the species (NSW Scientific Committee 2003c).

Local and Regional Conservation Status

The Spotted-tailed Quoll is listed as Vulnerable under the NSW TSC Act (1995) and as Endangered under the Commonwealth EPBC Act (1999). The southern populations are believed to have declined in range by up to 50 percent in recent years (Maxwell *et al.* 1996). Within NSW the species has been recorded most in the NSW North Coast, Sydney Basin and South East Corner Bioregions (DEC 2005d). Within the Sydney Basin Bioregion the species is very rarely recorded and is likely to occur at densities far lower than the north coast. It is most frequently recorded in mountain and coastal areas with records from Blue Mountains, southern Wollemi and Brisbane Water National Parks amongst others. The species is occasionally observed around the townships of the central Blue Mountains and Picton (DEC 2005a), either in the vicinity of chicken coops or as road kill.

Extensive survey work has failed to confirm the presence of the Spotted-tailed Quoll although these results are tempered by the fact that cage trapping and hair tubing have not been widely used. The most recent evidence of the species is derived from hair analysis that identified samples taken from a hair tube transect as a 'probable' Quoll. However the absence of sightings of this species from landowners that adjoin the northern boundary point toward low and sparse populations. Trapping in Pokolbin State Forest fifteen kilometres to the east caught several individuals in moist habitats in the mid 1990's and the animal has also been observed in Wollemi NP (DEC 2005b; DEC 2005d). Similar habitats exist in northern Yengo NP and as such it is considered that the Spotted-tailed Quoll is likely to occur within the study area.

Impacts on Quoll numbers may arise from a number of threats. Feral predators such as Foxes pose a direct threat, though equally Fox control programs using poisoned meats have the potential to kill this native carnivore. Fire may directly kill individuals or modify habitat for both the animal and its prey, although these impacts are perhaps less likely to provide the level of threat as those associated with feral predators.

KOALA

Species Profile

The Koala (*Phascolarctos cinereus*) is a distinctive arboreal mammal of eucalypt forest and woodland. It feeds on a wide range of eucalypt and other tree species, though in a local area a few species will be preferred almost exclusively. Individuals spend most of the day resting in the forks of trees, and are most active following sunset (NPWS 1999c). They generally move about a home range, the size of which varies on the density of food trees and population size, though individuals, particularly dispersing juveniles, are known to travel up to 50 kilometres (Martin and Handasyde 1995; NPWS 1999c). Three subspecies occur between north Queensland and the Eyre Peninsula in South Australia. However, the distribution is now fragmented and introductions, such as to Phillip Island, have possibly altered the genetic diversity of many of the populations (Martin and Handasyde 1995).



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Threats

NPWS (1999c) summarises the threats to the Koala as follows: destruction of habitat by clearing for urban development, agriculture and mining; degradation of habitat through fragmentation and disturbance such as fire or weed invasion; direct mortality from dogs and motor vehicles; and infection by *Chlamydia* which causes keratoconjunctivitis (an infection of the eyes) and infertility. The latter appears to occur naturally in Koalas in NSW, and symptoms are displayed when animals are stressed (NPWS 2003d). Throughout its entire range loss, fragmentation and degradation of habitat is its greatest threat (NPWS 2003d). Reed *et al.* (1990) reported that a survey in 1986-87 found the Koala had disappeared from 50 to 75 percent of its known range in NSW and populations had been lost from many localities, particularly on the southern and western edges of its distribution. Within the Hunter Range region all of the listed threatening processes are likely to be important, including road mortalities as the species attempts to move between habitat areas (such as across the Putty Road).

Local and Regional Conservation Status

The Koala is listed as Vulnerable under the NSW TSC Act (1995). The species is widespread across the eastern third of the state, with records scattered throughout the South Eastern Highlands Bioregion (DEC 2005d). The recovery plan for this species (NPWS 2003d) indicates that much of the Sydney Basin Bioregion comprises secondary habitat that support populations that are widespread and at low abundance. Sightings within reserves this Bioregion are regular in Morton National Park and Bungonia State Conservation Area, and less frequent in South East Forest National Park and a number of small Nature Reserves (DEC 2005d). Within the Sydney Basin Bioregion, Koalas have recently been discovered in Nattai National Park and Wollondilly River Nature Reserve (DEC 2004a; DEC 2004f) and are known from Lower Blue Mountains and Wollemi National Parks (DEC 2004d; DEC 2005b). Prominent populations occur around Campbelltown, Avon Catchment and Port Stephens (DEC 2005d).

Koalas have been the subject of targeted survey effort in Yengo NP in 1995 (Curtin and Lunney 1995). While much of the survey effort was conducted south of Settlers Road outside the study area the authors estimated between 50 to 100 individuals were likely to occur in habitat that was dominated by Grey Gum (*Eucalyptus punctata*) and Narrow-leaved Stringybark (*E. sparsifolia*). Recent survey effort confirms that Koalas continue to use the reserve and evidence of use was found concentrated along Yengo Track. However, this finding traces major access routes and available habitat extends north across gullies and ridges and it is anticipated that the species would browse widely across this area. Evidence found in the headwaters of Bulga Creek confirms such a pattern. Similar vegetation that supports dominant stands of Grey Gum in the adjoining northern Wollemi National Park and Pokolbin State Forest also show strong evidence of Koala use. Koalas have been shown to survive extensive wildfire in Nattai and Avon populations (DEC 2005a) though the degree of impact is not well known. Feral predators such as Fox and Wild Dogs pose localised threats.

EASTERN PYGMY-POSSUM

Species Profile

The Eastern Pygmy-possum (*Cercartetus nanus*) is a small (between 14 and 21 centimetre) possum that is found in a wide variety of habitats, including rainforest, sclerophyll forest and woodland and heaths. It is generally nocturnal, and is an opportunistic omnivore, including nectar, pollen, insects, seeds and fruit in its diet. Each individual has a number of nests, which are usually constructed in tree hollows, throughout their territory, and will move up to 125 metres, through tree, shrub and ground layers (Turner and Ward 1995). It is distributed between far south east Queensland and the far south east of South Australia, and Tasmania, though it is only found at higher altitudes in the north of its range and is generally more abundant in southern latitudes (Bowen and Goldingay 2000, Menkhorst 1995).

Threats

The NSW Scientific Committee (2001f) listed the following potential threats to the Eastern Pygmy-possum: isolated sub-populations with little dispersal potential which increase the risk of local extinction; habitat loss and fragmentation caused by clearing; inappropriate fire regimes that may effect understorey plants; the loss of nest sites through intensive forestry and firewood collection; and predation by Foxes and Cats.



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Local and Regional Conservation Status

The Eastern Pygmy-possum is listed as Vulnerable under the NSW TSC Act (1995). This listing appears to be chiefly based on Bowen and Goldingay (2000), which showed that despite intensive survey effort throughout the known distribution, relatively few individuals have been detected. The survey techniques used in many of these surveys, however, may have underestimated the abundance of this species. Over a two week period in early 2000, 22 individuals were removed from a ten kilometre stretch of trench dug as part of a natural gas pipe laying procedure between Cataract and Cordeaux dams (NPWS 2002a). Broadscale regional habitat mapping for this species (NPWS 2000a) indicate that most of the suitable habitat occurs in the sandstone areas surrounding the Sydney metropolitan area. Recent records of this species have been located in coastal reserves including Royal, Ku-ring-gai Chase and Morton National Parks and most recently Munmorah SCA (DEC 2005d).

The Eastern Pygmy-possum is known to occur in northern Yengo National Park, although its cryptic nature makes it a difficult species to sample adequately. Only one record derived from hair analysis of a Wild Dog scat has been made near Old Bulga Road. This record, obtained during recent surveys, is the first for the reserve. The Eastern Pygmy-possum is poorly known in the Hunter Catchment, which is likely to be a direct result of inadequate trapping effort in the region. However, a substantial effort of pitfall and Elliot trapping was employed in the State Forests to the east with only a single capture at McPherson State Forest (Ecotone Ecological Consultants 1995). The species is likely to use a wide variety of vegetation communities but most commonly occurs in habitats with a good diversity of nectar producing shrubs and eucalypts. Tulloch (2004) notes that they are generally more common in open woodlands and heathland dominated by plants from the Proteaceae and Myrtaceae families although these results are derived from coastal sandstone vegetation in Royal NP. Nevertheless, wildfire that results in loss of shrub layer is likely to remove a core feeding resource for the species. The threats posed by feral predators are confirmed by a number of positive hair samples for this possum sourced from Wild Dog scats in both Wollemi and Yengo National Parks (DEC 2005d).

YELLOW-BELLIED GLIDER

Species Profile

The Yellow-bellied Glider (*Petaurus australis*) is a medium-sized nocturnal mammal found in tall open sclerophyll forests and woodlands of eastern Australia. As an arboreal species, it requires mature hollow bearing trees within which to den during the day, and at night from which to leap and glide using a membrane that extends from the wrists to the ankles (NPWS 1999a). It is characterised by grey fur above and a whitish to orange fur underneath with large bare ears. The species is more often heard than seen, as it frequently emits a distinctive throaty call, which can be heard from some distance. It feeds on eucalypt nectar, sap, manna and invertebrates found under shedding bark. Its feeding habits to extract sap can leave deep V-notched incisions in the bark of eucalypts, with individuals and families demonstrating preference for repeated use of individual trees for many seasons (Mackowski 1988). Yellow-bellied Gliders are known to utilise a home range of between 30 and 65 hectares (Goldingay and Kavanagh 1991). The southern, nominate subspecies ranges between south-eastern South Australia and central coastal Queensland with a separate subspecies isolated in the wet tropics of north Queensland (Russell 1995).



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Threats

Yellow bellied Gliders are known to be greatly affected by the reduction of nesting resources when the availability of hollow-bearing trees are lost through clearing, fragmentation or timber extraction (NPWS 1999a). Predation by Cats and Foxes are also thought to contribute to the species vulnerability. Impacts of fire regimes are poorly understood, although some scientists suggest that availability of food is reduced after fire (NPWS 1999a).

Local and Regional Conservation Status

The Yellow-bellied Glider is listed as Vulnerable under the NSW TSC Act (1995). The species appears to have a patchy distribution within the Sydney Basin Bioregion (DEC 2005a), with most localities restricted to taller moist forests associated with incised sandstone gullies. The locations of populations of this species suggest a coastal preference with highly elevated, cold environments exhibiting a total absence of records in the region. Recent surveys for this species have significantly expanded knowledge on its distribution in the Sydney Basin reserve system. As little as ten years ago the species was thought to be uncommon, however, the converse has been found to be the case in the Southern Blue Mountains and Warragamba Catchment (DEC 2005d). Typical examples of population strongholds include the tall moist forests of the Central Coast, Watagan Ranges and Blue Mountains Escarpments and gullies (DEC 2005d). Numerous records are known from a large number of reserves including Jervis Bay, Morton, Nattai, Blue Mountains, Yengo, Watagans and Wollemi National Parks amongst others (DEC 2005a). In fact, the large number of records of Yellow-bellied Gliders that have been collected following extensive surveys in the past decade, together with their wide distribution and the extent to which threatening processes (logging and land clearing) have been controlled, has led some researchers to suggest that the conservation status accorded to the species be reviewed and possibly down-listed (Kavanagh 2004).

Recent DEC surveys have revealed that northern Yengo NP supports far higher numbers of Yellow-bellied Gliders than previously known. Many lower slope and gully sites that included taller stands of Grey Gum revealed evidence of this glider through its distinctive gurgling vocalisations or by the v-shaped notches left behind on the trunks of preferred feed trees. There are now over 30 known locations for the species across the study area (see Map 9). Grey Gums are abundant in northern Yengo NP and habitat is widespread across sheltered slopes and gullies. It is expected that the Yellow-bellied Glider is common within this habitat.

SQUIRREL GLIDER

Species Profile

The Squirrel Glider (*Petaurus norfolcensis*) is a small to medium-sized nocturnal mammal that inhabits dry sclerophyll forests and woodlands where it shelters in leaf-lined nests in tree hollows. It is similar in appearance to the smaller and more common Sugar Glider (*Petaurus breviceps*). However, the Squirrel Glider is larger, has a longer more pointed face, longer and narrower ears and a bushier tail and also lacks the persistent yapping call of the smaller species. It has a varied diet, including insects, nectar, pollen, seeds, *Acacia* gum and sap from eucalypts (Suckling 1995). It usually occurs in family groups of up to ten, consisting of one male, one or more females and their dependant young. Home ranges vary between 0.65 and 8.55 hectares, depending on vegetation type and habitat quality, and individuals have been known to move up to 500 metres in one night. It is patchily distributed along the east coast and inland slopes between north Queensland and northern Victoria (NPWS 1999d) in habitats that comprise sufficient numbers of hollow-bearing trees for shelter and winter flowering plant species for food (Quin 1995).

Threats

The greatest threat to the Squirrel Glider is loss of habitat by broadscale clearing for agriculture (Kavanagh 2004). Most clearing has fallen on open forests and woodlands growing on relatively fertile soils on gentle topography, especially in river valleys (Lunney and Leary 1988), which in many areas comprises prime habitat for the Squirrel Glider. Clearing of land for mining has also resulted in habitat loss in the Hunter Valley (N. Williams pers. comm.). NPWS (1999d) lists the following threats to the Squirrel Glider: loss of nesting resources when the availability of hollow bearing trees are lost through fragmentation or timber extraction; predation by Cats and Foxes; and the entanglement of individuals on barbed-wire fences. Impacts of fire regimes are poorly understood although the availability of food resources and shelter sites may be reduced or lost after fire. The simplification of forest structure resulting from frequent low-intensity prescribed burns, especially where domestic stock also graze, may also threaten the species (Catling 1991).

Local and Regional Conservation Status

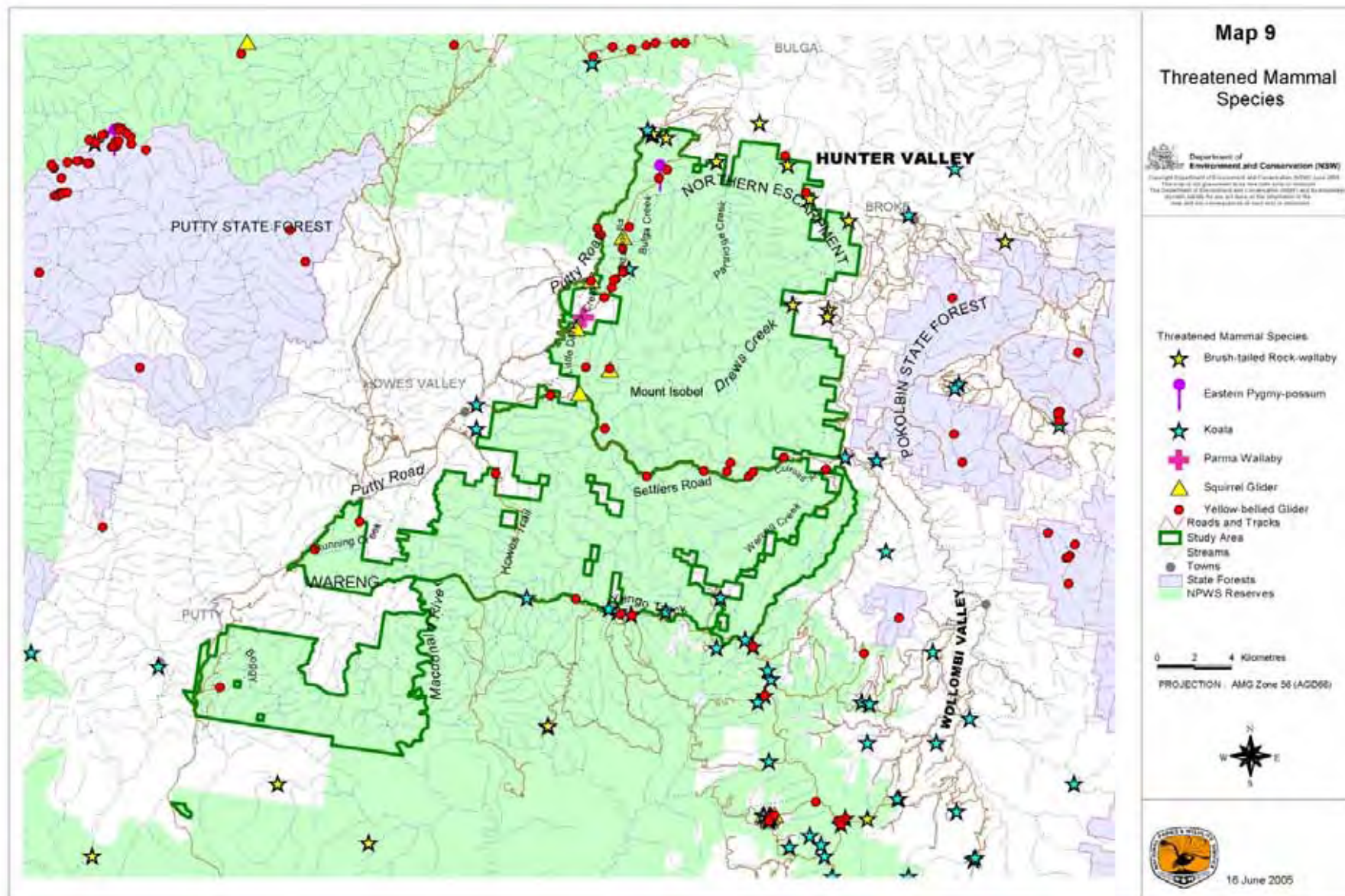
The Squirrel Glider is listed as Vulnerable under the NSW TSC Act (1995). Across its range, habitat for the Squirrel Glider appears to occur primarily outside of public forest lands (Kavanagh 2004). Within the Sydney Basin Bioregion the dry woodlands of the Central Coast provide very high quality habitat for the species and the area has been well documented as a stronghold for the species (Smith and Murray 2003). Elsewhere in the Bioregion the species has only been patchily recorded at very low densities, including on a few reserves such as Yengo, Wollemi, Blue Mountains, Dharug and Werakata National Parks (DEC 2005d).

Squirrel Gliders have been recorded at five locations near the western side of northern Yengo NP since 1997 (DEC 2005d). These records occur along the northern Link track, Old Bulga Road and in the "Little Darkey Addition", in a mixture of gully, slope and ridge sites. These observations are closely associated with the dry Ironbark woodlands, where the species has been observed in the canopy and in regrowth Wattle (*Acacia* spp.). These western localities remain the only known records despite extensive searches elsewhere in the reserve. It is expected that the species would occur at low densities. The pattern of distribution evident in Wollemi NP, where the species appears to prefer lower elevations in proximity to creekflats and Box-Ironbark woodlands, are likely to be repeated in northern Yengo NP.

This species is under considerable pressure arising from the loss of habitat due to land clearing and fragmentation throughout the Hunter Valley and Central Coast. As urban development pressures permeates the Hunter Valley, Squirrel Glider populations on reserves in the region will assume increased conservation significance despite the habitat being of secondary quality compared to that on the valley floor itself. Consequently viability of populations in northern Yengo NP will be dependent upon sympathetic fire management programs that maintain tree hollows and feeding resources, as well as active feral predator control programs.



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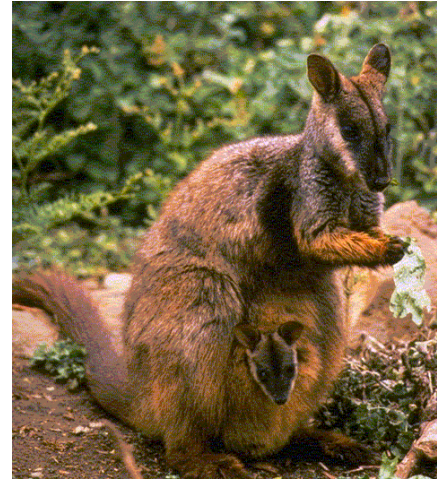


Map 9: Threatened mammal records within five kilometres of northern Yengo National Park

BRUSH-TAILED ROCK-WALLABY

Species Profile

The Brush-tailed Rock-wallaby (*Petrogale penicillata*) is a medium-sized macropod, characterised by its distinctive facial markings, black paws and high level of agility (NSW Scientific Committee 2003a). The tail is often used to aid identification, being long and thickly furred with a distinctive brush-like appearance near its tip (NPWS 2002b). Habitats occupied by this species tend to take one of three forms: loose piles of large boulders containing a maze of subterranean holes and passageways; cliffs (usually over fifteen metres high) with many mid level ledges covered by overhangs; or isolated rock stacks, usually sheer sided and often girdled with fallen boulders (NPWS 2003f). Vegetation forms a vital component of the habitat, especially as refugia near major rock outcrops. The species typically exhibits low migration rates between colonies, impeding persistence and recovery of populations affected by threatening processes. The Brush-tailed Rock-wallaby was once abundant and ubiquitous throughout the mountainous country of south-eastern Australia from the Grampians in western Victoria to Nanango in south-east Queensland (Short and Milkovits 1990). The Rock-wallaby has declined significantly in the west and south of its former range, and populations have become more fragmented throughout (NSW Scientific Committee 2003a). It was thought to be extinct in Victoria until small populations were rediscovered in the Grampians and near the Snowy River (Eldridge and Close 1995).



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Threats

Historical decline of the Brush-tailed Rock-wallaby is attributed to three factors: hunting for bounty and fur; predation by introduced predators; and competition with introduced herbivores (especially Feral Goat (*Capra hircus*), Rabbit (*Oryctolagus cuniculus*) and domestic stock) (NSW Scientific Committee 2003a). The major threats continuing to impact on the species include ongoing predation and competition with feral species such as Goats, Foxes (*Vulpes vulpes*) and Wild Dogs (*Canis lupus familiaris*), habitat modification by fire, vegetation clearing, disease transmission (toxoplasmosis and hydatosis) by feral carnivores (NSW Scientific Committee 2003a) and inbreeding (Environment ACT 1999).

Local and Regional Conservation Status

The Brush-tailed Rock-wallaby is listed as Endangered under the NSW TSC Act (1995) and as Vulnerable under the Commonwealth EPBC Act (1999). In the Sydney Basin Bioregion the species forms part of one of the three Evolutionary Significant Units (ESU) that summarise genetically distinctive groups on the basis of DNA. The nominate ESU encompasses closely related populations in central NSW including Kangaroo Valley, Jenolan Caves, the Hunter Valley and the Warrambungles. This central ESU is one of the most fragile in NSW and all sites within it are of very high conservation significance (NSW Scientific Committee 2003a). Recent records from reserves within the Sydney Basin are mostly confined to Yengo, Wollemi, Watagans and Morton NPs and Parr SCA (DEC 2005a) as well as a recently discovered colony in Nattai NP (DEC 2004c).

Northern Yengo NP is well recognised for the significance of its Brush-tailed Rock-wallaby populations and habitat. The species and the reserve have been subject to a considerable amount of research and survey effort to examine habitat use and population numbers (Rummery *et al.* 1995). Currently, several sites are part of an experiment looking at the impact of Fox control measures on population numbers for the statewide Fox Threat Abatement Plan (NPWS 2001f).

Nine locations of Brush-tailed Rock-wallaby occur within or very close to the perimeter of the study area. All are located along the north and eastern edge (see Map 9). Two colonies, "Drews Creek" near the eastern edge and "Portion 78" in the very north-west, are the largest of the reserve. Additionally, four animals were recorded in 2001 just south of the study area in the vicinity of Bunjim creek, and a colony has recently been discovered near 'Big Yengo' (D. Beckers pers. comm.). These populations are part of a network of sites that extend across the sandstone escarpment of the southern Hunter Valley between the Watagan Ranges, Pokolbin State Forest, Yengo and Wollemi NPs. These sites are of statewide conservation significance to the species.

GREY-HEADED FLYING-FOX

Species Profile

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is a large fruit bat that has dark grey body fur, a slightly paler grey head and a russet collar. It is the largest bat in the study area, with a wingspan of up to one metre. It is a highly mobile species and the numbers roosting at specific camps may vary depending on season and food availability. They feed on nectar and pollen of various trees including *Eucalyptus*, *Melaleuca* and *Banksia* as well as fruits, originally of rainforest species, but now including commercial and garden crops. They can travel up to twenty kilometres to a food source, and are an important pollinator and disperser of native plants. The species is endemic to eastern Australia, between central Victoria and Bundaberg in Queensland (NPWS 2001f). The species range has contracted, previously occurring as far north as Rockhampton (NPWS 2001g). It primarily occurs along the eastern coastal plain, east slopes and tablelands, although regular movements occur over the Great Dividing Range to the western slopes in northern NSW (NPWS 2001g). A number of studies have noted the annual southerly movement of animals in spring and summer and their return to north-east NSW and south-east Queensland in winter (NPWS 2001g).

Threats

The main threats to the Grey-headed Flying-fox are: destruction of habitat, particularly of foraging habitat, by clearing for urban development and agriculture; disturbance at roosting sites, particularly of pregnant females; unregulated shooting, particularly when feeding on commercial crops or close to residential developments; electrocution on power lines, particularly in urban areas; and accumulation of pollutants and pesticides (NPWS 2001g, Duncan *et al.* 1999).

Local and Regional Conservation Status

The Grey-headed Flying-fox is listed as Vulnerable under the NSW TSC Act (1995) and is also listed as Vulnerable under the Commonwealth EPBC Act (1999). Eby *et al.* (1999) estimated that there are approximately sixteen camps within the Sydney Basin Bioregion, three of which were occupied in July 1998. Camps are generally located based on roost suitability and proximity to food sources and may move when conditions change. Current locality data suggests that the species is primarily distributed across the coastal and hinterland environments although this may reflect reporting bias in the data. They have been recorded in a number of reserves across the region including records from Royal, Wyrabalong, Blue Mountains, Werakata, Wollemi and Yengo National Parks (DEC 2005d). They have also been recorded at numerous locations off reserve in farming and urban environments including the Botanic Gardens in the centre of Sydney. The Hunter Valley and Newcastle area presently contain a large number of the total population with average numbers up around 440 000 (N. Williams pers. comm.)

Northern Yengo NP lies less than 25 kilometres to the south of the recently formed Flying-fox colony in Burdekin Park, Singleton. This camp varies in numbers year to year but contained up to 4000 animals in early 2005 (N. Williams pers. comm.) and is often used as a maternity site, with adults flying substantial distances at night to forage on fruiting and flowering trees. Recent surveys observed the Grey-headed Flying-fox within the reserve at a number of locations feeding on flowering Ironbarks in and around Old Bulga and Putty roads (Map 10). The Singleton Camp is likely to be the source population for these individuals. The species is well known to target flowering Spotted Gum (*Corymbia maculata*), a tree which is common in the lower Hunter and on coastal foothills. However, these environments are under the continual, though gradual, threats of clearing. The sporadic flowering events of species such as the Ironbarks in northern Yengo NP are likely to be an important supplementary food source for the Grey-headed Flying-fox.



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EAST-COAST FREETAIL-BAT

Species Profile

The East-coast Freetail-bat (*Mormopterus norfolkensis*) is a member of a complex group of bats that remain in a state of considerable taxonomic uncertainty (Churchill 1998). The species can be distinguished from other members of the group by its long forearm, upright ears and robust build (Allison and Hoye 1995, Parnaby 1992a). Reinhold *et al.* (2001) describes the ultrasonic call as “a pattern of alternating pulses”, making it unique among *Mormopterus*, though it can also call without this pattern. There are very few confirmed specimens of this species on record, but it appears to be restricted to the east of the Great Dividing Range between approximately Brisbane (Queensland) and southern New South Wales (Duncan *et al.* 1999;



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Parnaby 1992a). Habitat preferences are poorly understood, but the species appears to favour dry eucalypt forest and woodland, though it has also been captured in rainforest and wet sclerophyll forest (Churchill 1998). It usually roosts in tree hollows (Gilmore and Parnaby 1994), though it has been recorded in the roof of a hut and under the metal caps of telegraph poles (Churchill 1998).

Threats

The threats to this species are poorly known, though it is suspected that clearing for agriculture, development and logging have serious impacts (Duncan *et al.* 1999). These threats may be of increased significance since the species' entire known distribution lies within an area of concentrated human population density and increasing urban development.

Local and Regional Conservation Status

The East-coast Freetail-bat is listed as Vulnerable under the NSW TSC Act (1995). Most records for the species in NSW are contained within the NSW North Coast, South East Corner and Sydney Basin Bioregions (DEC 2005d). Broad-scale habitat models predicted dry inland valleys and hinterlands to be the highest quality habitat for the species, such as occur within Goulburn River, Wollemi and Yengo NPs (NPWS 2000a). These models were based on very limited information about the species, however, and most records for the species come from the Cumberland Plain and Central Coast areas, with scattered records (usually from call analysis) from reserves like Blue Mountains National Park and Western Sydney Regional Park. This disparity most likely reflects the low levels of knowledge about this species. Recent surveys of the species across the southern Sydney region have suggested an association with more fertile country (DEC 2005a).

There are three records of the East-coast Freetail Bat within the reserve (see Map 10). Recent surveys were only able to detect this species through the identification of ultrasonic calls near Old Bulga Road. Current records are likely to be an underestimate of the status and distribution of the bat, since it would often fly above the range of traps and ultrasonic call detectors. As habitat requirements for the species are so poorly known it is difficult to draw associations between use of vegetation communities with so few records. However, it appears from available data that northern Yengo approaches the western limit of the species distribution, given that it has been only rarely recorded (despite extensive survey effort) in Wollemi, Goulburn River NP and Yengo NPs (DEC 2005b, NPWS 2001c). It is likely to occur at very low densities.

LARGE-EARED PIED BAT

Species Profile

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is readily distinguished from other members of its genus by the combination of large ears and overall black colour, with bands of white fur along the undersides of the body, that typically join to form a V-shape (Parnaby 1992a, Churchill 1998). The call (undetectable by the human ear) is an alternate pattern made at a low frequency, which is readily distinguishable from all other species (Reinhold *et al.* 2001). Originally described from Copeton in 1966, it has been recorded from a number of scattered locations on either side of the Great Dividing Range between Rockhampton (Queensland) and Bungonia (New South Wales) (Hoye and Dwyer 1995). It has been found in a wide range of habitats, including wet and dry eucalypt forest, rainforest, Cypress (*Callitris*) forest and sub-alpine woodland (Duncan *et al.* 1999). It is a cave-roosting species, though it has also been detected roosting in disused mine shafts and overhangs (Churchill 1998) as well as abandoned Fairy Martin (*Petrochelidon ariel*) nests (Schulz 1998). It seems to prefer the 'twilight' areas of caves, and may be dependent on sandstone outcrops (Duncan *et al.* 1999, Hoye and Dwyer 1995).



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Threats

The only confirmed threat to this species is the destruction or interference of roost sites (Duncan *et al.* 1999). Other potential threats include mining induced subsidence (particularly coal-mining in sandstone areas) which may destroy roost sites, habitat destruction for agriculture and urban development, and predation by feral animals (Duncan *et al.* 1999).

Local and Regional Conservation Status

The Large-eared Pied Bat is listed as Vulnerable under the NSW TSC Act (1995) and also as Vulnerable under the Commonwealth EPBC Act (1999). The Sydney Basin appears to form a stronghold for the Large-eared Pied Bat, with only scattered records occurring to the north, south and west of the Bioregion (DEC 2005d, Hoye and Schulz in prep.). Recent surveys conducted by DEC across the Greater Blue Mountains has found the species to be more widespread in the region than previously thought, yielding important information on the species habitat preferences and conservation status (DEC 2005a). Records are scattered throughout the Bioregion, including southern Wollemi, Kanangra-Boyd, Royal, Gardens of Stone and Morton National Parks (DEC 2005a). However, despite this wide distribution the species is infrequently detected, suggesting that it occurs at low abundance.

Large-eared Pied Bats have been recorded at sixteen locations in a range of environments across northern Yengo NP (see Map 10). Harp trapping has proved to be an effective method to detect this species within the study area. The sandstone environments of the Sydney Basin reserves are core habitat for the Large-eared Pied Bat and northern Yengo NP is no exception. Recent work on the species in southern Sydney suggests that it may require both sandstone overhangs for shelter and proximate to this, more productive landscapes such as Box woodlands for foraging (DEC 2005d). These bats were observed roosting in rock overhangs during recent surveys. Suitable habitat for the Large-eared Pied Bat is likely to be widespread in the reserve, particularly in sandstone areas adjacent to more fertile country, and the species is likely to occur in reasonable numbers.

EASTERN FALSE PIPISTRELLE

Species Profile

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is a relatively large (up to 70 millimetres) bat that is similar to the Greater Broad-nosed Bat (*Scoteanax rueppellii*). It is distinguished by the possession of two pairs of upper incisors, a gap between the incisors and the canines, and larger ears (Parnaby 1992a; Churchill 1998). Its ultrasonic call pattern can be easily confused with various species of *Scotorepens* and the Greater Broad-nosed Bat, though good quality calls can be distinguished (Reinhold *et al.* 2001). It is patchily distributed throughout its range in south-eastern Australia, between south-east Queensland and western Victoria, and Tasmania. It appears to prefer wet forested habitats, particularly riparian or high rainfall areas, with large trees (taller than 20 metres) (Menkhorst and Lumsden 1995). It may be more common at high elevations in northern parts of its range (Phillips 1995), though it has been recorded between sea level and 1500 metres in Victoria (Menkhorst and Lumsden 1995) and Tasmania (M. Schulz pers. comm.). It usually roosts in hollows in *Eucalyptus*, though it has been recorded in caves (Churchill 1998). It may hibernate over winter and has been known to travel at least twelve kilometres from its roost site (Churchill 1998).

Threats

Threats to the species are poorly known, but the main threat would appear to be destruction of roosting sites, through land clearance and timber harvesting (Gilmore and Parnaby 1994).

Local and Regional Conservation Status

The Eastern False Pipistrelle is listed as Vulnerable under the NSW TSC Act (1995). The species has a disjunct distribution along and to the east of the Great Dividing Range, with scattered records on the western slopes (DEC 2005a). Records for the species are scattered across the Sydney Basin Bioregion, with only a few sightings recorded north of Singleton. The species has been relatively well reported from a number of reserves in the Sydney Basin, including, in addition to Wollemi, Royal, Nattai, Blue Mountains, Kanangra-Boyd and Gardens of Stone National Parks (DEC 2005a).

The Eastern False Pipistrelle has not been trapped within northern Yengo NP, although there are five locations where ultrasonic calls have been used to identify this species with varying degrees of reliability (see Map 10). The call of the species is easily confused the Greater Broad-nosed Bat which is also known to occur within the reserve. The Eastern False Pipistrelle is thought to be uncommon or localised across its range (Parnaby 1992a), which appears to be the case in the Hunter Range area, having been recorded only sporadically in Wollemi and Yengo National Parks. The region is never-the-less important to the conservation of the species as it lies towards the western edge of the species' known range.



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EASTERN BENT-WING BAT

Species Profile

The Common Bent-wing Bat (*Miniopterus schreibersii*) is the most widely distributed bat in the world, occurring through Europe, Africa and Australasia (Churchill 1998). However, recent research suggests there to be three taxa in Australia (Duncan *et al.* 1999). The subspecies *oceanensis* occurs in eastern Australia and extends from central Victoria to Cape York Peninsula, Queensland (Duncan *et al.* 1999). This subspecies is commonly called the Eastern Bent-wing Bat. This species is distinguished from most other bats by the long last bone in the third wing digit and from the Little Bent-wing Bat (*M. australis*) by the longer forearm (greater than 44 mm) (Parnaby 1992a). The ultrasonic call can be distinctive, although it is often inseparable from *Vespadelus darlingtoni* and *V. regulus* (Reinhold *et al.* 2001). The species utilises a wide variety of habitats where it usually roosts in caves, though it has been known to use mines and road culverts (Churchill 1998). It is a fast flying bat that usually feeds above the canopy (Churchill 1998) and has been known to travel up to 65 kilometres in a night (Dwyer 1966 in Ayers *et al.* 1996). Though individuals often use numerous roosts, they congregate en masse at a small number of caves and abandoned mines to breed and hibernate (Churchill 1998).

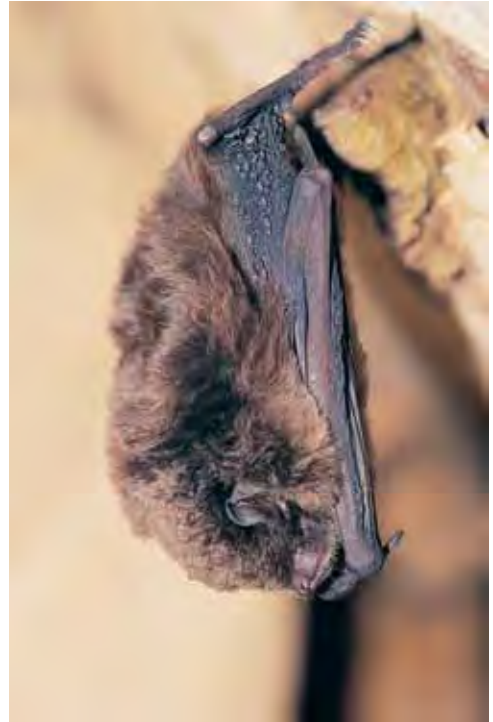
Threats

Damage and disturbance to hibernating and maternity roosting sites is the greatest known threat to this species. Because only relatively few nursery caves are used, significant population changes can occur if these sites are damaged (Dwyer 1995). Disturbance of hibernating colonies can lead to starvation due to loss of energy reserves (Gilmore and Parnaby 1994). Disturbance of smaller diurnal roosts by recreational caving and tourism may also be significant. Other potential threats include modification to feeding habitat by agriculture and urban development (Gilmore and Parnaby 1994) and predation by Feral Cats (*Felis catus*) and, less often, Foxes (*Vulpes vulpes*) (Dwyer 1995).

Local and Regional Conservation Status

The Eastern Bent-wing Bat is listed as Vulnerable under the NSW TSC Act (1995). The species is widely recorded in the eastern third of NSW, with the number of records decreasing with distance from the coast (DEC 2005d). Sightings for the species are scattered throughout the South Eastern Highlands Bioregion, and good numbers have been recorded in the Sydney Basin Bioregion in recent years (DEC 2005d). Broad-scale habitat modelling for the species has identified a very large area of suitable habitat within these bioregions (NPWS 2000b), reflecting the large distances that this species travels whilst foraging. Individuals have been recorded flying through a diverse range of National Parks within the Bioregion, including Nattai, Kanangra-Boyd, Blue Mountains, and Abercrombie River National Parks and Bargo and Nattai State Conservation Areas. (DEC 2004a, 2004b, 2004d, 2005d). However, roost sites for the species, particularly maternity roosts, are much less frequently recorded and poorly reserved. The species is known to roost in old Shale Mine Shafts in Baerami Valley in Wollemi NP (DEC 2005b).

The Eastern Bent-wing Bat is known from very few records across Yengo National Park. Within the northern area it has been identified using ultrasonic call analysis at two locations, the first at the fire dam on Old Bulga Road and the other along the Yengo Track (see Map 10). Given the number of sampling sites for bat fauna it is likely that the Eastern Bent-wing Bat occurs very infrequently. This may be due to the absence of suitable roosting caves of sufficient depth and protection and unlike northern Wollemi NP there are no disused mine shafts that could provide good supplementary habitat.



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GREATER BROAD-NOSED BAT

Species Profile

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is a large microchiropteran bat usually found in gullies draining east from the Great Dividing Range between south east New South Wales and north Queensland (Atherton Tablelands). The species can only be confused with the Eastern False Pipistrelle from which it can be distinguished by its single pair of upper incisors and its smaller ears (Parnaby 1992a). The ultrasonic call overlaps in frequency and may be confused with Eastern False Pipistrelle, Eastern Broad-nosed Bat and Inland Broad-nosed Bat, though they can be distinguished if a good call sequence is recorded (Pennay *et al.* 1994). The Greater Broad-nosed Bat utilises creeks and clearings for hunting (Churchill 1998; Hoyer and Richards 1995). In southern New South Wales the species appears to be restricted to lower altitude forests (McKean 1966), while in the centre of its range it occurs at a wide range of altitudes from near sea level to upland areas (Calaby 1966 in Duncan *et al.* 1999). It usually roosts in tree hollows, in cracks and fissures in trunks or under exfoliating bark, though it may also utilise old buildings (Churchill 1998).

Threats

The threats to this species are poorly known, though they probably include habitat clearance and fragmentation for agriculture and urban development, and timber harvesting, which may remove suitable hollows and alter the availability of prey (Duncan *et al.* 1999).

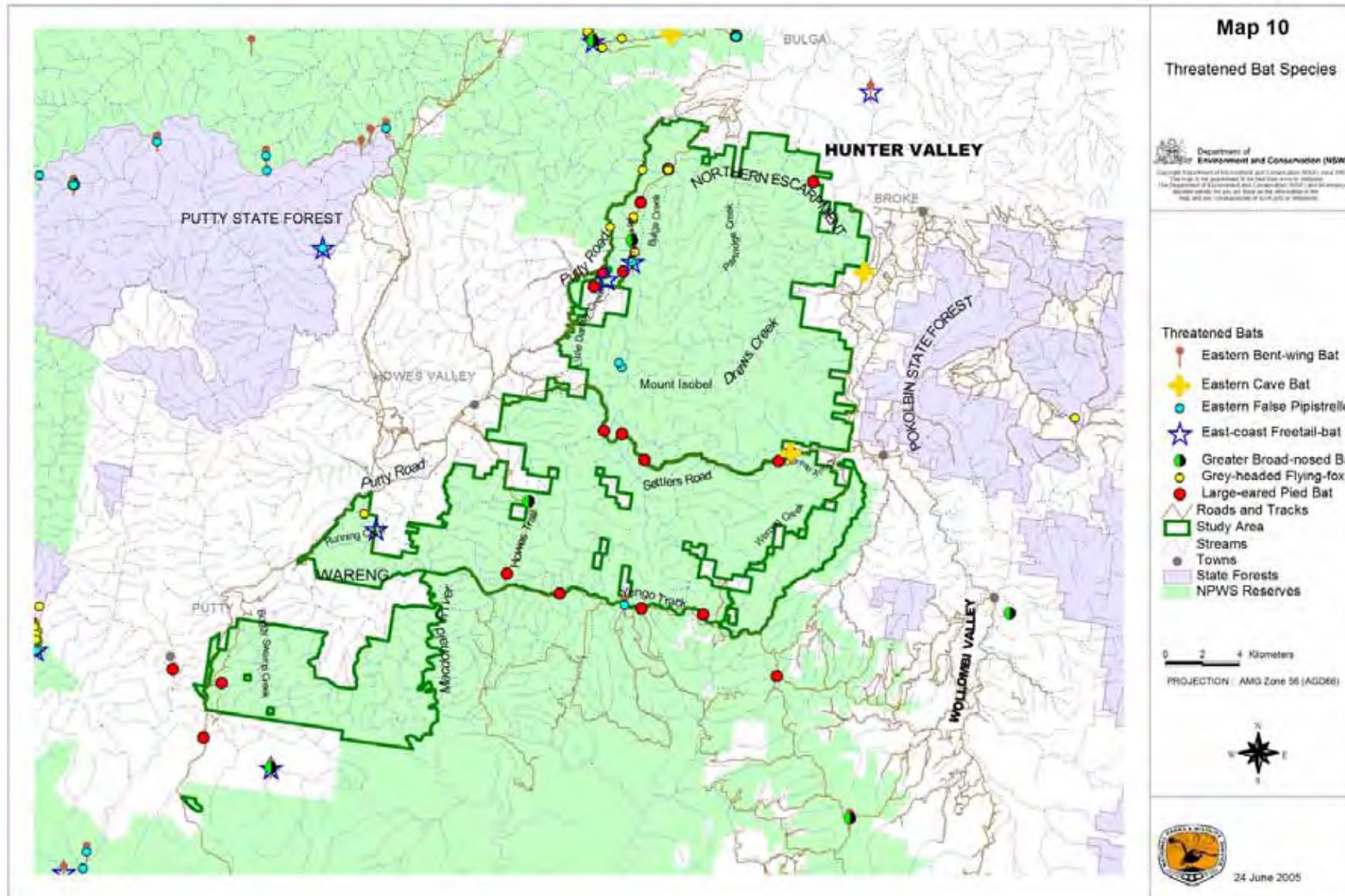
Local and Regional Conservation Status

The Greater Broad-nosed Bat is listed as Vulnerable under the NSW TSC Act (1995). The majority of records for the species in NSW occur in the NSW North Coast, South East Corner and Sydney Basin, with some records in the New England Tableland Bioregion and South-eastern Highlands Bioregion (DEC 2005d). Within the Sydney Basin the species is mainly restricted to the eastern half of the Bioregion, with the greatest density of records on the Central Coast, the Cumberland Plain and to a lesser extent the southern Blue Mountains. The species is reasonably well reported from DEC reserves within the Sydney Basin, including Nattai, Kanangra-Boyd, Blue Mountains and Wollemi National Parks (DEC 2005d).

The Greater Broad-nosed Bat has only been recorded at two locations within northern Yengo National Park, the first at Old Bulga Road and the other at Howes Valley Trail (see Map 10). The latter site was discovered during recent surveys when the species was caught in a harp trap near gully vegetation. This finding concurs with available literature (Churchill 1998) that suggests moist vegetation to be preferred habitat. Moist gully systems are uncommon in northern Yengo NP and as a result the species is likely to be restricted in both distribution and abundance. The Greater Broad-nosed Bat is thought to be sparse across its range (Parnaby 1992b), as suggested by these results and those recently obtained in the neighbouring north-eastern Wollemi National Park (DEC 2005b).



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Map 10: Threatened bat records within five kilometres of northern Yengo National Park

EASTERN CAVE BAT

Species Profile

The Eastern Cave Bat (*Vespadelus troughtoni*) is a small mustard yellow-brown bat with dark wings. It has a patchy distribution throughout eastern Australia and remains one of the least known and understood members of its genus. It is very similar in size to the Large Forest Bat (*V. darlingtoni*), the most reliable distinguishing feature between the two species being the shape and size of the male's genitalia, with *V. troughtoni* possessing a larger more pendulous penis (Parnaby 1992a). The species is very difficult to distinguish from ultrasonic call recordings, as the frequency and call pattern overlaps with that of the Little Forest Bat (*Vespadelus vulturnus*) (Pennay *et al.* 2004). The Eastern Cave Bat displays a predominantly tropical distribution that ranges down the east coast from Cape York in Queensland to Kempsey in NSW, with smaller numbers recorded south to at least the Sydney Basin (Law *et al.* 2005). The western limit appears to be the Warrumbungle Range, with a single record from southern NSW, east of the ACT (DEC 2005f). Although little is known about the biology and ecology of this species, the general preferences of habitat seem to range from dry open forest and woodland in the west and inland through to moister wet eucalypt forest and rainforest along the coast (Churchill 1998; DEC 2005f). A cave-dwelling species, it roosts in small groups in reasonably well lit areas near the entrances of sandstone overhangs, mine tunnels, boulder piles and occasionally buildings (Churchill 1998). It has also been discovered roosting in disused Fairy Martin (*Hirundo ariel*) mud nests (Schulz 1998).



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Threats

Threats to the species are poorly known as little is known about its habitat preferences, diet and breeding requirements. As for other cave-dwelling bats destruction or damage of roosting sites is likely to be the main threat (DEC 2005f). This type of disturbance is likely to result from clearing and isolation of habitat as a result of increasing development, both residential and agricultural, as well as altered fire regimes and consequential habitat species modification and from practices such as timber harvesting and grazing (DEC 2005f). Disturbance of roost sites by cave visitors may also have localised impacts on this bat.

Local and Regional Conservation Status

The Eastern Cave Bat is listed as Vulnerable under the NSW TSC Act (1995). This poorly understood species has only been recorded 34 times on the Atlas of NSW Wildlife between 1980 and the current surveys. The majority of records occur in the North Coast and Sydney Basin Bioregions, with a few records in the Brigalow Belt South Bioregion and one record south of Ulladulla on the NSW South Coast (DEC 2005a). The species is reported in low numbers from DEC reserves including, in addition to Wollemi, Yengo, Goulbourn River and Warrumbungle National Parks and Arakoola and Manobalai Nature Reserves (DEC 2005a). Extensive DEC surveys in various reserves and Sydney Catchment Authority Special Areas in the central area of the Sydney Basin Bioregion have failed to locate this species in that area (DEC 2005d), although targeted searches of overhangs and caves was not undertaken.

The Eastern Cave Bat was detected within northern Yengo NP for the first time during recent DEC surveys. Twenty-five individuals were recorded at two locations. Five individuals were found in a rock overhang near Settlers Road on the eastern side of the study area, and a further twenty individuals were found roosting in a cave to the north of Drews creek (DEC 2005d). These findings confirm that the sandstone cave systems in the north of the park provide suitable habitat. In combination with dry woodlands of the sandstone reserves of the western Hunter catchment northern Yengo NP provides an important conservation area for the species.

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APPENDIX A – LOCATION OF SURVEY SITES

Location, vegetation type and techniques undertaken at systematic fauna survey sites in northern Yengo National Park. Note that mapped vegetation unit as presented here does not always equal vegetation community observed in the field. Transect spotlight surveys traverse a variety of vegetation types and therefore have not been aligned to a single community in this table.

Site name	Easting	Northing	Mapped vegetation community	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap	Bat ultrasound detection	Nocturnal call playback	Nocturnal streamside search	Elliott traps	Hair tubes	Transect spotlight survey
BLG01W	312857	6377989	[3c] Grey Box open forest	1									
BLG02O	315185	6377759	[5] Northern Escarpment Woodland	1		1							
BLG03C	315373	6378034	[5] Northern Escarpment Woodland						1	1			
BLG04W	314047	6377469	[5] Northern Escarpment Woodland	1	1								
BLG05O	316398	6376104	Unclassified				1						
BLG06O	316351	6375544	[5] Northern Escarpment Woodland		1								
BLG07O	313755	6375295	[4b] Nrbn-Hwksbry Ironbark W/F		1								
BLG08W	313539	6376479	[4b] Nrbn-Hwksbry Ironbark W/F	1	1								
BLG13O	316483	6376015	[5] Northern Escarpment Woodland	1		1	1		1				1
BLG14W	316244	6375062	[5] Northern Escarpment Woodland		1								
BRB01W	314543	6361132	[4b] Nrbn-Hwksbry Ironbark W/F				1						
BRB02W	315190	6361617	[4b] Nrbn-Hwksbry Ironbark W/F	1				1	1				
BRB03W	315929	6361616	[4b] Nrbn-Hwksbry Ironbark W/F	1		1							
BRB04O	313825	6361141	[4a] Exposed Narrabeen Woodland	1	1	1							
BRB05O	315339	6370062	[3b] Sheltered Forest-rich soils					1					
BRB06O	316158	6370252	[5] Northern Escarpment Woodland	1		1	1		1	1			1
BRB07O	317922	6371502	[5] Northern Escarpment Woodland	1					1				
BRB08O	317184	6372160	[4b] Nrbn-Hwksbry Ironbark W/F		1								
BRB09O	318034	6372722	[4b] Nrbn-Hwksbry Ironbark W/F		1								
BRB10W	314242	6373966	[4b] Nrbn-Hwksbry Ironbark W/F		1								
BRB11O	315274	6374360	[4a] Exposed Narrabeen Woodland		1								
BRB12C	313340	6367925	[3b] Sheltered Forest-rich soils	1	1								
BRB15W	318536	6374416	[5] Northern Escarpment Woodland	1	1				1				1
BRB16O	314004	6368244	[4a] Exposed Narrabeen Woodland	1	1								
BRB17W	319132	6371292	Unclassified					1					
BRB18W	315330	6370008	[3b] Sheltered Forest-rich soils	1	1								
BRB19W	317411	6370593	Unclassified	1	1								

Site name	Easting	Northing	Mapped vegetation community	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap	Bat ultrasound detection	Nocturnal call playback	Nocturnal streamside search	Elliott traps	Hair tubes	Transect spotlight survey
BRB20W	316417	6370608	[4b] Nrbn-Hwksbry Ironbark W/F		1								
BRB21O	314715	6369127	[4a] Exposed Narrabeen Woodland	1	1								
BRB22W	319218	6371656	[5] Northern Escarpment Woodland		1								
HWS01W	312241	6360997	[4a] Exposed Narrabeen Woodland	1	1	1							
HWS02W	307306	6361202	[2a] Exposed Hwksbry woodland				1						
HWS03O	310300	6361300	[4b] Nrbn-Hwksbry Ironbark W/F			1							
HWS04O	299425	6364541	[4b] Nrbn-Hwksbry Ironbark W/F	1									
HWS05O	300505	6364405	[2a] Exposed Hwksbry woodland		1								
HWS06O	310543	6361317	[2a] Exposed Hwksbry woodland				1						
HWS07W	311152	6361092	[4a] Exposed Narrabeen Woodland	1	1	1							
HWS08W	305120	6362772	[2a] Exposed Hwksbry woodland				1						
HWS09O	306100	6362608	[2a] Exposed Hwksbry woodland	1			1						
HWS10O	305086	6362414	[2a] Exposed Hwksbry woodland	1	1	1							
HWS11O	305684	6363299	[3b] Sheltered Forest-rich soils	1		1		1					
HWS12W	307936	6360795	[2a] Exposed Hwksbry woodland	1	1	1		1					
HWS13O	307086	6361415	[2a] Exposed Hwksbry woodland	1	1	1							
HWS14O	304974	6364168	[1] Sheltered Dry Hwksbry Forest	1		1							
HWS15W	300568	6364354	[4b] Nrbn-Hwksbry Ironbark W/F	1		1			1				
HWS16W	302778	6365098	[2a] Exposed Hwksbry woodland	1	1	1	1		1				
HWS17O	306172	6371326	[2a] Exposed Hwksbry woodland	1	1	1	1						
HWS18O	306663	6371854	[4b] Nrbn-Hwksbry Ironbark W/F				1	1	1				
HWS19W	306741	6374279	[4b] Nrbn-Hwksbry Ironbark W/F				1						
HWS20W	305670	6370369	[4b] Nrbn-Hwksbry Ironbark W/F		1	1							
HWS21W	299757	6360940	[3c] Grey Box Open Forest	1	1	1							
HWS22W	303989	6361053	[2a] Exposed Hwksbry woodland	1	1								
HWS23O	305082	6362975	[2a] Exposed Hwksbry woodland						1				
HWS24W	307933	6360733	[2a] Exposed Hwksbry woodland						1				
HWS25W	310326	6361557	[1] Sheltered Dry Hwksbry Forest						1				
HWS26O	303039	6361034	[4b] Nrbn-Hwksbry Ironbark W/F	1	1								
HWS27O	306905	6363409	[3a] Hwksbry-Nrbn shelt. forest	1	1								
HWS28O	306415	6362562	[3a] Hwksbry-Nrbn shelt. forest	1									
HWS29O	307236	6364587	[3b] Sheltered Forest-rich soils	1	1								
HWS30W	312294	6362775	[4a] Exposed Narrabeen Woodland		1								

Site name	Easting	Northing	Mapped vegetation community	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap	Bat ultrasound detection	Nocturnal call playback	Nocturnal streamside search	Elliott traps	Hair tubes	Transect spotlight survey
HWS31W	312360	6361791	[4a] Exposed Narrabeen Woodland	1									
HWS32W	309299	6361191	[2a] Exposed Hwksbry woodland	1									
HWS33O	304121	6361344	[1] Sheltered Dry Hwksbry Forest						1				
HWS34O	304939	6371243	[4b] Nrbn-Hwksbry Ironbark W/F						1				
HWS35O	305461	6373740	[4b] Nrbn-Hwksbry Ironbark W/F						1				
HWS36W	299817	6360892	[4b] Nrbn-Hwksbry Ironbark W/F						1				
MTY01O	303545	6354397	[2a] Exposed Hwksbry woodland									1	
MTY02O	304934	6353824	[2a] Exposed Hwksbry woodland									1	
MTY03O	302308	6354072	[1] Sheltered Dry Hwksbry Forest		1	1							
MTY04W	310488	6352925	[2a] Exposed Hwksbry woodland				1						
MTY05O	305888	6353618	[2a] Exposed Hwksbry woodland				1						
MTY06O	303737	6354344	[2a] Exposed Hwksbry woodland				1						
MTY07O	302744	6354029	[2a] Exposed Hwksbry woodland				1						
MTY08O	299904	6355118	[1] Sheltered Dry Hwksbry Forest				1						
MTY09O	301187	6357647	[2a] Exposed Hwksbry woodland				1						
MTY10O	301079	6358996	[2a] Exposed Hwksbry woodland				1						1
MTY11O	291666	6358100	[1] Sheltered Dry Hwksbry Forest				1						
MTY12W	289717	6356604	[2a] Exposed Hwksbry woodland				1						
MTY13W	311177	6354984	[4b] Nrbn-Hwksbry Ironbark W/F	1	1	1							
MTY14O	311677	6352900	[2a] Exposed Hwksbry woodland	1	1	1							
MTY15O	312050	6353969	[4b] Nrbn-Hwksbry Ironbark W/F	1	1	1							
MTY16O	312703	6352040	[2a] Exposed Hwksbry woodland	1	1	1							
MTY17O	291292	6357746	[6a] Woodland on Perched Sands	1	1	1							
MTY18O	289730	6356381	[6a] Woodland on Perched Sands	1	1	1						1	
MTY19O	292221	6358336	[1] Sheltered Dry Hwksbry Forest		1	1			1				
MTY20W	292861	6357509	[6a] Woodland on Perched Sands	1	1	1		1					
MTY21O	291900	6356875	[6b] Swamp Wdln - Perched Sands	1	1								
MTY22O	307891	6353985	[1] Sheltered Dry Hwksbry Forest	1									
MTY23O	307982	6355075	[2a] Exposed Hwksbry woodland	1	1								
MTY24O	307983	6356132	[4b] Nrbn-Hwksbry Ironbark W/F	1	1								
MTY25O	308739	6356862	[4b] Nrbn-Hwksbry Ironbark W/F	1	1								
MTY26O	300887	6356212	[2a] Exposed Hwksbry woodland				1						
MTY27O	301968	6358616	[1] Sheltered Dry Hwksbry Forest	1	1	1							1

Site name	Easting	Northing	Mapped vegetation community	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap	Bat ultrasound detection	Nocturnal call playback	Nocturnal streamside search	Elliott traps	Hair tubes	Transect spotlight survey
MTY28W	302740	6359141	[2a] Exposed Hwksbry woodland	1	1	1							
MTY29O	303166	6359905	[2a] Exposed Hwksbry woodland		1								
MTY30O	300603	6359242	[2a] Exposed Hwksbry woodland	1	1	1							
MTY31O	299666	6359561	[4b] Nrbn-Hwksbry Ironbark W/F		1	1							
MTY32O	298846	6358949	[4b] Nrbn-Hwksbry Ironbark W/F		1	1							
MTY33O	297928	6358744	[4b] Nrbn-Hwksbry Ironbark W/F	1	1								
MTY34O	300010	6354600	[2a] Exposed Hwksbry woodland		1								
MTY35O	302832	6359476	[4b] Nrbn-Hwksbry Ironbark W/F						1				
MTY36O	300010	6354600	[2a] Exposed Hwksbry woodland						1				
MTY37W	304119	6354140	[2a] Exposed Hwksbry woodland						1				
MTY38W	312196	6351713	[2a] Exposed Hwksbry woodland						1				
MTY39O	290112	6356791	[1] Sheltered Dry Hwksbry Forest						1				
PRN01O	307828	6375919	[4b] Nrbn-Hwksbry Ironbark W/F	1									
PRN02W	308585	6376799	[2a] Exposed Hwksbry woodland	1	1	1					1		
PRN03O	309572	6377809	[1] Sheltered Dry Hwksbry Forest	1		1							
PRN04W	310527	6379216	[5] Northern Escarpment Woodland	1		1					1		
PRN05W	307599	6378047	[5] Northern Escarpment Woodland	1	1								
PRN06W	312483	6376978	[5] Northern Escarpment Woodland	1	1	1		1					
PRN07O	307245	6377305	[3d] Rough-barked Apple Woodland							1			
PRN08O	312267	6376956	[5] Northern Escarpment Woodland							1			
PRN10O	308750	6377784	[1] Sheltered Dry Hwksbry Forest		1								
PRN11O	312416	6374973	[5] Northern Escarpment Woodland	1	1								
PRN12O	307232	6376804	[4b] Nrbn-Hwksbry Ironbark W/F	1		1		2					
PRN13O	312176	6375940	[5] Northern Escarpment Woodland	1	1	1							
PRN14O	307827	6378961	[5] Northern Escarpment Woodland	1	1	1						1	
PRN15W	310639	6378928	[4a] Exposed Narrabeen Woodland					1					
PRN16O	309675	6378072	[2a] Exposed Hwksbry woodland					1					
PRN17W	309028	6377226	[4a] Exposed Narrabeen Woodland					1					
PRN41W	312548	6377625	[5] Northern Escarpment Woodland						1				
PRN42O	308847	6377571	[4b] Nrbn-Hwksbry Ironbark W/F						1				
PTT01O	286563	6350151	[3d] Rough-barked Apple Woodland		1								
PTT02O	286881	6349349	[4b] Nrbn-Hwksbry Ironbark W/F										
PTT03O	287396	6350493	[1] Sheltered Dry Hwksbry Forest		1								

Site name	Easting	Northing	Mapped vegetation community	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap	Bat ultrasound detection	Nocturnal call playback	Nocturnal streamside search	Elliott traps	Hair tubes	Transect spotlight survey
PTT04W	284000	6349173	[2a] Exposed Hwksbry woodland				1						
PTT05W	284665	6350214	[4b] Nrbn-Hwksbry Ironbark W/F				1	1					
PTT06O	284719	6349090	[3d] Rough-barked Apple Woodland	1									
PTT07O	285654	6349464	[4b] Nrbn-Hwksbry Ironbark W/F	1									
PTT08W	284536	6349249	Unclassified					1					
PTT09O	285540	6351341	[4b] Nrbn-Hwksbry Ironbark W/F						1				
PTT10W	285002	6349376	[2a] Exposed Hwksbry woodland						1				
S-F-LNE-41-038-R	306850	6374300	[4b] Nrbn-Hwksbry Ironbark W/F	1	1			1	1				
S-F-LNE-41-039-M	307100	6375025	[4b] Nrbn-Hwksbry Ironbark W/F	1	1			1	1				
S-F-LNE-41-040-G	306650	6373000	[4b] Nrbn-Hwksbry Ironbark W/F	1	1			1	1	1			1
S-F-LNE-41-042-R	304660	6366620	[2a] Exposed Hwksbry woodland	1	1			1	1				
S-F-LNE-41-043-M	304900	6366150	[2a] Exposed Hwksbry woodland	1	1			1	1				
S-F-LNE-41-044-G	304750	6365250	[2a] Exposed Hwksbry woodland	1	1			1	1	1			
S-F-LNE-41-046-R	306100	6366200	[1] Sheltered Dry Hwksbry Forest	1	1			1	1				1
S-F-LNE-41-047-M	305950	6366450	[1] Sheltered Dry Hwksbry Forest	1	1			1	1				
S-F-LNE-41-048-G	305950	6366550	[1] Sheltered Dry Hwksbry Forest	1	1			1		1			
S-F-LNE-43-121-G	306250	6353475	[2a] Exposed Hwksbry woodland	1	1	1		1	1				
S-F-LNE-43-122-M	308975	6353450	[2a] Exposed Hwksbry woodland	1	1	1		1	1				
S-F-LNE-43-123-R	307150	6353250	[2a] Exposed Hwksbry woodland	1	1	1		1	1				
S-F-LNE-41-041-	304668	6366576	[1
T-F-LNE-43-145	311450	6352250	[2a] Exposed Hwksbry woodland					1					
T-F-SYD-41-023	304300	6367750	[2a] Exposed Hwksbry woodland				1						
T-F-SYD-41-024	305450	6374000	[4b] Nrbn-Hwksbry Ironbark W/F				1						
T-F-SYD-43-121	314225	6353125	[1] Sheltered Dry Hwksbry Forest				1						
T-F-SYD-43-122	307225	6353125	[1] Sheltered Dry Hwksbry Forest				1						
WLM01O	317990	6359425	[3d] Rough-barked Apple Woodland				1						
WLM02O	316163	6358321	[4b] Nrbn-Hwksbry Ironbark W/F				1						
WLM03O	316095	6359489	[4b] Nrbn-Hwksbry Ironbark W/F		1								
WLM04O	317496	6357966	[4b] Nrbn-Hwksbry Ironbark W/F		1								
WLM05O	316672	6360748	[4b] Nrbn-Hwksbry Ironbark W/F	1								1	
WLM06W	317689	6359213	[3d] Rough-barked Apple Woodland	1	1	1	1						
WLM07O	318363	6359839	[4b] Nrbn-Hwksbry Ironbark W/F	1	1	1			1			1	
WLM08O	318021	6359446	[4b] Nrbn-Hwksbry Ironbark W/F					1					

Site name	Easting	Northing	Mapped vegetation community	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap	Bat ultrasound detection	Nocturnal call playback	Nocturnal streamside search	Elliott traps	Hair tubes	Transect spotlight survey
WLM09O	316659	6358586	[3d] Rough-barked Apple Woodland	1	1	1							
WLM10O	318581	6358869	[4b] Nrbn-Hwksbry Ironbark W/F	1	1			1					
WLM11O	316486	6358682	[4b] Nrbn-Hwksbry Ironbark W/F				1						
WLM12O	316149	6358157	[4b] Nrbn-Hwksbry Ironbark W/F			1							
WLM13W	316150	6357750	[4b] Nrbn-Hwksbry Ironbark W/F	1									
WLM14O	313221	6351949	[2a] Exposed Hwksbry woodland				1						
WLM15O	313425	6360712	[4b] Nrbn-Hwksbry Ironbark W/F						1				

APPENDIX B – FAUNA SPECIES RECORDED IN NORTHERN YENGO NATIONAL PARK

List of the fauna species within northern Yengo National Park from the DEC Atlas of NSW Wildlife. Records have been included from DEC systematic surveys, licensed data sets (Birds Australia and the Australian Museum) and incidental observations submitted by individuals, including park rangers and field officers; catchment officers; bushwalkers and naturalists; scientific researchers working in the area; and other visitors to the park. The list contains records of various levels of reliability and spatial accuracy. Species where there is doubt about the occurrence within the study area have been marked with an asterisk *. Introduced species are indicated by U in the Conservation status.

Family	Scientific name	Common name	Conservation Status	Data Priorities Systematic Surveys	CRA Systematic Surveys	Birds Australia	Australian Museum specimens	Other Sources
Frogs								
Myobatrachidae	<i>Crinia signifera</i>	Common Eastern Froglet	P	✓	✓			✓
Myobatrachidae	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	✓				
Myobatrachidae	<i>Limnodynastes dumerilii</i>	Bullfrog	P	✓				✓
Myobatrachidae	<i>Limnodynastes ornatus</i>	Ornate Burrowing Frog	P	✓	✓			
Myobatrachidae	<i>Limnodynastes peronii</i>	Striped Marsh Frog	P	✓				
Myobatrachidae	<i>Mixophyes fasciolatus</i>	Great Barred Frog	P	✓				
Myobatrachidae	<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	✓	✓			
Myobatrachidae	<i>Pseudophryne bibronii</i>	Bibron's Toadlet	P	✓	✓			✓
Myobatrachidae	<i>Uperoleia fusca</i>	Dusky Toadlet	P	✓				
Myobatrachidae	<i>Uperoleia laevigata</i>	Smooth Toadlet	P	✓	✓			✓
Hylidae	<i>Litoria caerulea</i>	Green Tree Frog	P		✓			✓
Hylidae	<i>Litoria dentata</i>	Keferstein's Tree Frog	P	✓	✓			
Hylidae	<i>Litoria fallax</i>	Eastern Dwarf Tree Frog	P		✓			✓
Hylidae	<i>Litoria latopalmata</i>	Broad-palmed Frog	P	✓	✓		✓	✓
Hylidae	<i>Litoria lesueuri</i>	Lesueur's Frog	P	✓	✓			✓
Hylidae	<i>Litoria peronii</i>	Peron's Tree Frog	P	✓	✓			✓
Reptiles								
Chelidae	<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle	P	✓			✓	✓
Gekkonidae	<i>Diplodactylus vittatus</i>	Eastern Stone Gecko	P	✓	✓			
Gekkonidae	<i>Oedura lesueurii</i>	Lesueur's Velvet Gecko	P	✓	✓			✓
Gekkonidae	<i>Oedura robusta</i>	Robust Velvet Gecko	P	✓				
Gekkonidae	<i>Phyllurus platurus</i>	Broad-tailed Gecko	P	✓	✓			✓
Gekkonidae	<i>Underwoodisaurus milii</i>	Thick-tailed Gecko	P	✓	✓			
Pygopodidae	<i>Delma plebeia</i>	Leaden Delma	P	✓			✓	

Family	Scientific name	Common name	Conservation Status	Data Priorities Systematic Surveys	CRA Systematic Surveys	Birds Australia	Australian Museum specimens	Other Sources
Pygopodidae	<i>Lialis burtonis</i>	Burton's Snake-lizard	P		✓		✓	✓
Pygopodidae	<i>Pygopus lepidopodus</i>	Southern Scaly-foot	P	✓				
Agamidae	<i>Amphibolurus muricatus</i>	Jacky Lashtail	P	✓	✓			
Agamidae	<i>Physignathus lesueurii</i>	Eastern Water Dragon	P	✓				
Agamidae	<i>Pogona barbata</i>	Eastern Bearded Dragon	P	✓				✓
Agamidae	<i>Tympanocryptis diemensis</i>	Mountain Heath Dragon	P	✓	✓			✓
Varanidae	<i>Varanus varius</i>	Lace Monitor	P	✓	✓			✓
Scincidae	<i>Anomalopus swansonii</i>	Punctate Worm-skink	P	✓	✓		✓	
Scincidae	<i>Bassiana platynota</i>	Red-throated Cool-skink	P	✓	✓			
Scincidae	<i>Carlia tetradactyla</i>	Southern Rainbow-skink	P	✓				✓
Scincidae	<i>Carlia vivax</i>	Tussock Rainbow-skink	P	✓			✓	
Scincidae	<i>Cryptoblepharus virgatus</i>	Cream-striped Shinning-skink	P	✓	✓			
Scincidae	<i>Ctenotus robustus</i>	Robust Ctenotus	P	✓	✓		✓	✓
Scincidae	<i>Ctenotus taeniolatus</i>	Copper-tailed Ctenotus	P	✓	✓		✓	✓
Scincidae	<i>Egernia cunninghami</i>	Cunningham's Spiny-tailed Skink	P	✓				✓
Scincidae	<i>Egernia striolata</i>	Tree-crevice Skink	P	✓			✓	✓
Scincidae	<i>Egernia whitii</i>	White's Rock-skink	P	✓	✓		✓	✓
Scincidae	<i>Eulamprus heatwolei</i>	Warm-temperate Water-skink*	P					✓
Scincidae	<i>Eulamprus quoyii</i>	Eastern Water-skink	P	✓	✓			✓
Scincidae	<i>Eulamprus tenuis</i>	Bar-sided Forest-skink	P	✓	✓		✓	
Scincidae	<i>Hemisphaeriodon gerrardii</i>	Pink-tongued Skink	P	✓				
Scincidae	<i>Lampropholis amacula</i>	Friendly Sunskink*	P					✓
Scincidae	<i>Lampropholis delicata</i>	Dark-flecked Garden Sunskink	P	✓	✓			
Scincidae	<i>Lampropholis guichenoti</i>	Pale-flecked Garden Sunskink	P	✓				✓
Scincidae	<i>Lerista bougainvillii</i>	South-eastern Slider	P	✓	✓			
Scincidae	<i>Lygisaurus foliorum</i>	Tree-base Litter-skink	P	✓	✓		✓	
Scincidae	<i>Morethia boulengeri</i>	South-eastern Morethia Skink	P	✓			✓	
Scincidae	<i>Pseudemoia spenceri</i>	Trunk-climbing Cool-skink*	P					✓
Scincidae	<i>Saiphos equalis</i>	Yellow-bellied Three-toed Skink	P	✓				

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Scincidae	<i>Saproscincus mustelinus</i>	Weasel Shadeskink	P	✓	✓			
Scincidae	<i>Tiliqua scincoides</i>	Common Bluetongue	P	✓	✓			✓
Typhlopidae	<i>Ramphotyphlops wiedii</i>	Brown-snouted Blind Snake*	P				✓	
Boidae	<i>Morelia spilota spilota</i>	Diamond Python	P	✓				
Colubridae	<i>Boiga irregularis</i>	Eastern Brown Tree Snake	P	✓				
Colubridae	<i>Dendrelaphis punctulata</i>	Green Tree Snake	P					✓
Elapidae	<i>Acanthophis antarcticus</i>	Southern Death Adder	P		✓			✓
Elapidae	<i>Demansia psammophis</i>	Yellow-faced Whipsnake	P	✓	✓			
Elapidae	<i>Furina diadema</i>	Red-naped Snake	P	✓	✓		✓	
Elapidae	<i>Notechis scutatus</i>	Mainland Tiger Snake	P	✓				✓
Elapidae	<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake	P	✓				✓
Elapidae	<i>Pseudonaja textilis</i>	Eastern Brown Snake	P	✓	✓			✓
Elapidae	<i>Suta spectabilis dwyeri</i>	Variable Black-naped Snake	P	✓				
Elapidae	<i>Vermicella annulata</i>	Eastern Bandy-bandy	P	✓				
Birds								
Megapodiidae	<i>Alectura lathami</i>	Australian Brush-turkey	P	✓	✓			✓
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail	P					✓
Phasianidae	<i>Coturnix ypsilophora</i>	Brown Quail	P					✓
Anatidae	<i>Anas gracilis</i>	Grey Teal*	P			✓		
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck	P	✓		✓		
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck	P	✓	✓	✓		✓
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe*	P			✓		
Phalacrocoracidae	<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant	P					✓
Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian Pelican	P					✓
Ardeidae	<i>Ardea intermedia</i>	Intermediate Egret*	P			✓		
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron	P			✓		✓
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron	P			✓		
Ardeidae	<i>Ixobrychus flavicollis</i>	Black Bittern	V	✓				✓
Threskiornithidae	<i>Platalea flavipes</i>	Yellow-billed Spoonbill*	P			✓		
Threskiornithidae	<i>Platalea regia</i>	Royal Spoonbill	P					✓

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Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis	P					✓
Accipitridae	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	P	✓				
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk	P	✓		✓		✓
Accipitridae	<i>Accipiter novaehollandiae</i>	Grey Goshawk	P					✓
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle	P	✓	✓	✓		✓
Accipitridae	<i>Aviceda subcristata</i>	Pacific Baza	P	✓				
Accipitridae	<i>Circus approximans</i>	Swamp Harrier	P					✓
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite	P			✓		✓
Falconidae	<i>Falco berigora</i>	Brown Falcon	P	✓		✓		✓
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel	P			✓		✓
Falconidae	<i>Falco longipennis</i>	Australian Hobby*	P			✓		
Falconidae	<i>Falco peregrinus</i>	Peregrine Falcon	P	✓				
Rallidae	<i>Gallinula tenebrosa</i>	Dusky Moorhen*	P			✓		
Rallidae	<i>Porphyrio porphyrio</i>	Purple Swamphen	P			✓		✓
Rallidae	<i>Porzana pusilla</i>	Baillon's Crake*	P			✓		
Turnicidae	<i>Turnix varia</i>	Painted Button-quail	P	✓	✓			✓
Scolopacidae	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper*	P			✓		
Scolopacidae	<i>Gallinago hardwickii</i>	Latham's Snipe*	P			✓		
Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt*	P			✓		
Charadriidae	<i>Euseyonis melanops</i>	Black-fronted Dotterel*	P			✓		
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing	P	✓		✓		✓
Columbidae	<i>Columba livia</i>	Rock Dove*	U			✓		
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove	P	✓				✓
Columbidae	<i>Geopelia placida</i>	Peaceful Dove	P	✓	✓	✓		✓
Columbidae	<i>Leucosarcia melanoleuca</i>	Wonga Pigeon	P	✓	✓	✓		✓
Columbidae	<i>Macropygia amboinensis</i>	Brown Cuckoo-Dove	P	✓				
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon	P			✓		✓
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing	P	✓	✓	✓		✓
Columbidae	<i>Phaps elegans</i>	Brush Bronzewing*	P					✓
Columbidae	<i>Streptopelia chinensis</i>	Spotted Turtle-Dove	U			✓		✓
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P	✓	✓	✓		✓
Cacatuidae	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	P	✓	✓	✓		✓
Cacatuidae	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-Cockatoo	P	✓	✓	✓		✓

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Cacatuidae	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	✓	✓	✓		✓
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah	P	✓		✓		
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot	P	✓	✓	✓		✓
Psittacidae	<i>Glossopsitta concinna</i>	Musk Lorikeet	P	✓				
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	P	✓	✓	✓		
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot	V	✓		✓		✓
Psittacidae	<i>Platycercus adscitus eximius</i>	Eastern Rosella	P	✓	✓	✓		✓
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella	P	✓	✓	✓		✓
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot*	P			✓		
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	P	✓	✓	✓		✓
Cuculidae	<i>Cacomantis variolosus</i>	Brush Cuckoo	P	✓	✓	✓		
Cuculidae	<i>Chalcites basalís</i>	Horsfield's Bronze-Cuckoo	P	✓				✓
Cuculidae	<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo	P	✓	✓			
Cuculidae	<i>Cuculus pallidus</i>	Pallid Cuckoo	P	✓				
Cuculidae	<i>Eudynamys orientalis</i>	Pacific Koel	P	✓				✓
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	P	✓	✓			✓
Strigidae	<i>Ninox boobook</i>	Southern Boobook	P	✓	✓			✓
Strigidae	<i>Ninox connivens</i>	Barking Owl	V	✓	✓			
Strigidae	<i>Ninox strenua</i>	Powerful Owl	V	✓	✓			✓
Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	V		✓			
Tytonidae	<i>Tyto tenebricosa</i>	Sooty Owl	V		✓			
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth	P	✓	✓			✓
Caprimulgidae	<i>Eurostopodus mystacalis</i>	White-throated Nightjar	P	✓	✓	✓		
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	P	✓	✓			
Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needle-tail	P	✓	✓			
Alcedinidae	<i>Alcedo azurea</i>	Azure Kingfisher	P	✓		✓		
Halcyonidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P	✓	✓	✓		✓
Halcyonidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher	P	✓	✓	✓		✓
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	P	✓		✓		✓
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird	P	✓		✓		✓
Menuridae	<i>Menura novaehollandiae</i>	Superb Lyrebird	P	✓	✓	✓		✓
Climacteridae	<i>Climacteris erythroptus</i>	Red-browed Treecreeper	P	✓	✓	✓		
Climacteridae	<i>Climacteris picumnus</i>	Brown Treecreeper	V		✓	✓		✓

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Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper	P	✓	✓	✓		✓
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	P	✓		✓		✓
Maluridae	<i>Malurus lamberti</i>	Variegated Fairy-wren	P	✓	✓	✓		✓
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote	P	✓	✓	✓		✓
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	P	✓	✓	✓		✓
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	P	✓		✓		✓
Acanthizidae	<i>Acanthiza lineata</i>	Striated Thornbill	P	✓	✓	✓		✓
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill	P	✓		✓		✓
Acanthizidae	<i>Acanthiza pusilla</i>	Brown Thornbill	P	✓	✓	✓		✓
Acanthizidae	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	P	✓	✓	✓		✓
Acanthizidae	<i>Calamanthus pyrrhopygius</i>	Chestnut-rumped Heathwren	P	✓	✓			✓
Acanthizidae	<i>Gerygone mouki</i>	Brown Gerygone	P	✓	✓			✓
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone	P	✓		✓		✓
Acanthizidae	<i>Origma solitaria</i>	Rockwarbler	P	✓	✓	✓		✓
Acanthizidae	<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	V	✓		✓		✓
Acanthizidae	<i>Sericornis citreogularis</i>	Yellow-throated Scrubwren	P	✓				
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren	P	✓	✓	✓		✓
Acanthizidae	<i>Sericornis magnirostris</i>	Large-billed Scrubwren	P	✓				
Acanthizidae	<i>Smicrornis brevirostris</i>	Weebill	P	✓		✓		
Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	P	✓	✓	✓		✓
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird	P	✓				✓
Meliphagidae	<i>Anthochaera chrysoptera</i>	Little Wattlebird	P	✓		✓		✓
Meliphagidae	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	P	✓		✓		✓
Meliphagidae	<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	P	✓	✓	✓		✓
Meliphagidae	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater	P	✓	✓	✓		
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater	P	✓	✓	✓		✓
Meliphagidae	<i>Lichenostomus melanops</i>	Yellow-tufted Honeyeater	P	✓	✓	✓		✓
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	P			✓		✓
Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater*	P					✓
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	P	✓	✓	✓		✓
Meliphagidae	<i>Manorina melanophrys</i>	Bell Miner	P	✓	✓	✓		✓
Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's Honeyeater	P	✓	✓	✓		✓

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Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	P	✓				
Meliphagidae	<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subsp.)	V	✓				
Meliphagidae	<i>Melithreptus lunatus</i>	White-naped Honeyeater	P	✓	✓	✓		✓
Meliphagidae	<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater	P	✓		✓		✓
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird	P	✓	✓	✓		✓
Meliphagidae	<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	P	✓	✓	✓		
Meliphagidae	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	P	✓		✓		
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	P	✓				✓
Meliphagidae	<i>Xanthomyza phrygia</i>	Regent Honeyeater	E1			✓		✓
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin	P	✓	✓	✓		✓
Petroicidae	<i>Melanodryas cucullata</i>	Hooded Robin*	V			✓		
Petroicidae	<i>Microeca fascians</i>	Jacky Winter	P	✓	✓	✓		✓
Petroicidae	<i>Petroica boodang</i>	Scarlet Robin	P		✓	✓		
Petroicidae	<i>Petroica rosea</i>	Rose Robin	P	✓				✓
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subsp.)	V	✓		✓		✓
Eupetidae	<i>Cinclosoma punctatum</i>	Spotted Quail-thrush	P	✓	✓			✓
Eupetidae	<i>Psophodes olivaceus</i>	Eastern Whipbird	P	✓	✓			✓
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	P	✓	✓	✓		✓
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P	✓	✓	✓		✓
Pachycephalidae	<i>Falcunculus frontatus</i>	Eastern Shrike-tit	P	✓				✓
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler	P	✓	✓	✓		✓
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler	P	✓	✓	✓		✓
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark	P			✓		✓
Dicruridae	<i>Monarcha melanopsis</i>	Black-faced Monarch	P	✓				
Dicruridae	<i>Myiagra inquieta</i>	Restless Flycatcher	P	✓		✓		
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher	P	✓	✓	✓		✓
Dicruridae	<i>Rhipidura albiscapa</i>	Grey Fantail	P	✓	✓	✓		✓
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	P	✓		✓		✓
Dicruridae	<i>Rhipidura rufifrons</i>	Rufous Fantail	P	✓	✓			✓

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Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	P	✓	✓	✓		✓
Campephagidae	<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike	P	✓	✓			
Campephagidae	<i>Coracina tenuirostris</i>	Cicadabird	P	✓	✓	✓		✓
Campephagidae	<i>Lalage tricolor</i>	White-winged Triller	P			✓		
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole	P	✓	✓	✓		✓
Oriolidae	<i>Sphecotheres vieilloti</i>	Australasian Figbird	P	✓				
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow	P	✓	✓	✓		✓
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird	P	✓		✓		✓
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird	P	✓	✓	✓		✓
Artamidae	<i>Gymnorhina tibicen</i>	Australian Magpie	P	✓	✓	✓		✓
Artamidae	<i>Strepera graculina</i>	Pied Currawong	P	✓	✓	✓		✓
Corvidae	<i>Corvus coronoides</i>	Australian Raven	P	✓	✓	✓		✓
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough	P	✓	✓	✓		✓
Ptilonorhynchidae	<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird	P	✓	✓	✓		
Alaudidae	<i>Alauda arvensis</i>	Eurasian Skylark*	U			✓		
Motacillidae	<i>Anthus australis</i>	Australian Pipit	P			✓		
Passeridae	<i>Passer domesticus</i>	House Sparrow	U			✓		
Estrildidae	<i>Lonchura punctulata</i>	Nutmeg Mannikin*	U			✓		
Estrildidae	<i>Neochmia temporalis</i>	Red-browed Finch	P	✓	✓	✓		✓
Estrildidae	<i>Stagonopleura guttata</i>	Diamond Firetail	V	✓		✓		
Estrildidae	<i>Taeniopygia bichenovii</i>	Double-barred Finch	P	✓	✓	✓		✓
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird	P	✓	✓			✓
Hirundinidae	<i>Cheramoeca leucosternus</i>	White-backed Swallow*	P			✓		
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow	P	✓		✓		✓
Hirundinidae	<i>Petrochelidon ariel</i>	Fairy Martin	P	✓		✓		
Hirundinidae	<i>Petrochelidon nigricans</i>	Tree Martin*	P			✓		
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye	P	✓	✓	✓		✓
Muscicapidae	<i>Zoothera lunulata</i>	Bassian Thrush	P	✓				
Sturnidae	<i>Acridotheres tristis</i>	Common Myna	U			✓		
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling	U			✓		

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Mammals								
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	P	✓	✓			
Dasyuridae	<i>Antechinus stuartii</i>	Brown Antechinus	P	✓				✓
Dasyuridae	<i>Antechinus swainsonii</i>	Dusky Antechinus*	P					✓
Peramelidae	<i>Perameles nasuta</i>	Long-nosed Bandicoot	P					✓
Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	V	✓	✓			✓
Vombatidae	<i>Vombatus ursinus</i>	Common Wombat	P	✓	✓			✓
Burramyidae	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	✓				
Petauridae	<i>Petaurus australis</i>	Yellow-bellied Glider	V	✓	✓			
Petauridae	<i>Petaurus breviceps</i>	Sugar Glider	P	✓	✓			✓
Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider	V	✓	✓			✓
Pseudocheiridae	<i>Petauroides volans</i>	Greater Glider	P	✓				✓
Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	P	✓				✓
Acrobatidae	<i>Acrobates pygmaeus</i>	Feathertail Glider	P	✓	✓			
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	P	✓	✓			✓
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P	✓	✓			✓
Macropodidae	<i>Macropus parma</i>	Parma Wallaby	V					✓
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo	P	✓	✓			✓
Macropodidae	<i>Macropus rufogriseus</i>	Red-necked Wallaby	P	✓	✓			✓
Macropodidae	<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E1					✓
Macropodidae	<i>Wallabia bicolor</i>	Swamp Wallaby	P	✓	✓			✓
Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	✓				
Rhinolophidae	<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe-bat	P	✓	✓			
Molossidae	<i>Mormopterus norfolkensis</i>	East-coast Freetail-bat	V					✓
Molossidae	<i>Mormopterus species 2</i> (Adams et al. 1988)	Eastern Freetail-bat	P	✓	✓			
Molossidae	<i>Mormopterus species 4</i> (long penis form) (Adams et al. 1988)	Southern Freetail-bat (long penis)	P	✓				
Molossidae	<i>Nyctinomus australis</i>	White-striped Freetail-bat	P	✓	✓			✓
Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	✓	✓			✓
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	P	✓	✓			
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	P	✓	✓			✓
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		✓			

Family	Scientific name	Common name	Conservation Status	Data Priorities Systematic Surveys	CRA Systematic Surveys	Birds Australia	Australian Museum specimens	Other Sources
Vespertilionidae	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V		✓			
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	P	✓				✓
Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	P	✓	✓			✓
Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	✓	✓			
Vespertilionidae	<i>Scotorepens orion</i>	Eastern Broad-nosed Bat	P	✓	✓			✓
Vespertilionidae	<i>Vespadelus darlingtoni</i>	Large Forest Bat	P		✓			
Vespertilionidae	<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V	✓				
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat	P	✓	✓			✓
Muridae	<i>Mus musculus</i>	House Mouse	U					✓
Muridae	<i>Rattus fuscipes</i>	Bush Rat	P	✓				✓
Muridae	<i>Rattus rattus</i>	Black Rat	U					✓
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit	U	✓				
Canidae	<i>Canis lupus</i>	Dingo, domestic Dog	U	✓	✓			✓
Canidae	<i>Vulpes vulpes</i>	Fox	U	✓	✓			✓
Felidae	<i>Felis catus</i>	Cat	U	✓	✓			
Bovidae	<i>Bos taurus</i>	European Cattle	U	✓				

APPENDIX C – FAUNA SPECIES AROUND (BUT NOT WITHIN) NORTHERN YENGO NATIONAL PARK

Fauna species recorded on the Atlas of NSW Wildlife (as at 21/02/06) within a five kilometre radius of the study area boundary, but not recorded from within the study area. Species where there is doubt about the occurrence have been marked with an asterisk *. Introduced species are indicated by U in the Conservation status. Note that this area includes parts of Wollemi National Park and Pokolbin State Forest.

Family	Scientific name	Common name	NSW Legal Status	National Legal Status
Frogs				
Myobatrachidae	<i>Adelotus brevis</i>	Tusked Frog *	P	
Myobatrachidae	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	P	
Myobatrachidae	<i>Neobatrachus sudelli</i>	Painted Burrowing Frog	P	
Myobatrachidae	<i>Uperoleia tyleri</i>	Tyler's Toadlet	P	
Hylidae	<i>Litoria chloris</i>	Red-eyed Tree Frog	P	
Hylidae	<i>Litoria freycineti</i>	Freycinet's Frog	P	
Hylidae	<i>Litoria jervisiensis</i>	Jervis Bay Tree Frog	P	
Hylidae	<i>Litoria phyllochroa</i>	Green Stream Frog	P	
Hylidae	<i>Litoria tyleri</i>	Tyler's Tree Frog	P	
Hylidae	<i>Litoria verreauxii</i>	Verreaux's Tree Frog	P	
Reptiles				
Typhlopidae	<i>Ramphotyphlops nigrescens</i>	Blackish Blind Snake	P	
Birds				
Anatidae	<i>Anas castanea</i>	Chestnut Teal	P	
Anatidae	<i>Anas rhynchotis</i>	Australasian Shoveler	P	
Anatidae	<i>Aythya australis</i>	Hardhead	P	
Anatidae	<i>Cygnus atratus</i>	Black Swan	P	
Anatidae	<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck	P	
Anatidae	<i>Tadorna tadornoides</i>	Australian Shelduck	P	
Podicipedidae	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	P	
Anhingaidae	<i>Anhinga melanogaster</i>	Darter	P	
Phalacrocoracidae	<i>Phalacrocorax carbo</i>	Great Cormorant	P	
Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	P	
Phalacrocoracidae	<i>Phalacrocorax varius</i>	Pied Cormorant	P	
Ardeidae	<i>Ardea alba</i>	Great Egret	P	
Ardeidae	<i>Nycticorax caledonicus</i>	Nankeen Night Heron	P	

Family	Scientific name	Common name	NSW Legal Status	National Legal Status
Threskiornithidae	<i>Threskiornis molucca</i>	Australian White Ibis	P	
Accipitridae	<i>Circus assimilis</i>	Spotted Harrier	P	
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	P	
Accipitridae	<i>Haliastur sphenurus</i>	Whistling Kite	P	
Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle	P	
Accipitridae	<i>Milvus migrans</i>	Black Kite	P	
Rallidae	<i>Fulica atra</i>	Eurasian Coot	P	
Scolopacidae	<i>Calidris ruficollis</i>	Red-necked Stint	P	
Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing	P	
Laridae	<i>Larus novaehollandiae</i>	Silver Gull	P	
Laridae	<i>Sterna bergii</i>	Crested Tern	P	
Columbidae	<i>Chalcophaps indica</i>	Emerald Dove	P	
Columbidae	<i>Lopholaimus antarcticus</i>	Topknot Pigeon	P	
Cacatuidae	<i>Cacatua sanguinea</i>	Little Corella	P	
Psittacidae	<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet	P	
Psittacidae	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	P	
Tytonidae	<i>Tyto alba</i>	Barn Owl	P	
Maluridae	<i>Stipiturus malachurus</i>	Southern Emu-wren*	P	
Acanthizidae	<i>Aphelocephala leucopsis</i>	Southern Whiteface	P	
Acanthizidae	<i>Pycnoptilus floccosus</i>	Pilotbird	P	
Meliphagidae	<i>Grantiella picta</i>	Painted Honeyeater	V	
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird	P	
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin	P	
Dicruridae	<i>Myiagra cyanoleuca</i>	Satin Flycatcher*	P	
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow	P	
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow	P	
Corvidae	<i>Corvus orru</i>	Torresian Crow*	P	
Fringillidae	<i>Carduelis carduelis</i>	European Goldfinch	U	
Estrildidae	<i>Neochmia modesta</i>	Plum-headed Finch	P	
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch	P	
Sylviidae	<i>Acrocephalus australis</i>	Australian Reed-Warbler	P	
Sylviidae	<i>Cincloramphus mathewsi</i>	Rufous Songlark	P	
Sylviidae	<i>Cisticola exilis</i>	Golden-headed Cisticola	P	
Sylviidae	<i>Megalurus timoriensis</i>	Tawny Grassbird	P	
Mammals				
Dasyuridae	<i>Antechinus flavipes</i>	Yellow-footed Antechinus	P	

Family	Scientific name	Common name	NSW Legal Status	National Legal Status
Dasyuridae	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E
Dasyuridae	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale*	V	
Peramelidae	<i>Isoodon macrourus</i>	Northern Brown Bandicoot	P	
Molossidae	<i>Mormopterus planiceps</i>	Little Mastiff-bat	P	
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	P	
Vespertilionidae	<i>Kerivoula papuensis</i>	Golden-tipped Bat*	V	
Vespertilionidae	<i>Vespadelus regulus</i>	Southern Forest Bat*	P	
Muridae	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	
Leporidae	<i>Lepus capensis</i>	Brown Hare	U	
Bovidae	<i>Capra hircus</i>	Goat	U	
Cervidae	<i>Cervus sp.</i>	Unidentified Deer	U	

APPENDIX D – FREQUENCY RANGE OF INSECTIVOROUS BAT CALLS RECORDED IN THE HUNTER RANGE AREA

This table has been compiled by Narawan Williams, based on the analysis of ultrasonic calls recorded during the 2004-05 DEC surveys of the Hunter Range Area.

Key:

The first row for each species shows the frequency range (in kilohertz) of reference calls, recorded during release of bats captured in harp traps.

The second row for each species shows the frequency range (in kilohertz) of calls recorded at anabat various sites. These only includes sequences for which a 'definite' identification was obtained, unless stated otherwise in the notes. The number in brackets next to each frequency range is the total number of call sequences referred to for frequency range sample.

There are notes under each species.

Bat species	Northern Park	Yengo National	Eastern Park (California Commission Roads)	Wollemi National (and)	Northern Wollemi (Baerami, Hungerford, Martindale & Doyles Creek areas)	Manobalai Nature Reserve and Crown Lands	Werakata National Park	
Reference call samples followed by analysis result samples.	Valley floors to lower slopes (6 sites)	Mid slopes to ridgelines (7 sites)	Valley floors to lower slopes (0 sites)	Mid slopes to ridgelines (5 sites)	Valley floors to lower slopes (9 sites)	Mid slopes to ridgelines (1 site)	Valley floors to lower slopes (5 sites)	Mid slopes to ridgelines (1 site)
<i>Chalinolobus dwyeri</i>				22-25 (1)				
		23-28(2)		21-27 (12)	22-27 (10)		22-27 (5)	22-24 (4)
Stepped call in good sequence usually between 22- 27 kHz – easy to determine with good sequence.								
<i>Chalinolobus gouldii</i>		28-32 (3) 31-34(3)		29-33(2) 31-33(2)			30-34 (2)	
	29-33(1)	28-33(11)		31-34(2) 29-32 (2)	29-32 (10)	31-34 (2)	28-31(5) 26-30 (2)	28-30 (1)
Stepped call – one of the easier species to determine.								
<i>Chalinolobus morio</i>		49-51(2) 50-52 (4)		50-53(3)			49-50(2)	
	48-55(7)	47-56 (24)		48-53 (14)	47-57 (25)	49-53 (4)	45-53 (19)	49-54 (4) 49-54 (4)
Call frequencies are variable between call sequences and within call sequence.								

Bat species	Northern Yengo National Park	Eastern Wollemi National Park (California Commission Roads)	Northern Wollemi (Baerami, Hungerford, Martindale & Doyles Creek areas)	Manobalai Nature Reserve and Crown Lands	Werakata National Park
<i>Falsistrellus tasmaniensis</i>	See notes below		35-41(7)	34-38 (1)	
	35-39 (1) 36-39(1)				
Note: All these frequencies are from only probable <i>Falsistrellus tasmaniensis</i> results – no definite. This species' calls are generally hard to define against variation in <i>Scotorepens orion</i> calls and also <i>Scoteanax rueppellii</i> .					
<i>Miniopterus schreibersii oceanensis</i>					
	43-46 (5)		44-46 (12)	43-47 (30)	44-47 (3) 43-44 (3)
Fairly consistent in frequency – the higher numbers in Northern Wollemi are due to this species using mine shafts in Baerami Creek.					
<i>Mormopterus norfolkensis</i>					
	29.5-32 (2)				28-33(1) 30-32(1) 30-34 (1)
Stepped call usually between 31 – 34 kHz. A couple of the calls are below this however there was regular stepping.					
<i>Mormopterus sp. 4 (long penis form)</i> (Adams <i>et al.</i> 1988)				27-29 (10)	
	24-25 (2)		24-26 (2)	25-29 (9)	25-27 (5)
The higher frequency range of this species overlaps with other <i>Mormopterus</i> species.					
<i>Mormopterus sp. 3 (short penis form)</i> (Adams <i>et al.</i> 1988)			See notes		
			30-36 (4)		
Notes: This one call was only 'probable'. Other possible calls were not able to be defined as there is known overlap with other <i>Mormopterus</i> species.					
<i>Mormopterus sp. 2</i> (Adams <i>et al.</i> 1988)	29-32 (1) 28-29 (1)			32-34 (1)	
	27-32 (6)		29-30 (3)	29-32 (8)	28-31(3) 28-32 (15)

Bat species	Northern Yengo National Park	Eastern Wollemi National Park (California and Commission Roads)	Northern Wollemi (Baerami, Hungerford, Martindale & Doyles Creek areas)	Manobalai Nature Reserve and Crown Lands	Werakata National Park
Most pulses flat and at the lower frequency with occasional step (the higher frequency). There is overlap in frequency with other <i>Mormopterus</i> species.					
<i>Nyctophilus geoffroyi</i>		30-34 (1)			38-43 (1) 43-46 (2)
Could not define between other <i>Nyctophilus</i> species.					
<i>Nyctophilus gouldi</i>		38-45 (5)	28-39 (1) 36-43 (5)		
Could not define between other <i>Nyctophilus</i> species.					
<i>Nyctophilus timoriensis</i>					
No reference calls. Could not define between other <i>Nyctophilus</i> species.					
<i>Nyctophilus species</i>	40 (1)	40-45 (2)	38-43 (6)	41-48 (11)	39-44 (8) 43-46 (3)
<i>Rhinolophus megaphyllus</i>					
	65-67.5 (3)	66.5 – 67 (5)	66-68 (2)	64-68 (14)	66 (1)
A very distinctive call at fairly consistent frequency.					
<i>Saccolaimus flaviventris</i>					
					17.5 (1) 21 (1)
Call frequency and characteristics within normal range for this species.					
<i>Scoteanax rueppellii</i>			37-40 (2)		
				32-34 (2)	
Call often hard to define against <i>Scotorepens orion</i> and <i>S. balstoni</i> unless a good call sequence is recorded.					
<i>Scotorepens balstoni</i>					32-35 (5)
	31-32 (1)	32 (1) Probable	32-34 (2)	31-35 (10)	32-35 (11)
Most often call frequency was around 31- 33 kHz. The higher frequency of this species overlaps with <i>Scotorepens orion</i> .					

Bat species	Northern Yengo National Park	Eastern Wollemi National Park (California Commission Roads)	Northern Wollemi (Baerami, Hungerford, Martindale & Doyles Creek areas)	Manobalai Nature Reserve and Crown Lands	Werakata National Park
<i>Scotorepens orion</i>			35-36 (3)		
	34-39 (12)		34-36 (2) 35 – 38(4)	34-38 (7)	
Calls can overlap with <i>Scoteanax rueppellii</i> and <i>Falsistrellus tasmaniensis</i> .					
<i>Tadarida australis</i>					
	11-12 (2)	11 (2)	11-20 (3)	10-15.5 (9)	10-15 (7) 9.5-12.5 (3)
Standard frequency around 10 –12 kHz.					
<i>Vespadelus darlingtoni</i>			41-45 (6)		
		42-45 (9)	41-44 (9)	42-45 (6)	
Calls were at expected frequency range and characteristics.					
<i>Vespadelus troughtoni</i>	See notes				
No Reference calls from area. Overlaps with <i>Vespadelus vulturnus</i> .					
<i>Vespadelus vulturnus</i>		49-52 (12) 52-55 (7)	49-52 (4) 51-54 (8)		45-48 (1) 47-50 (15) 49-52 (7)
	48-50 (2)	51-54(1) 49-53 (11)	48-53 (7)	47-53(23)	46-50 (3) 46-51 (4) 47-52 (2)
It appears that the call frequency is generally lower in the Valley floors and Manobalai NR which fits the general expected trend for this species.					