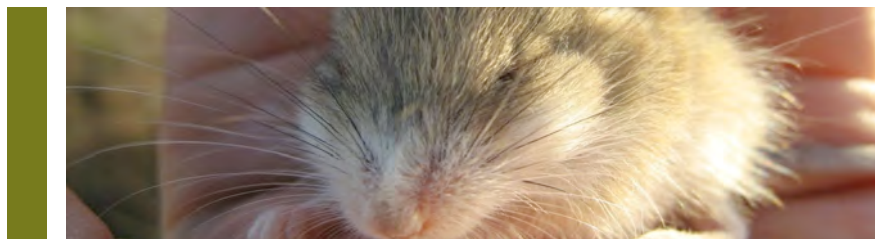




Rio Tinto Iron Ore Rail Duplication Fauna Survey: Cape Lambert Variation



Prepared for Rio Tinto Iron Ore

September 2008



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Cape Lambert Variations Fauna Survey

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1.0 Summary

1.1 Background

Rio Tinto Iron Ore seeks to duplicate its existing rail network from Cape Lambert Port to Juna Downs to accommodate additional iron ore output from the expansion of existing mines and the development of new operations. The planned rail duplication complements Rio Tinto's proposal to expand port facilities and increased iron ore exports.

Biota Environmental Sciences (Biota) was commissioned to complete a fauna survey of a variation to the Cape Lambert to Emu Siding section of the planned Rail Duplication; this section is referred to as the Cape Lambert Variations. Potential workshop areas were also considered.

The scope of the study was to:

- document the vertebrate and short range endemic (SRE) invertebrate fauna assemblage within the defined study area using established sampling techniques;
- identify and assess the local and regional conservation significance of the fauna habitats and assemblage present in the project area; and
- identify fauna (particularly Schedule and Priority listed fauna as well as potential SRE taxa) of particular conservation significance.

1.2 Methods

The survey took place over a single phase conducted in mid-August 2008. Systematic censusing of terrestrial fauna assemblages, including avifauna, mammals and herpetofauna, was carried out at eight sites, each located within defined habitats. Five primary habitat types were identified from the study corridor, comprising:

- boulder pile;
- rocky hill slope with *Triodia*;
- plain with *Acacia* over *Triodia*;
- dune with *Acacia* over *Triodia*; and
- plain adjacent to creekline with *Corymbia* over *Acacia* over *Triodia*.

The central component of the censusing consisted of trapping grids at six sites; comprising ten pit-fall traps (alternating 20 litre buckets and 20 cm diameter PVC tubes) spaced at 10 m intervals and connected by a single length (100 m) of 30 cm high flywire fence. A further sampling site comprised 25 Elliott traps, and one more site comprised 14 Funnel traps.

Twelve avifauna censuses were conducted during the surveys at each site. Censuses were conducted between approximately 7:00 am and 9:00 am, 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:

- Mygalomorphae (trapdoor spiders);
- Diplopoda (millipedes);
- Pulmonata (land snails); and
- Pseudoscorpionida (pseudoscorpions).

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 Results

1.3.1 Vertebrate Fauna

The vertebrate fauna survey of the Cape Lambert Variation study area yielded a total of 65 species. This included 26 avifauna species, thirteen native mammal species, one introduced mammal species and 25 herpetofauna species (Table 1.1).

Table 1.1: Overview of vertebrate fauna species recorded during the Cape Lambert Variations survey.

Fauna Group	Number of Species
Avifauna	26
Native Non-volant Mammals	8
Introduced Non-volant Mammals	1
Bats	5
Amphibians	0
Reptiles	25
Total	65

1.3.2 Invertebrate Fauna

The Cape Lambert Variations fauna survey yielded a total of six invertebrate taxa. This included one mygalomorph spider, two pseudoscorpions, two terrestrial snails and one millipede (Table 1.2).

Table 1.2: Overview of invertebrate fauna species recorded during the Cape Lambert Variations survey.

Taxa	Total
Mygalomorph spider	
Nemesiidae sp.	3
Pseudoscorpions	
Chernetidae: <i>Haplochernes</i> sp.	24
Olipiidae: <i>Indolpium</i> sp.	3
Garypinidae: <i>Solinus</i> sp.	21
Terrestrial snails	
<i>Rhagada convicta</i>	28
<i>Quistrachia</i> sp.	61
Millipede	
Polydesmida: <i>Antichiropus</i> sp.	1
	141

Further information on these taxa can be found in Section 4.6.

1.4 Fauna of Conservation Significance

Two species of elevated conservation significance were recorded during the Cape Lambert Variations fauna survey (Table 1.3). These were the Little Northern Freetail-bat *Mormopterus loriae cobourgiana* (Priority 1) and the skink *Notoscincus butleri* (Priority 4).

A further nine species listed under State and Federal legislation could occur within the study area (Table 1.3).

Table 1.3: Threatened fauna species potentially occurring within the Cape Lambert Variations study area.

Species	Status	
	State	Federal
<i>Macronectes giganteus</i> Southern Giant-Petrel	Schedule 1	Endangered
<i>Dasyercus blythi</i> Brush-tailed Mulgara	Schedule 1	Vulnerable
<i>Dasyurus hallucatus</i> Northern Quoll	Schedule 1	Endangered
<i>Rhinonictis aurantius</i> Pilbara Orange Leaf-nosed Bat	Schedule 1	Vulnerable
<i>Liasis olivaceus barroni</i> Pilbara Olive Python	Schedule 1	Vulnerable
<i>Mormopterus loriae cobourgiana</i> Little Northern Freetail-bat*	Priority 1	
<i>Ardeotis australis</i> Australian Bustard	Priority 4	
<i>Numenius madagascariensis</i> Eastern Curlew	Priority 4	
<i>Phaps histrionica</i> Flock Bronzewing	Priority 4	
<i>Neochmia ruficauda subclarescens</i> Star Finch (western)	Priority 4	
<i>Pseudomys chapmani</i> Western Pebble-mound Mouse	Priority 4	
<i>Notoscincus butleri</i> *	Priority 4	

* denotes species recorded during the fauna survey.

1.5 Comparison with original Cape Lambert to Emu Siding fauna survey

Thirteen vertebrate fauna species were recorded during the Cape Lambert Variations fauna survey that were not recorded during the Cape Lambert to Emu Siding fauna survey (Biota 2008a). These comprised four avifauna species, two mammal species and seven reptile species.

The only species of conservation significance identified amongst these species are the skinks *Notoscincus butleri* and *Lerista neviniae*. It is highly unlikely there will be major impacts on either of these species as both have been previously recorded in the Cape Lambert area. Habitat supporting *Notoscincus butleri* is widespread in the area (arid, rocky and near-coastal; Wilson and Swan 2008). The one record of *Lerista neviniae* from this survey was found in dune habitat, which is unlikely to be disturbed by the proposed development. Additional observations of *Lerista neviniae* have been recorded to the west and east of this location (Biota 2008c). Further information on both can be found in Section 6.2.

2.0 Introduction

2.1 Project Background

Rio Tinto Iron Ore seeks to duplicate its existing rail network from Cape Lambert Port to Juna Downs to accommodate additional iron ore output from the expansion of existing mines and the development of new operations. The planned rail duplication complements Rio Tinto's proposal to expand port facilities as part of its Cape Lambert Port B Development and increase in iron ore exports (Biota 2008a). The terrestrial fauna of the original Cape Lambert – Emu rail duplication corridor was surveyed by Biota (2008a), and the current survey builds on the data collected during the earlier exercise.

The location and a proposed provisional layout of the variation to the proposed rail section from Cape Lambert to Emu Siding are shown in Figure 2.1 and Figure 2.2.

2.2 Study Objectives and Scope

Biota Environmental Sciences (Biota) was commissioned to complete a fauna survey along approximately 20 km of a variation to the planned Rail Duplication from Cape Lambert to Emu Siding, and the proposed workshop area. The survey was planned and implemented in accordance with 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 2003).

The scope of the study was to:

- document the vertebrate and short-range endemic (SRE) invertebrate fauna assemblage within the defined study area using established sampling techniques;
- identify and assess the local and regional conservation significance of the fauna habitats and assemblage present in the project area; and
- identify fauna (particularly Schedule and Priority listed fauna as well as potential SRE taxa) of particular conservation significance.

2.3 Purpose of Report

This report describes the methodology employed for the fauna survey of the Cape Lambert Variations study area. It documents the results of the survey and assesses the fauna habitats and assemblages on a local and regional scale by discussing the data in the context of previous surveys in the vicinity and published data. Its intended use is as a supporting document for the statutory environmental assessment of the project. Both the survey and report are subject to specific limitations that are discussed in detail in Section 3.5.

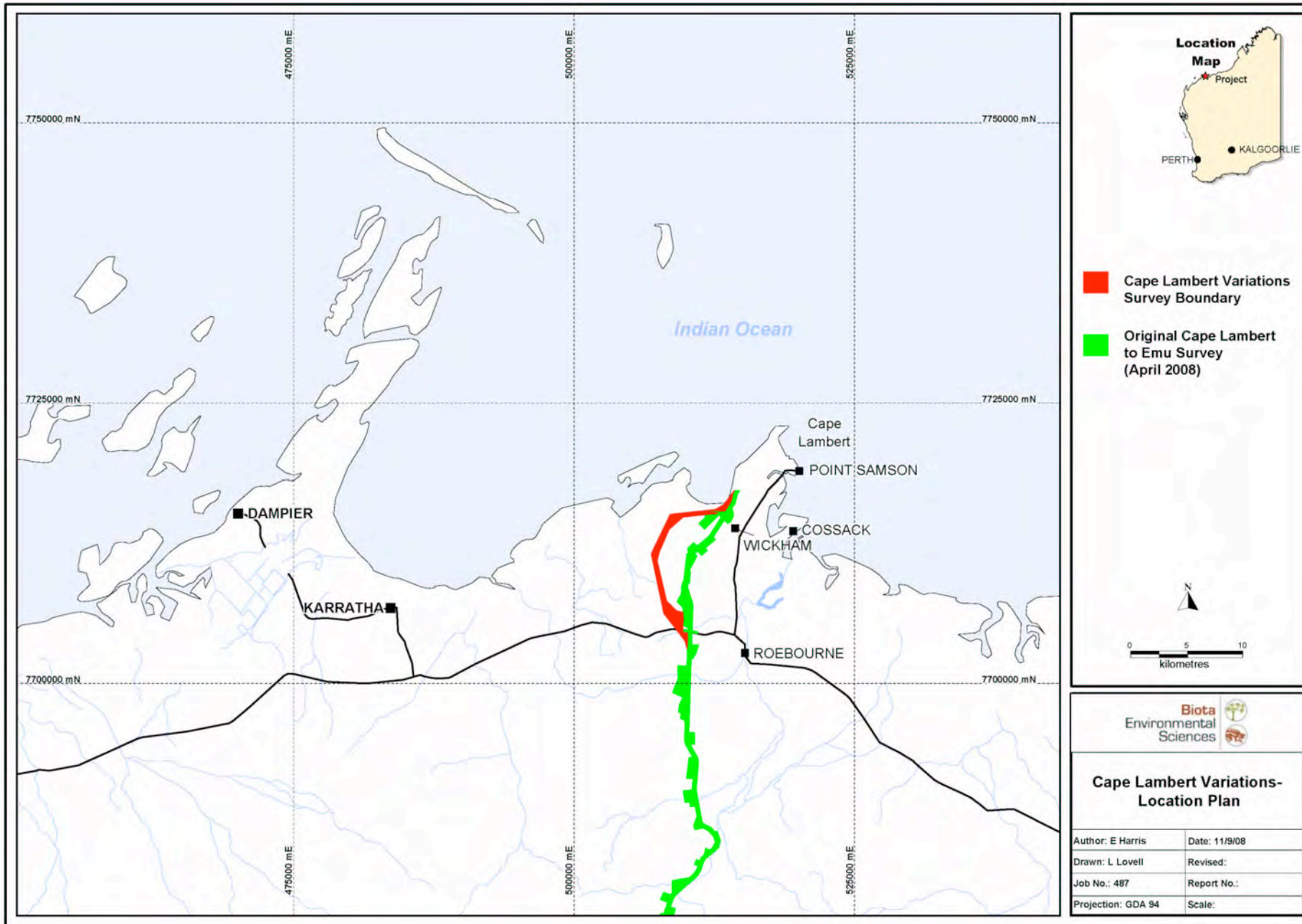


Figure 2.1: Location map for the Cape Lambert Variations study area.

2.4 Geological and Physiographic Context of the Study Area

2.4.1 Geology

Thorne and Trendall (2001) have mapped the superficial geology of the study area at regional scale (Table 2.1 and Figure 2.2).

Table 2.1: Geological units occurring within the Cape Lambert Variations study area.

Unit	Description
Qhms	Coastal sand in beach deposits and dunes; chiefly marine sand reworked by wind, but includes some reworked alluvium near deltas; shelly sand contains <i>Anadara granosa</i>
Qhm	Marine mud and silt on supratidal to intertidal flats; includes intertidal deposits with mangroves
Qaa	Alluvial sand and gravel in rivers and creeks; clay, silt, and sand in channels on floodplains
AFr	MOUNT ROE BASALT: massive, vesicular, and glomeroporphyritic basalt
Qc	Colluvium - sand, silt, and gravel in outwash fans; scree and talus; proximal mass-wasting deposits
AGI	CLEAVERVILLE FORMATION: banded iron-formation, jaspilite, chert, siltstone, shale, and minor felsic volcanoclastic rock; metamorphosed
ARr	REGAL FORMATION: pillowed and massive basalt, with a basal unit of peridotitic komatiite; minor chert; metamorphosed
ARrt	Basaltic tuff; well bedded; metamorphosed
Qw	Low-gradient sheetwash deposits - silt, sand, and pebbles on distal outwash fans; no defined drainage
Qwb	Sand, silt, and clay in distal outwash fans, with gilgai surface in areas of expansive clay
Czrf	Residual ferricrete; includes ferruginous duricrust and pisolitic ironstone; dissected by present-day drainage

2.4.2 Land Systems

Land System (Rangelands) mapping covering the study area has been prepared by Agriculture Western Australia (van Vreeswyk et al. 2004). These represent broad units that each consist of a series of "land units" that occur on characteristic physiographic types within the Land System. 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 (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 (Environment Australia 2000) in ArcView 3.2.]. There are seven land systems represented within the Cape Lambert Variations study area (Figure 2.3). Table 2.2 provides a summary of the extent of each of these land systems within the survey area and the proportion this represents of their extent in the region. Less than 1% of each of the regional extent of these land systems will be disturbed by the proposed variation to the rail corridor (Table 2.2).

Table 2.2: Land Systems occurring within the Cape Lambert Variations study area.

Land System	Description	Area within subregion	Area within study area (ha)	% occurring within study area
Rocklea (RGEROC)	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands.	2,881,200	2	<0.0001
Littoral (RDELIT)	Bare coastal mudflats with mangroves on seaward fringes, samphire flats, sandy islands, coastal dunes and beaches.	210,733	54	0.026
Cheerawarra (RGECHC)	Sandy coastal plain and saline clay plains supporting soft and hard spinifex grasslands and minor tussock grasslands.	49,211	75	0.152
Ruth (RGERUT)	Hills and ridges of volcanic and other rocks supporting hard spinifex (and occasionally soft spinifex) grasslands.	169,300	359	0.212
Boolgeeda (RGEBCD)	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,635	423	0.044
Horseflat (RGEHOF)	Gilgaied clay plains supporting tussock grasslands and minor grassy snakewood shrublands.	328,122	90	0.027
Uaroo (RGEUAR)	Broad sandy plains supporting shrubby hard and soft spinifex grasslands.	987,066	11	0.001
		5,587,267	1,015	0.0182

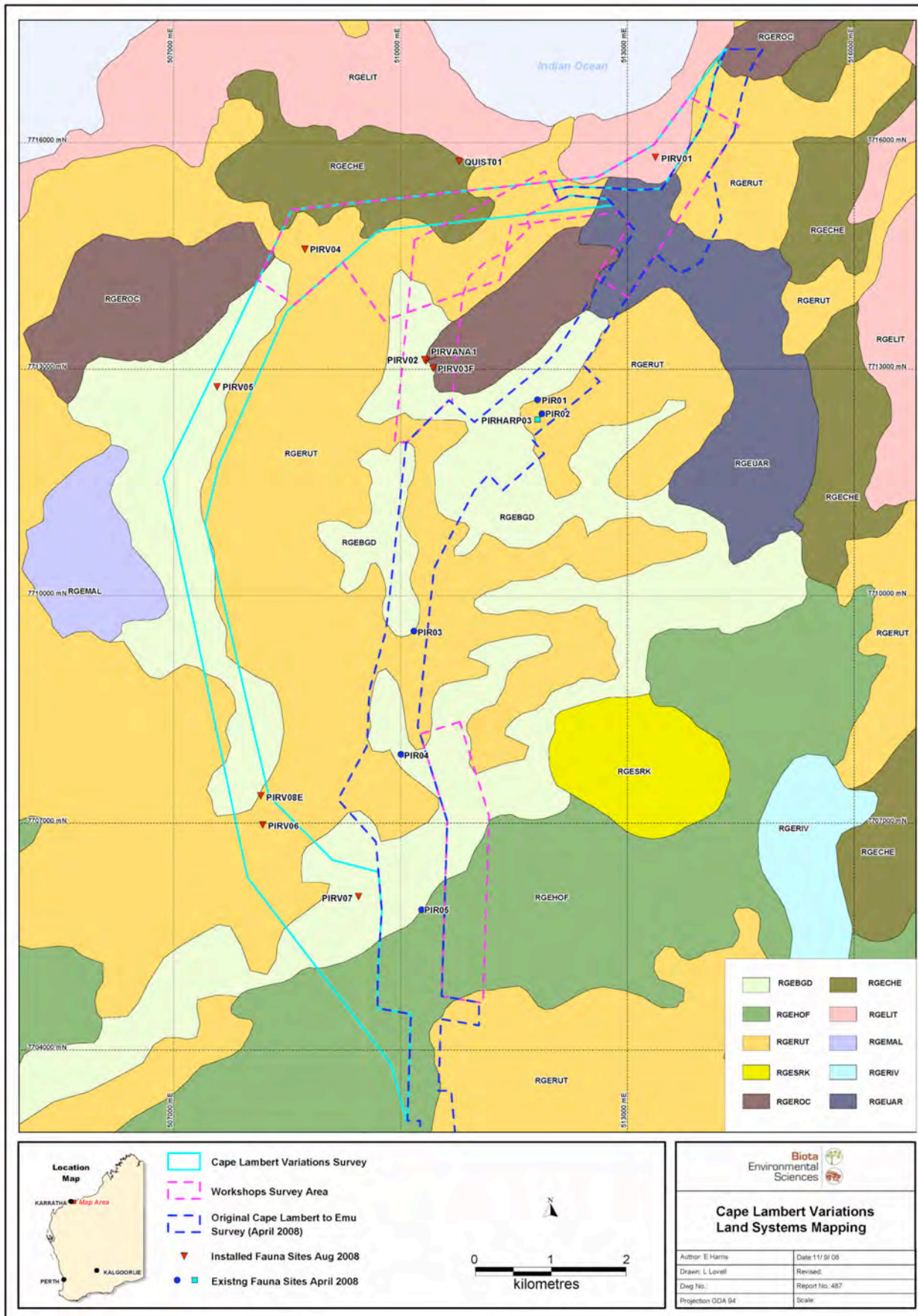


Figure 2.3: Land Systems mapping for the Cape Lambert Variations study area.

2.5 Biological Context of the Study Area

2.5.1 IBRA Bioregions and Subregions

The Interim Biogeographic Regionalisation for Australia (IBRA) recognises 85 bioregions (May and McKenzie 2002). The Cape Lambert Variations study area lies within the Pilbara bioregion, which is divided into four subregions: Roebourne, Chichester, Fortescue Plains and Hamersley. The Cape Lambert Variations study area comprises ha within the Roebourne (PIL4) biological subregion within the Pilbara bioregion (May and McKenzie 2002). The Roebourne subregion is described as:

“Quaternary alluvial and older colluvial coastal and sub- coastal plains with a grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of Acacia stellaticeps or A. pyrifolia and A. inaequilatera. Uplands are dominated by Triodia hummock grasslands. Ephemeral drainage lines support Eucalyptus victrix or Corymbia hamersleyana woodlands. Samphire, Sporobolus and mangal occur on marine alluvial flats and river deltas. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite. Islands are either Quaternary sand accumulations, or composed of basalt or limestone, or combinations of any of these three. Climate is arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer. Cyclonic activity is significant, with several systems affecting the coast and hinterland annually. Subregional area is 2, 008, 983ha”.

2.5.2 Previous Fauna Surveys

A number of biological surveys have previously been conducted in the general vicinity of the Cape Lambert Variations study area. The most relevant is the recently completed survey of the original Cape Lambert – Emu Siding rail duplication corridor (Biota 2008a). Other surveys that have been considered, along with database searches, during the compilation of this report include:

- Biota Environmental Sciences (2008b). Cape Lambert Ore Stockpile and Port Expansion Seasonal Fauna Survey. Unpublished Report for Rio Tinto Pty. Ltd.
- Biota Environmental Sciences (2007). Cape Lambert – Targeted SRE Fauna Survey. Unpublished report prepared for Cape Lambert Iron Ore Ltd.
- Biota Environmental Sciences (2004). Sherlock Bay Nickel Fauna Survey. Unpublished report for Sherlock bay Nickel Corporation Ltd.
- Department of Environment and Conservation – Pilbara Biological Survey (2003-2007).

2.5.3 Conservation Reserves in the Locality

There are no conservation reserves in the immediate vicinity of the study area.

3.0 Survey Methodology

3.1 Database Searches

A search of the Department of Environment and Conservation (DEC) Threatened Fauna Database was conducted for the Cape Lambert Variations study area (Appendix 1). The FaunaBase database of the Western Australian Museum was also searched for records of vouchered fauna from the area (Appendix 2). In addition, the *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* Protected Matters database was searched for fauna of environmental significance within the study area (Appendix 3).

Due to the shape of the study area, the database searches were conducted using two lines to delineate the search area. The bounding coordinates for these searches were:

- 20°38'38.237" S, 117°08'14.522" E and 20°41'43.384" S, 117°03'57.285" E; and
- 20°41'43.384" S, 117°03'57.285" E and 20°46'19.798" S, 117°05'48.601" E.

The area defined by these coordinates was given a 25 km buffer surrounding the study area. It should be noted that with the inclusion of a buffer, the search area encompassed marine environments. However, because marine environments will not be impacted during the proposed Cape Lambert Variation, marine species extracted from database searches are not discussed further.

3.2 Survey Timing and Weather

The survey (including trap installation) was conducted over a nine day period between 12th August and 20th August 2008. Minimum temperatures recorded at Roebourne during the survey ranged from 7.5°C to 16.8°C and maximum temperatures ranged from 25.4°C to 29.6°C (Table 3.1). No rainfall was recorded in Roebourne during the survey (Table 3.1).

Conditions were generally windy during the survey, with maximum wind speed gusts of between 43 km/h and 65 km/h (Table 3.1).

A total of 261.6 mm of rain fell in Roebourne in the six months prior to the survey, compared to an expected rainfall of 232.9 mm for this period (based on long term averages at Roebourne). This indicates that the survey was conducted following a period of higher than average rainfall.

Table 3.1: Daily meteorological observations at Roebourne during the Cape Lambert Variations survey (data provided by the Western Australian Bureau of Meteorology).

Date	12/8	13/8	14/8	15/8	16/8	17/8	18/8	19/8	20/8	Mean
Minimum Temp. (°C)	13.8	16.8	14.6	12.1	16.0	14.0	13.4	8.1	7.5	12.9°C
Maximum Temp. (°C)	29.2	29.6	29.0	28.9	28.6	27.7	25.4	26.4	28.5	28.1°C
Maximum Wind Gust Speed (km/h)	46	52	52	54	52	65	65	44	43	53 km/h

3.3 Fauna Survey Team

The vertebrate fauna sampling for this survey was conducted under "Licence to Take Fauna for Scientific Purposes" No. SF006301 issued to Mr Roy Teale (Appendix 4). The fauna survey team comprised Mr Dan Kamien, Mr Michael Greenham, Ms Erin Harris and Mr Tim Sachse (all of Biota Environmental Sciences).

Invertebrate identifications were completed by Dr Mark Harvey of the Western Australian Museum and Mr Dan Kamien of Biota.

3.4 Fauna Sampling

3.4.1 Selection and Location of Sampling Sites

The principal component of this study consisted of a combination of systematic fauna sampling and targeted searches within habitats suitable for short-range endemic or threatened fauna. The systematic sampling centred on six trapping grids, each of ten pit-traps, installed in defined habitats considered to represent the range available habitats within the study area. Targeted searches were conducted in as many areas as practicable and encompassed the range of habitats available within the study area.

Each sample site was located 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, or repeat targeted sampling of habitats where necessary. Locations of systematic trapping sites are presented in Table 3.2 and shown in Figure 2.2, while representative site photos are presented in Plate 4.1 - Plate 4.8.

3.4.2 Trapping Effort and Design

The trapping effort at the systematic trapping sites is shown in Table 3.2. An indicative layout for the Cape Lambert Variations fauna survey pit-trapping sites is shown in Figure 3.1. On this survey, pit-traps at each site were arranged in a single row of ten traps, alternating between 20 litre buckets (350 mm diameter) and PVC tubes (150 mm diameter). Pit-traps were spaced at ~10 m intervals and connected with a single length of 30 cm tall flywire fence. Pit-traps were utilised at six sites during this survey. Additionally one site of fourteen funnel traps and one site of 25 Elliott traps were also placed (Table 3.2).

Table 3.2: Location of systematic sampling sites and trap effort for the Cape Lambert Variations fauna survey.

Site	Location	Trap type	Date Opened	Date Closed	Nights Open	No. of Traps	Trap Effort
PIRV01	513372mE; 7715806mN	Pit-trap	14/8/08	20/8/08	6	10	60
PIRV02	510319mE; 7713127mN	Pit-trap	14/8/08	20/8/08	6	10	60
PIRV03F	510431mE; 7713012mN	Funnel	14/8/08	20/8/08	6	14	84
PIRV04	508736mE; 7714588mN	Pit-trap	14/8/08	20/8/08	6	10	60
PIRV05	508178mE; 7706977mN	Pit-trap	13/8/08	19/8/08	6	10	60
PIRV06	507576mE; 7712768mN	Pit-trap	13/8/08	19/8/08	6	10	60
PIRV07	509445mE; 7706030mN	Pit-trap	13/8/08	19/8/08	6	10	60
PIRV08E	508154mE; 7707364mN	Elliott	14/8/08	20/8/08	6	25	150
						Pit-trap Effort	360
						Funnel Trap Effort	84
						Elliott Trap Effort	150
						Total Trap Effort	594

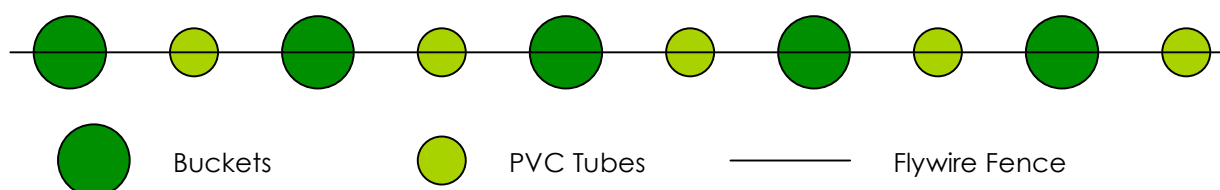


Figure 3.1: Indicative layout of trapping grids within the Cape Lambert Variations survey area (NB. not to scale).

A further five systematic survey grids were also sampled immediately adjacent to the current study area during the Biota (2008a) survey of the original rail duplication corridor.

3.4.3 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 3.3);
- 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 12 avifauna censuses were completed across the six pit-trapping sites during the survey period (Table 3.3). Avifauna was sampled using 30-minute censuses at established trapping grids, comprising a total of six hours dedicated to avifauna sampling. Censuses were conducted between 7:00 am and 9:00 am and were supplemented by recording avifauna species observed opportunistically within the study area.

Table 3.3: Date and time of systematic avifauna censuses during the Cape Lambert Variations survey.

Site	14/8/08	15/8/08	16/8/08	17/8/08	18/8/08	19/8/08	20/8/08	Total (min)
PIRV01		0730 - 0800		*		0720 - 0750		60
PIRV02 & PIRV03F	*	0820 - 0850				0810 - 0840		60
PIRV04			0727 - 0757		0730 - 0800			60
PIRV05		*	0812 - 0842		0810 - 0840			60
PIRV06	0825 - 0855			0806 - 0836				60
PIRV07	0745 - 0815			0724 - 0754			*	60
PIRV08E					*		*	*
								360 min

* denotes opportunistic records.

3.4.4 Bat Sampling

Bat echolocation calls were recorded using an Anabat II bat detector, which detects and records ultrasonic echolocation calls emitted during bat flight. This detector was placed in creek-line habitat for five nights (Plate 3.1).

The calls were stored on a compact flash card after being processed by an Anabat CF ZCAIM. Calls were visualised on Analook 3.3f software. Only sequences containing good quality search phase calls were considered for identification. Analyses of bat recordings were completed by Dr Kyle Armstrong (Specialised Zoological; Appendix 5).



**Plate 3.1: Site PIRVANA1
(510338mE; 7713108mN)**

3.4.5 Non-systematic Sampling of Vertebrate Fauna

A range of non-systematic fauna survey activities was also undertaken by the Biota survey team in August 2008 to supplement the 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 (where possible) including tracks, scats and diggings.

3.4.6 Invertebrate Fauna Sampling

Invertebrates were collected from systematic sampling sites in the course of removing vertebrates from traps, as well as searches being conducted in these habitats. Additional non-systematic sampling for invertebrate groups supporting potential short-range endemic (SRE) taxa was also conducted.

Groups targeted during these activities included:

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

Trapdoor spiders were targeted by searching for, and excavating burrows. Individuals were preserved in 70% ethanol, with one or two legs removed and placed in 100% ethanol for future molecular studies.

Pseudoscorpions and millipedes were searched for by removing bark from trees and turning rocks. Specimens were preserved in 70% or 100% ethanol. Snail searches involved looking under rocks and beneath upturned *Triodia* hummocks. Individuals were kept alive and stored in calico bags pending molecular analysis.

3.5 Study Limitations

Not all sections of the study area were ground-truthed or equally sampled for fauna. However, systematic fauna sampling, the primary component of the study, was completed on the basis of trapping grid installation in habitats considered to be representative of the range of units present within the expansion area.

Terrestrial invertebrate sampling was targeted at a small number of specific groups and collection of other taxa was largely opportunistic.

Note that this report documents the results of a baseline terrestrial fauna survey and primarily provides an assessment of conservation significance and generic impacts. Analysis of potential impacts specific to the design of the rail duplication proposal, and related management measures, have not been discussed here as these will be considered as part of the forthcoming environmental assessment process.

4.0 Results

4.1 Fauna Habitats

The study area comprised a range of habitat units, distinguished on the basis of differences in substrate, landform and vegetation. On this basis, the eight trapping sites utilised for the survey yielded five primary habitat types defined by landform (Table 4.1).

Table 4.1: Fauna habitats occurring within the Cape Lambert Variations study area.

Landform	Site	Description	Plate Reference
Boulder pile	PIRV03F	Basalt rock pile on edge of native tussock grasses.	Plate 4.3
Rocky hill slope	PIRV04	Base of rocky hill slope with <i>Triodia</i> over exposed rock outcrops and rocky loam.	Plate 4.4
	PIRV08E	<i>Acacia inaequilatera</i> over <i>Triodia</i> hummocks on rock.	Plate 4.8
Plain	PIRV07	Open <i>Hakea</i> , over open <i>Acacia</i> , over <i>Triodia</i> on clayey loam.	Plate 4.7
	PIRV05	<i>Acacia</i> over <i>Triodia</i> on stony clayey loam.	Plate 4.5
Dune	PIRV01	Scattered <i>Acacia</i> spp. over <i>Triodia</i> and buffel grasses on sand.	Plate 4.1
Plain adjacent to creekline	PIRV02	<i>Acacia</i> over <i>Triodia</i> on stony loam. <i>Corymbia</i> along creekline.	Plate 4.2
	PIRV06	Scattered <i>Corymbia</i> , over scattered <i>Acacia</i> , over <i>Triodia</i> on clayey loam with stony surface.	Plate 4.6



Plate 4.1: Site PIRV01



Plate 4.2: Site PIRV02



Plate 4.3: Site PIRV03F



Plate 4.4: Site PIRV04



Plate 4.5: Site PIRV05



Plate 4.6: Site PIRV06



Plate 4.7: Site PIRV07



Plate 4.8: Site PIRV08E

4.2 Vertebrate Fauna Overview

The vertebrate fauna survey of the Cape Lambert Variation study area yielded a total of 65 species. This included 26 avifauna species, thirteen native mammal species, one introduced mammal species and 25 herpetofauna species (Table 4.2).

Table 4.2: Overview of vertebrate fauna species recorded during the Cape Lambert Variations survey.

Fauna Group	Number of Species
Avifauna	26
Native Non-volant Mammals	8
Introduced Non-volant Mammals	1
Bats	5
Amphibians	0
Reptiles	25
Total	65

4.3 Avifauna

4.3.1 The Assemblage

A total of 26 species of avifauna were recorded during the Cape Lambert Variations survey, comprising 17 families. This total includes twelve non-passerine species and 14 passerine species (Table 4.3).

The most commonly recorded species was the Zebra Finch *Taeniopygia guttata* with a total of 266 records, representing 66.2% of all avifauna records. The next most commonly recorded species was the Black-faced Woodswallow *Artamus cinereus* with a total of 27 records, representing just 6.7% of all avifauna records. All other species recorded during the survey each represented less than 4% of total avifauna records. The most speciose avifauna family was the Columbidae (pigeons and doves) with 4 species recorded. The most abundant family recorded was the Passeridae (finches) with 282 records representing 70.1% of the total avifauna records (a function of the abundance of *T. guttata*). This was followed by the Meliphagidae (honeyeaters) with 31 records representing 7.7% of the total avifauna records.

The sites adjacent to drainage lines (PIRV02 and PIRV07; Figure 2.2) exhibited the highest avifauna diversity within the study area. Fifteen species were recorded at PIRV07, representing 57.7% of the total recorded species in the study area.

Four species were recorded during this survey that were not recorded during the adjacent Cape Lambert to Emu Siding fauna survey (Biota 2008a). These species were the Emu *Dromaius novaehollandiae*, White-faced Heron *Ardea novaehollandiae*, Brahminy Kite *Haliastur indus* and the Weebill *Smicrornis brevirostris*. All are common in coastal and inland habitats in the bioregion.

Table 4.3 presents the data for all avifauna species recorded within the Cape Lambert Variations study area during the fauna survey.

4.3.2 Breeding Records

There were no observations of avifauna breeding recorded during the Cape Lambert Variations fauna survey.

4.3.3 Regional Endemism and Restricted Taxa

No avifauna species considered endemic to the Pilbara bioregion were recorded during the Cape Lambert Variations fauna survey.

4.3.4 Avifauna of Conservation Significance

No avifauna species of elevated conservation significance were recorded during the Cape Lambert Variation fauna survey.

However there is the potential for at least one further avifauna species of elevated conservation significance to occur within the study area. This is the Southern Giant-Petrel *Macronectes giganteus*.

Further information on this species of elevated conservation significance can be found in Section 6.2.

Table 4.3: Avifauna species recorded during the Cape Lambert Variations fauna survey.

FAMILY Common Name	Species Name	PIRV01	PIRV02 & PIRV03F	PIRV04	PIRV05	PIRV06	PIRV07	PIRV08E	Total
CASUARIIDAE Emu	<i>Dromaius novaehollandiae</i>						T		T
ARDEIDAE White-faced Heron	<i>Ardea novaehollandiae</i>	1							1
ACCIPITRIDAE Brahminy Kite	<i>Haliastur indus</i>	2							2
Wedge-tailed Eagle	<i>Aquila audax</i>		2						2
Spotted Harrier	<i>Circus assimilis</i>				2		1		3
FALCONIDAE Australian Kestrel	<i>Falco cenchroides</i>	1							1
COLUMBIDAE Crested Pigeon	<i>Ocyphaps lophotes</i>		1						1
Spinifex Pigeon	<i>Geophaps plumifera</i>					1	1		2
Diamond Dove	<i>Geopelia cuneata</i>			2			4		6
Peaceful Dove	<i>Geopelia striata</i>				1				1
PSITTACIDAE Galah	<i>Cacatua roseicapilla</i>		2		2	1	4		9
HALCYONIDAE Red-backed Kingfisher	<i>Todiramphus pyrrophygia</i>		1				1		2
MALURIDAE Variegated Fairy-wren	<i>Malurus lamberti</i>	7					2		9
ACANTHIZIDAE Weebill	<i>Smicronis brevirostris</i>					1			1
MELIPHAGIDAE Brown Honeyeater	<i>Lichmera indistincta</i>		5	3		1	1		10
Singing Honeyeater	<i>Lichenostomus virescens</i>		3	5	2		3		13
Yellow-throated Miner	<i>Manorina flavigula</i>		6		2				8
PACHYCEPHALIDAE Crested Bellbird	<i>Oreoica gutturalis</i>			1	1	2	1	1	6
DICRURIDAE Willie Wagtail	<i>Rhipidura leucophrys</i>		3						3
Magpie-lark	<i>Grallina cyanoleuca</i>						2		2

FAMILY Common Name	Species Name	PIRV01	PIRV02 & PIRV03F	PIRV04	PIRV05	PIRV06	PIRV07	PIRV08E	Total
CAMPEPHAGIDAE Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		2	1		2			5
ARTAMIDAE Black-faced Woodswallow	<i>Artamus cinereus</i>		14		6	2	5		27
CRACTICIDAE Pied Butcherbird	<i>Cracticus nigrogularis</i>	5							5
CORVIDAE Torresian Crow	<i>Corvus orru</i>						1		1
PASSERIDAE Zebra Finch	<i>Taeniopygia guttata</i>		79	167		7	13		266
Painted Finch	<i>Emblema pictum</i>		4				2	10	16
	Total Number of Individuals	16	122	179	16	17	41	11	402
	Total Number of Species	5	12	6	7	8	15	2	26

4.4 Mammals

4.4.1 The Assemblage – Non-volant Mammals

A total of nine species of non-volant mammals were recorded during the Cape Lambert Variations survey. This total includes eight native mammal species and one non-native species (Table 4.4).

The most commonly recorded species was the Stripe-faced Dunnart *Sminthopsis macroura*, with a total of five records, representing 29.4% of all non-volant mammal records. All the remaining species recorded represented less than 18% of all non-volant mammal records for the fauna survey. The most abundant non-volant mammal family recorded was the Dasyuridae, with ten records representing 58.8% of all non-volant mammal records. The most speciose family was also the Dasyuridae, comprising four species.

Two species were recorded during this survey that were not recorded during the adjacent Cape Lambert to Emu Siding fauna survey (Biota 2008a). These were the Lesser Hairy-footed Dunnart *Sminthopsis youngsoni* and the Spinifex Hopping-mouse *Notomys alexis*.

The most speciose site for the Cape Lambert Variations fauna survey was PIRV04, with three species recorded. This site was also the most abundant with five individuals recorded, representing 29.4% of all non-volant mammal records.

Table 4.4 presents the data for all mammal species recorded within the Cape Lambert Variations study area during the fauna survey.

4.4.2 The Assemblage – Bats

Five species of bat were identified from the Anabat echolocation calls recorded during the Cape Lambert Variations fauna survey. These represented three families: the Emballonuridae, the Vespertilionidae and the Molossidae (Table 4.4).

4.4.3 Breeding Records

There were no observations of mammal breeding recorded during the Cape Lambert Variations fauna survey.

4.4.4 Regional Endemism and Restricted Taxa

One species considered endemic to the Pilbara bioregion was recorded during the Cape Lambert Variations fauna survey; this was the Pilbara Ningai *Ningai timealeyi* (Table 4.4).

4.4.5 Mammals of Conservation Significance

One mammal species of elevated conservation significance was recorded during the Cape Lambert Variations fauna survey; this was the Priority 1 listed Little Northern Freetail-bat *Mormopterus loriae cobourgiana*.

A further four mammal species of elevated conservation significance could potentially occur within the study area. These are the Brush-tailed Mulgara *Dasyurus blythi*, the Northern Quoll *Dasyurus hallucatus*, the Pilbara Orange Leaf-nosed Bat *Rhinocterus aurantius* and the Western Pebble-mound Mouse *Pseudomys chapmani*. None of these species were recorded during the original survey of the Cape Lambert – Emu rail duplication corridor (Biota 2008a).

Further information on these species can be found in Section 6.2.

4.5 Herpetofauna

4.5.1 The Assemblage

A total of twenty-five herpetofauna species was recorded during the Cape Lambert Variations fauna survey (Table 4.5). This total comprised five dragons (Agamidae), four geckos (Gekkonidae), two legless lizards (Pygopodidae), eleven skinks (Scincidae), one blind snake (Typhlopidae) and two front-fanged snakes (Elapidae).

The most commonly recorded herpetofauna species was the dragon *Ctenophorus isolepis* with a total of thirteen records, representing 13.5% of all herpetofauna records. This was followed by *Ctenophorus caudicinctus* and *Menetia greyii*, with eleven and ten records, representing 11.5% and 10.4% respectively. The remaining species recorded represented less than 10% of the total herpetofauna species.

The most abundant herpetofauna family recorded during the survey was the Scincidae with 40 records representing 41.7% of the total records. The Scincidae was also the most speciose family recorded comprising eleven species. No frogs were recorded during the fauna survey.

Seven herpetofauna species were recorded during the Cape Lambert Variations fauna survey that were not recorded during the adjacent Cape Lambert to Emu Siding fauna survey (Biota 2008a). These species were *Strophurus ciliaris*, *Lialis burtonis*, *Lerista bipes*, *Lerista neviniae*, *Notoscincus butleri*, *Demansia rufescens* and *Furina ornata*.

The most abundant sites during the Cape Lambert Variations fauna survey were PIRV01 and PIRV06, with each site recording 25 individuals, each representing 26.0% of total herpetofauna records. The most speciose sites during the survey were PIRV05 and PIRV06, with each site recording nine species (Table 4.5).

Table 4.5 presents the data for all herpetofauna species recorded within the Cape Lambert Variations study area during the fauna survey.

4.5.2 Breeding Records

During the Cape Lambert Variations fauna survey there were four records of *Menetia greyii* and two records of *Ctenophorus isolepis* males in breeding colours.

4.5.3 Regional Endemism and Restricted Taxa

Three herpetofauna species recorded during the Cape Lambert Variations fauna survey could be considered endemic, or near-endemic, to the Pilbara bioregion. These species are *Notoscincus butleri*, *Lerista neviniae* and *Ctenotus duricola* (Table 4.5).

4.5.4 Herpetofauna of Conservation Significance

One herpetofauna species of elevated conservation significance was recorded during the Cape Lambert Variations fauna survey; this was the state-listed Priority 4 species *Notoscincus butleri*.

One further herpetofauna species of elevation conservation significance could potentially be found within the study area. This is the Pilbara Olive Python *Liasis olivaceus barroni*.

The skink *Lerista neviniae* is not currently listed, but appears to be of restricted distribution, and could be considered to be of conservation significance.

Table 4.4: Mammal species recorded during the Cape Lambert Variations fauna survey (C denotes Anabat echolocation call record).

FAMILY Species Name	Common Name	PIRV01	PIRV02	PIRV04	PIRV05	PIRV06	PIRV07	PIRV08E	PIRVANA1	Total
DASYURIDAE										
<i>Ningui timealeyi</i>	Pilbara Ningui		2			1				3
<i>Planigale</i> sp. K	Planigale sp. K		1							1
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart			2		1	2			5
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart				1					1
MACROPODIDAE										
<i>Macropus robustus</i>	Euro							2		2
<i>Macropus rufus</i>	Red Kangaroo			2						2
EMBALLONURIDAE										
<i>Taphozous georgianus</i>	Common Sheath-tail-bat								C	C
VESPERTILIONIDAE										
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat								C	C
<i>Chalinolobus morio</i>	Chocolate Wattled Bat								C	C
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat								C	C
MOLOSSIDAE										
<i>Mormopterus loriae</i>	Little Northern Freetail-bat								C	C
MURIDAE										
<i>Notomys alexis</i>	Spinifex Hopping-mouse	1								1
<i>Pseudomys desertor</i>	Desert Mouse	1								1
FELIDAE										
<i>Felis catus</i>	Cat			1						1
Total Number of Individuals		2	3	5	1	2	2	2		17
Total Number of Species		2	2	3	1	2	1	1	5	14

Table 4.5: Herpetofauna species recorded during the Cape Lambert Variations fauna survey.

FAMILY Species Name	PIRV01	PIRV02	PIRV04	PIRV05	PIRV06	PIRV07	Total	
AGAMIDAE								
<i>Ctenophorus caudicinctus</i>			9	1		1	11	
<i>Ctenophorus isolepis</i>		2		1	8	2	13	
<i>Ctenophorus nuchalis</i>						1	1	
<i>Lophognathus longirostris</i>						1	1	
<i>Pogona minor</i>			1		6	2	9	
GEKKONIDAE								
<i>Diplodactylus conspicillatus</i>				3			3	
<i>Lucasium stenodactylum</i>			1				1	
<i>Strophurus ciliaris</i>				1			1	
<i>Heteronotia binoei</i>		1	2		2		5	
PYGOPODIDAE								
<i>Delma pax</i>	3	1				1	5	
<i>Lialis burtonis</i>				1			1	
SCINCIDAE								
<i>Carlia munda</i>					2		2	
<i>Ctenotus duricola</i>			1			1	2	
<i>Ctenotus hanloni</i>					2		2	
<i>Ctenotus pantherinus</i>		1	2	1		1	5	
<i>Ctenotus saxatilis</i>					2		2	
<i>Ctenotus serventyi</i>	3			1			4	
<i>Cyclodomorphus melanops</i>					1		1	
<i>Lerista bipes</i>	9						9	
<i>Lerista neviniae</i>	1						1	
<i>Menetia greyii</i>	9	1					10	
<i>Notoscincus butleri</i>			1		1		2	
TYPHLOPIDAE								
<i>Ramphotyphlops ammodytes</i>		1					1	
ELAPIDAE								
<i>Demansia rufescens</i>			1	1	1		3	
<i>Furina ornata</i>				1			1	
	Total Number of Individuals	25	7	18	11	25	10	96
	Total Number of Species	5	6	8	9	9	8	25

4.6 Potential Short Range Endemic Invertebrates

Taxonomic groups of invertebrates with naturally small distributions are described as short-range endemics (SREs) and are in part characterised by poor dispersal capabilities, confinement to disjunct habitats and low fecundity (Harvey 2002, Ponder and Colgan 2002). Given the importance of short-range endemism to the conservation of biodiversity, the assessment of such invertebrate taxa is a potentially important component of impact assessment. Examples of taxonomic groups that show high levels of short-range endemism in this respect include mygalomorph spiders, millipedes, pseudoscorpions and freshwater and terrestrial molluscs.

4.6.1 Mygalomorph Spiders

Three mygalomorph spiders were collected during the survey. These individuals were juveniles belonging to the family Nemesiidae and were excavated from two sites within the study area (Plate 4.9, Table 4.6 and Figure 2.2). Mygalomorph spider burrows identified as being from the same species were also observed at PIRV02 (Figure 2.2).

Table 4.6: Mygalomorph spiders collected during the Cape Lambert Variations fauna survey.

Taxa	PIRV05	PIRV07	Total
Nemesiidae sp.	1	2	3
			3



Plate 4.9: Mygalomorph spider burrow excavated at PIRV07.



Plate 4.10: Aname sp. A female.

Mygalomorph spider burrows were also observed at PIRV01. These were identified as belonging to *Aname* sp. A, a taxon previously identified at Cape Lambert (Plate 4.10; Biota 2008b).

4.6.2 Pseudoscorpions

Three pseudoscorpion families were represented in the pseudoscorpions collected during the Cape Lambert Variations fauna survey. These were the Chernetidae, Olipiidae and Garypinidae (Table 4.7). The Chernetidae and Garypinidae species were collected opportunistically under the bark of *Eucalyptus* sp. and *Corymbia* sp. trees. The Olipiidae were collected under rock.

Table 4.7: Pseudoscorpions collected during the Cape Lambert Variations fauna survey.

Taxa	PIRV02	PIRV06	PIRV07	Q1	Q5	Total
Chernetidae: <i>Haplochernes</i> sp.	2	4	7		11	24
Garypinidae: <i>Solinus</i> sp.	6	3	7	5		21
Olipiidae: <i>Indolpium</i> sp.				3		3
						48

These specimens have been lodged with the Western Australian Museum.

4.6.3 Terrestrial Snails

The terrestrial land snails of the Pilbara bioregions are divided into three broad groups: the micro-snails (including the Pupillidae, Charopidae etc), the Bulimulidae (represented by *Bothriembryon*) and the Camaenidae (represented by *Rhagada*, *Quistrachia* and possibly *Plectorhagada*). Based on current taxonomy (Solem 1986, 1988), species of micro-snails belonging to the genera *Pupoides*, *Gastrocopta* and *Discocharopa* appear to have distributions extending beyond the Pilbara bioregion and are therefore not currently considered to represent SREs.

Two species of live terrestrial snails were collected within the vicinity of the Cape Lambert Variations study area. These were identified as *Rhagada convicta* and *Quistrachia* sp. (Table 4.8 and Table 4.9).

Table 4.8: Terrestrial Snails collected during the Cape Lambert Variations fauna survey.

Taxa	PIRV01	PIRV02	PIRV04	PIRV06	PIRV08E	Q1	Q2	Q3	Q4	Total
<i>Rhagada convicta</i>	12	1	4	9	1	1			1	28
<i>Quistrachia</i> sp.					11	25	4	21		61
										89

Table 4.9: Opportunistic invertebrate collection locations.

Site	Location
Q1	20°39'27.124" S 117°06'12.480" E
Q2	20°50'31.685" S 117°05'44.340" E
Q3	20°44'58.985" S 117°05'48.060" E
Q4	20°44'25.324" S 117°06'17.100" E
Q5	20°45'18.860" S 117°06'07.617" E

As currently described, *Rhagada convicta* has an extensive coastal distribution and as a result is not considered to be a SRE. Furthermore, molecular investigations of the species to date show no evidence of distinct populations or populations restricted to small geographical areas (Biota 2006a, 2006b, 2006c, 2007).

A research project on the Camaenid land snail genus *Quistrachia* is currently being undertaken. This project is a being completed at the University of Western Australia, in conjunction with Biota Environmental Sciences and Rio Tinto Iron Ore. This research will help gain an understanding of the taxonomic relationships of this, as yet, undescribed species.

4.6.4 Millipedes

One millipede, a juvenile belonging to the Order Polydesmida, *Antichiropus* sp, was collected during the Cape Lambert Variations fauna survey (from site PIRV08; Figure 2.2). This specimen has been lodged with the Western Australian Museum.

5.0 Discussion

5.1 Overview

The species inventory recorded from the Cape Lambert Variations fauna survey area, while comparatively low for the Pilbara Bioregion, is representative of both the relatively small total area encompassed by the study, and the consequently low degree of habitat diversity available to fauna. The short duration of the survey, and its timing in early spring, has also contributed to the relatively small tally.

The five basic habitat types within this study area yielded a total of 65 fauna species. In comparison, the Sherlock Bay fauna survey (Biota 2004) yielded a total of 56 vertebrate fauna species over three primary habitat types. The seven primary habitat types in the Cape Lambert to Emu Siding fauna survey (Biota 2008a) yielded a total of 118 vertebrate fauna species. Similarly the Cape Lambert Port B Development fauna survey (Biota 2008b) yielded a total of 120 vertebrate fauna species over six primary habitat types.

The overall lower numbers of species recorded during the Cape Lambert Variations fauna survey may indicate that additional seasonal sampling would probably augment the species list for the study area. Habitat assessment suggests, however, that there is a low likelihood that this would include any currently unidentified significant populations of threatened fauna (Section 6.2).

The following sections contain more detailed comparison of the fauna compositions above.

5.2 Avifauna

The 26 avifauna species recorded during the Cape Lambert Variations fauna survey represent approximately 49% of the 53 species documented by Biota (2008a) for the Cape Lambert to Emu Siding fauna survey, 41% of those recorded by Biota (2008b) for the Cape Lambert Port B Development survey and 93% of the numbers recorded by Biota (2004) for the Sherlock Bay area.

This relatively smaller size of inventory could be contributed to several factors. The most significant of these factors is wind speed (Table 3.1). The high wind speeds almost certainly had a detrimental effect on avifauna observations as fewer birds were calling and moving around the study area. Another factor is lack of habitat diversity (see Section 4.1). The five primary habitat types defined for the study area, on the basis of vertical stratification and foraging opportunity, in effect yield only three habitat types comprising:

- *Acacia* spp. over *Triodia* on loam;
- Rocky hillslopes with *Triodia*; and
- Dunes with *Acacia* spp. over native and introduced grasses.

Other factors contributing to the small inventory size include widely ranging species, shy, cryptic species and nocturnal species. Taxa such as birds of prey (Accipitridae and Falconidae) and the Australian Bustard *Ardeotis australis* have large ranges and may only occur periodically in any given area.

5.3 Mammals

5.3.1 Non-volant Mammals

The nine species of non-volant mammals recorded during the Cape Lambert Variations fauna survey represent approximately 47% of the 19 species documented by Biota (2008a) for the Cape Lambert to Emu Siding fauna survey, 75% of those recorded by Biota (2008b) for the Cape

Lambert Port B Development survey and 150% of the number recorded by Biota (2004) for the Sherlock Bay area.

Species that are considered to be common and non-specialists, including the Pilbara Ningau *Ningau timealeyi* and the Stripe-faced Dunnart *Sminthopsis macroura*, were typically recorded during three or more of the studies.

Typically, where species were not recorded by one or more surveys, their absence can be attributed to a lack of suitable habitat or their relatively sparse distribution where habitat is available. An example of this is the Spinifex Hopping-mouse *Notomys alexis* which favours hummock grasslands on sandy substrates, and was only recorded during this survey (Table 4.4).

5.3.2 Bats

The total of five bat species documented during the Cape Lambert Variations fauna survey documents compares favourably with the inventories reported elsewhere. Biota (2004, 2008a and 2008b) recorded five, seven and five bat species respectively.

Of the bat species recorded only one is currently considered to be of elevated conservation significance. The Little Northern Freetail-bat *Mormopterus loriae cobourgiana* is listed as a Priority 1 species under State legislation (see Section 6.2.2).

5.4 Herpetofauna

The 25 species of herpetofauna recorded during the Cape Lambert Variations fauna survey represented six families. Notably missing from this inventory were the Hylidae (Tree Frogs), Myobatrachidae (Ground Frogs), Varanidae (Monitors) and the Boidae (Pythons). These families represent species that may be either dependent on seasonality (such as the frogs), or those that while not uncommon, may not be abundant at any given time, as is the case for many of the monitors and snakes.

The 25 species of herpetofauna recorded during the Cape Lambert Variations fauna survey represent approximately 54% of the 46 species documented by Biota (2008a) for the Cape Lambert to Emu Siding fauna survey, 63% of those recorded by Biota (2008b) for the Cape Lambert Port B Development survey and 147% of the number recorded by Biota (2004) for the Sherlock Bay area.

The seven species recorded during the Cape Lambert Variations fauna survey that were not recorded during the Cape Lambert to Emu Siding survey (Biota 2008a) were most likely recorded due to habitat or seasonal differences.

5.5 Comparison with original Cape Lambert to Emu Siding fauna survey

Thirteen vertebrate fauna species were recorded during the Cape Lambert Variations fauna survey that were not recorded during the Cape Lambert to Emu Siding fauna survey (Biota 2008a). These comprised four avifauna species, two mammal species and seven reptile species.

The only species of conservation significance identified amongst these species are the skinks *Notoscincus butleri* and *Lerista neviniae*. It is highly unlikely there will be major impacts on either of these species as both have been previously recorded in the Cape Lambert area. Habitat supporting *Notoscincus butleri* is widespread in the area (arid, rocky and near-coastal; Wilson and Swan 2008). The one record of *Lerista neviniae* from this survey was found in dune habitat, which is unlikely to be disturbed by the proposed development. Additional observations of *Lerista neviniae* have been recorded to the west and east of this location (Biota 2008c). Further information on both can be found in Section 6.2.

6.0 Conservation Significance

6.1 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 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)*.

6.1.1 *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.unep-wcmc.org/species/animals/categories.html>).

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).

6.1.2 *Wildlife Conservation Act 1950-1979*

Classification of rare and endangered fauna under the *Wildlife Conservation (Specially Protected Fauna) Notice 2006* recognises four distinct schedules of taxa:

- Schedule 1** taxa are fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection;
- Schedule 2** taxa are fauna which are presumed to be extinct and are declared to be fauna in need of special protection;
- 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
- 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.

6.2 Threatened Fauna

Two species of elevated conservation significance were recorded during the Cape Lambert Variations fauna survey (Table 6.1). These were the Little Northern Freetail-bat *Mormopterus loriae cobourgiana* (Priority 1) and the skink *Notoscincus butleri* (Priority 4).

A further nine species listed under State and Federal legislation could occur within the study area (Table 6.1).

Table 6.1: Threatened fauna species potentially occurring within the Cape Lambert Variations study area.

Species	Status	
	State	Federal
<i>Macronectes giganteus</i> Southern Giant-Petrel	Schedule 1	Endangered
<i>Dasyercus blythi</i> Brush-tailed Mulgara	Schedule 1	Vulnerable
<i>Dasyurus hallucatus</i> Northern Quoll	Schedule 1	Endangered
<i>Rhinonicteris aurantius</i> Pilbara Orange Leaf-nosed Bat	Schedule 1	Vulnerable
<i>Liasis olivaceus barroni</i> Pilbara Olive Python	Schedule 1	Vulnerable
<i>Mormopterus loriae cobourgiana</i> Little Northern Freetail-bat*	Priority 1	
<i>Ardeotis australis</i> Australian Bustard	Priority 4	
<i>Numenius madagascariensis</i> Eastern Curlew	Priority 4	
<i>Phaps histrionica</i> Flock Bronzewing	Priority 4	
<i>Neochmia ruficauda subclarescens</i> Star Finch (western)	Priority 4	
<i>Pseudomys chapmani</i> Western Pebble-mound Mouse	Priority 4	
<i>Notoscincus butleri</i> *	Priority 4	

* denotes species recorded during the fauna survey.

The record of the Banded Hare-wallaby *Lagorchestes fasciatus fasciatus* at Cossack (Appendix 1) is likely to be an old record as this species is considered extinct on the mainland (Prince and Richards 2008), as such it will not be discussed further here.

6.2.1 Schedule Species

Southern Giant-Petrel – *Macronectes giganteus*

State: Schedule 1

Federal: Endangered

Distribution: This species is found in southern and western seas north to 22°S (Johnstone and Storr 1998).

Ecology: These birds are usually recorded singly and occasionally in small groups. They are often recorded sitting on the sea and are attracted to large schools of tuna (Johnstone and Storr 1998).

Likelihood of Occurrence: Any individuals occurring within the study area are likely to be immatures dispersing.

Potential Impacts: As a Schedule 1 and federally listed species the Southern Giant Petrel is considered fauna in need of special protection. However, the proposed rail corridor is not considered likely to have a significant impact upon this species or its conservation status.

Brush-tailed Mulgara – *Dasyercus cristicauda*

State: Schedule 1

Federal: Vulnerable

Overview: Until recently, there has been considerable taxonomic confusion within the genus *Dasyercus*. For the last 30 years only one species, *D. cristicauda*, was recognized (Schedule 1, Vulnerable). More recently, based on genetic and morphological attributes, two species are now recognised – the Crest-tailed Mulgara, *D. cristicauda* and the Brush-tailed Mulgara, *D. blythi* (Woolley 2005, 2006). Woolley (2005, 2006) distinguished these two species on the following characteristics:

- Appearance of black hairs on the distal half of the tail (a brush in *D. blythi* versus a dorsal crest in *D. cristicauda*);
- The number of upper pre-molar teeth (two in *D. blythi* versus three in *D. cristicauda*); and
- In females, the number of teats (six in *D. blythi* versus eight in *D. cristicauda*).

It should be noted that as of the date of this report, the Western Australian Museum and the Department of the Environment, Water, Heritage and the Arts have yet to update their databases. As a result, both the Western Australian Museum FaunaBase search and the EPBC Act 1999 Protected Matters report do not currently distinguish between the two species. That is, both species are currently registered as *D. cristicauda*.

Distribution: The Brush-tailed Mulgara occurs in spinifex sandplain habitat across the arid zone of Western Australia, the Northern Territory and Queensland. The Mulgara was formerly widespread in sandy deserts but they are now rare and patchily distributed. Recent records are from the Great Victoria, Gibson, Great Sandy, Little Sandy and Tanami deserts, the Pilbara, Gascoyne, Murchison, north-eastern Goldfields, the Central Ranges region and Carnarvon basin (Kennedy Range).

Ecology: The Brush-tailed Mulgara inhabits Spinifex grasslands and larger colonies coincide with relatively well watered areas such as paleo-drainage channels or drainage lines in sandplain or sand dune habitats (Maxwell et al 1996). They have a diet of small vertebrates and larger invertebrates. Little is known about breeding of Brush-tailed Mulgaras, although females with up to six young in the pouch have been captured in September. Among captive animals, mating has been observed in May to June with young born in late June to August. Individuals have been known to come into breeding condition each year for six years (Woolley 2008).

Likelihood of Occurrence: This species may potentially occur within the Cape Lambert Variations study area where suitable habitat occurs.

Potential Impacts: The main impact to be considered is habitat loss. However, in the case of the proposed variation to the rail corridor habitat loss will be minimal and therefore is unlikely to affect either *D. blythi* or the conservation status of this species.

Northern Quoll – *Dasyurus hallucatus*

State: Schedule 1

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.

Likelihood of Occurrence: It is possible that the Northern Quoll occurs within the study area, particularly near major creek lines and rivers. In addition to creek lines, this species is most abundant in open, rocky habitat and is also commonly found in gorges, where breeding is successful (Oakwood 2008). Aside from areas with major creeks and rivers, the majority of the Cape Lambert Variations study area comprises sub-optimal habitat for this species as gorges and significant rocky habitat is absent.

Potential Impacts: As the proposed variation to the rail corridor will not significantly impact on any major creeks, rivers, or other habitat utilised by the Northern Quoll, it is unlikely to affect the Northern Quoll or affect the conservation status of the species.

Pilbara Orange Leaf-nosed Bat – *Rhinonictis aurantius*

State: Schedule 1

Federal: Vulnerable

Distribution: The 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: Not recorded during the recent Cape Lambert Variations fauna survey. Although foraging may potentially occur within the study area, the lack of suitable habitat indicates this species is unlikely to roost within the project area.

Potential Impacts: As no major caves were observed to occur within the Cape Lambert Variations study area, the proposed development will not affect either *R. aurantius* or the conservation status of the species.

Pilbara Olive Python – *Liasis olivaceus barroni*

State: Schedule 1

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 potentially occur within the Cape Lambert Variations study area where suitable habitat occurs.

Potential Impacts: As the works associated with the variation to the rail corridor are unlikely to impact on gorge or escarpment habitat, the proposed development is unlikely to affect either the Pilbara Olive Python or the conservation status of this species.

6.2.2 Priority Species

Little Northern Freetail-bat – *Mormopterus loriae cobourgiana*

State: Priority 1

Distribution: Endemic to Australia, this species' distribution encompasses the Western Australian coastal areas from Derby to the Exmouth Gulf (Churchill 1998).

Ecology: This species is a mangrove specialist, restricted to mangrove forest and adjacent areas. (Churchill 1998). This species has been found roosting in small spouts and crevices in dead upper branches of the mangrove *Avicennia marina*. Individuals emerge early in the evening in groups of up to 100 individuals above the mangrove canopy, before dispersing to forage alone or in pairs. *M. loriae* prey on insects above and beside the forest canopy. They give birth to single young which are born in the wet season (summer) (Churchill 1998).

Likelihood of occurrence: This species was recorded during the Cape Lambert Variations fauna survey (Table 4.4). This species was also recorded at three locations by Biota during a recent survey at Cape Lambert (Biota 2008b).

Potential Impacts: Impacts through habitat loss are considered low as roosting occurs within the mangrove habitat and outside the proposed impact area. The conservation status of this species is unlikely to be altered by the proposed development.

Australian Bustard – *Ardeotis australis*

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).

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). The Bustard 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 is common in the Pilbara and is likely to occur within the Cape Lambert Variations study area.

Potential Impacts: Small-scale habitat loss associated with additional infrastructure and potentially altered fire regimes are potential impacts to the Australian Bustard. However, the proposed variation to rail corridor would not affect the conservation status of this species at either the Pilbara bioregion or Chichester subregion level.

Eastern Curlew – *Numenius madagascariensis*

State: Priority 4

Distribution: The Eastern Curlew occurs throughout coastal Western Australia, south to Bunbury (Johnstone and Storr 1998).

Ecology: This species occurs mainly on tidal mudflats, and also on sandy beaches and rarely near coastal lakes (including saltfields ponds) (Johnstone and Storr 1998). The Eastern Curlew breeds in northern Asia and is a summer migrant to Australia. It is moderately common in the Pilbara.

Likelihood of occurrence: This species was recorded by Biota during a recent survey at Cape Lambert (Biota 2008b).

Potential Impacts: The project is unlikely to present any significant habitat loss for this species as mangrove and intertidal habitats will not be affected by the proposed expansion.

Flock Bronzewing – *Phaps histrionica*

State: Priority 4

Distribution: Inhabits coastal riverine plains of north-west WA, south to Carnarvon. Also in Kimberley and arid and semiarid north-eastern interior of Australia. (Johnstone and Storr 1998).

Ecology: The Flock Bronzewing is typically found on treeless or sparsely wooded grassy plains and is probably nomadic (Marchant and Higgins 1993; Johnstone and Storr 1998). It has declined greatly in the last century due to the degradation of its habitat by livestock and there were no records of this species in the Pilbara during the most recent Birds Australia Bird Atlas Project (Barrett et al. 2003).

Likelihood of Occurrence: This species has potential to occur within the study area, but given its rarity in the Pilbara, this is unlikely. However, it should be noted that populations fluctuate dramatically throughout space and time and they are known as a 'boom-bust' species. They can be locally abundant following good seasons but then vanish and may not reappear in the area for decades.

Potential Impacts: The proposed variation to the rail corridor will not affect the conservation status of this species.

Star Finch (western) – *Neochmia ruficauda subclarescens*

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 and 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. 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: The Star Finch was recorded during the two recent surveys (Biota 2008a, 2008b) in the Cape Lambert area and could be present in the study area.

Potential Impacts: Destruction of habitat is likely to be the main potential impact on this species. The variation to the rail corridor will not significantly impact the core habitat of the Star Finch and as a result is unlikely to affect the conservation status of this species.

Western Pebble-mound Mouse – *Pseudomys chapmani*

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 m² (Start 2008). This mound formation is most common on spurs and gentle slopes with suitable size class stones.

Likelihood of Occurrence: This species was not recorded during the recent Cape Lambert Variations fauna survey. The study area does contain rocky/stony hill slopes that have potential to support *P. chapmani*.

Potential Impacts: There is potential for mortality of *P. chapmani* during construction of the rail corridor. However, due to the relatively narrow area impacted the conservation status of this species is unlikely to be affected by the proposed development.

Notoscincus butleri

State: Priority 4

Distribution: *Notoscincus butleri* is endemic to Western Australia and restricted to the arid northwest of the Pilbara bioregion (Storr et al. 1999).

Ecology: *N. butleri* has been associated with spinifex-dominated areas near creek and river margins (Wilson and Swan 2003; Mr Greg Harold, pers. comm. 2004). This small skink is diurnal and oviparous (Wilson and Knowles 1988).

Likelihood of Occurrence: This species was recorded during the recent Cape Lambert Variations fauna survey at sites PIRV04 and PIRV06 (Table 4.5 and Figure 2.2).

Potential Impacts: There is potential for mortality of *N. butleri* during construction of the rail corridor. However, due to the relatively narrow area impacted the conservation status of this species is unlikely to be affected by the proposed development.

6.2.3 Migratory Avifauna Species

Avifauna species can be listed as Migratory and/or Marine under the *EPBC Act 1999* and could potentially occur in or near the study area.

The following species are listed as Migratory species under the *EPBC Act 1999*: White-bellied Sea-Eagle *Haliaeetus leucogaster*, Barn Swallow *Hirundo rustica*, Rainbow Bee-eater *Merops ornatus*, Great Egret *Ardea alba*, Cattle Egret *Ardea ibis*, Oriental Plover *Charadrius veredus*, Oriental Pratincole *Glareola maldivarum*, Little Curlew *Numenius minutus*, Fork-tailed Swift *Apus pacificus*, Southern Giant-Petrel *Macronectes giganteus*, Wedge-tailed Shearwater *Puffinus pacificus* and Caspian Tern *Sterna caspia*.

The following species are also listed as Marine species under the *EPBC Act 1999*: Fork-tailed Swift *Apus pacificus*, Great Egret *Ardea alba*, Cattle Egret *Ardea ibis*, Oriental Plover *Charadrius veredus*, Oriental Pratincole *Glareola maldivarum*, White-bellied Sea-Eagle *Haliaeetus leucogaster*, Barn Swallow *Hirundo rustica*, Silver Gull *Larus novaehollandiae*, Southern Giant-Petrel *Macronectes giganteus*, Rainbow Bee-eater *Merops ornatus*, Little Curlew *Numenius minutus*, Osprey *Pandion haliaetus*, Wedge-tailed Shearwater *Puffinus pacificus*, Crested Tern *Sterna bergii* and Caspian Tern *Sterna caspia*.

6.2.4 Other Species of Significance***Lerista neviniae***

Though not formally listed as threatened, the fossorial skink *Lerista neviniae* (Plate 6.1) is currently only known from the general vicinity of Cape Lambert, having been recorded from the pale coastal sands between 20°37'00" S, 117°10'59" E and 20°39'12" S, 117°06'21" E. This is equivalent to roughly 15 km of the coastline in the locality, and includes parts of the Cape Lambert Variations study area. This species is considered likely to extend further west to at least 20°38'50" S, 117°05'39" E. A single specimen of this species was recorded from the most coastal site in this study (PIRV01; Table 4.5). This area seems likely to be on the most inland extent of the species' local habitat, with a further 25 specimens having been recorded from coastal dunes at Cape Lambert Port B Development (Biota 2008b).



Plate 6.1: *Lerista neviniae*.

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Appendix 1



DEC Threatened Fauna Database Search Results



Threatened and Priority Fauna Database

Page 1 of 1

20.4757°S 116.8643°E / 20.9296°S 117.3384°E

Cape Lambert area (plus ~25km buffer)

* Date Certainty Seen Location Name

Method

Schedule 1 - Fauna that is rare or is likely to become extinct

Dasyurus hallucatus

Northern Quoll

4 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.

	1		ROEBOURNE	
1900	1		ROEBOURNE	
1967	1		POINT SAMSON	
1975	1		WICKHAM	

Lagostrophus fasciatus fasciatus

Banded Hare-wallaby, Mernine

1 records

This small macropod occurs in low shrubland and extant populations occur on Bernier and Dorre islands in Shark Bay. An attempted reintroduction to Peron Peninsula showed that the species is highly vulnerable to predation from cats as well as foxes.

	1		Cossack	Day sighting
--	---	--	---------	--------------

Megaptera novaeangliae

Humpback Whale

1 records

1996	1	1	Point Samson	Dead
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Schedule 4 - Other specially protected fauna

Dugong dugon

Dugong

2 records

2000	1	1	Point Samson	Dead
2004	1	4	Antomymyre	Day sighting

Priority Four: Taxa in need of monitoring

Pseudomys chapmani

Western Pebble-mound Mouse, Ngadji

2 records

This species is well-known for the characteristic pebble-mounds which it constructs over an deep round burrow systems. These mounds are most common on spurs and lower slopes of rocky hills.

1979	2	0	Karratha	Definite signs
1994	2	0	Mt Anketell	Definite signs

Ardeotis australis

Australian Bustard

1 records

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

2007	1	2	Mount Anketell	Day sighting
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Numenius madagascariensis

Eastern Curlew

2 records

This species is a migratory visitor and has been observed on reef flats and sandy beaches along the West Australian coast and in coastal estuaries.

1966	1		Nichol Bay	Day sighting
2002	1	2	Nichol Bay	

Phaps histrionica

Flock Bronzewing

1 records

This species is gregarious and occurs in treeless or sparsely wooded grassy plains within reach of open water.

1968	1	300	Nichol River	Day sighting
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Wednesday, 17 September 2008

Department of
Environment and Conservation

Appendix 2

WA Museum FaunaBase Search Results



Birds collected between

**-20.644, 117.018 and -20.696, 117.186 and
-20.696, 117.186 and -20.771, 116.977**

Acanthizidae
Gerygone tenebrosa

Accipitridae
Circus assimilis
Haliastur indus girrenera

Anatidae
Anas gracilis

Campephagidae
Coracina novaehollandiae subpallida

Charadriidae
Charadrius ruficapillus

Columbidae
Geopelia humeralis

Halcyonidae
Todiramphus chloris pilbara

Meliphagidae
Melithreptus gularis laetior

Muscicapidae
Ficedula cyanomelana cyanomelana

Pachycephalidae
Pachycephala lanioides

Petroicidae
Eopsaltria pulverulenta

Zosteropidae
Zosterops luteus balstoni

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Mammals collected between

**-20.644, 117.018 and -20.696, 117.186 and
-20.696, 117.186 and -20.771, 116.977**

Dasyuridae
Dasyurus hallucatus

Muridae
Pseudomys chapmani
Pseudomys hermannsburgensis

Vespertilionidae
Chalinolobus gouldii
Vespadelus finlaysoni
Vespadelus regulus

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No amphibians collected between

**-20.644, 117.018 and -20.696, 117.186 and
-20.696, 117.186 and -20.771, 116.977**

Reptiles collected between

**-20.644, 117.018 and -20.696, 117.186 and
-20.696, 117.186 and -20.771, 116.977**

Agamidae
Ctenophorus caudicinctus caudicinctus
Ctenophorus isolepis isolepis
Ctenophorus nuchalis
Lophognathus longirostris
Pogona minor minor

Colubridae
Fordonia leucobalia

Elapidae
Acanthophis wellsi
Demansia psammophis cupreiceps
Hydrelaps darwiniensis

Gekkonidae
Diplodactylus conspicillatus
Diplodactylus stenodactylus
Gehyra punctata
Gehyra variegata
Heteronotia binoei

Pygopodidae
Delma pax
Delma tincta
Lialis burtonis

Scincidae
Ctenotus grandis titan
Ctenotus helenae
Ctenotus pantherinus ocellifer
Ctenotus saxatilis
Ctenotus serventyi
Cyclodomorphus melanops
Egernia depressa
Egernia pilbarensis
Lerista bipes
Lerista muelleri
Menetia greyii
Morethia ruficauda exquisita

Typhlopidae
Ramphotyphlops grypus

Varanidae
Varanus eremius

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Appendix 3

EPBC Act 1999 Protected Matters Report



Matters of National Environmental Significance		
Threatened Species	Status	Type of Presence
Birds		
<i>Macronectes giganteus</i> Southern Giant-Petrel	Endangered	Species or species habitat may occur within area
Mammals		
<i>Dasyercus cristicauda</i> Mulgara	Vulnerable	Species or species habitat likely to occur within area
<i>Dasyurus hallucatus</i> Northern Quoll	Endangered	Species or species habitat may occur within area
<i>Rhinonicteris aurantius</i> Pilbara Leaf-nosed Bat	Vulnerable	Community likely to occur within area
Reptiles		
<i>Liasis olivaceus barroni</i> Olive Python (Pilbara subspecies)	Vulnerable	Species or species habitat may occur within area
Migratory Species	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	Migratory	Breeding known to occur within area
<i>Hirundo rustica</i> Barn Swallow	Migratory	Species or species habitat may occur within area
<i>Merops ornatus</i> Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Migratory Wetland Species		
Birds		
<i>Ardea alba</i> Great Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Migratory	Species or species habitat may occur within area
<i>Charadrius veredus</i> Oriental Plover	Migratory	Species or species habitat may occur within area
<i>Glareola maldivarum</i> Oriental Pratincole	Migratory	Species or species habitat may occur within area
<i>Numenius minutus</i> Little Curlew	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
<i>Apus pacificus</i> Fork-tailed Swift	Migratory	Species or species habitat may occur within area
<i>Ardea alba</i> Great Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Migratory	Species or species habitat may occur within area
<i>Macronectes giganteus</i> Southern Giant-Petrel	Migratory	Species or species habitat may occur within area
<i>Puffinus pacificus</i> Wedge-tailed Shearwater	Migratory	Breeding known to occur within area
<i>Sterna caspia</i> Caspian Tern	Migratory	Breeding known to occur within area

Other Matters Protected by the EPBC Act		
Listed Marine Species	Status	Type of Presence
<i>Apus pacificus</i> Fork-tailed Swift	Listed – overfly marine area	Species or species habitat may occur within area
<i>Ardea alba</i> Great Egret	Listed – overfly marine area	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Listed – overfly marine area	Species or species habitat may occur within area
<i>Charadrius veredus</i> Oriental Plover	Listed – overfly marine area	Species or species habitat may occur within area
<i>Glareola maldivarum</i> Oriental Pratincole	Listed – overfly marine area	Species or species habitat may occur within area
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	Listed	Breeding known to occur within area
<i>Hirundo rustica</i> Barn Swallow	Listed – overfly marine area	Species or species habitat may occur within area
<i>Larus novaehollandiae</i> Silver Gull	Listed	Breeding known to occur within area
<i>Macronectes giganteus</i> Southern Giant-Petrel	Listed	Species or species habitat may occur within area
<i>Merops ornatus</i> Rainbow Bee-eater	Listed – overfly marine area	Species or species habitat may occur within area
<i>Numenius minutus</i> Little Curlew	Listed – overfly marine area	Species or species habitat may occur within area
<i>Pandion haliaetus</i> Osprey	Listed	Breeding known to occur within area
<i>Puffinus pacificus</i> Wedge-tailed Shearwater	Listed	Breeding known to occur within area
<i>Sterna bergii</i> Crested Tern	Listed	Breeding known to occur within area
<i>Sterna caspia</i> Caspian Tern	Listed	Breeding known to occur within area

Appendix 4

Regulation 17
“Licence to take fauna for scientific purposes”
SF006301





DEPARTMENT OF ENVIRONMENT AND CONSERVATION

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Facsimile: 08 9334 0242



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Bentley Delivery Centre WA 6983

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NO. SF006301

DATE OF ISSUE 31/03/2008
VALID FROM 30/03/2008
DATE OF EXPIRY 30/03/2009

Roy John
LICENSING OFFICER

(ROY JOHN)

LICENSEE: MR RJ TEALE
ADDRESS BIOTA ENVIRONMENTAL SERVICES
P.O. BOX 155
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RECEIPT NO. AMOUNT
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**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 DIRECTOR GENERAL, 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 *1 to 10*) ARE ATTACHED.

PURPOSE INVERTEBRATE AND VERTEBRATE SURVEY RUNNING ALONGSIDE THE EXISTING PILBARA IRON RAILWAY FROM JUNA DOWNS TO CAPE LAMBERT

AUTHORISED PERSONS GARTH HUMPHREYS, DAN KAMIEN,
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Appendix 5

Anabat Echolocation Call Analyses



