Bird Communities in Remnant and Planted Native Vegetation, southern Moore River Catchment

InSight Ecology

December 2011

for the project

Recovery and Protection of the Moore River Catchment's Threatened Natural Assets

Moore Catchment Council

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Photographs: (front cover): The main photograph shows a pattern of distribution of remnant native vegetation and habitat connectivity from Jenny Kelly's (managed by Neil Botha) ridgetop remnant near Gillingarra, looking north toward Bindoon-Moora Road (4 May 2011). This site was surveyed for birds during this study. The smaller panel of photographs below this centrepiece, from left to right, are mallee with patches of heathy ground cover in Jenny Kelly's ridgetop remnant (4 May 2011); a group of Carnaby's Black-Cockatoo *Calyptorhynchus latirostris* at Gillingarra (courtesy Ingrid Krockenberger, 23 October 2011); planted rows of 6 year-old *Melaleuca thyoides* and other melaleuca along Langwood Creek on Sarah and Geoff Mason's Carrah Farms, Calingiri (Mason Revegetation Site 2, 1 May 2011); and male Red-capped Robin *Petroica goodenovii* in Wandoo woodland and Acacia/Melaleuca shrubland (Mason's ridgetop remnant site, 5 October 2011). All three sites shown in these photographs, with the exception of the Carnaby's Black-Cockatoo location, were surveyed during this study.
All photographs presented in this report without credits were taken by InSight Ecology.

Acknowledgements

This work was commissioned by Moore Catchment Council (MCC) as part of the Recovery and Protection of the Moore River Catchment's Threatened Natural Assets Project. This initiative included remnant native vegetation on ridges, upland and lowland slopes, and along riparian zones and sandplain country. It was funded by the WA State NRM Program 2009-2010 (Regional and Community Groups).

I am grateful to MCC and particularly Rachel Walmsley and Ingrid Krockenberger, MCC's natural resource management (NRM) officers, for the opportunity to work in this special landscape. Rachel managed the project providing local knowledge, spatial data, NRM expertise and landholder liaison. Ingrid supplied valuable botanical knowledge, NRM, photographs and GIS data and helped with farm access and landholder liaison. Both also proved good company in the field.

I am equally grateful to a number of farmers participating in the natural assets project for permission to access and work on their properties in the southern Moore River catchment. These included Sarah and Geoff Mason ("Carrah Farms", Calingiri), Bob Harridge ("Cooinda Park", New Norcia), Don and Ann Nixon ("Dalmeny Downs", New Norcia), Bob and Ann Hendry (managers of "Flora Downs", Gillingarra), Shane and Emma Kelly ("Waalidjap", Gillingarra), Jenny Kelly (owner) and Neil Botha (manager) (Gillingarra), Steve and Liz Slater ("Margam Farm", Wannamal), Bob Leeson (owner) and John Hunt (manager) ("Red Gully Farm", Wannamal West), Rick and Jackie Pearson ("Sammon Hills", Waddington), Nick Scotney ("Wensleydale", Piawaning), David Isbister ("Homewood Farm", Moora), and Kristin Lefroy ("Cranmore Park", Bindi Bindi). It was a privilege to listen to their views and reflections and share in their knowledge about the land and how they are managing it for their future. Their passion for birds and other native fauna on their properties was encouraging and inspiring. I am particularly grateful for the warm hospitality and vibrant company provided by Geoff and Sarah at Carrah Farms. This included accommodation at Langwood Cottage for the spring survey.

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Executive summary

The Moora-Gillingarra-Calingiri-New Norcia district (the 'study area') is a mixed cropping/grazing landscape situated 130 km northeast of Perth within the southern Moore River catchment. This area has retained approximately 30% of its native vegetation cover since its settlement over 130 years ago. This is significantly more than other parts of the Western Australian cropping zone where only 2-5% of native vegetation remains. This confers significant conservation value to the study area's remnants and their protection and rehabilitation. Added to this is the district's location within the Southwest Australia Ecoregion - an area of outstanding yet critically threatened biological diversity and Australia's only global biodiversity hotspot.

Remnant native vegetation of the study area is mostly Wandoo woodland, mallee, and Dryandra shrubland on the lateritic ironstone and granite ridges and upper slopes, heath on the valley slopes and, occasionally, valley floor, York Gum, Wandoo and Salmon Gum woodland along drainage lines, and some ephemeral wetlands along valley floors. Some of these upland plant communities are in notably good ecological condition following fencing and exclusion of stock. Others are recovering from past grazing and weed incursion. The heaviest human footprint, however, has typically been on the sandy and loamy valley floors and lower slopes where removal of woodland, shrubland and heathland has substantially fragmented habitat for wildlife. As a consequence, remaining patches of native vegetation have become disconnected from their upland counterparts, surrounded by a matrix of cropping and grazing land, roads and villages. This has prevented or at best significantly impeded the normal movement and dispersal of key groups of native fauna across the landscape.

This report presents the results of surveys of bird communities and habitats in remnant and some planted native vegetation across the study area. They were undertaken to provide baseline information on the structure and conservation significance of local native bird communities. These data will help assess the effectiveness of recent fencing of remnants and revegetation undertaken through the Recovery and Protection of the Moore River Catchment's Threatened Natural Assets Project. This will also help inform and guide management of the farming landscape for biodiversity conservation and production outcomes. This work complements the results of previous bird surveys undertaken on local farms and in nature reserves by InSight Ecology from 2008-2009.

The surveys were conducted in autumn (May) and spring (October) of 2011 at 19 sites (12 farming properties) across the catchment. These sites were located in remnant Wandoo woodland, shrubland and heathland on lateritic ironstone and granite ridges, breakaways and upper slopes, Wandoo and York Gum woodland on lower slopes and along drainage lines, Salmon Gum woodland, sandplain heath and Banksia/coastal blackbutt woodland on valley floors, and ephemeral wetlands. Key bird attributes sampled at each of these sites were relative abundance, species richness, community structure (based on composition of foraging guilds), and habitat use.

The bird assemblages of the study area are a microcosm of a formerly more diverse and extensive avifauna. They are characterised by a diverse mix of ground insectivores, shrub, canopy and aerial insectivores, nectarivores/insectivores, a nectarivore, ground granivores,

carnivores, omnivores, and some aquatic guilds. A total of 1,796 individual birds from 76 species were recorded during the surveys in the study area. Most (61 or 80.2%) of these were terrestrial species with aquatic species (15 or 19.7%) comprising the remainder. Slightly more terrestrial birds (8.7%) were recorded in autumn than in spring but more terrestrial and aquatic bird species (76.7%) occurred in spring than autumn. This reflected the local and regional movement of birds tracking seasonally available food, dispersing after breeding, and species-specific migration patterns. Most terrestrial bird species recorded during the study occurred in remnants. There was a 56% increase in the number of these species detected in remnants in spring (61) compared with autumn (39). This was largely due to an influx of migratory and nomadic species in spring and an exodus of these species by autumn. Examples included three species of cuckoo, Sacred Kingfisher, Rainbow Bee-eater, Spiny-cheeked Honeyeater, Western Wattlebird, and Rufous Songlark.

The most abundant species in remnants were ubiquitous, often quite resilient and adaptable, and mainly insectivorous, insectivorous/nectarivorous, and granivorous birds of woodlands and shrublands of the medium-rainfall mixed farming zone. These included Weebill, Australian Ringneck, Brown Honeyeater, Galah, Splendid Fairy-wren and Silvereye. The least abundant birds in remnants across both seasons were Grey Butcherbird, Spotted Pardalote, Pallid Cuckoo, Shining Bronze-Cuckoo, Varied Sittella, Golden Whistler, and Yellow-plumed Honeyeater.

A total of 17 foraging guilds were recorded during the study – 10 of these were terrestrial. Seven foraging guilds dominated the bird communities of the study area, of which ground insectivores (e.g. Splendid Fairy-wren, Variegated Fairy-wren, Red-capped Robin), shrub insectivores (e.g. Western Thornbill, Rufous Whistler, Grey Shrike-thrush, Grey Fantail), nectarivores/insectivores (e.g. Brown Honeyeater, Western Wattlebird, Red Wattlebird, Spiny-cheeked Honeyeater), and carnivores (e.g. Pied Butcherbird, Australian Magpie, Sacred Kingfisher, Wedge-tailed Eagle) were the main contributors. Some of these species – both fairy-wrens, Red-capped Robin, Rufous Whistler, Grey Fantail and Brown Honeyeater – foraged and nested in 8-10 year-old eucalypt, melaleuca, acacia and she-oak revegetation. Younger (3-6 year old) plantings were only used for foraging and by fewer species, e.g. White-winged Fairy-wren, White-fronted Chat and Silvereye.

Forty-seven (47) bird species or 61.8% of the sampled bird community were observed breeding during the study. Most (39 species) were terrestrial species while the remainder were aquatic species in Slater's and Hendry's ephemeral wetlands. Most breeding records came from remnants and included obligate hollow-nesters – e.g. Carnaby's Black-Cockatoo, Galah, Australian Ringneck and Sacred Kingfisher, large and small canopy-nesters – e.g. Wedge-tailed Eagle, Australian Magpie, Magpie-lark and Weebill, shrub-nesters – e.g. Inland Thornbill (included in 8-10 year old broombush revegetation), Red-capped Robin and Silvereye, and ground or near-ground nesters – e.g. Splendid Fairy-wrenand Variegated Fairy-wren. Several aquatic species were breeding in ephemeral wetlands and farm dams. These included Purple Swamphen, Eurasian Coot, Australian Wood Duck, Grey Teal, Pacific Black Duck, and Australasian Grebe.

The study area occurs within four Important Bird Areas in Western Australia – Moora, Walebing, Gillingarra and Calingiri. The study area provides habitat for 38 bird species of global, national, state or local conservation significance. Sixteen of these species are significant at

national and state levels. One of these – Carnaby's Black-Cockatoo - was recorded during the study. The remaining 22 species are locally significant because of the extent of loss and fragmentation of their habitat across the catchment, possible consequent declines in population size, or other threats. Several of these species were recorded during the study – e.g. Western Thornbill, Brown-headed Honeyeater, Varied Sittella and Grey Shrike-thrush.

Practical actions to protect, enhance and restore existing bird assemblages and their habitat are presented. These emphasise the importance of maintaining and, where possible, increasing the area and connectivity of key remnants while improving their condition for woodland, shrubland and heathland birds through adoption of a landscape design. The mitigation of threats, particularly ongoing vegetation clearance, salinity, waterlogging, pest plant and animal incursion, and impacts associated with climate change and variability is discussed.

Examples of remnants that should continue to be targeted for conservation in the study area are upland mixed woodland-mallee-shrubland-heathland on Jenny Kelly's (managed by Neil Botha) property, Bob Harridge's wandoo woodland-shrubland ridgetop remnant, Mason's ridgetop remnant and connecting strips to and along riparian zones, sandplain heath and woodland patches on "Flora Downs" (managed by Bob Hendry) and the properties of Shane and Emma Kelly and Bob Leeson (managed by John Hunt), York Gum remnants along drainage lines on Isbister's and Pearson's properties, and ephemeral wetlands on "Flora Downs" and Slater's farm. These remnants provide key habitat for a range of endemic species and are important building blocks for re-connecting habitat and fauna populations across the local and regional landscape. They are some of the real 'bush gems' of the district.

CONTENTS

1. Introduction

1.1 Project background

The native vegetation of southwestern Australia has been extensively fragmented by over 130 years of clearance for agriculture, roads and urban development (Saunders and de Rebeira 1991; Cramer and Hobbs 2005). Native fauna dependent on habitat provided by this vegetation have consequently declined and, in many districts, disappeared (Burbidge and McKenzie 1989; Abbott 1997). Coupled with pressure from predation by introduced mammalian carnivores - European fox, cat and rodents, competition from rabbits, weeds, feral bees and introduced and naturalised native birds, altered fire regimes, and a changing climate, ecosystems of this region are at risk of further degradation and potential collapse (Hobbs 1993; Keighery et al 2004; Department of Environment and Conservation [DEC] 2006). Small mammal, reptile, and dispersal-limited and habitat condition-sensitive terrestrial bird species are particularly vulnerable (Brooker and Brooker 1997, 2001; Huggett et al 2004; Keighery et al 2004; InSight Ecology 2007).

Paradoxically, these impacts have occurred in Australia's only global biodiversity hotspot – the forests and woodlands of southwestern Australia. Dry eucalypt woodlands belong to one of the 10 Australian ecosystems most vulnerable to tipping points – the Mediterranean ecosystems of southwestern Australia (Laurance et al 2011). Tipping points occur where modest environmental changes can cause disproportionately large changes in the properties or characteristics of ecosystems (also see ecological thresholds, reviewed in Huggett 2005).

The need for strategic, science-informed action to attempt to arrest these declines has led to a range of biodiversity conservation and natural resource management programs and projects across the state's southwest. These have targeted predator and pest management (e.g. DEC's Western Shield Project, NACC's Weeds of National Significance Project), threatened species and community conservation (e.g. BirdLife Australia's Carnaby's Black-Cockatoo Project, WWF's Woodland Watch Project), conservation planning (e.g. WWF's Southwest Australia Ecoregion Initiative), ecological rehabilitation and restoration (e.g. DEC's natural diversity recovery catchment program, Greening Australia and Bush Heritage Australia's Gondwana Link Project), salinity mitigation (e.g. the Catchment Demonstration Initiative), and conservation farming (e.g. Moore Catchment Council's riparian fencing and protection of priority woodland remnant projects, perennial pastures and other production systems projects). A common goal of these initiatives has been to educate land managers and ultimately improve how land is managed for better on-ground production and conservation outcomes.

At the catchment and farm scales, Moore Catchment Council (MCC) has recently (2006-current) initiated four projects to protect priority native woodland, shrubland and heathland remnants, revegetate degraded riparian and valley-floor systems, utilise saltbush pastures to mitigate wind erosion, and improve habitat and connectivity on farms for threatened and declining birds. These have been funded by the State NRM Program (regional and community groups), the Federal Government's Caring For Our Country (CFOC) Program, and private investment. In addition, MCC has recently completed or is currently working with NACC to help deliver four

other CFOC-funded erosion control, pest and weed management, and community engagement projects across Moore River catchment.

This report is an investigation of the habitat value, utilisation and management of remnant and some planted native vegetation for avian biodiversity in southern Moore River catchment. It builds on the results of an earlier, smaller study of bird use and management of revegetated natural drainage lines in the southeastern part of the catchment (InSight Ecology 2008).

1.2 Objectives

This report presents the results of baseline surveys of terrestrial and aquatic birds and their habitat conducted over two seasons in remnant and some planted native vegetation at sites in southern Moore River catchment (the "study area"). Specifically, the report aims to:

- Describe the relative abundance, species richness, and structure (using composition of foraging guilds) of bird communities present;
- Characterise bird use of habitat in native remnant and some revegetated sites;
- Discuss the conservation significance of birds recorded during the surveys;
- Identify pertinent biological conservation and natural resource management issues in the study area;
- Provide some recommendations to help protect and recover the Moore River catchment's threatened natural assets - priority native vegetation and riparian habitats - for birds and people.

2. Methods

2.1 Site selection

Familiarity with the study area (Figure 1) and land ownership patterns was established during bird surveys undertaken by InSight Ecology for previous projects in the catchment. These included the Revegetation of Natural Drainage Lines and Protection of Remnant Vegetation in the East Moore Catchment Project (2006-08) and West Koojan-Gillingarra Catchment Demonstration Initiative (CDI) (2006-09).

A total of 19 sites were selected for bird surveying across 12 farms in the study area for this project. These surveyed mostly remnant native vegetation (16 sites) and some revegetation (3 sites). Aerial photographs were supplied by MCC for each site to assist in selection of surveying routes, identification of vegetation communities, and analysis of landscape context and pattern.

Vegetation communities surveyed in remnants included eucalypt woodland – principally Wandoo, York Gum and Salmon Gum, mixed woodland/shrubland/heath, heathland, and ephemeral freshwater/brackish wetland. Table 1 shows stratification of the survey effort by site number, site and property name, remnant or revegetation status, season surveyed, vegetation type, topographic unit, and soil type/geology. No nature reserves, national parks or road reserves were surveyed during the study.

All sites selected had either already been fenced under the project or previous projects or were scheduled for imminent fencing. Both wetland sites were dry in autumn but inundated during winter and spring. Several of the sites had been separately assessed for the condition, composition and health of their remnant native vegetation, land use history, and fauna habitat types present. This was undertaken by MCC project officers in September 2010-February 2011. This information was recorded on Rivercare Site Assessment and Remnant Vegetation Site Assessment Forms and photopoints were established.

Figure 1: Location of the study area. The black line indicates the location of the project study area situated within Moore River catchment. The red stars represent the location of each of the 12 properties surveyed for birds in this project and thus broadly define the bird survey study area (southern Moore River catchment) for this project. The green-infilled areas are the Important Bird Areas that occur within southern Moore River catchment. Image: Moore Catchment Council.

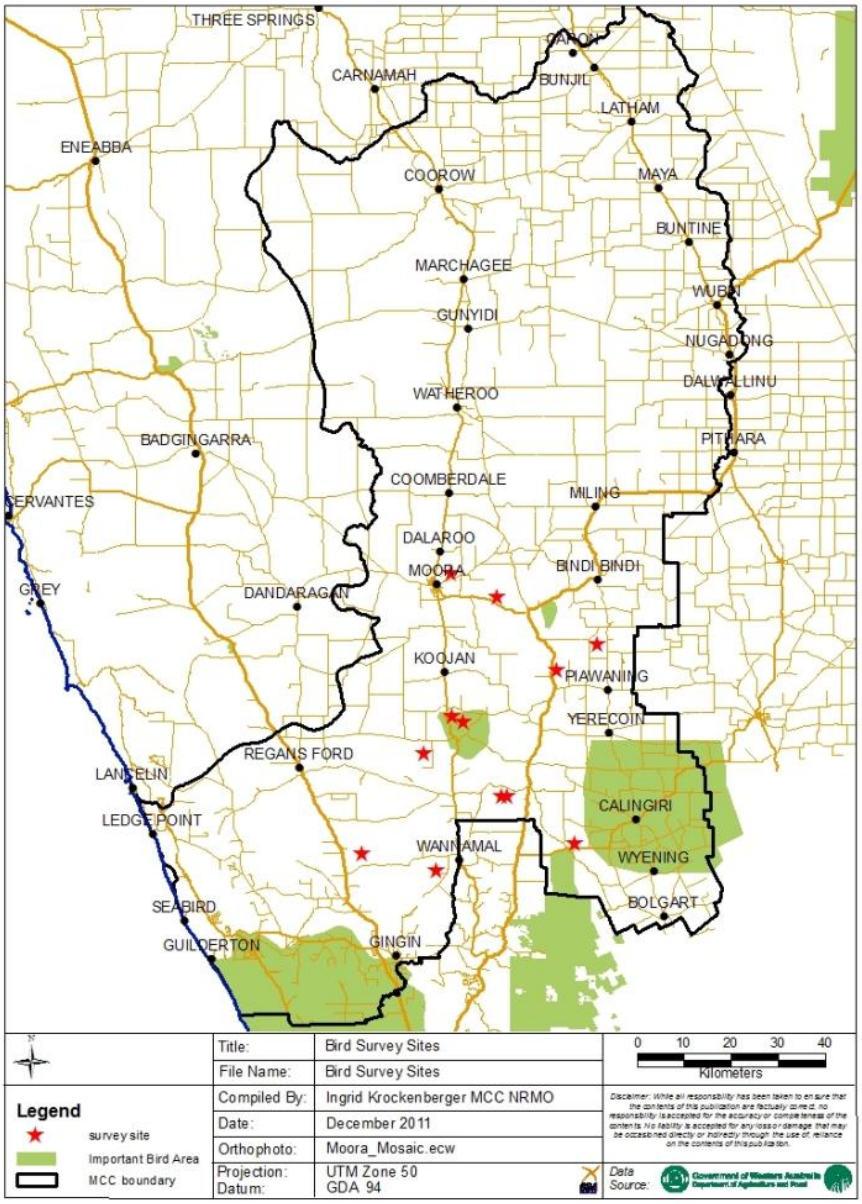


Table 1: Sites surveyed for birds in the study area. Stratification of the survey effort follows the approach used in the CDI surveys (InSight Ecology 2010). The site shown with a single asterisk was surveyed during the CDI project. Two sites (on Carrah Farms, indicated by double asterisks) were surveyed for all three projects - the revegetation of natural drainage lines (InSight Ecology 2008), CDI project, and this project.

Site no.	Site and property name	Remnant or revegetation	Seasons surveyed	Vegetation type/s	Topographic unit	Soil type/ geology
1	Mason (Carrah Farms)	remnant**	autumn & spring 2011	Wandoo-Marri woodland, Banksia-Acacia-Dryandra shrubland, heathland	ridgetop/ breakaway, upland slopes	lateritic ironstone capping with granite outcrops
2	Mason (Carrah Farms)	Revegetation Site 1**	autumn & spring 2011	mixed species plantings (5-10 yr old)	lower valley slopes, drainage line	sand
3	Mason (Carrah Farms)	Revegetation Site 2	autumn & spring 2011	Melaleuca, saltbush, Hakea (8-9 yr old)	riparian (Langwood Creek)	sand
4	Mason (Carrah Farms)	Revegetation Site 3	autumn & spring 2011	Allocasuarina-Acacia-Melaleuca-Salmon Gum plantings (8-9 yr old)	lower slopes, drainage line (Goodden Gully)	sand
5	Harridge/ Nixon (Cooinda Park/ Dalmeny Downs)	remnant	autumn & spring 2011	Wandoo woodland, no understory (grazed)	riparian	granitic loam & gravels
6	Harridge (Cooinda Park)	remnant	spring 2011	Wandoo woodland, with Dryandra, Xanthorrhoea, heathy	ridgetop/ breakaway, upland slopes	lateritic ironstone & granite
7	Hendry (Flora Downs)	remnant*	autumn & spring 2011	mixed Banksia-coastal Blackbutt-Nuytsia woodland, sandplain heath, ephemeral wetland	valley floor	deep sand
8	Botha/Jenny Kelly	remnant	autumn & spring 2011	mixed mallee, heath, Melaleuca shrubland, Wandoo woodland	major ridgeline/ breakaway	lateritic ironstone capping
9	Botha/Jenny Kelly	remnant	autumn & spring 2011	wandoo woodland, minimal understorey (past grazed)	riparian	gravel, loam, sand
10	S&E Kelly (Waalidjap)	remnant	autumn & spring 2011	sandplain heath, with coastal Blackbutt isolates	valley floor	sand
11	Slater (Margam Farm)	remnant	autumn & spring 2011	mixed remnant wetland, Melaleuca shrubland	valley floor	sand
12	Leeson (Red Gully Farm)	remnant	autumn & spring 2011	Paperbark-Marri-Banksia woodland/wetland	spring-fed riparian	sand
13	Leeson (Red Gully Farm)	remnant	spring 2011	sandplain heath-Banksia-coast Blackbutt woodland	valley floor	deep sand
14	Pearson (Sammon Hills)	remnant	autumn & spring 2011	York Gum-Wandoo woodland, past grazed	low ridgeline	lateritic ironstone/ granite
15	Pearson (Sammon Hills)	remnant	autumn & spring 2011	York Gum woodland, past grazed	riparian	sand, sandy loam
16	Scotney (Wensleydale)	remnant	autumn & spring 2011	Salmon Gum woodland, past heavily grazed	lower valley slopes	sand
17	Isbister (Homewood Farm)	remnant	autumn & spring 2011	Wandoo/York Gum woodland, past heavily grazed	valley floor, non-riparian	sand
18	Isbister (Homewood	remnant	autumn & spring 2011	York Gum/Wandoo woodland with she-oaks,	valley floor, riparian	sand

Site no.	Site and property name	Remnant or revegetation	Seasons surveyed	Vegetation type/s	Topographic unit	Soil type/ geology
	Farm)			samphire community		
19	Lefroy (Cranmore Park)	remnant	autumn 2011	York Gum-Wandoo woodland, past heavily grazed	ridgeline	lateritic/ granitic, with greenstone outcropping

2.2 Bird surveys

Most (16 or 84%) of the sites were surveyed once in each of two different seasons – autumn (1-6 May 2011) and spring (5-11 October 2011) by the same experienced ornithologist (Andrew Huggett [A.H.]). Three sites were surveyed once only in either the autumn or spring period. These were Lefroy's Wandoo-York Gum remnant (autumn), Leeson's sandplain remnant (spring), and Harridge's ridgetop remnant (spring). The latter two sites were added because of their avifaunal habitat value and remnant size. Time constraints prevented sampling of the Lefroy remnant in spring. However, other surveyed sites provided an adequate sample of upland Wandoo-York Gum woodland across the study area.

Surveys were generally conducted during periods of peak bird activity in the morning (ca 0730-1100) and afternoon (ca 1600-1830). Surveys did not occur during windy or wet weather. Each site was surveyed for 30-140 minutes by A.H. undertaking an area search (Loyn 1987; Huggett et al. 2004; InSight Ecology 2008, 2010) of habitat. This involved A.H. steadily walking a loop route in which different forward and return legs, separated where possible by a distance of at least 60 metres (to minimise the potential for recording the same bird twice), were taken through the main habitats present at each site. Where possible, an equivalent area was surveyed in both remnants and revegetation (ca 5 ha per site). Two different age-classes of revegetation were surveyed – 3-6 and 8-10 year old – on one property (Carrah Farms). Where possible, revegetation and remnant sites on Carrah Farms were surveyed during the same session, ie. during the morning or the afternoon survey periods of the same day.

All birds observed or heard at a site were recorded, including individuals flying over the site. Data recorded included the species present, number of individuals observed, date, time and location (site) of record, behaviour (ie. foraging/feeding, nesting, pursuing potential mates, courtship feeding mates, calling, mobbing, resting, flying), use of habitat, and other relevant information such as age, species composition and condition of remnants and revegetation, weather, and bird interactions (eg. predation, predator avoidance, mating). Using nomenclature consistent with Christidis and Boles (2008), these data were entered in taxonomic order into a MS Excel spreadsheet.

The standard ornithological identification reference used in the field was Pizzey and Knight (2007). Barrett et al. (2003) in conjunction with Saunders and Ingram (1995) were used to confirm reported distribution and dispersal patterns of birds, especially nomadic and seasonally migratory species. These latter two texts were consulted in addition to relevant volumes of the authoritative "Handbook of Australian, New Zealand and Antarctic Birds" (or HANZAB, various editors – see References). In addition, historical records of bird occurrence in the catchment were accessed from DEC's NatureMap species reports (4 May 2011) and RAOU (now BirdLife Australia) Checklist records held by Shane and Emma Kelly for their property.

All observations were made using a pair of Zeiss 10x40BT® binoculars fixed to a Pro-Harness® chest-strap. Aerial photographs and maps of each of the properties and the district were used to provide landscape context and assist in the selection of survey sites. A total of 1,524 photographs were taken of the survey sites and the surrounding landscape, plant communities, and bird and mammal fauna. These were taken using a Canon PowerShot SX210 IS® 14x zoom digital camera and archived in an image library using Microsoft Office Picture Manager 2007® software. Some of these images are presented in this report. All images, data and related material were stored on a standard 500GB ATA HDD backed up to a 500GB external HDD.

A total of 40.1 hours (2.1 hours per site) was spent surveying birds at sites in the study area (in May and October 2011). Of this effort, remnants were sampled for a total of 36.8 hours (2.3 hours per site, 16 sites) while 5.4 hours were spent in revegetation (1.8 hours per site, 3 sites). Slightly more time was spent surveying remnants in spring (19.1 hours) than in autumn (15.5 hours). This marked differential in survey effort between remnants and revegetation was intentional and reflected the central focus of the project. This was to protect and recover threatened natural assets of the catchment - priority remnant native vegetation and riparian habitats. Also, mostly terrestrial birds were surveyed during the study, with the exception of spring influxes of aquatic species at two ephemeral wetland sites.

Therefore, this report focuses primarily on the use and value of remnant native vegetation to terrestrial birds in the study area. More extensive sampling of the utilisation of revegetation by birds is currently being undertaken by InSight Ecology in a new MCC project - "Improving habitat and connectivity in the farming landscape for birds in the Moore River catchment". The results of this work will be reported separately in 2012.

Throughout this report the common names of birds have been used. This facilitates ease of reading and interpretation by non-ornithologists. The scientific names of these species are provided in the appendices. The location of each bird survey site is provided in Appendices 1-2.

Plates 1-26 show representative sites surveyed for birds in the study area. These reflect each of the main topographic, soil/geologic, vegetation, and bird habitat types sampled.

Plate 1: Dryandra shrubland mixed with Wandoo woodland on Mason's ridgetop remnant.

Plate 2: Wandoo woodland on breakaway, Mason's remnant, with tree hollow habitat.

Plate 3: Wandoo woodland with Xanthorrhoea ground cover, Harridge ridgetop remnant.

Plate 4: Xanthorrhoea (grass tree) provides habitat for small mammals, reptiles and birds.

Plate 5: Ridgetop heathy shrubland on Botha's (Jenny Kelly's) high quality remnant. Adenanthos in the foreground provides sticky exudate for honeyeaters and insects attracting fairy-wrens.

Plate 6: Stands of mallee (*Eucalyptus eudesmoides*) on top of Botha/Kelly's diverse remnant. Weebill, Inland Thornbill and Western Gerygone glean insects from foliage and stems.

Plate 7: Low Melaleuca heathland provide insects and dense cover for Splendid Fairy-wren to move between parts of Botha/Kelly ridgetop remnant.

Plate 8: *Eremophila* sp. in Botha/Kelly's heathy breakaway. Insects and nectar provided by this shrub were harvested by Splendid Fairy-wren and Brown Honeyeater (Ingrid Krockenberger).

Plate 9: Salmon and York Gum woodland recently fenced on Scotney's property provides many hollows for cavity-nesters such as Galah, Australian Ringneck and Striated Pardalote.

Plate 10: Active Wedge-tailed Eagle's nest in an older Salmon Gum on Scotney's property. Sometimes Zebra Finch nest in the 'under-storey' of these large structures.

Plate 11: York Gum riparian remnant on Pearson's property which provided food and nest sites for Red Wattlebird, Western Gerygone and Weebill, among others.

Plate 12: Weebills are tiny, insect-eating birds that glean the foliage and branches of trees like York Gum and Wandoo, maintaining tree health (Pearson's riparian remnant).

Plate 13: Past grazing has removed the shrub layer from this young (now fully fenced) Wandoo and York Gum stand on Isbister's property.

Plate 14: York Gum, samphire and acacias stabilise sandy banks of Moore River, Isbister's riparian remnant. A pair of Sacred Kingfishers foraged here in spring.

Plate 15: Sandplain heath remnant on S&E Kelly's property in spring – food, cover and/or nest sites for Splendid Fairy-wren, 3 honeyeater species and Silvereye.

Plate 16: Fox Banksia provided nectar for White-cheeked, Brown and Brown-headed Honeyeaters in spring, S&E Kelly's 5.4 ha sandplain remnant.

Plate 17: Hendry's remnant shrubland on sandplain in autumn. An ephemeral waterway runs through the site and will also be fenced.

Plate 18: Near the same site shown in Plate 17 transformed into an ephemeral wetland in spring. Cormorants, herons, ducks, ibis and raptors foraged and nested here.

Plate 19: Ephemeral wetland in a low drainage area on Slater's farm in spring, showing debris piles constructed to encourage waterbird nesting, especially swans.

Plate 20: Grey Teal, Australian Shelduck, Yellow-billed Spoonbill and Black Swan foraged in Slater's remnant wetland site shown in Plate 19 in spring.

Plate 21: Farm dams such as this one on Leeson's property supported breeding grebe and duck species with fringing vegetation providing refugia for their young. The spring feeding this dam also supplies the creek shown in Plate 22.

Plate 22: A perennial freshwater wetland supporting paperbark tea-tree, Banksia and old Marri provided cover, roost and nest sites for raptors, owls, honeyeaters, etc (Leeson's riparian remnant).

Plate 23: Planted Melaleuca, Acacia, eucalypts and she-oaks (8-10 year-old) provided cover, insects and nest sites for several understorey birds (Mason's Revegetation Site 1).

Plate 24: Flowering *Acacia saligna* provided good cover and food for Weebill, Western Gerygone, and Splendid Fairy-wren (8-10 year-old – Mason's Revegetation Site 1).

Plate 25: Younger (3 year-old) Melaleuca plantings across a saline riparian section at Mason's Revegetation Site 2.

Plate 26: 8-9 year-old Salmon Gum, Sheoak and wandoo plantings provided foraging sites for Red-capped Robin (Mason Reveg 3)

2.3 Data analysis

Four key attributes of bird communities were selected for analysis from data collected at each site in each treatment type (ie. revegetation or remnant) in the study area in both seasons (ie. autumn and spring 2011). These were bird relative abundance, species richness, composition of foraging guilds (as a key indicative component of bird community structure), and habitat use (e.g. foraging, nesting, roosting, feeding, mate pursuits, calling). A total of 16 replicates (or sites) of remnant native vegetation and 3 of revegetation were used in this report.

Assignment of species recorded in the surveys to foraging guilds was based on existing professional knowledge and published data, especially from HANZAB (see references). Bird use of habitat was analysed qualitatively from notes compiled during site surveying.

Bird survey data were examined for the total, mean, and standard deviation from the mean statistic for each treatment type and for the overall study area using Microsoft Excel 2007® and SigmaPlot Version 11.2® (Systat Software, Inc. 2009), with the results presented in graphical and tabular form. Survey effort was calculated according to treatment type and across the survey period.

3. Results

3.1 Relative abundance

A total of 1,796 individual birds were recorded during the surveys in the study area (see Appendices 1 and 2). Terrestrial birds accounted for most (1,683 or 93.7%) of this total with the remainder (113) being aquatic birds. Fewer land birds were recorded in remnants in spring (716) than in autumn (784) representing an 8.7% reduction between seasons (Figure 2). In autumn, 784 land birds (mean 3.98, standard deviation [sd] 4.79) occurred in remnants, compared with 93 (mean 0.45, sd 1.71) in revegetation. These totals were slightly (2.5%) lower in spring – 716 in remnants (mean 3.67, sd 4.96) and 90 (mean 0.38, sd 1.19) in revegetation.

The most abundant bird species recorded in remnant native vegetation during the surveys in the study area were Weebill (201 individuals in total – 123 in autumn and 78 in spring), Australian Ringneck (188 total – 113, 75), Brown Honeyeater (182 – 87, 95), Galah (143 – 81, 62), Splendid Fairy-wren (62 – 37, 25), Australian Raven (46 – 33, 13), and Silvereye (43 – 31, 12). It is likely that the same individuals of several more sedentary species were recorded were during both the autumn and spring surveys. The numbers of some of these species remained relatively constant between seasons, e.g. Western Thornbill, Inland Thornbill (low numbers recorded), Singing Honeyeater (low numbers), Rufous Whistler, Red-capped Robin (low numbers), and Tree Martin. These are birds associated with core woodland and shrubland habitat in good condition. In aquatic habitats the most abundant species was Grey Teal with a total of 51 individuals recorded in Slater's and Leeson's wetlands in spring following heavy winter rainfall.

The least abundant bird species recorded in remnants during the surveys were Grey Butcherbird (one individual in autumn), Spotted Pardalote (1 in spring), Pallid Cuckoo, Shining Bronze-Cuckoo, Varied Sittella, Golden Whistler, and Yellow-plumed Honeyeater (1 individual

each, in spring). Three raptors were also recorded in spring – one individual each of Australian Hobby, Swamp Harrier and Brown Goshawk. Other less abundant species during the study included Little Button-quail, Wedge-tailed Eagle, Brown Falcon, Little Crow, Carnaby's Black-Cockatoo, Inland Thornbill, Western Thornbill, Tawny-crowned Honeyeater, New Holland Honeyeater and Red-capped Robin.

Section 3.2 presents images of some of these species detected during the surveys in the study area.

3.2 Bird species richness

A total of 76 bird species was recorded during the surveys in the study area (Appendices 1 and 2). This included 61 terrestrial species and 15 aquatic species. The autumn survey of remnants recorded a total of 43 species (39 terrestrial and 4 aquatic) while the spring survey of remnants produced a total of 76 species (61 terrestrial and 15 aquatic) (Figure 3). This represented a 76.7% increase in the number of terrestrial and aquatic bird species recorded in spring relative to autumn. The number of terrestrial bird species increased by 56.4% in spring compared with autumn. Bird species richness was expectedly greater in remnants (43 in autumn – mean 3.58, sd 2.19, 76 in spring - mean 6.61, sd 3.57) than in revegetation (18 in autumn and 23 in spring), although the revegetation sample size was inordinately small relative to the remnant sample.

Figure 2: Total number of terrestrial birds recorded in remnants, May-October 2011

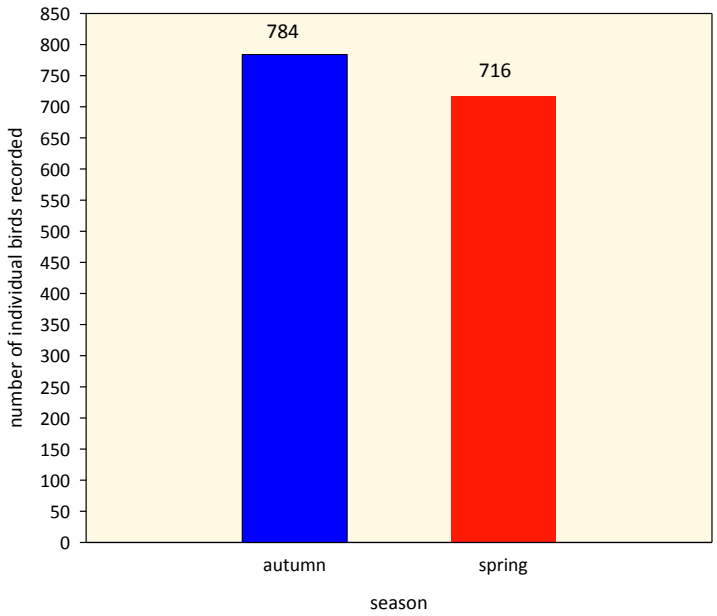
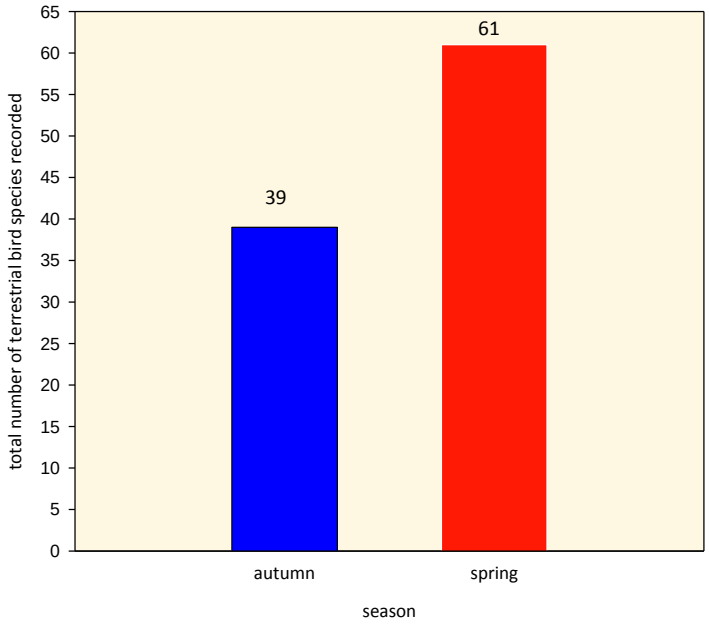


Figure 3: Total number of terrestrial bird species recorded in remnants, May-October 2011



Changes in bird species richness between the two seasons were most evident in remnants surveyed in the study area. Expectedly, spring saw a substantial influx of migratory and nomadic species. The latter group were attracted to the increased availability of nectar, insects, mates and nest sites in eucalypt woodland, shrubland, heath and ephemeral wetland habitats. Migratory terrestrial species that were sampled during spring but not in autumn included Horsfield's Bronze-Cuckoo, Shining Bronze-Cuckoo, Pallid Cuckoo, Sacred Kingfisher, Rainbow Bee-eater, Spiny-cheeked Honeyeater, Western Wattlebird, White-fronted Chat, Rufous Songlark, and Brown Songlark. Numbers of the summer breeding migrant, White-winged Triller, were higher in spring than autumn when most birds had already migrated north for winter. Conversely, land species detected in autumn but not in spring were Little Button-quail, Western Spinebill, New Holland Honeyeater, Little Crow, and White-backed Swallow. A number of cormorant, duck, ibis, spoonbill, swamphen, coot, swan, and heron species were recorded foraging and, in several cases, nesting in ephemeral wetlands in spring.

In contrast, the composition of terrestrial bird communities sampled in revegetation was generally more stable between autumn and spring. A cohort of relatively hardy or adaptive species such as Galah, Australian Ringneck, Weebill, Western Gerygone, Red Wattlebird, Brown Honeyeater, Rufous Whistler, Willie Wagtail and Silvereye exploited the food and cover resources of especially older mixed-species plantings across both seasons.

No exotic bird species were detected during the surveys in the study area. However, one native species naturalised from eastern Australia – Laughing Kookaburra – was recorded in two remnants in spring.

A suite of native species associated with larger, high quality and better connected woodland, shrubland and heathland habitats were recorded, often in low numbers, in some remnants in the study area. These were Carnaby's Black-Cockatoo, Sacred Kingfisher, Splendid Fairy-wren,

Variegated Fairy-wren, Western Thornbill, Inland Thornbill, Spiny-cheeked Honeyeater, Western Wattlebird, Tawny-crowned Honeyeater, Varied Sittella, Golden Whistler, Grey Shrike-thrush, and Red-capped Robin.

Plates 27-44 depict bird species recorded during surveys undertaken for this project in the study area.

Plate 27: Carnaby's Black-Cockatoo were recorded in one remnant in the study area in spring (Ingrid Krockenberger).

Plate 28: Yellow-billed Spoonbill was detected in Slater's ephemeral wetland in spring (en.wikipedia.org).

Plate 29: The summer breeding migrant, Horsfield's Bronze-Cuckoo, was detected attempting to parasitise an Inland Thornbill nest in Mason's 8 year-old revegetation (en.wikipedia.org from ABID).

Plate 30: Sacred Kingfisher, a hollow-nester detected in riparian remnants and along Langwood Creek (Mason Revegetation Site 2) – mostly males calling for females in spring (en.wikipedia.org).

Plate 31: Rainbow Bee-eaters had started arriving from the north during the spring survey (Greg Clancy).

Plate 32: Adult male Splendid Fairy-wren in S&E Kelly's 5.4 ha sandplain heath remnant, photographed in an isolated eucalypt.

Plate 33: Weebills are tiny canopy insectivores and the most abundant bird species recorded during the surveys (David Cook).

Plate 34: Western Gerygone – a small, partly migratory insectivore that breeds in southwest WA in summer before moving north and east in winter (Peter Head); used 6 yr+ eucalypt reveg.

Plate 35: Western Thornbills were recorded in small groups foraging along fallen branches and shrubs in larger remnants at Mason's and Harridge's (Brian Jenkins).

Plate 36: Spiny-cheeked Honeyeaters track nectar availability in Banksia woodland and shrubland, arriving in spring - recorded in Hendry's remnant (en.wikipedia.org).

Plate 37: Western Spinebill was recorded in small numbers in flowering wandoo in Harridge's and Hendry's remnants in autumn only (Tony Crittenden).

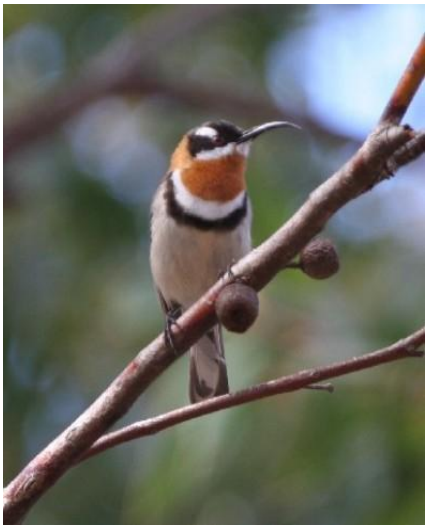


Plate 38: Tawny-crowned Honeyeater is a blossom nomad tracking flowering of eucalypts, melaleucas and other heathy shrubland plants. It was only recorded in spring-flowering Dryandra in Mason's remnant (Nevil Lazarus).

Plate 39: Varied Sittella has declined across its range in the WA wheatbelt. It forages for insects in the bark and on branches of larger eucalypt stands. One bird was recorded in the study area – in Botha/Kelly's riparian wandoo remnant in spring (B&B Wells/DEC).

Plate 40: White-winged Triller, pictured below in a paddock bordering Slater's remnant wetland in spring, is a summer breeding migrant from northern Australia. It forage for insects on the ground and in shrubs, often using dead tree branches along creeks as lookouts.

Plate 41: Rufous Whistlers (adult male shown) are a shrub insectivore and were recorded in remnant woodland and revegetation alike (B&B Wells/DEC).

Plate 42: Grey Fantails were recorded in older revegetation and woodland/ shrubland remnants, often following thornbills, fairy-wrens, and gerygones (en.wikipedia.org).

Plate 43: Red-capped Robin is a small woodland and shrubland bird that pounces on insect prey. Prefers larger remnants in good condition but can utilise 8 yr-old+ revegetation. The adult male (pictured) is much more colourful than the female.

Plate 44: Rufous Songlark is a summer breeding migrant from northern Australia. Calling males are a sound of spring. They were recorded in Mason's older revegetation and in Hendry's remnant performing aerial courtship displays.

3.3 Bird community structure and habitat

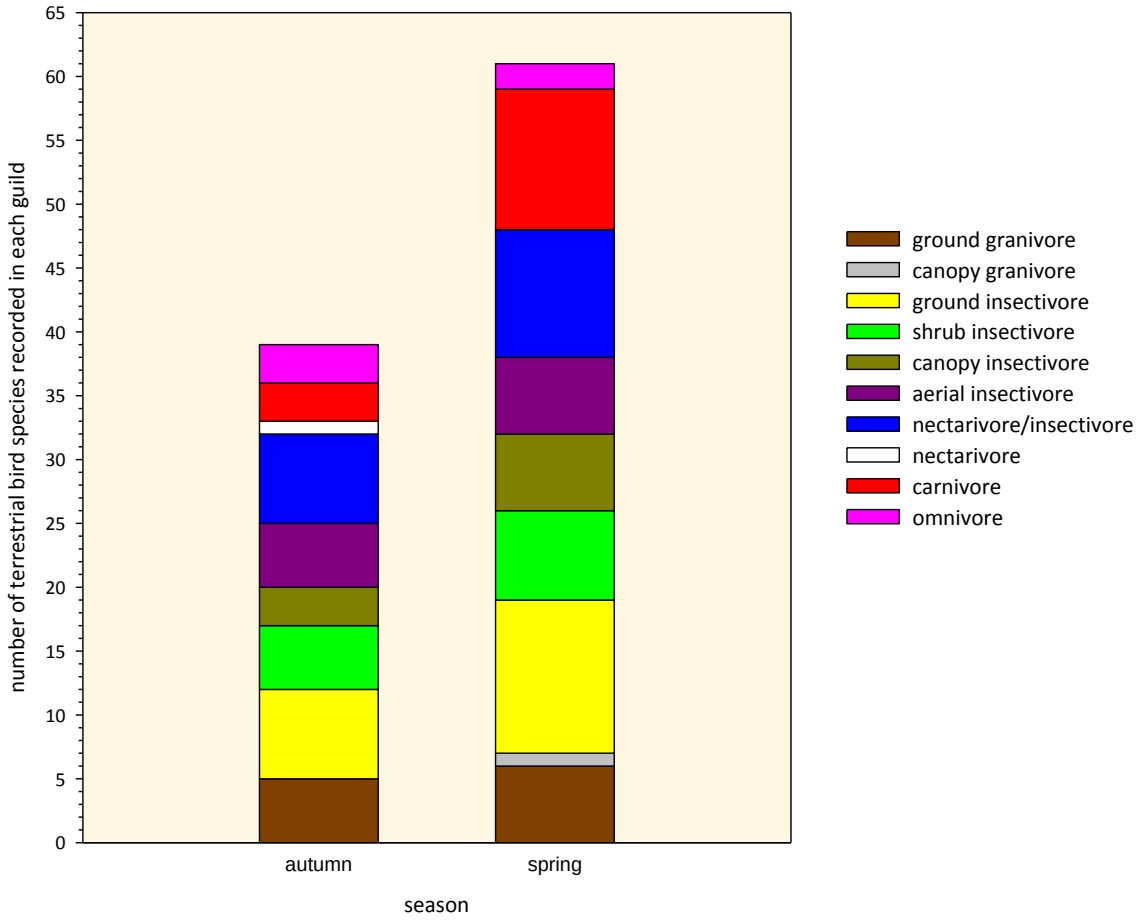
3.3.1 Composition of foraging guilds

The composition of foraging guilds is an important indicator of bird community structure (Ford 1989; Wiens 1989; Mills 2007) and, in turn, ecosystem health (Vesk and Mac Nally 2006; InSight Ecology 2008). A total of 17 foraging guilds were recorded during surveys in the study area. Ten (10) of these were terrestrial (Figure 4) and seven (7) aquatic (Appendices 1 and 2). Nine (9) terrestrial guilds occurred in autumn and in spring. Three (3) aquatic guilds were recorded in autumn and 7 in spring. All of the terrestrial guilds occurred in remnant sites while 9 terrestrial guilds were recorded in revegetation sites – the missing guild being nectarivores. No aquatic guilds were represented in revegetation sites. However, all 7 aquatic guilds occurred in

remnant sites – mostly remnant ephemeral wetland, farm dams in watercourses, and flowing creeks in spring.

The terrestrial bird community of the study area was dominated by seven (7) main foraging guilds – ground insectivores, shrub insectivores, canopy insectivores, aerial insectivores, nectarivores/insectivores, ground granivores, and carnivores (Figure 4). Ground insectivores comprised 19.7% of all land bird species recorded (remnants and revegetation) during the surveys undertaken for this study. They accounted for 17.9% (autumn, 7 species) and 19.7% (spring, 12 species) of all terrestrial bird species recorded in remnants during the surveys. In revegetation, they represented 27.8% (autumn, 18 species) and 17.4% (spring, 23 species) of all land birds recorded during the surveys. The main insectivores recorded in remnants were Splendid Fairy-wren, Variegated Fairy-wren, Yellow-rumped Thornbill, Willie Wagtail, Magpie-lark, and Red-capped Robin. A smaller subset of these insectivores – Splendid Fairy-wren, Willie Wagtail, and Red-capped Robin – and two additional species, White-winged Fairy-wren and the migratory Rufous Songlark, occurred in older revegetation.

Figure 4: Composition of terrestrial bird foraging guilds recorded in remnants, May-October 2011



Shrub insectivores accounted for 11.5% of all land bird species (in remnants and revegetation) recorded in the surveys. They included 12.8% of all land bird species recorded in remnants. Western Thornbill, Inland Thornbill, Rufous Whistler, Grey Shrike-thrush, and Grey Fantail were

the main members of this guild detected in the surveys. Spring additions were Horsfield's Bronze-Cuckoo and a vagrant Golden Whistler (in Mason's remnant). In revegetation, shrub insectivores comprised 16.7% of land bird recorded (autumn) and 17.4% (spring). Grey Fantail, Rufous Whistler and the migratory Horsfield's Bronze-Cuckoo (spring only) were the main species detected in revegetation. A partial surprise was Inland Thornbill foraging in autumn in two of Mason's older (8-10 year-old) revegetation sites.

Canopy insectivores comprised 9.8% of all terrestrial bird species (remnants and revegetation) recorded in the surveys. Member species in remnants (9.8% of all species recorded in remnants) were Weebill, Western Gerygone, and Striated Pardalote. In spring, the migratory Shining Bronze-Cuckoo was also detected (in Isbister's riparian remnant). In spring. a solitary Varied Sittella was detected foraging in Wandoo woodland at Botha/Kelly's riparian remnant site. Weebill, Western Gerygone and Shining Bronze-Cuckoo were all recorded foraging in revegetation, with 6 of the latter species detected in 8 year-old Salt River Gum and Flat-topped Yate in Mason's Revegetation Site 1.

Aerial insectivores accounted for 9.8% of all terrestrial bird species (remnants and revegetation) recorded in the surveys. Member species in remnants (9.8% of all species recorded in remnants) were Black-faced Cuckoo-shrike, Welcome Swallow, Tree Martin and the migratory Rainbow Bee-eater and White-winged Triller. Only one aerial insectivore (White-winged Triller) was recorded in revegetation.

Nectarivores/insectivores represented 18% of all terrestrial bird species (remnants and revegetation) surveyed in the study. They were recorded substantially more in remnants (7 species in autumn, 10 in spring – total 16.4%) than in revegetation (4, 3). Members that were recorded in remnants but not in revegetation included blossom/seasonal nomads (Western Wattlebird, Tawny-crowned, Yellow-plumed, and Spiny-cheeked Honeyeaters), a resident (Yellow-throated Miner), a partial seasonal migrant (Brown-headed Honeyeater), and an autumn-winter disperser (New Holland Honeyeater). Most of the nomadic and migratory honeyeaters were present in spring but not autumn, reflecting greater availability of nectar and insects. A smaller cohort of honeyeaters was found in 8-10 year-old revegetation in both seasons – the sedentary Singing Honeyeater and Brown Honeyeater and the partial seasonal migrant (part of the population moves to the coast and up north in autumn) Red Wattlebird. The seasonally dispersive White-cheeked Honeyeater was recorded in Mason's Revegetation Site 2 in autumn.

Nectarivores were represented by only one species – Western Spinebill – and only in autumn. These birds occurred in flowering Wandoo in Harridge/Nixon's riparian remnant, Botha/Kelly's ridgetop remnant mallee heath, and Hendry's sandplain heath.

Ground granivores comprised 9.8% of all terrestrial bird species (remnants and revegetation) recorded in the surveys. Member species in remnants (12.8% of all species recorded in remnants) were Common Bronzewing, Crested Pigeon, Little Button-quail, Galah, Long-billed Corella, Little Corella, and Australian Ringneck. Of these, only the Crested Pigeon and Little Button-quail were not detected in revegetation. A canopy granivore – Carnaby's Black Cockatoo which is a nationally threatened species was recorded in two remnants and one older revegetation site.

Carnivores accounted for 18% of all terrestrial bird species recorded in the surveys. There was a spring influx of carnivores into remnants resulting in 8 more member species being recorded in spring than autumn. Carnivores included Grey Butcherbird, Pied Butcherbird, Australian Magpie, Laughing Kookaburra, the summer migrant Sacred Kingfisher, and six raptor species including Wedge-tailed Eagle, Brown Falcon and Australian Hobby. Only Nankeen Kestrel and Australian Magpie were detected in revegetation.

Three omnivores were recorded in the surveys – Australian Raven, Little Crow (autumn only), and the partial nomad Silvereye (race *gouldi*). They comprised 4.9% of the terrestrial bird fauna sampled in the surveys. The latter species was the only omnivore that also utilised revegetation – Mason's 8-10 year-old sites 1 and 3. Silvereyes were present in greater number in autumn than spring, probably moving north for the approaching winter from coastal districts to the south.

Seven (7) aquatic guilds were recorded during the surveys in the study area and all in remnants. Together they accounted for 19.7% of all bird species recorded in the surveys. Three (3) of these guilds were detected in autumn while all 7 guilds were represented in the spring sample, following substantial winter rainfall in the area. These guilds and their member species were aquatic herbivore/insectivore (Australian Shelduck), aquatic herbivore (Australian Wood Duck, Grey Teal, Black Swan, Purple Swamphen, Eurasian Coot), aquatic omnivore (Pacific Black Duck, Australasian Grebe), aquatic insectivore (Straw-necked Ibis, Yellow-billed Spoonbill), aquatic molluscivore/insectivore (Black-fronted Dotterel), aquatic/terrestrial insectivore (White-necked Heron, White-faced Heron), and piscivore (Little Black Cormorant, Pied Cormorant). Most of these species were recorded foraging and/or breeding in two ephemeral wetlands, one on Slater's farm and the other on Hendry's property. A spring-fed dam in the headwaters of a perennial freshwater creek on Leeson's property (Leeson's riparian remnant site) also provided foraging and nesting habitat for Australian Wood Duck, Grey Teal, and Australasian Grebe.

Eight (8) of the ten (10) terrestrial bird foraging guilds recorded marked changes in their composition between the autumn and spring surveys. These were carnivores (266.7% increase in spring relative to autumn), canopy insectivores and canopy granivores (100% increase each in spring), ground insectivores (50% increase in spring), nectarivores/insectivores (42.8% increase in spring), and omnivores (33.3% decrease in spring). Most of these interseasonal changes were observed in remnants rather than revegetation, with the exception being ground granivores and canopy insectivores (50% increase each in spring). Section 4.2.3 discusses some possible reasons for these changes.

3.3.2 Bird habitats and their utilisation

A range of terrestrial and aquatic habitats were utilised by birds at surveyed sites in the study area. Remnants provided a wider suite of foraging, roosting, nesting and refuge habitats for birds than did the structurally simpler and floristically less diverse revegetation. These included ground substrates (rocky outcrops, fallen decaying logs, leaf, bark and branch debris), ground-covering vegetation (vines, prostrate and low shrubs, herbs and grasses), understorey plants (epacridaceous, myrtaceous and proteaceous shrubs, grass-trees Xanthorrhoea spp. and tall

grasses), and canopy trees such as Coastal Blackbutt *Eucalyptus todtiana*, Wandoo *E. wandoo*, York Gum *E. loxophleba*, Salmon Gum *E. salmonophloia*, Marri *Corymbia calophylla*, River Red Gum *E. camaldulensis*, Acorn Banksia *Banksia prionotes*, Slender-leaved Banksia *B. leptophylla*, Fox Banksia *B. sphaerocarpa* var *sphaerocarpa*, WA Christmas Tree *Nuytsia grandiflora*, Rock She-oak *Allocasuarina heugeliana*, Swamp She-oak *Casuarina obesa*, and various Acacia and Melaleuca species. All remnants surveyed other than Shane & Emma Kelly's and Nick Scotney's also provided aquatic habitats, including flowing creeks/rivers, farm dams, ephemeral freshwater/brackish wetlands, and temporally inundated paddocks.

These broad habitat types offered a suite of different classes of microhabitat and key resources for birds in the surveyed remnants. Hollows in the branches and trunks of Wandoo, Marri, York Gum, and Salmon Gum offered nest and shelter sites for Carnaby's Black-Cockatoo, Australian Ringneck, Long-billed Corella, Little Corella, Galah, Wedge-tailed Eagle, Sacred Kingfisher, Laughing Kookaburra, and Tree Martin. The dead outer branches of Coastal Blackbutt, York Gum, and Wandoo provided perches for aerial insectivores (Rainbow Bee-eater, Black-faced Cuckoo-shrike and White-winged Triller) and carnivores (e.g. Brown Goshawk, Wedge-tailed Eagle and Grey Butcherbird) to launch their pursuits of prey. Exfoliating bark on tree trunks and wedged in tree branch apices were searched for spiders and other invertebrates by Varied Sittella, Grey Shrike-thrush, Rufous Whistler, Red Wattlebird and Weebill. The surfaces of leaves and branchlets in Wandoo, Marri, York Gum, Salmon Gum, Coastal Blackbutt and Banksia canopies were searched for lerps and other insects by Western Gerygone, Weebill, Striated Pardalote, Singing Honeyeater and Rufous Whistler. Sugary exudates from eucalypt branches and trunks were harvested by Singing Honeyeater, Red Wattlebird and Western Wattlebird. Dense foliage also provided concealment for an ambush predator, the Brown Goshawk and nest sites for Australian Raven, Magpie-lark, Australian Magpie, Nankeen Kestrel and White-faced Heron.

The floristically diverse shrubland and heathland remnants provided insects and copious amounts of nectar from spring/autumn-flowering Banksia, Dryandra, Hakea, Melaleuca, Adenanthos, Calothamnus, Xanthorrhoea, Petrophile, Verticordia, *Eremaea pauciflora* and other proteaceous, myrtaceous and epacridaceous plants at sites on the Botha/Kelly, Hendry, Leeson (sandplain shrubland), Shane and Emma Kelly, and Harridge (ridgetop) sites. Sedentary, seasonally nomadic, and part-migratory honeyeaters foraged heavily in these habitats – Brown Honeyeater, Red wattlebird, Western Wattlebird, and Spiny-cheeked Honeyeater were key examples. Ground insectivores (Variegated Fairy-wren, Splendid Fairy-wren and occasionally White-winged Fairy-wren) took ants, flies, small wasps and moths attracted to these nectar-rich habitats. Red Wattlebird, Western Wattlebird and Spiny-cheeked Honeyeater maintained feeding territories around mature *Banksia menziesii* and *B. prionotes* stands in remnants at Hendry's, Botha/Kelly's, and Leeson's (sandplain shrubland) sites. Shrub insectivores (Western Thornbill, Inland Thornbill, Grey Fantail and Rufous Whistler) foraged in dense clumps of Broombush, Dryandra, Rock She-oak, and Acacia on rocky ridges at Mason's, Harridge's (ridgetop), and Botha/Kelly's remnants.

A suite of ground cover microhabitats provided food, shelter, and breeding resources for birds in the remnants. These included low shrubs, vines, grasses, rocky outcrops, fallen rotting logs and branches, and leaf and bark debris. Ground-foraging insectivores (Red-capped Robin, Variegated Fairy-wren, Splendid Fairy-wren, Yellow-rumped Thornbill) and ground granivores

(Common Bronzewing, Crested Pigeon, Little Button-quail, Australian Ringneck) foraged, and in some instances bred, in these microhabitats.

Microhabitats for a range of aquatic birds were provided by water bodies within surveyed remnants including stagnant and flowing open water, mud and sand flats along creeks and dam margins, reedbeds and shrubby fringes of rivers and dams, shallow pooled water in paddocks drains, and dead trees in freshwater/brackish wetlands. Pied Cormorant, White-faced Heron, Straw-necked Ibis, Purple Swamphen and Eurasian Coot foraged and probably nested in Hendry's ephemeral wetland. Its dense Melaleuca and Leptospermum shrubland fringe also provided a diversity of nesting opportunities for several terrestrial bird species. Standing dead trees in this wetland provided perches for White-faced Heron and Pied Cormorant. Slater's ephemeral wetland supported flocks of Grey Teal, Australian Shelduck and Straw-necked Ibis, together with small numbers of Black Swan, Yellow-billed Spoonbill, White-necked Heron and Black-fronted Dotterel – the latter along muddy shorelines.

Revegetation sites surveyed in the study area were confined to Mason's property, Carrah Farms. These sites provided a narrower suite of habitats and microhabitats for avifauna than those available in the remnants. Older (8-10 year) plantings of 3-9 rows (sampled sections of planted zones 20-80 m wide, 400-600 m long) of predominantly Salt River Gum, Flat-topped Yate, River Red Gum, Marri, Allocasuarina, Melaleuca and Acacia provided some ground cover (fallen leaf and bark debris), occasionally a basic shrub layer, and canopy foliage. These plantings occurred on the floors and slopes of shallow sandy valleys and targeted saline riparian zones and gullies. Some younger (3-5 year) plantings of *Melaleuca thyoides*, *M. uncinata*, *M. hamulosa*, *Hakea recurva*, and *Acacia saligna* were also surveyed for birds within these sites.

Habitat and microhabitat types present at the revegetated sites and examples of bird species likely to utilise these habitats included:

- Airspace above revegetation (Welcome Swallow, Black-faced Cuckoo-shrike);
- Fencelines along revegetation-paddock edges (Willie Wagtail, Red-capped Robin, Brown Songlark, Rufous Songlark, Australasian Pipit);
- Overhead powerlines, poles and windmills (Nankeen Kestrel, Galah, Australian Ringneck, Black-faced Woodswallow, Australian Magpie, Australian Raven, Welcome Swallow);
- Open ground under planted vegetation providing some leaf and bark litter, seeds and invertebrates (Common Bronzewing, Galah, Splendid Fairy-wren, White-winged Fairy-wren, Yellow-rumped Thornbill, Red-capped Robin, Australian Magpie, Willie Wagtail, Australian Raven, Magpie-lark, Australasian Pipit);
- Shrub and canopy foliage and bark/stem substrates providing leaf and bark insects, nectar, and fruit – older plantings (Western Gerygone, Striated Pardalote, Weebill, Grey Fantail, Rufous Whistler, Singing Honeyeater, Brown Honeyeater, Red Wattlebird, Silvereye) and younger plantings (Weebill, Western Gerygone, Brown Honeyeater, Grey Fantail);
- Creek/rivers, farm dams, vegetated dam margins, wetlands with standing dead trees, and pooled water in paddocks (species as listed above).

3.4 Breeding activity

A total of 118 individual records of breeding activity were obtained for 47 bird species surveyed in the study area (39 terrestrial and 8 aquatic species – Appendices 1 and 2). This represented 61.8% of the total bird community sampled during the surveys and 63.9% of all terrestrial bird species surveyed. Thirty-nine (83%) of these records related to terrestrial bird species while 8 (17%) were for aquatic bird species. Remnants accounted for forty-five (95.7%) of these records with the residual (2 records or 4.2%) breeding observations being made in revegetation. In species terms therefore, 45 species or 95.7% of all birds that were recorded breeding in the study area did so in remnants.

Direct evidence of breeding activity accounted for 52 records across 27 species – 50 records (26 species) in remnants and 2 records (in revegetation) or 44.1% of all breeding bird records obtained during the surveys. These involved observations of birds constructing nests, incubating eggs, carrying food en route to nests, searching for nests to parasitise (ie. bronze-cuckoos and thornbill nests), feeding nestlings or fledglings, decoy behaviour (ie. adults faking broken wings to draw the surveyor away from recently fledged young usually secreted in nearby dense vegetation – commonly used by Red-capped Robin, for example). In remnants, these included obligate hollow-nesters (Carnaby's Black-Cockatoo, Galah, Long-billed Corella, Australian Ringneck, Sacred Kingfisher and Laughing Kookaburra), a stick platform nester (Australian Magpie) and mud-nester (Magpie-lark), small canopy (Weebill) and shrub nesters (Inland Thornbill, Silvereye), small open-cup (Red-capped Robin, Willie-Wagtail) and dome (Inland Thornbill) nesting ground and shrub insectivores, and ground or near-ground dome nesting insectivores (Splendid Fairy-wren, Variegated Fairy-wren). In revegetation, only two shrub nesters (Inland Thornbill and Brown Honeyeater) were detected.

There was ample indirect evidence of bird breeding activity at the surveyed sites with 63 records obtained (26 species or 53.4% of all breeding records) - 52 (24 species) in remnants and 11 (10 species) in revegetation. These involved observations of breeding territory defence (including calling), mate pursuits, copulation, pair protection and maintenance (ie. allo-preening, pursuit and expulsion of rival males), courtship provisioning (ie. males feeding females to enhance the female's breeding condition), and courtship display. Indirect records of breeding birds in remnants encompassed ground/near-ground nesters (3 species of fairy-wrens), shrub insectivores (Western Thornbill, Inland Thornbill), honeyeaters (Brown, Singing, Spiny-cheeked Honeyeaters, Red Wattlebird, Western Wattlebird), and a migratory aerial insectivore (White-winged Triller). In revegetation, one ground/near-ground nester (White-winged Fairy-wren), two canopy insectivores (Weebill, Western Gerygone), three shrub nesters (Rufous Whistler, Grey Fantail, White-fronted Chat), two honeyeaters (Red Wattlebird and Brown Honeyeater), a nest parasite (Horsfield's Bronze-cuckoo), and Silvereye were indirectly observed engaging in breeding activity. This activity was only recorded in older (8-10 year) revegetation.

3.5 Birds of conservation significance

The study area occurs within Southwest Australia, a region recognised internationally as Endemic Bird Area No. 186 (BirdLife International 2003), a 'Global 200' Ecoregion (WWF 2006),

and as an international biodiversity hotspot – the only terrestrial hotspot in Australia and among only 34 worldwide (Conservation International [CI] 2007). This recognition is based on the region's critical priority for conservation, given that it supports 2,948 endemic plant species, 80% of which are found nowhere else in the world, 3 endemic threatened (ET) birds, 6 ET mammals, and 3 ET amphibians (CI 2007). The region is also recognised as having undergone major habitat loss and fragmentation, losing at least 70% of its original habitat extent (CI 2007).

The study area also occurs within four Important Bird Areas (IBAs) in Western Australia – Moora, Walebing, Calingiri and Gillingarra. These are sites that are recognised as internationally important for bird conservation (Dutson et al 2009). Each of these IBAs has been nominated on the basis of supporting known populations of south-west endemic bird species. These include breeding areas in the wheatbelt for the nationally endangered Carnaby's Black-Cockatoo (Dutson et al 2009).

Thirty-eight (38) bird species of global, national, state or local conservation significance have been recorded, could be reasonably expected to occur in suitable habitat, or have gone extinct in the WA wheatbelt and/or study area (Table 2). Their current conservation status is also indicated. Sixteen (16) of these species are of conservation significance at national and state levels. The remaining 22 species are locally significant because they may be experiencing substantial declines in population size and contractions in distributional range as their core habitats become smaller, more fragmented and thus isolated, and of poorer condition or other factors such as culling and other threats are important.

Table 2: The conservation status of significant terrestrial and terrestrial-aquatic bird taxa of wheatbelt habitats in Western Australia. Global status follows IUCN (2001, 2006) and refers to the status of the species not subspecies. National status observes Garnett and Crowley (2000) while status in WA is based on HANZAB (1990-2006). Status in WA wheatbelt follows Serventy and Whittell (1976), Saunders and Ingram (1995), Barrett et al (2003), and Huggett et al (2004). Status in the study area is based on data from HANZAB (1990-2006) and results of the current survey. LC=Least Concern, NT=Near Threatened, EN=Endangered, V=Vulnerable, EX=Extinct (likely), U=Unknown status (data deficient), ADL=At or near distributional limit of species or race. The superscripts after common names indicate that the species was recorded during surveys conducted by InSight Ecology for this or previous projects in the area[1], or by local farmers or bird observers in recent years[2]. Note that Wedge-tailed Eagle numbers have historically declined across the wheatbelt in response to culling by landholders. In the absence of new targeted surveys in the study area their current status remains uncertain despite anecdotal claims that numbers are increasing.

Common name	**Scientific name**	**Global status**	**National status**	**Status in WA**	**Status in WA wheatbelt**	**Likely status in study area**
Birds of global, national and/or state conservation significance						
Malleefowl	*Leipoa ocellata*	V	V	V	V	U
Brush Bronzewing[1]	*Phaps elegans*	LC	LC	NT?	U	U
Australian Little Bittern	*Ixobrychus dubius*	LC	NT	NT	NT	EX
Australian Bustard	*Ardeotis australis*	NT	NT	NT	V	U
Bush Stone-curlew	*Burhinus grallarius*	NT	NT	NT	V	EX

Common name	Scientific name	Global status	National status	Status in WA	Status in WA wheatbelt	Likely status in study area
Hooded Plover (western)	*Thinornis rubricollis* race *tregellasi*	NT	NT	NT	NT	U, ADL
Red-tailed Black-Cockatoo (south-western)	*Calyptorhynchus banksii* race *naso*	NT	NT	NT	NT	EX?
Carnaby's Black-Cockatoo[1,2]	*Calyptorhynchus latirostris*	EN	EN	EN	EN	EN
Western Corella (southern)	*Cacatua pastinator* race *pastinator*	EN	EN	EN	EN	EN, ADL
Western Rosella (wheatbelt)	*Platycercus icterotis* race *xanthogenys*	NT	NT	NT	NT	EX
Barking Owl (southern – WA sub-population)	*Ninox connivens connivens*	LC	NT	NT	U	U, ADL
Masked Owl (southern Australia)	*Tyto novaehollandiae* race *novaehollandiae*	LC	NT	NT	U	U, ADL
Rufous Fieldwren (western wheatbelt)	*Calamanthus campestris* race *montanellus*	NT	NT	NT	V	U
Western Yellow Robin[2]	*Eopsaltria griseogularis*	LC	LC	NT	NT	U, ADL
Crested Shrike-tit (western)	*Falcunculus frontalis* race *leucogaster*	NT	NT	NT	NT	EX
Southern Scrub-robin[2]	*Drymodes brunneopygia*	LC	LC	LC	NT	U, ADL
Birds of local conservation significance (Moora-Gillingarra-Calingiri-New Norcia district)*						
Wedge-tailed Eagle[1]	*Aquila audax*	LC	LC	LC	U	U
Purple Swamphen[1]	*Porphyrio porphyrio*	LC	LC	LC	LC	LC, ADL
Little Button-quail[1]	*Turnix velox*	LC	LC	LC	LC	LC
Regent Parrot (western)[2]	*Polytelis anthopeplus* race *anthopeplus*	LC	LC	LC	LC	U
Red-capped Parrot[1,2]	*Purpureicephalus spurius*	LC	LC	LC	NT	NT, ADL
Splendid Fairy-wren[1,2]	*Malurus splendens*	LC	LC	LC	LC	LC
Variegated Fairy-wren[1]	*Malurus lamberti* race *assimilis*	LC	LC	LC	LC	LC, ADL
Southern Emu-wren[1]	*Stipiturus malachurus*	LC	LC	V	EN	EN, ADL
White-browed Scrubwren[1]	*Sericornis frontalis* race *maculatus*	LC	LC	LC	LC	U, ADL
Western Gerygone[1,2]	*Gerygone fusca*	LC	LC	LC	LC	LC
Western Thornbill[1,2]	*Acanthiza inornata*	LC	LC	LC	LC	LC, ADL
Inland Thornbill[1,2]	*Acanthiza apicalis*	LC	LC	LC	LC	LC
Western Spinebill[1,2]	*Acanthorhynchus superciliosus*	LC	LC	LC	LC	LC, ADL
White-eared Honeyeater[1]	*Lichenostomus leucotis*	LC	LC	LC	NT	NT, ADL
Brown-headed	*Melithreptus*	LC	LC	LC	LC	NT, ADL

Common name	Scientific name	Global status	National status	Status in WA	Status in WA wheatbelt	Likely status in study area
Honeyeater[1,2]	*brevirostris* race *leucogenys*					
New Holland Honeyeater[1,2]	*Phylidonyris novaehollandiae*	LC	LC	LC	LC	LC, ADL
White-browed Babbler[2]	*Pomatostomus superciliosus*	LC	LC	LC	NT	U, ADL
Varied Sittella[1]	*Daphoenositta chrysoptera* race *pileata*	LC	LC	LC	LC	NT
Golden Whistler[1]	*Pachycephala pectoralis*	LC	LC	LC	LC	LC
Jacky Winter[1]	*Microeca fascinans*	LC	LC	LC	NT	NT
Grey Shrike-thrush[1,2]	*Colluricincla harmonica*	LC	LC	LC	LC	LC
Scarlet Robin[1]	*Petroica boodang*	LC	LC	LC	NT	NT, ADL

*These species are in addition to birds of global, national, and state significance that have been recorded or may occur in the study area and which are listed above.

The bird species of highest conservation value observed during the study was Carnaby's Black-Cockatoo, detected in two Wandoo ridgetop remnants and flying over older revegetation in spring. This species is listed under Schedule 2 (Fauna that is rare or likely to become extinct) of the WA Government's Wildlife Conservation Act 1950 and the Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2). It is listed as "Endangered" under international classificatory (IUCN Red List of Threatened Species 2001, 2006) and national legislative (Environment Protection and Biodiversity Conservation Act 1999) systems. Carnaby's Black-Cockatoo has been the subject of a successful ongoing WWF-BirdLife Australia-community conservation initiative in the study area and across other parts of its range, including in part of its non-breeding range on the Swan Coastal Plain (see Dutson et al 2009).

Two other species of high global and national conservation significance could be expected to occur or may have historically occurred in the study area but were not recorded during the study. They are the Western Corella and Malleefowl – there are anecdotal reports of Malleefowl presence on some farms in and near the study area over the past decade. The conservation status of seven other species that might still occur in the study area but were not recorded during the surveys was indeterminable due to a lack of data. These included Australian Bustard, two owls (Barking and Masked), and three declining ground insectivores (Rufous Fieldwren, Western Yellow Robin, Southern Scrub-robin). One individual Southern Scrub-robin was recorded by Donna Rayner currently of Mingenew-Irwin Group in 2007 along the Moore River at Mogumber Farm. This site was re-surveyed by InSight Ecology as part of the CDI Project in April and October 2009 but no scrub-robins were detected (see InSight Ecology 2010).

Fourteen (14) of the 22 species of local conservation significance were recorded during the study. These included 2 ground insectivores (Splendid Fairy-wren, Variegated Fairy-wren), 4 shrub insectivores (Western Thornbill, Inland Thornbill, Golden Whistler, Grey Shrike-thrush), 3 remnant-only honeyeaters (Western Spinebill, New Holland Honeyeater, Brown-headed

Honeyeater), 2 canopy insectivores (Western Gerygone, Varied Sittella), a ground granivore (Little Button-quail), one carnivore (Wedge-tailed Eagle), and an aquatic herbivore (Purple Swamphen). Remnant heathland, shrubland, woodland, wetland, and riparian zones provided key habitats for these species in the study area. The local conservation status of two other species – Regent Parrot and White-browed Babbler – was indeterminable due to a lack of data. The study area is close to the south-western tip of the White-browed Babbler's range, although historical records for this species exist in the area.

4. Discussion

4.1 Landscape context and effects

The human ecological footprint on the woodland, shrubland and heathland ecosystems of the Western Australian wheatbelt has been particularly heavy and wide-reaching. In many districts less than 10% of the original native vegetation cover remains. In the central wheatbelt, only 2 to 5% of the original native vegetation remains (Frost et al. 1999). This ranks these ecosystems and their remnant fauna among some of the most fragmented and threatened in the world (Saunders and Ingram 1995; DEC 2008; InSight Ecology 2008; Laurance et al 2011).

Significantly, the Moora-Calingiri-Gillingarra-New Norcia landscape supports about 30% of its original native vegetation cover. Most of this vegetation occurs along lateritic ironstone or granitic hills and ridges such as at Carrah Farms and on Botha/Kelly's property, Harridge's and Lefroy's farms, and along perennial streams such as Moore River and its tributaries. The degree of habitat connectivity varies across this landscape in response to past patterns of clearance and associated occurrence of arable, accessible land along the sandy valley slopes and floors. Some larger upland patches of remnant woodland and shrubland are linked to adjacent drainage lines via midslope and lowland woodland and shrubland strips or small uncleared blocks such as on Carrah Farms at Calingiri and around Gillingarra (Plates 45-46). Elsewhere in the district, however, remnant native vegetation of the lower valley slopes and especially the valley floor is often poorly connected to adjacent upland woodland patches, usually only by narrow strips of York Gum and Wandoo stands along creeks (Plate 47). In other places, these patches are effectively islands surrounded by pastures and crops and often grazed by livestock (Plate 48). Despite this, several significant blocks of mixed sandplain heathland, shrubland, Banksia and Coastal Blackbutt woodland, and wetland still occur such as at Hendry's, Leeson's, Slater's and Isbister's sites. Together with the ridgetop woodlands and shrubland/heathland, these are the true ecological gems of the local farming landscape. Their preservation and protection of habitat condition is paramount (see Section 5). Several of these sites have been recently fenced under this project.

The potential for the long-term ecological recovery of this landscape is therefore higher than in the more cleared and degraded northern and central WA wheatbelt districts where only 2-12% of native vegetation remains (Huggett et al 2004). The condition and spatial arrangement of remnant native vegetation in the study area also contributes to this more positive local outlook for ecological restoration. A third prominent factor in this prognosis is the supplementary habitat contribution of planted vegetation, especially to help link and widen remnant patches across topographic units (ie. ridges to valley floors and drainage lines) and establish new habitat 'building blocks'.

Plate 45: Local habitat connectivity is relatively high on Carrah Farms, for example, where a 68 ha ridgetop wandoo remnant connects with other ridgeline remnants to the north and south via a network of riparian plantings (May 2011).

Plate 46: 'Stepping stones' of Dryandra and mallee heath on Brian Kelly's ridgeline, York Gum and Wandoo woodland midslope remnants, and riparian woodland present key building blocks for improving habitat connectivity around Gillingarra (April 2009).

Plate 47: Narrow strips of unfenced York Gum woodland provide a lower level of habitat connectivity with upper slope and ridgeline remnants in this West Gillingarra landscape.

Plate 48: 'Islands' of remnant heathland are disconnected from other remnant heathland in this landscape at Bundarra Nature Reserve, Gillingarra West (May 2009).

The study area also occurs within a regional landscape characterised by decreasing intensification of land use along a gradient from west (urban) to east (wheat farming and grazing). The rapidly urbanising Swan Coastal Plain lies to the west and contrasts strongly, in terms of the amount, extent and configuration of remnant native vegetation, with central wheatbelt districts to the east. These land uses and their proximity, at a landscape scale, to the study area, influence the occurrence and composition of bird assemblages and their movement into and out of the area.

Importantly, the study area provides key life cycle resources including refugia such as ironstone and granite outcrops, sandplain heath and shrublands, and Wandoo/York Gum/Salmon Gum woodlands for conservation-reliant bird and other fauna species (e.g. critical weight range mammals) that are no longer available or are much less available in the adjoining urban and central wheatbelt landscapes. The location of the study area adjacent to a centre of narrow

endemism between Gingin and New Norcia (Williams and Mitchell 2001) supports this assertion. This is an area containing concentrations of locally endemic plant and animal species, that is, species with ranges of less than 100 km (Williams and Mitchell 2001). Concentrations of locally endemic species are often indicative of higher quality of habitat and diversity of available ecological niches in a particular area, relative to other neighbouring areas (Keighery et al. 2004, InSight Ecology 2009).

4.2 Bird assemblages of the study area

4.2.1 Landscape and habitat attributes

Bird assemblages of the Moora-Gillingarra-Calingiri-New Norcia district reflect the nature of the landscape within which they occur and the influence of their neighbouring regional landscapes (Section 4.1). Specifically, these bird communities have evolved in response to the type, amount, condition, connectivity, spatial arrangement, floristic composition, and structural complexity of habitats available in remnant and planted vegetation at different spatial and temporal scales. Other factors such as the pattern and timing of historical land clearance, fire regimes, and climate change are also implicated.

At the site scale, small variation in the quality, extent, spatial arrangement, floristic composition and structural characteristics of habitats help determine the abundance, diversity and richness of bird assemblages present. Coupled with anthropogenic factors such as degree of physical disturbance - from livestock grazing, removal of understorey and ground cover, fire, logging, firewood collection, pest plant and animal incursion, dieback (*Phytophthora*), and vegetation clearance for road widening and boundary adjustments, these influences shape the type of bird (and other fauna) communities present in the catchment today.

Interspecific differences in the way bird species are able to use their habitat and respond to change in the quality and seasonal availability of these resources also help determine the composition of the bird fauna of the study area. There are even differences between individual birds of the same species that can affect their ability to persist and reproduce in modified habitats and landscapes. These reflect age and genetic factors, e.g. young birds require experience over time to know their habitat – where to find food, shelter, mates and how to recognise, avoid or repel potential predators, competitors and nest parasites.

Within the context of the Southwest Australia Ecoregion, bird assemblages of the study area are likely to be less taxonomically and functionally rich than those of more extensive and contiguous woodland and shrubland communities along the Darling Range and to the southeast (e.g. Great Western Woodlands) and south (e.g. Fitzgerald Biosphere Reserve/Gondwana Link). This reflects the degree of loss, fragmentation and modification of remnant native vegetation that has occurred in the Moora-Gillingarra-Calingiri-New Norcia district since European settlement. Some evidence for this exists in the relatively low number of core (interior) woodland, shrubland and heathland bird species that were recorded in the study area's remnants – 17 species from 7 foraging guilds. Three of these guilds were represented by only one or two member species which may indicate a taxonomically depauperate bird fauna. The

risk that this might be due to inadequate sampling was substantially minimised by surveying sites thoroughly over two different seasons.

4.2.2 Trajectories of potential change in bird communities

Changes over time and space in the variables that shape bird communities in the study area may be implicated in potential fluxes in the conservation status of bird species and communities in the study area. Trajectories of potential change include persistence, decline, increase/expansion, and potential recovery.

A cohort of birds of the interior of woodland, shrubland and heathland remnants appear to be currently persisting in the study area, albeit in low-moderate low numbers and despite local and landscape-scale threats to their survival. Some of these birds belong to the postulated 'next-wave' of likely extinctions of woodland and shrubland species in the WA wheatbelt/sheepbelt (Recher 1999; InSight Ecology 2008, 2009) and are also termed 'decliners' or 'conservation-reliant species' (InSight Ecology 2007). These are species whose local populations may become extinct if intervention does not occur as the condition, size, connectivity, and intactness of their habitat continues to be eroded by grazing livestock, local land clearing events, cats and foxes, rabbits (as agents of ground cover removal and soil erosion) and weeds. These include the shrub-foraging insectivores Inland Thornbill, Western Thornbill, Grey Shrike-thrush, and Golden Whistler.

Other bird species appear to have increased in abundance and/or expanded their distributional range across the region. These include common, more resilient birds include mostly ground granivores (Australian Ringneck, Galah, Crested Pigeon and possibly Common Bronzewing), one nectarivore/insectivore (Brown Honeyeater), and the canopy insectivore Weebill.

The most abundant species recorded in both remnants and revegetation in the study area – Weebill, Australian Ringneck, Brown Honeyeater, Galah, Splendid Fairy-wren, Australian Raven and Silvereye - are adaptable, opportunistic, and quite resilient species. Some of their member guilds – canopy insectivore, ground granivore, nectarivore/insectivore, and ground insectivore – generally contained other species of greater sensitivity to the local consequences of habitat loss and fragmentation, principally reduced patch size, increased patch isolation, lowered habitat condition, and increased amount of edge. These included Varied Sittella, Little Button-quail, Tawny-crowned Honeyeater, Spiny-cheeked Honeyeater, and Red-capped Robin – most of which were recorded only in woodland and shrubland remnants.

A candidate for population recovery in the study area and surrounding Wandoo woodland districts is the nationally endangered Carnaby's Black-Cockatoo. This species may be slowly recovering its breeding numbers, largely in response to targeted revegetation and protection/restoration of breeding and non-breeding (on Swan Coastal Plain) and foraging habitat by BirdLife Australiam WWF, and several local community groups.

Some species appear to have gone locally extinct following the large-scale clearance of native woodland and shrubland for farming over 130 years ago and the introduction of mammalian predators such as the European Red Fox and cat. These include the Bush Stone-curlew - a

ground insectivore highly susceptible to fox predation, loss and fragmentation of its open woodland habitat, and trampling of nesting habitat by livestock (Plate 49), granivores dependent on suitable tree hollows for nesting (Western Rosella – Plate 50 and Red-tailed Black-Cockatoo – Plate 51), and the Crested Shrike-tit - a canopy insectivore dependent on insects in decorticating bark of eucalypt woodland (Plate 52).

Plate 49: Bush Stone-curlew with fledgling (bird on right), a Vulnerable species in the WA wheatbelt (Garnett and Crowley 2000) (en.wikipedia.org).

Plate 50: Male Western Rosella. The wheat-belt subspecies *xanthogenys* is listed nationally Near Threatened (Garnett and Crowley 2000) (flickr.com).

Plate 51: Red-tailed Black-Cockatoo, southwest WA subspecies *naso* (female) listed nationally as Near Threatened (Garnett and Crowley 2000) (DEC WA)

Plate 52: Crested Shrike-tit (western subspecies *leucogaster*) listed nationally as Near Threatened (Garnett and Crowley 2000) (A. Pattison/Global Twitcher)

4.2.3 Seasonal changes

Fluctuations in the abundance, species richness, and composition of terrestrial bird communities recorded during the surveys reflected seasonal changes in food availability, species-specific movement patterns including migration, dispersal and nomadism, and breeding behaviour. The presence of slightly more birds in remnants in autumn compared with spring could be attributed to autumn dispersal of honeyeaters (New Holland Honeyeater, Western

Spinebill) tracking variation in quantity and quality of nectar flows from Banksia, Dryandra, Coastal Blackbutt and some Wandoo in the study area. Other plausible reasons include the stopover of summer breeding migrants on their way north for winter (e.g. Grey Fantail and White-backed Swallow), nomads tracking food supplies (e.g. Silvereye), new season young out of their natal areas, and the higher detectability of sedentary species after the breeding season had finished, e.g. Splendid Fairy-wren, Red-capped Robin, and Grey Shrike-thrush. Greater amounts of foliage insects in autumn may have explained more Weebills occurring in remnants and revegetation than in spring, in association with breeding-related factors raised above.

Markedly higher species richness in remnants in spring relative to autumn could be explained by several factors. There was an influx of nomadic and part-migratory honeyeaters tracking the increased availability and insects in flowering heathland, shrubland and mallee (especially *Eucalyptus eudesmoides*) and Wandoo woodland remnants. These included Western Wattlebird, Red Wattlebird, Spiny-cheeked Honeyeater, Brown-headed Honeyeater, and Tawny-crowned Honeyeater. Also present in spring but generally not autumn were summer breeding migrants – 3 cuckoo species, White-winged Triller, Rufous Songlark, Brown Songlark, Rainbow Bee-eater and Sacred Kingfisher. Six species of raptors were recorded only in spring, drawn to increased abundance and diversity of prey in remnants – nesting adult birds, nestlings, fledglings, rabbits, small mammals and reptiles. Three less encountered species in this landscape were Golden Whistler, Varied Sittella and White-fronted Chat all detected in spring but not autumn, again reflecting increased invertebrate availability and diversity. Carnaby's Black-Cockatoo occurred in spring but not autumn when there is a coastwards movement to winter non-breeding grounds.

Other factors such as local (ie. remnant, habitat patch and revegetation block/strip) variation in the condition, food resources, and nesting and refuge value of plant communities, habitat patch and landscape metrics (especially perimeter-area ratio, patch size, shape and connectivity), disturbance history (weeds, feral animals, fire, clearing, recreation), climate change effects, and the need for survey replication over several seasons may have been implicated in the seasonal changes to bird assemblages detected in this study.

4.3 Bird use of habitat

4.3.1 Remnant native vegetation

Remnant native vegetation supported more individuals and species of birds than revegetation in both surveyed seasons. This was expected given the wider range of structurally more complex and floristically more diverse habitats present in remnant woodland, shrubland and heathland than in planted vegetation.

Birds recorded only in remnants were ground insectivores – Little Button-quail, Yellow-rumped Thornbill, White-fronted Chat, Red-capped Robin, Magpie-lark, and Australasian Pipit, shrub insectivores – Western Thornbill, Grey Shrike-thrush and Golden Whistler, four species of honeyeater, an aerial insectivore – Rainbow Bee-eater, and six species of raptor. Some of these species - Western Thornbill, Inland Thornbill, Grey Shrike-thrush - are usually core woodland species, preferring the interior of remnants away from edge impacts, although Inland Thornbill

was detected nesting in 8-10 year old broombush plantings. Others - New Holland Honeyeater, White-cheeked Honeyeater and Western Spinebill - were attracted to the abundance and diversity of nectar and insects associated with flowering ground cover, shrub and tree species available in the multi-layered, fenced-off remnants. Summer visitors from northern and inland zones - Rainbow Bee-eater and White-winged Triller - utilised standing dead trees and the outer dead branches of York Gum, Marri, Wandoo, Salmon Gum and other tree species in and adjacent to remnants to forage and move through.

Differences in bird species richness that occurred between sampled remnants (Section 3.2) can be attributed in part to site-specific variation in the size, condition, connectedness, and habitat structural complexity of remnants.

Fine-scale variation, which occurs within habitats in individual remnants, in the range and type of microhabitat available for use by birds may also have influenced the composition and structure of resident and migratory bird communities recorded in the study. Differences in the amount and distribution of foliage cover, height of cover, floristic composition, and spatial arrangement of ground substrates such as logs, leaf litter, grasses and rocky outcrops are factors implicated in influencing bird community composition and structure (see, e.g., Wiens 1989; Huggett 2000). Some evidence for this was found in the apparent preference of shrub and ground insectivores (e.g. Western Thornbill, Grey Shrike-thrush, Splendid Fairy-wren,) and some nectarivores/insectivores (e.g White-cheeked Honeyeater, Tawny-crowned Honeyeater, Western Spinebill) for sites containing a range of microhabitats.

The impact of land use management regimes such as past (but recent) cattle grazing in the “Flora Downs” remnant, sheep grazing in Harridge/Nixon’s riparian remnant, and past patterns of clearing across the district has contributed to the observed variation in the condition and structural complexity of bird habitat in these remnants. In contrast, Mason’s ridgetop remnant and S&E Kelly’s sandplain remnant have been fenced longer than most of the other remnants surveyed in this study. Thus, much of their original or at least older regrowth native vegetation seems to have been retained. In effect, these are microcosms of the formerly more extensive and more interconnected Moora-Gillingarra-Calingiri-New Norcia woodlands and shrublands. They are also some of the building blocks for re-connecting key remnants and landscape units across the study area and as such deserve special conservation management focus (Section 5).

4.3.2 Planted native vegetation

Strategic plantings of native vegetation have been undertaken in parts of the study area since the early 1980s. These were established primarily to mitigate water-logging, control erosion, and provide windbreaks for crops and livestock. Later (post-1995) plantings have focused on providing wildlife habitat/potential corridors, mitigating salt impact, and integrating soil and water management. These wider and more layered efforts have introduced a degree of bird habitat complexity into revegetated drainage lines and waterways. The three revegetation sites along drainage lines on Mason’s property that were surveyed for birds in this study are good examples of these plantings in the district.

Birds able to forage and, in some cases, breed in the older (8-10 year+) plantings have been attracted by developing shrub and canopy cover and an abundance of insect prey. Ground insectivores – Splendid Fairy-wren, Variegated Fairy-wren and White-winged Fairy-wren called for mates and/or defended breeding territory in Mason's older Melaleuca-eucalypt-Acacia-she-oak revegetation. Shrub insectivores such as Grey Fantail, Inland Thornbill and Rufous Whistler nested or were detected calling for mates in Mason's revegetation sites 1 and 2. Canopy insectivores including Weebill and Western Gerygone and nectarivores/insectivores - Brown Honeyeater and Red Wattlebird - foraged and called for potential mates in this revegetation. Younger (3-6 year) plantings generally lacked the structural complexity and canopy development to offer more than supplementary foraging habitat to a small group of more resilient or adaptable species – Silvereye and White-winged Fairy-wren. No nests were detected in these younger plantings.

Plantings of native trees and shrubs along drainage lines and lower valley slopes are performing a landscape connectivity role in the study area. They are helping to re-connect lowland habitat with upslope remnant patches in the study area. This is also enhancing the width and structure of remnant lowland woodland stands, especially as foraging and breeding space for small ground- and shrub-dwelling insectivorous birds. Moreover, it is re-introducing connectivity into the landscape as a whole which may, in time, allow other fauna species such as critical weight range mammals, e.g. Woylie (Brush-tailed Bettong), Chuditch (Western Quoll) and Wambenger (Brush-tailed Phascogale) to return (or be re-introduced) to areas from which they had previously disappeared. This would be a key beneficial outcome for the conservation of threatened and declining wheatbelt biodiversity at the landscape scale.

4.4 Targeting conservation action

A cornerstone of sustainable ecosystem management involves identifying and protecting, through strategic intervention, species, communities and habitats of conservation significance. Specific conservation strategies and actions are developed and implemented to achieve these objectives. Opportunities currently exist to improve the protection of birds (and other fauna) and their habitat from threats and threatening processes, as part of a landscape approach to biodiversity conservation across the catchment. These should focus on ensuring that the 'next wave' of ground-, shrub-, and canopy-foraging insectivores that are most vulnerable to local extirpation are adequately protected and their habitat carefully managed. These are the species and guilds most sensitive to reduced core remnant and habitat area and connectivity and declining habitat condition.

Protection of existing populations and guilds of threatened and declining avifauna and their habitat is the priority bird conservation action in the study area. This includes monitoring the size, demography, and genetic health of, and habitat use by, these populations and the implementation of practical measures to mitigate key threats (Section 5). Benchmarks may need to be devised to permit evaluation of the performance of these measures over time.

Increasing the size and improving the condition and connectivity of remnant native vegetation is another action requiring priority attention in the study area. Emphasis is also needed on revegetation that increases the width and length of existing key remnants and helps connect

ridge, valley slope and floor landscape units. Block or 'stepping stone' plantings of local species should also be integrated into the landscape-based revegetation design. Stratification and renewal of existing planted zones along drainage lines and as buffers around wetlands is needed to provide structural complexity and improved breeding habitat value for declining birds and other fauna. Fencing of key identified remnants and all revegetation and maintenance of fences is essential to ensure habitat condition is improved and threats from livestock trampling and browsing of native vegetation are removed. Attention to appropriate fire management actions and control of feral animal and plant pests are also needed.

A practical and interactive community education and participation plan should form the basis of a long-term conservation strategy in the study area (Section 5). This should inform and guide the conservation commitment to protecting threatened and declining bird species, guilds and communities (and other fauna and flora) in perpetuity. It should also enable strategic revegetation and best-practice habitat restoration to occur, based on the development and implementation of a community-endorsed landscape design.

5. Recommendations

An opportunity exists to adopt a strategic whole-of-landscape approach to conserving and managing biodiversity in the study area and its catchment, using land birds as a planning tool or template. The precedent for this approach has been established in Buntine-Marchagee Catchment situated within Moore River Catchment to the north of the study area (see Department of Environment and Conservation 2008). It has been recommended in work undertaken for the CDI Project (InSight Ecology 2010) and Revegetation of Natural Drainage Lines and Protection of Remnant Vegetation in the East Moore Catchment Project (InSight Ecology 2008). Strategies and actions contained in the DEC Buntine-Marchagee recovery plan that relate to the conservation of birds and other fauna are based on the production of a community-informed landscape design (Huggett et al. 2004). This used field survey data of vegetation and bird communities over three years, GIS data, and landholder feedback to develop a design for the long-term protection and restoration of the habitat of declining woodland and heath/shrub/mallee bird species. This design is currently guiding strategic revegetation and habitat protection and management activities in the catchment for the period 2007-2027. It has recently been listed by the Society for Ecological Restoration International as one of the Top 25 ecological restoration projects in Australasia.

There is substantial potential in the study area to develop a landscape design for habitat protection and restoration, adapted from the Buntine-Marchagee work. This would provide a robust scientific and community-endorsed basis for strategically planning and implementing actions to help, over time, restore ecological structure and function to the landscape. It would also help integrate and coordinate ecological restoration actions occurring in one part of the catchment with those proposed for or underway in other parts of this landscape and indeed neighbouring regions. Some elements of the landscape design approach are already being implemented in Moore River catchment in other projects.

In this way, the potential for achieving key local, regional and cross-regional biodiversity conservation and management goals and targets may be substantially increased. The outcome

should ultimately be a more resilient, functional and biodiverse landscape that serves as a model for habitat restoration and landscape recovery in other agricultural systems.

The recommendations below provide a set of practical actions to help protect and manage birds and their habitats in the study area. They are informed by the results of this study and previous ones in the catchment, knowledge of bird species and communities in the WA wheatbelt, and understanding of the principles and practices of landscape ecology in agricultural environments. Key landscape ecological and biodiversity conservation drivers include the creation and maintenance of habitat and landscape connectivity, protection and restoration of habitat condition, complexity and floristic diversity, mitigation of threats and threatening processes, and community education and participation.

This suite of recommended actions is by no means exhaustive. Rather, it provides a useful framework to begin tackling the task of protecting declining woodland and heath/shrub/mallee birds and restoring and managing their habitat. In the immediate term, these actions can be implemented within an adaptive management framework. Ideally, however, the actions should emerge from issues identified during research and development of the recommended landscape design. This will help ensure that land management issues and actions to remediate their impact on birds and other biota are addressed within the whole-of-landscape approach advocated in Section 5.1. It will also provide key opportunities for local landholder participation in, and ownership of, the landscape design. This is essential to the long-term success of the design.

Collectively, this approach will ultimately boost the potential for landscape recovery over time. This has important consequences for humans and biodiversity alike in this farming system.

The recommended specific actions are (some of these may be underway already in the district):

- Develop a landscape design for the southern Moore River Catchment (or the study area initially)

This should be based on the ecological requirements of declining woodland and heath/shrub/mallee birds in the catchment. Funding from the Caring for our Country (CFOC) program, National Biodiversity Fund, National Wildlife Corridors Plan (draft currently being finalised), or other sources should be pursued to allow this work to commence. This will require the collaboration of local landholders, LCDCs, NACC, Shire of Victoria Plains (and possibly adjoining councils), and other partners.

A key task is to establish baseline data of bird populations and communities in remnants and revegetation in the study area (or across southern Moore River catchment). This will require professional surveys to be undertaken of bird populations and guilds, targeting declining woodland and heath/shrub/mallee species, and obtaining data on occurrence, abundance and breeding status. A greater number of sites in more remnants and revegetation across different landscape units in the study area should be surveyed in this way. Nocturnal birds could also be surveyed (possibly for the first time in the area). The results of these surveys should help inform a separate monitoring study of declining bird population size, demography, local/regional conservation status, breeding success, genetic health, and habitat use, especially of core

remnants and revegetation. The role and importance of microhabitat variation in influencing bird community structure and use of revegetation and remnants could also be investigated. A relationship with a university could be developed to help undertake this work through student projects.

A detailed vegetation survey of remnants and revegetation in the study area would also be required. Both bird and vegetation datasets should then be incorporated with landscape information into a GIS mapping framework to drive the landscape design process (see Huggett et al. 2004).

Local landholder and LCDC engagement in, and support of, these information gathering activities from the outset are strongly recommended.

- Implement a strategic habitat protection and revegetation program, using the study area as a trial for implementing the proposed landscape design

This should include the targeting of key remnants to join together, focusing also on connecting remnant upslope and valley floor patches (including revegetated areas), continuing to fence them to exclude livestock (see below), controlling feral animal pests (fox, cat, rabbit) and weeds, and managing the fire risk. Other important parts of the program are the planting of new 'stepping stones' of local native vegetation to connect key ecological neighbourhoods (see Huggett et al. 2004) and renovation of existing planted areas to increase habitat structural complexity and reduce the weed burden. These actions aim to increase the size and improve the connectivity and habitat condition of key remnants across the study area.

New habitat linkages should be at least 100 metres in width. This will minimise the amount of edge habitat created and thus reduce incursion by edge-specialist bird species (e.g. Yellow-throated Miner, Australian Raven). Wider linkages may also encourage area-sensitive possibly declining bird species (e.g. Western Thornbill, Inland Thornbill, Varied Sittella) to enter, forage and move through them. New linkages should also be generally linear, elliptical or oblong in shape, avoiding sharp corners or angles. Highly angular linkages may impede the movement of small area-sensitive birds, forcing them to cross open gaps. This may increase their risk of being predated by carnivorous birds such as Pied Butcherbird and raptors like the Brown Falcon and Australian Hobby.

Priority attention should be given to connecting existing higher quality remnants on the Mason, Botha/Kelly, S&E Kelly, Hendry, Leeson, Harridge and Pearson properties to revegetated riparian zones and ridgelines. Renovation of some of these plantings will be needed to improve their quality as bird habitat. This will involve within-site enhancement plantings and the addition of ground microhabitat such as native grasses, decaying logs (obtained from on-farm pruning/lopping and not from existing remnants or windblown trees in remnants), and rocks (sourced from quarries not from existing remnants), where possible. This has the effect of introducing patchiness into revegetation to ensure that a mosaic of different types of microhabitat is available for bird use.

The exclusion of sheep from Harridge/Nixon's riparian remnant and Leeson's sandplain shrubland/woodland remnant including during autumn should be a high priority, noting that

remnant protection fencing is underway on Leeson's property. The practice of allowing livestock to graze revegetated areas during times of reduced paddock feed should be stopped. Many years of hard work establishing structurally complex and floristically diverse revegetation for woodland birds and other fauna can be ruined by one sheep grazing episode.

Consultation and negotiation with local landholders and LCDCs is essential and requires skilful and experienced field extension effort (see Communication section below).

The performance of the proposed landscape design should be evaluated over time, with attention paid to progress achieved with establishing habitat linkages, 'stepping stones', fencing key remnants, and feral animal and weed control. Benchmarks for biodiversity-based revegetation of ex-agricultural land may need to be developed to allow measurable evaluation (and auditing) of the effectiveness of this work.

- Communication, education and knowledge acquisition

Support existing programs and help initiate new communication and education activities in the study area, especially those that strengthen links between farmers, local/regional NRM bodies, and ecologists. These include:

- Field training days in the latest revegetation and habitat restoration techniques for biodiversity conservation on farms;
- Workshops on landscape design recommendations including corridors, fencing, and the ecological importance of retaining dead trees on farms. Standing dead trees offer valuable perching, foraging and roosting microhabitat for resident and migratory land birds and other taxa such as bats;
- Strengthen existing links and establish new communication avenues with local, regional and state media to ensure wider dispersal and sharing of information and knowledge;
- Devise novel ways to engage farmers in strategic vegetation management for birds. Opportunities for 'hands-on' local farmer participation in the proposed landscape design project exist, from assisting with bird surveys to planting new habitat linkages and fencing remnants;
- Work with local councils to improve road verge management practices, particularly along flora roads and routes that connect key remnants for declining woodland birds. Support any proposed studies of the values and management of road verges for threatened and declining biodiversity;
- Consider preparing a communication plan for biodiversity conservation in the study area (or reviewing any existing one to capture the points raised above);
- Encourage studies of biodiversity that will provide new knowledge to improve our understanding of how animals and plants utilise and respond to revegetation (especially the novel habitat value of crops like tagasaste and saltbush), habitat protection, and land use practices in the study area. These include active adaptive management studies and applied research.

References

Abbott, I., 1997. Extinctions in Western Australia. *Landscope* 12, 49-53.

Abbott, I., 1999. The avifauna of the forests of southwest Western Australia: Changes in species composition, distribution and abundance following anthropogenic disturbance. *CALMScience* Supplement No. *5*: 1-175 and Corrigenda in *Conservation Science Western Australia* 2004*,* 5, 136.

Barrett, G., Silcocks, A., Barry, S., Cunningham, R., and Poulter, R., 2003. The New Atlas of Australian Birds. Birds Australia (RAOU), Melbourne.

Brooker, M. and Brooker, L., 1997. Dispersal of the Blue-breasted Fairy-wren in fragmented habitat in the wheatbelt of Western Australia. *Pacific Conservation Biology* 3, 295-300

Brooker M. and Brooker, L., 2001. Breeding biology, reproductive success and survival of blue-breasted fairy-wrens in fragmented habitat in the Western Australian wheatbelt. *Wildlife Research* 28, 205-214.

Burbidge, A. H. and McKenzie, N. L., 1989. Patterns in the modern decline of WesternAustralia's vertebrate fauna: Causes and conservation implications. *Biological Conservation* 50, 143-198.

BirdLife International, 2003. BirdLife's online World Bird Database: the site for bird conservation. Version 2.0. Cambridge, UK: BirdLife International. Available from URL: http://www.birdlife.org

Conservation International, 2007. Biodiversity Hotspots. Available from URL: http://www.biodiversityhotspots.org/xp/hotspots/australia/Pages/default.aspx

Cramer V. A. and R. J. Hobbs, 2005. Assessing the ecological risk from secondary salinity: A framework addressing questions of scale and threshold responses. *Austral Ecology* 30, 537-545.

Department of Environment and Conservation, 2006. Draft – A 100-year Biodiversity Conservation Strategy for Western Australia: Blueprint to the Bicentenary in 2029, Government of Western Australia.

Department of Environment and Conservation, 2008. The Buntine-Marchagee Natural Diversity Recovery Catchment Plan 2007-2027. Department of Environment and Conservation, Perth.

Dutson, G., Garnett, S., and Gole, C., 2009. Australia's key sites for bird conservation. Birds Australia (RAOU) Conservation Statement No. 15, October 2009.

Ford, H. A., 1989. Ecology of Birds: An Australian Perspective. Surrey Beatty & Sons Pty. Ltd, Chipping Norton, Sydney.

Frost, F., Lambeck, R., Dymond, W., Rowley, T., and Gowdie, T., 1999. Living Landscapes. A report commissioned by the Natural Heritage Trust, Canberra.

Garnett, S.G. and Crowley G.M. 2000. The Action Plan for Australian Birds. Environment Australia and Birds Australia, Melbourne.

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

Higgins, P. J. and Davies, S. J. J. F., (Eds.) 1996. Handbook of Australian, New Zealand and Antarctic Birds. Volume 3: Snipe to Pigeons. Oxford University Press, Melbourne.

Higgins, P.J, Peter, J. M., and Steele, W. K., (Eds) 2001. Handbook of Australian, New Zealand and Antarctic Birds. Volume 5: Tyrant-flycatchers to Chats. Oxford University Press, Melbourne.

Higgins, P. J. and Peter, J. M., (Eds.) 2002. Handbook of Australian, New Zealand and Antarctic Birds. Volume 6: Pardalotes to Shrike-thrushes. Oxford University Press, Melbourne.

Higgins, P. J., Peter, J. M., and Cowling, S. J., (Eds.) 2006. Handbook of Australian, New Zealand and Antarctic Birds. Volume 7: Boatbill to Starlings. Oxford University Press, Melbourne.

Hobbs, R. J. and Saunders, D. A. (Eds.), 1993. Reintegrating Fragmented Landscapes Towards Sustainable Production and Nature Conservation, Springer-Verlag, New York.

Hobbs, R. J, 2003. Effects of landscape fragmentation on ecosystem processes in the Western Australian wheatbelt. *Biological Conservation* 64, 193-201.

Huggett, A. J., 2000. An Experimental Study of the Impacts of Gaps and Clusters Silviculture on Insectivorous Birds in a Continuous Forest Landscape, PhD thesis, School of Biological Sciences, University of New England, Armidale, NSW.

Huggett, A. J., Parsons, B. C., Atkins, L. A., and Ingram, J. A., 2004. Landscape Design for Bird Conservation in the Buntine-Marchagee Catchment, Western Australia. Technical Report to Land & Water Australia, CSIRO Sustainable Ecosystems.

Huggett, A. J., 2005. The concept and utility of 'ecological thresholds' in biodiversity conservation. *Biological Conservation* 124, 301-310.

InSight Ecology, 2007. A Review of the Application of the Landscape Design for Bird Conservation in Buntine-Marchagee Natural Diversity Recovery Catchment. Technical report by InSight Ecology for WA Department of Environment and Conservation.

InSight Ecology, 2008. A survey of birds in planted and remnant native vegetation around Calingiri and New Norcia, east Moore catchment, WA. Report by InSight Ecology to Moore Catchment Council.

InSight Ecology, 2009. A Monitoring and Evaluation Strategy for the Landscape Design for Bird Conservation in Buntine-Marchagee Natural Diversity Recovery Catchment, 2009-2029. Technical report by InSight Ecology to Department of Environment and Conservation for "Project BM2: Monitoring and Evaluation of the Landscape Design for Bird Conservation in Buntine-Marchagee Natural Diversity Recovery Catchment".

InSight Ecology, 2010. The Avifauna of West Koojan-Gillingarra Catchment Demonstration Initiative Area. Technical report by InSight Ecology for Northern Agricultural Catchments Council, Geraldton, WA.

IUCN, 2001. Red List Classification Criteria and Categories, International Union for Conservation of Nature (IUCN) Species Survival Commission, Gland, Switzerland.

IUCN, 2006. Red List of Threatened Species, International Union for Conservation of Nature (IUCN), Gland, Switzerland.

Keighery, G. J., Halse, S. A., Harvey, M. S. and McKenzie, N. L. (Eds), 2004. A biodiversity survey of the Western Australian agricultural zone. *Records of the Western Australian Museum*, Supplement **67**. (Western Australian Museum: Perth.)

Laurance, W. F., Dell, B., Turton, S. M., Lawes, M. J., Hutley, L. B., McCallum, H., Dale, P., Bird, M., Hardy, G., Prideaux, G., Gawne, B., McMahon, C. R., Yu, R., Hero, J-M., Schwarzkopf, L., Krockenberger, A., Douglas, M., Silvester, E., Mahony, M., Vellam, K., Saikia, U., Wahren C-H, Xu, Z., Smith, B., and Cocklin, C., 2011. The 10 Australian ecosystems most vulnerable to tipping points. *Biological Conservation* 144, 1472–1480.

Mills, A.M., 2007. Foraging segregation in a breeding bird guild declines following nesting. *Canadian Journal of Zoology* 85, 141-150.

Recher, H.F., 1999. The state of Australia's avifauna: a personal opinion and prediction for the new millenium. *Australian Zoologist*, 31: 11-27.

Saunders DA, de Rebeira, CP, 1991. Values of corridors to avian population in a fragmented landscape. Pp. 221-240 in Nature Conservation 2: The Role of Corridors (Eds.) DA Saunders & RJ Hobbs. Surrey Beatty & Sons.

Saunders, D. A. And Ingram, J., 1995. Birds of Southwestern Australia: An Atlas of Changes in Distribution and Abundance of the Wheatbelt Fauna. Surrey Beatty & Sons, Sydney.

Serventy, D. L, and Whittell, H. M., 1976. Birds of Western Australia (Fifth revised version), UWA Press, Perth.

Systat Software, Inc., 2009. User's Guide – Parts 1 & 2 for SigmaPlot Version 11.2 supplied under licence to InSight Ecology.

Vesk, P., Mac Nally, R., 2006. The clock is ticking: revegetation and habitat for birds and arboreal mammals in rural landscapes of southern Australia. *Agricultural Ecosystems and Environment* 112, 356-366.

Wiens, J. A. 1989. The Ecology of Bird Communities, Volume 1: Foundations and Patterns. Cambridge University, Cambridge, UK.

Williams, K. and Mitchell, D., 2001. Jarrah Forest 1 - Subregional description and biodiversity values *in* A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Conservation and Land Management, Perth.

WWF, 2006. The Southwest Australia Ecoregion – Jewel of the Australian Continent. Southwest Australia Ecoregion Initiative, WWF Australia, Wembley, Perth. Available from URL: http://wwf.org.au/publications/southwest-australia-ecoregion-jewel-booklet/

Appendices

Appendix 1: All individual birds recorded by InSight Ecology during the Autumn (1-6 May 2011) survey in the study area

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
1	Australian Shelduck	*Tadorna tadornoides*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	4	0	foraging	no	in spring-fed dam
2	Pacific Black Duck	*Anas superciliosa*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging	no	in flowing creek in swamp
3	Australasian Grebe	*Tachybaptus novaehollandiae*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging	no	in spring-fed dam
4	Common Bronzewing	*Phaps chalcoptera*	O20511	1025-1135	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	2	foraging, resting	no	
5	Common Bronzewing	*Phaps chalcoptera*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	2	0	resting (flushed)	no	
6	Black-fronted Dotterel	*Elseyornis melanops*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	no	edge of dry lake
7	Little Button-quail	*Turnix velox*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	foraging, flying (flushed)	no	flushed from wandoo-heath ecotone (photos)
8	Galah	*Eolophus roseicapillus*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	4	0	foraging, calling	no	
9	Galah	*Eolophus roseicapillus*	O40511	1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	flying	no	
10	Galah	*Eolophus roseicapillus*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	2	0	flyover	no	
11	Galah	*Eolophus roseicapillus*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	6	0	nesting, calling	yes	defending nest hollows in wandoo (2 prs)

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
12	Galah	*Eolophus roseicapillus*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	13	0	foraging, calling, possibly nesting	yes?	
13	Galah	*Eolophus roseicapillus*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	19	0	foraging, roosting, nesting	yes	
14	Galah	*Eolophus roseicapillus*	O60511	0840-0930	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	12	0	calling, perching, nesting?	yes?	remnant fully fenced last wk
15	Galah	*Eolophus roseicapillus*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	9	0	calling, perching	no	remnant fully fenced last wk
16	Galah	*Eolophus roseicapillus*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	14	0	foraging, calling	no	remnant fenced recently
17	Long-billed Corella	*Cacatua tenuirostris*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	3	0	foraging, calling	no	
18	Australian Ringneck	*Barnardius zonarius*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	29	0	foraging, calling	no	in wandoo and on bare ground
19	Australian Ringneck	*Barnardius zonarius*	O10511	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	16	foraging, calling	no	creekline planted 2002
20	Australian Ringneck	*Barnardius zonarius*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	2	foraging	no	in 4-5m tall salmon & river red gum NW trib
21	Australian Ringneck	*Barnardius zonarius*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	4	0	foraging, calling	no	342 m asl ridgeline, some wandoo flowering S slope
22	Australian Ringneck	*Barnardius zonarius*	O20511	1025-1135	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	3	foraging, calling	no	feeding on sheoak fruit
23	Australian Ringneck	*Barnardius zonarius*	O20511 & 040511	1700-1735, 1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	8	0	foraging, flying	no	in *Banksia menziesii* & blackbutt woodland
24	Australian Ringneck	*Barnardius zonarius*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging	no	

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
25	Australian Ringneck	*Barnardius zonarius*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	2	0	foraging, calling	no	slopes of wandoo breakaway
26	Australian Ringneck	*Barnardius zonarius*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	8	0	foraging, calling	no	
27	Australian Ringneck	*Barnardius zonarius*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	13	0	foraging, calling, flying	no	
28	Australian Ringneck	*Barnardius zonarius*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	19	0	foraging, flying, calling	no	feeding on green York Gum fruit
29	Australian Ringneck	*Barnardius zonarius*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	8	0	foraging, roosting	no	
30	Australian Ringneck	*Barnardius zonarius*	O60511	0840-0930	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	3	0	calling, foraging	no	remnant fully fenced last wk
31	Australian Ringneck	*Barnardius zonarius*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	8	0	foraging, calling	no	remnant fully fenced last wk
32	Australian Ringneck	*Barnardius zonarius*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	9	0	foraging, calling	no	remnant fenced recently
33	Splendid Fairy-wren	*Malurus splendens*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	8	0	foraging, calling	no	2 adult males in eclipse plumage, 3 immat males, 3 females; in 1-1.5m upslope heath nr wandoo & with Western Thornbill group @ MREM04
34	Splendid Fairy-wren	*Malurus splendens*	O20511	1025-1135	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	7	foraging, calling	no	2 eclipse males, rest adult females, young males & females
35	Splendid Fairy-wren	*Malurus splendens*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	5	0	foraging, calling	no	

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
36	Splendid Fairy-wren	*Malurus splendens*	O30511	1720-1745	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	9	0	foraging, calling	no	
37	Splendid Fairy-wren	*Malurus splendens*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	15	0	foraging, calling	no	3 groups in ridgetop mallee & Adenanthos heath & moving between wandoo/dryandra small plateaux & upslope ridgeline via low Melaleuca heath in saddle
38	White-winged Fairy-wren	*Malurus leucopterus*	O10511	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	3	foraging, calling	no	Langwood Creek planted 2002; in *Melaleuca thyoides*
39	Variegated Fairy-wren	*Malurus lamberti*	O10511	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	12	foraging, calling	no	in 1.5 m tall 3m inter-row *Melaleuca thyoides* rows in between isolated York Gum
40	Variegated Fairy-wren	*Malurus lamberti*	O40511	1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	5	0	foraging, flying	no	one female and young males
41	Variegated Fairy-wren	*Malurus lamberti*	O30511	1720-1745	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	8	0	foraging, calling	no	adult male in full colour
42	Weebill	*Smicrornis brevirostris*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	19	0	foraging, calling	no	with Western Gerygone occasionally
43	Weebill	*Smicrornis brevirostris*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	5	foraging, calling	no	in salmon & river red gum plantings in NW side-trib (Goodden Gully)
44	Weebill	*Smicrornis brevirostris*	O20511	1025-1135	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	5	foraging, calling	no	main creekline established mixed reveg
45	Weebill	*Smicrornis brevirostris*	O10511	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	4	foraging, calling	no	Langwood Creek reveg
46	Weebill	*Smicrornis brevirostris*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	18	0	foraging, calling, contesting territory (2 groups)	no	in mallee & tall dryandra patches on lower plateaux, nr wandoo breakaway (12 birds in territory dispute)

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
47	Weebill	*Smicrornis brevirostris*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	22	0	foraging, calling	no	in wandoo mostly W side ck and along entire ck length (surveyed section)
48	Weebill	*Smicrornis brevirostris*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	9	0	foraging, calling	no	
49	Weebill	*Smicrornis brevirostris*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	28	0	foraging, flying, calling	no	
50	Weebill	*Smicrornis brevirostris*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	5	0	foraging, calling	no	
51	Weebill	*Smicrornis brevirostris*	O60511	0840-0930	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	9	0	calling, foraging	no	remnant fully fenced last wk
52	Weebill	*Smicrornis brevirostris*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	8	0	foraging, calling	no	remnant fully fenced last wk
53	Weebill	*Smicrornis brevirostris*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	5	0	foraging, calling	no	remnant fenced recently
54	Western Gerygone	*Gerygone fusca*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	3	0	foraging, calling	no	with Weebill in wandoo
55	Western Gerygone	*Gerygone fusca*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	2	foraging, with weebill, inland thornbill	no	in 4-5m tall salmon & river red gum NW trib (Goodden Gully)
56	Western Gerygone	*Gerygone fusca*	O20511	1700-1735	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	calling	no	
57	Western Gerygone	*Gerygone fusca*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	calling	no	in marri, blackbutt and Nutysia stand east side of ck
58	Western Gerygone	*Gerygone fusca*	O30511	1720-1745	S&E Kelly remnant	S 30 54 26,0 E 116 03 21.7	1	0	calling	no	

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
59	Western Gerygone	*Gerygone fusca*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	calling	no	wandoo breakaway
60	Western Gerygone	*Gerygone fusca*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging	no	in isolated old wandoo paddock edge with creek
61	Western Gerygone	*Gerygone fusca*	O60511	0840-0930	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	2	0	foraging	no	remnant fully fenced last wk
62	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	no	melaleuca shrubland lake perimeter
63	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	6	0	foraging	no	along creek edge with paddock
64	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O30511	1720-1745	S&E Kelly remnant	S 30 54 26,0 E 116 03 21.7	5	0	foraging, calling	no	along site's boundary with adjacent wandoo stand
65	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	2	0	foraging, calling	no	in 1-1.5m Melaleuca patch (saddle between ridge and dryandra plateaux) with Splendid FW group
66	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	4	0	foraging	no	
67	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	4	0	foraging	no	
68	Western Thornbill	*Acanthiza inornata*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	8	0	foraging, calling	no	similar spot as Oct 2007 survey (=grp 1); grp 2=4 nr MREM04 with Splendid FW group

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
69	Inland Thornbill	*Acanthiza apicalis*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	2	foraging, with weebill, western gerygone	no	in 4-5m tall salmon & river red gum NW trib (Goodden Gully)
70	Inland Thornbill	*Acanthiza apicalis*	O20511	1025-1135	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	2	foraging, calling	no	main creekline reveg
71	Inland Thornbill	*Acanthiza apicalis*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	4	0	foraging, calling	no	in mallee euc patches & tall dryandra heath
72	Striated Pardalote	*Pardalotus striatus*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	calling, foraging	no	in isolated old wandoo paddock edge with creek
73	Striated Pardalote	*Pardalotus striatus*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	3	0	foraging, calling	no	
74	Striated Pardalote	*Pardalotus striatus*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	2	0	foraging, calling	no	
75	Striated Pardalote	*Pardalotus striatus*	O60511	0840-0930	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	1	0	calling	no	remnant fully fenced last wk
76	Striated Pardalote	*Pardalotus striatus*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	2	0	foraging, calling	no	remnant fenced recently
77	Western Spinebill	*Acanthorhynchus superciliosus*	O10511	1	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	2	0	foraging	no	in flowering creekline wandoo
78	Western Spinebill	*Acanthorhynchus superciliosus*	O20511	1700-1735	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, flying	no	both males
79	Western Spinebill	*Acanthorhynchus superciliosus*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	calling	no	
80	Singing Honeyeater	*Lichenostomus virescens*	O10511	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	1	foraging	no	Langwood Creek planted 2002

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
81	Singing Honeyeater	*Lichenostomus virescens*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	1	0	foraging	no	
82	Singing Honeyeater	*Lichenostomus virescens*	O20511	1700-1735	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, flying	no	
83	Singing Honeyeater	*Lichenostomus virescens*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging, calling	no	melaleuca shrubland lake perimeter
84	Singing Honeyeater	*Lichenostomus virescens*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	foraging	no	
85	Singing Honeyeater	*Lichenostomus virescens*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	1	0	foraging	no	
86	Singing Honeyeater	*Lichenostomus virescens*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	1	0	foraging	no	remnant fully fenced last wk
87	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	foraging	no	in flowering creekline wandoo
88	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	1	0	foraging	no	in tall wandoo canopy
89	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	4	0	foraging	no	2 adults feeding 1 fledgling in top of creekline wandoo
90	Yellow-throated Miner	*Manorina flavigula*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	3	0	foraging, calling	no	obs foraging for bark insects in York Gums along creek
91	Yellow-throated Miner	*Manorina flavigula*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	2	0	foraging, calling	no	
92	Yellow-throated Miner	*Manorina flavigula*	O60511	0840-0930	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	3	0	foraging, calling	no	remnant fully fenced last wk
93	Yellow-throated Miner	*Manorina flavigula*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	11	0	calling, foraging, flying	no	remnant fully fenced last wk

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
94	Yellow-throated Miner	*Manorina flavigula*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	5	0	foraging, calling	no	remnant fenced recently
95	Red Wattlebird	*Anthochaera carunculata*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	1	foraging	no	in 4-5m tall salmon & river red gum NW trib (Goodden Gully)
96	Red Wattlebird	*Anthochaera carunculata*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	foraging, calling	no	in creekline tall Banksia and adjacent remnant marri
97	Red Wattlebird	*Anthochaera carunculata*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	2	0	foraging	no	in wandoo nr horseyard
98	Brown Honeyeater	*Lichmera indistincta*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	17	0	foraging, calling, bathing	no	in flowering creekline wandoo
99	Brown Honeyeater	*Lichmera indistincta*	O10511	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	5	foraging, calling	no	creekline planted 2002
100	Brown Honeyeater	*Lichmera indistincta*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	10	0	foraging, calling	no	342 m asl ridgeline, some wandoo flowering S slope
101	Brown Honeyeater	*Lichmera indistincta*	O20511	1025-1135	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	5	foraging, calling	no	main creekline established eucs & sheoaks
102	Brown Honeyeater	*Lichmera indistincta*	O20511 & 040511	1700-1735, 1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	7	0	foraging, flying	no	
103	Brown Honeyeater	*Lichmera indistincta*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging	no	in mature acorn banksia east side of ck (flowering)
104	Brown Honeyeater	*Lichmera indistincta*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	4	0	foraging, calling	no	in tall old Banksia (flowering) in creekline
105	Brown Honeyeater	*Lichmera indistincta*	O30511	1720-1745	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	5	0	foraging, calling, flying	no	between adjacen wandoo remnant and site
106	Brown Honeyeater	*Lichmera indistincta*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	7	0	foraging, calling, flying	no	in Adenanthos medium heath (feeding on sticky exudate - not flowering) & mallees

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
107	Brown Honeyeater	*Lichmera indistincta*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	15	0	foraging, calling	no	in flowering wandoo along creek
108	Brown Honeyeater	*Lichmera indistincta*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	6	0	foraging	no	some wandoo flowering
109	Brown Honeyeater	*Lichmera indistincta*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	8	0	foraging, calling	no	in flowering wandoo along creek (mixed with yorks)
110	Brown Honeyeater	*Lichmera indistincta*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	6	0	foraging, calling	no	remnant fully fenced last wk; in salmon & wandoo along ck (not flowering)
111	New Holland Honeyeater	*Phylidonyris novaehollandiae*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	3	0	foraging	no	in tall old Banksia (flowering) in creekline
112	White-cheeked Honeyeater	*Phylidonyris niger*	O10511	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	1	foraging	no	Langwood Creek planted 2002
113	White-cheeked Honeyeater	*Phylidonyris niger*	O20511 & 040511	1700-1735, 1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	8	0	foraging, calling	no	in Banksia oblongifolia & Adenanthos sp. (exudate)
114	White-cheeked Honeyeater	*Phylidonyris niger*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	2	0	foraging, calling	no	in 1.5-2.5m medium heath patch - Adenanthos (feeding on sticky exudate - not flowering) & Hakea
115	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	foraging	no	obs inspecting caterpillar cocoon in ridgetop mallee
116	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	2	0	perching, foraging	no	
117	White-winged Triller	*Lalage sueurii*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	flyover	no	melaleuca shrubland lake perimeter
118	Rufous Whistler	*Pachycephala rufiventris*	O10511	0800-0950	Harridge/Nixon riparian	S 31 03 19.0 E 116 09 25.8	1	0	foraging	no	in wandoo & York Gum, side-tributary nr silos

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
					remnant						
119	Rufous Whistler	*Pachycephala rufiventris*	O10511	1600-1730	Mason Reveg 1	S 31 08 17.5 E 116 19 35.2	0	1	foraging, calling	no	in 4-5m tall salmon & river red gum NW trib; adult male
120	Rufous Whistler	*Pachycephala rufiventris*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	foraging, calling	no	one male, one female
121	Rufous Whistler	*Pachycephala rufiventris*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	1	foraging	no	one adult male in Goodden Gully 8-9 yo salmon and sheoak plantings
122	Rufous Whistler	*Pachycephala rufiventris*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	foraging	no	one male
123	Rufous Whistler	*Pachycephala rufiventris*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	foraging, calling	no	male in creekline tall Banksia and adjacent remnant marri
124	Rufous Whistler	*Pachycephala rufiventris*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	3	0	calling, foraging	no	1 adult, 1 adult female, 1 indet.
125	Rufous Whistler	*Pachycephala rufiventris*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	2	0	foraging, calling	no	1 adult male, 1 adult female
126	Rufous Whistler	*Pachycephala rufiventris*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	2	0	foraging, calling	no	remnant fenced recently
127	Grey Shrike-thrush	*Colluricincla harmonica*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	location calling	no	side-trib wandoo Nixon's side
128	Grey Shrike-thrush	*Colluricincla harmonica*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	foraging, calling	no	342 m asl ridgeline, some wandoo flowering S slope
129	Grey Shrike-thrush	*Colluricincla harmonica*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	no	melaleuca shrubland lake perimeter
130	Grey Shrike-thrush	*Colluricincla harmonica*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	calling	no	in old marri edge of swamp

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
131	Grey Shrike-thrush	*Colluricincla harmonica*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	foraging	no	mallee eucs
132	Grey Butcherbird	*Cracticus torquatus*	O40511	1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	flying	no	
133	Pied Butcherbird	*Cracticus nigrogularis*	O40511	1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	perching	no	
134	Pied Butcherbird	*Cracticus nigrogularis*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	foraging	no	in paperbark swamp
135	Pied Butcherbird	*Cracticus nigrogularis*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	4	0	foraging, calling	no	2 adult and 2 juvs (photos)
136	Pied Butcherbird	*Cracticus nigrogularis*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	1	0	foraging	no	
137	Pied Butcherbird	*Cracticus nigrogularis*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	2	0	foraging	no	1 adult, 1 juvenile
138	Pied Butcherbird	*Cracticus nigrogularis*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	3	0	foraging, calling	no	
139	Pied Butcherbird	*Cracticus nigrogularis*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	3	0	foraging, calling	no	remnant fully fenced last wk
140	Pied Butcherbird	*Cracticus nigrogularis*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	1	0	foraging	no	remnant fenced recently
141	Australian Magpie	*Cracticus tibicen*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	6	0	foraging	no	
142	Australian Magpie	*Cracticus tibicen*	O20511	1025-1135	Mason Reveg 1	S 31 08 17.5 E 116 19 35.2	0	2	perching	no	
143	Australian Magpie	*Cracticus tibicen*	O40511	1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	3	0	perching	no	

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
144	Australian Magpie	*Cracticus tibicen*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	8	0	foraging, calling	no	
145	Australian Magpie	*Cracticus tibicen*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging	no	
146	Australian Magpie	*Cracticus tibicen*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	2	0	foraging	no	
147	Australian Magpie	*Cracticus tibicen*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	2	0	foraging	no	
148	Australian Magpie	*Cracticus tibicen*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	5	0	foraging	no	remnant fully fenced last wk
149	Grey Fantail	*Rhipidura albiscapa*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	3	0	foraging, calling, bathing	no	
150	Grey Fantail	*Rhipidura albiscapa*	O10511	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	2	foraging, calling	no	Langwood Creek reveg & rem York Gum patches
151	Grey Fantail	*Rhipidura albiscapa*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	1	foraging	no	in 4-5m tall salmon & river red gum NW trib (Goodden Gully)
152	Grey Fantail	*Rhipidura albiscapa*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	4	0	foraging, calling	no	342 m asl ridgeline, some wandoo flowering S slope
153	Grey Fantail	*Rhipidura albiscapa*	O20511	1025-1135	Mason Reveg 1	S 31 08 17.5 E 116 19 35.2	0	3	foraging, calling	no	older (planted 10 yrs ago) eucs and sheoaks main creekline
154	Grey Fantail	*Rhipidura albiscapa*	O20511 & 040511	1700-1735, 1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	3	0	foraging, calling	no	
155	Grey Fantail	*Rhipidura albiscapa*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	foraging	no	
156	Grey Fantail	*Rhipidura albiscapa*	O30511	1720-1745	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	4	0	foraging, calling	no	

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
157	Grey Fantail	*Rhipidura albiscapa*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	foraging	no	
158	Grey Fantail	*Rhipidura albiscapa*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	3	0	foraging	no	in wandoo along creek
159	Grey Fantail	*Rhipidura albiscapa*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	2	0	foraging, flying	no	crossed into remnant from planted strip
160	Grey Fantail	*Rhipidura albiscapa*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	2	0	foraging, calling	no	remnant fully fenced last wk
161	Grey Fantail	*Rhipidura albiscapa*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	1	0	foraging	no	remnant fenced recently
162	Willie Wagtail	*Rhipidura leucophrys*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	foraging, calling	no	
163	Willie Wagtail	*Rhipidura leucophrys*	O10511	1600-1730	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	1	foraging	no	Langwood Creek planted 2002
164	Willie Wagtail	*Rhipidura leucophrys*	O20511	1700-1735	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, calling	no	
165	Willie Wagtail	*Rhipidura leucophrys*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	no	
166	Willie Wagtail	*Rhipidura leucophrys*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging	no	
167	Willie Wagtail	*Rhipidura leucophrys*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	1	0	perching, foraging	no	
168	Willie Wagtail	*Rhipidura leucophrys*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	1	0	foraging	no	
169	Willie Wagtail	*Rhipidura leucophrys*	O60511	0950-1040	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	2	0	foraging, calling	no	remnant fully fenced last wk

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
170	Australian Raven	*Corvus coronoides*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	9	0	foraging, calling	no	old nest in wandoo
171	Australian Raven	*Corvus coronoides*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	flyover	no	342 m asl ridgeline, some wandoo flowering S slope
172	Australian Raven	*Corvus coronoides*	O40511	1625-1740	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	perching	no	
173	Australian Raven	*Corvus coronoides*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	3	0	foraging	no	
174	Australian Raven	*Corvus coronoides*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	2	0	foraging, calling	no	
175	Australian Raven	*Corvus coronoides*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging	no	
176	Australian Raven	*Corvus coronoides*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	3	0	perching, foraging	no	
177	Australian Raven	*Corvus coronoides*	O50511	0910-1030	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	2	0	foraging	no	
178	Australian Raven	*Corvus coronoides*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	2	0	foraging	no	
179	Australian Raven	*Corvus coronoides*	O60511	0840-0930	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	3	0	foraging, calling	no	remnant fully fenced last wk
180	Australian Raven	*Corvus coronoides*	O60511	1130-1200	Lefroy ridgetop remnant	S 30 34 51.7 E 116 18 30.2	3	0	foraging	no	remnant fenced recently
181	Little Crow	*Corvus bennetti*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	5	0	flying, calling	no	
182	Magpie-lark	*Grallina cyanoleuca*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	foraging	no	

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
183	Magpie-lark	*Grallina cyanoleuca*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	perching	no	
184	Magpie-lark	*Grallina cyanoleuca*	O40511	0955-1100	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging, calling	no	
185	Magpie-lark	*Grallina cyanoleuca*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	1	0	foraging	no	
186	Magpie-lark	*Grallina cyanoleuca*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	1	0	foraging	no	
187	Red-capped Robin	*Petroica goodenovii*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	2	foraging	no	in 8-11m tall wandoo, sheoak & planted salmon (Goodden Gully); male & female
188	Red-capped Robin	*Petroica goodenovii*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	foraging	no	342 m asl ridgeline, some wandoo flowering S slope
189	Red-capped Robin	*Petroica goodenovii*	O20511	1700-1735	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging	no	both females
190	Red-capped Robin	*Petroica goodenovii*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	no	adjacent marri remnant
191	Red-capped Robin	*Petroica goodenovii*	O50511	0815-0905	Pearson wandoo remnant	S 30 49 10.9 E 116 34 35.0	2	0	foraging, flying	no	in adjacent small wandoo patch 15m to SE & flew into remnant
192	Silvereye	*Zosterops lateralis*	O10511	0800-0950	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	8	0	foraging, calling	no	in flowering creekline wandoo
193	Silvereye	*Zosterops lateralis*	O10511	1700-1730	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	2	foraging	no	in 4-5m tall salmon & river red gum NW trib (Goodden Gully)
194	Silvereye	*Zosterops lateralis*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	foraging	no	bark-probing & branch surface foraging in wandoo on breakaway (ESE slope)

Record No.	Common Name	Scientific Name	Date	Time	Site Name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
195	Silvereye	*Zosterops lateralis*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	no	
196	Silvereye	*Zosterops lateralis*	O30511	1720-1745	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	11	0	foraging, calling	no	
197	Silvereye	*Zosterops lateralis*	O40511	0820-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	8	0	foraging, calling	no	in Adenanthos medium heath (feeding on sticky exudate - not flowering)
198	White-backed Swallow	*Cheramoeca leucosterna*	O20511	1700-1735	Hendry remnant	S 30 58 59.1 E 115 58 24.9	3	0	foraging, flying	no	
199	White-backed Swallow	*Cheramoeca leucosterna*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	foraging	no	
200	Welcome Swallow	*Hirundo neoxena*	O30511	1030-1140	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging	no	
201	Tree Martin	*Petrochelidon nigricans*	O20511	0810-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	9	0	foraging, calling, perching	no	perching in tall wandoo nr nth edge of remnant (nr new house site) nr MREM02 - photos taken
202	Tree Martin	*Petrochelidon nigricans*	O50511	1645-1745	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	3	0	foraging, perching	no	
203	Australasian Pipit	*Anthus novaeseelandiae*	O30511	0830-0930	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	no	

Appendix 2: All individual birds recorded by InSight Ecology during the Spring (5-11 October 2011) survey in the study area. Breeding records are also shown.

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
1	Black Swan	*Cygnus atratus*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	nd	on main lake's open water
2	Australian Shelduck	*Tadorna tadornoides*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	7	0	perching	nd	on debris pile in main lake & smaller lake open water
3	Australian Wood Duck	*Chenonetta jubata*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging	yes	nr spout in wandoo nr dam
4	Australian Wood Duck	*Chenonetta jubata*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	8	0	foraging, resting	yes	2 adults with 6 ducklings on spring-fed dam
5	Grey Teal	*Anas gracilis*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	42	0	foraging	yes	on main lake's open water and smaller lake
6	Grey Teal	*Anas gracilis*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	9	0	foraging, resting	yes	2 adults with 7 ducklings on spring-fed dam
7	Pacific Black Duck	*Anas superciliosa*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	2	0	foraging	no	at small weir in creek
8	Pacific Black Duck	*Anas superciliosa*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging	no	2 adults on spring-fed dam
9	Australasian Grebe	*Tachybaptus novaehollandiae*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	4	0	foraging	yes	2 adults with 2 fledglings on spring-fed dam
10	Common Bronzewing	*Phaps chalcoptera*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	1	resting	no	
11	Common Bronzewing	*Phaps chalcoptera*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	resting	no	
12	Common Bronzewing	*Phaps chalcoptera*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	calling	no	in dryandra grading into mallee (*E. eudesmoides*)

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
13	Common Bronzewing	*Phaps chalcoptera*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging	nd	near larger dam in creek
14	Common Bronzewing	*Phaps chalcoptera*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	1	0	resting	nd	
15	Common Bronzewing	*Phaps chalcoptera*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	1	0	nesting	yes	flushed off nest 4m up in horizontal salmon branch
16	Common Bronzewing	*Phaps chalcoptera*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	1	0	foraging	no	
17	Crested Pigeon	*Ocyphaps lophotes*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	perching	no	
18	Crested Pigeon	*Ocyphaps lophotes*	O71011	1600-1630	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	1	0	foraging	no	
19	Crested Pigeon	*Ocyphaps lophotes*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging	no	along creek edge
20	Little Black Cormorant	*Phalacrocorax sulcirostris*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, likely nesting	yes	in ephemeral wetland
21	Pied Cormorant	*Phalacrocorax varius*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, likely nesting	yes	in ephemeral wetland
22	White-necked Heron	*Ardea pacifica*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	foraging	no	main lake's edges, shrubs
23	White-faced Heron	*Egretta novaehollandiae*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	flyover	no	flew over flowing creek nr small weir
24	White-faced Heron	*Egretta novaehollandiae*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, mate pursuit	yes	in ephemeral wetland
25	White-faced Heron	*Egretta novaehollandiae*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging, mate	yes	edges of main lake

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
									pursuit		
26	Straw-necked Ibis	*Threskiornis spinicollis*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	foraging	nd	in ephemeral wetland
27	Straw-necked Ibis	*Threskiornis spinicollis*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	8	0	foraging	nd	lake shallows
28	Yellow-billed Spoonbill	*Platalea flavipes*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	perching	no	debris pile 'island' in lake middle of wetland
29	Brown Goshawk	*Accipiter fasciatus*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	foraging	no	immature plumage
30	Swamp Harrier	*Circus approximans*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	foraging	nd	
31	Wedge-tailed Eagle	*Aquila audax*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	flyover	no	above ephemeral wetland, mobbed by 2 ravens
32	Wedge-tailed Eagle	*Aquila audax*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	1	0	flying nr nest	yes	adult female obs flying to nr active nest @ S 30 44 47.2 E 116 21 59.3 (10-15 yo nest in old salmon gum)
33	Wedge-tailed Eagle	*Aquila audax*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	1	0	flyover	no	mobbed by 5 ravens
34	Nankeen Kestrel	*Falco cenchroides*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	1	perching	no	in *E.occidentalis* dead branch
35	Nankeen Kestrel	*Falco cenchroides*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	perching	yes	nesting in old marri east bank of ck
36	Brown Falcon	*Falco berigora*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging	nd	over banksia woodland/heath
37	Brown Falcon	*Falco berigora*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	foraging	nd	
38	Australian Hobby	*Falco longipennis*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	1	0	perching	no	

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
39	Purple Swamphen	*Porphyrio porphyrio*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, likely nesting	yes	in ephemeral wetland
40	Eurasian Coot	*Fulica atra*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, likely nesting	yes	in ephemeral wetland
41	Black-fronted Dotterel	*Elseyornis melanops*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	foraging	no	muddy shoreline of lake
42	Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	flyover	not determined (nd)	
43	Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	4	flyover	no	from Mason remnant (nearest further upslope)
44	Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	2	0	foraging	nd	adult pair feeding on allocasuarina fruit on ridgetop
45	Galah	*Eolophus roseicapillus*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	3	perching, flying	no	Goodden Gully eucs, sheoaks & melaleuca
46	Galah	*Eolophus roseicapillus*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	2	0	calling, perching	likely	
47	Galah	*Eolophus roseicapillus*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	flyover	no	
48	Galah	*Eolophus roseicapillus*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	3	0	perching, calling	yes	wandoo breakaway
49	Galah	*Eolophus roseicapillus*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	nesting, calling	yes	nesting in wandoo
50	Galah	*Eolophus roseicapillus*	O71011	1600-1630	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	7	0	foraging, nesting, calling	yes	nesting in wandoo
51	Galah	*Eolophus roseicapillus*	O91011	0835-0910	Pearson Wandoo	S 30 49 10.9 E 116 34 35.0	28	0	nesting, calling	yes	min 3 pairs nesting in wandoo

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
					remnant						
52	Galah	*Eolophus roseicapillus*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	8	0	nesting, calling, defending	yes	nesting in old larger York along ck
53	Galah	*Eolophus roseicapillus*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	10	0	calling, foraging, nesting	yes	in older Salmon Gum
54	Long-billed Corella	*Cacatua tenuirostris*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	12	0	calling, foraging, nesting	yes	in older Salmon Gum
55	Little Corella	*Cacatua sanguinea*	O51011	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	2	flyover	nd	
56	Little Corella	*Cacatua sanguinea*	O91011	0835-0910	Pearson Wandoo remnant	S 30 49 10.9 E 116 34 35.0	5	0	nesting, calling, flying	yes	in wandoo
57	Little Corella	*Cacatua sanguinea*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	2	0	perching, calling	nd	not as many suitable nest holes in York as wandoo
58	Australian Ringneck	*Barnardius zonarius*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	7	0	calling, mate pursuit	yes	
59	Australian Ringneck	*Barnardius zonarius*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	7	foraging, flying	no	
60	Australian Ringneck	*Barnardius zonarius*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	17	0	foraging, calling, mate pursuits	yes	in old wandoo along ck
61	Australian Ringneck	*Barnardius zonarius*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	21	0	feeding, calling, nesting	yes	nesting in old wandoo, feeding on everlasting daisy-like heads
62	Australian Ringneck	*Barnardius zonarius*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	7	0	foraging, calling, nesting	yes	2 pairs nesting in wandoo

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
63	Australian Ringneck	*Barnardius zonarius*	O71011	1600-1630	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	8	0	nesting, calling	yes	2 pairs nesting in wandoo; no shrub layer (past heavy grazing)
64	Australian Ringneck	*Barnardius zonarius*	O71011	1645-1800	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	3	0	foraging, calling	nd	
65	Australian Ringneck	*Barnardius zonarius*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	4	0	foraging, calling	likely	in old marri stand
66	Australian Ringneck	*Barnardius zonarius*	O91011	0835-0910	Pearson Wandoo remnant	S 30 49 10.9 E 116 34 35.0	4	0	nesting	yes	in wandoo
67	Australian Ringneck	*Barnardius zonarius*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	4	0	foraging, calling	likely	
68	Horsfield's Bronze-Cuckoo	*Chalcites basalis*	O51011	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	1	calling, perching	nd	in isolated marri nr plantings with w/w trillers & rufous songlark (along Langwood Ck)
69	Horsfield's Bronze-Cuckoo	*Chalcites basalis*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	foraging, calling, mate pursuits	yes	in mallee and wandoo, near weebill
70	Horsfield's Bronze-Cuckoo	*Chalcites basalis*	O71011	1300-1310	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	5	perching, nest detecting	yes	attempting to parasitise Inland Thornbill nest in 8 yo *Melaleuca uncinata* rows nr paddock & old marri
71	Horsfield's Bronze-Cuckoo	*Chalcites basalis*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	foraging	likely	immature bird in drilled paddock at wetland edge
72	Horsfield's Bronze-Cuckoo	*Chalcites basalis*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	mate-calling	likely	

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
73	Shining Bronze-Cuckoo	*Chalcites lucidus*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	6	foraging, mate calling	yes	mostly males in 8 yrold salt river gum, acacia, melaleuca uncinata & flat-topped yate (*E. occidentalis*) plantings
74	Shining Bronze-Cuckoo	*Chalcites lucidus*	O71011	1600-1630	Isbister riparian remnant	S 30 36 19.9 E 116 02 45.5	1	0	calling	nd	
75	Pallid Cuckoo	*Cacomantis pallidus*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	foraging	no	immature bird obs ground-pouncing on grass insects along wandoo creekline edge with paddock
76	Laughing Kookaburra	*Dacelo novaeguineae*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	flyover to main creek	likely	
77	Laughing Kookaburra	*Dacelo novaeguineae*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	foraging, calling	nd	
78	Sacred Kingfisher	*Todiramphus sanctus*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	calling, mate pursuit	yes	pair in wandoo breakaway
79	Sacred Kingfisher	*Todiramphus sanctus*	O51011	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	1	foraging, calling	nd	along flowing Langwood Creek
80	Sacred Kingfisher	*Todiramphus sanctus*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	4	0	calling, likely nesting	yes	2 prs - first nr carpark on isolated wandoo and second nr small weir in flowing ck
81	Sacred Kingfisher	*Todiramphus sanctus*	O71011	1600-1630	Isbister riparian remnant	S 30 36 19.9 E 116 02 45.5	2	0	foraging, likely nesting	yes	likely nesting in creek bank York spouts; obs taking crustacean, fish and skink in & along flowing Moore River
82	Sacred Kingfisher	*Todiramphus sanctus*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	1	0	calling	nd	

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83	Sacred Kingfisher	*Todiramphus sanctus*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	2	0	foraging, calling	likely	wandoo ridgetop
84	Rainbow Bee-eater	*Merops ornatus*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	5	0	perching, calling	nd	in ridgetop mallee (pics)
85	Rainbow Bee-eater	*Merops ornatus*	O71011	1600-1630	Isbister riparian remnant	S 30 36 19.9 E 116 02 45.5	1	0	foraging	nd	
86	Splendid Fairy-wren	*Malurus splendens*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	1	0	foraging	nd	one adult male nr granite boulders southern slope heath patch (usual spot)
87	Splendid Fairy-wren	*Malurus splendens*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	2	foraging	nd	in 1.7m *Melaleuca uncinata* nr paddock edge along Goodden Gully
88	Splendid Fairy-wren	*Malurus splendens*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	6	0	foraging, territory calling, flying	yes	
89	Splendid Fairy-wren	*Malurus splendens*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	8	0	foraging, calling, with juvs	yes	grp of 4 (1 adult male, 1 adult female, 2 immats) along ridgetop; second grp (1 adult male, 1 adult female, 2 immats) in saddle's disturbed low heath
90	Splendid Fairy-wren	*Malurus splendens*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	6	0	foraging, calling territory, mate pursuits	yes	2 grps: first =2 adult males, 2 adult females in low-medium heath, second = 1 immat male & 1 subadult male - both using blackbutt branches (4-5m) & *Allocasuarina humilis* as lookouts

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
91	Splendid Fairy-wren	*Malurus splendens*	O81011	1620-1715	Leeson sandplain remnant	S 31 08 20.5 E 115 50 31.6	4	0	foraging, territory calling	yes	1 adult male, adult females, 1 indeter. in Banksia heath and Blackbutt woodland
92	White-winged Fairy-wren	*Malurus leucopterus*	O51011	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	4	territory calling, foraging	yes	eclipse-plumage male and 3 females in *M. thyoides* and saltbush plantings along Langwood Ck
93	White-winged Fairy-wren	*Malurus leucopterus*	O71011	1600-1630	Isbister riparian remnant	S 30 36 19.9 E 116 02 45.5	2	0	foraging, territory calling	yes	1 adult male and female in samphire/grassy flat
94	White-winged Fairy-wren	*Malurus leucopterus*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	6	0	foraging, calling	yes	adult male & female in remnant Melaleuca clumps adjacent to recently drilled paddock
95	Variegated Fairy-wren	*Malurus lamberti*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	4	0	foraging, territory calling	yes	moving between weed edge of adjacent wheat crop & 20m back to remnant
96	Variegated Fairy-wren	*Malurus lamberti*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	5	0	foraging, territory calling	yes	2 adult males, one female and 3 immat birds in heath
97	Variegated Fairy-wren	*Malurus lamberti*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	6	0	foraging, territory calling	yes	1 adult male & female + 4 indets in creek rushes and bracken fern
98	Variegated Fairy-wren	*Malurus lamberti*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	4	0	foraging, territory calling, male song displays	yes	1 adult male, 2 adult females, 1 indet.
99	Weebill	*Smicrornis brevirostris*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	4	0	calling, mate pursuit & territory defence	yes	

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100	Weebill	*Smicrornis brevirostris*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	3	foraging, calling, mate pursuits	yes	in *E. occidentalis* & *E. sargentii* + sheoaks & acacia
101	Weebill	*Smicrornis brevirostris*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	5	foraging	no	in 3 m swamp mallet & taller eucs N side gully
102	Weebill	*Smicrornis brevirostris*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	11	0	foraging, calling, mate pursuits	yes	
103	Weebill	*Smicrornis brevirostris*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	16	0	foraging, territory calling, flying	yes	territory calling, mate pursuits in ridgetop mallee & wandoo breakaway
104	Weebill	*Smicrornis brevirostris*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	14	0	foraging, territory calling, mate pursuits	yes	in wandoo along creek
105	Weebill	*Smicrornis brevirostris*	O71011	1600-1630	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	2	0	foraging, calling	nd	
106	Weebill	*Smicrornis brevirostris*	O71011	1645-1800	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	4	0	foraging, calling, territory defence	yes	
107	Weebill	*Smicrornis brevirostris*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	calling, foraging	no	
108	Weebill	*Smicrornis brevirostris*	O91011	0835-0910	Pearson Wandoo remnant	S 30 49 10.9 E 116 34 35.0	2	0	foraging, calling	nd	
109	Weebill	*Smicrornis brevirostris*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	12	0	foraging, calling	likely	

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
110	Weebill	*Smicrornis brevirostris*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	11	0	foraging, territory calling, mate pursuits	yes	
111	Western Gerygone	*Gerygone fusca*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	8	0	calling, territory calling	yes	
112	Western Gerygone	*Gerygone fusca*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	4	foraging, mate calling	yes	in *E. occidentalis* & *E. sargentii* + sheoaks & acacia
113	Western Gerygone	*Gerygone fusca*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	3	foraging, calling	no	in taller eucs/dead sheoaks N side of gully
114	Western Gerygone	*Gerygone fusca*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	calling	no	
115	Western Gerygone	*Gerygone fusca*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging	nd	in blackbutt woodland bordering wetland
116	Western Gerygone	*Gerygone fusca*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging, mate pursuit	yes	in wandoo along creek
117	Western Gerygone	*Gerygone fusca*	O71011	1645-1800	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	2	0	foraging	nd	
118	Western Gerygone	*Gerygone fusca*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	foraging	no	
119	Western Gerygone	*Gerygone fusca*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	1	0	foraging, calling	no	in blackbutt isolate edge of remnant
120	Western Gerygone	*Gerygone fusca*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	5	0	territory calling, mate pursuits, foraging	yes	musical extended (territory?) call noted; ground and understorey foraging with Western Thornbill group under wandoo & on ant-like insects on wandoo sap stains

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
121	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	2	0	foraging	no	
122	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O71011	1600-1630	Isbister riparian remnant	S 30 36 19.9 E 116 02 45.5	3	0	foraging	nd	
123	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	3	0	roosting	no	in adjacent marri paddock tree
124	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	2	0	foraging	nd	
125	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	4	0	mate pursuits, foraging, mate provisioning	yes	along western edge of remnant, obs male courtship feeding of female
126	Western Thornbill	*Acanthiza inornata*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	5	0	foraging, courtship feeding	yes	male obs courtship feeding female in flowering *Melaleuca radula* (insects) stand (SE facing below wandoo breakaway); 3 others in group foraging over fallen debris
127	Western Thornbill	*Acanthiza inornata*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	5	0	foraging, calling, with 1 young	yes	adults + 1 fledgling foraging on ground, over logs, in wandoo foliage to 3m and on ant-like insects on wandoo sap stains, with Western Gerygone grp @ S 31 03 02.3 E 116 08 48.0
128	Inland Thornbill	*Acanthiza apicalis*	O71011	1300-1310	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	4	defending nest from Horsfields Bronze-Cuckoo	yes	nesting in 8 yo *Melaleuca uncinata* rows nr paddock & old marri (5 Horsfield Bronze-Cuckoo perched)

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
129	Inland Thornbill	*Acanthiza apicalis*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	nesting	yes	in west bank paperbark
130	Spotted Pardalote	*Pardalotus punctatus*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	1	0	calling	nd	
131	Striated Pardalote	*Pardalotus striatus*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	6	0	foraging, mate calling & pursuits	yes	2 males & 1 female in 1 grp
132	Striated Pardalote	*Pardalotus striatus*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	2	0	foraging, mate calling	yes	
133	Striated Pardalote	*Pardalotus striatus*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	4	0	foraging, calling, mate pursuits	yes	in mallee and wandoo
134	Striated Pardalote	*Pardalotus striatus*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	1	0	foraging	no	in wandoo along creek
135	Striated Pardalote	*Pardalotus striatus*	O91011	0835-0910	Pearson Wandoo remnant	S 30 49 10.9 E 116 34 35.0	1	0	calling	nd	
136	Striated Pardalote	*Pardalotus striatus*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	1	0	calling	nd	
137	Striated Pardalote	*Pardalotus striatus*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	1	0	calling	nd	
138	Striated Pardalote	*Pardalotus striatus*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	1	0	foraging, calling	no	
139	Singing Honeyeater	*Lichenostomus virescens*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	1	foraging	no	in 4m dense flowering *Melaleuca uncinata*
140	Singing Honeyeater	*Lichenostomus virescens*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	foraging	nd	over banksia woodland/heath
141	Singing Honeyeater	*Lichenostomus virescens*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	perching	nd	

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
142	Singing Honeyeater	*Lichenostomus virescens*	O81011	1620-1715	Leeson sandplain remnant	S 31 08 20.5 E 115 50 31.6	2	0	foraging, territory calling	yes	in Banksia heath and Blackbutt woodland
143	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	1	0	foraging	nd	
144	Yellow-throated Miner	*Manorina flavigula*	O71011	1600-1630	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	5	0	foraging, calling	nd	
145	Yellow-throated Miner	*Manorina flavigula*	O71011	1645-1800	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	3	0	foraging, calling	nd	
146	Yellow-throated Miner	*Manorina flavigula*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	calling, foraging	nd	
147	Yellow-throated Miner	*Manorina flavigula*	O91011	0835-0910	Pearson Wandoo remnant	S 30 49 10.9 E 116 34 35.0	5	0	calling, flying	nd	
148	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	5	0	foraging, calling, competing with Western Wattlebird	yes	in banksia/blackbutt woodland; competing aggressively with Spiny-cheeked HE for banksia access
149	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	O81011	1620-1715	Leeson sandplain remnant	S 31 08 20.5 E 115 50 31.6	3	0	foraging, mate and territory calling	yes	in Banksia heath and Blackbutt woodland
150	Western Wattlebird	*Anthochaera lunulata*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	4	0	foraging, territory defence calling	yes	in banksia/blackbutt woodland; defending territory and banksia access against Spiny-cheeked HE
151	Western Wattlebird	*Anthochaera lunulata*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	5	0	foraging, flying, calling	nd	feeding in flowering parrot bush

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
152	Red Wattlebird	*Anthochaera carunculata*	O51011	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	2	calling, perching	yes	in isolated York and flew into *Melaleuca thyoides* plantings
153	Red Wattlebird	*Anthochaera carunculata*	O71011	1600-1630	Isbister riparian remnant	S 30 36 19.9 E 116 02 45.5	2	0	foraging, feeding fledgling	yes	adult feeding fledgling in eucs along river bank
154	Red Wattlebird	*Anthochaera carunculata*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging, calling	nd	in flowering paperbarks
155	Red Wattlebird	*Anthochaera carunculata*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	9	0	foraging, calling, feeding yng	yes	with 3 recent fledglings being fed insects by adults in flowering York along ck
156	Red Wattlebird	*Anthochaera carunculata*	O81011	1620-1715	Leeson sandplain remnant	S 31 08 20.5 E 115 50 31.6	2	0	foraging, territory calling	likely	1 pair in Banksia heath and Blackbutt woodland
157	White-fronted Chat	*Epthianura albifrons*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	11	0	foraging, calling	likely	group foraging across recently sown paddock bordering wetland
158	Tawny-crowned Honeyeater	*Glyciphila melanops*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	foraging	nd	in flowering tall Dryandra ridgetop patch
159	Brown Honeyeater	*Lichmera indistincta*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	15	0	foraging, territory calling	yes	in flowering wandoo patches
160	Brown Honeyeater	*Lichmera indistincta*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	7	foraging, mate calling	yes	in insect-laden *E. sargentii* & *E. occidentalis* plantings
161	Brown Honeyeater	*Lichmera indistincta*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	4	foraging	no	in taller eucs/dead sheoaks N side of gully
162	Brown Honeyeater	*Lichmera indistincta*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	19	0	foraging, territory calling, flying	yes	

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
163	Brown Honeyeater	*Lichmera indistincta*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	17	0	foraging, calling, territory defence	yes	with 2 recent fledglings feeding sticky Adenanthos exudate nr saddle section
164	Brown Honeyeater	*Lichmera indistincta*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging, calling	nd	downstream end nr adjacent large remnant
165	Brown Honeyeater	*Lichmera indistincta*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	11	0	foraging, feeding young, calling	yes	immat bird plus 1 adult obs feeding 1 recent fledgling; feeding in flowering *Calothamnus*, *Eremaea pauciflora* & parrot bush
166	Brown Honeyeater	*Lichmera indistincta*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	7	0	foraging, territory calling, mate pursuits	yes	in flowering wandoo (patchy)
167	Brown Honeyeater	*Lichmera indistincta*	O81011	1620-1715	Leeson sandplain remnant	S 31 08 20.5 E 115 50 31.6	24	0	foraging, territory calling, mate pursuits, guarding	yes	in Adenanthos thickets, flowering Banksia, blackbutt isolates within heath
168	White-cheeked Honeyeater	*Phylidonyris niger*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	5	0	foraging, flying, calling	nd	in flowering *Eremaea pauciflora*, Parrot Bush, Calothamnus
169	Brown-headed Honeyeater	*Melithreptus brevirostris*	O71011	1645-1800	Isbister riparian remnant	S 30 36 24.2 E 116 02 47.9	1	0	foraging	nd	in river bank York foliage
170	Brown-headed Honeyeater	*Melithreptus brevirostris*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	2	0	foraging	nd	in Adenanthos, flowering Calothamnus, Parrot Bush & *Eremaea pauciflora*
171	Varied Sittella	*Daphoenositta chrysoptera*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	1	0	foraging	no	foraging dead and live branches of Wandoo just below dam

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
172	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	1	0	foraging	no	
173	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	3	0	calling, perching	yes	in wandoo along creek
174	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	perching	nd	in ephemeral wetland
175	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	perching	yes	immature plumage
176	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O71011	1600-1630	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	1	0	perching	nd	
177	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	perching	nd	
178	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	foraging	no	
179	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	1	0	calling	nd	
180	White-winged Triller	*Lalage sueurii*	O51011	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	5	perching	nd	3 males & 2 females in isolated marri nr plantings with rufous songlark & horsfield's bronze-cuckoo
181	White-winged Triller	*Lalage sueurii*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	foraging	nd	in ephemeral wetland
182	White-winged Triller	*Lalage sueurii*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	6	0	foraging, calling, mate pursuits, contests	yes	3 males, 3 females in group moving across recently drilled paddock of wetland edge
183	Golden Whistler	*Pachycephala pectoralis*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	1	0	foraging	nd	immat male in wandoo ridgetop

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
184	Rufous Whistler	*Pachycephala rufiventris*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	3	foraging, mate calling	yes	2 adult males and 1 female in isolated York rem and planted allocasuarina
185	Rufous Whistler	*Pachycephala rufiventris*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	2	foraging	no	in taller eucs N side of gully
186	Rufous Whistler	*Pachycephala rufiventris*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	4	0	territory calling, foraging	likely	pr + 2 adult males 400 m apart along ck
187	Rufous Whistler	*Pachycephala rufiventris*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	3	0	foraging, territory calling	yes	2 males territory calling, 1 female
188	Rufous Whistler	*Pachycephala rufiventris*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	1	0	foraging	no	1 adult male in wandoo
189	Rufous Whistler	*Pachycephala rufiventris*	O71011	1600-1630	Isbister riparian remnant	S 30 36 19.9 E 116 02 45.5	1	0	foraging, calling	nd	1 adult male in York Gum
190	Rufous Whistler	*Pachycephala rufiventris*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	1	0	calling, foraging	no	adult male
191	Rufous Whistler	*Pachycephala rufiventris*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	1	0	calling	no	adult male
192	Rufous Whistler	*Pachycephala rufiventris*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	3	0	foraging, mate calling, contests	yes	2 adult males competing for 1 adult female
193	Rufous Whistler	*Pachycephala rufiventris*	O81011	1620-1715	Leeson sandplain remnant	S 31 08 20.5 E 115 50 31.6	1	0	foraging	nd	1 adult male in blackbutt isolate
194	Grey Shrike-thrush	*Colluricincla harmonica*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	1	0	foraging	nd	in flowering white thryptomene patch of marri/wandoo ridgetop
195	Grey Shrike-thrush	*Colluricincla harmonica*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	1	0	foraging	no	in heathy banksia woodland

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196	Grey Shrike-thrush	*Colluricincla harmonica*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	1	0	foraging	no	in dryandra grading into mallee (*Euc. eudesmoides*)
197	Black-faced Woodswallow	*Artamus cinereus*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	1	0	foraging	nd	
198	Black-faced Woodswallow	*Artamus cinereus*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	6	0	foraging	nd	group moving across recently drilled paddock of wetland edge
199	Grey Butcherbird	*Cracticus torquatus*	O71011	1600-1630	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	1	0	foraging	nd	
200	Grey Butcherbird	*Cracticus torquatus*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	1	0	calling	nd	
201	Pied Butcherbird	*Cracticus nigrogularis*	O81011	0925-1010	Pearson riparian remnant	S 30 49 13.5 E 116 16 17.2	1	0	foraging	nd	
202	Australian Magpie	*Cracticus tibicen*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	3	0	foraging, perching	nd	
203	Australian Magpie	*Cracticus tibicen*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	1	0	nesting	yes	in upper gully wandoo
204	Australian Magpie	*Cracticus tibicen*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	3	0	roosting	no	in creek paperbark
205	Australian Magpie	*Cracticus tibicen*	O91011	0835-0910	Pearson Wandoo remnant	S 30 49 10.9 E 116 34 35.0	1	0	foraging	no	
206	Australian Magpie	*Cracticus tibicen*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	2	0	foraging	yes	with 1 juvenile
207	Grey Fantail	*Rhipidura albiscapa*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	2	0	foraging, calling, mate pursuit	yes	pair in old wandoo nr new house site

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
208	Grey Fantail	*Rhipidura albiscapa*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	2	foraging, calling, flying	yes	
209	Grey Fantail	*Rhipidura albiscapa*	O51011	1710-1820	Mason Reveg 3	S 31 07 96.3 E 116 19 44.5	0	1	foraging	no	taller drought stricken eucs and sheoaks N side of gully
210	Grey Fantail	*Rhipidura albiscapa*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	1	0	nesting	yes	in wandoo shrubland halfway up slope
211	Grey Fantail	*Rhipidura albiscapa*	O61011	1000-1120	Harridge ridgetop remnant	S 31 02 57.0 E 116 08 50.0	7	0	foraging, territory calling, mate pursuits	yes	
212	Willie Wagtail	*Rhipidura leucophrys*	O51011	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	2	nesting, calling	yes	in York Gum remnant beside plantings
213	Willie Wagtail	*Rhipidura leucophrys*	O71011	1600-1630	Isbister riparian remnant	S 30 36 19.9 E 116 02 45.5	1	0	foraging	nd	
214	Willie Wagtail	*Rhipidura leucophrys*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	1	0	foraging	nd	
215	Willie Wagtail	*Rhipidura leucophrys*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	foraging, calling	likely	
216	Australian Raven	*Corvus coronoides*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	foraging, chasing WT Eagle	yes	in ephemeral wetland
217	Australian Raven	*Corvus coronoides*	O71011	1005-1105	Botha (Jenny Kelly) riparian remnant	S 30 53 64.5 E 116 03 25.5	2	0	foraging	nd	
218	Australian Raven	*Corvus coronoides*	O91011	1725-1830	Scotney York/Salmon Gum remnant	S 30 44 38.7 E 116 21 54.6	4	0	calling, foraging	likely	old nest found in Salmon Gum
219	Australian Raven	*Corvus coronoides*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	5	0	mobbing WT Eagle in flyover	yes	

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
220	Magpie-lark	*Grallina cyanoleuca*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	4	0	foraging	nd	edge of Banksia woodland
221	Magpie-lark	*Grallina cyanoleuca*	O71011	1600-1630	Isbister York/Wandoo remnant	S 30 36 19.9 E 116 02 45.5	1	0	foraging	nd	
222	Magpie-lark	*Grallina cyanoleuca*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging, calling	nd	
223	Magpie-lark	*Grallina cyanoleuca*	O81011	1730-1820	Leeson riparian remnant	S 31 09 15.4 E 115 49 43.6	2	0	calling, foraging	no	
224	Red-capped Robin	*Petroica goodenovii*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	3	0	foraging, territory calling	yes	adult male and female feeding/decoying away from 1 wk-old fledgling in wandoo
225	Rufuous Songlark	*Cincloramphus mathewsi*	O51011	1600-1700	Mason Reveg 2	S 31 08 17.5 E 116 19 35.2	0	1	calling, perching	nd	in isolated marri nr plantings with w/w trilers & horsfield's bronze-cuckoo
226	Rufuous Songlark	*Cincloramphus mathewsi*	O61011	1605-1825	Hendry remnant	S 30 58 59.1 E 115 58 24.9	2	0	perching, calling, flying (male display flights)	yes	one male and one female flying from canopy perches in blackbutt woodland bordering wetland
227	Brown Songlark	*Cincloramphus cruralis*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	2	0	foraging	likely	1 male, 1 female foraging across drilled paddock
228	Silvereye	*Zosterops lateralis*	O51011	1030-1110	Mason Reveg 1	S 31 07 91.2 E 116 17 79.6	0	4	foraging, calling, flying	yes	in edge plantings of 8 yrold salt river gum & yate
229	Silvereye	*Zosterops lateralis*	O61011	0820-0940	Harridge/Nixon riparian remnant	S 31 03 19.0 E 116 09 25.8	1	0	calling	no	
230	Silvereye	*Zosterops lateralis*	O71011	0740-0950	Botha (Jenny Kelly) ridgetop remnant	S 30 53 13.8 E 116 02 35.4	5	0	foraging, calling	yes	

Record No.	Common Name	Scientific Name	Date	Time	Site name	Site location	Remnant	Revegetation	Behaviour	Breeding	Comments
231	Silvereye	*Zosterops lateralis*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	6	0	calling, foraging, flying	nd	flying between adjacen wandoo stand and heath
232	Welcome Swallow	*Hirundo neoxena*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	4	0	foraging, calling	nd	
233	Welcome Swallow	*Hirundo neoxena*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	12	0	foraging, calling, courtship	yes	over lake and adjacent shrubland/paddocks
234	Tree Martin	*Petrochelidon nigricans*	O51011	0755-1005	Mason remnant	S 31 07 29.9 E 116 18 02.1	10	0	foraging, nesting, calling	yes	colony nesting in old wandoo spouts nr new house area
235	Australasian Pipit	*Anthus novaeseelandiae*	O81011	0920-1030	Slater remnant wetland	S 31 11 02.2 E 115 59 52.0	5	0	foraging, calling, male aerial courtship displays	yes	males giving aerial courtship displays
236	Australasian Pipit	*Anthus novaeseelandiae*	111011	0750-0930	S&E Kelly remnant	S 30 54 26.0 E 116 03 21.7	2	0	foraging, calling, male courtship flights	yes	at paddock edge of remnant