Systematic Survey of Vertebrate Fauna in Lane Cove National Park

Conservation Programs and Planning
Branch, Metropolitan
Environmental Protection and Regulation Division
Department of Environment and Conservation (NSW)
August 2004

Department of Environment and Conservation (NSW)

SYSTEMATIC SURVEY OF VERTEBRATE FAUNA IN LANE COVE NATIONAL PARK

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

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Conservation Programs and Planning Branch, Metropolitan
Environment Protection and Regulation Division
Department of Environment and Conservation

ACKNOWLEDGMENTS

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Special thanks to:
Staff of the Lane Cove NP Office for invaluable assistance in planning and support during the surveys.

The numerous volunteers and DEC staff who helped with the surveys.

This report should be referenced as follows:

DEC (2004) "Systematic Survey of Vertebrate Fauna in Lane Cove National Park." Unpublished report funded by Sydney North, Central Directorate Parks and Wildlife Division of Department of Environment and Conservation. Conservation Assessment and Data Unit, Conservation Programs and Planning Branch, Environment Protection and Regulation Division.

All photographs are held by DEC. To obtain a copy please contact the Bioregional Data Group Coordinator, DEC Hurstville

Cover Photos

Feature Photo (Elizabeth Magarey)
White-striped Freetail-bat (Michael Todd)
Sandstone outcrops in Pennant Hills Park (E. Magarey)
Powerful Owl (Narawan Williams)
Lane Cove River (Michele Cooper)
Common Ringtail Possum (Nick Corkish)
Blackbutt – Smooth-barked Apple Forest (E. Magarey)
Creekline habitat (E. Magarey)
Short-beaked Echidna (David O'Connor)
Blackbutt – Smooth-barked Apple Forest (Kylie Madden)
Red-crowned Toadlet (Dave Hunter)

ISBN 1 74122 142 0

OVERVIEW

This report documents a systematic survey of vertebrate fauna within Lane Cove National Park and adjacent council-managed land, undertaken by the Department of Environment and Conservation (DEC) between February and May 2004. The primary objective of the survey was to implement systematic fauna survey techniques within the study area for the first time and provide a baseline against which future work might be compared. In particular, the survey focused on fauna within the recent Pennant Hills additions to the park. DEC established and surveyed 47 systematic fauna survey sites covering the range of dominant habitats and landscapes present within the study area. A range of survey methods were applied to sample birds, reptiles, arboreal and terrestrial mammals and frogs.

The following results were obtained:

- One hundred and six vertebrate fauna species were observed during the survey period, including seventeen species that had not previously been recorded within the park (fourteen native and three introduced species). Over 670 records were collected during the surveys, including 345 within the boundaries of the park and 331 in neighbouring lands, thereby vastly increasing the knowledge of fauna distribution, abundance and habitat use in the area.
- Four species that are listed as threatened on the NSW Threatened Species Conservation Act (1995) (NSW TSC Act) were recorded. These were the Powerful Owl, Red-crowned Toadlet, Eastern Bent-wing Bat and Grey-headed Flying-fox.
- The study area supports particularly high numbers of Powerful Owl and Red-crowned Toadlet, contributing significantly to the survival of these species within the region.
- The Gang-gang Cockatoo was recorded, which in the north of the study area is part of the Hornsby and Ku-ring-gai Council Local Government Area population, which is listed as an endangered population on the NSW TSC Act.
- Ten introduced species, including four birds and six ground mammals, were recorded of which three (Cat, Fox and Rabbit) are listed as a Key Threatening Process under the NSW TSC Act.
- A complete list of fauna species for the park was derived from the Atlas of NSW Wildlife. A total of 156 species have been recorded within the study area since 1950, including nineteen threatened species and fifteen introduced species.

The results of the vertebrate fauna survey indicate that Lane Cove National Park supports a diverse mix of fauna species and plays an integral role in the survival of a number of native fauna species within the region. All of the records collected during the survey have been entered into the Atlas of NSW Wildlife, which can be accessed by park management and members of the public.

CONTENTS

1 INTRODUCTION

1.1 PROJECT AIMS

This report presents the results of a systematic survey of terrestrial vertebrate fauna in Lane Cove National Park (NP) and adjacent council-managed bushland (the study area). The survey was undertaken by the Department of Environment and Conservation (DEC, formerly the National Parks and Wildlife Service (NPWS)) between February and May 2004. The primary objective of the survey was to implement systematic fauna survey techniques within the study area for the first time and provide a baseline against which future work might be compared to determine long-term trends. Particular attention was given to the Pennant Hills Park addition and to fauna groups that had not previously been surveyed such as microbats. The ability to monitor change is fundamental to isolated reserves like Lane Cove NP, so that conservation management can respond to threats and changes in fauna values in the future.

The specific objectives of this report are to:

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

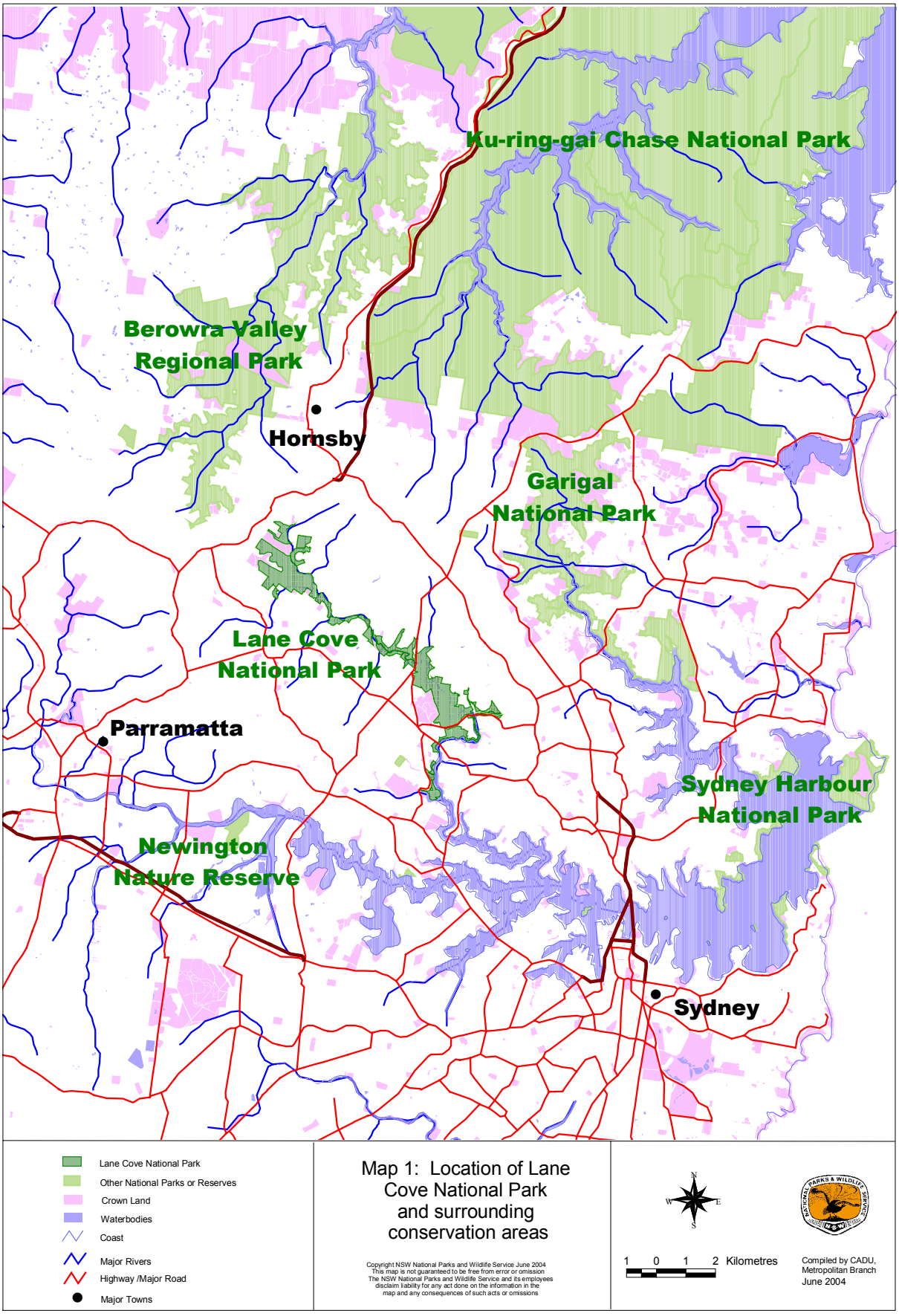
Future projects can build on this project to more comprehensively address patterns in fauna occurrence and habitat use across the park and investigate differences between weed-infested and intact environments.

1.2 BACKGROUND

Lane Cove NP is located approximately nine kilometres north-west of Sydney GPO. The systematic fauna survey described in this report was undertaken across Lane Cove NP (including the newly gazetted Pennant Hills section), as well as within council and public lands that immediately abut the park (Map 1, the study area).

Lane Cove NP is the most southern of a series of reserves that stretch between the Parramatta and Hawkesbury Rivers (Map 1), and hence together with Berowra Valley Regional Park, Garigal NP and Ku-ring-gai Chase NP provides an important refuge for fauna within this densely urban landscape.

The fauna of Lane Cove NP is popular with locals and amateur naturalists, particularly bird watchers, who have contributed to the knowledge of flora and fauna in the area. A large amount of this information, together with records collected by Birds Australia, park rangers and field officers, recreational park users, and environmental consultants is held within the Atlas of NSW Wildlife. Vegetation within the study area has been surveyed on a number of occasions (including Clarke and Benson 1987, P. and J. Smith Ecological Consultants 1993), and most recently has been comprehensively analysed and mapped by UBM Consultants (2001). The study area, however, has never been the subject of a dedicated systematic fauna survey that sought to sample the full range of environments. The systematic vertebrate fauna survey described in this report was undertaken within the park over the summer and autumn of 2004 in order to address this shortfall.


Ku-ring-gai Chase National Park
Berowra Valley
Regional Park
Hornsby
Garigal
National Park
Lane Cove
National Park
Parramatta
Sydney Harbour
National Park
Newington
Nature Reserve
Sydney
Lane Cove National Park
Other National Parks or Reserves
Crown Land
Waterbodies
Coast
Major Rivers
Highway /Major Road
Major Towns
Map 1: Location of Lane Cove National Park and surrounding conservation areas
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Compiled by CADU, Metropolitan Branch
June 2004

1.3 ENVIRONMENT

The study area lies along an incised sandstone gully on the Hornsby Plateau, within the Sydney Basin Bioregion. The Bioregion is dominated by extensive sandstone plateaux between Ulladulla, the Hunter Valley and Mudgee. The Bioregion is characterised by a temperate climate with warm summers with no dry season (NPWS 2003). 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.

A summary of geology, soils and historical land use of the park is provided in the *Lane Cove National Park Plan of Managemen*t (NPWS 1998). Vegetation in the study area is typical of remnant Sydney Sandstone habitats in the region and described in *Lane Cove National Park Vegetation Survey* (UBM Consultants 2001). A map of the distribution of vegetation communities within the park is provided in Maps 2a and 2b.

Lane Cove NP and surrounds have a high level of disturbance, resulting from the large proportion of urban-bushland interface, heavy recreational use, and contamination of the catchment area with pollutants and weeds. Weeds are abundant within vegetation communities with higher fertility soils, along gully lines and watercourses. However, the dry sandy environments in the park are less affected by this disturbance, and retain relatively high integrity and habitat quality.

1.4 FIRE

Almost all of the study area has been affected by fire within the last decade. During January 1994 the Lane Cove Valley experienced a very high intensity fire that burnt approximately 87 percent of the park. In December 1994 a second fire broke out in the Fox Valley area and burnt a further eight percent of the park, leaving only small sections along Blue Gum, Blackbutt and Carters Creeks unburnt. In January 2002 an intense fire burnt the northern half of the study area, including all of the former Pennant Hills Park, and south to Christie Park. Consequently, native flora and fauna were still recovering from these fires at the time of survey.

2 METHODS

2.1 EXISTING FAUNA DATA

The Atlas of NSW Wildlife (DEC 2004aA) was the primary resource used to access existing data on the fauna of the park, and compile a species list. The majority of records within the Atlas prior to the summer of 2004 derive from the licensed data sets of the Royal Australian Ornithologists Union and Birds Australia (Blakers *et al.* 1984 and Barrett *et al*. 2003) and the specimen register of the Australian Museum. A large amount of this data, however, has inaccurate temporal and spatial referencing, including species that have never been recorded within the study area itself or are considered to be locally extinct. To increase the accuracy of the fauna species list for the park, and avoid misinterpretation of data, a number of records were excluded, as follows:

- All records collected prior to 1950 were removed due to low spatial and temporal accuracy.
- All records from the Royal Australian Ornithologists Union prior to 1984 (Blakers *et al.* 1984) were removed due to the very low spatial accuracy.

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

2.2 SURVEY STRATIFICATION AND SITE SELECTION

The primary stratum used for site selection was vegetation type, using the digital vegetation map produced by UBM Consultants (2001). The preferable sampling strategy would have aimed to sample the mapped vegetation communities proportionately according to the mapped area of each community within the reserves and have included enough repeat sampling within each vegetation community to provide reasonable reliability that potential variations within widespread stratum were captured. Such replication of sites serves to strengthen the reliability of patterns derived from collected data. The pre-trip site selection process aimed to fulfil this goal as much as possible. However, due to temporal and spatial constraints, replicated sampling could only be undertaken within the most extensive vegetation communities. At least one site was placed in each vegetation type, with the exception of Swamp Oak Forest, Rushland, Grey Mangrove Low Closed Forest and Cleared Land. The first three of these vegetation communities were targeted for opportunistic surveys, where possible.

Sites were initially selected using a Geographic Information System (ArcView 3.2) with information gained from topographic maps, vegetation maps, access trails, and knowledge held by Lane Cove NP staff. Wherever possible sites were placed a minimum of one kilometre apart from each other, however due to the size and shape of the study area this was not always achievable. Owl call playback sites were spaced two kilometres apart to avoid double counting of responses. Sites were positioned primarily on or close to access trails to facilitate conduct of spotlighting and harp trapping surveys and to maximise the number of sites that could be accessed during the limited survey period. In the field, the proposed site locations were 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 metres by 200 metres (two hectares) in area.

The placing of sites for some survey techniques also aimed to sample potential habitat for target species, such as Bandicoots, small mammals and bats. For example, cage traps were placed in areas where rangers and field officers had recently sighted Bandicoot diggings. The placement of harp traps to capture microbats was limited by the availability of suitable fly-ways, such as vegetation constrictions along roads and creeklines.

Maps 2a and 2b show the location of fauna survey sites and the distribution of vegetation communities within the study area. Appendix A provides the specific AMG, vegetation type and survey techniques completed at each systematic survey site.

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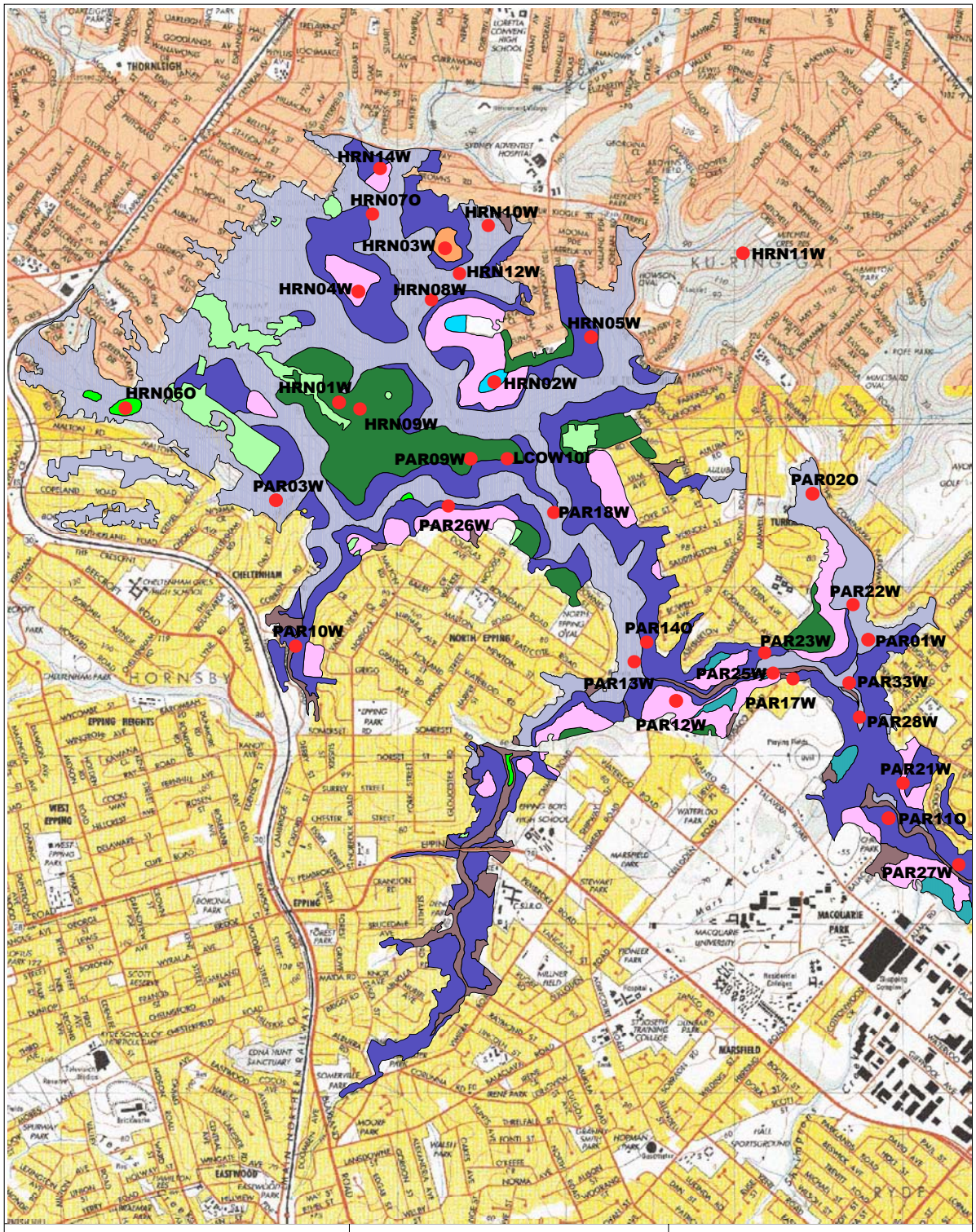
Table 1: Vegetation communities within Lane Cove National Park and surrounding public lands and corresponding allocation of systematic fauna survey methods. Vegetation communities are listed in descending order of the area they cover within the study area.

Vegetation type (UBM Consultants 2001)	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 cage trap sites
Sydney Peppermint - Smooth-barked Apple Tall Forest / Forest / Open Forest	3	3	3	3	5	1	1	2
Blackbutt - Smooth-barked Apple Tall Forest / Forest / Open Forest	3	2	3	5	4	3	3	2
Sydney Peppermint Woodland / Open Woodland / Mallee Open Woodland	3	3	3	1	2	1	1	0
Scribbly Gum Woodland / Open Woodland / Low Open Woodland	3	2	3	1	0	1	1	0
Cleared	0	0	0	0	0	0	0	0
Weed Dominated Community	1	0	0	0	0	0	0	0
Grey Mangrove Low Closed Forest	0	0	0	0	0	0	0	0
Closed Shrubland / Shrubland	1	0	0	0	0	0	0	0
Scribbly Gum Open Forest	1	1	1	0	0	0	0	0
Rushland	0	0	0	0	0	0	0	0
Coachwood Simple Rainforest	0	1	0	0	0	1	0	0
Red Bloodwood Low Open Forest	2	2	2	0	0	1	1	0
Silvertop Ash Low Woodland / Low Open Woodland	1	1	1	0	0	0	0	0
Swamp Oak Forest	0	0	0	0	0	0	0	0
Unmapped land. Red Bloodwood canopy with dense and diverse shrub storey.	0	0	0	1	0	1	0	0
Total	18	15	16	11	11	9	7	4



Vegetation Communities

- Blackbutt - Smooth-barked Apple Tall Forest / Forest / Open Forest
- Cleared
- Closed Shrubland / Shrubland
- Coachwood Simple Rainforest
- Eucalyptus sieberi Low Woodland / Low Open Woodland
- Grey Mangrove Low Closed Forest
- Red Bloodwood Low Open Forest
- Rushland
- Scribbly Gum Open Forest
- Scribbly Gum Woodland / Open Woodland / Low Open Woodland
- Swamp Oak Forest
- Sydney Peppermint - Smooth-barked Apple Tall Forest / Forest / Open Forest
- Sydney Peppermint Woodland / Open Woodland / Mallee Open Woodland
- Weed Dominated Community

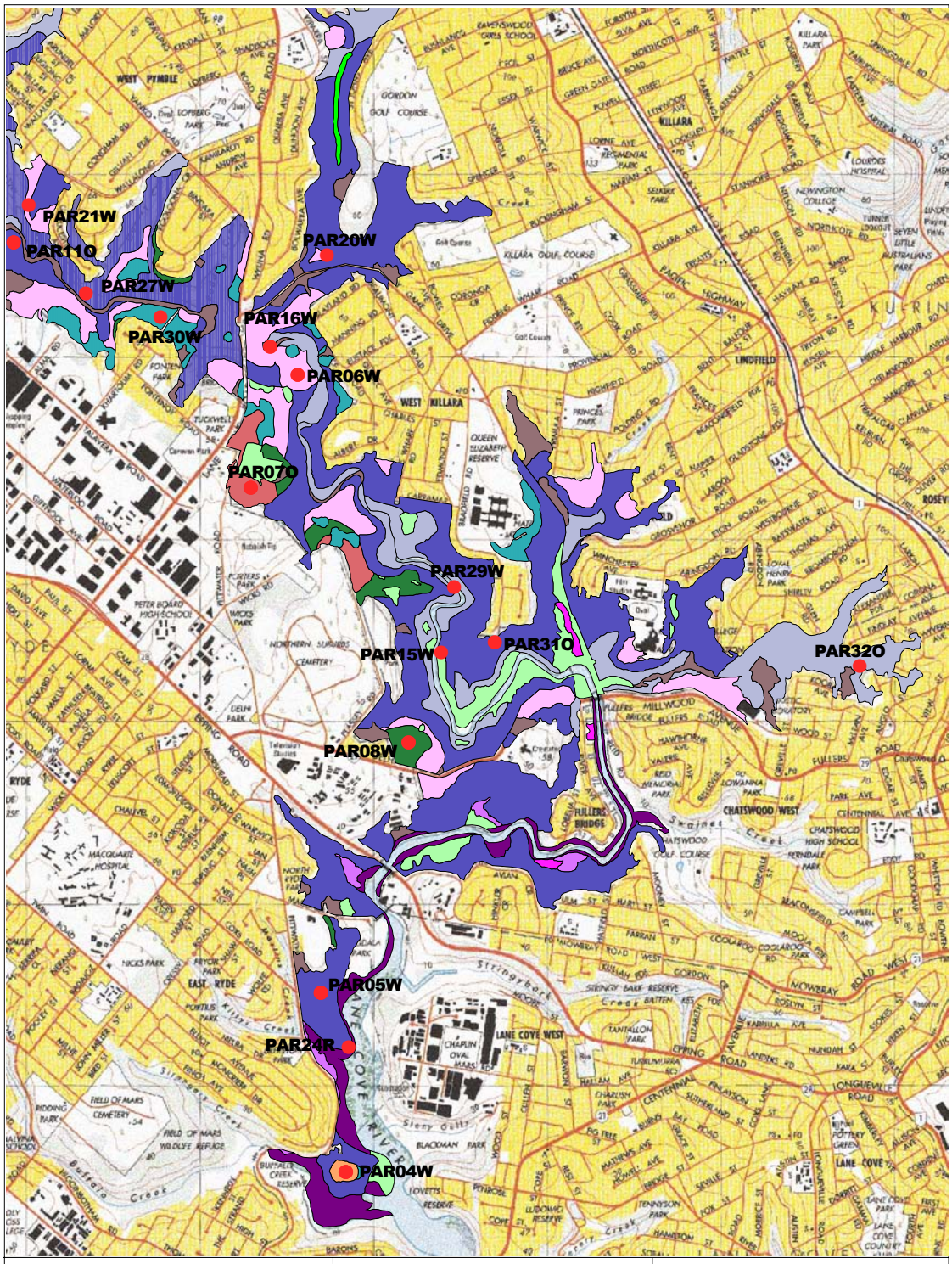
Map 2a: Vegetation communities and location of systematic survey sites in and around north Lane Cove National Park

200 0 200 400 Metres

Vegetation Map By:
UBM Consultants 2001

Compiled by CADU,
Metropolitan Branch

June 2004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PAR06W
PAR07O
PAR29W
PAR15W
PAR31O
PAR32O
PAR08W
PAR05W
PAR24R
PAR04W
WEST PYMBLE
GORDON GOLF COURSE
KILLARA
KILLARA GOLF COURSE
LINDFIELD
WEST KILLARA
KU-RING-GAI
RYDE
EAST RYDE
MILLWOOD
CHATSWOOD WEST
LANE COVE WEST
LANE COVE
LANE COVE RIVER
Vegetation Communities
Blackbutt - Smooth-barked Apple Tall Forest / Forest / Open Forest
Cleared
Closed Shrubland / Shrubland
Coachwood Simple Rainforest
Eucalyptus sieberi Low Woodland / Low Open Woodland
Grey Mangrove Low Closed Forest
Red Bloodwood Low Open Forest
Rushland
Scribbly Gum Open Forest
Scribbly Gum Woodland / Open Woodland / Low Open Woodland
Swamp Oak Forest
Sydney Peppermint - Smooth-barked Apple Tall Forest / Forest / Open Forest
Sydney Peppermint Woodland / Open Woodland / Mallee Open Woodland
Weed Dominated Community
Map 2b: Vegetation communities and location of systematic survey sites in and around south Lane Cove National Park
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This map is not guaranteed to be free from error or omission
The NSW National Parks and Wildlife Service and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions
200 0 200 400 Metres
Vegetation Mapping By: UBM Consultants 2001
Map Compiled by CADU, Metropolitan Branch
June 2004

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. Frogs were surveyed on a targeted and opportunistic basis, as described below, as weather conditions at the time of survey prevented the use of systematic techniques. Consistency in the use of the systematic techniques allows a comparison between fauna species detected across different vegetation types and environments within the park. Furthermore, it will allow future comparisons with consistent surveys of environments elsewhere.

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

2.3.1 Systematic site-based methods

Diurnal bird survey

Diurnal bird censuses comprised a twenty minute observation and listening search within a two hectare (100 by 200 metre) area, conducted by an experienced bird surveyor. Censuses were 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 area subplot (50 by 100 metres) within a two hectare 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 overcast or rainy 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 metre transect within a site for half a person hour. Fifty-watt spotlights were used to scan the vegetation for animals and enable detection of reflected eye shine. Surveyors also listen intently for fauna calls during the survey period. All fauna observed within the census period were recorded, noting whether they were on or off site.

Harp trapping

While ultrasonic recorders were used principally to detect high flying bat species, collapsible bat traps, known as harp traps (Tidemann and Woodside 1978), captured low flying species. Two nights of trapping were conducted at each bat trap site. Sites were selected for their perceived potential to interrupt bats along their flight paths, and were usually 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 on the following night at the point of capture.

Bat ultrasonic ('Anabat') call recording

Ultrasonic recorders (Corben 1989) are particularly useful for detection of high-flying species, which often comprise more than one third of an area's bat species (Parnaby 1992b), 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, that is, inaudible to humans.

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

Anabat recordings were transferred onto computer and analysed by Narawan Williams, a recognised expert in this field. Identification was designated as either definite, probable or possible, following the methodology of Parnaby (1992b). Calls that proved difficult to identify were also assessed by Michael Pennay (DEC Western Regional Assessments Unit) using the techniques described in Pennay *et al.* (2004).

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. Call playback surveys were undertaken in autumn, as previous DEC surveys in the Sydney Basin have indicated that owls are most likely to respond to the playback between April and August (DEC unpublished data).

Elliott trapping

This technique involved setting ten Elliott B traps at twenty metre intervals along a 200 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 four nights, checked and emptied every morning soon after dawn. Any animals captured within the traps were identified, sexed if possible, and released.

Cage trapping

This technique involved setting ten large cage traps at 20 metre intervals along a 200 metre transect through a site. The technique is designed to target medium-sized ground mammals, particularly Bandicoots (*Isoodon* spp. and *Parameles* spp.) and Spotted-tailed Quolls (*Dasyurus maculatus*). Traps were baited with a mixture of rolled oats, peanut butter, honey and tuna fish. Traps were left in place for four nights, checked and emptied every morning soon after dawn. Any animals captured within the traps were identified, sexed if possible, and released.

2.3.2 Targeted survey for Red-crowned Toadlet

Heavy rainfalls during the first week of survey provided an ideal opportunity to undertake targeted surveys for Red-crowned Toadlet (*Pseudophryne australis*). Initially, a recognised expert on the species (Dr. Arthur White) examined topographic and vegetation maps to identify sites that held potential as high quality habitat. These sites were then visited during the day, after the heaviest rain periods had ceased. Intermittent falls continued during the day, keeping conditions moist and humid. On arrival at a site, further assessment of habitat quality was made, followed by the emission of loud (verbal) noises to provoke a calling response from any frogs present. This is a recognised technique for detecting frogs of this species (Wells 2002).

2.3.3 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, 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. 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 three levels of reliability: definite, probable and possible.

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

Incidental records

Surveyors driving or walking through the park recorded the location of interesting fauna when it was seen or heard. Particular animals targeted by this technique were those undersampled by systematic surveys, including 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 the 17th February and 14th May 2004. Table 2 summarises the timing of each survey technique and the prevailing weather conditions over this period.

Table 2: Timing of DEC systematic fauna surveys within Lane Cove National Park and surrounds

Timing	Techniques employed	Notes on prevailing weather conditions
17 – 18 Feb	Site selection and opportunistic methods	Sunny and warm
23 – 24 Feb	Diurnal bird census, spotlighting, anabat, opportunistic methods	Overcast with rain (light showers to heavy falls)
26 Feb	Targeted Red-crowned Toadlet surveys	Warm and humid with intermittent showers and sunshine
27 Feb – 4 Mar	Diurnal herpetofauna census	Warm and sunny
8 – 12 Mar	Diurnal bird census, diurnal herpetofauna census, spotlighting, anabat, harp trapping, elliott trapping, cage trapping, opportunistic methods	Warm to hot. Sunny to overcast.
28 April and 13 May	Nocturnal call playback, opportunistic methods	Cool and overcast.

3 RESULTS AND DISCUSSION

3.1 OVERVIEW

DEC established and surveyed 47 systematic fauna survey sites within Lane Cove NP and adjacent public lands between February and May 2004. These sites cover the range of dominant habitats and landscapes present within the park. During the surveys, a number of records collected by park rangers and field officers, volunteers and neighbours were collated and added to the Atlas of NSW Wildlife.

One hundred and six vertebrate fauna species were observed during the survey period, including seventeen species that had not previously been recorded within the park (fourteen native and three introduced species). Over 670 records were collected during the surveys, including 345 within the boundaries of the park and 331 in neighbouring lands, thereby vastly increasing the knowledge of fauna distribution, abundance and habitat use in the area.

Four species that are listed as threatened on the NSW Threatened Species Conservation Act (1995) (NSW TSC Act) were recorded during the surveys. These were the Powerful Owl, Red-crowned Toadlet, Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). The latter of these species is also listed as Vulnerable on the commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act). In addition, the Gang-gang Cockatoo (*Callocephalon fimbriatum*) was recorded during the surveys, which in the north of the study area are part of the Hornsby and Ku-ring-gai Council Local Government Area population, which is listed as an endangered population on the NSW TSC Act.

Ten introduced species, including four birds and six ground mammals, were recorded during the survey, of which three (Cat (*Felis catus*), Fox and Rabbit (*Oryctolagus cuniculus*)) are listed as a Key Threatening Process under the NSW TSC Act and the EPBC Act.

A complete list of fauna species, as recorded on the Atlas of NSW Wildlife, within 200 metres of Lane Cove NP, is presented in Appendix B. As described above, the species list was refined in order to increase its accuracy and avoid misinterpretation of the data. Initially the list comprised 301 species, however, this has been reduced to a considerably more accurate 156 species. In total, nineteen threatened and fifteen introduced species have been recorded within the study area by various observers since 1950, as will be discussed further below.

An incidental record was also made of the Common Jollytail (*Galaxias maculatus*) in the unnamed creek below Turramurra High School. This native fish is very common in the coastal drainages of south eastern Australia and descends from freshwater to estuaries to breed, hence tolerating a wide range of salinities (Allen *et al.* 2002). Other native fish may also be present, but systematic survey would be required to compile a complete list. The presence of this fish in the waterway has positive implications for water quality in that area.

The results of the vertebrate fauna survey indicate that Lane Cove NP supports a diverse mix of fauna species and plays an integral role in the survival of a number of native fauna species within the region.

3.2 NATIVE BIRDS

Eighteen systematic diurnal bird surveys were conducted in the study area during February and March 2004, generating 238 records of 40 native species. The species most often recorded was the Rainbow Lorikeet (*Trichoglossus haematodus*), followed by the Australian Raven (*Corvus coronoides*), Pied Currawong (*Strepera graculina*), and Sulphur-crested Cockatoo (*Cacatua galerita*). This is typical of many areas that have been disturbed, with large dominating species forming the core of the species assemblage. However, Lane Cove NP retains many species that only occur if a suitable intact shrub layer is still present, providing habitat and protection from the aggressive species. Examples of such species include the White-browed Scrubwren (*Sericornis frontalis*), Variegated Fairy-wren (*Malurus lamberti*) and Brown Thornbill (*Acanthiza pusilla*), which are all typical of undisturbed environments in the Sydney Basin. The continued presence of the White-throated Treecreeper (*Cormobates leucophaeus*) is also encouraging, as this is a species that often disappears from isolated fragments of bushland. Three new species were added to the park record list during the survey: Little Lorikeet (*Glossopsitta pusilla*), White-bellied Sea-eagle (*Haliaeetus leucogaster*) and Silver Gull (*Larus novaehollandiae*).

Plate 1: Gang-gang Cockatoo ©Kylie Madden/DEC

In addition to the above, fifteen species were observed incidentally during the study period. These included birds of prey, which are not commonly recorded during systematic sampling, and waterbirds, whose habitats were not targeted systematically during the survey. The Lane Cove River provides habitat for numerous waterbirds, including Pacific Black Duck (*Anas superciliosa*), Australian Wood Duck (*Chenonetta jubata*) and Dusky Moorhen (*Gallinula tenebrosa*). Four birds of prey were observed within the park during the surveys, including the Brown Goshawk (*Accipiter fasciatus*), Pacific Baza (*Aviceda subcristata)*, Peregrine Falcon (*Falco peregrinus*) and White-bellied Sea-eagle. The majestic White-bellied Sea-eagle was seen soaring over the top of the tree canopy at Sugarloaf Hill, and is likely to use the estuarine habitats in the park regularly. The Peregrine Falcon is thought to be in decline in various parts of the nation (Barrett *et al.* 2003), thus protection of their habitat within Lane Cove NP and the surrounding region is important. Birds of prey are wide ranging, but Lane Cove NP is likely to form an important component of remnant bushland in their home range. The Gang-gang Cockatoo (Plate 1) was also recorded during the surveys, which in the north of the study area are part of the Hornsby and Ku-ring-gai Council Local Government Area population, listed as an endangered population on the NSW TSC Act.

Overall, 143 species of birds have been recorded within Lane Cove NP since 1950 (DEC 2004aA). This is an incredibly high number given the level of urbanisation surrounding the park, and compares favourably with many larger sandstone reserves that do not experience such intense urban pressures. The composition of bird species is a reflection of the diversity of habitats present within the study area, and includes species typical of shrubby sandstone woodland and open forest (such as White-browed Scrubwren), wet sclerophyll forest and simple rainforest (such as Brown Gerygone (*Gerygone mouki*)), riparian strips (such as Pacific Black Duck and Australian Wood Duck) and estuarine habitats, and species characteristic of disturbed environments (such as Noisy Miner (*Manorina melanocephala*) and Rainbow Lorikeet).

Three species of nocturnal bird were recorded during the surveys, including the Powerful Owl, Southern Boobook (*Ninox boobook*) and Tawny Frogmouth (*Podargus strigoides*). The former of these species is considered vulnerable in NSW, and will be discussed further in Section 5 below. The latter two species are widespread within the Sydney Basin Bioregion. The Tawny Frogmouth is commonly recorded in urban environments, as is the Southern Boobook to a lesser extent, depending on the availability of prey species (including insects and introduced rodents) and suitable roosting sites.

3.3 ARBOREAL MAMMALS

Four species of arboreal mammal were detected during the surveys. The most notable of these is the Greater Glider (*Petauroides volans*) which has not previously been recorded within the study area. Unfortunately, both the records of Greater Glider were collected by remains present in introduced predator scats (Dog and Dog/Fox). This lends some doubt as to the origin of the record, as it cannot be ascertained where the predator consumed the prey, particularly if it was a domestic Dog. Previous research has suggested, however, that in the wild, predators defecate within an average of two kilometres of where the prey item was consumed (Lunney *et al.* 2002). The closest known established population of the species occurs in Bouddi National Park, on the southern point of Brisbane Water, with a few scattered records in the north of Ku-ring-gai Chase NP (DEC 2004aA). Greater Gliders are easily detected by systematic spotlighting surveys, due to their extremely bright eye-shine. Given that the Gliders were not detected during any of the sixteen spotlighting surveys, they can be assumed to occur within the park only at very low density, if at all. The recent fires within the park are likely to have had a significant impact on the species, particularly given the isolated nature of the study area. A recent study on the Woronora Plateau found Greater Gliders to be significantly negatively effected by high intensity fire in Eucalypt forest, located at only one site out of ten two years after the fire, whereas prior to the fire an average of one individual was found for every spotlighting site (DEC 2004b). Continued predation on the species by introduced predators, in combination with other pressures, may push the species to extinction within the study area.

The most commonly recorded arboreal mammal during the surveys was the Common Ringtail Possum (*Pseudocheirus peregrinus*), which is present at high densities in the park. Nests (dreys) were observed in a number of locations, particularly within the sandstone woodlands with a dense tall shrub layer. The high density of Ringtails in turn provides a strong prey base for Powerful Owls in the area, as discussed in Section 5 below. Common Brushtail Possums (*Trichosurus vulpecula*) are also widespread in the park, captured in three cage traps and detected during spotlighting, nocturnal call playback surveys and in predator scats. The Sugar Glider (*Petaurus breviceps*) is also widespread, though occurring only in relatively low numbers.

3.4 BATS

Seven species of bat were recorded during the systematic surveys of Lane Cove NP and adjoining council reserves. The surveys have greatly improved the knowledge of microbats within the reserve, detecting four new species and providing over fifty new location records. Six of the species recorded are Microchiropteran bats, which are small flying mammals that feed on insects and use echo-location to forage and navigate. Two systematic techniques, harp trapping and ultrasound call detection, were used to identify these species. The harp trapping results were disappointing, as the erection of eleven harp traps (each left in place for two nights) captured only

Plate 2: Gould's Wattled Bat ©Ray Williams

three individuals of two species, the Little Forest Bat (*Vespedelus vulturnus)* and Gould's Wattled Bat (*Chalinolobus gouldii*, Plate 2). These are tree-roosting species, sheltering in hollows and under bark, that forage below the tree canopy (Churchill 1998). The former species is one of the smallest mammals in the world, weighing just four grams. It is commonly observed flying at dusk chasing insects that gather around street lights. The harp trapping results represent a low trapping rate for this group of bats, suggesting that low-flying microbats are present only at low abundance in the reserve, and may still be recovering from recent fires (A. White pers. comm.).

Use of ultrasound recording devices (Anabat) proved more successful, detecting an additional four species. One of these, the Common (Eastern) Bent-wing Bat, is listed as Vulnerable on the NSW TSC Act, 1997 and is discussed in more detail in Section 5 of this report. The other species recorded were Chocolate Wattle Bat (*Chalinolobus morio*), undescribed Mastiff Bat (*Mormopterus* sp. 1) and White-striped Mastiff-bat (*Nyctinomus australis*). Ultrasound call recordings were dominated by calls emitted by the Gould's Wattled Bat. This suggests that this species is the most common microbat in the study area, given that it was also recorded at the most number of sites and in the greatest number of vegetation communities.

The Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as vulnerable on both the TSC Act and EPBC Act, is well known within the reserve and from camps at Gordon and Ku-ring-gai. The species will be discussed in greater detail in Section 5.

3.5 NATIVE GROUND MAMMALS

Four species of native ground mammal were recorded during the surveys. Two of these, the Bush Rat (*Rattus fuscipes*, Plate 3) and Brown Antechinus (*Antechinus stuartii*) have not previously been recorded on the Atlas of NSW Wildlife within the study area. A total of 280 Elliott trap nights were undertaken during the survey period, during which only one individual of each of the above species were captured. This indicates that though the species are present, they occur only at low abundance. In contrast, the introduced Black Rat (*Rattus rattus*) was captured sixteen times and the introduced House Mouse (*Mus musculus*) four times, though some of these are likely to be recaptures.

Plate 3: Bush Rat ©Narawan Williams

The presence of Long-nosed Bandicoot (*Perameles nasuta*) in the park holds conservation significance, as this species has largely disappeared from more densely populated parts of the Sydney Metropolitan area, between Sutherland and Brookvale (DEC 2004a). A well-known population of the species also occurs at North Head (DEC 2004a). These animals are notoriously trap shy and the 160 cage trapping nights failed to capture any Bandicoots. Evidence of their presence was clear however, with tracks, scratching and diggings located around a number of the traps. An individual was spotted during a systematic spotlighting survey, and the species is regularly seen by rangers that live in the park (A. Duffy pers. comm.).

The Swamp Wallaby (*Wallabia bicolor*) is well known within Lane Cove NP, frequently observed by rangers, field officers and park visitors in the vicinity of the depot behind Bradfield Avenue. A single Swamp Wallaby was observed in this location during the current surveys. It is likely that only one or two individuals of this species remain within the park, however, with the same individuals being repeatedly recorded. Nevertheless these are important records, as this is one of the closest known locations of the species to the Sydney CBD. Swamp Wallabies would once have been widespread within the area, but have suffered greatly due to habitat fragmentation and road mortality. The species is still commonly observed throughout Ku-ring-gai chase NP (DEC 2004a).

3.6 REPTILES

Eight species of reptile were detected during the fifteen systematic reptile surveys undertaken between February and March 2004. The most common of these was the Dark-flecked Garden Sunskink (*Lampropholis delicata*, recorded at fourteen sites), followed by the Eastern Water-skink (*Eulamprus quoyii*, recorded at ten sites). Two reptile species were detected during the surveys that had not previously been recorded within the study area: Cream-striped Shining-skink (*Cryptoblepharus virgatus*) and Yellow-faced Whipsnake (*Demansia psammophis*). The latter species is uncommon within remnant bushland in the more densely populated parts of Sydney (DEC 2004a), and the location of the species within the park is therefore an exciting find. The species is regularly observed within Ku-ring-gai Chase NP (DEC 2004a).

In addition to the above, a further six species were recorded during the survey period using other systematic techniques and on an opportunistic basis (Appendix B). In total, 23 reptile species are recorded within 200 metres of Lane Cove NP on the NSW Wildlife Atlas (Appendix B). The diversity of landscapes within the park provides a variety of habitats for reptiles that facilitates the occurrence of this diverse mix of species. Habitats are provided for litter-dwelling species (such as Dark-flecked Garden Sunskink), species that rely on sandstone outcrops (Broad-tailed Gecko (*Phyllurus platurus*)), fossorial species (such as the Yellow-bellied Three-toed Skink (*Saiphos equalis*)) and riparian species (such as the Eastern Water Dragon (*Physignathus lesueurii*)). The park is large enough to support some wide-ranging species such as the Lace Monitor (*Varanus varius*), which is increasingly rare within the dense urban environment of Sydney. Lane Cove NP supports the only recent records of this species between the Georges River, Blacktown and Belrose (DEC 2004a).

3.7 FROGS

Systematic frog surveys were not undertaken due to the prolonged period of drought leading up to the survey period. However, a period of heavy rain during the last week of February provided an opportunity to undertake targeted surveys for Red-crowned Toadlet, and to collect opportunistic records of other frog species. The results of the Red-crowned Toadlet surveys are discussed in Section 5 below. An example of the sandstone quarries within which many of the toadlets were located is shown in Plate 4.

Plate 4: Pool at base of sandstone cutting where Red-crowned Toadlets were heard calling ©Elizabeth Magarey/DEC

Five other species of frog were observed during the surveys, including three ground frogs and two tree frogs. The Common Eastern Froglet (*Crinia signifera*) and Striped Marsh Frog (*Limnodynastes peronii*) are common and widespread within the greater Sydney Metropolitan area, capable of inhabiting highly disturbed waterbodies. The Green Stream Frog (*Litoria phyllochroa*), however, tends to disappear from heavily disturbed environments. Their presence within the upper Lane Cove River, below George Christie Playing Field, indicates that areas of quality habitat are retained within the park, and that water quality is reasonable within this part of the river. This is the first time that the species has been recorded within the study area. Smooth Toadlet (*Uperoleia laevigata*) and Keferstein's Tree Frog (*Litoria dentata*) are capable of inhabiting altered environments, but are generally less common within the Sydney suburbs. Tadpoles of the latter species were located on Sugarloaf Hill during the surveys, indicating that breeding occurs within the study area.

3.8 INTRODUCED SPECIES

Six species of introduced mammal were recorded during the surveys (Appendix B). The most commonly recorded of these was the Black Rat, followed by the Fox. The latter species was not directly observed, but recorded in the form of scats four times within park boundary and five times in adjacent land (Map4). Dogs were detected on eight occasions during the surveys, five times within the National Park boundary, and three times on adjacent public land (Map 4). Remains of native fauna were detected within the scats of both of these latter species, as discussed in Section 3.9. The locations of records of introduced species on the Atlas of NSW Wildlife within 200 metres of Lane Cove NP are presented in Maps 3 and 4.

Three of the introduced species detected (Cat, Fox and Rabbit) are listed as a Key Threatening Process under the NSW TSC Act and the commonwealth EPBC Act and are likely to be having a significant negative impact on the native terrestrial flora and fauna of the park. The threats posed to native fauna by each animal are summarised as follows:

- Feral Rabbits impact negatively on indigenous species via competition for resources, alteration of the structure and composition of vegetation, and land degradation (NSW Scientific Committee 2002).
- 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-nesting birds at greatest risk. Fox predation has been implicated in limiting habitat choice and population size of a number of medium-sized marsupials (NSW Scientific Committee 1998). The fact that Foxes prey upon native animals within the park is evident from scat analysis, as summarised in section 3.9.
- Feral Cats threaten native fauna by direct predation. Cats are carnivorous and capable of killing vertebrates up to three kilograms. Preference is shown for mammals weighing less that 220 grams and birds less than 200 grams, but reptiles, and amphibians are also eaten (NSW Scientific Committee 2000).

Clearly the potential for introduced predators to significantly impact on native fauna in Lane Cove NP and surrounds is of conservation concern. Comprehensive targeted survey of the species, assessment of their impacts, followed by appropriate management actions and raising of public awareness, should remain a high priority for park management.

Three introduced bird species (Red-whiskered Bulbul (*Pycnonotus jocosus*), Spotted Turtle-dove (*Streptopelia chinensis*) and Common Myna (*Acridotheres tristis*)) were recorded during systematic surveys. Another species, Little Corella (*Cacatua sanguinea*), which has established a feral population from escaped aviary birds was also recorded. All these species are typical of Sydney urban environments. The presence of a Pacific Black Duck/Mallard hybrid (*Anas superciliosa x platyrhynchos*) is of concern, because this is a species that is likely to be fed by visitors, and has the potential to cause the local population of native ducks to disappear.

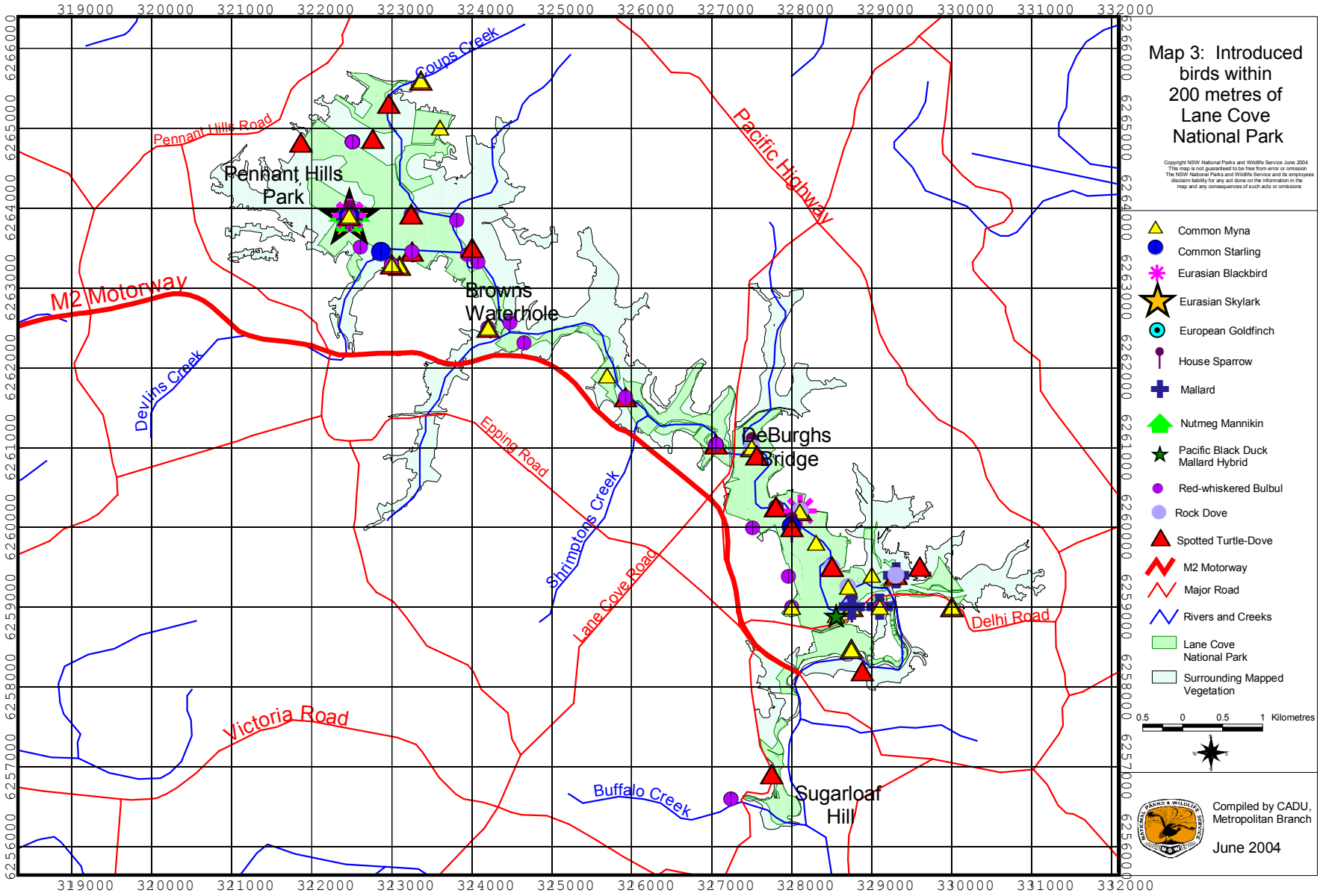
3.9 PREDATOR SCAT AND PELLET ANALYSIS

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

The most interesting finding obtained from scat analysis during the current surveys is the identification of Greater Glider hair in two predator scats. One scat was collected on the slope behind Christie Park, which was positively identified to have come from a Dog. The other scat was collected Pennant Hills Park, behind the sports complex, but is not known whether to have come from a Dog or a Fox. Unfortunately, the origin of the prey species cannot be ascertained, as discussed in Section 3.3.

Eight of the nine Fox scats that were analysed during the surveys contained native arboreal mammal remains, including Common Ringtail and Common Brushtail Possum. The ninth scat contained fur of the introduced Rabbit.

These results prove that Domestic Dogs and Foxes impact on native fauna within the reserve, and that management programs to manage these introduced species should continue to be a high priority.


Map 3: Introduced birds within 200 metres of Lane Cove National Park
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Common Myna
Common Starling
Eurasian Blackbird
Eurasian Skylark
European Goldfinch
House Sparrow
Mallard
Nutmeg Mannikin
Pacific Black Duck Mallard Hybrid
Red-whiskered Bulbul
Rock Dove
Spotted Turtle-Dove
M2 Motorway
Major Road
Rivers and Creeks
Lane Cove National Park
Surrounding Mapped Vegetation
0.5 0 0.5 1 Kilometres
Compiled by CADU, Metropolitan Branch
June 2004
Pennant Hills Park
Browns Waterhole
DeBurghs Bridge
Sugarloaf Hill
Goups Creek
Pennant Hills Road
Pacific Highway
M2 Motorway
Devlins Creek
Epping Road
Shrimptons Creek
Lane Cove Road
Delhi Road
Victoria Road
Buffalo Creek
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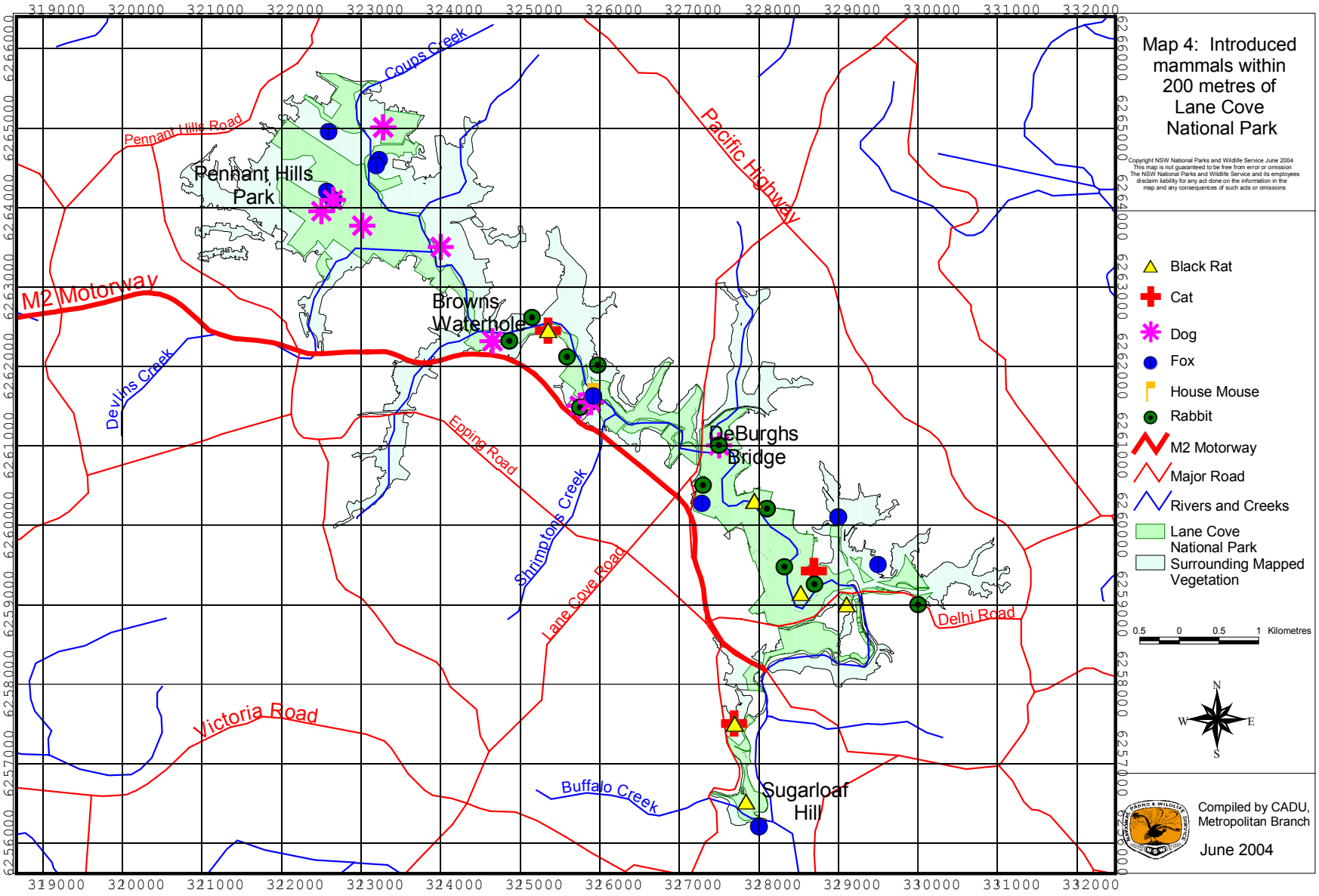
Map 4: Introduced mammals within 200 metres of Lane Cove National Park
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Black Rat
Cat
Dog
Fox
House Mouse
Rabbit
M2 Motorway
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0.5 0 0.5 1 Kilometres
N
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4 FUTURE SURVEY WORK

The systematic fauna survey described here provides adequate baseline information on the fauna of Lane Cove NP. There is much scope to build on this work in the future, in a way that provides important information to aid in the management of biodiversity within the park.

Future work could include the formation of a plan to undertake systematic fauna surveys within the park on a regular basis, for example every five years. These surveys should use the techniques described herein, thus providing a means of monitoring fauna within the park over time. Of particular interest would be to investigate changes in the distribution of threatened species and changes in fauna species composition and abundance in relation to time since fire, feral animal control programs, and other management actions. Future systematic surveys should also attempt to established sites within vegetation communities that were not targeted during this survey, particularly Coachwood Simple Rainforest and Grey Mangrove Low Closed Forest. Any systematic work undertaken in the future should be undertaken utilising the methods described in Section 2.3 and in NPWS (1997). Data entry into the BSS is the responsibility of the survey coordinator and time and resources for data entry should be included within the original survey proposal. This will ensure that the data is available to all staff and clients of DEC with accurate details and also the data to be included in any analysis of systematic data undertaken

Future work could also seek to assess the difference in fauna species composition between areas where native vegetation is largely intact and areas that are heavily weed-infested. This could also include an investigation of the impact of bush regeneration works on fauna species. Addressing this question would require a replicated sampling design, where multiple survey sites were established in a number of treatments within the same vegetation type, including: in tact vegetation; weed infested vegetation; bush regeneration sites. Ideally sites in each of these treatments would be sampled repeatedly over time, in order to ascertain the impact that progressive 'improvement' in vegetation due to bush regeneration has on fauna species.

5 THREATENED SPECIES

This section provides a profile of each of the threatened fauna species that were recorded during the current surveys. The aim of these profiles is to provide:

- A background on the species biology.
- A summary of threats to the species.
- An assessment of how well the species is protected in the region.
- A map of known records of the species in the park and the surrounding two kilometres.
- An appraisal of the distribution and status of the species in Lane Cove NP and the adjacent public lands.

A number of other threatened species have previously been recorded within and in a two kilometre radius surrounding Lane Cove NP. The list of threatened vertebrate fauna for Lane Cove NP and surrounds, however contains records of various levels of reliability. These species are listed in Table 3, together with annotation for each species regarding the latest record in the area, spatial and temporal accuracy and the reliability of identification. Maps 5, 6, 7 and 8 present the location of records of threatened fauna species within a two kilometre radius of the park.

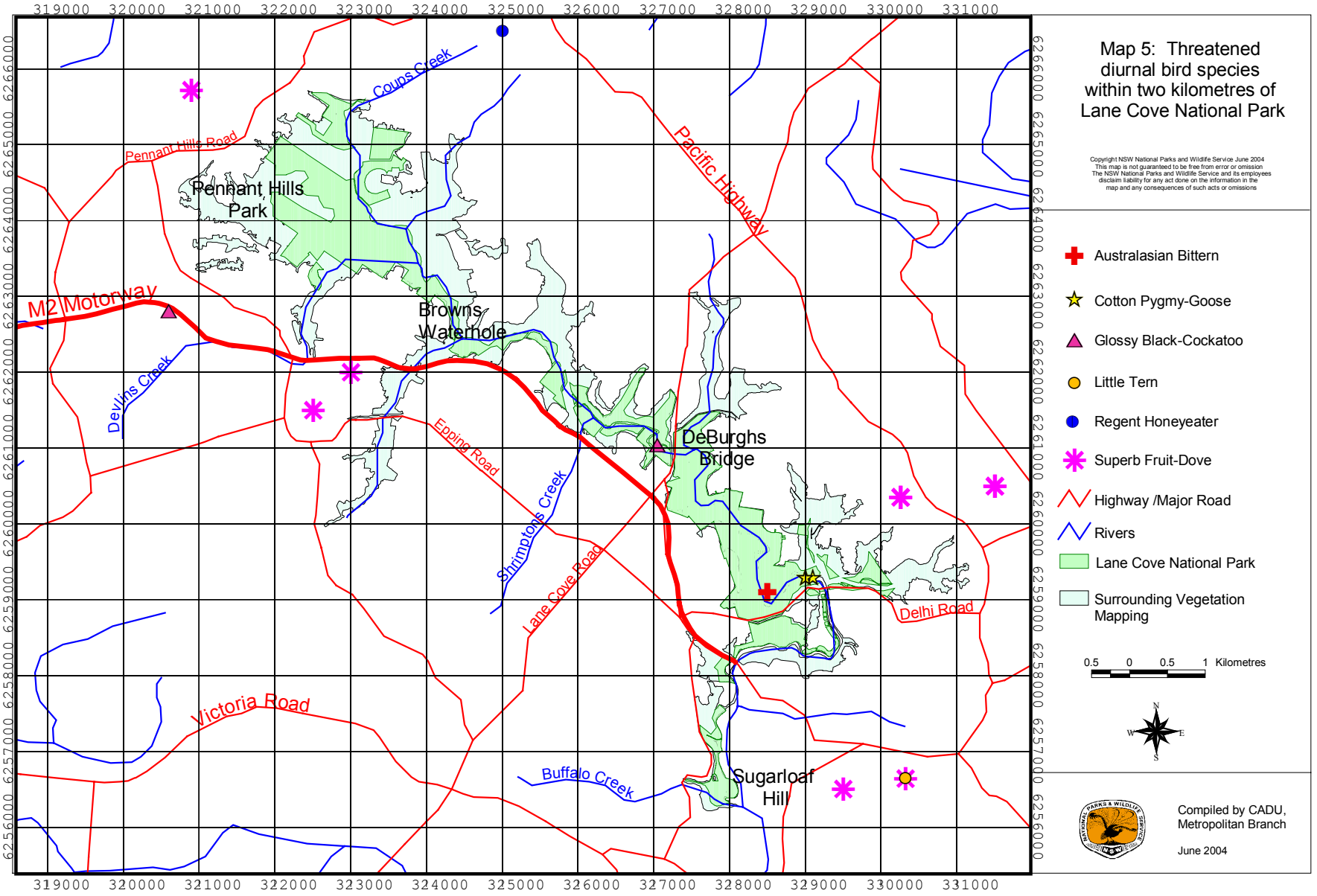
Table 3: Threatened fauna species recorded on the Atlas of NSW Wildlife within and two kilometres surrounding Lane Cove National Park. Data extracted June 2004.

Scientific name	Common name	Status in NSW (TSC Act)	Status in Australia (EPBC Act)	No. of locations within LCNP[1]		No. of locations within adjacent public lands		No. of locations within a two kilometre radius of LCNP[1]	Notes on reliability and date of last record
				DEC[2]	Other[3]	DEC[2]	Other[3]		
Ptilinopus superbus	Superb Fruit-Dove	V						9	Not recorded in park. Detected between 1973 and 1996, including three Australian Museum records.
Sterna albifrons	Little Tern	V						1	Not recorded in park. Australian Museum record from 1970.
Botaurus poiciloptilus	Australasian Bittern	V			1				Observed once in the park in 2000.
Nettapus coromandelianus	Cotton Pygmy-Goose	E			4				Observed in the park, near the weir, on four occasions between 1991 and 1992. Most likely the same animal repeatedly recorded.
Falco hypoleucos	Grey Falcon	V						1	Not recorded in park. An anonymous record from the 1960s. Low reliability, therefore not included on map.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V			1			1	Recorded in 1999 and 2000. One record is from Birds Australia and has low spatial accuracy.
Cacatua leadbeateri	Major Mitchell's Cockatoo	V						1	Not recorded in park. Recorded in 1994 outside park. Likely to be an aviary escapee, therefore not included on map.
Xanthomyza phrygia	Regent Honeyeater	E	E					1	Not recorded in park. Last recorded in 1951. Three records occur prior to this date, but the species has not been detected since.
Ninox connivens	Barking Owl	V					1		Not recorded in park. Observed once just outside the park in 2000.
Ninox strenua	Powerful Owl	V		2	11	2	4	21	Recorded during DEC surveys in 2004 in and around the park. Numerous records in the area but likely to be a limited number of birds recorded repeatedly.
Dasyurus maculatus	Spotted-tailed Quoll	V	E					2	Not recorded in park. Two sightings made by different people in 2001 and 2002 within two kilometres of park.
Petaurus australis	Yellow-bellied Glider	V					1		Not recorded in park. Recorded once just outside of the park in 1999 by a consultant. Uncertain reliability therefore not included on map.
Cercartetus nanus	Eastern Pygmy-possum	V						1	Not recorded in park. Recorded once in region in 1972.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	4	1	4	2	10	Most recently recorded on park in early 2004 during DEC surveys. Numerous records throughout the area.
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V		5		2	8	2	Detected during DEC surveys on park by ultrasonic recordings (Anabat). Numerous other records occur in region, including a museum specimen.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		0				1	Not recorded in park. Museum specimen collected in 1969.
Mormopterus norfolkensis	Eastern Freetail-bat	V						1	Not recorded in park. Detected once by ultrasonic call within two kilometres of the park in 2002.
Pseudophryne australis	Red-crowned Toadlet	V		2	6	4	15	3	Recorded in and around park during DEC surveys in early 2004. A number of records occur in region, including a museum specimen.
Litoria aurea	Green and Golden Bell Frog	E	V					4	Not recorded in park. Recorded four times within two kilometres of the park between 1988 and 1999, at different locations by different observers.

[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 2004 DEC surveys

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


Map 5: Threatened diurnal bird species within two kilometres of Lane Cove National Park
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Australasian Bittern
Cotton Pygmy-Goose
Glossy Black-Cockatoo
Little Tern
Regent Honeyeater
Superb Fruit-Dove
Highway /Major Road
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Lane Cove National Park
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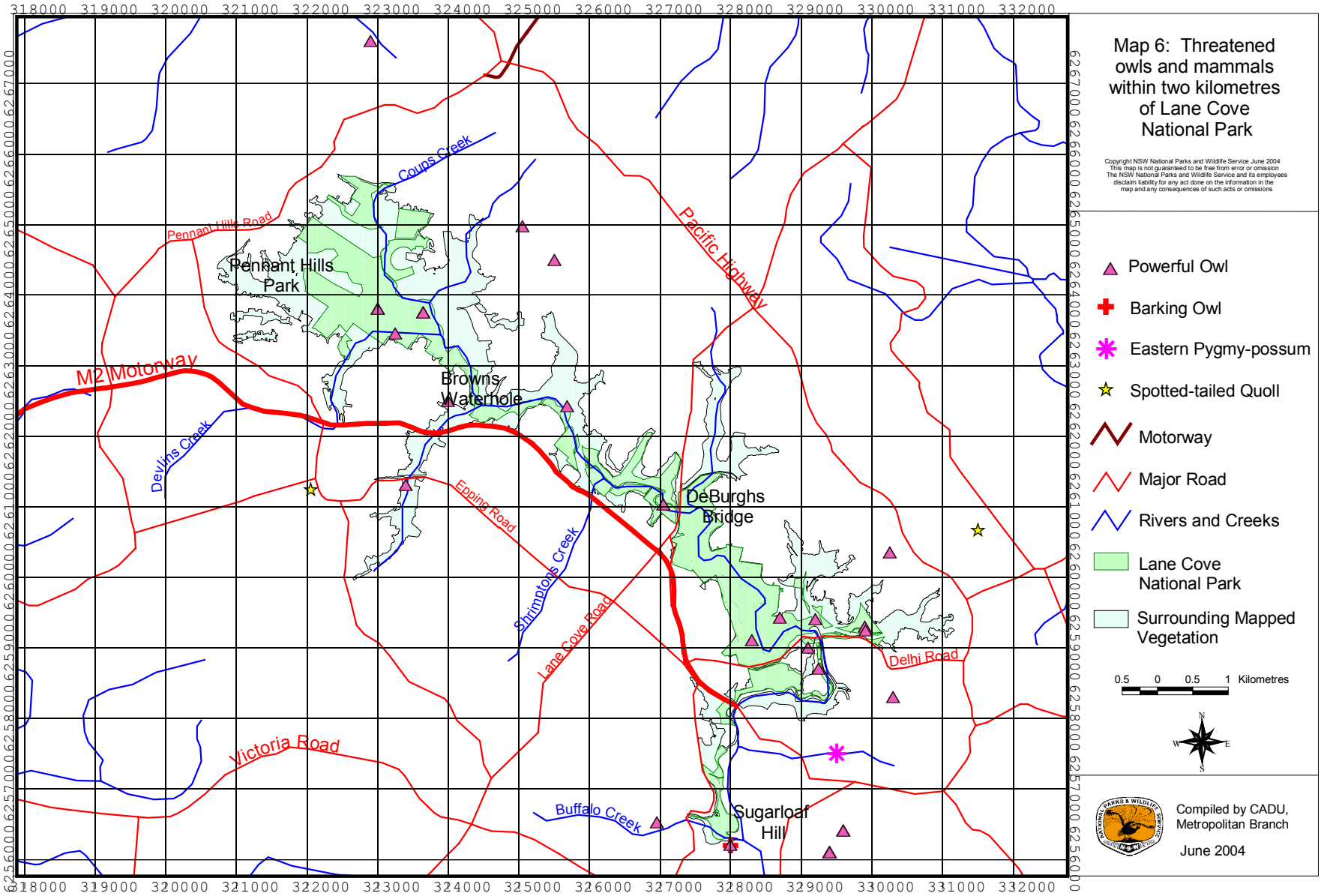
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Browns Waterhole
Epping Road
DeBurghs Bridge
Shrimptons Creek
Lane Cove Road
Delhi Road
Victoria Road
Buffalo Creek
Sugarloaf Hill
Map 6: Threatened owls and mammals within two kilometres of Lane Cove National Park
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Powerful Owl
Barking Owl
Eastern Pygmy-possum
Spotted-tailed Quoll
Motorway
Major Road
Rivers and Creeks
Lane Cove National Park
Surrounding Mapped Vegetation
0.5 0 0.5 1 Kilometres
N
W
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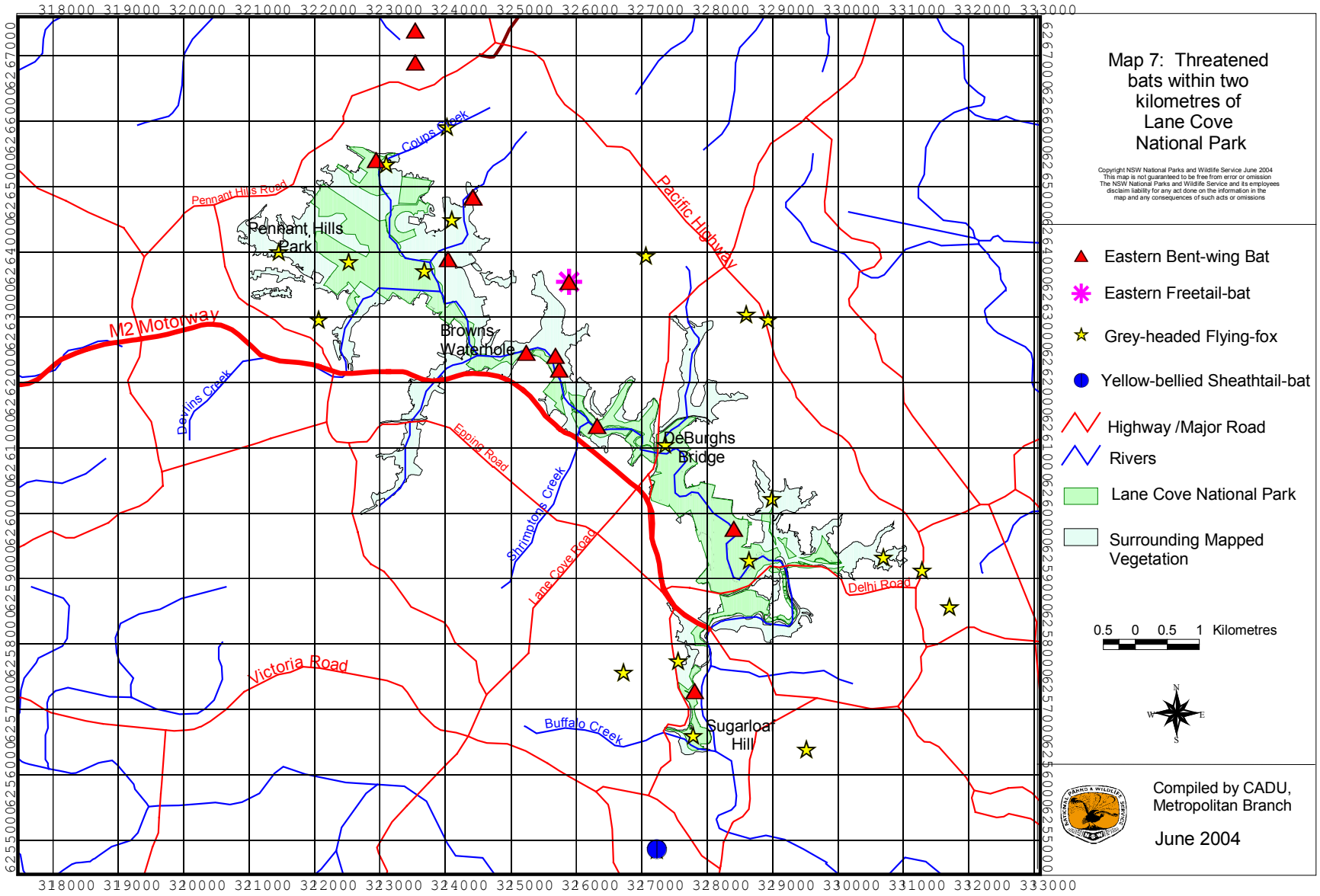
Compiled by CADU, Metropolitan Branch
June 2004


318000 319000 320000 321000 322000 323000 324000 325000 326000 327000 328000 329000 330000 331000 332000 333000
6255000 6256000 6257000 6258000 6259000 6260000 6261000 6262000 6263000 6264000 6265000 6266000 6267000
Map 7: Threatened bats within two kilometres of Lane Cove National Park
Copyright NSW National Parks and Wildlife Service June 2004
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The NSW National Parks and Wildlife Service and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions
Eastern Bent-wing Bat
Eastern Freetail-bat
Grey-headed Flying-fox
Yellow-bellied Sheathtail-bat
Highway /Major Road
Rivers
Lane Cove National Park
Surrounding Mapped Vegetation
0.5 0 0.5 1 Kilometres
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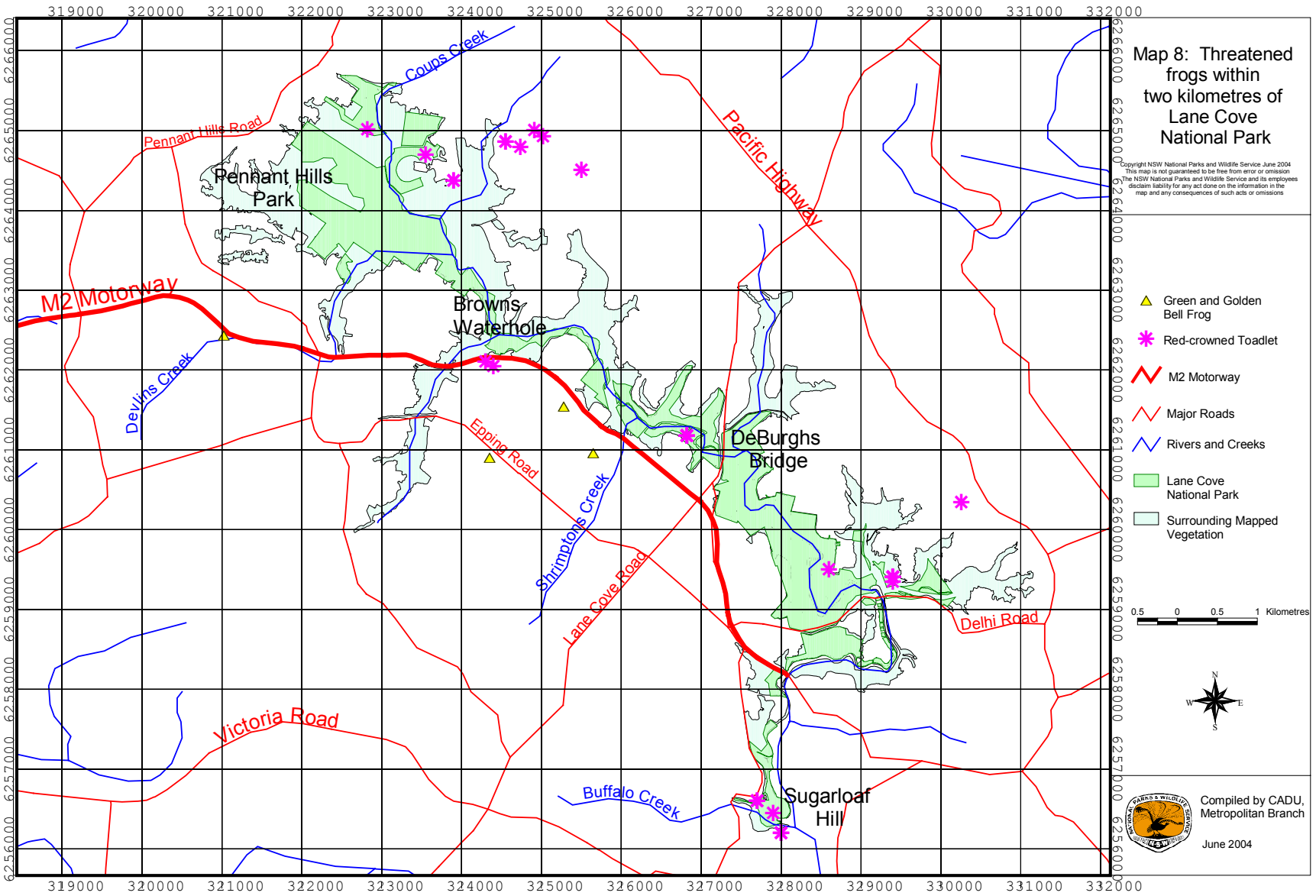
Compiled by CADU, Metropolitan Branch
June 2004
Pennant Hills Road
Coups Creek
Pennant Hills Park
Pacific Highway
M2 Motorway
Browns Waterhole
Devlins Creek
Epping Road
DeBurghs Bridge
Shrimptons Creek
Lane Cove Road
Delhi Road
Victoria Road
Buffalo Creek
Sugarloaf Hill


Map 8: Threatened frogs within two kilometres of Lane Cove National Park
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Green and Golden Bell Frog
Red-crowned Toadlet
M2 Motorway
Major Roads
Rivers and Creeks
Lane Cove National Park
Surrounding Mapped Vegetation
0.5 0 0.5 1 Kilometres
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Compiled by CADU, Metropolitan Branch
June 2004
Pennant Hills Park
Browns Waterhole
DeBurghs Bridge
Sugarloaf Hill
M2 Motorway
Pacific Highway
Pennant Hills Road
Coups Creek
Devlins Creek
Epping Road
Shrimptons Creek
Lane Cove Road
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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).

©Dave Hunter/DEC

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 NP (DEC 2004a). 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 and Royal National Parks and Berowra Valley Regional Park (DEC 2004a). 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 assessment to be made prior to developments.

During the current survey, these small distinctive frogs were seen or heard calling in two locations within the boundaries of the park, and four locations in adjacent remnant bushland. The frogs were located in a variety of habitats, including along drainage lines, in soaks, and most commonly within small sandstone quarries. These old quarries ranged in size from one metre by two metres to 40 metres by twelve metres (Plate 4). Each contained ephemeral pools of water, from the edges of which the Toadlets were heard calling. In addition to these sites, between 1993 and 2000 the species has been recorded at a further twelve locations within two kilometres of the park (Map 8). Potential habitat for the species is widespread in the study area, within drainage lines and ephemeral soaks and pools within remnant sandstone ridgetop woodlands and forests that sit above the narrow Lane Cove River Valley. Any additional quarries with the above characteristics within the study area would also provide habitat for the species, and should be managed accordingly. It is likely that further records of the species will be collected in coming years, particularly after the current drought breaks.

Lane Cove National Park and surrounding remnant bushland are located within the dense cluster of Red-crowned Toadlet records associated with the sandstone ridges and upper slopes of the Hornsby Plateau. Within this area, now mostly covered by Sydney's expanding northern and north-western suburbs, over half of this species former habitat has been lost (Wells 2002). Degradation and fragmentation of remnant populations are a continued threat to the persistence of the species in the region (Wells 2002). Records within the study area thus have high conservation significance, due to the level of protection they are afforded within the National Park and council reserves. Known locations and areas of potential habitat should be managed accordingly, with a focus placed in 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).

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 maintain 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).

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Threats

Past land clearance for agriculture has reduced the area of habitat available for the Powerful Owl (Garnett and Crowley 2000), particularly the availability of 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 on 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 DEC surveys across the Warragamba Special Area, and the neighbouring Blue Mountains, Kanangra-Boyd and Nattai NPs have found Powerful Owls to be relatively abundant and widespread in the region (DEC in prep.).

Powerful Owls are well known from remnant bushland within the Northern Suburbs of Sydney (DEC 2004a). The species has been recorded within Lane Cove NP and the surrounding gully systems over many years (Map 6). Bird observers occasionally report roosting sites in sandstone gullies from Cattai to Berowra Valley Regional Park. As an indication of the propensity of the species to persist in urban environments, an owl was recorded roosting for several weeks in the Royal Botanic Gardens in the Sydney CBD, and others have been recorded at Dover Heights, and at Brighton in the south of Sydney. A cursory examination of Powerful Owl records in the urban areas of northern Sydney, however, may lead to an over-estimation of numbers as it likely that resident individuals and pairs of the species are repeatedly reported by bird-watchers and enthusiastic locals.

One of the aims of the current survey was to estimate the minimum number of Powerful Owls that occur within Lane Cove NP and surrounding public lands. Nine systematic nocturnal call playback surveys were undertaken over the two nights, during which a total of four owls were heard calling and an additional two owls observed. The pattern of responses suggests, using a conservative estimate, that at least four Powerful Owls utilise the study area, including at least one pair. The pair was observed on the northern bank of the Lane Cove River within Blackbutt-Smooth-barked Apple Forest that included tall Sydney Blue Gum (*Eucalyptus saligna*) trees. This is typical habitat for the species. The high density of prey species, particularly Common Ringtail Possum, and the presence of remnant trees with hollows, sustains the very high density of the owls within the area. It is possible that a high number of Powerful Owls use the park for nesting and roosting, yet forage widely in surrounding suburbs. These results highlight the important contribution the bushland of Lane Cove NP makes to the conservation of species in the region. Habitats for the species within the park should be managed accordingly, including minimising disturbance to known or potential roost sites and trees with hollows.

GREY-HEADED FLYING-FOX

Species Profile

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is a large fruit bat that has dark grey body fur, a slightly paler grey head and a russet collar. It is the largest bat in the study area, with a wingspan of up to one metre. It is a highly mobile species and numbers roosting at specific camps may vary depending on season and food availability. They feed on nectar and pollen of various trees including *Eucalyptus, Melaleuca* and *Banksia* as well as fruits, originally of rainforest species, but now including commercial and garden crops. They can travel up to twenty kilometres to a food source, and are an important pollinator and disperser of native plants. It is endemic to the east of Australia between Melbourne, Victoria and Bundaberg in Queensland, though it formerly ranged as far north as Rockhampton (NSW Scientific Committee 2001).

©Linda Broome/DEC

Threats

Counts of flying-foxes over the past decade suggest that the national population may have declined by up to 30 percent (Birt 2000 in NSW Scientific Committee 2001). 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 of roosting sites (particularly of pregnant females) unregulated shooting (particularly when feeding on commercial crops) and electrocution on power lines (particularly in urban areas) (NSW Scientific Committee 2001).

Local and Regional Conservation Status

The Grey-headed Flying-fox is listed as Vulnerable on the NSW TSC Act (1995) and as Vulnerable on the Commonwealth EPBC Act (1999). It has declined in numbers across the entire state of NSW and is considered to be vulnerable to further declines. Eby *et al.* (1999) estimated that there are approximately sixteen camps within the Sydney Basin Bioregion, three of which were occupied in July 1998. The nearest known maternity roost for the species to the study area is located at Flying-fox Reserve in Gordon. Current locality data suggest that the species is primarily distributed across coastal and hinterland environments in the Bioregion, although this is may reflect a reporting bias due to the density of human observers. The species has been recorded in a number of reserves including Royal, Ku-ring-gai Chase and Garigal National Parks (DEC 2004a) and is an iconic inhabitant of the Royal Botanic Gardens in the Sydney CBD. The large home range and nomadic habit of the species means, however, that colonies do not rely on any single reserve for their survival.

The Grey-headed Flying-fox is well known and well documented within Metropolitan Sydney and a feature of the city skies at dusk in summer, as the animals leave their roosts in search of fruiting and flowering trees (often large planted figs (*Ficus microphylla*) and Cocos Palms (*Arecastrum romanzoffianum*)). Grey-headed Flying-foxes were observed flying over the Lane Cove National Park in large numbers at dusk during the fauna surveys in February and March 2004. Individuals were heard uttering their distinctive calls during numerous spotlighting and nocturnal call playback surveys, most frequently at the margins of the park, where the species was likely to be feeding within planted trees in neighbouring gardens. Prior to the 2004 surveys, the species has been recorded on numerous occasions within the park (Map 7), and injured individuals from the region are often rehabilitated at the Kukundi Wildlife Shelter. The species is known to feed on flowering Blackbutt (*Eucalyptus pilularis*) (NPWS 2002) which is a dominant canopy species on sheltered slopes and gullies in the study area. Consequently, Lane Cove National Park and surrounding lands are likely to make an important contribution to the matrix of foraging habitat for the species across northern Sydney, the retention of which is crucial to the continued survival of the species in the region.

EASTERN BENT-WING BAT

Species Profile

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

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Threats

Damage and disturbance to roosting sites are the greatest threats to this species. Because only relatively few nursery caves are used, significant population changes can occur if these sites are damaged (Dwyer 1995). Disturbance of hibernating colonies can lead to starvation due to loss of energy reserves (Gilmore and Parnaby 1994). Disturbance of smaller roosts by recreational caving and tourism may also be significant, as may modification to feeding habitat by agriculture and urban development (Gilmore and Parnaby 1994). Some individuals are preyed upon by feral Cats (*Felis catus*) and, less often, foxes (*Vulpes vulpes*) (Dwyer 1995).

Local and Regional Conservation Status

The Eastern Bent-wing Bat is listed as Vulnerable on the NSW TSC Act (1995). The species is widely recorded in the eastern third of NSW, with the number of records decreasing with distance from the coast (DEC 2004a). Large numbers of records of the species have been collected in the Sydney Metropolitan area in recent years, particularly with the increase in use of ultrasonic bat call recording devices by wildlife surveyors. The number of ultrasonic call records is inflated, however, by the very large distances travelled by individuals whilst foraging. In contrast, the species is rarely captured in harp traps, due to their high-flying habits. Thus it is hard to estimate the abundance and density of the species in the region. Records of the species are known from numerous reserves, such as Berowra Valley Regional Park, and Ku-ring-gai Chase, Sydney Harbour and Royal National Parks. The species has the ability roost in man-made infrastructures, for example the species has been recorded within stormwater drains in the vicinity of Sydney Olympic Park at Homebush Bay (SOPA 2002).

The Eastern Bent-wing Bat was recorded for the first time within Lane Cove National Park during the systematic surveys. The species was detected by its ultrasonic call at five locations in the park, and at two locations in adjacent public lands, during March and May 2004 (Map 7). These locations are spread across the length of the reserve and within adjoining council reserves to the north of the park boundary. It is evident that the animal forages widely over in the area, being detected at both ridge and gully sites and in a variety of vegetation communities from Sydney Peppermint Woodlands to Blackbutt-Smooth-barked Apple Tall Forest. The surveys did not detect any potential roosting sites for the species, though it is possible the species roosts nearby (if not within) the study area, possibly within man-made structures such as a road culverts. In addition to records obtained during the current surveys, the species has previously been detected at numerous locations within two kilometres of the park boundary (Map 7).

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APPENDIX A: SURVEY SITES

Location of, vegetation type and techniques undertaken at systematic fauna survey sites in Lane Cove National Park and adjacent public lands

Site number	Easting	Northing	Vegetation community (UBM Consultants 2001)	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap	Bat ultrasound detection	Nocturnal call playback	Elliott trap	Cage trap
HRN01W	322650	6264090	Scribbly Gum Woodland/Open Woodland/Low Open Woodland	1	1	1					
HRN02W	323574	6264209	Silvertop Ash Low Woodland/Low Open Woodland	1	1	1					
HRN03W	323279	6265005	Red Bloodwood Low Open Forest	1	1	1					
HRN04W	322763	6264749	Sydney Peppermint Woodland/Open Woodland/Mallee Open Woodland	1	1	1					
HRN05W	324147	6264476	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest	1	1	1					
HRN06O	321379	6264058	Coachwood Simple Rainforest		1				1		
HRN07O	322848	6265210	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest							1	
HRN08W	323200	6264700	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest								1
HRN09W	322775	6264053	Scribbly Gum Woodland/Open Woodland/Low Open Woodland				1				
HRN10W	323536	6265138	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest				1				
HRN11W	325050	6264975	Unmapped. Red Bloodwood canopy with dense and diverse shrub storey.				1		1		
HRN12W	323365	6264857	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest					1			
HRN14W	322892	6265478	Sydney Peppermint Woodland/Open Woodland/Mallee Open Woodland					1	1		
LCOW10I	323650	6263755	Scribbly Gum Woodland/Open Woodland/Low Open Woodland						1		
PAR01W	325798	6262682	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest	1		1				1	
PAR02O	325465	6263546	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest	1	1	1				1	
PAR03W	322273	6263510	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest	1	1	1					
PAR04W	327834	6256517	Red Bloodwood Low Open Forest	1	1	1			1	1	
PAR05W	327692	6257500	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest	1	1	1					1
PAR06W	327559	6260894	Sydney Peppermint Woodland/Open Woodland/Mallee Open Woodland	1	1	1					
PAR07O	327286	6260274	Scribbly Gum Open Forest	1	1	1					
PAR08W	328196	6258877	Scribbly Gum Woodland/Open Woodland/Low Open Woodland	1	1	1					

Site number	Easting	Northing	Vegetation community (UBM Consultants 2001)	Diurnal bird census	Diurnal reptile census	Site spotlight census	Harp trap	Bat ultrasound detection	Nocturnal call playback	Elliott trap	Cage trap
PAR09W	323432	6263755	Scribbly Gum Woodland/Open Woodland/Low Open Woodland	1		1				1	
PAR10W	322390	6262644	Weed Dominated Community	1							
PAR11O	325918	6261621	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest	1	1	1				1	
PAR12W	324654	6262313	Sydney Peppermint Woodland/Open Woodland/Mallee Open Woodland	1	1	1				1	
PAR13W	324405	6262550	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest				1				
PAR14O	324478	6262666	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest				1				
PAR15W	328384	6259372	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest					1			
PAR16W	327400	6261050	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest						1		1
PAR17W	325350	6262450	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest								1
PAR18W	323927	6263436	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest				1				
PAR19W	328020	6262930	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest				1				
PAR20W	327725	6261550	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest				1				
PAR21W	326005	6261826	Sydney Peppermint Woodland/Open Woodland/Mallee Open Woodland				1				
PAR22W	325705	6262885	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest				1				
PAR23W	325180	6262600	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest				1				
PAR24R	327850	6257200	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest					1			
PAR25W	325230	6262480	Sydney Peppermint Woodland/Open Woodland/Mallee Open Woodland					1			
PAR26W	323300	6263475	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest					1			
PAR27W	326336	6261340	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest					1			
PAR28W	325745	6262218	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest					1			
PAR29W	328460	6259730	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest					1			
PAR30W	326767	6261211	Closed Shrubland/Shrubland	1							
PAR31O	328694	6259425	Sydney Peppermint-Smooth-barked Apple Tall Forest/Forest/Open Forest					1	1		
PAR32O	330799	6259294	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest						1		
PAR33W	325684	6262424	Blackbutt-Smooth-barked Apple Tall Forest/Forest/Open Forest					1	1		
Total				**18**	**15**	**16**	**11**	**11**	**9**	**7**	**4**

APPENDIX B: FAUNA SPECIES LIST

Below is a list of fauna species recorded on the Atlas of NSW Wildlife within 200 metres of Lane Cove National Park. The data was extracted from the Atlas on 14 June 2004.

Records have been included from the 2004 DEC systematic survey, licensed data sets (Birds Australia and the Australian Museum) and incidental observations submitted by park rangers, field officers, environmental consultants and individuals. In order to increase the accuracy of the list, records collected prior to 1950 and from the Royal Australian Ornithologists Union prior to 1984, have been excluded (for reasons outlined in Section 2.1 above). The list contains records of various levels of reliability. Introduced species are indicated with the addition of an [I].

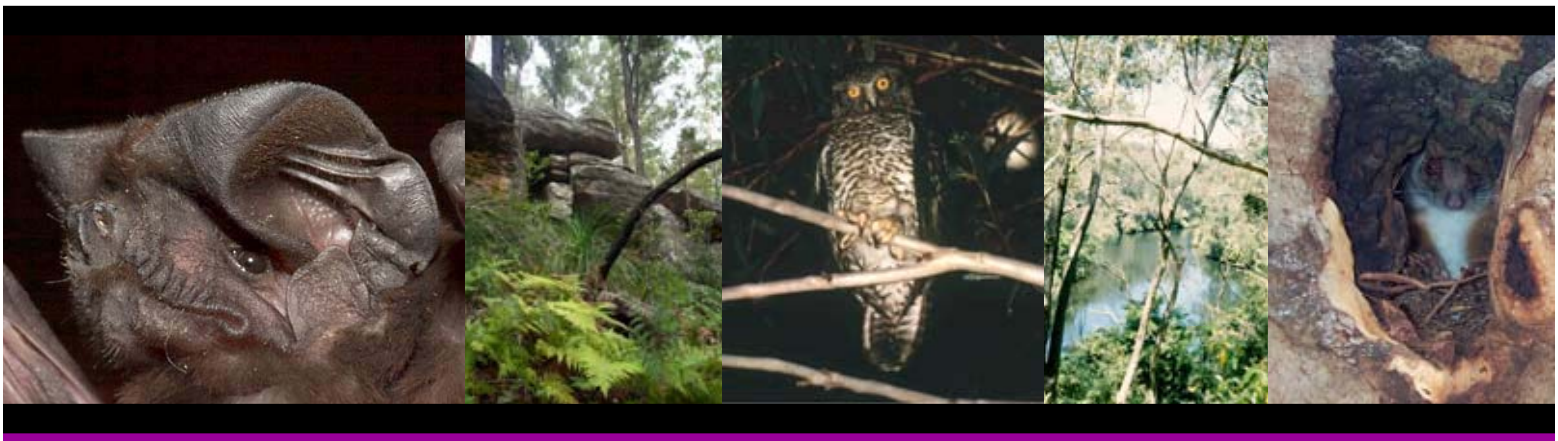
Family	Scientific Name	Common Name	Conservation Status	DEC Systematic Survey	Licensed Datasets	Other Sources
Frogs						
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	P	x		x
Myobatrachidae	*Limnodynastes peronii*	Striped Marsh Frog	P	x		x
Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V	x		x
Myobatrachidae	*Uperoleia laevigata*	Smooth Toadlet	P	x		x
Hylidae	*Litoria caerulea*	Green Tree Frog	P			x
Hylidae	*Litoria dentata*	Keferstein's Tree Frog	P	x		x
Hylidae	*Litoria peronii*	Peron's Tree Frog	P			x
Hylidae	*Litoria phyllochroa*	Green Stream Frog	P	x		
Reptiles						
Gekkonidae	*Oedura lesueurii*	Lesueur's Velvet Gecko	P			x
Gekkonidae	*Phyllurus platurus*	Broad-tailed Gecko	P	x		x
Pygopodidae	*Lialis burtonis*	Burton's Snake-lizard	P			x
Agamidae	*Amphibolurus muricatus*	Jacky Lashtail	P	x		x
Agamidae	*Physignathus lesueurii*	Eastern Water Dragon	P	x	x	x
Varanidae	*Varanus varius*	Lace Monitor	P	x		x
Scincidae	*Bassiana platynota*	Red-throated Cool-skink	P	x	x	x
Scincidae	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink	P	x		
Scincidae	*Ctenotus taeniolatus*	Copper-tailed Ctenotus	P	x	x	x
Scincidae	*Egernia whitii*	White's Rock-skink	P			x
Scincidae	*Eulamprus quoyii*	Eastern Water-skink	P	x		x
Scincidae	*Eulamprus tenuis*	Bar-sided Forest-skink	P			x
Scincidae	*Lampropholis delicata*	Dark-flecked Garden Sunskink	P	x	x	x
Scincidae	*Lampropholis guichenoti*	Pale-flecked Garden Sunskink	P	x	x	x
Scincidae	*Saiphos equalis*	Yellow-bellied Three-toed Skink	P		x	x
Scincidae	*Saproscincus mustelinus*	Weasel Shadeskink	P		x	x
Scincidae	*Tiliqua scincoides*	Common Bluetongue	P	x	x	x
Typhlopidae	*Ramphotyphlops nigrescens*	Blackish Blind Snake	P		x	
Boidae	*Morelia spilota spilota*	Diamond Python	P	x		x
Colubridae	*Dendrelaphis punctulata*	Green Tree Snake	P		x	
Elapidae	*Cacophis squamulosus*	Golden Crowned Snake	P			x
Elapidae	*Demansia psammophis*	Yellow-faced Whipsnake	P	x		

Family	Scientific Name	Common Name	Conservation Status	DEC Systematic Survey	Licensed Datasets	Other Sources
Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake	P	x		x
Elapidae	*Pseudonaja textilis*	Eastern Brown Snake	P			x
Birds						
Anatidae	*Anas castanea*	Chestnut Teal	P		x	x
Anatidae	*Anas platyrhynchos*	Mallard[I]	U			x
Anatidae	*Anas superciliosa*	Pacific Black Duck	P	x	x	x
Anatidae	*Anas superciliosa x platyrhynchos*	Pacific Black Duck Mallard Hybrid[I]	U	x		
Anatidae	*Aythya australis*	Hardhead	P			x
Anatidae	*Chenonetta jubata*	Australian Wood Duck	P	x	x	x
Anatidae	*Cygnus atratus*	Black Swan	P		x	x
Anatidae	*Nettapus coromandelianus*	Cotton Pygmy-Goose	E			x
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	P			x
Anhingidae	*Anhinga melanogaster*	Darter	P			x
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant	P			x
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant	P	x	x	x
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant	P		x	x
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant	P		x	x
Ardeidae	*Ardea alba*	Great Egret	P			x
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	V			x
Ardeidae	*Butorides striatus*	Striated Heron	P			x
Ardeidae	*Egretta garzetta*	Little Egret	P			x
Ardeidae	*Egretta novaehollandiae*	White-faced Heron	P	x		x
Ardeidae	*Nycticorax caledonicus*	Nankeen Night Heron	P			x
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill	P		x	x
Threskiornithidae	*Platalea regia*	Royal Spoonbill	P		x	x
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk	P			x
Accipitridae	*Accipiter fasciatus*	Brown Goshawk	P	x	x	x
Accipitridae	*Aviceda subcristata*	Pacific Baza	P	x	x	x
Accipitridae	*Elanus axillaris*	Black-shouldered Kite	P		x	
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	P	x		
Falconidae	*Falco berigora*	Brown Falcon	P			x
Falconidae	*Falco peregrinus*	Peregrine Falcon	P	x		x
Rallidae	*Fulica atra*	Eurasian Coot	P			x
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen	P	x	x	x
Rallidae	*Gallirallus philippensis*	Buff-banded Rail	P			x
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	P	x		x
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	P		x	
Charadriidae	*Vanellus miles*	Masked Lapwing	P	x	x	x
Laridae	*Larus novaehollandiae*	Silver Gull	P	x		
Columbidae	*Chalcophaps indica*	Emerald Dove	P		x	
Columbidae	*Columba leucomela*	White-headed Pigeon	P			x
Columbidae	*Columba livia*	Rock Dove	U			x
Columbidae	*Geopelia humeralis*	Bar-shouldered Dove	P			x
Columbidae	*Macropygia amboinensis*	Brown Cuckoo-Dove	P	x		x
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	P	x	x	x

Family	Scientific Name	Common Name	Conservation Status	DEC Systematic Survey	Licensed Datasets	Other Sources
Columbidae	*Phaps chalcoptera*	Common Bronzewing	P			x
Columbidae	*Streptopelia chinensis*	Spotted Turtle-Dove[I]	U	x	x	x
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	P	x	x	x
Cacatuidae	*Cacatua sanguinea*	Little Corella	P	x		x
Cacatuidae	*Cacatua tenuirostris*	Long-billed Corella	P		x	x
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	P	x	x	x
Cacatuidae	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo	P	x	x	x
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V		x	
Cacatuidae	*Eolophus roseicapillus*	Galah	P	x	x	x
Psittacidae	*Alisterus scapularis*	Australian King-Parrot	P	x	x	x
Psittacidae	*Glossopsitta concinna*	Musk Lorikeet	P		x	x
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	P	x		
Psittacidae	*Platycercus adscitus*	White Cheeked Rosella	P			x
Psittacidae	*Platycercus adscitus x eximius*	Eastern/Pale-headed Rosella	P			x
Psittacidae	*Platycercus adscitus eximius*	Eastern Rosella	P		x	x
Psittacidae	*Platycercus elegans*	Crimson Rosella	P	x	x	x
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	P	x	x	x
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	P		x	x
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo	P		x	
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-Cuckoo	P		x	
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo	P		x	x
Cuculidae	*Eudynamys orientalis*	Pacific Koel	P	x	x	x
Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo	P		x	x
Strigidae	*Ninox boobook*	Southern Boobook	P	x	x	x
Strigidae	*Ninox connivens*	Barking Owl	V			x
Strigidae	*Ninox strenua*	Powerful Owl	V	x	x	x
Podargidae	*Podargus strigoides*	Tawny Frogmouth	P	x	x	x
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	P		x	x
Alcedinidae	*Alcedo azurea*	Azure Kingfisher	P			x
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra	P	x	x	x
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher	P		x	x
Coraciidae	*Eurystomus orientalis*	Dollarbird	P		x	x
Menuridae	*Menura novaehollandiae*	Superb Lyrebird	P			x
Climacteridae	*Cormobates leucophaeus*	White-throated Treecreeper	P	x	x	x
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	P	x	x	x
Maluridae	*Malurus lamberti*	Variegated Fairy-wren	P	x	x	x
Maluridae	*Malurus splendens*	Splendid Fairy-wren	P			x
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	P	x	x	x
Pardalotidae	*Pardalotus striatus*	Striated Pardalote	P		x	
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	P		x	
Acanthizidae	*Acanthiza lineata*	Striated Thornbill	P		x	x
Acanthizidae	*Acanthiza nana*	Yellow Thornbill	P	x	x	x
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill	P	x	x	
Acanthizidae	*Gerygone mouki*	Brown Gerygone	P	x	x	x
Acanthizidae	*Gerygone olivacea*	White-throated Gerygone	P		x	

Family	Scientific Name	Common Name	Conservation Status	DEC Systematic Survey	Licensed Datasets	Other Sources
Acanthizidae	*Origma solitaria*	Rockwarbler	P			x
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren	P	x	x	x
Acanthizidae	*Sericornis magnirostris*	Large-billed Scrubwren	P		x	
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	P	x	x	x
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	P	x	x	x
Meliphagidae	*Anthochaera chrysoptera*	Little Wattlebird	P	x	x	x
Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater	P	x	x	x
Meliphagidae	*Lichenostomus fuscus*	Fuscous Honeyeater	P		x	
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater	P		x	
Meliphagidae	*Manorina melanocephala*	Noisy Miner	P	x	x	x
Meliphagidae	*Manorina melanophrys*	Bell Miner	P		x	x
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater	P		x	x
Meliphagidae	*Melithreptus lunatus*	White-naped Honeyeater	P		x	x
Meliphagidae	*Myzomela sanguinolenta*	Scarlet Honeyeater	P		x	x
Meliphagidae	*Philemon corniculatus*	Noisy Friarbird	P		x	x
Meliphagidae	*Phylidonyris nigra*	White-cheeked Honeyeater	P	x	x	x
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater	P	x		x
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	P	x	x	x
Petroicidae	*Petroica boodang*	Scarlet Robin	P			x
Petroicidae	*Petroica rosea*	Rose Robin	P		x	x
Eupetidae	*Psophodes olivaceus*	Eastern Whipbird	P	x	x	x
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	P		x	
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	P	x	x	x
Pachycephalidae	*Falcunculus frontatus*	Eastern Shrike-tit	P		x	x
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	P	x	x	x
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	P		x	x
Dicruridae	*Dicrurus bracteatus*	Spangled Drongo	P			x
Dicruridae	*Grallina cyanoleuca*	Magpie-lark	P	x	x	x
Dicruridae	*Monarcha melanopsis*	Black-faced Monarch	P	x	x	x
Dicruridae	*Monarcha trivirgatus*	Spectacled Monarch	P		x	
Dicruridae	*Myiagra cyanoleuca*	Satin Flycatcher	P			x
Dicruridae	*Myiagra inquieta*	Restless Flycatcher	P		x	
Dicruridae	*Myiagra rubecula*	Leaden Flycatcher	P		x	x
Dicruridae	*Rhipidura albiscapa*	Grey Fantail	P	x	x	x
Dicruridae	*Rhipidura leucophrys*	Willie Wagtail	P	x	x	x
Dicruridae	*Rhipidura rufifrons*	Rufous Fantail	P	x	x	x
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	P	x	x	x
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole	P		x	x
Oriolidae	*Sphecotheres vieilloti*	Australasian Figbird	P			x
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	P			x
Artamidae	*Cracticus torquatus*	Grey Butcherbird	P	x	x	x
Artamidae	*Gymnorhina tibicen*	Australian Magpie	P	x	x	x
Artamidae	*Strepera graculina*	Pied Currawong	P	x	x	x
Corvidae	*Corvus coronoides*	Australian Raven	P	x	x	x
Ptilonorhynchidae	*Ailuroedus crassirostris*	Green Catbird	P			x

Family	Scientific Name	Common Name	Conservation Status	DEC Systematic Survey	Licensed Datasets	Other Sources
Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird	P			x
Passeridae	*Passer domesticus*	House Sparrow[I]	U			x
Estrildidae	*Neochmia temporalis*	Red-browed Finch	P	x	x	x
Estrildidae	*Stagonopleura oculata*	Red-eared Firetail	P		x	
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird	P			x
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	P	x	x	x
Pycnonotidae	*Pycnonotus jocosus*	Red-whiskered Bulbul[I]	U	x	x	x
Zosteropidae	*Zosterops lateralis*	Silvereye	P	x	x	x
Muscicapidae	*Turdus merula*	Eurasian Blackbird[I]	U			x
Sturnidae	*Acridotheres tristis*	Common Mynal[I]	U	x	x	x
Sturnidae	*Sturnus vulgaris*	Common Starling[I]	U		x	x
Mammals						
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna	P		x	x
Dasyuridae	*Antechinus* sp.	Unidentified Antechinus	P	x		
Dasyuridae	*Antechinus stuartii*	Brown Antechinus	P	x		
Peramelidae	*Perameles nasuta*	Long-nosed Bandicoot	P	x		
Petauridae	*Petaurus australis*	Yellow-bellied Glider	V			x
Petauridae	*Petaurus breviceps*	Sugar Glider	P	x	x	x
Pseudocheiridae	*Petauroides volans*	Greater Glider	P	x		
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum	P	x		x
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	P	x		x
Macropodidae	*Wallabia bicolor*	Swamp Wallaby	P	x		x
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	x	x	x
Pteropodidae	*Pteropus scapulatus*	Little Red Flying-fox	P			x
Molossidae	*Mormopterus* sp 1	undescribed mastiff-bat	P	x		
Molossidae	*Nyctinomus australis*	White-striped Freetail-bat	P	x	x	
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	P	x		x
Vespertilionidae	*Chalinolobus morio*	Chocolate Wattled Bat	P	x		
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat	V	x		
Vespertilionidae	*Scotorepens orion*	Eastern Broad-nosed Bat	P			x
Vespertilionidae	*Vespadelus vulturnus*	Little Forest Bat	P	x		
Muridae	*Mus musculus*	House Mouse[I]	U	x		
Muridae	*Rattus fuscipes*	Bush Rat	P	x		
Muridae	*Rattus rattus*	Black Rat[I]	U	x		x
Leporidae	*Oryctolagus cuniculus*	Rabbit[I]	U	x		x
Canidae	*Canis lupus familiaris*	Dog[I]	U	x		x
Canidae	*Vulpes vulpes*	Fox[I]	U	x		x
Felidae	*Felis catus*	Cat[I]	U	x		



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