Biota Environmental Sciences

Yandicoogina Junction South West and Oxbow Fauna Survey

Prepared for Rio Tinto Iron Ore

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Biota Environmental Sciences

ABN 49 092 687 119
Level 1, 228 Carr Place
Leederville Western Australia 6007
Ph: (08) 9328 1900 Fax: (08) 9328 6138

Project No.: 428/541

Prepared by: Erin Harris, Phil Runham

Checked by: Garth Humphreys

Approved for Issue: Garth Humphreys

Yandicoogina JSW and Oxbow Fauna Survey

Contents

Appendix 4

DEC Regulation 17 "Licence to take fauna for scientific purposes"

Appendix 5

Bat Call Identifications

Tables

Figures

Plates

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1.0 Summary

1.1 Background

The Yandicoogina iron ore mine is located approximately 90 km north-west of Newman, in the Pilbara region of Western Australia (Figure 2.1). The mine site is owned by Hamersley Iron and operated by Pilbara Iron on behalf of Rio Tinto Iron Ore (RTIO). Both companies form part of the larger Rio Tinto Group.

RTIO is seeking to expand their current mining operations at Yandicoogina. This involves two expansion areas, located to the west and south of the existing operations:

- Yandicoogina Junction South West (JSW); and
- Oxbow.

A third development site, Billiards, is located to the south of the existing Yandicoogina operation. This site is the subject of a related, but separate report. Biota Environmental Sciences (Biota) was commissioned to complete a fauna survey of the proposed Yandicoogina JSW and Oxbow project areas. The survey was planned and implemented in accordance with the Environmental Protection Authority (EPA) Position Statement No. 3 "Terrestrial Biological Surveys as an Element of Biodiversity Protection" (EPA 2002) and Guidance Statement No. 56 "Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia" (EPA 2004).

The scope of the study was to:

- identify the fauna habitats, particularly those with conservation significance, within the study area;
- document the vertebrate and SRE invertebrate fauna assemblage within the study area; and
- identify fauna (particularly Schedule and Priority listed fauna as well as potential short-range endemic taxa) of particular conservation significance occurring within the area.

1.2 Methods

The fauna survey took place during a single phase conducted in July 2008, with a further phase targeting SRE invertebrate fauna during March 2010.

The principal component of the field survey consisted of systematic fauna sampling centred on a total of 11 trapping sites in environments considered to represent the range of habitats available within the study area. Six grids of 10 pit-traps, three funnel trap sites of 20 traps each, and two lines of Elliott traps were used.

Nineteen avifauna censuses were conducted during the surveys at nine sites. Censuses were conducted between approximately 7:00 am and 12:00 pm, and were supplemented by opportunistic sightings of birds while traversing the study area.

Invertebrates were collected from both systematic sampling sites and opportunistic sampling sites. Groups targeted during these activities included:

- mygalomorph (trap-door) spiders;
- pseudoscorpions;
- scorpions;
- millipedes; and
- terrestrial snails.

Additional non-systematic collection techniques were undertaken by the survey team to supplement trapping efforts, and to investigate habitats not sampled using systematic methods.

1.3 Fauna

The single phase survey of the JSW and Oxbow study area yielded a total of 72 vertebrate species, comprising 46 avifauna species, 12 mammals and 14 herpetofauna species (Table 1.1; Section 5.0).

Table 1.1: Number of vertebrate fauna species recorded during the fauna survey of the study area.

Fauna Group	Number of Species	Number of Individuals
Avifauna	46	713
Non-volant mammals	6	48
Bats	6	-
Amphibians	0	0
Reptiles	14	55
Total	**72**	**816**

Two Priority 4 listed species were recorded by Biota from the survey area (Table 1.2). A further six Schedule and six Priority listed species have either previously been recorded or may occur in the region (as determined by a search of the DEC Threatened Fauna Database and the WAM FaunaBase; Appendix 1 and Appendix 2). Of these latter species, the Northern Quoll and the Night Parrot are listed as Endangered at the Federal level, while the Bilby, Pilbara Orange Leaf-nosed Bat and Pilbara Olive Python are listed as Vulnerable under the Federal *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. The Rainbow Bee-eater was also recorded during the survey and is listed as Migratory under the *EPBC Act 1999*. These species are discussed further in Section 6.4.

Table 1.2: Fauna of conservation significance recorded during the fauna survey, or with the potential to occur within the study area (* denotes recorded during the survey).

Threatened Fauna Species	Status	
	State	Federal
Pezoporus occidentalis Night Parrot	Schedule 1	Endangered
Dasyurus hallucatus Northern Quoll	Schedule 1	Endangered
Macrotis lagotis Bilby	Schedule 1	Vulnerable
Rhinonicteris aurantius Pilbara Orange Leaf-nosed Bat	Schedule 1	Vulnerable
Lerista olivaceus barroni Pilbara Olive Python	Schedule 1	Vulnerable
Falco peregrinus Peregrine Falcon	Schedule 4	
Ramphotyphlops ganei	Priority 1	
**Neochmia ruficauda subclarescens* Star Finch	Priority 4	
Falco hypoleucos Grey Falcon	Priority 4	
Ardeotis australis Australian Bustard	Priority 4	
Burhinus grallarius Bush Stone-curlew	Priority 4	
**Pseudomys chapmani* Western Pebble-mound Mouse	Priority 4	
Leggadina lakedownensis Short-tailed Mouse	Priority 4	
Macroderma gigas Ghost Bat	Priority 4	

Only two Priority 4 species, the Star Finch and the Western Pebble-mound Mouse, were confirmed from the study area (Table 1.1). Neither are restricted to the study area and are well represented in similar habitats across the Pilbara bioregion. No changes to their conservation status would be expected as a result of the development of Yandi JSW and Oxbow.

Invertebrate species representing five groups, the beetles (Coleoptera), terrestrial snails (Gastropoda), pseudoscorpions (Pseudoscorpionida), silver fish (Thysanura) and Sac spiders (Trochanteriidae) were collected from the study area. These have been lodged with the WA

Museum, although none are considered likely to support short-range endemic species in the Pilbara.

2.0 Introduction

2.1 Project Background and Study Area

The Yandicoogina iron ore mine is located approximately 75 km north-west of Newman, in the Pilbara region of Western Australia (Figure 2.1). This mine site is owned and operated by RTIO.

RTIO is seeking to sustain their current mining operations located at Yandicoogina. This involves three expansion areas, two of which are located to the west of the existing operations:

- Yandicoogina Junction South West (JSW); and
- Oxbow (Figure 2.1).

The study area for the JSW development lies immediately west of the existing Yandicoogina operations while the Oxbow study area abuts the western extremity of JSW. A potential third development site, Billiards, is located to the south of the existing Yandicoogina operation. This site is the subject of a related, but separate report.

The project footprint was altered subsequent to the field survey (see Section 4.0). For the purposes of this report, the original extent has been referred to as the 2007 survey boundary and the modified footprint the 2009 survey boundary.

2.2 Study Objectives and Scope

Biota was commissioned to complete a fauna survey of the proposed Yandicoogina Expansion. The survey was planned and implemented in accordance with the EPA Position Statement No. 3 "Terrestrial Biological Surveys as an Element of Biodiversity Protection" (EPA 2002) and Guidance Statement No. 56 "Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia" (EPA 2004).

The scope of the study was to:

- identify the fauna habitats, particularly those with conservation significance, within the study area;
- document the vertebrate and SRE invertebrate[1] fauna assemblage within the study area; and
- identify fauna (particularly Schedule and Priority listed fauna as well as potential short-range endemic taxa) of particular conservation significance occurring within the area.

2.3 Purpose of this Report

This report describes the methodology employed for the fauna survey of the Yandicoogina Expansion project area. It documents the methods and results of the survey and identifies potential fauna of conservation significance occurring within the project area. Its intended use is as a supporting document for the formal environmental assessment of the project. Both the survey and report are subject to specific limitations that are discussed in Section 4.5.

[1] Note that the survey referred to here was completed prior to publication of SRE survey guidelines (EPA 2009)

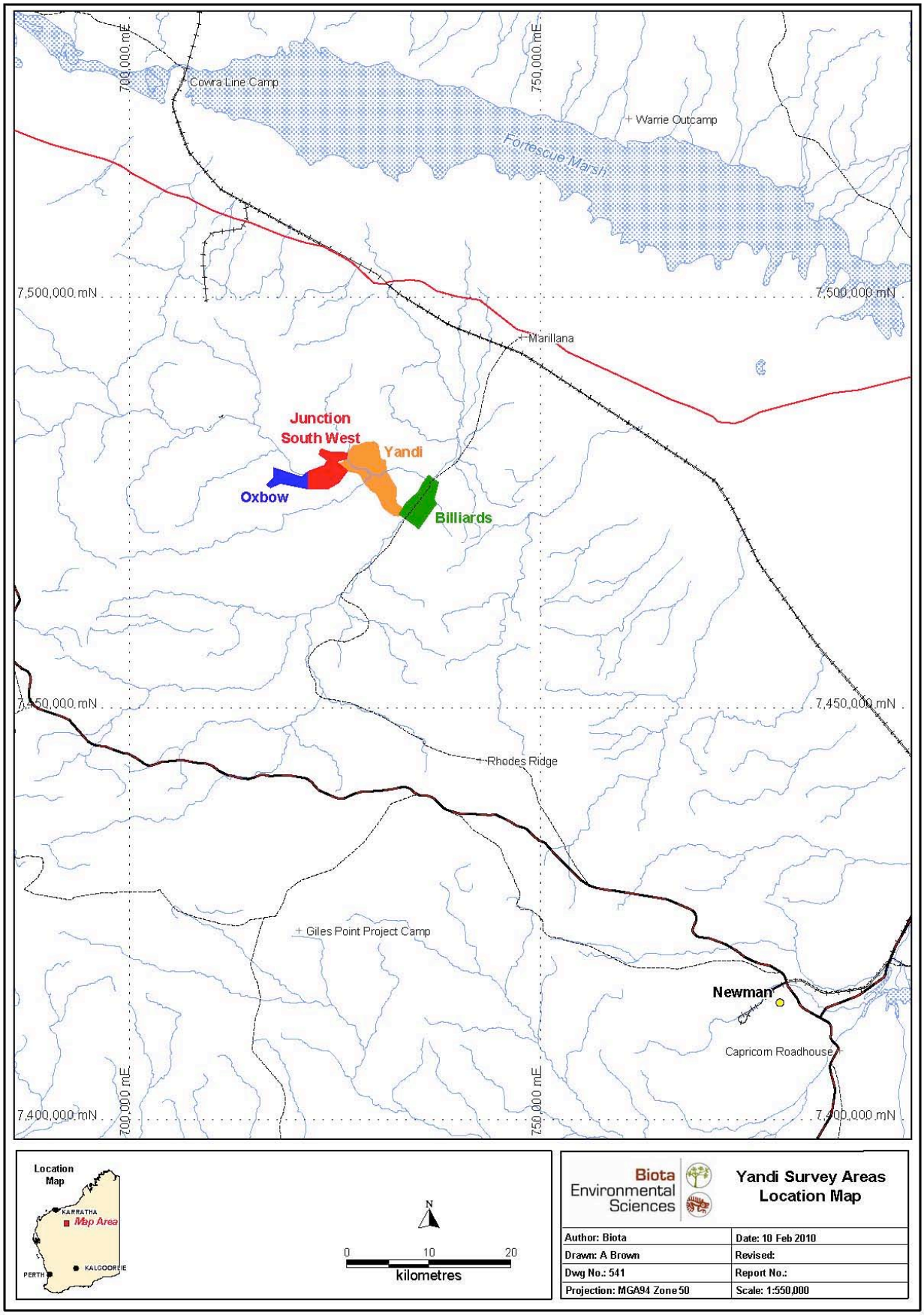

Figure 2.1: Location Map for the Yandicoogina Expansion fauna survey.

3.0 Existing Environment

3.1 Geological and Physiographic Context of the Study Area

3.1.1 Geology

Thorne and Trendall (2001) surveyed the geological units present within the proposed Yandicoogina Expansion study area as part of a wider Pilbara project. There are four of their geological units present within both the JSW and Oxbow study areas (Table 3.1; Figure 3.1 and Figure 3.2).

Table 3.1: Geological units present in the study area.

Unit	Description
PLHj	Weeli Wolli Formation: banded iron-formation (commonly jaspilitic), pelite, and numerous metadolerite sills
Czc	Colluvium - partly consolidated quartz and rock fragments in silt and sand matris; old valley-fill deposits, locally derived
Qa	Alluvium - unconsolidated silt, sand, and gravel; in drainage channels and adjacent floodplains
Czp	Robe Pisolite: pisolitic limonite deposits developed along river channels

3.1.2 Land Systems

Land Systems (Rangelands) mapping covering the study area has been prepared to a draft stage by the Western Australian Department of Agriculture (van Vreeswyk et al. 2004). Land Systems are comprised of repeating patterns of topography, soils, and vegetation (Christian and Stewart 1953) (i.e. a series of "land units" that occur on characteristic physiographic types within the Land System).

A total of 107 Land Systems occur in the Pilbara bioregion. [This information was obtained by combining the Land System mapping for the Pilbara (van Vreeswyk et al. 2004) and Ashburton (Payne et al. 1988), and intersecting this with the Pilbara bioregion in ArcView 3.2.]

Land Systems mapped by the Department of Agriculture (van Vreeswyk et al. 2004) for the region including the YSJW and Oxbow study area are shown in Figure 4.3 and Figure 4.4. Descriptions for each Land System within the project area are provided in Table 3.2.

Table 3.2: Land systems present in the study area (areas based on 2009 survey boundary).

Land System	Description	Extent within bioregion (ha)	Extent within JSW (ha)	Extent within Oxbow (ha)	% of total within bioregion
Boolgeeda (RGEBGD)	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,635	221	310	0.06
McKay (RGEMCK)	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands.	426,142	737	30	0.18
Newman (RGENEW)	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	1,993,742	135	238	0.02
Robe (RGEROB)	Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex grasslands).	128,859	205	137	0.27
River (RGERIV)	Active flood plains and major rivers supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	482,176	163	9	0.04
		3,992,554	**1,461**	**724**	

3.2 Biological Context of the Study Area

3.2.1 IBRA Bioregions and Subregions

The Interim Biogeographic Regionalisation for Australia (IBRA) recognises 85 bioregions (Environment Australia 2000). The JSW and Oxbow study area lies entirely within the Pilbara bioregion.

The Pilbara bioregion is divided into four subregions, described in Environment Australia (2000) as the four major components of the Pilbara Craton. The JSW and Oxbow study area is located in the east of the Hamersley subregion (Kendrick 2001):

- Hamersley (PIL3): mountainous area of Proterozoic ranges and plateaux with low Mulga (*Acacia aneura*) woodland over bunch grasses on fine textured soils, and Snappy Gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on the skeletal sandy soils of the ranges.

3.2.2 Previous Fauna Surveys

Numerous surveys have been undertaken adjacent to the study area, or are otherwise relevant because they have been undertaken nearby in the same sub-region of the Pilbara Craton. These include:

- Yandi (HI) biological survey (Ninox Wildlife Consulting 1995);
- BHPIO Yandi Stage II biological survey (Ecologia 1995);
- Mining Area C biological survey (Woodward-Clyde 1997);
- Seasonal survey of the Hope Downs mine area (Ecologia 1997);
- Weeli Wolli Springs biological survey (Ecologia 1998a);
- West Angelas biological survey (Ecologia 1998b);
- BHPIO Marillana Creek biological surveys (summarised in Halpern Glick Maunsell 1999);
- BHPIO Marillana Creek rare fauna survey (Bamford and Associates 2003);
- Western Rail Corridor survey from the Hope Downs mine to the vicinity of Coondewanna Flats (Halpern Glick Maunsell 2000);
- Eastern Rail Corridor survey from the Hope Downs mine to Weeli Wolli siding (Halpern Glick Maunsell 2000);
- Vertebrate fauna survey of the proposed Hope Downs rail corridor from Weeli Wolli Siding to Port Hedland (Biota 2002a);
- Mulgara *Dasycercus cristicauda* and Bilby *Macrotis lagotis* surveys completed in late October 2001 (Biota 2002b);
- Vertebrate fauna survey of a proposed extension to the Hope Downs rail corridor through the Hamersley Range (Biota 2004a);
- Vertebrate fauna survey of a proposed addition to the Hope Downs rail corridor through the Chichester Range (Biota 2004b);
- An assessment of the fauna habitats and fauna assemblage of the proposed Fortescue Metals Group (FMG) Stage A rail corridor (Biota 2004c);
- An assessment of the fauna habitats and fauna assemblage of the proposed FMG Stage B rail corridor and mine areas (Biota 2004d);
- Yandi Expansion Desktop Fauna Assessment and Targeted Invertebrate Survey (Biota 2004e); and
- Yandicoogina Targeted Northern Quoll Survey (Biota 2009).

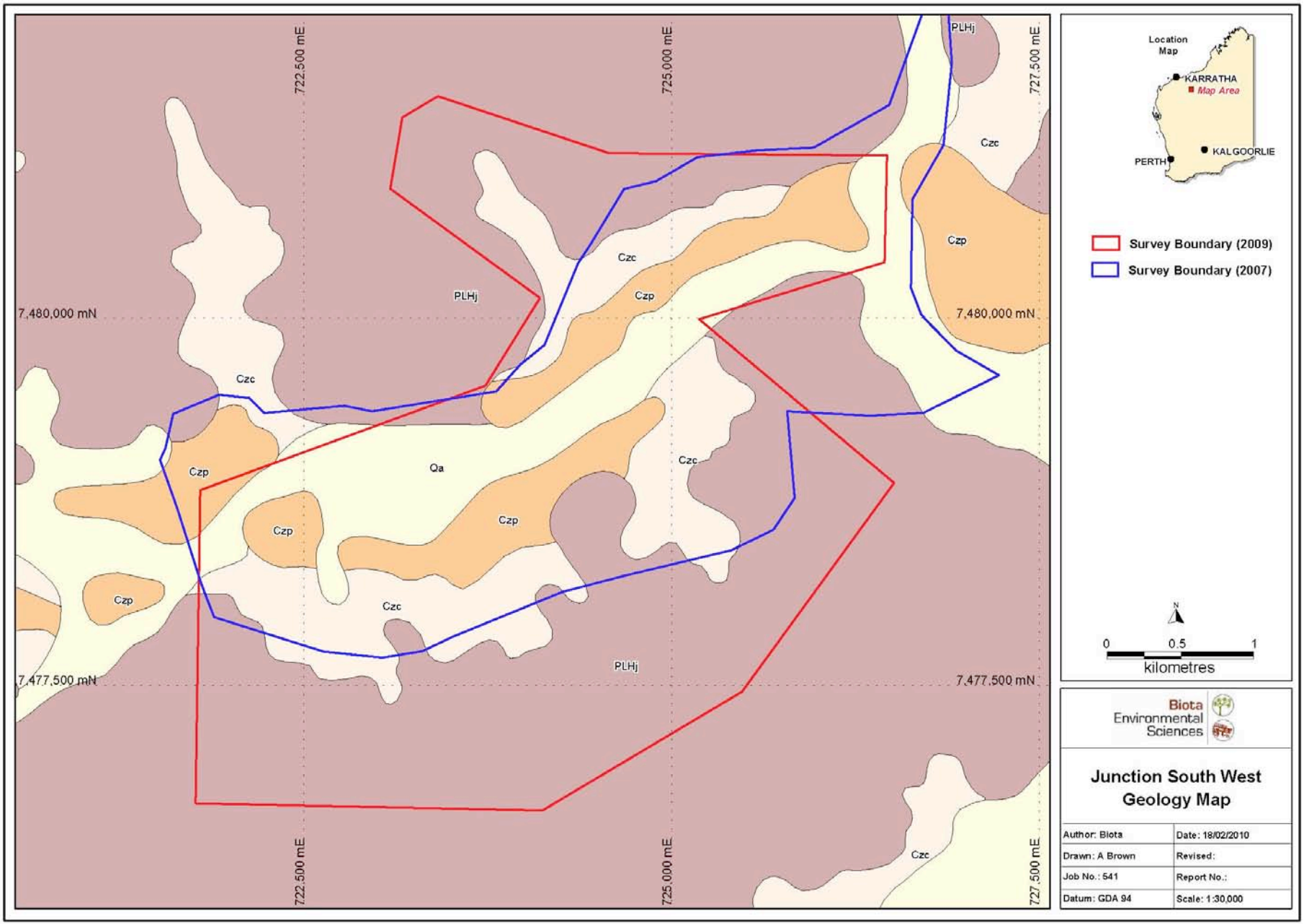

Figure 3.1: Geological units mapped for the Yandicoogina JSW study area.

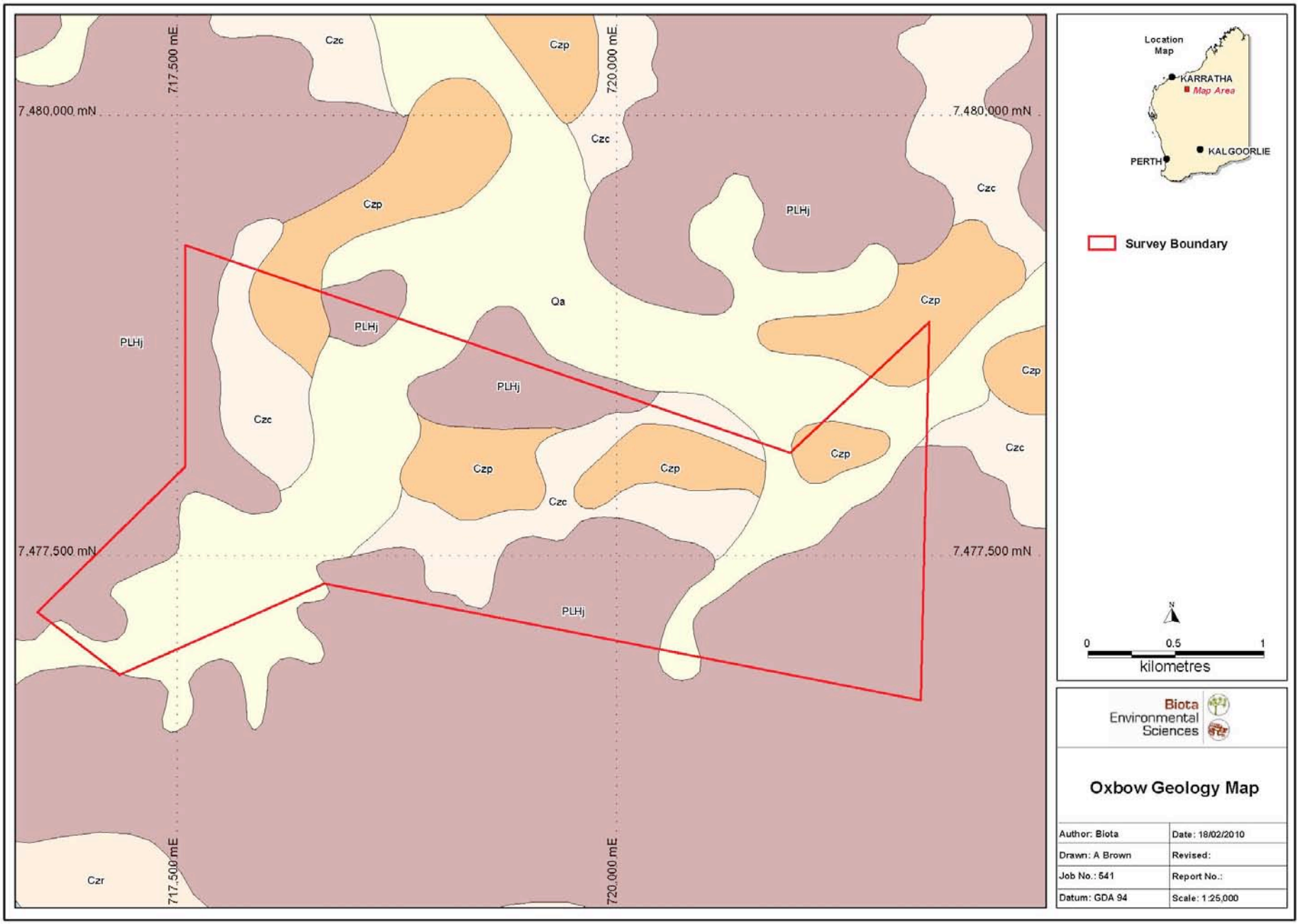

Figure 3.2: Geological units mapped for the Oxbow study area.

3.2.3 Conservation Reserves in the Locality

The main conservation reserve in the vicinity of the project area is the A-class Karijini National Park, approximately 100 km to the west-northwest of the study area.

While not listed as a conservation reserve the area known as Fortescue Marshes, approximately 45 km northeast of the study area, is listed as a Wetland of National Significance (Figure 2.1).

The Pilbara bioregion is listed as a medium priority for funding for land purchased under the National Reserves System Co-operative Program due to the limited representation of the area in conservation reserves. Portions of various pastoral leases in the region have been nominated for exclusion for public purposes in 2015, when the leases come up for renewal. Many of the submissions are from the Department of Environment and Conservation (DEC), with the intention of adding these areas to the existing conservation estate in order to provide a comprehensive, adequate and representative reserve system. None of these proposed exclusions are located in the vicinity of the expansion areas.

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4.0 Study Methodology

4.1 Database Searches

Database searches were conducted of the DEC Threatened Fauna database (Appendix 1), the WA Museum FaunaBase (Appendix 2), and the *EPBC Act 1999* Protected Matters database (Appendix 3).

These were completed using an area search utlising a 50 km buffer on the study area. The central coordinates for this search were:

- 22°47'5.61"S and 119°13'18.62"E

4.2 Survey Timing and Weather

The survey was conducted over a 7-day period between 5th July and 12th July 2008. Minimum temperatures during the survey ranged from 2.3°C to 11.5°C and maximum temperatures ranged from 20.4°C to 26.6°C (Table 4.1). No rainfall was recorded in Newman during the survey (Table 4.1).

The weather experienced during the fauna survey was comparable to the long-term climatic averages for Newman (Figure 4.1). The long-term averages for July include a maximum temperature of 22.3°C, a minimum temperature of 8.1°C. While the average rainfall for the month is 12.6 mm, rainfall events are typically only recorded sporadically at this time of year.

An additional survey phase targeting only invertebrate SRE taxa was completed between March 4th and 7th 2010.

Table 4.1: Daily meteorological observations at Newman Airport for July 2008 during the fauna survey (data provided by the Bureau of Meteorology).

	5/07	6/07	7/07	8/07	9/07	10/07	11/07	12/07	Average
Min. Temp. (°C)	11.5	7.9	6.7	2.6	4.0	2.3	3.5	8.1	5.8
Max. Temp. (°C)	23.7	21.1	20.4	23.8	24.7	24.8	26.6	22.4	23.4
Rainfall (mm)	0	0	0	0	0	0	0	0	

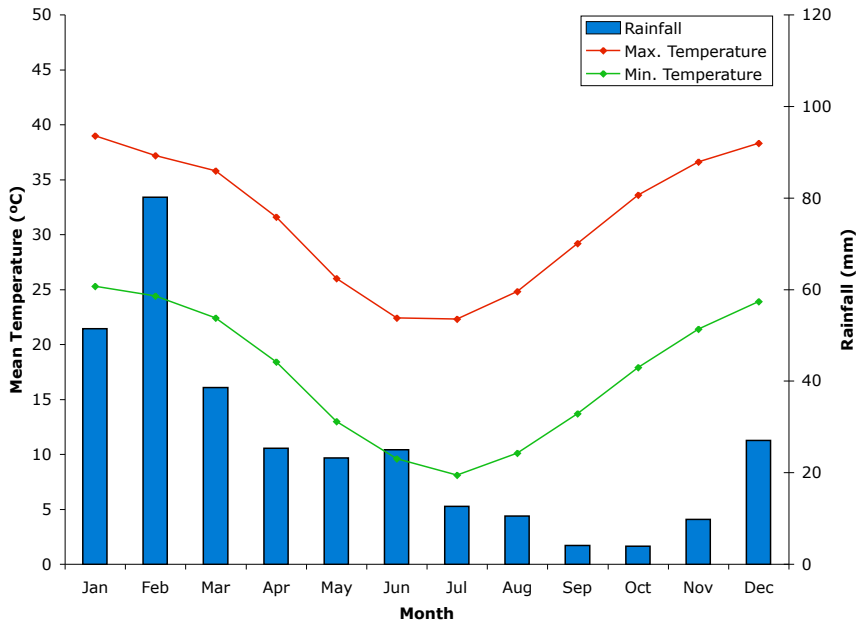

Figure 4.1: Long-term climatic averages for Newman (data provided by the Bureau of Meteorology).

4.3 Fauna Survey Team

The vertebrate fauna sampling for the field survey component of this study was conducted under "Licence to Take Fauna for Scientific Purposes" No. SF006426 issued to Dr Phil Runham (Appendix 4). The fauna survey team comprised Dr Phil Runham, Mr Dan Kamien, Ms Erin Harris and Ms Jessica Cairnes (all of Biota Environmental Sciences). Mr Michael Greenham and Mr Ashley Johnsen participated in the set-up process for the fauna survey.

4.4 Systematic Censusing

4.4.1 Selection and Location of the Survey Sites

The principal component of the field survey consisted of systematic fauna sampling centred on a total of 11 trapping sites, including six grids of 10 pit-traps in environments considered to represent the range of habitats available within the study area. Three funnel trap sites, each with 20 traps, and two lines of Elliott traps were also utilised.

Each survey site was installed within a defined habitat and was selected such that equal weight was given to accessibility of the sites in terms of regular inspection of traps (Plate 4.1 - Plate 5.10). Locations of trapping sites are presented in Table 4.2 and Figure 4.3 - Figure 4.4.

4.4.2 Trapping Effort and Layout of the Trapping Grids

The trapping effort at each of the systematic trapping sites is detailed in Table 4.2. The locations of the trapping sites are shown in Figure 4.3 - Figure 4.4. During the fauna survey, pit-traps at six sites were arranged in a single row of 10 traps, alternating between 20 litre buckets (~40 cm diameter) and PVC tubes (~20 cm diameter). Pit-traps were spaced at ~10 m intervals and connected with a single length of 30 cm tall flywire fence (Figure 4.2).

Funnel traps were placed in a layout similar to that used for pit-traps, whilst Elliott traps were spaced at 5 - 10 m intervals along the base of breakaways or other suitable landscape features.

Table 4.2: Trapping effort and trap location (WGS84, Zone 50) for the fauna survey.

Site	Location	Trap Type	Date Opened	Date Closed	Nights Open	No. of Traps	Total Trapping Effort
Yandicoogina JSW							
YAN01	723723 mE; 7478279 mN	Pit-traps	5/07/08	11/07/08	6	10	60
YAN02	725226 mE; 7480598 mN	Pit-traps	5/07/08	11/07/08	6	10	60
YAN03F	726033 mE; 7480563 mN	Funnel traps	5/07/08	11/07/08	6	20	120
YAN04	722824 mE; 7478290 mN	Pit-traps	5/07/08	11/07/08	6	10	60
YAN05E	723821 mE; 7479192 mN	Elliott traps	8/07/08	12/07/08	4	25	100
Oxbow							
OXB01	718566 mE; 7478410 mN	Pit-traps	5/07/08	11/07/08	6	10	60
OXB02F	719301 mE; 7477952 mN	Funnel traps	5/07/08	11/07/08	6	20	120
OXB03	717992 mE; 7477516 mN	Pit-traps	5/07/08	11/07/08	6	10	60
OXB04	719368 mE; 7478259 mN	Pit-traps	5/07/08	11/07/08	6	10	60
OXB05F	719569 mE; 7477160 mN	Funnel traps	5/07/08	11/07/08	6	20	120
OXB06E	717465 mE; 7477844 mN	Elliott traps	6/07/08	11/07/08	5	42	210
					Pit-trapping Nights		**360**
					Funnel Trap Nights		**360**
					Elliott Trap Nights		**310**
					Total Trap Nights		**1,030**

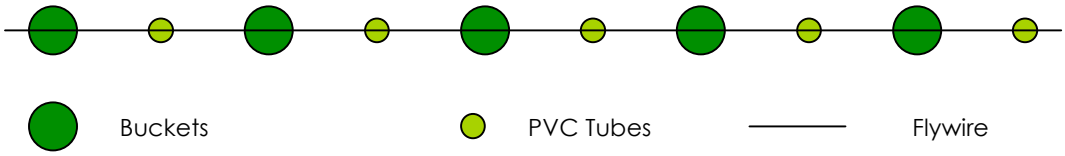

Figure 4.2: Indicative layout of trapping grids for the fauna survey.

4.4.3 Avifauna Sampling

The avifauna of the project area was sampled using a combination of techniques, which included:

- unbounded area searches conducted at the systematic sampling grids (Table 4.3);
- unbounded area searches conducted at opportunistic locations containing habitats or microhabitats likely to support previously unrecorded species; and
- opportunistic observation of birds while driving around the study area.

A total of 19 avifauna censuses were completed across nine sites during the survey period (Table 4.3). Avifauna were sampled using 30 or 40-minute censuses comprising a total in excess of 10 hours of dedicated avifauna sampling.

Censuses were supplemented by recording avifauna species observed opportunistically within the study area.

Table 4.3: Timing of avifauna censuses during the fauna survey.

Site	6/7/08	7/7/08	8/7/08	9/7/08	10/7/08	11/7/08	Total (min)
YAN01	0715 - 0745		0830 - 0900		0905 - 0945	*	100
YAN02	*		0750 - 0820	*	0805 - 0845		70
YAN03F			0710 - 0740		0715 - 0755		70
YAN04	0755 - 0825		0905 - 0935		*		60
OXB01	0855 - 0925			0817 - 0847			60
OXB02F	1025 - 1055			0853 - 0923			60
OXB03	1120 - 1150	0715 - 0745		1034 - 1104			90
OXB04				0740 - 0810	1010 - 1050		70
OXB05F			0945 - 1015				30
						Total	**610 min**

NB. * denotes opportunistic sampling. YAN05E was not directly sampled due to its proximity to YAN03F and the continuity of habitats across the two sites.

4.4.4 Bat Sampling

Bats were sampled at one site using a harp trap and at two sites using Anabat echolocation call detectors (Table 4.4 and Figure 4.3 - Figure 4.4; Plate 4.1). A total of 11 nights were devoted to sampling for bats during the study.

Table 4.4: Location of bat sampling during the JSW and Oxbow fauna surveys.

Site	Location	Structure	Type	Date Opened	Date Closed	No. of Nights
YANBAT01	723838 mE; 7479182 mN	Creekline	Harp Trap	8/07/08	12/07/08	4
			Anabat	8/07/08	12/07/08	4
OXBANA01	717400 mE; 7477886 mN	Rock overhang	Anabat	8/07/08	11/07/08	3
					Total Bat Sampling Nights	**11**

Plate 4.1: Site YANBAT01.

4.4.5 Non-systematic Sampling of Vertebrate Fauna

A range of non-systematic fauna survey activities was also undertaken to supplement trapping and investigate additional habitats identified during the course of the survey. These included:

- habitat-specific searches for Schedule and Priority listed fauna species;
- searching of microhabitats for reptile, frog and small mammal species;
- opportunistic sightings and records;
- identification of road kills and other animal remains; and
- recording and identification of secondary signs including tracks, scats and diggings.

4.4.6 Invertebrate Sampling

Hand foraging was undertaken for pseudoscorpions, involving peeling bark and lifting rocks. The latter technique was also used to search for scorpions, with additional specimens collected from pit traps. Millipedes were searched for whilst raking leaf litter and other debris and whilst searching for land snails. Representative samples of other invertebrates from pit traps were collected, sorted to morphotype, placed in 70% ethanol and lodged with the WA Museum.

Groups targeted during these activities included:

- mygalomorph (trap-door) spiders;
- pseudoscorpions;
- scorpions;
- millipedes; and
- terrestrial snails.

Sampling for potential short-range endemic (SRE) invertebrate taxa was completed at five sites within the Oxbow area, including two systematic sampling sites, as well as three non-systematic sampling sites. Invertebrate sampling in the JSW area was confined to one site (Table 4.5).

Table 4.5: SRE sampling site in the Yandicoogina JSW and Oxbow study areas.

Site	Easting	Northing
Yandicoogina JSW		
YANSRE03	723 450	7 478 143
Oxbow		
OXB04	719370	7478260
OXBF05	719569	7477160
OXBSRE01	717 596	7 477 767
OXBSRE04	718 320	7 478 526
OXBSRE05	720 343	7 478 342

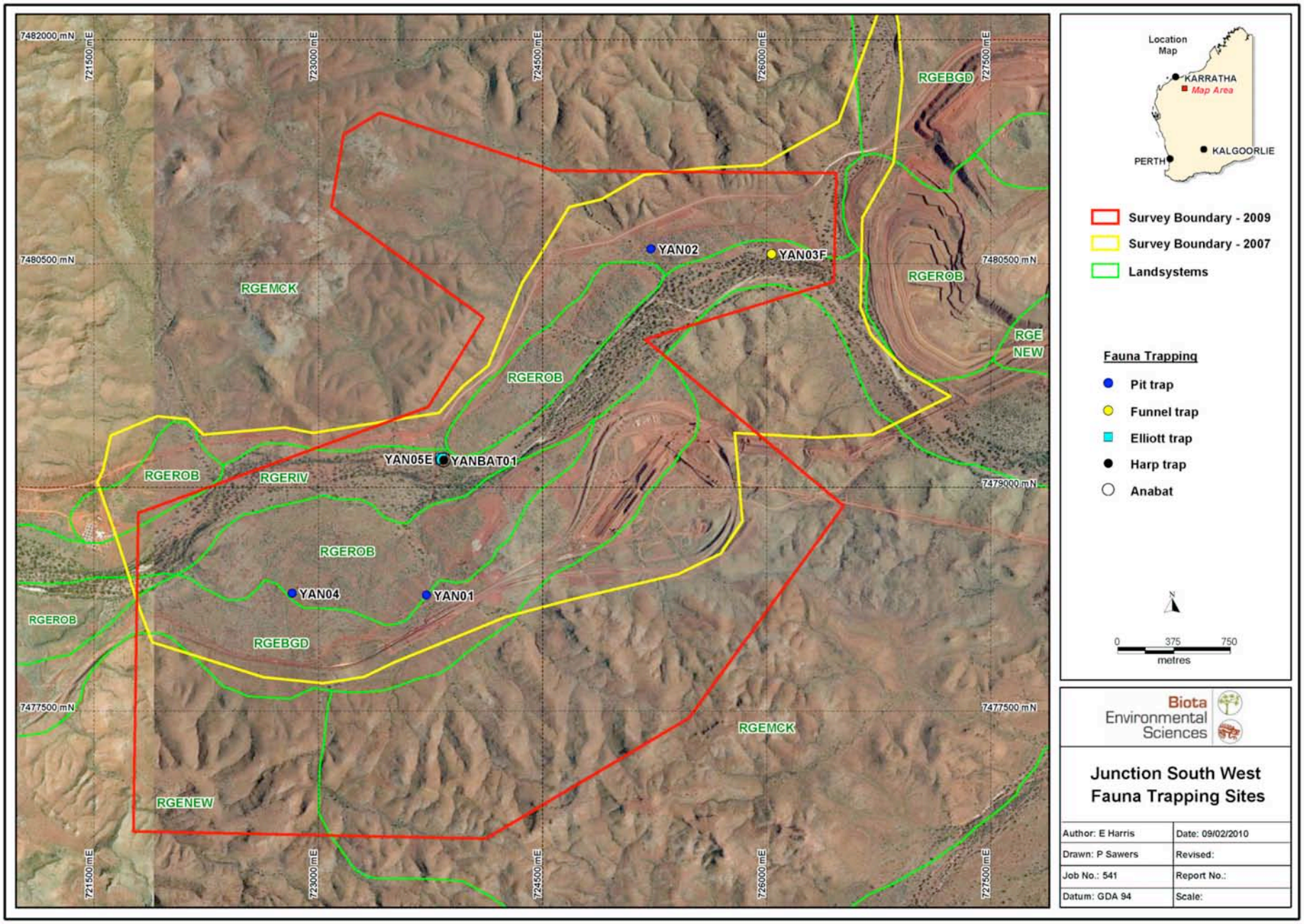

Figure 4.3: Fauna trapping site locations in the Junction South West study area.

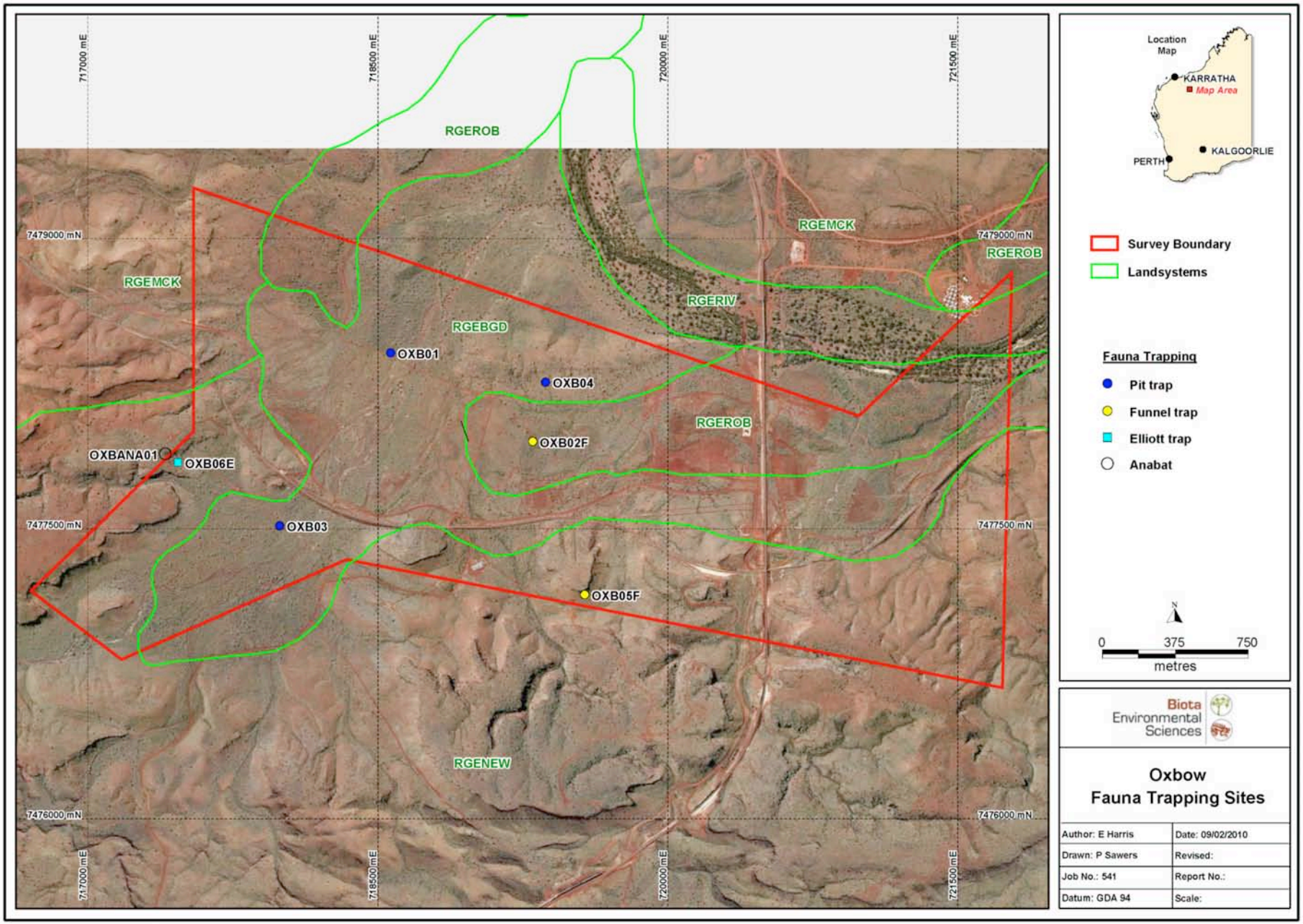

Figure 4.4: Fauna trapping site locations in the Oxbow study area.

4.5 Survey Limitations

The following limitations should be recognised by the reader of this report:

- The Yandicoogina Expansion fauna survey represents a single phase of sampling only. It is probable that a seasonal survey would augment the number of species recorded from the study area. However, the area around Yandicoogina has been extensively surveyed over past years, and the fauna of the area is well understood.
- It should be noted that much of the JSW study area was recently burnt prior to the survey. It is therefore likely that due to the sparsely vegetated habitats, fauna populations may not have been representative of those that might be expected in the area after revegetation.
- It should be noted that nightspotting was not undertaken during the survey in accordance with site operational and safety procedures.
- Not all sections of the study area were ground-truthed or equally sampled for fauna. Parts of the study area were inaccessible by vehicle hence regular checking of fauna traps in these areas would not have been possible. However, systematic fauna sampling was completed on the basis of trapping grid installation in habitats considered to be representative of the range of units present within the development area.
- Terrestrial invertebrate sampling was targeted at a small number of specific groups that are known to potentially harbour SRE taxa. Whilst the survey guidelines for SRE sampling were not published prior to completion of the survey, retrospective analysis has demonstrated that the sampling techniques utilised are in accordance with the EPA Guidelines for this type of work (EPA 2009).
- It should be noted that the southern portion of the JSW 2009 study boundary (Figure 4.3) was not surveyed during the 2008 fauna survey. This area is currently inaccessible by vehicle, however based on geology, land systems and vegetation present the survey sites installed in 2008 are still considered representative of the fauna habitats within the 2009 boundary.

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5.0 Results

5.1 Fauna Habitats

Five separate fauna habitat units were identified across the JSW and Oxbow study area during the Yandicoogina Expansion fauna survey (Table 5.1). The fauna habitats were distinguished primarily on the basis of landforms, but also on their associated vegetation and soil types.

Table 5.1: Fauna habitats sampled during the Yandicoogina fauna survey, distinguished by landform.

Vegetation Description and Substrate	Site	Plate
MAJOR DRAINAGE LINE		
Eucalyptus spp. over *Acacia* spp. over mixed shrubs over *Triodia* spp. and tussock grasses on river gravel (with semi-permanent pool).	YAN03F	Plate 5.3
	YAN05E	Plate 5.5
DRAINAGE LINE		
Eucalyptus spp. over *Acacia* spp. (some with *Grevillea wickhamii*) over *Triodia* spp. and grasses on stony loam.	YAN02	Plate 5.2
	OXB01	Plate 5.6
	OXB02F	Plate 5.7
	OXB03	Plate 5.8
HILL SLOPES		
Scattered *Eucalyptus* spp., *Corymbia* spp. and *Acacia* spp. over *Triodia* on stony slope.	OXB04	Plate 5.9
PLAIN AND VALLEY FLOORS		
Acacia spp. and *Grevillea* sp. over *Triodia* spp. on stony loam.	YAN01	Plate 5.1
	YAN04	Plate 5.4
ROCKY BREAKAWAYS AND SCREES		
Scattered *Eucalyptus* spp. and native grasses on scree slopes.	OXB05F	Plate 5.10
	OXB06E	-

Plate 5.1: Site YAN01.

Plate 5.2: Site YAN02.

Plate 5.3: Site YAN03F.

Plate 5.4: Site YAN04.

Plate 5.5: Site YAN05E.

Plate 5.6: Site OXB01.

Plate 5.7: Site OXB02F.

Plate 5.8: Site OXB03.

Plate 5.9: Site OXB04.

Plate 5.10: Site OXB05F.

5.2 Fauna Overview

The fauna survey of the Yandicoogina Expansion survey area yielded a total of 72 vertebrate fauna species representing 38 families (Table 5.2). Forty-six species of avifauna, 12 species of mammals and 14 species of herpetofauna were recorded during the survey (Table 5.2).

Table 5.2: Vertebrate fauna groups recorded during the fauna survey.

Fauna Group	Number of Species	Number of Families
Avifauna	46	25
Non-volant mammals (Native)	4	2
Non-volant mammals (Introduced)	2	2
Bats	6	3
Amphibians	0	0
Reptiles	14	6
Total	**72**	**38**

5.3 Avifauna

5.3.1 The Assemblage

A total of 46 species of birds was recorded during the JSW and Oxbow fauna survey, comprising 25 families. This included 17 non-passerine species and 29 passerine species (Table 5.4).

The most commonly recorded species was the Zebra Finch *Taeniopygia guttata* with a total of 176 records, representing 24.7% of all avifauna records. The White-plumed Honeyeater *Lichenostomus penicillatus* was also relatively common, with 10.4% of the total of all avifauna records for the survey. The most abundant family was the Meliphagidae (honeyeaters) with 193 records accounting for 27.1% of all records. The most speciose family observed was the Meliphagidae (honeyeaters) with six species; this was followed by the Columbidae (doves and pigeons) with four species recorded (Table 5.4).

The most species rich sites were YAN01 (stony loam plain) with 27 species, followed by YAN02 (drainage line habitat) both with 24 species (Table 5.4).

5.3.2 Avifauna of Conservation Significance

One species of avifauna of elevated conservation significance was recorded during the fauna survey; this was the Priority 4 listed Star Finch *Neochmia ruficauda subclarescens*. One Migratory species, the Rainbow Bee-eater *Merops ornatus* was also recorded (Table 5.4).

A further four avifauna species of elevated conservation significance may occur within the study area.

Information on these species of elevated conservation significance can be found in Section 6.4.

5.4 Mammals

5.4.1 The Assemblage – Non-volant mammals

A total of six species of non-volant mammals was recorded during the survey, representing four families (Table 5.5). This total includes four native mammal species and two non-native species.

The most commonly recorded native species was the Common Rock-rat *Zyzomys argurus* with a total of 14 records, representing 29.2% of all non-volant mammal records. The most commonly recorded non-native species was the European Cattle *Bos taurus*, with 16 records representing a total of 33.3% of all non-volant mammal records for the survey. The most abundant family was the Muridae, with 26 records accounting for 54.2% of all records. The most speciose family observed was also the Muridae, which comprised three species (Table 5.5).

The most speciose site during the fauna survey was YAN01 (stony loam plain) with three species recorded.

5.4.2 The Assemblage – Bats

Six species of bats were identified on the basis of call records from two sites within the project area (Appendix 5). These comprised two Emballonuridae, three Vespertilionidae and one Molossidae (Table 5.3).

5.4.3 Mammals of Conservation Significance

One mammal species of elevated conservation significance was recorded during the fauna survey; this was the Western Pebble-mound Mouse *Pseudomys chapmani* Table 5.5).

Table 5.3: Bat species recorded during the fauna survey.

FAMILY Common Name	Species Name	YANBAT01	OXBANA01	Total
EMBALLONURIDAE				
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	C		1C
Common Sheathtail-bat	*Taphozous georgianus*	C	C	2C
VESPERTILIONIDAE				
Gould's Wattled Bat	*Chalinolobus gouldii*	C	C	2C
Little Broad-nosed Bat	*Scotorepens greyii*		C	1C
Finlayson's Cave Bat	*Vespadelus finlaysoni*	C	C	2C
MOLOSSIDAE				
White-striped Freetail-bat	*Tadarida australis*	C		1C
	Total Number of Species	**5**	**4**	**6**

A further five mammal species of elevated conservation significance may occur within the study area, but were not recorded during the survey (see Section 6.4).

5.5 Herpetofauna

5.5.1 The Assemblage

A total of 14 species of herpetofauna were recorded during the fauna survey, representing six families (Table 5.6). This total comprised three dragons (Agamidae), three geckos (Diplodactylidae and Gekkonidae), two legless lizards (Pygopodidae), five skinks (Scincidae) and one front-fanged snake (Elapidae).

The most commonly recorded species was the skink *Ctenotus pantherinus* with a total of 13 records, representing 23.6% of all herpetofauna records. The dragon *Ctenophorus isolepis* was also relatively common, with 10 records representing 18.2% of all herpetofauna records for the survey. The most abundant herpetofauna family was the Scincidae, with 27 records accounting for 49.1% of all records. The most speciose family observed was also the Scincidae with five species.

The most speciose site was YAN01 with six species recorded, followed by YAN02 with five species (Table 5.5)

5.5.2 Herpetofauna of Conservation Significance

Two herpetofauna species of elevated conservation significance may occur within the study area, but were not recorded during the survey (see Section 6.4).

Table 5.4: Avifauna species recorded during the fauna survey.

FAMILY Common Name	Species Name	OXB01	OXB03	OXB04	OXBF02	OXBF05	YAN01	YAN02	YAN04	YANF03	Total
PHASIANIDAE											
Stubble Quail	*Coturnix pectoralis*						2				2
ANATIDAE											
Grey Teal	*Anas gracilis*							2			2
PHALACROCORACIDAE											
Little Pied Cormorant	*Phalacrocorax melanoleucos*						7				7
ACCIPITRIDAE											
Whistling Kite	*Haliastur sphenurus*							1			1
Little Eagle	*Aquila morphnoides*							2			2
FALCONIDAE											
Australian Kestrel	*Falco cenchroides*		3								3
COLUMBIDAE											
Crested Pigeon	*Ocyphaps lophotes*	1						3	8		12
Spinifex Pigeon	*Geophaps plumifera*		9	3			10	1	1	1	25
Diamond Dove	*Geopelia cuneata*						2				2
Peaceful Dove	*Geopelia striata*							6		4	10
PSITTACIDAE											
Little Corella	*Cacatua sanguinea*						9				9
Australian Ringneck	*Platycercus zonarius*						2	2		6	10
CUCULIDAE											
Horsfield's Bronze Cuckoo	*Chrysococcyx basalis*				1		2			1	4
CENTROPODIDAE											
Pheasant Coucal	*Centropus phasianinus*							1			1
HALCYONIDAE											
Blue-winged Kookaburra	*Dacelo leachii*						1	1			2
Red-backed Kingfisher	*Todiramphus pyrrhopygia*			1							1
MEROPIDAE											
Rainbow Bee-eater	*Merops ornatus*						5	14		3	22
MALURIDAE											
Variegated Fairy-wren	*Malurus lamberti*	11	4	15			2			13	45
PARDALOTIDAE											
Red-browed Pardalote	*Pardalotus rubricatus*	4	3	1			1	1	1		11
Striated Pardalote	*Pardalotus striatus*			1							1

FAMILY Common Name	Species Name	OXB01	OXB03	OXB04	OXBF02	OXBF05	YAN01	YAN02	YAN04	YANF03	Total
ACANTHIZIDAE											
Weebill	*Smicrornis brevirostris*	3	2	6	1	2	10	6	5	5	40
Western Gerygone	*Gerygone fusca*									1	1
MELIPHAGIDAE											
Brown Honeyeater	*Lichmera indistincta*	1	2	1	9		4	8	2	10	37
Singing Honeyeater	*Lichenostomus virescens*	9	7	5			6	4	11	2	44
Grey-headed Honeyeater	*Lichenostomus keartlandi*		1	3	3		1				8
White-plumed Honeyeater	*Lichenostomus penicillatus*			2			6	37		29	74
Yellow-throated Miner	*Manorina flavigula*		4			2	20	2		1	29
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*						1				1
PETROICIDAE											
Hooded Robin	*Petroica cucullata*		2				1				3
POMATOSTOMIDAE											
Grey-crowned Babbler	*Pomatostomus temporalis*		1		9		3			2	15
PACHYCEPHALIDAE											
Crested Bellbird	*Oreoica gutturalis*						2				2
Rufous Whistler	*Pachycephala rufiventris*					2		2			4
Grey Shrike-thrush	*Colluricincla harmonica*									1	1
DICRURIDAE											
Willie Wagtail	*Rhipidura leucophrys*		3		1				2	2	8
Magpie-lark	*Grallina cyanoleuca*		5		1		10	9		4	29
CAMPEPHAGIDAE											
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		3	1			3		1	4	12
ARTAMIDAE											
Masked Woodswallow	*Artamus personatus*						3				3
Black-faced Woodswallow	*Artamus cinereus*		10			4	1				15
Little Woodswallow	*Artamus minor*							7			7
CORVIDAE											
Torresian Crow	*Corvus orru*		4				4	3			11
Little Crow	*Corvus bennetti*			1							1
HIRUNDINIDAE											
Tree Martin	*Hirundo nigricans*							9			9
SYLVIIDAE											
Rufous Songlark	*Cincloramphus mathewsi*							1			1

FAMILY Common Name	Species Name	OXB01	OXB03	OXB04	OXBF02	OXBF05	YAN01	YAN02	YAN04	YANF03	Total
ESTRILDIDAE											
Zebra Finch	*Taeniopygia guttata*	2	81	1	10		31	10	36	5	176
Star Finch	*Neochmia ruficauda*									2	2
Painted Finch	*Emblema pictum*							8			8
	Total Number of Individuals	**31**	**144**	**41**	**35**	**10**	**149**	**140**	**67**	**96**	**713**
	Total Number of Species	**7**	**17**	**13**	**8**	**4**	**27**	**24**	**9**	**19**	**46**

Table 5.5: Non-volant Mammal species recorded during the fauna survey.

FAMILY Common Name	Species Name	OXB01	OXB03	OXB04	OXBE06	OXBF02	YAN01	YAN02	YAN04	YANE05	YANF03	Total
DASYURIDAE												
Pilbara Ningaui	*Ningaui timealeyi*	2		2			1					5
MURIDAE												
Western Pebble-mound Mouse	*Pseudomys chapmani*			6		1						7
Sandy Inland Mouse	*P. hermannsburgensis*		2					2	1			5
Common Rock-rat	*Zyzomys argurus*				12					2		14
EQUIDAE												
Donkey	*Equus asinus*						1					1
BOVIDAE												
European Cattle	*Bos taurus*						5		5		6	16
	Total Number of Individuals	**2**	**2**	**8**	**12**	**1**	**7**	**2**	**6**	**2**	**6**	**48**
	Total Number of Species	**1**	**1**	**2**	**1**	**1**	**3**	**1**	**2**	**1**	**1**	**6**

Table 5.6: Herpetofauna species recorded during the fauna survey.

FAMILY Species Name	YAN01	YAN02	YANF03	YAN04	OXB01	OXBF02	OXB03	OXB04	OXBF05	OXBE06	Total
AGAMIDAE											
Ctenophorus caudicinctus	1	2		1							4
Ctenophorus isolepis	1			7			1	1			10
Amphibolurus longirostris		1									1
DIPLODACTYLIDAE											
Lucasium stenodactylum							1				1
Oedura marmorata										1	1
GEKKONIDAE											

FAMILY **Species Name**	**YAN01**	**YAN02**	**YANF03**	**YAN04**	**OXB01**	**OXBF02**	**OXB03**	**OXB04**	**OXBF05**	**OXBE06**	**Total**
Gehyra punctata									8		8
PYGOPODIDAE											
Delma nasuta	1										1
Delma pax						1					1
SCINCIDAE											
Carlia munda		1	1		1						3
Ctenotus hanloni		2	5								7
Ctenotus pantherinus	4	2		2	2	2		1			13
Ctenotus rubicundus									2	1	3
Cyclodomorphus melanops	1										1
ELAPIDAE											
Demansia psammophis	1										1
Total Number of Individuals	**9**	**8**	**6**	**10**	**3**	**3**	**2**	**2**	**10**	**2**	**55**
Total Number of Species	**6**	**5**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**14**

5.6 Short-range Endemic (SRE) Taxa

Sampling of invertebrate fauna in the JSW study area yielded no invertebrate groups of interest. Searches at a total of five sampling sites at Oxbow yielded five groups of invertebrate fauna. Of these groups only three: the pseudoscorpions, arachnids and gastropods, are considered to potentially harbour SRE taxa. The details of the specimens collected are provided in the following sub-sections, and the distributions across sites shown in Figure 4.4.

Table 5.7: Invertebrates collected from the Oxbow study area.

Site	Taxon	No. of Specimens
OXB04	Pseudoscorpionida	1
OXBF05	Pseudoscorpionida	8
	Trochanteriidae	4
OXBSRE01	Trochanteriidae	1
OXBSRE04	Gastropoda	3
	Trochanteriidae	3
OXBSRE05	Coleoptera	1
	Pseudoscorpionida	2
	Thysanura	1
	Trochanteriidae	2

5.6.1 Gastropoda

Three shells of one snail taxon were found at a single site (OXBSRE04) in the Oxbow study area, but are likely to have washed into the site from elsewhere. Due to their poor condition they could not be further identified. No live specimens were located.

5.6.2 Pseudoscorpions

Pseudoscorpions representing a single family were collected from three sites within the Oxbow study area (Figure 4.4; Table 5.8). The specimens collected at site OXB04 were collected from under flaking bark on *Corymbia* sp. trees. The specimens collected at site OXBF05 and OXBSRE05 were collected from under rock.

Table 5.8: Pseudoscorpions collected from the Oxbow study area.

Site	Habitat	Family	No. of Specimens
OXB04	Under Tree bark	Oolpiidae	1
OXBF05	Under rock	Oolpiidae	8
OXBSRE05	Under rock	Oolpiidae	2

These specimens have been lodged with the WA Museum for further identification.

5.6.3 Trochanteriidae

Spiders from the Trochanteriidae family were collected from under rocks at four sites (Table 5.9) within the study area.

Table 5.9: Spiders collected from the Oxbow study area.

Site	Family	N. of Specimens
OXBF05	Trochanteriidae	4
OXBSRE01	Trochanteriidae	1
OXBSRE04	Trochanteriidae	3
OXBSRE05	Trochanteriidae	2

These specimens have been lodged with the WA Museum for further identification.

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6.0 Discussion

The discussion following provides a synopsis of the significance of the fauna habitats and assemblages documented in the JSW and Oxbow study area in the context of both the Pilbara Bioregion and the local area. The fauna assemblage is discussed predominantly in terms of the vertebrate families recorded and later in terms of fauna of elevated conservation significance.

6.1 Fauna Habitats

The survey of the JSW and Oxbow study area identified five primary habitat types on the basis of landform, substrate types and vegetation assemblages (see Section 5.1). This compares favourably with previous data, which indicate the potential for six habitat types (Biota 2004e). The habitat not found within the current survey areas are hill slopes vegetated with *Acacia aneura*. However, this habitat type represented only a very small proportion of the total area mapped in 2004 for the expansion of the Yandi operations (Biota 2004e).

The five habitat types identified within the JSW and Oxbow areas broadly comprise *Triodia* hummock grasslands on the hills, rises and valley floors, with or without overstoreys of scattered *Corymbia* and open *Acacia* shrublands. These areas are dissected by minor drainage lines, typically vegetated with *Acacia* shrubs over *Triodia*, and by the major drainage lines of Weeli Wolli, Marillana and Yandicoogina creeks, which are vegetated with *Corymbia* over stands of dense mixed shrubs over *Triodia* and Buffel grass.

These habitats represent a small subset of the extent of similar habitats in the Pilbara and would be considered to be widespread throughout the bioregion.

It should be noted here also that the habitats identified in the Yandicoogina JSW study area were characterised by high levels of degradation due to the presence of cattle and the frequency of fires. Much of the area was devoid of ground level vegetation and much of the overstorey showed evidence of long-term damage. Areas near the major drainage lines were dominated by heavily grazed Cenchrus ciliaris. The habitats of the Oxbow area appeared largely intact, with the exception of a large drainage line that showed signs of burning and subsequent regrowth.

6.2 Fauna Assemblage

The fauna assemblage recorded during the survey of the JSW and Oxbow study area comprised a total of 72 species, representing 38 families. This assemblage is considered to represent a subset of the vertebrate taxa that might be expected to occur in the study area, which has previously been estimated at 147 species across 51 families (Biota 2004e). For the greater part, the absence from the current study of families included in the earlier list can be attributed to factors including disturbed or unsuitable habitats, seasonality or the vagaries of species' biologies.

Comparison of the avifauna assemblage with that compiled earlier (Biota 2004e) reveals the absence of ten families from the assemblage documented during this study. The absence of many of these species can be related to the state and/or availability of suitable habitat. For instance, it is likely that members of avifauna families such as the Casuariidae (Emu), Otididae (Australian bustard) and Turnicidae (Little Button-quail) were absent due to the extent of habitat that had recently been burnt. These areas were vegetated with only very small *Triodia* hummocks in most places and would have offered little foraging for frugivorous or insectivorous species, and little protection for taxa reliant on *Triodia* respectively (Johnstone and Storr 1998). Similarly, the absence of water dependant taxa can reasonably be attributed to the lack of standing water in the JSW area (Marillana Creek). The availability of preferable habitat elsewhere in the vicinity, such as portions of Weeli Wolli Creek influenced by dewatering or the Fortescue Marshes, which lie less than 50 km to the northeast, will also have contributed to this result (Figure 2.1).

Amongst the terrestrial vertebrate fauna, there were only minor differences in the families recorded during the survey and those appearing in the earlier list (Biota 2004e). The sole native mammal family appearing in the report relating to the Yandi expansion (Biota 2004e), but not

recorded by the current survey was the Macropodidae. The two species representing this family in the vicinity of JSW and Oxbow are *Macropus robustus* and *Petrogale rothschildi*. The former taxon, whilst sometimes observed on plains, favours stony hills, slopes and gorges, is relatively fast moving and will avoid contact with people. Hence, it would be expected to occur in most study areas, but on occasion fails to be recorded due to its behaviour. The latter species inhabits gorges and breakaways and can be difficult to see due to its secretive nature and preference for resting in rock shelters during the majority of the daylight hours. Moreover, given the limited availability of habitat preferred by these species, the chance of recording them is greatly reduced.

Bat sampling yielded six of the nine species expected on the basis of the desktop survey completed previously (Biota 2004e). The species not recorded are considered to be widespread and common, and their absence from the records for this survey can be attributed to their biology: *Chalinolobus morio* and *Nyctophilus geoffroyi* (both Vespertilionidae) are species known to enter torpor and to curtail foraging during periods of low temperatures such as those during the 2008 survey. Additionally the molossid *Chaerephon jobensis* typically forages above the vegetation canopy, putting it beyond the range of the call detection units used in this study.

Although the herpetofauna documented during the current survey comprised representatives of the majority of families expected to occur in the JSW and Oxbow study areas, the numbers of both species and individuals were significantly below what might be expected for the area. However, this result and the associated low levels of herpetofauna activity are unsurprising given the low temperatures (both minima and maxima) experienced during the survey (Section 4.2).

6.3 Fauna of Conservation Significance

6.3.1 Threatened Fauna Statutory Framework

Native fauna species that are rare, threatened with extinction, or have high conservation value are specially protected by law under the Western Australian *Wildlife Conservation Act 1950-1979*. In addition, many of these species are listed under the Federal *EPBC Act 1999*.

6.3.1.1 *EPBC Act 1999*

Fauna species of national conservation significance are listed under the *EPBC Act 1999*, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'conservation dependent' (consistent with IUCN categories: http://www.iucn.org/themes/ssc/redlist2006/categories.htm).

Migratory wader species are also protected under the *EPBC Act 1999*. The national List of Migratory Species consists of those species listed under the following International Conventions:

- Japan-Australia Migratory Bird Agreement (JAMBA);
- China-Australia Migratory Bird Agreement (CAMBA); and
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

6.3.1.2 *Wildlife Conservation Act 1950-1979*

Classification of rare and endangered fauna under the *Wildlife Conservation (Specially Protected Fauna) Notice 2010* recognises four distinct schedules of taxa:

1. Schedule 1 taxa are fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection;
2. Schedule 2 taxa are fauna which are presumed to be extinct and are declared to be fauna in need of special protection;
3. Schedule 3 taxa are birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, which are declared to be fauna in need of special protection; and
4. Schedule 4 taxa are fauna that are in need of special protection, otherwise than for the reasons mentioned in paragraphs (1), (2) and (3).

In addition to the above, fauna are also classified under five different Priority codes:

Priority One Taxa with few, poorly known populations on threatened lands.
Taxa which are known from a few specimens or sight records from one or a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Two Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands.
Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Three Taxa with several, poorly known populations, some on conservation lands.
Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Four Taxa in need of monitoring.
Taxa which are considered to have been adequately surveyed or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. Taxa which are declining significantly but are not yet threatened.

Priority Five Taxa in need of monitoring.
Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

6.4 Threatened Fauna Species from the Study Area

Three species of elevated conservation significance were recorded during the Yandicoogina Expansion survey during (Table 6.1). The Star Finch *Neochmia ruficauda subclarescens* and the Western Pebble-mound Mouse *Pseudomys chapmani* are listed as Priority 4 species under State legislation. The Rainbow Bee-eater *Merops ornatus* is listed under Federal legislation as Migratory.

A further five species listed under Federal legislation as either Endangered or Vulnerable (and as Schedule 1 under State legislation) may also occur in the study area (Table 6.1). One Schedule 4 State-listed species may be present. A further six Priority listed species under State legislation may also be present within the study area.

Table 6.1: Threatened Fauna Species possibly occurring within the Yandicoogina vicinity (* denotes species recorded during the fauna survey).

Threatened Fauna Species	Status	
	State	Federal
Pezoporus occidentalis Night Parrot	Schedule 1	Endangered
Dasyurus hallucatus Northern Quoll	Schedule 1	Endangered
Macrotis lagotis Bilby	Schedule 1	Vulnerable
Rhinonicteris aurantius Pilbara Orange Leaf-nosed Bat	Schedule 1	Vulnerable
Lerista olivaceus barroni Pilbara Olive Python	Schedule 1	Vulnerable
Falco peregrinus Peregrine Falcon	Schedule 4	
Ramphotyphlops ganei	Priority 1	
**Neochmia ruficauda subclarescens* Star Finch	Priority 4	
Falco hypoleucos Grey Falcon	Priority 4	
Ardeotis australis Australian Bustard	Priority 4	
Burhinus grallarius Bush Stone-curlew	Priority 4	
**Pseudomys chapmani* Western Pebble-mound Mouse	Priority 4	
Leggadina lakedownensis Short-tailed Mouse	Priority 4	
Macroderma gigas Ghost Bat	Priority 4	

6.4.1 Schedule Fauna Species

***Pezoporus occidentalis* Night Parrot**
State: Schedule 1 'Critically Endangered'
Federal: Endangered

Distribution: Night Parrots have been reported from every state on the Australia mainland. Suitable habitat occurs, or has occurred, across most of the inland, covering at least half of the continent. Records are sparsely distributed through this area, however there do appear to be concentrations of records in western Queensland and the eastern Pilbara (Higgins 1999). There is a confirmed record from Minga Well north of the Fortescue Marsh (approx. 100 km north of Newman, and 250 km east of Brockman) and an unconfirmed sighting from near Yandicoogina on the edge of the Marshes (Mr Roy Teale, Biota, pers. obs.).

Ecology: Night Parrots inhabit areas where there is dense, low vegetation, which provides them shelter during the day. Most records come from hummock grasslands with spinifex (*Triodia*), from areas dominated by samphire, or particularly, where these two habitats are juxtaposed. It has been suggested that birds move into the grasslands when *Triodia* is seeding. They have also been reported in low chenopod shrublands with saltbush and bluebush, and from areas of Mitchell grass (*Astrebla*) with scattered chenopods.

Many records have come from waterholes, and almost all reports from areas of *Triodia* have noted the presence of nearby water. The species is secretive and almost all confirmed sightings of feeding or drinking birds have come after dark. Sightings during the day have almost always been of birds flushed from hiding places by herds of stock, dogs or fire. Birds typically sit very tight, flushing only if the disturbance is very close, actually affecting the clump of vegetation in which they are hiding. Early observers stressed the dependence of the parrot upon dense spinifex or samphire for daytime roosting spots and for nesting.

The Night Parrot is presumably like other arid zone birds in being markedly nomadic. The extent of the movements and the possibility of some seasonality in any part of the range are unknown. Several possible reasons have been proposed for the decline of this species in recent years, including (1) habitat loss through clearing, (2) changes in habitat from burning practices, (3) changes in habitat caused by or competition from stock, (4) reduced availability of water holes or surrounding suitable food plants and (5) predation from feral animals, particularly cats and foxes (cats were mentioned as a major problem by several early observers).

Likelihood of occurrence: While the proposed expansion areas contain areas of dense Triodia, this habitat is not restricted to these areas. Additionally, there are no areas vegetated with samphire in the vicinity of the study area.

Potential Impacts: As a Schedule 1 and federally listed species the Night Parrot is considered fauna in need of special protection. However the Night Parrot is considered unlikely to occur within the study area, and therefore the conservation status of this species would not be altered by the current proposal.

***Dasyurus hallucatus* Northern Quoll**
State: Schedule 1 'Endangered'
Federal: Endangered

Distribution: The Northern Quoll was originally recorded across Northern Australia from the Northwest Cape, Western Australia to south-east Queensland but has declined in recent years. Its distribution is now restricted to six main areas: the north and western top end of the Northern Territory, north of Cape York, the Atherton-Cairns area, the Carnarvon Range-Bowen area of Queensland (Menkhorst and Knight 2001), and the northwest Kimberley and Pilbara regions of Western Australia (Braithwaite and Griffiths 1994). It also occurs on numerous islands off the Australian coast (Abbott and Burbidge 1995, Burbidge and McKenzie 1978).

Ecology: The Northern Quoll, *Dasyurus hallucatus*, is classed as a medium-sized marsupial, with adult weight ranging from 300 g up to 1,200 g. It is considered a partially arboreal and aggressive carnivore, preying on a varied diet of small invertebrates and vertebrates, including lizards, birds, snakes, small mammals and frogs (Oakwood 1997).

The Northern Quoll is a short-lived mammal with both sexes maturing at 11 months. Females reproduce only once each year, and all males die shortly after reproducing (Dickman and Braithwaite 1992, Oakwood 2000). The discrete male cohorts that arise within populations make quolls vulnerable to extinction. If no juvenile male quolls survive to adulthood, there will be no males for females to mate with the following year, and the local population will rapidly become extinct (Braithwaite and Griffiths 1994, Oakwood 2000). Therefore, any factor that results in significant increases in mortality rates of female and juvenile quolls could cause local extinction of quoll populations. This species is most abundant near major creek lines and rivers and in open, rocky habitat and is also commonly found in gorges, where breeding is successful (Oakwood 2008).

Likelihood of Occurrence: The Northern Quoll may occur in the rocky gorge located in the Oxbow study area (OXB06E), as suitable habitat is available, although this site lies outside the proposed disturbance footprint. While not recorded during this study, an individual of this species has been observed by RTIO staff in the warehouse of the existing Yandicoogina operations over a period of approximately one month.

Potential Impacts: Under the *EPBC Act 1999*, an action requires referral to the Federal Environment Minister if it is deemed likely to have a significant impact on a matter of national environmental significance (eg. a listed threatened species such as the Northern Quoll *Dasyurus hallucatus*). Given the apparently broad distribution of the Northern Quoll in the Pilbara bioregion, the relatively small scale of clearing required for the current proposal, and the lack of core habitat for this species in the current study area, it is considered that the action will not result in a significant impact to the Northern Quoll.

***Macrotis lagotis* Bilby**
State: Schedule 1 'Vulnerable'
Federal: Vulnerable

Distribution: The former range of the Bilby included most of the semi-arid areas of mainland Australia, however, it is now confined to *Triodia* hummock grassland and *Acacia* scrub across parts of northern Australia. It has been reintroduced to parts of the south-west of Western Australia (eg. Dryandra Woodlands).

Ecology: The Bilby *Macrotis lagotis* is a medium sized ground mammal, ranging in weight from 1.0 - 2.5 kg. The species is apparently strictly nocturnal and constructs a substantial burrow system, which may be up to 3 m in length (Flannery 1990; Strahan 1995). Similar to the Mulgara, the species has been documented as holding temporary home ranges and showing relatively rapid changes in distribution in response to variation in habitat resources (Johnson 1995).

Likelihood of Occurrence: This species is considered unlikely to occur within the study area due to a lack of suitable habitat. It has never been recorded during any previous surveys in the vicinity of the Yandicoogina operations (Section 3.2.2).

Potential Impacts: As a Schedule 1 and federally listed species the Bilby is considered fauna in need of special protection. However, the proposed development is not considered likely to have a significant impact upon this species.

***Rhinonicteris aurantius* Pilbara Orange Leaf-nosed Bat**
State: Schedule 1 'Vulnerable'
Federal: Vulnerable

Distribution: The Pilbara Orange Leaf-nosed Bat is a relictual monotypic genus of the family Hipposideridae. It occurs in the Pilbara region of Western Australia, through the Kimberley and across the Top End into north-western Queensland (Churchill 1991).

Ecology: Occurrence of this species is influenced by the availability of suitable roost caves (Churchill 1998). That is, deep caves offering suitable humidity and a stable temperature. In the Pilbara, they are thought to be restricted to caves where at least semi-permanent water is nearby (Dr Kyle Armstrong, Kyoto University Museum, pers. comm. 2005).

Likelihood of Occurrence: The gorge located in the Oxbow study area (OXB06E) may provide foraging opportunities for this species, but does not contain core roosting habitat. The species was not recorded during this study and has not previously been recorded at Yandicoogina by any earlier surveys (Section 3.2.2).

Potential Impacts: As a Schedule 1 and federally listed species the Pilbara Orange Leaf-nosed Bat is considered fauna in need of special protection. However, the proposed development is not considered likely to have a significant impact upon this species.

***Liasis olivaceus barroni* Pilbara Olive Python**
State: Schedule 1 'Vulnerable'
Federal: Vulnerable

Distribution: Regarded as a Pilbara endemic, this subspecies has a known distribution that coincides roughly with the Pilbara bioregion (Environment Australia 2000).

Ecology: The Pilbara Olive Python occurs in rocky areas within the Pilbara, showing a preference for rocky habitats near water, particularly rock pools.

Likelihood of Occurrence: This species may occur within the study area, as suitable habitat is available.

Potential Impacts: As a Schedule 1 and federally listed species the Pilbara Olive Python is considered fauna in need of special protection. However, while the proposed development may impact on individuals it is not considered likely to have a significant impact upon this species.

***Falco peregrinus* Peregrine Falcon**
State: Schedule 4

Distribution: The Peregrine Falcon has an almost cosmopolitan distribution, but is absent from most deserts and the Nullarbor Plain (Johnstone and Storr 1998). The only subspecies in Australia, *F. p. macropus*, is widespread throughout Australia and Tasmania (Marchant and Higgins 1993). The Australian population has been estimated at 3,000 to 5,000 pairs (Cade 1982). Whilst its status is difficult to determine in the Pilbara, it is certainly more common than its Priority 4 listed cogener *Falco hypoleucos*.

Ecology: This species inhabits a wide range of habitats including forest, woodlands, wetlands and open country (Pizzey and Knight 1997). The availability of prey is apparently more important than habitat in determining its distribution. Home ranges are probably defended year round and are variable in size, though typically not less than 480 ha (Marchant and Higgins 1993).

This species typically nests on cliffs (81% of nests Australia-wide) but also on stick nests (11%) and in tree hollows (8%). Breeding typically occurs from August to November (Johnstone and Storr 1998). Food is almost exclusively birds such as pigeons, parrots and passerines, which are captured in flight (Johnstone and Storr 1998). Mammals such as possums and rabbits have been recorded as rare prey items (Marchant and Higgins 1993).

Likelihood of Occurrence: This species may occur within the study area, as suitable habitat is available.

Potential Impacts: Loss of potential nesting and foraging habitat. With its cosmopolitan distribution, the conservation status of this species is unlikely to be affected by the proposal. The reason for initially listing this species was a global decline associated with the use of DDT.

6.4.2 Priority Fauna Species

Ramphotyphlops ganei
State: Priority 1

Distribution: This blind snake is poorly collected, being represented by just 15 specimens in the WA Museum collection. This distribution places them across the Pilbara Bioregion from Pannawonica in the west, to Millstream in the north, to Newman in the east.

Ecology: This species is poorly known, but as for most blind snakes, individuals are likely to mostly inhabit the topsoil, termitaria and ant nests. Blind snake diet typically consists of the eggs, larvae and pupae of ants (Storr et al. 2002). A single specimen (R151749) of this species was recorded from a pitfall trap in *Triodia epactia* hummock grassland on a scree slope of the Chichester Range near Redmont Camp (22°01'02"E, 118°58'57"E; Biota database).

Likelihood of Occurrence: There is insufficient data known about the ecology of this species to determine whether it may occur within the habitats available within the study area.

Potential Impacts: Some potential habitat loss and possible direct mortality associated with construction of mines and infrastructure. The conservation status of this species is difficult to ascertain from the small number of known records. However, the records of the species suggest that it does not have a restricted distribution, and therefore its conservation status is unlikely to be affected by the proposal.

***Neochmia ruficauda subclarescens* Star Finch**
State: Priority 4

Distribution: This species is endemic to Australia where it is found from the Pilbara to south-eastern Australia. It remains most common in the tropics. Its population has not been estimated but the species is typically patchy and highly variable in abundance.

Ecology: This species is typically confined to reedbeds and adjacent vegetation communities along permanent waterways in the Pilbara. It is considered to be resident in most of its range but, as with all finches, the species can wander widely. Its ecology in the Pilbara is not well known but it has been observed feeding on the seed of sedges (*Cyperus* spp.) and Buffel Grass (*Cenchrus ciliaris*) (Dr Mike Craig, pers. obs.). In other parts of its range it feeds mainly on seeds, but insects are a common part of the diet during the breeding season. It typically nests in March and April, as seeds are maturing after summer cyclones, and its domed nest is usually built in reeds up to several metres from the ground. The clutch is between three and six and the young usually fledge after about 16 days. In captivity, Star Finches may produce as many as three broods per year.

The main threat to the species is considered to be overgrazing by stock along waterways, which destroys the riparian vegetation on which they depend (Garnett and Crowley 2000).

Likelihood of occurrence: This species was recorded during the Yandicoogina Expansion survey (Table 5.4). This species is likely to be found throughout the study area where suitable habitat is available.

Potential Impacts: Impacts would include loss of habitat and local mortality of individuals, but are unlikely to make an impact on the conservation status of this species.

***Falco hypoleucos* Grey Falcon**
State: Priority 4

Distribution: The Grey Falcon is endemic to Australia, where it is widespread but rare throughout the arid zone. Occurs in the northern half of Western Australia (Johnstone and Storr 1998). The Grey Falcon is a resident or nomadic visitor to inland parts of Australia (Pizzey and Knight 1997), but its movements are poorly understood. Its population has been estimated at 1,000 pairs, with about 5,000 individuals present post-breeding (Marchant and Higgins 1993).

Ecology: This species inhabits a wide range of habitats in the arid zone but appears to be least rare in lightly wooded coastal and riverine plains (Johnstone and Storr 1998). In the Pilbara, the Grey Falcon is mostly recorded from the coastal plain between the de Grey and Ashburton Rivers (Storr 1984). Little is known of the ecology of the species but it appears to feed primarily on birds, with mammals and insects forming variably important parts of the diet depending on season and location (Marchant and Higgins 1993; Johnstone and Storr 1998). It breeds in trees, such as *Eucalyptus* spp., typically in the abandoned nests of crows and butcherbirds (Marchant and Higgins 1993; Johnstone and Storr 1998). Eggs have been recorded in July and August but its breeding season is not certain.

Likelihood of Occurrence: This species may occur within the study area, as suitable habitat is available.

Potential Impacts: Potential impacts are likely to be similar to that of the Peregrine Falcon, such as loss of potential nesting and foraging habitat. The conservation status of this species, if present in the study area, is unlikely to be affected by the proposal.

***Ardeotis australis* Australian Bustard**
State: Priority 4

Distribution: The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily wooded southern portions of the state (Johnstone and Storr 1998). Its wider distribution includes eastern Australia and New Guinea. This species is classified as Near Threatened by Garnett and Crowley (2000).

Ecology: This species prefers open or lightly wooded grassland including Triodia sandplains (Johnstone and Storr 1998) and is considered scarce to common depending on season and habitat. It has an omnivorous diet and occurs in a relatively broad range of habitats, but appears to have some preference for grasshoppers and is often attracted to recently burnt areas (Marchant and Higgins 1993). This species is typically nomadic and has a large home range (Marchant and Higgins 1993). This species breeds from March to September and the eggs are laid on bare, preferably stony, ground (Johnstone and Storr 1998), which makes the eggs and young vulnerable to predation by foxes and cats.

Likelihood of Occurrence: This species has previously been recorded in the vicinity of the study area (Ecologia 1995 and Ecologia 1998a), and is likely to occur periodically within the study area as suitable habitat is available.

Potential Impacts: Impacts would include loss of habitat and deaths of individuals, but are unlikely to make an impact on the conservation status of this species.

***Burhinus grallarius* Bush Stone-curlew**
State: Priority 4

Distribution: This species is widespread in Australia and southern New Guinea. It remains common in tropical Australia, but has declined alarmingly in temperate Australia and has disappeared from many regions (Marchant and Higgins 1993). It is found in the Kimberley and western portion of the remainder of the state west of a line joining Port Hedland, Leonora and Albany.

Populations are apparently secure in the Pilbara (Ron Johnstone, WA Museum, pers. comm. 2003). The Australian population has been estimated at c. 15,000 individuals.

Ecology: The nocturnal Bush Stone-curlews inhabit sparsely grassed, lightly timbered forest or woodland. In southern Australia, they persist most often where there is a well-structured litter layer and fallen timber debris. Individuals have an estimated home range of about 250 ha (Johnson and Baker-Gabb 1993). Foxes are usually considered to be the primary cause for their decline, hence their relative abundance in the tropics, but habitat clearance has also been identified as a threatening process (Garnett and Crowley 2000).

Likelihood of Occurrence: This species may occur within the study area, as suitable habitat is available.

Potential Impacts: Impacts would include loss of habitat and deaths of individuals, but are unlikely to make an impact on the conservation status of this species.

***Pseudomys chapmani* Western Pebble-mound Mouse**
State: Priority 4

Distribution: *Pseudomys chapmani* is confined to the central and eastern Pilbara including Karijini National Park (Menkhorst and Knight 2001). This species is found on stony hillsides with hummock grasslands (Menkhorst and Knight 2001) and is common to very common in suitable habitat within the Hamersley and Chichester subregions of the Pilbara bioregion.

Ecology: The Western Pebble-mound Mouse is well known for its behaviour of constructing extensive mounds of small stones covering areas from 0.5 to 9.0 square meters (Start 2008). This mound formation is most common on spurs and gentle slopes with suitable size class stones.

Likelihood of Occurrence: This species was recorded during the Yandicoogina Expansion survey (Table 5.5). This species is known to be widespread in the Marillana Creek locality (Halpern Glick Maunsell 1997) and is likely to be found throughout the study area where suitable habitat is available.

Potential Impacts: Impacts would include loss of habitat and deaths of individuals, however given the broad distribution of the Western Pebble-mound Mouse and the habitats occupied by the species in the Pilbara, it is unlikely that the conservation status of this species will be affected by the current proposal.

***Leggadina lakedownensis* Short-tailed Mouse**
State: Priority 4

Distribution: Since 1997, the number of records of this species has increased substantially, such that it has now been recorded from over 20 locations (Armstrong et al. in prep). In Western Australia the distribution includes the Pilbara and Kimberley regions (Menkhorst and Knight 2001). We have recorded this species on cracking clay communities from Cape Preston (60 km west of Dampier) in the west to the northern flanks of the Fortescue Marshes in the east (Halpern Glick Maunsell and Biota 2000).

A recent taxonomic revision of *Leggadina* (Cooper et al. 2003) found that despite morphological variation, *L. lakedownensis* are genetically similar across their range and the variation is insufficient to warrant subspecific status for any regional populations.

Ecology: Regional records suggest that the primary mainland habitat comprises areas of cracking clay and adjacent habitats, although this species has also been recorded from hill tops (Dr Peter Kendrick, DEC Karratha, pers. comm. 2003) and sandy coastal areas near Onslow (Mr Garth Humphreys, Biota, pers. obs.). At Cape Preston this species was recorded from *Acacia xiphophylla* open shrubland over a mosaic of *Triodia wiseana* and *Eragrostis xerophila* mixed hummock and tussock grassland (Halpern Glick Maunsell and Biota 2000). At the Southern Plains study site (near Tom Price), numerous individuals were recorded from *Acacia xiphophylla*

shrubland over *Triodia longiceps* and annual grasses (Biota 2002c). Along the proposed Hope Downs rail alignment, this species was recorded from *Astrebla pectinata* tussock grassland (Biota 2002b). During the FMG Stage A rail corridor survey (Biota 2004c), this species was recorded from *Astrebla pectinata*, *Aristida latifolia* tussock grassland on the self-mulching clays at a similar location in the Chichester Range.

Likelihood of occurrence: Not recorded to date and considered unlikely to occur within the study area due to a lack of suitable habitat.

Potential Impacts: The conservation status of this species is unlikely to be affected by the proposal.

***Macroderma gigas* Ghost Bat**
State: Priority 4

Distribution: Previously distributed across most of inland and northern Australia, but now restricted to the tropical north of the continent (Churchill 1998). Occurs in a broad range of habitats, with their distribution being influenced by the availability of suitable caves and mines for roost sites (Churchill 1998). The distribution of Ghost Bats is fragmented, with each population showing some genetic differentiation (Armstrong and Wilmer 2004; Biota 2004f; and Dr. Kyle Armstrong, pers. comm. 2004). Populations in the Pilbara bioregion appear to be isolated from those in the Kimberley and Northern Territory.

Ecology: Ghost Bats are efficient predators of small birds, mammals and reptiles, and large insects, and they have highly developed echolocation, visual and hearing systems (Churchill 1998). Vocalisations audible to humans are used in their complex social interactions (Churchill 1998). Bats forage over large distances (ranges of ~ 60 ha; Churchill 1998), and the size of their foraging area is probably inversely related to the productivity of their landscape. Bats are known to have overlapping ranges (Churchill 1998).

Scat material from *M. gigas* is quite distinctive and can be used to identify temporary roosts or feeding sites. Fairy Martin (*Hirundo ariel*) nests within culverts provide a roosting substrate for *M. gigas* and culverts may function either as a night or feeding roost or (probably less commonly) as a temporary day roost. This is an example of where man-made habitat has benefited bats (Biota 2002d).

Likelihood of Occurrence: As for the Pilbara Orange Leaf-nosed Bat, the gorge located in the Oxbow study area (OXB06E) may provide foraging opportunities for this species, but does not contain core roosting habitat.

Potential Impacts: Possible loss or disturbance of roosting sites and foraging habitat. No effect on the conservation status of the species is expected.

6.4.3 Migratory and Marine Avifauna Species

Avifauna species can be listed as migratory and/or marine species under the *EPBC Act 1999*. Database searches completed for this study indicate the following species listed as Migratory under the act could occur in the study area: Rainbow Bee-eater, Night Parrot, Great Egret and Cattle Egret. The following species listed as Marine could also be present: Fork-tailed Swift, Great Egret, Cattle Egret, Oriental Plover and Rainbow Bee-eater. Of these taxa, only the Rainbow Bee-eater has been confirmed as occurring in the study area.

The proposed Yandicoogina Expansion is unlikely to adversely affect the conservation status of any of these species. Therefore they would not require further specific consideration as part of the assessment process.

6.5 Short-range Endemic (SRE) Fauna

The absence of invertebrate fauna collected from the Yandicoogina JSW area reflects the highly degraded state of the available habitats and is indicative of the reduced faunal values of these habitats. A range of invertebrates representing five groups was collected from Oxbow, reflecting the reasonably intact habitats. However, while three of these groups (sac spiders, terrestrial snails and pseudoscorpions) are know to contain potentially short-range endemic taxa, all of those collected during the current survey have been collected elsewhere in the Pilbara Bioregion.

6.6 Conclusions

The fauna habitats and assemblages recorded for the JSW and Oxbow study areas during this study represent a subset of those that might be expected to occur across the Pilbara Bioregion. The fauna habitats in particular are considered to be widespread and common throughout the local area and within the wider region.

On this basis, the expansion of existing operations at Yandi is unlikely to adversely affect the conservation value of the fauna habitats and assemblages in the local area or wider Bioregion. Similarly, the development is not considered likely to detrimentally alter the conservation significance of those fauna species having elevated conservation significance, including Schedule and Priority listed fauna as well as SRE invertebrate fauna.

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Appendix 1

DEC Threatened Fauna Database Search Results

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Threatened and Priority Fauna Database Page 1 of 2

22.3436 °S 118.7243 °E / 23.2377 °S 119.7228 °E Yandi area (plus ~50km buffer)

#	Date	Certainty	Seen	Location Name	Method
Schedule 1 - Fauna that is rare or is likely to become extinct					
Dasyurus hallucatus				**Northern Quoll**	*1 records*
This carnivorous marsupial occurs across much of northern Australia with a disjunct population in the Pilbara. Occurs in a wide range of habitats but most suitable habitat appear to be rocky areas.					
	1980	1		NULLAGINE	
Liasis olivaceus barroni				**Pilbara Olive Python**	*1 records*
	2004	1	1	Newman	Caught or trapped
Priority Two: Taxa with few, poorly known populations on conservation lands					
Ctenotus uber johnstonei					*1 records*
This species of skink is associated with small rock outcrops on open sandy and stony plains.					
	2001	1	2	Fortescue Valley	Caught or trapped
Priority Four: Taxa in need of monitoring					
Macroderma gigas				**Ghost Bat**	*2 records*
This species is Australia's only carnivorous bat and has a patchy distribution across northern Australia. It shelters in caves, mine shafts and deep rock fissures and is sensitive to disturbance.					
	1998	1	1	West Angela Hill	Caught or trapped
	2007	1	1	Newman	Caught or trapped
Pseudomys chapmani				**Western Pebble-mound Mouse, Ngadji**	*30 records*
This species is well-known for the characteristic pebble-mounds which it constructs over underground burrow systems. These mounds are most common on spurs and lower slopes of rocky hills.					
	1979	1	2	West Angela Hill	Caught or trapped
	1979	1	2	West Angela Hill	Caught or trapped
	1980	1	1	Marillana	Caught or trapped
	1992	1	1	Packsaddle Hill	Caught or trapped
	1993	1	1	The Governor	Caught or trapped
	1994	1	0	Rhodes Ridge	Definite signs
	1994	1	0	The Governor	Definite signs
	1994	1	0	Weeli Wolli Creek	Definite signs
	2001	1	1	Hamersley Range	Caught or trapped
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs
	2006	1	0	Marillana	Definite signs

Friday, 3 October 2008

Department of Environment and Conservation

Threatened and Priority Fauna Database

22.3436 °S 118.7243 °E / 23.2377 °S 119.7228 °E Yandi area (plus ~50km buffer)

*	Date	Certainty	Seen	Location Name	Method
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs
	2008	1	0	Newman	Definite signs

Ardeotis australis **Australian Bustard** *3 records*

This species is uncommon and may occur in open or lightly wooded grasslands.

	2007	1	1	Newman	Day sighting
	2007	0	1	Newman	Day sighting
	2008	1	1	Newman	Day sighting

Burhinus grallarius **Bush Stonecurlew** *1 records*

A well camouflaged, ground nesting bird which prefers to 'freeze' rather than fly when disturbed. It inhabits lightly timbered open woodlands.

	2007	1	2	Newman	Day sighting

Neochima ruficauda subclarescens **Star Finch (western)** *1 records*

A nomadic species inhabiting grasslands and eucalypt woodlands near water.

	2008	1	1	Newman	Day sighting

Leiopotherapon aheneus **Fortescue Grunter** *1 records*

A species of freshwater fish restricted to the Prince Regent and Roe River systems of the Kimberley region of Western Australia. Inhabits open rocky pools with minimal aquatic vegetation.

		1		Karijini NP	

* Information relating to any records provided for listed species:-
Date: date of recorded observation
Certainty (of correct species identification): 1=Very certain; 2=Moderately certain; and 3=Not sure.
Seen: Number of individuals observed.
Location Name: Name of reserve or nearest locality where observation was made
Method: Method or type of observation

Friday, 3 October 2008

Department of Environment and Conservation

Appendix 2

WA Museum FaunaBase Search Results

Amphibia collected between -22.5018, 118.8420 and -23.0666, 119.5959

Hylidae
Cyclorana maini
Litoria rubella

Myobatrachidae
Uperoleia russelli

Birds collected between -22.5018, 118.8420 and -23.0666, 119.5959

Acanthizidae
Gerygone fusca mungi

Caprimulgidae
Eurostopodus argus

Columbidae
Geopelia striata placida
Phaps chalcoptera

Pachycephalidae
Pachycephala rufiventris rufiventris

Ptilonorhynchidae
Ptilonorhynchus maculatus guttatus

Strigidae
Ninox connivens connivens
Ninox novaeseelandiae boobook

Turnicidae
Turnix velox

Mammals collected between -22.5018, 118.8420 and -23.0666, 119.5959

Dasyuridae
Dasykaluta rosamondae
Ningaui ridei
Ningaui timealeyi
Planigale sp
Pseudantechinus woolleyae
Sminthopsis macroura
Sminthopsis ooldea
Sminthopsis youngsoni

Emballonuridae
Saccolaimus flaviventris
Taphozous hilli

Macropodidae
Macropus robustus erubescens

Molossidae
Chaerephon jobensis
Mormopterus beccarii
Tadarida australis

Muridae
Mus musculus
Notomys alexis
Pseudomys chapmani
Pseudomys desertor
Pseudomys hermannsburgensis
Zyzomys argurus

Vespertilionidae
Chalinolobus gouldii
Chalinolobus morio
Nyctophilus bifax daedalus
Nyctophilus geoffroyi
Scotorepens greyii
Vespadelus finlaysoni

Reptiles collected between -22.5018, 118.8420 and -23.0666, 119.5959

Agamidae
Caimanops amphiboluroides
Ctenophorus caudicinctus caudicinctus
Ctenophorus isolepis
Ctenophorus isolepis gularis
Ctenophorus isolepis isolepis
Ctenophorus nuchalis
Ctenophorus reticulatus
Diporiphora valens
Lophognathus longirostris
Pogona minor
Pogona minor minor

Boidae
Antaresia perthensis
Liasis olivaceus barroni

Elapidae
Acanthophis wellsi
Brachyurophis approximans
Demansia psammophis cupreiceps
Parasuta monachus
Pseudechis australis
Pseudonaja modesta
Pseudonaja nuchalis
Suta fasciata

Gekkonidae
Diplodactylus conspicillatus
Diplodactylus pulcher
Diplodactylus savagei
Diplodactylus stenodactylus
Diplodactylus wombeyi
Gehyra pilbara
Gehyra punctata
Gehyra purpurascens

Gehyra variegata
Heteronotia binoei
Heteronotia spelea
Nephrurus wheeleri cinctus
Oedura marmorata
Rhynchoedura ornata
Strophurus elderi
Strophurus jeanae

Pygopodidae
Delma haroldi
Delma nasuta
Delma pax
Delma tincta
Lialis burtonis

Scincidae
Carlia munda
Cryptoblepharus carnabyi
Cryptoblepharus plagiocephalus
Ctenotus ariadnae
Ctenotus duricola
Ctenotus grandis titan
Ctenotus hanloni
Ctenotus helenae
Ctenotus pantherinus ocellifer
Ctenotus rubicundus
Ctenotus rutilans
Ctenotus saxatilis
Ctenotus schomburgkii
Ctenotus serventyi
Cyclodomorphus melanops melanops
Egernia depressa
Egernia formosa
Lerista bipes
Lerista labialis
Lerista muelleri
Lerista neander
Lerista zietzi
Menetia greyii
Menetia surda surda
Morethia ruficauda exquisita
Proablepharus reginae
Tiliqua multifasciata

Typhlopidae
Ramphotyphlops ammodytes
Ramphotyphlops ganei
Ramphotyphlops grypus
Ramphotyphlops waitii

Varanidae
Varanus acanthurus
Varanus brevicauda
Varanus caudolineatus
Varanus giganteus
Varanus gouldii
Varanus panoptes rubidus
Varanus pilbarensis
Varanus tristis tristis

Appendix 3

EPBC Act 1999 Protected Matters Report

Matters of National Environmental Significance		
Threatened Species	**Status**	**Type of Presence**
Birds		
Pezoporus occidentalis Night Parrot	Endangered	Species or species habitat likely to occur within area
Mammals		
Dasyurus hallucatus Northern Quoll	Endangered	Species or species habitat may occur within area
Macrotis lagotis Greater Bilby	Vulnerable	Species or species habitat may occur within area
Rhinonicteris aurantius (Pilbara form) Pilbara Leaf-nosed Bat	Vulnerable	Community likely to occur within area
Reptiles		
Liasis olivaceus barroni Olive Python (Pilbara subspecies)	Vulnerable	Species or species habitat may occur within area
Migratory Species	**Status**	**Type of Presence**
Migratory Terrestrial Species		
Birds		
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act		
Listed Marine Species	**Status**	**Type of Presence**
Birds		
Apus pacificus Fork-tailed Swift	Listed – overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret	Listed – overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed – overfly marine area	Species or species habitat may occur within area
Charadrius veredus Oriental Plover	Listed – overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed – overfly marine area	Species or species habitat may occur within area

Appendix 4

DEC Regulation 17 "Licence to take fauna for scientific purposes"

SF006426

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: **Locked Bag 30**
Bentley Delivery Centre WA 6983

PAGE 1
NO. SF006426

RECEIPT NO. **AMOUNT**
$0.00

WILDLIFE CONSERVATION ACT 1950
REGULATION 17

LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.

DIRECTOR GENERAL

CONDITIONS

1 THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.

2 UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE DIRECTOR GENERAL, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.

3 NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE DIRECTOR GENERAL. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.

4 NO ENTRY OR COLLECTION OF FAUNA TO BE UNDERTAKEN ON ANY PRIVATE PROPERTY OR PASTORAL LEASE WITHOUT THE CONSENT IN WRITING OF THE OWNER OR OCCUPIER, OR FROM ANY ABORIGINAL RESERVE WITHOUT THE WRITTEN APPROVAL OF THE DEPARTMENT OF INDIGENOUS AFFAIRS.

5 NO FAUNA OR THEIR PROGENY SHALL BE RELEASED IN ANY AREA WHERE IT DOES NOT NATURALLY OCCUR, NOR HANDED OVER TO ANY OTHER PERSON OR AUTHORITY UNLESS APPROVED BY THE DIRECTORGENERAL, NOR SHALL THE REMAINS OF SUCH FAUNA BE DISPOSED OF IN SUCH MANNER AS TO CONFUSE THE NATURAL OR PRESENT DAY DISTRIBUTION OF THE SPECIES.

6 THIS LICENCE AND THE WRITTEN PERMISSION REFERRED TO AT CONDITIONS 3 & 4 MUST BE CARRIED BY THE LICENSEE OR AUTHORISED AGENT AT ALL TIMES FOR THE PURPOSE OF PROVING THEIR AUTHORITY TO TAKE FAUNA WHEN QUESTIONED AS TO THEIR RIGHT TO DO SO BY A WILDLIFE OFFICER, ANY OTHER STATE OR LOCAL GOVERNMENT EMPLOYEE OR ANY MEMBER OF THE PUBLIC.

7 **********ANY INTERACTION INVOLVING GAZETTED THREATENED FAUNA THAT MAY BE HARMFUL AND/OR INVASIVE MAY REQUIRE APPROVAL FROM THE COMMONWEALTH DEPT OF THE ENVIRONMENT AND WATER RESOURCES, PHONE 02 6274 1900. INTERACTION WITH SUCH SPECIES IS CONTROLLED BY THE COMMONWEALTH GOVERNMENT'S "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999" & "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION REGULATIONS 2000" AS WELL AS DEC'S WILDLIFE CONSERVATION ACT & REGULATIONS.**********

8 NO BIOPROSPECTING INVOLVING THE REMOVAL OF SAMPLE AQUATIC AND TERRESTRIAL ORGANISMS (BOTH FLORA AND FAUNA) FOR CHEMICAL EXTRACTION AND BIOACTIVITY SCREENING IS PERMITTED TO BE CONDUCTED WITHOUT SPECIFIC WRITTEN APPROVAL BY THE DIRECTOR GENERAL OF DEC.

9 FURTHER CONDITIONS (NUMBERED TO) ARE ATTACHED.

PURPOSE BASELINE FAUNA INVENTORY SURVEY OF YANDI JUNCTION SW AND BILLIARDS FOR IMPACT ASSESSMENT.

AUTHORISED PERSONS
ROY TEALE
GREG HAROLD
ZOE HAMILTON
MICHAEL GREENHAM
ASH JOHNSON
DAN KAMIEN
ERIN HARRIS
JESS CAIRNES
JASON ALEXANDER
RICHARD SMETANA
LUKE LOVELL

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: **Locked Bag 30**
Bentley Delivery Centre WA 6983

WILDLIFE CONSERVATION ACT 1950
WILDLIFE CONSERVATION REGULATIONS

DATE OF ISSUE 30/06/2008
VALID FROM 01/07/2008
DATE OF EXPIRY 30/06/2009

LICENSING OFFICER

(PHILIP BERNARD)

LICENSEE: DR PB RUNHAM
ADDRESS BIOTA ENVIRONMENTAL SCIENCES
P.O. BOX 155
LEEDERVILLE
W.A. 6903

Appendix 5

Bat Call Identifications

Specialised Zoological

Bat call identification

from Yandi, WA

Type:	Bat Call Analysis
Prepared for:	Biota Environmental Sciences
Date:	10 April 2009
Job No.:	SZ098
Prepared by:	Specialised Zoological Kyle Armstrong and Yuki Konishi ABN 92 265 437 422 0404 423 264 kyle.armstrong@graduate.uwa.edu.au kyle.n.armstrong@gmail.com

SUMMARY

Bat identifications from Anabat echolocation call recordings are provided from Yandi, Western Australia. Six species were identified as being present (Table 1).

The calls of the yellow-bellied sheath-tailed bat *Saccolaimus flaviventris* can sometimes be confused with those of the northern free-tailed bat *Chaerephon jobensis*. In all cases the calls appeared to be from *S. flaviventris*.

Details supporting the identifications are provided, as recommended by the Australasian Bat Society (ABS 2006). A summary of pulse parameters is provided in Table 2, and representative call sequences are illustrated in Figure 1. Further data is available should verification be required.

METHODS

Signals as recorded with Anabat SD1 and Anabat II – CF-ZCAIM units were supplied as downloaded sequences, which were examined in AnalookW 3.7a software. Three call variables were measured on good quality search phase pulses in representative call sequences: pulse duration (milliseconds), maximum frequency (kHz) and characteristic frequency (equivalent to minimum frequency; kHz). Species were identified based on information in McKenzie and Muir (2000). Nomenclature follows Armstrong and Reardon (2006).

REFERENCES

ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* 27: 6–9. [ISSN 1448-5877]

Armstrong, K. and Reardon, T. (2006). Standardising common names of bats in Australia. *The Australasian Bat Society Newsletter* 26: 37–42.

McKenzie, N.L. and Muir, W.P. (2000). Bats of the southern Carnarvon Basin, Western Australia. *Records of the Western Australian Museum* Supplement 61: 465–477.

TABLE 1. Species identifications, with the degree of confidence indicated by a code. Date correlates with site; see Table 2 for full species names.

Date	Site	*C. gouldii*	*S. flaviventris*	*S. greyii*	*T. australis*	*T. georgianus*	*V. finlaysoni*
Serial 683							
8/07/2008	BILANA01	H	H	—	—	—	H
Serial 3709							
8/07/2008	YANBAT01	H	H	—	—	—	H
9/07/2008	YANBAT01	H	H	—	H	—	H
10/07/2008	YANBAT01	H	H	—	H	H	H
11/07/2008	YANBAT01	H	—	—	—	H	H
Serial 3726							
8/07/2008	OXBANA01	—	—	—	—	H	H
9/07/2008	OXBANA01	—	—	—	—	H	H
10/07/2008	OXBANA01	H	—	H	—	H	H

Definition of confidence level codes:

H High. Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or submission of a specimen/tissue to a museum.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the Summary section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

TABLE 2. Summary of variables from representative call sequences.

Species	s,p[1]	Duration (msec)[2]	Max Frequency (kHz)[2]	Char frequency (kHz)[2]
Gould's wattled bat *Chalinolobus gouldii*	1,8	6.5 ± 2.3 3.2 – 10.3	35.8 ± 0.7 34.8 – 37.0	31.8 ± 1.5 30.3 – 34.6
Yellow-bellied sheath-tailed bat *Saccolaimus flaviventris*	2,18	9.1 ± 2.6 2.3 – 12.5	20.1 ± 2.4 16.2 – 23.3	17.9 ± 1.3 15.6 – 20.8
Little broad-nosed bat *Scotorepens greyii*	2,25	3.5 ± 0.8 1.6 – 4.8	59.0 ± 5.1 47.3 – 66.7	36.5 ± 1.1 34.9 – 38.7
White-striped free-tailed bat *Tadarida australis*	1,10	8.1 ± 1.5 5.9 – 9.9	19.0 ± 1.7 16.5 – 21.2	13.7 ± 1.0 11.9 – 15.2
Common sheath-tailed bat *Taphozous georgianus*	3,22	9.0 ± 2.1 5.7 – 13.5	25.9 ± 1.0 24.5 – 28.1	23.8 ± 0.3 23.3 – 24.4
Finlayson's cave bat *Vespadelus finlaysoni*	4,100	4.8 ± 0.8 0.4 – 7.6	65.1 ± 5.0 54.8 – 83.3	54.3 ± 0.7 52.6 – 55.9

[1] s,p: number of sequences measured, combined total number of pulses measured;

[2] Mean ± SD; range.

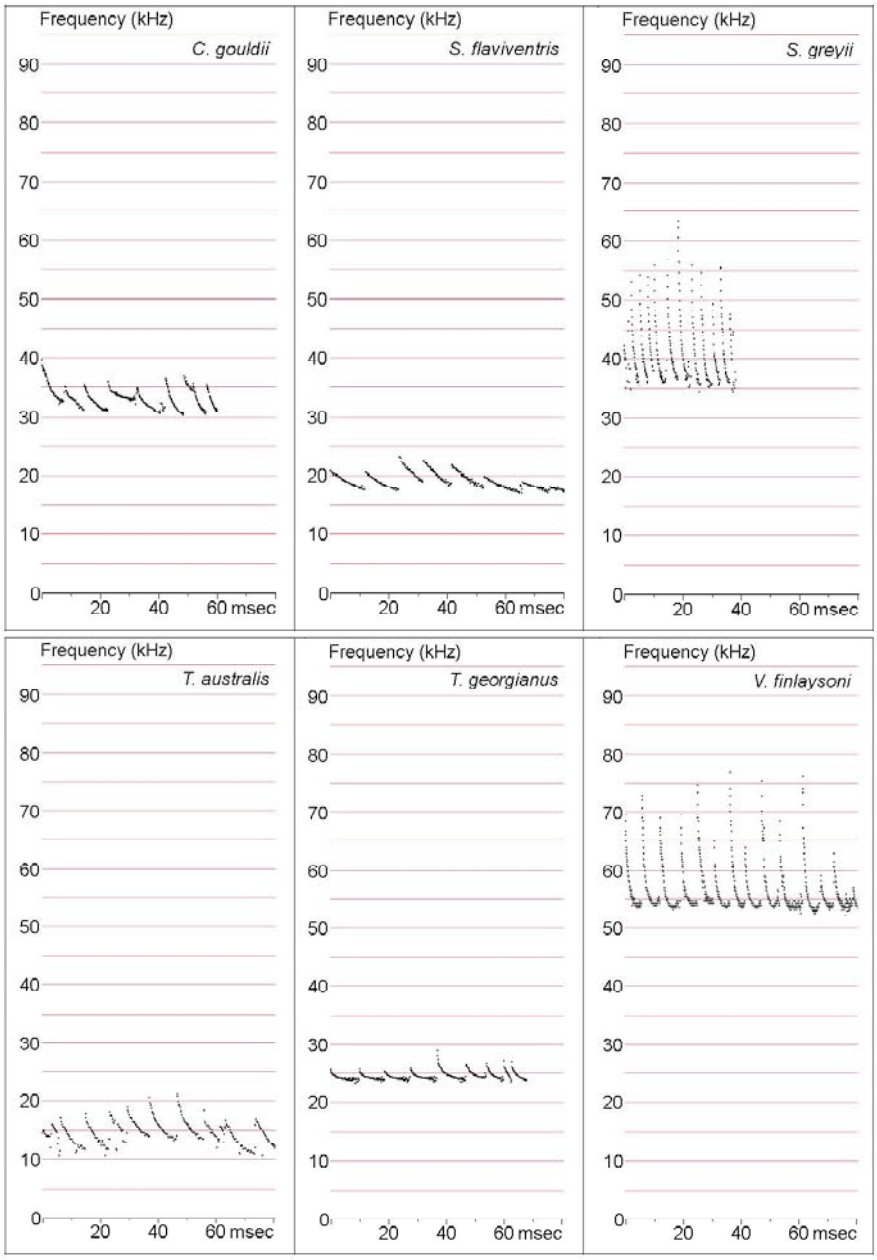

FIGURE 1. Representative call sequences of the six species identified (time is compressed between pulses).

Yandicoogina Regional Fauna Assemblage Addendum

Listing of All Fauna recorded from surveys within the Yandicoogina Locality

Herpetofauna (Reptiles and Frogs)

HYLIDAE
Cyclorana australis
Cyclorana maini
Litoria rubella
Notaden nichollsi
Platyplectrum spenceri

MYOBATRACHIDAE
Pseudophyrne douglasi
Uperoleia russelli

CHELUIDAE
Chelodina steindachneri

AGAMIDAE
Amphibolurus longirostris
Caimanops amphiboluroides
Ctenophorus caudicinctus
Ctenophorus isolepis
Ctenophorus nuchalis
Ctenophorus reticulatus
Diporiphora valens
Pogona minor
Tympanocryptis cephalus

DIPLODACTYLIDAE
Crenadactylus ocellatus
Diplodactylus conspicillatus
Diplodactylus pulcher
Diplodactylus savagei
Lucasium squarrosum
Lucasium stenodactylum
Lucasium wombeyi
Lucasium 'woodwardi'
Oedura marmorata
Rhynchoedura ornata
Strophurus ciliaris
Strophurus elderi
Strophurus jeanae
Strophurus wellingtonae

CARPHODACTYLIDAE
Nephrurus milii
Nephrurus wheeleri

GEKKONIDAE
Gehyra pilbara
Gehyra punctata
Gehyra purpurescens
Gehyra variegata
Heteronotia binoei
Heteronotia spelea

PYGOPODIDAE
Delma butleri
Delma elegans
Delma haroldi
Delma nasuta
Delma pax
Delma tincta
Lialis burtonis
Pygopus nigriceps

SCINCIDAE
Carlia munda
Carlia triacantha
Cryptoblepharus buchananii
Cryptoblepharus plagiocephalus
Cryptoblepharus ustulatus
Ctenotus aff. *helenae*
Ctenotus aff. *robustus*
Ctenotus ariadnae
Ctenotus duricola
Ctenotus grandis
Ctenotus hanloni
Ctenotus helenae
Ctenotus leonhardii
Ctenotus pantherinus
Ctenotus rubicundus
Ctenotus rutilans
Ctenotus saxatilis
Ctenotus schomburgkii
Ctenotus serventyi
Ctenotus uber
Cyclodomorphus melanops
Egernia depressa
Egernia formosa
Eremiascincus fasciolatus
Eremiascincus richardsonii
Lerista aff. *bipes*
Lerista amicorum
Lerista bipes
Lerista labialis
Lerista muelleri
Lerista neander
Lerista timida
Lerista zietzi
Menetia greyii
Menetia surda
Morethia ruficauda
Notoscincus ornatus
Proablepharus reginae
Tiliqua multifasciata

VARANIDAE
Varanus acanthurus
Varanus brevicauda
Varanus bushi

Varanus caudolineatus
Varanus eremius
Varanus giganteus
Varanus gilleni
Varanus gouldii
Varanus panoptes
Varanus pilbarensis
Varanus tristis

TYPHLOPIDAE
Ramphotyphlops ammodytes
Ramphotyphlops diversus
Ramphotyphlops ganei
Ramphotyphlops grypus
Ramphotyphlops hamatus
Ramphotyphlops waitii

BOIDAE
Antaresia perthensis
Antaresia stimsoni
Aspidites melanocephalus
Aspidites ramsayi
Liasis olivaceus barroni

ELAPIDAE
Acanthophis wellsi
Brachyurophis approximans
Demansia psammophis
Demansia rufescens
Furina ornata
Parasuta monachus
Pseudechis australis
Pseudonaja modesta
Pseudonaja nuchalis
Simoselaps anomalus
Suta fasciata
Suta punctata
Vermicella snelli

Avifauna

CASUARIIDAE
Emu *Dromaius novaehollandiae*

PHASIANIDAE
Brown Quail *Coturnix ypsilophora*

ANATIDAE
Australian Wood Duck *Chenonetta jubata*
Grey Teal *Anas gracilis*
Pacific Black Duck *Anas superiliosa*

PODICIPEDIDAE
Australasian Grebe *Tachybaptus novaehollandiae*

COLUMBIDAE
Common Bronzewing *Phaps chalcoptera*
Crested Pigeon *Ocyphaps lophotes*
Spinifex Pigeon *Geophaps plumifera*
Diamond Dove *Geopelia cuneata*
Peaceful Dove *Geopelia striata*
Bar-shouldered Dove *Geopelia humeralis*

PODARGIDAE
Tawny Frogmouth *Podargus strigoides*

EUROSTOPODIDAE
Spotted Nightjar *Eurostopodus argus*

AEGOTHELIDAE
Australian Owlet-nightjar *Aegotheles cristatus*

ANHINGIDAE
Australasian Darter *Anhinga novae-hollandiae*

PHALACROCORACIDAE
Little Pied Cormorant *Microcarbo melanoleucos*
Little Black Cormorant *Phalacrocorax sulcirostris*
Pied Cormorant *Phalacrocorax varius*

PELECANIDAE
Australian Pelican *Pelecanus conspicillatus*

CICONIIDAE
Black-necked Stork *Ephippiorhynchus asiaticus*

ARDEIDAE
White-necked Heron *Ardea pacifica*
Great Egret *Ardea modesta*
Striated Heron *Butorides striata*
White-faced Heron *Egretta novaehollandiae*
Little Egret *Egretta garzetta*
Nankeen Night Heron *Nycticorax caledonicus*

THRESKIORNITHIDAE
Australian White Ibis *Threskiornis molucca*
Straw-necked Ibis *Threskiornis spinicollis*

ACCIPITRIDAE
Black-shouldered Kite *Elanus axillaris*
Square-tailed Kite *Lophoictinia isura*
Black-breasted Buzzard *Hamirostra melanosternon*
Whistling Kite *Haliaeetus sphenurus*
Black Kite *Milvus migrans*
Brown Goshawk *Accipter gasciatus*
Collared Sparrowhawk *Acciptiter cirrocephalus*
Spotted Harrier *Circus assimilis*
Wedge-tailed Eagle *Aquila audax*
Little Eagle *Hieraaetus morphnoides*

FALCONIDAE
Nankeen Kestrel *Falco cenchroides*
Brown Falcon *Falco berigora*
Australian Hobby *Falco longipennis*
Grey Falcon *Falco hypoleucos*
Peregrine Falcon *Falco peregrinus*

RALLIDA
Eurasian Coot *Fulica atra*

OTIDIDAE

Australian Bustard *Ardeotis australis*

BURHINIDAE
Bush Stone-curlew *Burhinus grallarius*

RECURVIROSTRIDAE
Black-winged Stilt *Himanotopus himanotopus*

CHARADRIIDAE
Red-capped Plover *Charadrius ruficapillus*
Black-fronted Dotterel *Elseyornis melanops*
Red-kneed Dotterel *Erythrogonys cinctus*

SCOLOPACIDAE
Common Sandpiper *Actitis hypoleucos*

TURNICIDAE
Little Button-quail *Turnix velox*

LARIDAE
Gull-billed Tern *Gelochelidon niloctica*
Caspian Tern *Hydroprogne caspia*
Crested Tern *Thalasseus bergii*
Silver Gull Chroicocephalus *novaehollandiae*

CACATUIDAE
Galah *Eolophus roseicapillus*
Little Corella *Cacatua sanguinea*
Cockatiel *Nymphicus hollandicus*

PSITTACIDAE
Australian Ringneck *Barnardius zonarius*
Mulga Parrot *Psephotus varius*
Budgerigar *Melopsittacus undulatus*

CUCULIDAE
Pheasant Coucal *Centropus phasianinus*
Horsfield's Bronze Cuckoo *Chalcites basalis*
Black-eared Cuckoo *Chalcites osculans*
Pallid Cuckoo *Cacomantis pallidus*

STRIGIDAE
Barking Owl *Ninox connivens*
Southern Boobook *Ninox novaeseelandiae*

TYTONIDAE
Barn Owl *Tyto alba*

HALCYONIDAE
Blue-winged Kookaburra *Dacelo leachii*
Red-backed Kingfisher *Todiramphus pyrrhopygius*
Sacred Kingfisher *Todiramphus sanctus*

MEROPIDAE
Rainbow Bee-eater *Merops ornatus*

CLIMACTERIDAE
Black-tailed Treecreeper *Climacterus melanura*

PTILONORHYNCHIDAE
Western Bowerbird *Ptilonorhynchus guttatus*

MALURIDAE
Splendid Fairy-wren *Malurus splendens*
White-winged Fairy-wren *Malurus leucopterus*
Variegated Fairy-wren *Malurus lamberti*
Rufous-crowned Emu-wren *Stipiturus ruficeps*
Striated Grasswren *Amytornis striatus*

ACANTHIZIDAE
Redthroat *Pyrrholaemus brunneus*
Weebill *Smicrornis brevirostris*
Western Gerygone *Gerygone fusca*
Dusky Gerygone *Gerygone tenebrosa*
Slaty-backed Thornbill *Acanthiza robustirostris*
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*
Chestnut-rumped Thornbill *Acanthiza uropygialis*
Inland Thornbill *Acanthiz apicalis*
Southern Whiteface *Aphelocephala leucopsis*

PARDALOTIDAE
Red-browed Pardalote *Pardalotus rubricatus*
Striated Pardalote *Pardalotus striatus*

MELIPHAGIDAE
Pied Honeyeater *Certhionyx variegatus*
Singing Honeyeater *Lichenostomus virescens*
Grey-headed Honeyeater *Lichenostomus kearthlandi*
White-plumed Honeyeater *Lichenostomus penicillatus*
White-fronted Honeyeater *Pumella albifrons*
Yellow-throated Miner *Manorina flavigula*
Spiny-cheeked Honeyeater *Acanthagenys rufogularis*
Grey Honeyeater *Conopophila whitei*
Crimson Chat *Epthianura tricolor*
Black Honeyeater *Sugomel niger*
Brown Honeyeater *Lichmera indistincta*
Black-chinned Honeyeater *Melithreptus gularis*

POMATOSTOMIDAE
Grey-crowned Babbler *Pomatostomus temporalis*
White-browed Babbler *Pomatostomus superciliosus*

EUPETIDAE
Chestnut-breasted Quail-thrush *Cinclosoma castaneothorax*
Chiming Wedgebill *Psophodes occidentalis*

NEOSITTIDAE
Varied Sittella *Daphoenositta chrysoptera*

CAMPEPHAGIDAE
Ground Cuckoo-shrike *Coracina maxima*
Black-faced Cuckoo-shrike *Coracina novaehollandiae*
White-winged Triller *Lalage sueurii*

PACHYCEPHALIDAE
Rufous Whistler *Pachycephalus rufiventris*
Grey Shrike-thrush *Colluricincla harmonica*
Crested Bellbird *Oreoica guttaralis*

ARTAMIDAE
Masked Woodswallow *Artamus personatus*
White-browed Woodswallow *Artamus superciliosus*
Black-faced Woodswallow *Artamus cinereus*
Little Woodswallow *Artamus minor*
Grey Butcherbird *Cracticus torquatus*
Pied Butcherbird *Cracticus nigrogularis*
Australian Magpie *Cracticus tibicen*

RHIPIDURIDAE
Grey Fantail *Rhipidura albiscapa*
Willie Wagtail *Rhipidura leucophrys*

CORVIDAE
Little Crow *Corvus bennetti*
Torresian Crow *Corvus orru*

MONARCHIDAE
Magpie-lark *Grallina cyanoleuca*

PETROICIDAE
Red-capped Robin *Petroica goodenovii*
Hooded Robin *Melanodryas cucullata*

ALAUDIDAE
Horsfield's Bushlark *Mirafra javanica*

ACROCEPHALIDAE
Australian Reed Warbler *Acrocephalus australis*

MEGALURIDAE
Rufous Songlark *Cincloramphus mathewsi*
Brown Songlark *Cincloramphus cruralis*
Spinifex-bird *Eremiornis carteri*

HIRUNDINIDAE
White-backed Swallow *Cheromoeca leucosterna*
Fairy Martin *Petrochelidon ariel*
Tree Martin *Petrochelidon nigricans*

NECTARINIIDAE
Mistletoebird *Dicaeum hirundinaceum*

ESTRILDIDAE
Zebra Finch *Taeniopygia guttata*
Painted Finch *Emblema pictum*

MOTACILLIDAE
Richard's Pipit *Anthus novaeseelandiae*

Mammals
(* denotes introduced species)

TACHYGLOSSIDAE
Echidna *Tachyglossus aculeatus*

DASYURIDAE
Brush-tailed Mulgara *Dasycercus blythi*
Little Red Kaluta *Dasykaluta rosamondae*
Northern Quoll *Dasyurus hallucatus*
Wongai Ningaui *Ningaui ridei*
Pilbara Ningaui *Ningaui timealeyi*
Planigale sp.
Fat-tailed Pseudantechinus *Pseudantechinus macdonnellensis*
Woolley's Pseudantechinus *Pseudantechinus woolleyae*
Stripe-faced Dunnart *Sminthopsis macroura*
Ooldea Dunnart *Sminthopsis ooldea*
Lesser Hairy-footed Dunnart *Sminthopsis youngsoni*

THYLACOMYIDAE
Bilby *Macrotis lagotis*

MACROPODIDAE
Euro *Macropus robustus*
Red Kangaroo *Macropus rufus*
Rothschild's Rock-wallaby *Petrogale rothschildi*

PTEROPODIDAE
Black Flying-fox *Pteropus alecto*

MEGADERMATIDAE
Ghost Bat *Macroderma gigas*

HIPPOSIDERIDAE
Pilbara Orange Leaf-nosed Bat *Rhinonicteris aurantius*

EMBALLONURIDAE
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*
Common Sheathtail-bat *Taphozous georgianus*
Hill's Sheathtail-bat *Taphozous hilli*

VESPERTILIONIDAE
Gould's Wattled Bat *Chalinolobus gouldii*
Chocolate Wattled Bat *Chalinolobus morio*
Northwestern Long-eared Bat *Nyctophilus bifax*
Lesser Long-eared Bat *Nyctophilus geoffroyi*
Inland Broad-nosed Bat *Scotorepens balstoni*
Little Broad-nosed Bat *Scotorepens greyii*
Finlayson's Cave Bat *Vespadelus finlaysoni*

MOLOSSIDAE
Northern Freetail-bat *Chaerephon jobensis*
Beccari's Freetail-bat *Mormopterus beccarii*
Little Northern Freetail-bat *Mormopterus loriae*
White-striped Freetail-bat *Tadarida australis*

MURIDAE
Short-tailed Mouse *Leggadina lakedownensis*
*House Mouse *Mus musculus*
Spinifex Hopping-mouse *Notomys alexis*
Western Pebble-mound Mouse *Pseudomys chapmani*
Delicate Mouse *Pseudomys delicatulus*
Desert Mouse *Pseudomys desertor*
Sandy Inland Mouse *Pseudomys hermannsburgensis*
Common Rock-rat *Zyzomys argurus*

LEPORIDAE
*Rabbit *Oryctolagus cuniculus*

CANIDAE
*Dingo *Canis lupus dingo*
*Red Fox *Vulpes vulpes*

FELIDAE
*Cat *Felis catus*

EQUIDAE
*Donkey *Equus asinus*

BOVIDAE
*European Cattle *Bos taurus*