The Vertebrate Fauna of Maroota Ridge State Conservation Area

Project funded by the Sydney North Region, Parks and Wildlife Division

Information and Assessment Section, Metropolitan Branch
Environmental Protection and Regulation Division
Department of Environment and Climate Change (NSW)
May 2007

Department of **Environment & Climate Change** NSW

THE VERTEBRATE FAUNA OF MAROOTA RIDGE STATE CONSERVATION AREA

The Department of Environment and Conservation (DEC) is now known as the Department of Environment and Climate Change (DECC)

A project funded by the Sydney North Region, Parks and Wildlife Division

Information and Assessment Section
Metropolitan Branch
Environment Protection and Regulation Division
Department of Environment and Climate Change (NSW)

ACKNOWLEDGMENTS

For enquiries regarding this report please contact Manager of the Information and Assessment Section, Metropolitan Branch, Environment Protection and Regulation Group, Department of Environment and Climate Change, Hurstville.

This report should be referenced as follows:

DECC (2007) *"The Vertebrate Fauna of Maroota Ridge State Conservation Area"* Unpublished report funded by Central Branch, Sydney North Region, Parks and Wildlife Division of NSW Department of Environment and Climate Change. Hurstville

Cover Photos
Feature Photo (Narawan Williams); Echidna (Narawan Williams);Burnt Ridgetop (Narawan Wiliams); Giant Burrowing Frog (Tegan Burton) Moss (Tegan Burton); Bearded Dragon (Narawan Williams)

Published by:
Department of Environment and Climate Change
43 Bridge St, Hurstville NSW 2220
PO Box 1967, Hurstville NSW 1482
Phone (02) 9995 5000 (switchboard)
www.environment.nsw.gov.au

ISBN 978 1 74232 825 6

DECCW 2010/230

This project has been coordinated by Josh Madden, Elizabeth Magarey and Martin Schulz from the Information and Assessment Section, Metropolitan Branch, EPRD. Field Surveyors included the above with Narawan Williams and Tegan Burton. Hair and scat analysis by Barbara Triggs and bat call analysis Narawan Williams. Thank you to the volunteers and adjoining landowners who assisted with the project.

OVERVIEW

Maroota Ridge State Conservation Area lies at the north-western edge of the Sydney metropolitan area. This small reserve is found at Crescent Reach on the Hawkesbury River west of Wisemans Ferry Road and is bounded to the north and south by private and Crown Lands. The reserve provides habitat and refuge to a range of species typical of those found in Sydney Sandstone environments, including a number of threatened species.

This report is designed to provide baseline data on the vertebrate fauna species of the reserve. It documents a systematic fauna survey undertaken by the Department of Environment and Climate Change over six days in early November and mid December 2006. The survey involved the establishment of 15 systematic survey sites across the reserve to sample the main vertebrate fauna groups which include; diurnal and nocturnal birds, bats, reptiles, arboreal mammals and ground dwelling mammals. A number of systematic survey techniques were used to gather data on these groups which included incidental sightings to provide data on frogs and introduced species within the reserve.

Some key results of the survey are as follows:

- 129 vertebrate fauna species were recorded in and around the State Conservation Area during the survey period. Seventy-one percent of these species had never before been recorded in the conservation reserve.
- 564 records of fauna sightings in total were obtained during the survey, substantially adding to the existing 46 records that comprised results from past regional surveys and incidental sightings.
- Seven species found are currently listed as Vulnerable under the *NSW Threatened Species Conservation Act* (1995). These being; The Giant Burrowing Frog, Red-crowned Toadlet, Gang-gang Cockatoo, Glossy Black-cockatoo, Powerful Owl, Masked Owl, Grey-headed Flying-Fox. Old feed-marks of the Yellow-bellied Glider were encountered. However due to the lack of sightings it is not known whether the species is still extant within the area. Additionally, probable/possible records of six species requires confirmation through further survey work to determine their presence in the reserve. These are the Sooty Owl, Greater Broad-nosed Bat, Little Bent-wing Bat, East-coast Freetail-bat, Eastern False Pipistrelle and Southern-brown Bandicoot.
- Five introduced species (or evidence of) were located during the survey period. Two of these species (Fox and Rabbit) are listed as Key Threatening Processes under the *NSW Threatened Species Conservation Act* (1995).
- A complete list of fauna species recorded from the reserve and surrounding 200 metres can be viewed at the end of this report.

The results of this report indicate that Maroota Ridge State Conservation Area is a reserve which is rich in fauna species associated with the Sydney's Sandstone environments. It is a reserve that has suffered low levels of invasion by feral animals and is currently reasonably well connected to adjoining uncleared private and Crown Lands. Also, it has experienced relatively low levels of environmental disturbance despite being exposed to such landuses as motorcycle recreation and orchard growing on two sides of the reserve.

The report identifies management actions to protect threatened fauna species and details additional work to provide a better understanding of fauna present in the area. This report reinforces the importance and necessity of gathering quality baseline biodiversity data in all of our conservation reserves in order to make informed and long term management decisions to the benefit of local and regional biodiversity.

CONTENTS

1 INTRODUCTION

1.1 PROJECT AIMS

This report outlines the first systematic survey into the vertebrate fauna of the Maroota Ridge State Conservation Area. The project work was undertaken by the Information and Assessment Section of DECC with funding from the Lower Hawkesbury Area, Parks and Wildlife Division. The project aims to provide baseline data about the reserve's fauna values so that informed management policy can be formulated and decisions made in the best interests of conservation.

The specific objectives of this report are to:

1. Document the methodology of the survey techniques applied.
2. Provide a discussion of the fauna groups detected during the surveys.
3. Identify and profile threatened fauna species recorded during the surveys.
4. Provide an updated list of vertebrate fauna recorded on the Atlas of NSW Wildlife within the study area.

This systematic fauna survey is the first of its kind in the reserve and provides quality data adding to previous non-systematic survey work for the reserve and surrounds. Future projects may build on this to more comprehensively address patterns in fauna occurrence and habitat use across the reserve.

1.2 BACKGROUND

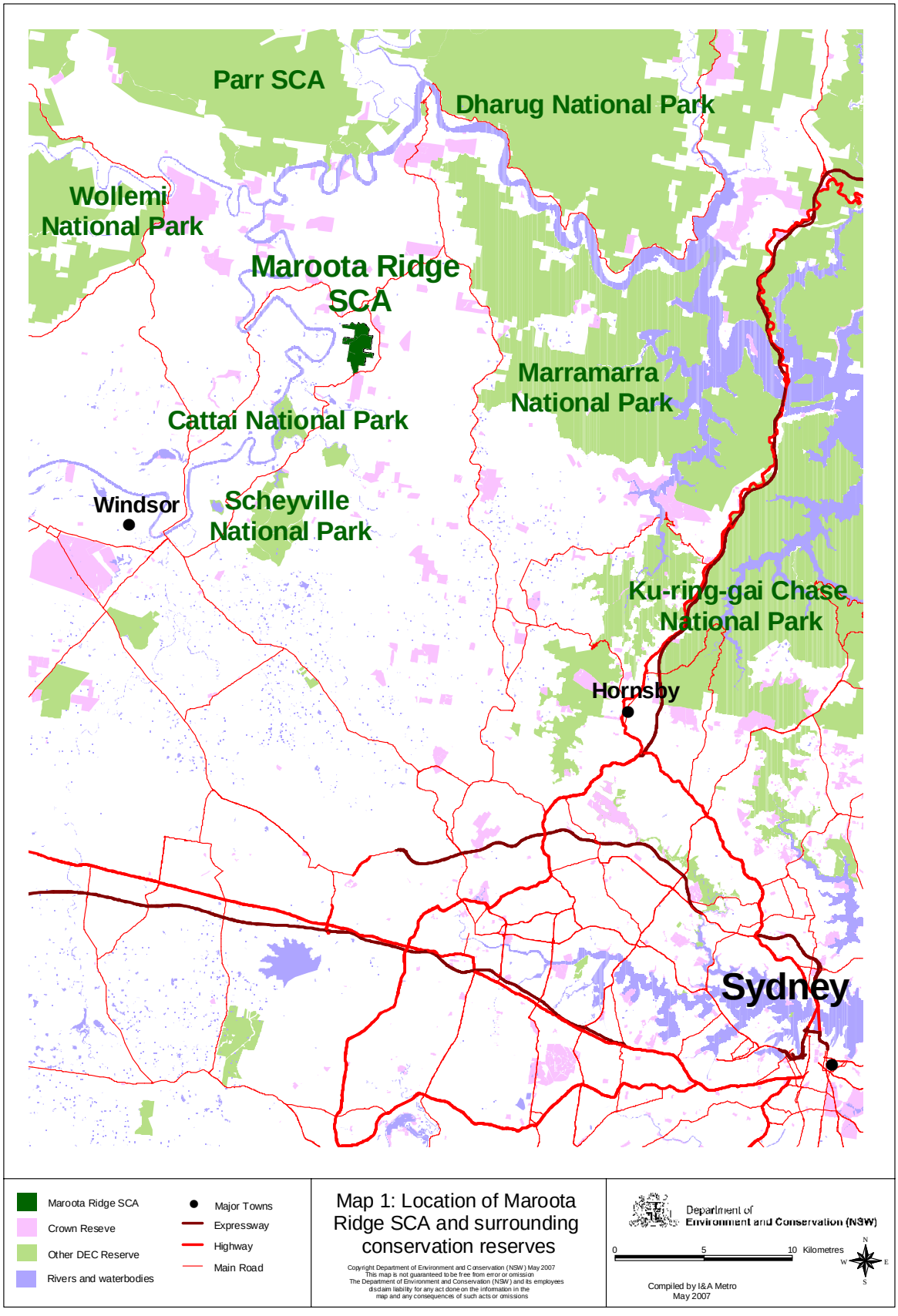
Maroota Ridge State Conservation Area (SCA) is located in the upper north-west of the Sydney Basin, about 16km north-east of Windsor township. The reserve was gazetted as State Conservation Area in January 2006 by the Governor of New South Wales after being named as an "Area of Conservation Significance" by the Urban Bushland Biodiversity Surveys in 1997 (NPWS 1997a).

Prior to gazettal, the 260 ha reserve was primarily Crown Land partly under the control of Baulkham Hills Shire Council. It was chosen for acquisition by the DECC because it satisfied one or more of the UBBS criteria for a "Significant Remnant" in Western Sydney. These are as follows:

1) support threatened species,
2) are representative samples of large, intact samples of endangered habitats, and/or
3) occupy a key position in the landscape.

Maroota Ridge SCA lies roughly between the much larger sandstone reserves of Marramarra and Ku-ring-gai Chase National Parks to the east and Wollemi National Park to the west (Map 1). Gazettal of the SCA was an important step in securing the conservation of remnant bushland areas in this part of north-western Sydney, accompanying the nearby though disjointed reserves of Cattai and Scheyville National Parks.

The reserve is bounded on its eastern and western edge by moderate to intensive agricultural and recreational land uses. Fruit and wine growing are common land uses to the east following the shale soils of the Maroota ridgeline. Immediately to the west of the reserve lies a largely cleared recreational park situated on the banks and terraces of the Hawkesbury River. Situated to the south of the reserve is predominantly uncleared private and crown lands, while to the north lies a patchwork of cleared and uncleared private lands interspaced with crown lands. Further to the east is Little Cattai Creek and over 4000 ha of remnant bushland under the control of Deerubbin Local Aboriginal Land Council. Existing bushland remnants represented in Aboriginal, Crown and private lands adjacent the reserve currently provide a reasonable level of facilitation of fauna movement between Maroota Ridge SCA and larger conservation reserves.


Parr SCA
Dharug National Park
Wollemi National Park
Maroota Ridge SCA
Marramarra National Park
Cattai National Park
Windsor
Scheyville National Park
Ku-ring-gai Chase National Park
Hornsby
Sydney
Maroota Ridge SCA
Crown Reseve
Other DEC Reserve
Rivers and waterbodies
Major Towns
Expressway
Highway
Main Road
Map 1: Location of Maroota Ridge SCA and surrounding conservation reserves
Copyright Department of Environment and Conservation (NSW) May 2007
This map is not guaranteed to be free from error or omission
The Department of Environment and Conservation (NSW) and its employees
disclaim liability for any act done on the information in the
map and any consequences of such acts or omissions
Department of Environment and Conservation (NSW)
0
5
10 Kilometres
N
W
E
S
Compiled by I&A Metro
May 2007

1.3 ENVIRONMENT

The reserve falls within the Sydney Basin Bioregion which is dominated by extensive sandstone plateaux between Ulladulla, the Hunter Valley and Mudgee. This Bioregion is characterised by a temperate climate with warm summers with no dry season (NPWS 2003a). It consists of a geological basin filled with near horizontal sandstones and shales of Permian to Triassic age that overlie older basement rocks of the Lachlan Fold Belt.

On a local scale the reserve lies at the very northern edge of the Cumberland Plain where the Hawkesbury River begins to cut through the sandstone landscapes of the Hornsby Plateau. The reserve is dominated by course-grained Hawkesbury Sandstone with a small area of Quaternary Alluvium at the flood-limits of the Hawkesbury River (DMR 1999). This rock type is responsible for forming the incised gullies with steep slopes and relatively flat ridgetops that characterise the reserve. It also forms the intermittent clifflines and caves on the slopes and exposed rock-plate outcrops on the ridges. Uplslope and to the east of the reserve lies a portion of higher fertility Ashfield Shale. This shale largely follows the main Maroota ridgeline where most of the remnant vegetation has been replaced with low to moderate intensity agriculture including fruit orchards, grazing and vineyards.

Soils in the reserve fall into five broad types (DLWC 1998). Ridges are defined by shallow and sometimes skeletal sandy soils (Lucas Heights, Faulconbridge and Gymea landscapes). Colluvial soils on the reserve's slopes (Hawkesbury landscape) are primarily of a loamy-sand texture, however areas of clay banding may be present. Valley floors within the reserve are deeply infilled with Quaternary sand deposits (Freemans Reach landscape), usually eroded at the stream channel (sometimes up to 2 m) despite the majority of the catchment suffering very little apparent disturbance. These valley infills are also likely to contain minor deposits of clays and shale due to erosion and subsequent accretion of the Ashfield shale and clay bands.

Vegetation of the reserve was mapped at 1:25 000 scale by AES Environmental Consultancy as part of Baulkham Hills Shire Council's wider Natural Asset Mapping program in 2002. From the mapping, nine distinct vegetation communities have been identified (Table 1) and their distribution within the reserve is presented in Map 2. Of the nine vegetation communities, two comprise the majority of the reserve; Sandstone Ridgetop Woodland (Plate 1) at 106.5ha; and Sydney Sandstone Gully Forest at 103.2ha (Plate 2).

Within the reserve Sydney Sandstone Ridgetop Woodland is usually dominated by Red Bloodwood (*Corymbia gummifera*), Yellow Bloodwood (*C. eximia*), Narrow-leaved Stringybark (*Eucalyptus sparsifolia*) and Grey Gum (*E. punctata*) in the canopy (AES 2002). Common understorey species include *Acacia linifolia*, *Dillwynia retorta, Pultenaea elliptica,* Paperbark (*Leptospermum trinervium),* Drumsticks *(Isopogon anemonifolius),* Conesticks *(Petrophile pulchella),* Thin-leaaved Geebung *(Persoonia linearis),* Hairpin Banksia *(Banksia spinulosa) and* Rusty Petals *(Lasiopetalum ferrugineum)* (AES 2002).

Plate 1: Typical Sandstone Ridgetop Woodland community © Tegan Burton

Sydney Sandstone Gully Forest canopies on the other hand are dominated by Blackbutt (*E. pilularis*), Red Bloodwood, Smooth-barked Apple (*Angophora costata*) and Turpentine (*Syncarpia glomulifera*) (AES 2002). Understorey genera may include *Bossia obcordata, Platylobium formosum, Acacia linifolia, Dillwynia retorta, Hakea sericea,* Paperbark*,* Mountain Devil *(Lambertia formosa),* Black She-oak *(Allocasuarina littoralis),* Sweet Pittosporum *(Pittosporum undulatum), Pittosporum revolutum, Phyllanthus hirtellus* and Thin-leaved Geebung (AEC 2002).

Generally, disturbance in the reserve has been limited to the impacts of trail-bike riding, some maintained intensive clearing on the alluvial flats and historic clearing for orchard growing. Also, due to the lack of large trees and hollows, it is possible the area has been logged in the past.

Maroota Ridge SCA is not fenced and boundaries are not yet clearly defined. Impacts from weeds are generally low throughout much of the reserve. The slopes, gullies and ridges remain relatively free from introduced flora. However, there are noticeable thickets of Lantana *(Lantana camara)* on the gully/cleared alluvial flat interface and old orchard area.

Plate 2: Sydney Sandstone Gully Forest community © Tegan Burton

1.4 FIRE

Maroota Ridge SCA has been subject to at least three significant fires over the last 15 years. The northern section of the reserve north of Pacific Park Drive was burnt in the early 1980's and then again in 1988.

A small 24 ha section of the reserve to the east burned in the bushfire season of 1994-95, however it appears this was confined mostly to the ridgetop. In 2002-03 approximately half of the reserve was affected by a prescribed burn which was contained by Pacific Park Drive in the north and Charcoal Road in the south. It is unclear whether fire affected the gullies during this burn, however site inspections and observations of recent fire activity in the south of the reserve suggest this is unlikely.

Most recently in late 2006 wildfire crossed the Hawkesbury River and burned part of the reserve south of Charcoal Road (Map 2). Appearing to be of low to moderate intensity in this area, the fire predominantly affected the ridges and upper slopes leaving most of the gullies unburnt.

2 METHODS

2.1 EXISTING FAUNA DATA

The Atlas of NSW Wildlife (DECC 2007) was the primary resource used to access existing data on the fauna of the reserve. The small number of records that pre-existed within the Atlas were helpful in understanding the reserve's general fauna distribution particularly in areas that were not targeted or were affected by fire at the time of surveying. Twenty-two of the 47 existing records were incidental sightings originating from the Urban Bushland Biodiversity Survey (UBBS) (NPWS 1997a), in which a large number of biodiversity surveys were conducted throughout the broader Western Sydney Region. These records were over nine years old and displayed very low or dubious spatial accuracy (generally ± 1 km). The remaining 25 records originated from 2003 when an environmental consultancy conducted research in the area prior to gazettal. Again these records displayed low spatial accuracy (± 100 m). In order to increase the accuracy of the fauna species list for the reserve, and avoid misinterpretation of data, these records have been separated from the results of this survey (Appendix B).

2.2 SURVEY STRATIFICATION AND SITE SELECTION

Selection for survey sites was undertaken based on the mapped vegetation communities identified by AES (2002). This stratified survey method aimed to select systematic sites proportionately according to the area of each vegetation community mapped within the reserve. There were however some limitations that hindered our ability to sample all of the mapped vegetation communities. These were as follows:

- The small mapped area (ha) of some vegetation communities meant that they were not representative of the overall vegetation within the reserve.
- Mapped vegetation communities such as "Intensive Agriculture" and "Other Rural" generally represented extremely poor habitat quality for most target species.
- Recent fire disturbance in a large portion of the reserve meant that communities in these areas were not able to be sampled.
- Access, terrain and time constraints were also influencing factors.

Vegetation communities which failed to be selected for systematic sampling relied on historical data from past surveys and were also targeted wherever possible for opportunistic records. In order to ensure that local differences in species composition at survey sites did not affect the true overall faunal assemblages of the vegetation communities, replication or repeat sampling was undertaken in the major habitat types; Sydney Sandstone Ridgetop Woodland and Sydney Sandstone Gully Forest.

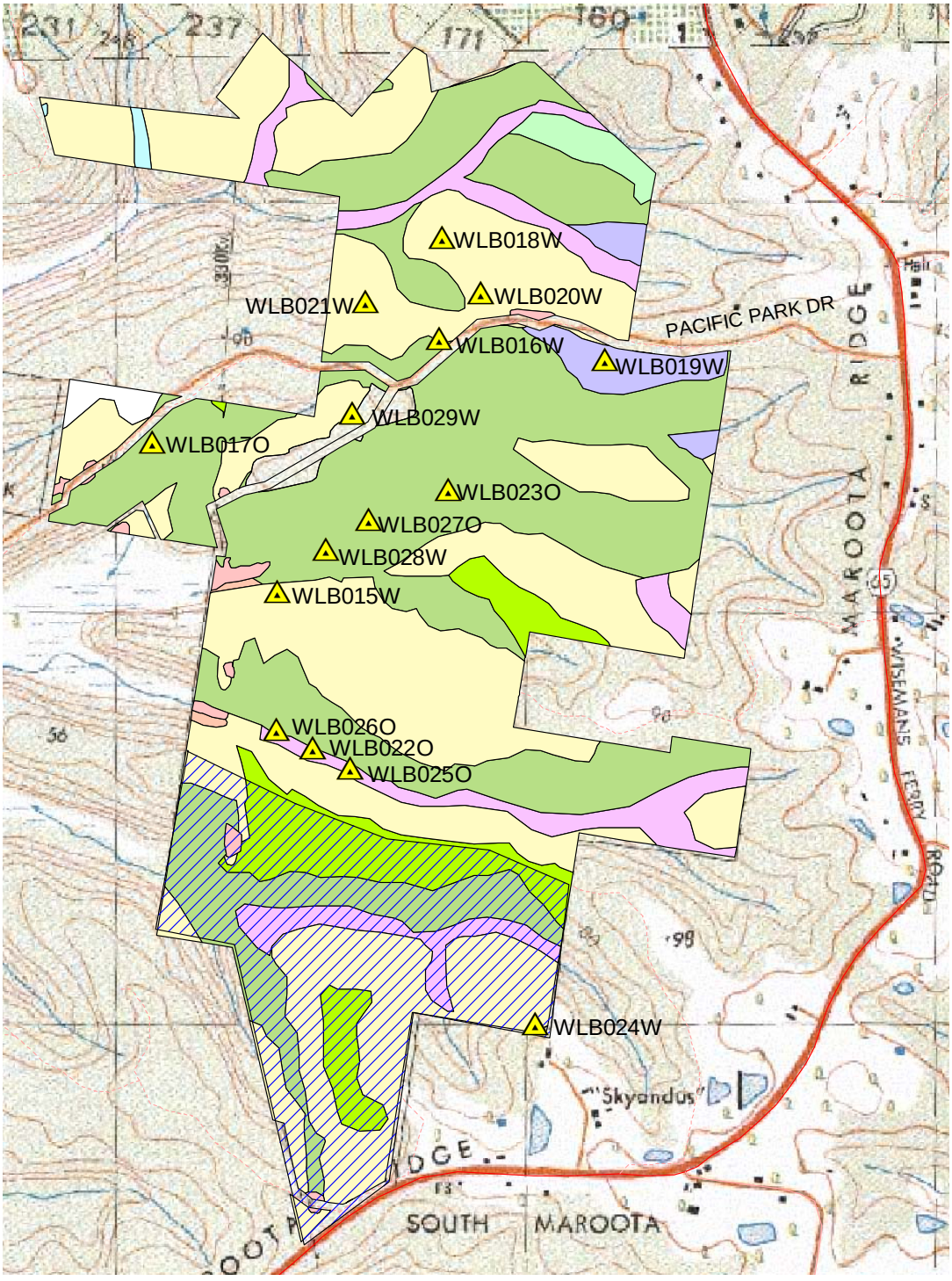
Initial site selection was undertaken using a Geographical Information System (Arcview GIS 3.3) which combined vegetation, topographical, soil, geological and tenure mapping with aerial photography. Information was also sought from the local Ranger in charge of the reserve. This allowed for selection to be based on habitat suitability and quality, aspect and topographical positioning and to facilitate ease of access. In the field, these proposed sites were then ground-truthed to ensure that they were representative of the mapped vegetation community, had suffered a minimum amount of disturbance and comprised a single vegetation community. If these criteria were not met, an alternative location was selected for the site. Systematic survey sites were 100 m by 200 m (two ha) in area.

Particular techniques such as Harp Trapping and Hair Tubing tend to produce the best results when the microhabitat of the target fauna group is taken into account. This meant that the positioning of sites which included such techniques was only able to be carried out in the field.

Map 2 shows the location of systematic fauna survey sites and the distribution of vegetation communities within the reserve. Appendix A provides the specific grid reference, vegetation type and survey techniques completed at each systematic survey site

Table 1: Vegetation communities targeted within Maroota Ridge SCA and corresponding allocation of systematic fauna survey techniques. Vegetation communities are listed in descending order of the area they cover within the reserve.

Vegetation type (Baulkham Hills Shire Council Natural Asset Mapping)	Area represented in reserve (Ha)	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 owl call broadcast sites	No. of Elliott trap sites	No. of Hair tube sites
Sydney Sandstone Ridgetop Woodland	106	4	3	2	4	3	3	1	1
Sydney Sandstone Gully Forest	103	2	1	1	2	2	2	0	1
Sydney Sandstone Gully Rainforest – rainforest understorey	18	1	1	1	2	0	0	1	1
Shale/Sandstone Transition Forest (High Sandstone Influence)	5.5	1	1	1	0	1	0	0	0
Other vegetation types	22	-	-	-	-	-	-	-	-
Total	**255**	**8**	**6**	**5**	**8**	**9**	**5**	**2**	**3**


WLB018W
WLB021W
WLB020W
WLB016W
WLB019W
WLB029W
WLB017O
WLB023O
WLB027O
WLB028W
WLB015W
WLB026O
WLB022O
WLB025O
WLB024W
PACIFIC PARK DR
MAROOTA RIDGE
WISEMANS FERRY ROAD
SOUTH MAROOTA
Skyandus
Systematic Survey Site
Area affected by recent fire
Vegetation communities
Intensive Agriculture
Other Rural
Paperbark forest (wetland forest)
Shale/SS Transition forest (HSI)
Shale/SS Transition forest (LSI)
Syd Sandstone Gully Rainforest - rainforest understorey
Sydney Sandstone Ridgetop Woodland
Sydney coastal riverflat forest
Sydney sandstone gully forest
Sydney sandstone heath
Western Sydney Dry Rainforest
Map 2: Vegetation communities and locations of systematic survey sites in Maroota Ridge SCA
Copyright Department of Environment and Conservation (NSW) February 2007
This map is not guaranteed to be free from error or omission
The Department of Environment and Conservation (NSW) and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions
Department of Environment and Conservation (NSW)
0 200 400 Meters
Compiled by I&AS
February 2007

2.3 SURVEY METHODS

The systematic fauna survey methods used 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, reptiles, bats, arboreal and terrestrial mammals. Consistent application of these systematic techniques allows a comparison between fauna species detected across different vegetation types and environments within the park. Furthermore, it allows for future comparisons with consistent surveys of environments elsewhere. Frogs were surveyed primarily on an opportunistic basis as described below. Unfortunately the scope of the survey prevented the use of systematic techniques for this group.

The field survey team were supplied with Information and Assessment standard field proformas to facilitate comprehensive, consistent recording of field data and to increase accuracy and efficiency of data entry into the DECC Biodiversity Sub-system (BSS) of the Atlas of NSW Wildlife database. The names of observers and recorders were noted on data sheets to aid data verification and entry.

2.3.1 Systematic site-based methods

Diurnal bird survey

Diurnal bird censuses comprised a 20 minute observation and listening search within a two ha (100 m by 200 m) area, conducted by an experienced bird surveyor. Censuses were conducted only during periods of relatively high bird activity (in the early morning) and reasonable detectability (eg. low wind and 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 two hectare plot. Individuals recorded outside the plot, in adjacent vegetation types or flying overhead were recorded as off-site.

Diurnal herpetofauna search

A standard half-hectare subplot (50 m by 100 m) within a two ha standard site was searched for one person-hour (standardised regardless of the number of people searching). Censuses were restricted to the period between mid-morning to late afternoon, when temperature and insolation are sufficient to ensure maximum reptile activity. Surveying was not conducted on rainy or extremely hot days.

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, decorticating and fallen bark, rock outcrops and other likely shelter sites. Incidental observations of other fauna were also recorded.

Nocturnal site spotlighting survey

This census comprised searching for arboreal mammals along a 200 m transect within a site for half a person hour. On foot, surveyors used fifty watt spotlights to scan the vegetation for animals, enabling detection of reflected eye shine. Surveyors also noted all calls heard. All fauna detected within the census period were recorded, noting whether they were on or off site.

Harp trapping

Low-flying bat species were captured using collapsible bat traps, known as harp traps (Tidemann and Woodside 1978). Between one and 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 along tracks or in gaps between trees where adjacent vegetation might force bats to fly.

Traps were checked 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 at dawn 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 bat species, which often comprise more than one third of an area's bat species (Parnaby 1992b), yet are under sampled by harp trapping (Richards 1992). The method requires the recording and identification of high frequency, echolocation "calls" made by bats, which, except for one or two species, are ultrasonic thus inaudible to humans.

The recording equipment for the surveys consisted of an Anabat II® detector and digital flash card recorder, housed within a weatherproof box. The box was set up in locations where bats were

expected to fly, such as over water bodies 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. In most cases the equipment was left for one night only at each site.

Anabat recordings were transferred onto computer and analysed by Narawan Williams, a recognised expert in this field. Identification was designated as either definite, probable or possible, following the methodology of Parnaby (1992b).

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 (*Ninox strenua*), Masked (*Tyto novaehollandiae*), Sooty (*T. tenebricosa*) and Barking (*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.

Elliott trapping

This technique involved setting ten Elliott A traps at ten metre intervals along a 100 metre transect through a site. This technique is designed to target small ground mammals. Traps were baited with a mixture of peanut butter, oats and honey. Traps were left in place for three nights, checked and emptied every morning. Any animals captured within the traps were identified, sexed if possible, and released.

Hair Tube sampling

During the survey ten large hair-sampling tubes were placed at approximately ten metre intervals along a 100 metre transect at three locations. All tubes were baited with a mixture of peanut butter, honey, oats and sardines. Each tube was fitted with an adhesive wafer to collect hairs of small and medium sized mammals that were attracted to the bait. Tubes were left on site for a minimum of 40 nights. Hair samples were identified using the techniques described by Brunner and Coman (1974) by an expert in the field, Barbara Triggs. Identifications were classified into two levels of reliability: definite and probable.

2.3.2 Opportunistic methods

Predator and herbivore scat collection

The large numbers of hairs, and occasionally skeletal remains, in predator scats and 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 (*Canis lupus familiaris*) and Pig (*Sus scrofa*). Due to the unknown 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. However, Lunney *et al.* (2002) showed that on average Dogs and Foxes defecate within a two kilometre radius of the site 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 two levels of reliability: definite and probable.

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 sent to a specialist for identification.

Incidental records

The survey team recorded the location of interesting fauna (or signs of presence) whenever seen or heard while walking or driving in the reserve. Particular animals targeted by this technique were those undersampled by systematic surveys, including frogs, large ground mammals, non-vocalising birds, and secretive, shy and/or rare animals. The date, time, map grid location (usually obtained from a GPS) and microhabitat of the animal were recorded on a data sheet.

2.4 SURVEY TIMING

Systematic surveys were undertaken between 6-9 November and 14-15 December 2006. Table 2 summarises the timing of each survey technique and the prevailing weather conditions over this period.

Table 2: Timing of DECC systematic fauna surveys within Maroota Ridge SCA

Timing	Techniques employed	Notes on prevailing weather conditions
6 – 9 November	Site selection, diurnal bird census, Elliott trapping, harp trapping, setting hair tubes, nocturnal call playback, spotlighting, Anabat, opportunistic methods	Sunny to cool and overcast with rain (light drizzle only)
14 – 15 December	Site selection, diurnal bird census, harp trapping, collecting hair tubes, nocturnal call playback, Anabat, opportunistic methods	Hot and sunny to overcast with rain (light drizzle only)

3 RESULTS AND DISCUSSION

3.1 OVERVIEW

DECC established and surveyed 15 systematic fauna survey sites within Maroota Ridge SCA between November and December 2006. These sites cover the range of dominant habitats and landscapes present within the reserve. This recent survey has added a total of 543 records to the existing 46 already collected within the reserve, significantly increasing our knowledge of fauna distribution, abundance and habitat use in the area. In addition to the surveys, a number of records collected by council officers, volunteers and neighbours were also collated and added to the Atlas of NSW Wildlife.

One hundred and twenty-six vertebrate fauna species were observed during the survey period, including 90 species that had not previously been recorded within the reserve.

Eight species recorded are listed as threatened under the NSW *Threatened Species Conservation Act (1995)* (TSC Act). These were the Gang-gang Cockatoo (*Callocephalon fimbriatum*), Giant Burrowing Frog (*Heleioporus australiacus*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Red-crowned Toadlet (*Pseudophryne australis*) and Yellow-bellied Glider (*Petaurus australis*). In addition, the Gang-gang Cockatoos recorded in the reserve are likely to be part of the Hornsby and Ku-ring-gai Council Local Government Area population, which is listed as an Endangered population under the TSC Act.

Five introduced species, comprising entirely ground mammals, were recorded during the survey. Two species, the Fox (*Vulpes vulpes*) and Rabbit (*Oryctolagus cuniculus*) are listed as Key Threatening Processes under the TSC Act and the Commonwealth *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act).

A complete list of fauna species, as recorded on the Atlas of NSW Wildlife for Maroota Ridge SCA is presented in Appendix B.

The results of the vertebrate fauna survey indicate that Maroota Ridge SCA supports a faunal assemblage that is typical of bushland areas within Hawkesbury Sandstone geologies of the Sydney Basin Bioregion. Given the relatively high species diversity and the number of threatened species, the area is likely to play an integral role in the survival of a number of native fauna species within the region.

3.2 DIURNAL BIRDS

Diurnal birds represent the most diverse faunal group present within the area, with 72 species recorded during the survey (Appendix B). An additional four species had been recorded in the area prior to the survey (DECC 2007). These species were the Crimson Rosella (*Platycercus elegans*) and Eastern Rosella (*P. adscitus eximius*) and Little Lorikeet (*Glossopsitta pusilla*). Surprisingly, no introduced bird species were recorded in the area during the current survey or in the Atlas of NSW Wildlife. This is unusual for a reserve situated in relatively close proximity to rural/urban lands.

Widespread species in all major vegetation communities included the Brown Thornbill (*Acanthiza pusilla*), Cicadabird (*Coracina tenuirostris*), Eastern Spinebill (*Acanthorhynchus tenuirostris*), Grey Fantail (*Rhipidura albiscapa*), Grey Shrike-thrush (*Colluricincla harmonica*), Laughing Kookaburra (*Dacelo novaeguineae*), Mistletoebird (*Dicaeum hirundinaceum*), Rufous Whistler (*Pachycephala rufiventris*), Spotted Pardalote (*Pardalotus punctatus*), White-throated Treecreeper (*Cormobates leucophaeus*) and Yellow-faced Honeyeater (*Lichenostomus chrysops*). The Rockwarbler (*Origma solitaria*), primarily restricted

Plate 3: Yellow-tailed Black-cockatoo © Amy Moss

to the Sydney Basin Bioregion, was found in a number of rocky localities on and adjacent to escarpment edges and in rocky gorges within the area.

Bird species primarily found in the drier ridgetop vegetation included the Common Bronzewing (*Phaps chalcoptera*), Spotted Quail-thrush (*Cinclosoma punctatum*), Little Wattlebird (*Anthochaera chrysoptera*), White-cheeked Honeyeater (*Phylidonyris nigra*) and White-eared Honeyeater (*Lichenostomus leucotis*). While in the moister gully and lower slope vegetation, a range of different species occurred. Species typical of these more mesic environments included the Brown Gerygone (*Gerygone mouki*), Eastern Whipbird (*Psophodes olivaceus*), Eastern Yellow Robin (*Eopsaltria australis*), Lewin's Honeyeater (*Meliphaga lewinii*) and Satin Bowerbird (*Ptilonorhynchus violaceus*). Less frequently recorded species in moist gully vegetation included the Black-faced Monarch (*Monarcha melanopsis*) and Brown Cuckoo-Dove (*Macropygia amboinensis*).

Raptors were generally uncommon in the area, with just four species recorded and only single sightings made for each species. Other aerial-hunting species included the migratory White-throated Needletail (*Hirundapus caudacutus*) and Welcome Swallow (*Hirundo neoxena*), which were observed hawking insects over the area.

The presence of adjacent cleared vegetation for farmland and other land use activities accounted for a number of species either flying across the area or occurring on the edges of the reserve. These species included the Australian Raven (*Corvus coronoides*), Bar-shouldered Dove (*Geopelia humeralis*), Galah (*Eolophus roseicapillus*), Little Corella (*Cacatua sanguinea*), Magpie-lark (*Grallina cyanoleuca*), Masked Lapwing (*Vanellus miles*) and Noisy Miner (*Manorina melanocephala*).

3.3 NOCTURNAL BIRDS

Given the size of the reserve, the diversity of nocturnal birds was surprising (Appendix B). The most widespread and commonly recorded species were the Australian Owlet-nightjar (*Aegotheles cristatus*) and the White-throated Nightjar (*Eurostopodus mystacalis*). The Powerful Owl (*Ninox strenua*) was recorded at four sites, including a roosting bird that was disturbed in a gully close to cleared land near the western boundary of the reserve. The Southern Boobook (*Ninox boobook*) was located at two sites, while a single record was obtained of the regionally rare Masked Owl (*Tyto novaehollandiae*). An owl roost in an overhang in a gully in the north of the area is highly likely to be that of a Sooty Owl (*Tyto tenebricosa*) (N. Williams, wildlife consultant, pers. comm.). However, playback of this species' call conducted at or overlooking this site on two different nights in November and December failed to induce a response therefore the presence of this species must be considered unconfirmed within the reserve.

One additional species, the Tawny Frogmouth (*Podargus strigoides*), was recorded within 200 metres of the reserve and has previously been recorded in the area (DECC 2007). It is likely that this species occurs in small numbers across the reserve.

3.4 ARBOREAL MAMMALS

The most frequently recorded arboreal mammal species were the Sugar Glider (*Petaurus breviceps*) and the Common Ringtail Possum (*Pseudocheirus peregrinus*) (Appendix B). These species were present in most forest types within the reserve. The Common Brushtail Possum (*Trichosurus vulpecula*) was less common and primarily recorded in taller gully forest habitat where large hollows were present. No Yellow-bellied Gliders (*Petaurus australis*) were heard calling or spotlit within the area. However, feed trees with old scratchings were found at two sites. The Greater Glider (*Petauroides volans*) was not recorded in the current survey but had been located in the area in 1996 (DECC 2007). The presence of these last two arboreal species in the area requires further investigation.

3.5 BATS

Bat fauna was relatively representative of the forest types present in the reserve, comprising nine species (Appendix B). The most commonly trapped species were the Little Forest Bat (*Vespadelus vulturnus*) and the Gould's Long-eared Bat (*Nyctophilus gouldi*). A single Eastern Horseshoe-bat (*Rhinolophus megaphyllus*) was found sheltering in a recess under a large rock outcrop in a gully adjacent to the western boundary of the reserve. Only a single sighting of the Grey-headed Flying-fox (*Pteropus poliocephalus*) was made during the current survey. However, it is likely that at other times

of the year, such as when the Swamp Mahogany (*Eucalyptus robusta*) is in flower, this species will be a frequent visitor to the area.

Anabat analysis revealed some further information about the reserve's bat diversity. The most commonly detected "definite" species using this technique were Gould's Wattled Bat *(Chalinolobus gouldii)* and the Chocolate Wattled Bat *(Chalinolobus morio).* In addition, two more species were detected; Little Bentwing-bat (Miniopterus australis) and the Greater Broad-nosed Bat (Scoteanax rueppellii). These records were designated as "probable" having between 80 – 95% reliability in analysis. Three more species require further investigation to confirm their presence in the reserve. These are the Eastern False Pipistrelle *(Falsistrellus tasmaniensis)*, the Eastern Freetail-bat *(Mormopterus norfolkensis)* and the Large-footed Myotis *(Myotis macropus)* which were all recorded by Anabat but have been designated as "possible" due to unreliable call quality. In order to avoid confusion, "probable" and "possible" bat records have been omitted from the species list in this report.

3.6 NATIVE GROUND MAMMALS

The native small ground-dwelling mammal fauna comprised two species, the Brown Antechinus (*Antechinus stuartii*) and the Bush Rat (*Rattus fuscipes*) (Appendix B). These species were most abundant in the gullies and moister forest habitats within the area. A total of 60 Elliott trap nights were undertaken during the survey, resulting in the capture of four Brown Antechinus and one Bush Rat. No introduced rodent species were trapped.

Medium to large-sized native ground mammals present within the reserve comprised three species; the Swamp Wallaby (*Wallabia bicolor*), Common Wombat (*Vombatus ursinus*) and the Short-beaked Echidna (*Tachyglossus aculeatus*) (Appendix B). Unidentified bandicoot diggings were detected in three locations within the area. It is likely that these diggings belonged to the Long-nosed Bandicoot (*Perameles nasuta*); a species that is patchily distributed within the Sydney Basin Bioregion.

3.7 REPTILES

Plate 4: Bearded Dragon © Narawan Williams

The current survey located 16 reptile species within the reserve comprising nine skink, three gecko, two dragon, one goanna and one snake species (Appendix B). The most commonly recorded reptiles in the current survey were the Dark-flecked Garden Sunskink (*Lampropholis delicata*), Tree-base Litter-skink (*Lygisaurus foliorum*) and the Broad-tailed Gecko (*Phyllurus platurus*). The Common Blue Tongue Lizard (*Tiliqua scincoides*) is likely to occur within the area, as it has been found on adjacent private property (David Moss pers. comm.). The only snake encountered was a single Diamond Python (*Morelia spilota spilota*) in a gully on the western boundary of the reserve. It is likely that other snakes occur within the area, such as the Red-bellied Black Snake (*Pseudechis porphyriacus*), Common Tree Snake (*Dendrelaphis punctulatus*) and the Eastern Brown Snake (*Pseudonaja textilis*). These species have been observed on adjacent private lands (D. Moss pers. comm.) (D. Marchant pers. comm.). Additionally a single Thick-tailed Gecko (*Underwoodisaurus milii*) was observed during a community clean-up operation in the reserve in March 2007.

3.8 FROGS

The current survey located six frogs within the reserve (Appendix B), the most frequently recorded species being the threatened Red-crowned Toadlet (*Pseudophryne australis*). The majority of amphibian species were restricted to pools and moist situations in gullies and along watercourses. Whereas the Broad-palmed Frog (*Litoria latopalmata*) and Giant Burrowing Frog (*Heleioporus australiacus*) were recorded in dry ridgetop situations.

3.9 INTRODUCED SPECIES

Since Maroota Ridge SCA is bordered by cleared land and situated close to houses, a recreational park and other modified land types it is not surprising that a variety of introduced species were

recorded in the reserve. A total of five species were located in small numbers (Map 3; Appendix B). No introduced bird species were recorded within the area during the surveys. This is probably largely due to the intact nature of the vegetation within the reserve. Recent habitat modelling undertaken by DECC in the Sydney Basin has shown that most introduced bird species rarely penetrate undisturbed sandstone vegetation (DECC 2007a).

Two of the introduced species detected (Fox and Rabbit) are listed as Key Threatening Processes under the TSC Act and the Commonwealth EPBC Act and are likely to be having a negative impact on the native terrestrial flora and fauna of the area. The threats posed to native fauna by each species are summarised as follows:

- Rabbits impact negatively on indigenous species via competition for resources, alteration of the structure and composition of vegetation, and land degradation. The primary areas within the park that may be impacted by this species are adjacent to cleared areas or locations that were formerly under cultivation within the reserve.
- Predation by Foxes is a major threat to the survival of native Australian fauna, with non-flying mammals weighing between 35 and 5500 grams and ground-frequenting 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 1998). This species ranges across the entire reserve and thereby impacts on fauna within all habitats in the area.

It is likely that additional species, such as the Eurasian Blackbird *Turdus merula* and the Feral Cat *Felis catus* also occur within the reserve. The Eurasian Blackbird is abundant in Sydney's smaller reserves such as the neighbouring Scheyville NP and has found to be increasing its range (DECC 2007a). The Feral Cat on the other hand has been found to inhabit almost all Australian environments with its distribution in the Sydney Basin Bioregion particularly concentrated to within 50 km of the coast (DECC 2007a).

3.10 PREDATOR SCAT ANALYSIS

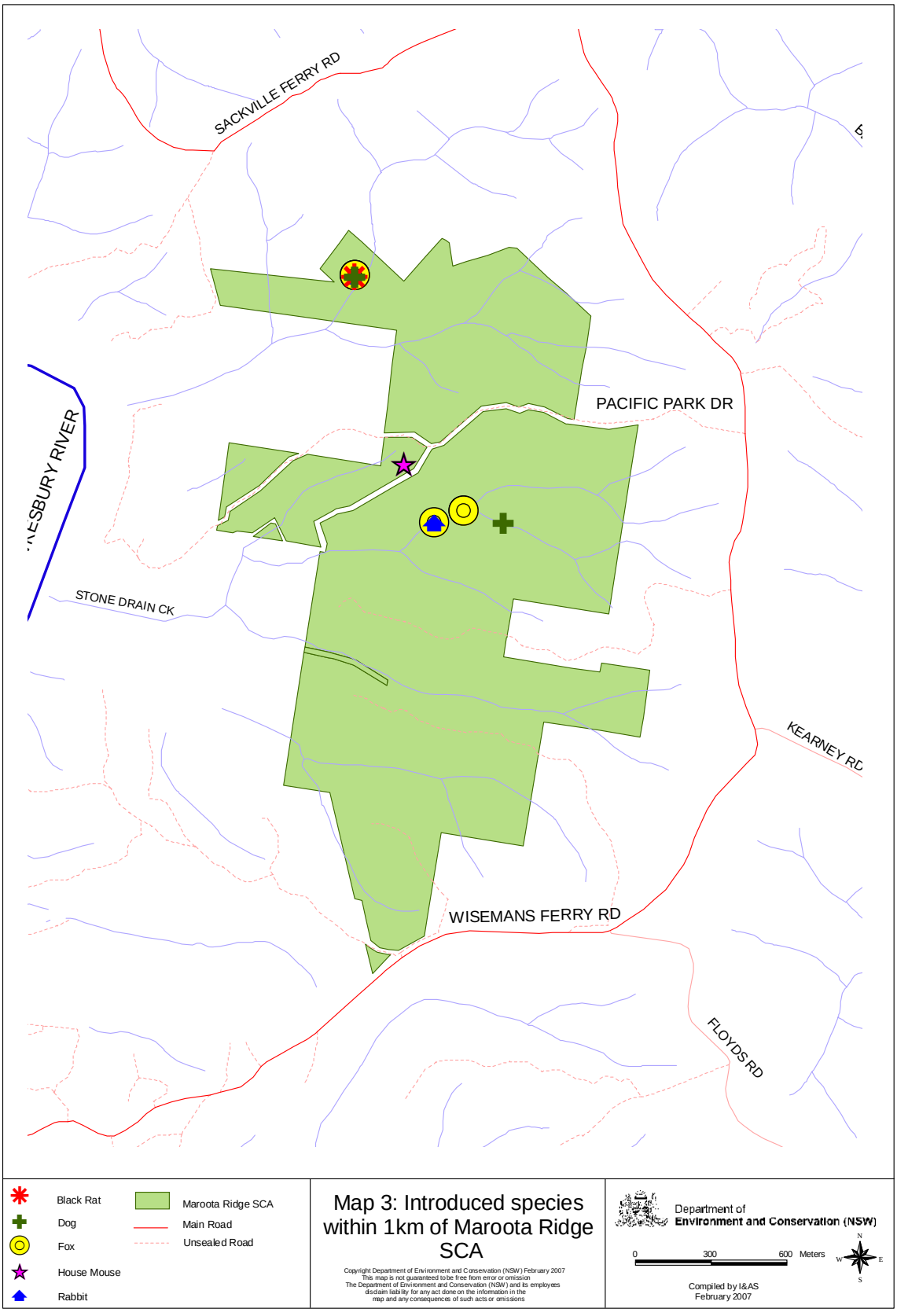
Analysis of prey remains in predator scats is a valuable method of collecting information about prey species that are cryptic, and yields information about the vertebrate prey composition of the predator's diet in a given area.

Four of the eight predator scats (either Fox or Feral Dog (*Canis familiaris*)) located during the survey contained native mammal remains: Swamp Wallaby (*Wallabia bicolor*), Bush Rat and unidentified Brushtail Possum (*Trichosurus* sp.). Two other scats contained remains of the introduced Rabbit.

A single pellet found in the vicinity of the roosting Powerful Owl contained the remains of a Sugar Glider. Two pellets of the unconfirmed Sooty Owl collected in an overhang along a gully in the north of the reserve contained the remains of the Common Ringtail Possum, Sugar Glider and Black Rat (*Rattus rattus*).

3.11 HAIR TUBE ANALYSIS

Similar to predator scat analysis, hair tubes provide a valuable technique for detecting the presence of cryptic and/or trap-shy species present within an area. However, in the current survey no additional mammal species were recorded using this technique. Ground-frequenting mammals recorded in the 30 hair tubes set at three sites comprised the Brown Antechinus, Bush Rat, unidentified Brushtail Possum and Swamp Wallaby.


SACKVILLE FERRY RD
PACIFIC PARK DR
STONE DRAIN CK
KEARNEY RD
WISEMANS FERRY RD
FLOYDS RD
Black Rat
Dog
Fox
House Mouse
Rabbit
Maroota Ridge SCA
Main Road
Unsealed Road
Map 3: Introduced species within 1km of Maroota Ridge SCA
Copyright Department of Environment and Conservation (NSW) February 2007
This map is not guaranteed to be free from error or omission
The Department of Environment and Conservation (NSW) and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions
Department of Environment and Conservation (NSW)
0
300
600 Meters
N
W
E
S
Compiled by I&AS
February 2007

4 THREATENED SPECIES

This section provides a profile of each of the threatened fauna species that were recorded during the current survey. 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 Sydney Basin Bioregion.
- A map of known records of the species in the reserve and surrounding one kilometre.
- An appraisal of the distribution and status of the species in Maroota Ridge SCA and the adjacent public lands.

Following is a table summarising the threatened species found during this survey (Table 3). It lists each species' protection status, at how many locations it was found and by whom, and finally summarises reliability of the sighting and gives a brief location description.

Please note that a dedicated recommendations section has not been included in this report. However, brief recommendations for the management of threatened species included in these profiles *are* specific to Maroota Ridge SCA therefore should be used as guide when making management decisions in and around the reserve. For more detailed management recommendations please refer to the particular species associated recovery plans.

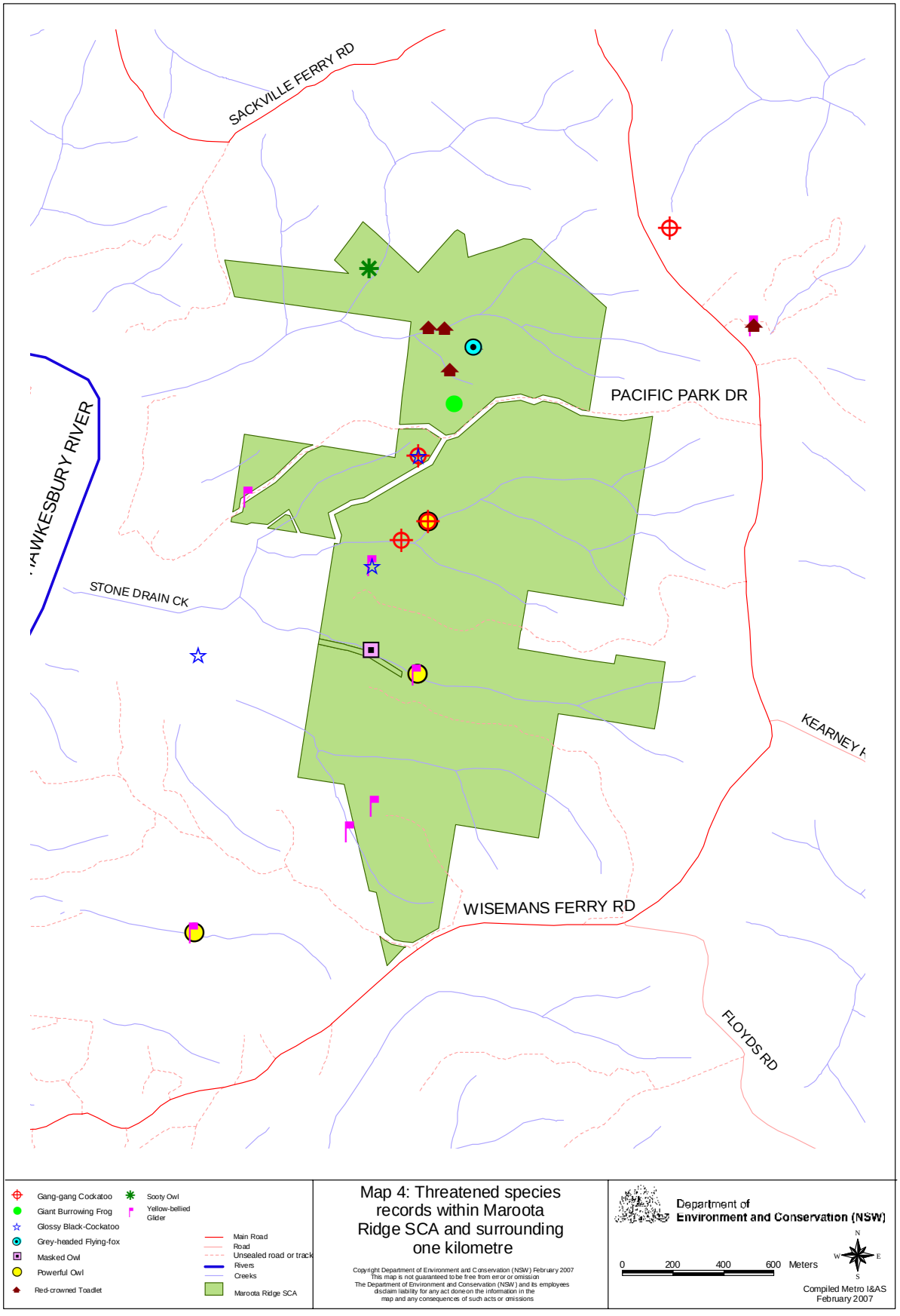
Table 3: Threatened fauna species recorded on the Atlas of NSW Wildlife within and one kilometre surrounding Maroota Ridge SCA. Data extracted February 2007.

Scientific name	Common name	Status in NSW (TSC Act)	Status in Australia (EPBC Act)	No. of locations within the reserve[1]		No. of locations within a one kilometre radius of the reserve[1]	Notes
				DECC[2]	Other[3]		
Callocephalon fimbriatum	Gang-gang Cockatoo	V		3		1	Also recorded outside the reserve in 1998 by Birds Australia
Heleioporus australiacus	Giant Burrowing Frog	V	V	1			Recorded at one location. Likely to occur in similar habitats at other locations throughout the reserve
Calyptorhynchus lathami	Glossy-black Cockatoo	V		2		1	Also observed by Conacher Travers Environmental in 2003 to the west of the reserve.
Scotoneax rueppellii	Greater Broad-nosed Bat	V		2			Highly probable. Detection by Anabat at above cleared motorcycle tracks and at cleared/ forested interface in centre of reserve. No profile has been generated for this species as records remain unconfirmed.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	1			Seen once flying over the northern portion of the reserve.
Miniopterus australis	Little Bentwing Bat	V					Probable (80% likely). Detected by Anabat in a central gully adjoining cleared land. No profile has been generated for this species as records remain unconfirmed.
Tyto novaehollandiae	Masked Owl	V		1			Heard once responding to a Nocturnal Call Playback. Known to occur at other locations within 5km of reserve.
Ninox strenua	Powerful Owl	V		2		1	Also recorded by Baulkham Hills Council in 2005 south-west of the reserve.
Pseudophryne australis	Red-crowned Toadlet	V		4		1	Recorded at four locations in the northern portion of the reserve. Also recorded in 2000 to the east of Wisemans Ferry Road.
Tyto tenebricosa	Sooty Owl	V		1			Pellet and prey remains found in a cave-roost in northern portion of reserve. Unsure of current residency status.
Petaurus australis	Yellow-bellied Glider	V		2	1	4	Current survey only identified feed marks on trees within the reserve. Evidence of this species was also recorded in the reserve in 1996. A number of populations are known to occur within 3km of the reserve in Little Cattai Creek (Peter Irish pers. comm.). Current residency status is unknown.

[1] Numbers indicate the number of records for the species, rather than the number of individuals. Only includes records on the Atlas of NSW Wildlife.

[2] Includes all records collected during 2007 DECC surveys

[3] Includes records on the Atlas of NSW Wildlife obtained from sources other than DECC systematic survey


SACKVILLE FERRY RD
PACIFIC PARK DR
HAWKESBURY RIVER
STONE DRAIN CK
KEARNEY
WISEMANS FERRY RD
FLOYDS RD
Gang-gang Cockatoo
Giant Burrowing Frog
Glossy Black-Cockatoo
Grey-headed Flying-fox
Masked Owl
Powerful Owl
Red-crowned Toadlet
Sooty Owl
Yellow-bellied Glider
Main Road
Road
Unsealed road or track
Rivers
Creeks
Maroota Ridge SCA
Map 4: Threatened species records within Maroota Ridge SCA and surrounding one kilometre
Copyright Department of Environment and Conservation (NSW) February 2007
This map is not guaranteed to be free from error or omission
The Department of Environment and Conservation (NSW) and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions
Department of Environment and Conservation (NSW)
N
W
E
S
0 200 400 600 Meters
Compiled Metro I&AS
February 2007

4.1 GIANT BURROWING FROG

Species Profile

The Giant Burrowing Frog (*Heleioporus australiacus*) is a large rotund ground-dwelling frog. Its powerful limbs are used to excavate burrows where they can stay 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 2001c). It has been suggested that this disjunct distribution may reflect two separate species, though at present evidence is inconclusive (Penman *et al.* 2004).

© Narawan Williams

Threats

The primary threat to the Giant Burrowing Frog in NSW is development of preferred habitat for housing and agriculture (NPWS 2001c). Other threats are not well known but may include frequent fire, infection by Chytrid fungus, alteration to drainage patterns, road mortality, pollutants, UV radiation and forestry operations. As a large, slow moving species, it is also likely to be vulnerable to predation by Foxes (*Vulpes vulpes*) and Feral Cats (*Felis catus*). Of the above threats, Penman *et al.* (2004) dismissed UV radiation, sedimentation and fire as being significant threats and questioned whether this species has in fact declined. Regardless, long wall mining may be a significant future threat (NSW Scientific Committee 2005b) as it can drain upland swamps that have been shown to be important breeding habitat for the Giant Burrowing Frog.

Local and Regional Conservation Status

The Giant Burrowing Frog is listed as Vulnerable under the NSW TSC Act (1995) and the Commonwealth 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). The species has been recorded within a number of Sydney Sandstone reserves including Royal, Ku-ring-gai Chase, Garigal and Brisbane Waters National Parks and across the Woronora Plateau. Fewer records have been obtained in Blue Mountains, Nattai and Yengo National Park's and Bargo State Conservation Area, as well as the southern section of Wollemi National Park.

The Giant Burrowing Frog was first recorded within the study area during the current survey on 6 November 2006, when a single individual was located on a sidetrack off Pacific Park Drive (Map 4). This individual was located in woodland in an elevated section of the reserve. No other individuals or tadpoles were located despite wet conditions during the early November field trip. The frog is likely to breed in a number of locations within the reserve, particularly along creeklines with alluvial sand and rocky pools surrounded by tall moist forest. This habitat is typical of this species' breeding habitat in the northern part of its range (DEH 2004b). The status of this species is uncertain within the area, but aside from protecting all pools within watercourses in the reserve it probably requires few immediate management actions. Sections of gully lines accessed by trail bikes on the western boundary of the park, where possible, need to be closed off to reduce the impact of erosion, sedimentation and direct rubbish dumping on some of these pools. Management may be required in the future if Chytrid fungus is discovered within the reserve.

4.2 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. 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 2001a).

© Narawan Williams

Threats

Development of ridgetop land 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 2001a). Due to their size and morphology, this species has only a limited ability to disperse, making them vulnerable to local extinction.

Local and Regional Conservation Status

The Red-crowned Toadlet is listed as Vulnerable on the NSW TSC Act (1995). Suitable habitat for this species is widespread across the sandstone plateaux of the Sydney Basin Bioregion, with the major populations in the upper and lower Blue Mountains, Hornsby Plateau near the Hawkesbury River and the Woronora Plateau extending to Royal National Park (DECC 2007a). Throughout its range it has been recorded in numerous National Parks, including a number within the Sydney urban area such as Garigal, Ku-ring-gai Chase, Lane Cove and Royal National Parks and Berowra Valley Regional Park (DECC 2007). The majority of locality data for the species is concentrated within the proximity of urban areas, where reporting of the species has dramatically increased since the introduction of threatened species legislation requiring environmental impact assessment prior to developments.

The Red-crowned Toadlet was first recorded within Maroota Ridge SCA in November 2006, when it was detected at three localities (Map 4). All records were from the main northern gully system of the reserve, yet the vegetation types in which they were found differed between Sydney Sandstone Gully Forest and Sydney Sandstone Gully Rainforest (rainforest understorey). In the November survey, this species was the most commonly recorded frog species, with seven individuals observed and heard calling in a single locality from under dense leaf litter in the main channel of an ephemeral stream within the main northern gully system. At least five individuals were heard calling from approximately the same locality in mid-December 2006. During the wet conditions of the early November field trip no individuals were heard calling from gullies within the central and southern sections of the area. However, more remote sections of gullies, particularly in the south of the reserve that also support Sydney Sandstone Gully Forest (rainforest understorey) were not visited during this period. Therefore, it is likely that further targeted work following rain in spring may locate additional populations of this species elsewhere within the reserve.

Threatening processes that may be impacting on this species within the area include loss of microhabitat such as leaf litter in gullies due to fire, water pollution particularly from sources outside the reserve in the catchment of the northern gully localities and the removal of bushrock. This frog was not recorded during the current survey in sections of gully lines accessed by trail bikes on the western boundary of the park. However, it is recommended that since further targeted work may find this frog in this part of the reserve, trail bikes be excluded to reduce the impact on ground cover and soil structure through erosion within the stream channels. Known locations and areas of potential habitat should be managed with the aim of reducing disturbance and minimising the chance of spreading Chytrid fungus. Any further visitation to the habitats must be undertaken in strict accordance with the *Hygiene Protocol for the Control of Disease in Frogs* (NPWS 2001b).

4.3 GANG-GANG COCKATOO

Species Profile

© Kylie Madden

The Gang-gang Cockatoo (*Callocephalon fimbriatum*) is a medium-sized, stocky cockatoo with dark grey feathers on its body, narrowly margined with pale grey, orange and red (Pizzey and Knight 1997). 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 southwest Victoria and occasionally into South Australia (Higgins 1999). Gang-gang Cockatoos 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. The species 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 1997).

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 2001a, 2005a). 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 2001), with observations of nest displacement by Sulphur-crested Cockatoos noted from the Sydney Region (T. Saunders pers. comm.). 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 2005a).

Local and Regional Conservation Status

The Gang-gang Cockatoo has recently been listed as a Vulnerable Species on the NSW TSC Act (1995) (NSW Scientific Committee 2005a) 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 common south of the Hunter River with numerous records from many National Parks, though there are fewer records in the Sydney and Wollongong urban areas.

The population in the Hornsby-Ku-ring-gai area had been listed as an endangered population under the NSW TSC Act (1995). The boundary limits of this population are uncertain and therefore it is possible that individuals within the Maroota Ridge SCA were a component of this threatened population.

The Gang-gang Cockatoo was first recorded within Maroota Ridge SCA in December 2006, when single pairs were sighted at three localities (Map 4). Due to the proximity of these locations it is possible that the same two individuals were sighted at all three localities. These sightings occurred in Sydney Sandstone Ridgetop Woodland and Sydney Sandstone Gully Forest. Given the widespread occurrence of these vegetation types across the reserve it is likely that this bird ranges throughout much of the area. No nesting records or breeding behaviour was observed. Therefore, it is not known whether this species breeds within the area. It is likely that since this cockatoo is an altitudinal migrant it may more commonly frequent the area during the late autumn to late winter months. The most important management actions are to ascertain whether the species nests in the park and to protect all trees with large hollows that may serve as potential nesting habitat. Important food trees utilised by the species within the area are unknown. Protection of commonly used feed trees such as the Sydney

Peppermint (*Eucalyptus piperita*) and Wattle species (*Acacia spp*.) (N. Williams pers. comm.) is important for the maintenance of a population within the reserve. This species is occasionally hit by vehicles, therefore speed limits on the access road to the Pacific Park Tourist Area could be considered.

4.4 GLOSSY BLACK-COCKATOO

Species Profile

The Glossy Black-Cockatoo (*Calyptorhynchus lathami*) is a large black cockatoo, which has a diagnostic black-brown head, the female with yellow patches, and orange-red tail panels. It is usually seen in pairs or trios (with dependant young) in eucalypt woodland or forest, where it nests in tree hollows. Glossy-Black Cockatoos feed almost exclusively on Sheoaks (*Allocasuarina* species including *A. verticillata, A. torulosa* and *A. littoralis*) (Higgins 1999), and chewed cones scattered underneath these trees are a distinctive indication of the presence of this bird.

© Narawan Williams

Threats

The major threat is habitat destruction for agriculture or residential development due to the removal of nesting and feeding sites and also from nest hollow competition from open-habitat species such as Galahs (*Eolophus roseicapillus*) and the Feral Honeybee (*Apis mellifora*) (NSW Scientific Committee 2002). Fire may be a threat as many *Allocasuarina* species are fire sensitive, thus inappropriate burning regimes may affect food supplies (NSW Scientific Committee 2000a). In addition, the removal of dead wood and dead trees is a Key Threatening Process that may impact on this species (NSW Scientific Committee 2003). Illegal trapping for aviculture may be a localised, minor threat (Garnett and Crowley 2000) along with infection by Psittacine Circoviral (beak and feather) Disease (DEH 2004a).

Local and Regional Conservation Status

The Glossy Black-Cockatoo is listed as Vulnerable under the NSW TSC Act (1995). Being a large, conspicuous species there are numerous records in the coastal third of the state, though it is also found on the western slopes and an apparently isolated population occurs in the Narrandera-Lake Cargelligo area of the Riverina (NSW Scientific Committee 1999). Relatively large areas of the Sydney Basin provide suitable habitat for the species and there are a large number of records throughout the Bioregion (DECC 2007). Feeding habitat is well protected, occurring in numerous DECC reserves, including Morton, Nattai, Blue Mountains, Ku-ring-gai Chase, Yengo and southern Wollemi National Parks.

The Glossy Black-Cockatoo was first recorded within Maroota Ridge SCA in November 2006, when chewed cones were found beneath *Allocasuarinas* on a northwest facing slope in Sydney Sandstone Ridgetop Woodland above cleared alluvial flats on the western edge of the reserve (Map 4). On 15 December 2006 two adults accompanied by a juvenile were observed feeding in widely scattered *Allocasuarina* on the edge of the old orchard in Sydney Sandstone Ridgetop Woodland (Map 4). Given the widespread occurrence of this vegetation type across the reserve it is likely that this species ranges throughout much of the area. However, the population utilising the area is likely to be very small due to the low abundance of *Allocasuarinas* within Maroota Ridge SCA. The presence of a juvenile may suggest that this species nests within the reserve or in adjacent forest areas. The most important management actions are to protect all trees with large hollows that may serve as potential nesting habitat and protect stands of *Allocasuarinas* to ensure continuing food supply for this species.

4.5 MASKED OWL

Species Profile

The Masked Owl (*Tyto novaehollandiae*) is a large 'barn' owl that 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 and forest habitats with large hollows for roosting and open areas for hunting. It feeds mostly on small ground-dwelling mammals and occasionally on diurnal birds, Sugar Gliders (*Petaurus breviceps*) and insects. This owl has a home range of 800 to 1200 hectares, nesting in hollow trees (usually eucalypts) where it lays two to three eggs (Kavanagh 2002). It will also occasionally nest in large rock overhangs.

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). The removal of dead wood and dead trees is considered to be a Key Threatening Process affecting this species (NSW Scientific Committee 2003). The core areas of the species distribution in NSW are located on the Central Coast and Lower Hunter Valley and much habitat in these areas is not reserved and is under continued pressure from habitat fragmentation and clearance due to urban and industrial development.

Local and Regional Conservation Status

The Masked Owl is listed as Vulnerable under the NSW TSC Act (1995). Most records for the species in New South Wales are located within the three coastal bioregions (NSW North Coast, Sydney Basin and South East Corner), with a few scattered records west of the Divide (DECC 2007). Within the Sydney Basin Bioregion, the woodlands of the coastal plains between Wyong and Port Stephens support relatively high numbers of this species. Concentrations of records also occur in the south of the Bioregion and to a lesser extent across the southern Blue Mountains. Records of the Masked Owl are scattered within a number of DECC reserves, including Royal, Blue Mountains, Nattai, Kanangra-Boyd, Wollemi, Brisbane Waters and Dharug National Parks, Towra Point Nature Reserve and Berowra Valley Regional Park (DECC 2007).

The Masked Owl was first recorded within Maroota Ridge SCA in December 2006, when a single bird responded to playback in Sydney Sandstone Gully Rainforest on the western edge of the reserve (Map 4). No other individuals were located in five playbacks conducted elsewhere in the reserve during the study period, including two within or overlooking the main northern gully that also supports Sydney Sandstone Gully Rainforest. Therefore, it is unknown whether the single individual located in December represented a resident bird or an individual that was moving through the area. The most important management actions are to protect all trees with large hollows that may serve as potential nesting/roosting habitat and exclude trail bikes from gullies on the western edge of the reserve.

4.6 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 closed forest, 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*). It usually nests in a hollow in a eucalypt within or below the canopy, and normally lays two eggs. A breeding pair usually maintains a territory of between 300 and 1500 hectares, with size dependent on habitat quality and prey density. It is endemic to eastern Australia, being recorded between Eungella (Queensland) to near the South Australia-Victoria border (Higgins 1999).

© Narawan Williams

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 roost sites. It can, however, survive in areas with some levels of disturbance, such as in selectively logged forests (Kavanagh 1997), and is also frequently recorded in suburban areas of Brisbane, Sydney and Melbourne (Garnett and Crowley 2000). 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).

Local and Regional Conservation Status

The Powerful Owl is listed as Vulnerable under the NSW TSC Act (1995). It is found throughout the Sydney Basin Region from the rural-urban fringes of the Sydney Metropolitan area to the west of the Dividing Range and into the Central Tablelands. Many reserves within the Bioregion support known territories of this species, including Berowra Valley Regional Park, Ku-ring-gai Chase, Garigal and Royal National Parks (NPs). Recent DECC surveys across the Warragamba Special Area, and the neighbouring Blue Mountains, Kanangra-Boyd and Nattai National Parks have found the Powerful Owl to be relatively abundant and widespread in the region (DECC 2007). This species occurs in lower densities in other DECC reserves within the Bioregion, such as Lane Cove, Wollemi and Yengo National Parks.

The Powerful Owl was first recorded within Maroota Ridge SCA in December 2006, when it was recorded from two locations (Map 4). A single roosting bird was flushed from dense foliage in a gully on the western edge of the reserve supporting Sydney Sandstone Gully Rainforest. This individual appeared to be an immature bird, judging by the plumage characteristics. A pellet collected from this location comprised the remains of a Sugar Glider, a common arboreal species within the area. Two birds responded to playback from a different gully on the western edge of the area (Map 4). The male called from closeby in Sydney Sandstone Gully Forest while the more distant responding female may have been in Sydney Sandstone Ridgetop Woodland to the south of the gully. No other individuals were located in five playbacks conducted elsewhere in the reserve in November and December 2006. It is likely that at least one pair of birds is resident within Maroota SCA. The presence of an immature bird suggests breeding may occur within the area. Therefore, the most important management actions are to protect all trees with large hollows that may serve as potential nesting habitat; exclude trail bikes from gullies on the western edge of the reserve to avoid the disturbance of roosting individuals; and to minimise the incidence of fires in gully and moist forest type habitats within the area to ensure adequate populations of prey species are maintained.

4.7 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 tree hollows and deep sandstone overhangs (DEC 2005). It is usually located within 100 metres of streams (Kavanagh 1997). Pairs probably maintain permanent territories that are between 200 and 800 hectares in area, depending on the availability of prey (Higgins 1999). The species feeds on a wide range of arboreal and terrestrial mammals (Kavanagh 2002a). In Australia the subspecies *tenebricosa* is distributed along the east coast between the Conondale Ranges (Queensland) and central Victoria.

Threats

Garnett and Crowley (2000) listed the main threat as habitat clearance for agriculture and urban development, along with additional fragmentation or degradation caused by logging, burning and dieback. The exact impacts of logging remain unclear (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. The Sooty Owl is a highly specialised species occupying a narrow range of habitats, which makes it particularly vulnerable to climate change (NSW Scientific Committee 2000b).

Local and Regional Conservation Status

The Sooty Owl is listed as Vulnerable under the NSW TSC Act (1995). Within New South Wales it is largely 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 2002). In these areas it has been most often recorded in the Illawarra Escarpment and Jilliby State Conservation Areas, with other records in Royal, Blue Mountains, Bouddi and Wollemi National Parks (DECC 2007).

This species has not been confirmed to occur within Maroota Ridge SCA. However, a roost located in an overhang along the northern main gully in Sydney Sandstone Gully Rainforest was suspected to be of this species (N. Williams, wildlife consultant, pers. comm.). Sooty Owls were recorded nearby at two locations in 2005, Mitchell Park and off the Idlewild Trail, Little Cattai Creek (DECC 2007). Further targeted playback is required to confirm the presence of this owl within the reserve. In the interim it is recommended that actions be undertaken to minimise the incidence of fires in gully and moist forest habitats within the area to protect potential roosts and to ensure adequate populations of potential prey species are maintained.

4.8 GREY-HEADED FLYING-FOX

Species Profile


© Narawan Williams

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 recorded in the study area, with a wingspan of up to one metre. It is a highly mobile species and numbers roosting at specific camps may vary depending on season and food availability. It feeds 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. The species can travel up to twenty kilometres to a food source, and is an important pollinator and disperser of native plants. The Grey-headed Flying-fox is endemic to eastern Australia, between Melbourne, Victoria and Bundaberg, Queensland (NPWS 2001d). The species range has contracted, previously occurring as far north as Rockhampton (NPWS 2001d). It primarily occurs along the 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 2001d). 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 2001d).

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 2001d, 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). The species is regularly recorded in all three coastal bioregions (DECC 2007). Eby *et al.* (1999) estimated there to be approximately sixteen camps within the Sydney Basin Bioregion. Current locality data suggests the species to be primarily distributed across the coastal and hinterland environments of the Sydney Basin, although this may reflect reporting bias in the data. The species has been recorded foraging in numerous conservation reserves, including Royal, Lane Cove, Dharug, Blue Mountains, Wyrrabalong, Yengo and Werakata National Parks (DECC 2007), as well as south, east and north-western Wollemi National Park. However, a greater number of records occur off reserve, including within parks and gardens in metropolitan areas between Sydney and Newcastle. The majority of known camps are not within national parks or other DECC reserves.

The Grey-headed Flying-fox was first recorded within Maroota Ridge SCA in November 2006, when a single individual was observed flying over Sydney Sandstone Ridgetop Woodland (Map 4). No individuals were observed feeding in flowering or fruiting trees within the reserve on either the November or December 2006 visits. It is likely that at other times of the year when tree species such as the Swamp Mahogany are in blossom that this bat may be a frequent visitor to the area. Due to the paucity of sightings there are few specific management actions proposed to protect this species within the reserve. However, a high priority is to protect all Swamp Mahoganies on the western boundary of the reserve; restrict trail bike access in this section of the park; and if feasible undertake bush regeneration on cleared land in this area to encourage known food trees for this and other threatened nectarivorous species during the autumn months.

4.9 YELLOW-BELLIED GLIDER

Species Profile


Yellow-bellied Glider feed tree © Daniel Connolly

The Yellow-bellied Glider (*Petaurus australis*) is a medium-sized nocturnal mammal found in tall sclerophyll forests and woodlands of eastern Australia. As an arboreal species, it requires mature hollow-bearing trees within which to den during the day (NPWS 1999). 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 characteristic 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 region of north-eastern Queensland (Russell 1995).

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 1999). Predation by Feral Cats (*Felis catus*) and Foxes (*Vulpes vulpes*) is also thought to contribute to the species' vulnerability. Impacts of fire regimes are poorly understood, although some studies suggest that high intensity fire reduces populations and the availability of food resources (NPWS 1999, 2003b). The Yellow-bellied Glider is also listed as potentially negatively affected by the Key Threatening Process of competition from Feral Honeybees (NSW Scientific Committee 2002).

Local and Regional Conservation Status

The Yellow-bellied Glider is listed as Vulnerable under the NSW TSC Act (1995). Within New South Wales, records are largely concentrated within the coastal Bioregions (being NSW North Coast, Sydney Basin and South East Corner, as well as parts of the South East Highlands Bioregion (DECC 2007). The species appears to have a patchy distribution within the Sydney Basin Bioregion (DECC 2007), although recent surveys have significantly expanded the knowledge of its distribution and habitat preferences. As little as ten years ago the species was considered to be uncommon in the greater southern Sydney region. However, the converse has been found to be the case (DECC 2007). Here the species has been found to strongly associate with habitats that have a high cover of Grey Gum (*Eucalyptus punctata*) and Forest Red Gum (*E. tereticornis*), with large numbers located in the Blue Mountains escarpments and gullies (DECC 2007). Population strongholds elsewhere in the Sydney Basin Bioregion include the tall forests of the Central Coast and Watagan Ranges (DECC 2007). Numerous records are known from a large number of reserves including Jervis Bay, Morton, Blue Mountains, Yengo, Watagans and Wollemi National Parks amongst others (DECC 2007). In fact, the large number and wide distribution of records of the Yellow-bellied Glider that have been collected in the past decade, together with 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 should be reviewed and possibly down-listed (Kavanagh 2004).

There were no actual sightings or identification of the distinctive call of this species during the surveys. All records were based on the location of feed trees. The presence of Yellow-bellied Glider feed trees was first recorded within Maroota Ridge SCA in May 1996, when marks were located on a tree 2 km west of Cheesemans Road (DECC 2007). In the current survey, feed trees supporting old feedmarks were located at three sites (Map 4). These feed marks were on the trunks of the Grey Gum at two sites and Blue Gum (*E. deanei*) at one site. The presence of feed marks but the lack of sightings and vocalisations is of interest in that it may suggest that the species is present in very low numbers,

particularly in more remote sections of the reserve. Alternatively it may no longer occur within the reserve. It is recommended that targeted surveys, particularly in moister forest types in gullies and on lower slopes of the more remote sections of the area be undertaken. Additional management actions recommended include the protection of hollow-bearing trees within the area and minimising the impact of wildfire in moist gully and lower slope vegetation.

5 FUTURE SURVEY WORK

The systematic fauna survey described here provides detailed baseline information on the fauna of Maroota Ridge SCA. There is much scope to build on this work in the future, in a way that will provide important information to aid in the management of biodiversity within the park.

Future work to further improve on the level of baseline information could include:

- Targeted surveys using Harp Traps and Anabat to determine the presence of; two probable species (The Little Bentwing-bat and the Greater Broad-nosed Bat); and three possible species (The Eastern False Pipistrelle, the Eastern Freetail Bat and the Large-footed Myotis).
- Targeted survey work to confirm the presence of the Yellow-bellied Glider and areas within the reserve that are utilised.
- Further spotlighting in more remote sections of the reserve to ascertain whether a population of the Greater Glider still exists within the area.
- Confirm the presence of the Sooty Owl within the area.
- Monitor the presence of large forest owls and their prey species within the area, particularly the Masked Owl.
- Confirm the identification of the bandicoot species present within the area.
- Undertake autumn/winter surveys, particularly when tree species such as Swamp Mahogany are in flower to determine the usage of the park by threatened species, such as the Swift Parrot (*Lathamus discolor*), Regent Honeyeater (*Xanthomyza phrygia*) and the Grey-headed Flying-fox.
- Undertake a targeted late spring frog survey following a significant rainfall event to determine whether the Red-crowned Toadlet is present in other sections of the reserve than the main northern gully and to determine more accurately the abundance, distribution and habitat use of the Giant Burrowing Frog within the area.
- Determine whether the Koala (*Phascolarctos cinereus*) still occurs within the area.
- Devise and conduct a plan to undertake systematic fauna surveys within the area on a regular basis, for example every five years. These surveys should incorporate monitoring sites to assess faunal assemblage changes in terms of abundance and composition and threatened species presence over time and in response to events such as wildfire, feral animal control programs and other management actions. Any future work must be entered into the Atlas of NSW Wildlife and funds allocated for this data entry to be undertaken.

6 REFERENCES

AES Environmental Consultancy (2002) *Natural Asset Mapping for Baulkham Hills Shire Council*: *Plant Communities in Baulkham Hills Shire*. Report for Baulkham Hills Shire Council by Roger Lembit and Paul Burcher.

Anstis, M. (2002) *Tadpoles of South eastern Australia: a guide with keys.* Reed New Holland: Sydney.

Barrett, G., Silcocks, A., Barry S., Cunningham, R. and Poulter, R. (2003) *The New Atlas of Australian Birds*. Royal Australian Ornithologists Union. Hawthorn East, Victoria.

Brunner, H. and Coman, B. (1974). *Identification of Mammalian Hair*. Inkata Press, Melbourne.

Chafer, C.J. (1992). Observations of the Powerful Owl *Ninox strenua* in the Illawarra and Shoalhaven Regions of New South Wales. *Australian Bird Watcher* 14: 289-300.

Churchill, S. (1998) *Australian Bats* Reed New Holland, Sydney.

Corben, C. (1989). Computer-based call analysis for microbat identification. *Macroderma* **5**:7.

Debus, S.J.S. and Chafer, C.J. (1994). The Powerful Owl *Ninox strenua* in New South Wales. *Australian Birds* (Supplement) 28: 40-64.

DEC (2005) *Draft Recovery Plan for the Large Forest Owls: Powerful Owl* (*Ninox strenua)* *Sooty Owl* (*Tyto tenebricosa)* *Masked Owl* (*Tyto novaehollandiae)*. NSW DEC, Sydney.

DECC (2007) *Atlas of NSW Wildlife. Database of Fauna and Flora records*. GISG, NSW DECC, Hurstville. Data extracted February 2007.

DECC (2007a) *Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region: Part 2 Species of Conservation Concern*. A joint project between the Sydney Catchment Authority and the Parks and Wildlife Division of the Department of Environment and Climate Change by the Information and Assessment Section, Metropolitan Branch, Environment Protection and Regulation Division, Department of Environment and Climate Change (NSW)

DEH (2004a) Draft Threat Abatement Plan for Psittacine Circoviral (Beak and Feather) Disease Affecting Endangered Psittacine Species. http://www.deh.gov.au/biodiversity/threatened/publications/tap/p-circoviral/pubs/p-circoviral.pdf Accessed 23/05/05

DEH (2004b) *Heleioporus australiacus* Giant Burrowing Frog. Species profile. http://www.deh.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1973 Accessed 08/02/07

DLWC (1998) Soil Landscapes of the Penrith 1:100 000 sheet - SCS SL 3208, Information and Planning Branch, Department of Land and Water Conservation, NSW

DMR (1999) *Cartographic Geological Spatial Data - 100K scale* - Penrith 1:100 000 Geological Layer. Cartographic Section, Geological Survey, Department of Mineral Resources, NSW

Duncan, A., Baker, G.B. and Montgomery, N. (Eds) (1999) *The Action Plan for Australian Bats*. Environment Australia, Canberra.

Eby, P., Richards, G.C., Collins, L. and Parry-Jones, K. (1999) The distribution, abundance and vulnerability to population reduction of a nomadic nectarivore, the Grey-headed flying fox *Pteropus poliocephalus* in New South Wales, during a period of resource concentration. *Australian Zoologist* 31:240-253.

Garnett, S.T. and Crowley, G.M. (2000) *The Action Plan for Australian Birds 2000*. Environment Australia, Canberra.

Goldingay R.L and Kavanagh R.P (1991) The Yellow-bellied Glider: a review of its ecology, and management considerations. In *Conservation of Australia's Forest Fauna*. (ed.) D.Lunney. Royal Zoological Society of NSW, Mosman.

Higgins, P.J. (Ed.) (1999). *Handbook of Australian, New Zealand and Antarctic Birds, Volume 4, Parrots to Dollarbird*. Oxford University Press, Melbourne.

Kavanagh, R. P. (1997). *Ecology and Management of Large Forest owls in South-eastern Australia*. Thesis submitted for the degree of Doctor of Philosophy at the School of Biological Sciences, University of Sydney

Kavanagh, R. P. (2002) Conservation and management of large forest owls in southeastern Australia. Pp 201-219 in *Ecology and Conservation of Owls*. (eds.) I. Newton, R. Kavanagh, J. Olsen and I. Taylor. CSIRO, Victoria.

Kavanagh, R. P. (2002a) Comparative diets of the Powerful Owl *(Ninox strenua),* Sooty Owl *(Tyto tenebricosa)* and Masked Owl *(Tyto novaehollandiae)* in southeastern Australia. Pp 175-191 in *Ecology and Conservation of Owls*. (eds.) I. Newton, R. Kavanagh, J. Olsen and I. Taylor. CSIRO, Victoria.

Kavanagh, R. P. (2004) Distribution and conservation status of the possums and gliders of New South Wales. Pp 130-148 in *The Biology of Australian Possums and Gliders*. (eds.) R.L. Goldingay and S.M. Jackson*.* Surrey Beatty and Sons, Chipping Norton.

Lunney, D., Matthews, A. and Triggs, B. (2002) Long-term changes in the mammal fauna of logged, coastal forests near Bega, New South Wales, detected by analysis of dog and fox scats. *Australian Mammalogy* 23: 101-114

Mackowski, C.M. (1988) Characteristics of eucalypts incised for sap by Yellow-bellied Glider *Petaurus australis* (Marsupalia: Petauridae) in northeast NSW. *Australian Mammalogy* 11: 5-13

NPWS (1997) *NSW Comprehensive Regional Assessments: Vertebrate fauna surveys, 1997-1998 summer survey season: Field survey methods*. NSW National Parks and Wildlife Service. Unpublished.

NPWS (1997a) *Urban Bushland Biodiversity Survey: Native Fauna of Western Sydney.* NSW National Parks and Wildlife Service, Hurstville.

NPWS (1999) Threatened Species Information – Yellow-bellied Glider. http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_yellowbellied_glider.pdf Accessed 07/02/07.

NPWS (2001a) Threatened Species Information – Red-crowned Toadlet. http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_redcrowned_toadlet.pdf Accessed 8/2/07.

NPWS (2001b) *Hygiene protocol for the control of disease in frogs*. Information Circular No. 6. NSW NPWS, Hurstville NSW.

NPWS (2001c) Threatened Species Information – Giant Burrowing Frog. http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_giant_burrowing_frog.pdf Accessed 8/2/07.

NPWS (2001d) Threatened Species Information – Grey-headed Flying Fox. http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_greyheaded_flyingfox.pdf Accessed 09/02/07.

NPWS (2002) *Wollongong LGA Bioregional Assessment (Part II): Fauna of the Illawarra Escarpment, Coastal Plain and Plateau.* Central CPPD, NSW NPWS, Hurstville.

NPWS (2003a) *The Bioregions of New South Wales: their biodiversity, conservation and history*. NSW National Parks and Wildlife Service, Hurstville.

NPWS (2003b) Recovery Plan for the Yellow-bellied Glider (*Petaurus australis*). NSW National Parks and Wildlife Service. Hurstville

NSW Scientific Committee (1998) Final determination to list predation by European Red Fox as a Key Threatening Process. http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Predation+by+the+European+red+fox+key+threatening+process+declaration Accessed 13/2/07.

NSW Scientific Committee (1999) Final Determination to list the Glossy black-cockatoo population, Riverina as an endangered population. http://www.nationalparks.nsw.gov.au/npws.nsf/content/glossy+black+cockatoo+population+riverina+endangered+population+listing Accessed 07/02/07

NSW Scientific Committee (2000a) Final Determination to list Ecological consequences of high frequency fires as a Key Threatening Process. http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Ecological+consequences+of+high+frequency+fires+key+threatening+process+declaration Accessed 09/02/07

NSW Scientific Committee (2000b) Final Determination to list human-caused climate change as a Key Threatening Process. http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Human+caused+climate+change+key+threatening+process+declaration. Accessed 09/02/07

NSW Scientific Committee (2001). Final Determination to list Gang-gang Cockatoo population, Hornsby and Ku-ring-gai Local Government Areas as an Endangered Population. http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Gang+gang+cockatoo+population+Hornsby+and+Ku+ring+gai+Local+Government+Areas+endangered+population+listing Accessed 8//02/07

NSW Scientific Committee (2002) Final Determination to list Competition from Feral Honeybees as a Key Threatening Process.

http://www.nationalparks.nsw.gov.au/npws.nsf/content/competition+from+feral+honeybees+-+key+threatening+process+declaration Accessed 09/02/07

NSW Scientific Committee (2003) Final determination to list removal of dead wood and dead trees as a key threatening process. http://www.nationalparks.nsw.gov.au/npws.nsf/Content/deadwood_removal_ktp Accessed 09/02/07

NSW Scientific Committee (2005a) Final Determination to list Gang-gang Cockatoo as a Vulnerable Species. http://www.nationalparks.nsw.gov.au/npws.nsf/Content/gang-gang_cockatoo_vulnerable Accessed 17/04/07

NSW Scientific Committee (2005b) Final Determination to list Alteration of habitat following subsidence due to longwall mining as a Key Threatening Process. http://www.nationalparks.nsw.gov.au/npws.nsf/content/longwall_mining_ktp Accessed 8/02/07

Olsen, P., Weston, M., Cunningham, R. and Silcocks, A. (2003) The State of Australia's Birds 2003. *Wingspan* 13(4) Supplement.

Parnaby, H. (1992a) *An interim guide to identification of insectivorous bats of south-eastern Australia. Technical Reports of the Australian Museum Number 8.* Australian Museum, Sydney.

Parnaby, H. (1992b) *An ultrasonic survey of microchiropteran bats of north-east NSW forests. North East Forests Biodiversity Study Report No. 3b.* NSW National Parks and Wildlife Service, Hurstville.

Penman, T., Lemckert, F. and Mahony, M. (2004) Two hundred and ten years looking for the Giant Burrowing Frog. *Australian Zoologist* 32: 597-604

Pennay, M., Law, B. and Reinhold, L. (2004) *Bat calls of New South Wales: region based guide to the echolocation of microchiropteran bats.* NSW Department of Environment and Climate Change, Hurstville.

Pizzey, G. and Knight, F. (1997) *Field Guide to the Birds of Australia.* HarperCollinsPublishers, Sydney.

Richards, G.C. (1992). *Fauna Survey: Wingham Management Area, Port Macquarie Region. Part 4: Bats.* Forestry Commission of New South Wales, Forest Resources Services Report No. 22.

Russell, R. (1995) Yellow-bellied Glider *Petaurus australis*. Pp 226-8 in *The Mammals of Australia*. (ed.) R. Strahan. Reed Books, Chatswood.

Tidemann, C.R. and Woodside, D.P. (1978) A collapsible bat trap compared with mist-nets. *Australian Wildlife Research* 5: 363-384.

APPENDIX A: SURVEY SITES

Location of, vegetation type and techniques undertaken at systematic fauna survey sites in Maroota Ridge SCA.

Site number	Zone	Easting	Northing	Vegetation community (AES Environmental Consultancy 2002)	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap (nights)	Bat ultrasound detection (nights)	Nocturnal call playback	Elliott trap-nights	Hair tube trap-nights
WLB015W	56	308390	6290051	Sydney Sandstone Ridgetop Woodland – NW facing lowerslope	1	1	1		2			
WLB016W	56	308784	6290665	Sydney Sandstone Ridgetop Woodland				4		1		
WLB017O	56	308084	6290414	Sydney Sandstone Gully Forest – SE facing upperslope	1							
WLB018W	56	308792	6290912	Sydney Sandstone Ridgetop Woodland		1		1	1	2		
WLB019W	56	309189	6290614	Shale/Sandstone Transition Forest (High Sandstone Influence)	1	1	1		1			
WLB020W	56	308886	6290776	Sydney Sandstone Ridgetop Woodland				2				
WLB021W	56	308603	6290758	Sydney Sandstone Ridgetop Woodland	1	1	1		1		3x10	40x10
WLB022O	56	308475	6289670	Sydney Sandstone Gully Rainforest – rainforest understorey	1		1	3	1		3x10	40x10
WLB023O	56	308807	6290298	Sydney Sandstone Gully Forest	1	1	1					40x10
WLB024W	56	309018	6288997	Sydney Sandstone Ridgetop Woodland	1							
WLB025O	56	308567	6289620	Sydney Sandstone Gully Rainforest – rainforest understorey		1		1				
WLB026O	56	308386	6289714	Sydney Sandstone Gully Forest – SW facing lowerslope				1		1		
WLB027O	56	308611	6290225	Sydney Sandstone Gully Forest				1		1		
WLB028W	56	308507	6290151	Sydney Sandstone Ridgetop Woodland/Gully Forest Transition					1			
WLB029W	56	308573	6290484	Sydney Sandstone Ridgetop Woodland	1			1		1		
TOTAL					**8**	**6**	**5**	**14**	**7**	**6**	**60**	**1200**

APPENDIX B: FAUNA SPECIES LIST

Below is a list of fauna species recorded on the Atlas of NSW Wildlife within 200 metres of Maroota Ridge SCA. This data was extracted from the Atlas on 7 February 2007.

Records have been included from the 2006 DECC systematic survey, the 1996 UBBS systematic survey of western Sydney and incidental observations supplied by the park ranger, council officers, environmental consultants and individuals. The list contains records of various levels of reliability. Introduced species are indicated with the addition of a "*".

Scientific Name	Common Name	Conservation Status (TSC Act) P=protected U=unprotected V=vulnerable	DECC Systematic Survey	UBBS (NPWS 1997a)	Conacher Travers Environmental	Other Sources
Diurnal Birds						
Tachybaptus novaehollandiae	Australasian Grebe	P				X
Falco longipennis	Australian Hobby	P	X			
Alisterus scapularis	Australian King-Parrot	P	X			
Gymnorhina tibicen	Australian Magpie	P	X			
Corvus coronoides	Australian Raven	P	X	X	X	
Geopelia humeralis	Bar-shouldered Dove	P	X			
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P	X			
Monarcha melanopsis	Black-faced Monarch	P	X			
Macropygia amboinensis	Brown Cuckoo-Dove	P	X	X		
Falco berigora	Brown Falcon	P	X			
Gerygone mouki	Brown Gerygone	P	X			
Accipiter fasciatus	Brown Goshawk	P	X			
Acanthiza pusilla	Brown Thornbill	P	X			
Melithreptus brevirostris	Brown-headed Honeyeater	P	X			
Scythrops novaehollandiae	Channel-billed Cuckoo	P	X			
Coracina tenuirostris	Cicadabird	P	X			
Phaps chalcoptera	Common Bronzewing	P	X	X		
Platycercus elegans	Crimson Rosella	P			X	
Eurystomus orientalis	Dollarbird	P	X			
Platycercus adscitus eximius	Eastern Rosella	P		X	X	
Acanthorhynchus tenuirost	Eastern Spinebill	P	X		X	
Psophodes olivaceus	Eastern Whipbird	P	X		X	
Eopsaltria australis	Eastern Yellow Robin	P	X	X		

Scientific Name	Common Name	Conservation Status (TSC Act) P=protected U=unprotected V=vulnerable	DECC Systematic Survey	UBBS (NPWS 1997a)	Conacher Travers Environmental	Other Sources
Cacomantis flabelliformis	Fan-tailed Cuckoo	P	X			
Eolophus roseicapillus	Galah	P	X			
Callocephalon fimbriatum	Gang-gang Cockatoo	V	X			
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	X			
Pachycephala pectoralis	Golden Whistler	P	X			
Cracticus torquatus	Grey Butcherbird	P	X		X	
Rhipidura albiscapa	Grey Fantail	P	X	X	X	
Colluricincla harmonica	Grey Shrike-thrush	P	X	X	X	
Dacelo novaeguineae	Laughing Kookaburra	P	X	X	X	
Myiagra rubecula	Leaden Flycatcher	P	X			
Meliphaga lewinii	Lewin's Honeyeater	P	X	X		
Cacatua sanguinea	Little Corella	P	X			
Glossopsitta pusilla	Little Lorikeet	P		X		
Anthochaera chrysoptera	Little Wattlebird	P	X	X	X	
Grallina cyanoleuca	Magpie-lark	P	X			
Vanellus miles	Masked Lapwing	P	X			
Dicaeum hirundinaceum	Mistletoebird	P	X			
Philemon corniculatus	Noisy Friarbird	P	X		X	
Manorina melanocephala	Noisy Miner	P	X	X	X	
Oriolus sagittatus	Olive-backed Oriole	P	X			
Eudynamys orientalis	Pacific Koel	P	X			
Geopelia placida	Peaceful Dove	P	X			
Strepera graculina	Pied Currawong	P	X	X	X	
Trichoglossus haematodus	Rainbow Lorikeet	P	X			
Neochmia temporalis	Red-browed Finch	P	X			
Origma solitaria	Rockwarbler	P	X			
Pachycephala rufiventris	Rufous Whistler	P	X	X		
Todiramphus sanctus	Sacred Kingfisher	P	X			
Ptilonorhynchus violaceus	Satin Bowerbird	P	X			
Myzomela sanguinolenta	Scarlet Honeyeater	P	X			
Zosterops lateralis	Silvereye	P	X			
Pardalotus punctatus	Spotted Pardalote	P	X	X	X	

Scientific Name	Common Name	Conservation Status (TSC Act) P=protected U=unprotected V=vulnerable	DECC Systematic Survey	UBBS (NPWS 1997a)	Conacher Travers Environmental	Other Sources
Cinclosoma punctatum	Spotted Quail-thrush	P	X			
Pardalotus striatus	Striated Pardalote	P	X			
Acanthiza lineata	Striated Thornbill	P	X			
Cacatua galerita	Sulphur-crested Cockatoo	P	X			
Malurus cyaneus	Superb Fairy-wren	P	X			
Menura novaehollandiae	Superb Lyrebird	P	X			
Malurus lamberti	Variegated Fairy-wren	P	X		X	
Aquila audax	Wedge-tailed Eagle	P	X			
Smicrornis brevirostris	Weebill	P	X			
Hirundo neoxena	Welcome Swallow	P	X			
Sericornis frontalis	White-browed Scrubwren	P	X	X		
Phylidonyris nigra	White-cheeked Honeyeater	P	X		X	
Lichenostomus leucotis	White-eared Honeyeater	P	X		X	
Melithreptus lunatus	White-naped Honeyeater	P	X			
Gerygone olivacea	White-throated Gerygone	P	X			
Hirundapus caudacutus	White-throated Needletail	P	X			
Cormobates leucophaeus	White-throated Treecreeper	P	X	X		
Leucosarcia melanoleuca	Wonga Pigeon	P	X		X	
Lichenostomus chrysops	Yellow-faced Honeyeater	P	X	X	X	
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	P	X	X		
Lichenostomus melanops	Yellow-tufted Honeyeater	P	X			
Nocturnal Birds						
Aegotheles cristatus	Australian Owlet-nightjar	P	X			
Tyto novaehollandiae	Masked Owl	V	X			
Ninox strenua	Powerful Owl	V	X			
Tyto tenebricosa	Sooty Owl	V	X			
Ninox boobook	Southern Boobook	P	X			
Podargus strigoides	Tawny Frogmouth	P	X	X		
Eurostopodus mystacalis	White-throated Nightjar	P	X			
Arboreal Mammals						
Trichosurus vulpecula	Common Brushtail Possum	P	X			
Pseudocheirus peregrinus	Common Ringtail Possum	P	X	X		

Scientific Name	Common Name	Conservation Status (TSC Act) P=protected U=unprotected V=vulnerable	DECC Systematic Survey	UBBS (NPWS 1997a)	Conacher Travers Environmental	Other Sources
Petauroides volans	Greater Glider	P		X		
Petaurus breviceps	Sugar Glider	P	X			
Petaurus australis	Yellow-bellied Glider	V	X		X	
Bats						
Chalinolobus morio	Chocolate Wattled Bat	P	X			
Chalinolobus gouldii	Gould's Wattled Bat	P	X			
Scotorepens orion	Eastern Broad-nosed Bat	P	X			
Rhinolophus megaphyllus	Eastern Horseshoe-bat	P	X			
Nyctophilus gouldi	Gould's Long-eared Bat	P	X			
Pteropus poliocephalus	Grey-headed Flying-fox	V	X			
Vespadelus vulturnus	Little Forest Bat	P	X			
Mormopterus sp. 1	Undescribed Mastiff-bat	P	X			
Tadarida australis	White-striped Freetail-bat	P	X			
Native Ground Mammals						
Antechinus stuartii	Brown Antechinus	P	X		X	
Rattus fuscipes	Bush Rat	P	X		X	
Vombatus ursinus	Common Wombat	P	X	X		
Tachyglossus aculeatus	Short-beaked Echidna	P	X			X
Rattus lutreolus	Swamp Rat	P	X			
Wallabia bicolor	Swamp Wallaby	P	X		X	
Isoodon/Perameles sp.	unidentified Bandicoot	P	X			
Reptiles						
Eulamprus tenuis	Bar-sided Forest-skink	P	X			
Phyllurus platurus	Broad-tailed Gecko	P	X			
Tiliqua scincoides	Common Bluetounge	P				X
Ctenotus taeniolatus	Copper-tailed Ctenotus	P	X			X
Cryptoblepharus virgatus	Cream-striped Shinning-skink	P	X			
Egernia cunninghami	Cunningham's Spiny-tailed Skink	P	X			
Lampropholis delicata	Dark-flecked Garden Sunskink	P	X			
Morelia spilota spilota	Diamond Python	P	X			
Pogona barbata	Eastern Bearded Dragon	P	X			X
Pseudonaja textilis	Eastern Brown Snake	P				X

Scientific Name	Common Name	Conservation Status (TSC Act) P=protected U=unprotected V=vulnerable	DECC Systematic Survey	UBBS (NPWS 1997a)	Conacher Travers Environmental	Other Sources
Diplodactylus vittatus	Eastern Stone Gecko	P	X			
Physignathus lesueurii	Eastern Water Dragon	P	X			
Eulamprus quoyii	Eastern Water-skink	P	X			
Dendrelaphis punctulata	Green Tree Snake	P				X
Varanus varius	Lace Monitor	P	X			X
Oedura lesueurii	Lesueur's Velvet Gecko	P	X			
Pseudechis porphyriacus	Red-bellied Black Snake	P				X
Underwoodisaurus milii	Thick-tailed Gecko	P				X
Lygisaurus foliorum	Tree-base Litter-skink	P	X			
Egernia whitii	White's Rock-skink	P	X			
Saiphos equalis	Yellow-bellied Three-toed Skink	P	X			
Frogs						
Litoria latopalmata	Broad-palmed Frog	P	X			
Litoria fallax	Eastern Dwarf Tree Frog	P	X			
Heleioporus australiacus	Giant Burrowing Frog	V	X			
Litoria peronii	Peron's Tree Frog	P	X			
Pseudophryne australis	Red-crowned Toadlet	V	X			
Limnodynastes peronii	Striped Marsh Frog	P	X			
Introduced Species						
Rattus rattus *	Black Rat *	U	X			
Canis lupus *	Dingo, domestic dog *	U	X			
Vulpes vulpes *	Fox *	U	X			
Mus musculus *	House Mouse *	U	X			
Oryctolagus cuniculus *	Rabbit *	U	X			




Department of Environment & Climate Change NSW

43 Bridge Street
Hurstville 2220
www.environment.nsw.gov.au