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Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage B Rail Corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas Mine Areas

Fauna Habitat and Fauna Assemblage Survey




Prepared for:

Fortescue Metals Group (FMG)

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1.0 Summary

1.1 Background and Methods

Biota Environmental Sciences was commissioned to undertake a fauna survey of the proposed FMG Stage B rail corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas mine areas. Up to five zoologists sampled different sections of the study area over two separate sampling trips in March and in June-July 2004.

The central component of the systematic censusing consisted of 36 trapping grids, with a total of 1,960 pit trap nights, 400 Elliott trap nights and 70 funnel trap nights. The trapping design replicates that used by the authors along the proposed FMG Stage A rail corridor and within the proposed Hope Downs rail corridor. Hand foraging, road spotting and head-torching supplemented the systematic trapping.

The avifauna of the FMG Stage B rail corridor and mine areas was sampled using a combination of techniques, which included:

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

In total 103 censuses were carried out across 50 sites for a combined duration of 71.5 hours.

Bat fauna were surveyed using an Anabat II ultrasonic detector connected to a CF ZCAIM unit (Titley Electronics, Ballina, NSW).

Targeted invertebrate groups were sampled through opportunistic and systematic collections during the survey. Prior to field work, WA Museum staff were consulted to confirm invertebrate groups of interest and to identify any specific curation methods (eg. the preservation of Wolf Spiders for DNA analyses).

Invertebrate groups targeted during the survey included:

- Araneae (Spiders, in particular Trapdoor and Wolf Spiders);
- Pseudoscorpionida (Pseudoscorpions);
- Scorpionida (Scorpions);
- Diplopoda (Millipedes); and
- Pulmonata (Land snails).

1.2 Habitats

Fauna habitat classification was developed on the basis of the dominant landform and vegetation type. It does not cover all habitats available to the entire assemblage of invertebrate and vertebrate fauna, as this would be difficult to resolve and logistically impracticable to sample. Rather, the classifications provide a convenient framework within which to summarise species occurrence in the annotated lists and associated tables.

A total of 81 broad vegetation types was defined for the survey areas, each comprised of a wide range of structural and floristic variants. The broad units that best represented the most convenient fauna habitat classification included hummock grasslands of *Triodia* species with a variable shrub overstorey on low stony hills of the Chichester and Hamersley Ranges; tall shrublands of *Acacia* species, usually with an overstorey of *Corymbia*, in creeklines; open woodlands of Coolibah *Eucalyptus victrix* over tall shrublands of *Acacia* or *Melaleuca* spp. on river banks and beds; Mulga (*Acacia aneura* and

associated taxa) woodlands and tall shrublands over spinifex or various grasses on the plains of the Fortescue Valley; and varied vegetation on cracking clays of the Fortescue Valley.

The vegetation of the study area was mostly in at least good condition, with the exception of some creeklines that were degraded due to invasion by weeds (mainly Buffel Grass **Cenchrus ciliaris*).

Our habitat classifications do not adequately address both vertebrate and invertebrate taxa and not enough is known of the habitat preferences of so called short-range endemic taxa to comment adequately on the conservation significance of our habitat classifications for these taxa. As such we have defaulted to a habitat conservation significance assessment based on the smallest mapped unit, in this case vegetation types. Within the caveat that different taxonomic groups respond differently to different elements of the environment, it is plausible that distributions may coincide at least with the level of vegetation mapping provided by our botanists. Rare and restricted vegetation types, perhaps indicating discrete substrate types, potentially supporting short range endemics sensitive to that component of the physical environment (eg. mygalomorph spiders).

The vegetation assessment identified a number of vegetation types of particular conservation significance within the study area, including:

- Vegetation type Fa10 was considered to be of Very High conservation significance. This unit occurred between Mt Lewin and Mt Nicholas and comprised Mulga-dominated vegetation of seasonally-wet broad drainage areas, which is an uncommon habitat in the area. It was strongly associated with the Washplain Land System, which has a restricted distribution in the Pilbara, with the study area being located at the northern edge of this range. This vegetation was also in excellent condition, and is considered likely to support flora species of restricted distribution in the region.

- Seven vegetation types of High conservation significance were identified (Fa1, Fa13, Fa18, Fa19, Fa20, Fa25 and Fa27). These were all Mulga-dominated vegetation types that occurred mainly on restricted Land Systems (particularly Washplain and Jamindie). These vegetation types were also in very good condition, and considered likely to support restricted flora taxa.

- The survey also identified 20 vegetation types of Moderate to High conservation significance, 34 vegetation types of Moderate conservation significance, 18 vegetation types of Low to Moderate conservation significance and one vegetation type of Low conservation significance.

Given the very high conservation significance of one of the vegetation types identified, the high conservation significance of an additional seven vegetation types, and the apparently restricted or highly restricted geographic distribution of 44 of the remaining vegetation types, the study area is believed to have high to very high conservation value for vegetation and potentially for some fauna and faunal assemblages.

Vegetation types supporting Schedule fauna clearly have a degree of conservation significance imparted on them in terms of fauna habitats by the presence of these species. The following vegetation types supported fauna recorded by our survey that are either Schedule 1 or Schedule 4.

- Fp2 supported the Mulgara *Dasycercus cristicauda.*

- Fp4, Fx10 and Fx12 supported the Peregrine Falcon *Falco peregrinus*.

1.3 Fauna

The current study recorded 175 taxa of terrestrial vertebrate fauna belonging to 58 families from the combined survey area of the FMG Stage B rail corridor and the Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas mine areas. The tally comprised two frogs, 42 reptiles, 105 birds, three bats and 23 non-volant mammals. In addition we recorded over 100 invertebrate species including two potential Short Range taxa.

Two Schedule and four Priority fauna species were recorded from the project areas during the current surveys:

- Mulgara *Dasycercus cristicauda* Schedule 1
- Peregrine Falcon *Falco peregrinus* Schedule 4 -
- Australian Bustard *Ardeotis australis* Priority 4 -
- Long-tailed Dunnart *Sminthopsis longicaudata* Priority 4 -
- Short-tailed Mouse *Leggadina lakedownensis* Priority 4 -
- Western Pebble-mound Mouse *Pseudomys chapmani* Priority 4 -

Two potential Short Range mygalomorph taxa were recorded, however without further taxonomic work and collection it is not possible to make any conclusive statements about their status.

The study area has not been adequately sampled for herpetofauna to make a statement on its conservation significance for this group. The study area supports a divers array of both mammals and birds and therefore would appear to have a moderate to high conservation value for vertebrate fauna in general.

2.0 Introduction

2.1 Background to the Project and Location of the Study Area

Fortescue Metal Group (FMG) proposes to develop the Pilbara Iron Ore and Infrastructure Project, which includes development of iron ore mines as well as rail and port infrastructure.

Stage A of the project involves development of a port facility at Port Hedland, and construction of a 345 km railway between Port Hedland and Mindy Mindy. Stage B of the project involves development of four iron ore mines at Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas, and construction of a 160 km railway between the Stage A railway and Mt Nicholas (Figure 2.1).

The Environmental Protection Authority determined that both stages of the project would be assessed at the Public Environmental Review (PER) level. The PER for Stage A has been submitted and is currently undergoing assessment. The PER for Stage B is currently being assembled.

To provide input to the environmental assessment process, Biota Environmental Sciences was commissioned to conduct biological surveys of both the Stage A and Stage B areas in 2004.

2.1.1 Purpose of this Report

This document describes a survey of the fauna assemblage and fauna habitats of the FMG Stage B rail corridor and mine areas undertaken by Biota Environmental Sciences in 2004, and is intended as a supporting document to the Stage B PER. It contains baseline information regarding habitat types and fauna species occurring within the study area, and includes an assessment of the conservation significance of both. It does not describe potential impacts of the project or strategies to manage these. A description of generic impact and management strategies was provided by Biota to FMG in November 2004. This was intended as a framework for the PER's ultimate assessment of impact and management strategies, which would utilise the results of the various completed technical documents (including this report).

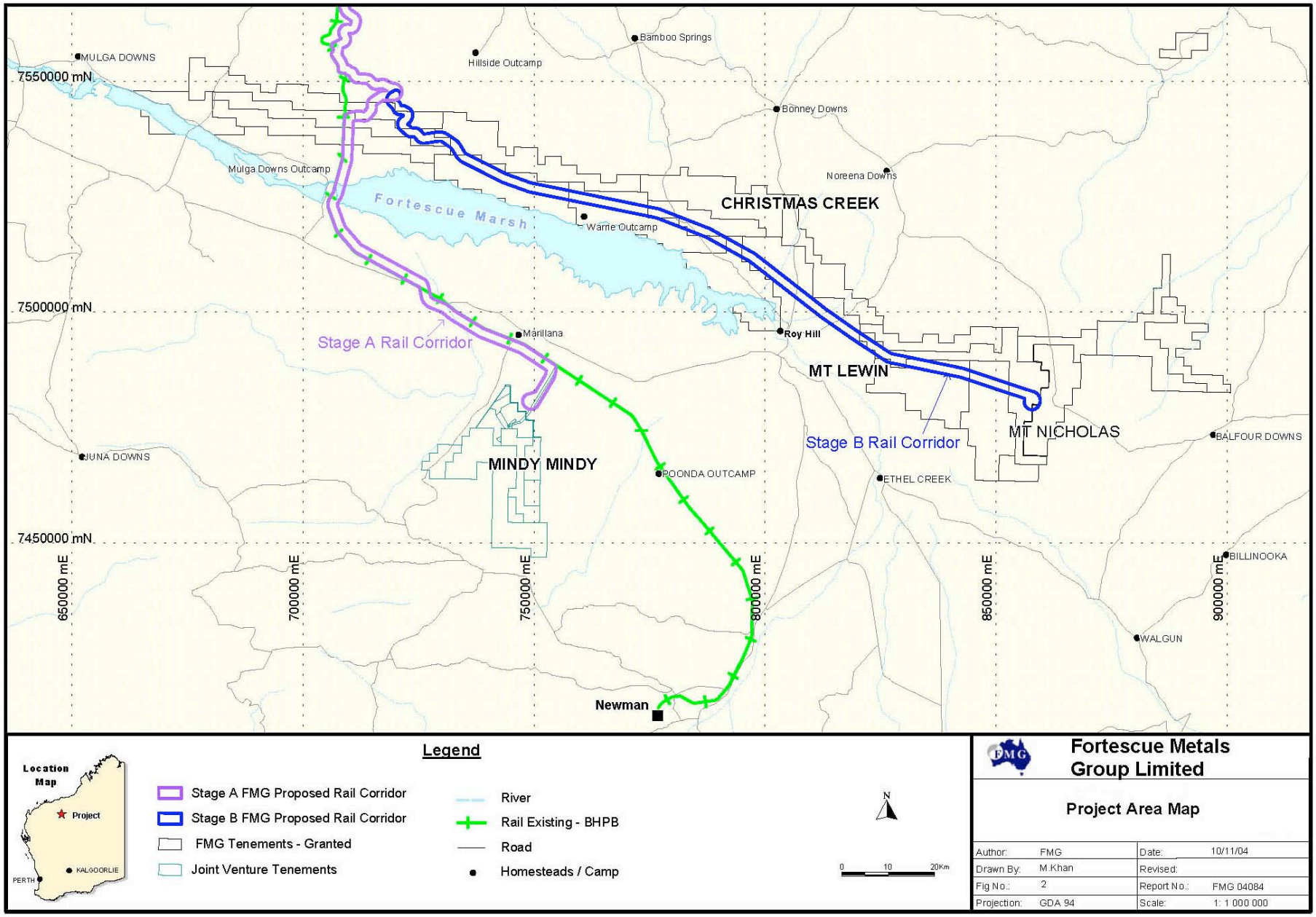


Figure 2.1: Location of the Stage B rail corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas mine areas.

2.2 Geological and Physiographic Context of the Study Area

2.2.1 Geology

The study area includes a large variety of geological types. On the Geological Survey of Western Australia 1:500,000 scale map sheets (Thorne and Trendall 2001), these are:

- AFm (Maddina Formation: massive to amygdaloidal basaltic flows and breccia, andesite, dacite and rhyolite; local thin beds of sandstone and dolomite: metamorphosed),

  AFj (Jeerinah Formation: Carbonaceous mudstone and siltstone, thin-bedded sandstone, chert, felsic volcaniclastic rock, basalt, and dolomite: metamorphosed),

  AFjo (Jeerinah Formation: Carbonaceous mudstone and siltstone, thin-bedded sandstone, chert, felsic volcaniclastic rock, basalt, and dolomite: metamorphosed; *Woodiana Member: quartzitic sandstone, chert (locally stromatolitic), chert breccia and argillite; metamorphosed),* and

  AHm (Marra Mamba Iron Formation: chert, banded iron-formation, mudstone, and siltstone; metamorphosed): occurring from north to south over the Chichester Range, and dominating the western end of the rail corridor and the low hills of the Christmas Creek, Mt Lewin and Mt Nicholas study areas (the latter is primarily AFj);
- Qx (Undivided Quaternary Deposits: includes colluvium, reworked alluvium, eolian sand, and clay), and

  Qa (Alluvium: unconsolidated silt, sand and gravel; in river channels): dominating the clayey plains of the remainder of the rail corridor, the southern portions of the Christmas Creek and Mt Lewin study areas, and the western side of the Mt Nicholas study area;
- Czx (Undivided Cainozoic Deposits: includes partly consolidated colluvium and alluvium, and silcrete and laterite): occurring in a band along the southern edge of the Mt Lewin study area and within the rail corridor in this area; and
- PHb (Brockman Iron Formation: banded iron-formation, chert, mudstone and siltstone; metamorphosed) in the northern part of the Mindy Mindy study area, and

  PHj (Weeli Wolli Formation: banded iron-formation (often jaspilitic), mudstone, siltstone and numerous dolerite sills; metamorphosed) dominating the remainder of the Mindy Mindy study area.

2.2.2 Major Physiographic Units

Beard (1975) identified three major physiographic units within the section of the Fortescue District encompassing the study area:

1. Chichester Plateau - a plateau of mainly basalts, with included siltstone, mudstone, shale, dolomite and jaspilite; forming a watershed between numerous rivers flowing north through the Abydos Plain to the coast, and the Fortescue drainage on the southern side of the range;
2. Fortescue Valley - occupying a trough between the Chichester and Hamersley Plateaus; the eastern portion drains into the Fortescue Marsh; and
3. Hamersley Plateau - rounded hills and ranges, mainly of jaspilite and dolomite with some shale, siltstone and volcanics.

2.2.3 Land Systems

Land System (Rangelands) mapping covering the project area has been prepared to a draft stage by Agriculture Western Australia (Department of Agriculture 2002) (see Figure 2.2). These are broad units that each consist of a series of "land units" that occur on characteristic physiographic types within the Land System.

The project area includes areas of the Land Systems listed in Table 2.1.

All of the Land Systems occurring within the study area (comprising the Stage B rail corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas mine areas combined) are relatively large units, with even the smallest (Turee) covering more than 58,000 ha (Table 2.2).

Most of the Land Systems occurring in the study area are widespread through the Pilbara, however the Divide, Elimunna, Turee and Washplain Land Systems are more restricted in distribution (see Table 2.2). In addition, the study area is located towards the extremes of distribution of a number of the Land Systems.

The area of each Land System unit within the study area is less than 3% of the total mapped for the Pilbara, with the exception of the Divide, Washplain, Jamindie and Turee Land Systems (~4%, 5%, 11% and 20% of the total areas respectively). In the case of the Turee Land System in particular, six of the eight polygons mapped in the vicinity of the Fortescue Marsh are intersected by the FMG Stage B study area.

Table 2.1: Land Systems in the FMG Stage B project area (data from Department of Agriculture 2002).

Land System	Description
Wona	Basalt upland gilgai plains supporting tussock grasslands and minor hard spinifex grasslands; occurred only at the westernmost end of the rail corridor where it joins the proposed FMG Stage A rail corridor.
Capricorn	Hills and ridges of sandstone and dolomite supporting shrubby hard and soft spinifex grasslands; occurred only at the westernmost end of the rail corridor where it joins the proposed FMG Stage A rail corridor.
McKay	Hills, ridges, plateaux remnants and breakaways of metasedimentary and sedimentary rocks supporting hard spinifex grasslands; within the rail corridor, occurred only at the westernmost end and near Mt Lewin; dominated the stony hills in the northern portion of the Mt Lewin study area and the range of hills running north-south through the Mt Nicholas study area.
Newman	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands; occurred within the rail corridor in the western third and near Mt Lewin, and dominated the Mindy Mindy area and the northern portion of the hills in the Christmas Creek study area.
Jamindie	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey; occurred throughout the rail corridor from near the western end to Mt Lewin, and through the Christmas Creek and Mt Lewin study areas.
Turee	Stony alluvial plains with gilgaied and non-gilgaied surfaces supporting tussock grasslands and grassy shrublands; dominated the central portion of the rail corridor and extended north into the Christmas Creek and Mt Lewin study areas.
Boolgeeda	Stony lower slopes and plains found below hill systems supporting hard and soft spinifex grasslands and mulga shrublands; large areas occurred within the Mt Lewin study area, and there were small occurrences within the rail corridor west of Mt Lewin, in the eastern portion of the Christmas Creek study area and the central portions of the Mt Nicholas and Mindy Mindy study areas.
River	Active flood plains and major rivers supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands; common throughout the Pilbara in major river systems such as the Yule, de Grey and Fortescue Rivers, and Weeli Wolli Creek; only one occurrence mapped, in the rail corridor west of Mt Lewin.
Brockman	Alluvial plains with cracking clay soils supporting tussock grasslands; occurred in the rail corridor south of the Mt Lewin study area.
Washplain	Hardpan plains supporting groved mulga shrublands; occurred within the rail corridor south of Mt Lewin; also in the eastern half of the Mt Lewin study area, the southern portion of the Mt Nicholas study area, and areas between.
Elimunna	Stony plains on basalt supporting sparse *Acacia* and *Cassia* shrublands and patchy tussock grasslands; a very small occurrence along the northern edge of the central Mt Lewin study area.
Divide	Sandplains and occasional dunes supporting shrubby hard spinifex grasslands; dominated the broad sandplain at the eastern section of the rail corridor, including the rail loop.
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands; small occurrences along the eastern edge of the Mt Nicholas study area.

Table 2.2: Distribution of Land Systems within the FMG Stage B rail corridor and mine areas and wider Pilbara region (data from Department of Agriculture 2002).

Land System	Total Area in the Pilbara (ha)	Number of Mapping Polygons in the Pilbara	General Distribution through the Pilbara Bioregion	Area within FMG Stage B Study Area	
				Hectares	% of total in Pilbara
Boolgeeda	826416	487	Widespread with a large number of occurrences, particularly through the Hamersley Range sub-region	4124.48	0.50%
Brockman	73529	33	Widespread through the Fortescue Plains sub-region, but a relatively small number of occurrences	318.23	0.43%
Capricorn	563279	175	Widespread with a large number of occurrences, mainly through the Chichester Range sub-region	138.98	0.02%
Divide	530170	82	Restricted to the south-eastern corner of the Fortescue Plains sub-region	21386.40	4.03%
Elimunna	61806	26	Relatively restricted; occurs in two distinct areas to the north and south of the Fortescue Marsh, with relatively few occurrences	19.59	0.03%
Jamindie	207601	52	Mainly occurs bordering the northern side of the Fortescue Marsh, with a small amount on the southern side; also areas of this land system near the southern edge of the Pilbara	22112.21	10.65%
McKay	420494	127	Widespread, mainly along the Chichester Range, with fewer occurrences in the Hamersley Range	9268.68	2.20%
Newman	1458028	267	Relatively widespread through the Hamersley Range, also occurring as a band along the Chichester Range to the north of the Fortescue Marsh; numerous occurrences	14891.87	1.02%
River	463956	98	Widespread in major river systems	0.61	<0.01%
Rocklea	2428594	321	Widespread through both the Hamersley and Chichester Ranges	47.53	<0.01%
Turee	58085	10	Largely restricted to the vicinity of the Fortescue Marsh (two small areas at the southern border of the Pilbara); few occurrences	11583.71	19.94%
Washplain	91809	46	Restricted to the south-eastern corner of the Pilbara, associated with the eastern end of the Fortescue Valley	5001.98	5.45%
Wona	181709	186	Widespread with numerous occurrences along the Chichester Range	17.67	0.01%

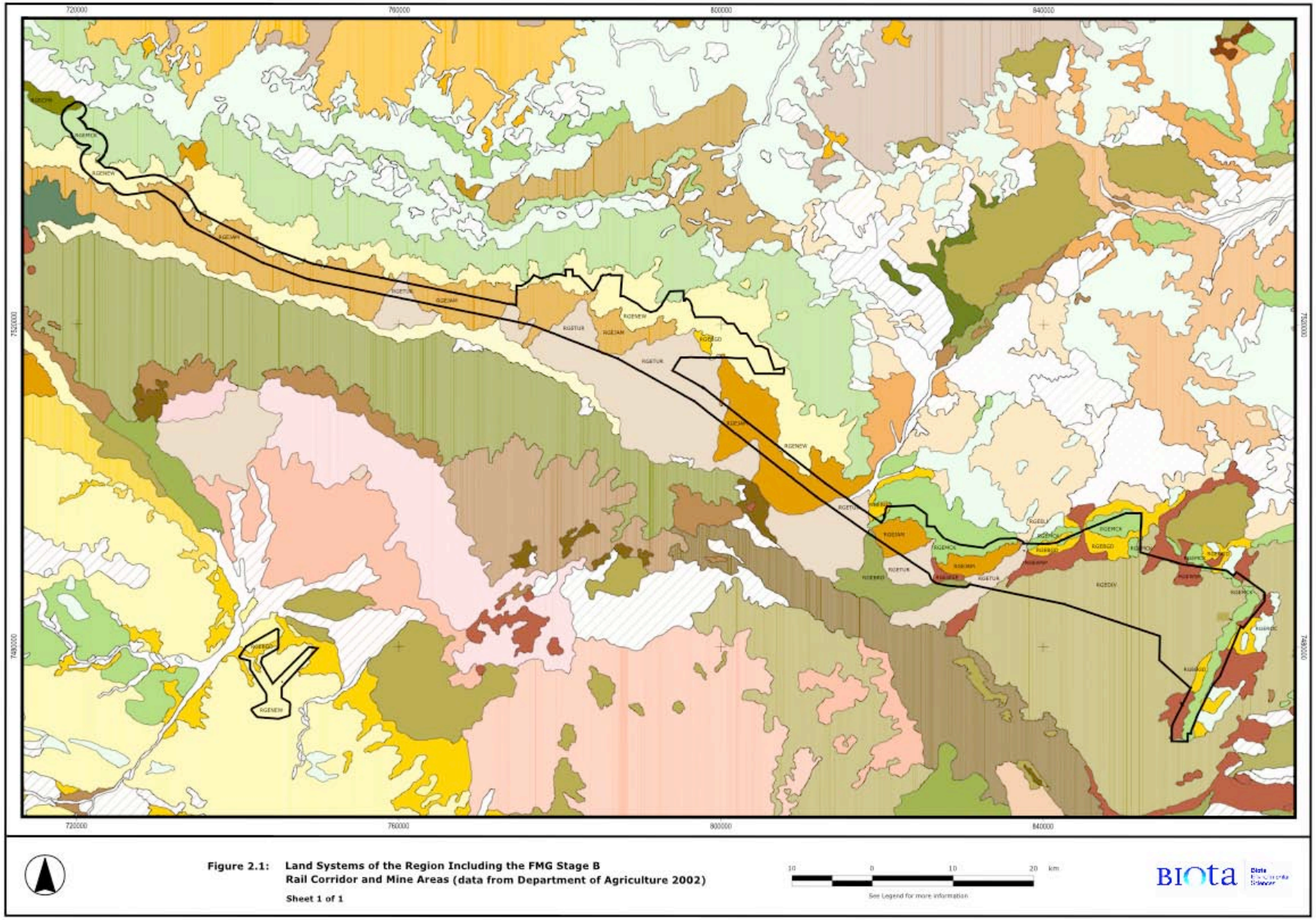


Figure 2.1: **Land Systems of the Region Including the FMG Stage B Rail Corridor and Mine Areas (data from Department of Agriculture 2002)**

Sheet 1 of 1


Legend
FMG rail and mine areas
RGEBGD
Boolgeeda Land System
RGEBRO
Brockman Land System
RGECPN
Capricorn Land System
RGEDIV
Divide Land System
RGEELI
Elimunna Land System
RGEJAM
Jamindie Land System
RGENEW
Newman Land System
RGETUR
Turee Land System
RGEWSP
Washplain Land System
Adrian Land System
Balfour Land System
Billygoat Land System
Black Land System
Bonney Land System
Boolaloo Land System
Calcrete Land System
Coongimah Land System
Charley Land System
Christmas Land System
Coolibah Land System
Cowra Land System
Egerton Land System
Fan Land System
Fortescue Land System
Granitic Land System
Jigalong Land System
Jurrawarrina Land System
Kumina Land System
RGELAB
Laterite Land System
Macroy Land System
McKay Land System
Mosquito Land System
Marillana Land System
Marsh Land System
Narbung Land System
Nooingnin Land System
Oakover Land System
Pindering Land System
Platform Land System
Robertson Land System
River Land System
Robe Land System
Rocklea Land System
Spearhole Land System
Talga Land System
Urandy Land System
Warri Land System
White Springs Land System
Wannamunna Land System
Wona Land System
RGEX_MINE
Zebra Land System
Landsystems mapping in the FMG rail and mine areas
Legend Sheet 1 of 1
BIOta
Biota Environmental Sciences

2.3 Biological Context of the Study Area

2.3.1 Pilbara IBRA Bioregion

The study area occurs in the Pilbara bioregion, one of the 85 bioregions recognised under the Interim Biogeographic Regionalisation for Australia (IBRA). The Pilbara bioregion has four main components, based on the physiographic work of Beard (see Section 2.2.2): the Hamersley Ranges, Chichester Ranges, Fortescue Plains and Roebourne Plains sub-regions (Environment Australia 2000). The proposed FMG Stage B rail corridor lies at the junction of the Fortescue Plains and Chichester Ranges sub-regions. The proposed Mindy Mindy mining area is at the eastern edge of the Hamersley Range, while the Christmas Creek, Mt Lewin and Mt Nicholas mining areas lie along the southern edge of the Chichester Range.

With increasing survey work in the Pilbara, it is becoming apparent that this region is one of the centers of biodiversity in the State. This appears to be related to the diversity of geological, altitudinal and climatic elements in the region, as well as a function of its location. The eastern portion of the Pilbara in particular is located in a transitional zone between the fauna assemblages of the Eyrean (central desert) and southern Torresian (tropical) bioclimatic regions, and contains elements of both. A similar situation exists for the flora. In recognition of this high species diversity and the high levels of endemism in the region, the Pilbara has been nominated as one of 15 national biodiversity "hotspots" by the Minister for the Environment and Heritage (go to www.deh.gov.au/minister/env/2003/ mr03oct03.html).

The Pilbara Bioregion is listed as a medium priority for funding for land purchase 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 Conservation and Land Management, with the intention of adding these areas to the existing conservation estate in order to provide a comprehensive, adequate and representative reserve system. Of relevance to the proposed FMG Stage B rail and mine developments is the proposed exclusion of some 135,537 ha from Marillana Station, mainly north of the Munjina – Roy Hill Road.

2.3.2 Fortescue Marsh

The clear intent of the proposed exclusion of areas of pastoral leases in the Fortescue Valley is to protect the highly significant Fortescue Marsh, which is listed as a nationally important wetland (Environment Australia 2001), and its surrounds. A wetland may be considered nationally important if it meets at least one of the following criteria:

1. It is a good example of a wetland type occurring within a biogeographic region in Australia;
2. It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex;
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail;
4. The wetland supports 1% or more of the national populations of any native plant or animal taxa;
5. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level; or
6. The wetland is of outstanding historical or cultural significance (Environment Australia 2001).

Under this classification, the Fortescue Marshes is listed as meeting criteria 1, 2, 3 and 6, the same criteria by which the more widely known Millstream wetland is listed.

2.3.3 Beard's Vegetation Mapping

Beard (1975) mapped the vegetation of the Pilbara at a scale of 1:1,000,000. The study area lies entirely within the Fortescue Botanical District of the Eremaean Botanical Province as defined by Beard. The vegetation of this province is typically open, and frequently dominated by spinifex, wattles and occasional Eucalypts.

The FMG Stage B rail corridor traverses three of Beard's mapping units. From west to east, these are:

- Snappy Gum *Eucalyptus leucophloia* scattered trees over *Triodia wiseana* hummock grassland, with Mulga *Acacia aneura* low woodland in valleys, on the southern side of the Chichester Range;
- Extensive Mulga groving on the broad plain north of the Fortescue Marsh; and
- Twin-leaf Mallee *Eucalyptus gamophylla* over *Triodia basedowii* hummock grassland on sandplain at the easternmost end of the rail corridor.

The prevalence of Mulga vegetation within the study area, as demonstrated even at the scale of Beard's mapping, was identified during initial investigations as likely to be one of the major conservation features of the area.

The proposed Mindy Mindy mine area is mapped by Beard as Snappy Gum *Eucalyptus leucophloia* scattered trees over *Triodia wiseana* hummock grassland, as is the Christmas Creek mine area, which also has Mulga low woodland in valleys. The Mt Lewin and Mt Nicholas mine areas are both mapped predominantly as Kanji *Acacia pyrifolia* shrubland over *Triodia pungens, T. wiseana* hummock grassland, with areas of Mulga low woodland.

3.0 Survey Methodology

3.1 Survey Area

The study area comprised five discrete entities: the proposed Stage B rail corridor, and the Mindy Mindy, Mount Nicholas, Mount Lewin and Christmas Creek mine areas (Figure 2.1).

3.2 Survey Team and Licences

The fauna survey team comprised Mr Roy Teale, Dr Michael Craig, Mr Phil Runham and Ms Zoë Hamilton (all of Biota Environmental Sciences), and Mr Greg Harold (consultant). Mr Dan Kamien, Mr Phil Runham and Mr Mike Greenham also assisted with set-up. Ms Michi Maier, Ms Kelli McCreery and Mr Raimond Orifici (Biota Environmental Sciences) kindly provided descriptions and mapping of vegetation types and description of soils at each of the fauna trapping sites. Analysis of bat recordings was completed by Mr Lee Mould.

Invertebrate identification was undertaken by Mr Dan Kamien (Biota) using the resources of the WA Museum: Dr Volker Fromenau, Dr Mark Harvey, Ms Julianne Waldock, Dr Barbara York Main and Ms Shirley Slack-Smith provided assistance with invertebrate identification and information.

Also acknowledged are Dr Ric How, Mr Brad Maryan and Dr Paul Doughty of the WA Museum, who assisted with confirmation of mammal and herpetofauna identifications.

The vertebrate fauna sampling for this survey was conducted under the Licence To Take Fauna For Scientific Purposes No. SF004491, which was issued to RJ Teale and also covered Mr Greg Harold, Dr Michael Craig, Mr Phil Runham and Ms Zoë Hamilton. Ethics approval was granted under the WA Museum application to the Department of Conservation and Land Management (CALM) Animal Ethics Committee, which covers Mr Roy Teale as a Research Associate with the WA Museum.

3.3 Survey Timing and Weather

The fauna survey of the Mindy Mindy mine area was carried out between 20th March and 7th April 2004, during the survey of the proposed FMG Stage A rail corridor and port facility (Biota 2004c). This was approximately six weeks after sustained and heavy rainfall in the area in February (see Figure 3.1). Additional rain fell in this study area during the latter part of the trip, arising out of Tropical Cyclone Fay.

The fauna survey of the Stage B rail corridor and Christmas Creek, Mount Lewin and Mount Nicholas mine areas was carried out between 21st June and 16th July 2004. Little rain had fallen since the survey of the Mindy Mindy study area, although some light falls were experienced during the survey.

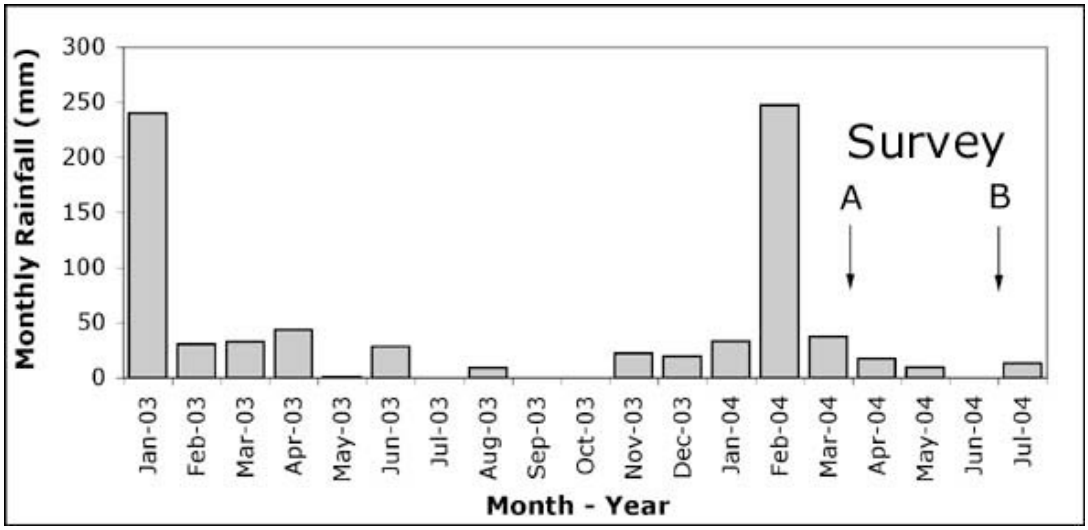


Figure 3.1: Monthly rainfall for Newman from January 2003 to July 2004, with timing of the surveys for Mindy Mindy (A) and the Stage B rail corridor and other mine areas (B) (data supplied by Bureau of Meteorology).

3.4 Systematic Censusing

3.4.1 Site Selection

Systematic sampling was undertaken in areas of potentially high biodiversity (as indicated by topographical, substrate and vegetative complexity), and in restricted habitats or habitats thought likely to support rare species.

The FMG Stage B rail corridor and mine areas were reviewed prior to installation of the trapping sites to confirm broad habitat types and evaluate the accessibility of proposed trapping grids. Fauna survey sites were selected so that they sampled:

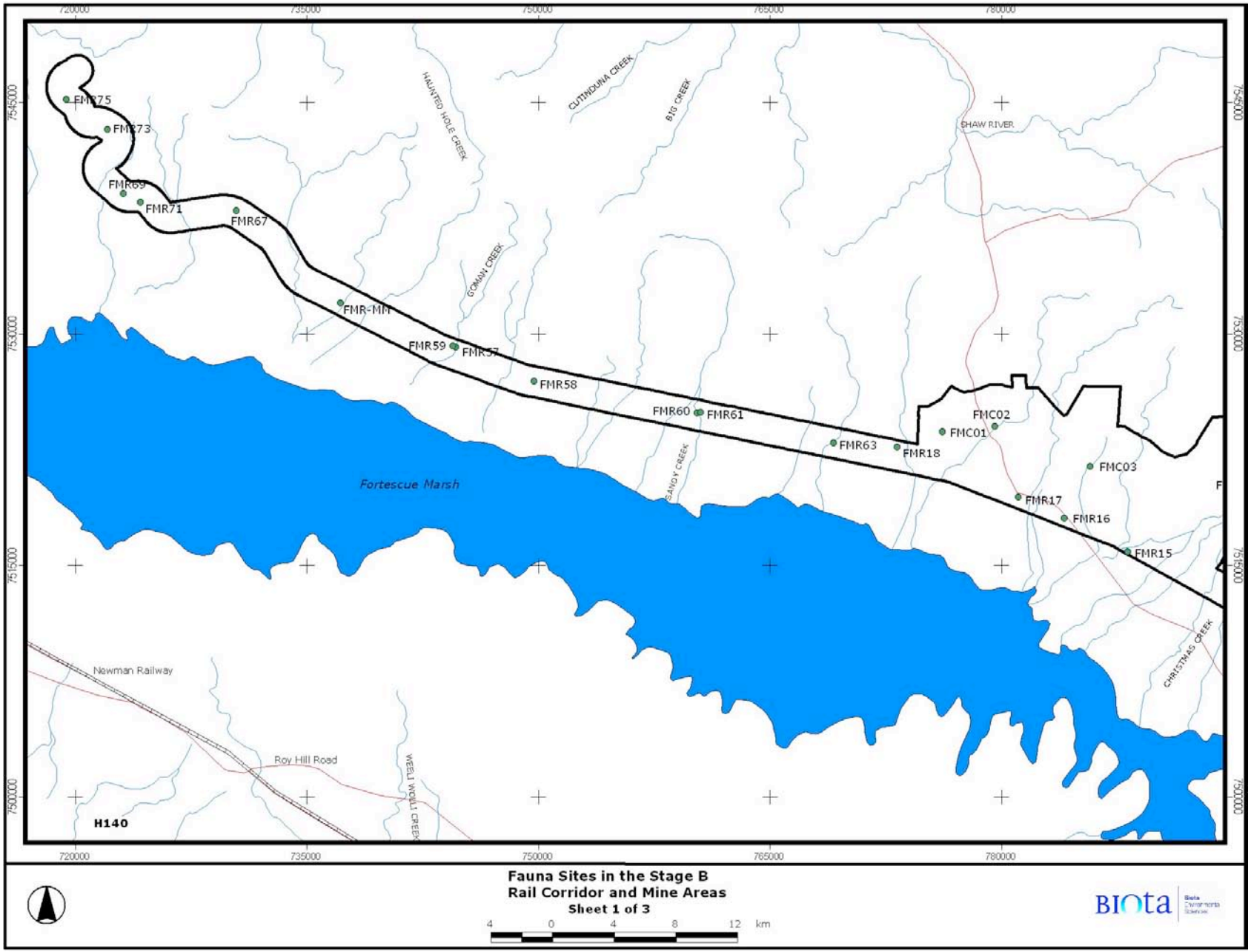
- a representative set of the fauna habitats/community types within the project area;
- areas of perceived conservation significance; and
- across the geographic extent of the project area, with emphasis on proposed impact areas.

Sampling was undertaken within the corridor and tenement boundaries proposed by FMG at the time of survey.

3.4.2 Trap Effort

The central component of the systematic censusing consisted of 36 trapping grids, with a total of 1,960 pit trap nights, 400 Elliott trap nights and 70 funnel trap nights (Table 3.1; Figures 3.2 and 3.3). Each site was located within a defined habitat. In selecting survey sites, consideration was also given to accessibility such that pitfall traps could be regularly checked.

The trapping design replicates that used by the authors along the proposed FMG Stage A rail corridor (Biota 2004c) and within the Hope Downs rail corridor (Biota 2002, 2004a and 2004b). This was done with the intention of using the two datasets to provide some regional context. The trapping design has also been used at a number of other sites in the Pilbara bioregion (Straits Solar Salt Field, Onslow Salt Field, Southern Plains, Nammuldi / Silvergrass; Biota Environmental Sciences unpublished data).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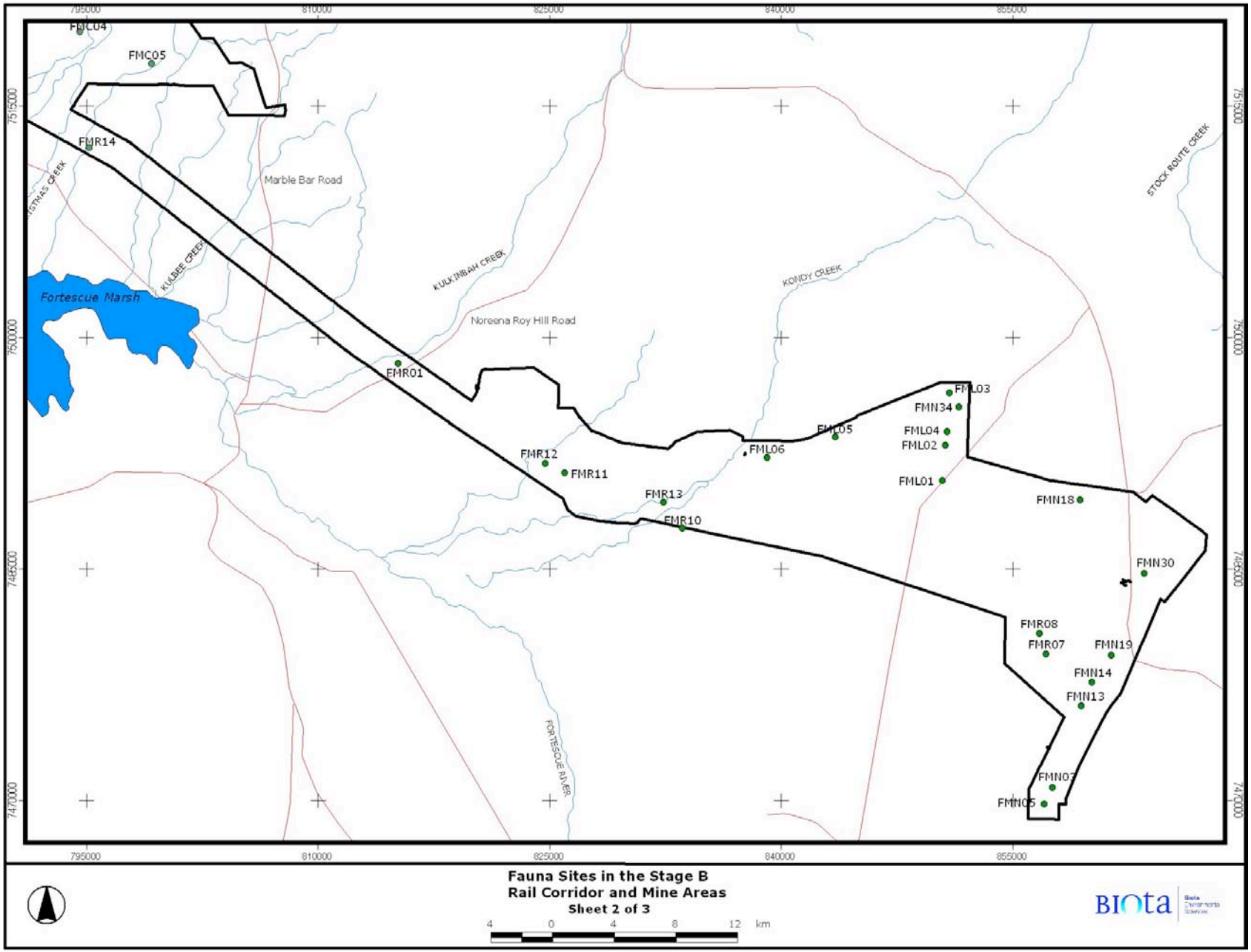
FMR-MM
FMR59
FMR57
FMR58
FMR60
FMR61
FMR63
FMR18
FMC02
FMC01
FMC03
FMR17
FMR16
FMR15
HAUNTED HOLE CREEK
CUTINDUNA CREEK
BIG CREEK
SHAW RIVER
GOMAN CREEK
SAVOY CREEK
CHRISTMAS CREEK
Fortescue Marsh
Newman Railway
Roy Hill Road
WEELI WOLLI CREEK
H140
Fauna Sites in the Stage B
Rail Corridor and Mine Areas
Sheet 1 of 3
4 0 4 8 12 km
BIOta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FMC04
FMC05
FMR14
Marble Bar Road
KULKINBAH CREEK
KULBEE CREEK
KONDY CREEK
STOCK ROUTE CREEK
Fortescue Marsh
Noreena Roy Hill Road
FMR01
FMR12
FMR11
FMR13
FMR10
FML06
FML05
FML03
FMN34
FML04
FML02
FML01
FMN18
FMN30
FMR08
FMR07
FMN19
FMN14
FMN13
FMN07
FMN05
FORTESCUE RIVER
Fauna Sites in the Stage B
Rail Corridor and Mine Areas
Sheet 2 of 3
4 0 4 8 12 km
BIOta

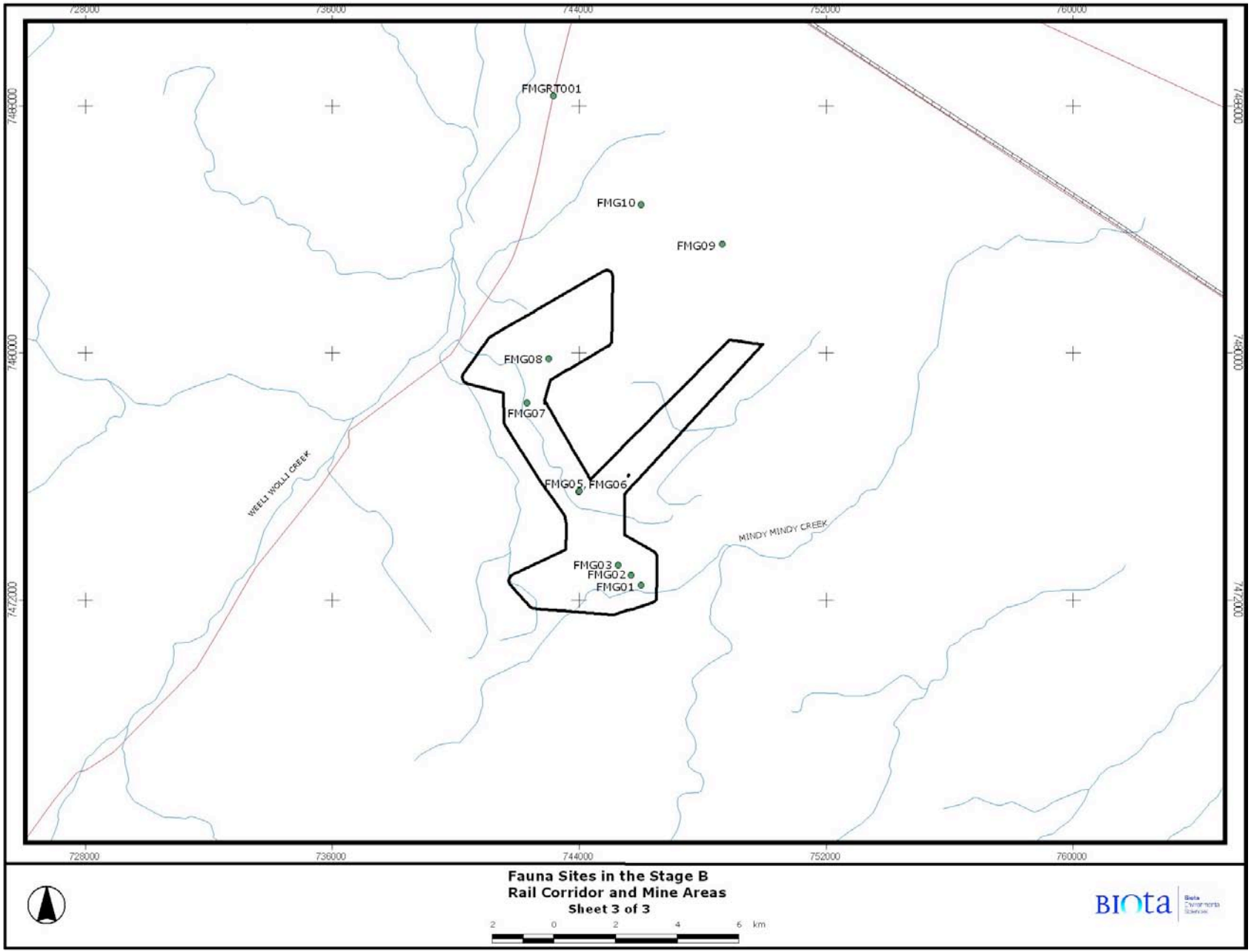
728000
736000
744000
752000
760000
7488000
7480000
7472000
FMGRT001
FMG10
FMG09
FMG08
FMG07
FMG05, FMG06
FMG03
FMG02
FMG01
WEELI WOLLI CREEK
MINDY MINDY CREEK
Fauna Sites in the Stage B
Rail Corridor and Mine Areas
Sheet 3 of 3
2 0 2 4 6 km
BIOta

Table 3.1: Site codes, location and trap effort for the FMG Stage B fauna survey (FMG = Mindy Mindy; FMC = Christmas Creek; FML = Mt Lewin; FMN = Mt Nicholas; FMR = Stage B rail corridor).

Site	Datum	Easting	Northing	Date Opened	Date Closed	Nights Open	Pitfalls	Pit Trap Effort	Elliotts	Elliott Trap Effort	Funnels	Funnel Trap Effort
FMG01	WGS84	746018	7472474	30/3/04	2/4/04	3	10	30				
FMG02	WGS84	745703	7472796	1/4/04	2/4/04	1	10	10				
FMG03	WGS84	745271	7473127	31/3/04	2/4/04	2	10	20				
FMG05	WGS84	744000	7475497	30/3/04	2/4/04	3	10	30				
FMG07	WGS84	742315	7478385	28/3/04	2/4/04	5	10	50				
FMG08	WGS84	743032	7479809	28/3/04	2/4/04	5	10	50				
FMC01	WGS84	776187	7523676	3/7/04	9/7/04	6	10	60				
FMC02	WGS84	779569	7524001	4/7/04	9/7/04	5	10	50				
FMC03	WGS84	785773	7521416	4/7/04	9/7/04	5	10	50				
FMC04	WGS84	794596	7519804	4/7/04	9/7/04	5	10	50				
FMC05	WGS84	799221	7517754	5/7/04	9/7/04	4	10	40	25	100		
FML01	WGS84	233827	7492435	9/7/04	15/7/04	6	10	60				
FML02	WGS84	233920	7494743	9/7/04	15/7/04	6	10	60				
FML03	WGS84	234044	7498119	9/7/04	15/7/04	6	10	60				
FML04	WGS84	233985	7495615	9/7/04	15/7/04	6	10	60				
FML05	WGS84	226758	7494955	9/7/04	15/7/04	6	10	60				
FML06	WGS84	222419	7493465	9/7/04	15/7/04	6	10	60				
FMN03	WGS84	241726	7472837	9/7/04	16/7/04	7	10	70				
FMN05	WGS84	241235	7471778	9/7/04	16/7/04	7	10	70				
FMN13	WGS84	243403	7478208	9/7/04	16/7/04	7	10	70				
FMN14	WGS84	244011	7479778	9/7/04	16/7/04	7	10	70				
FMN18	WGS84	242774	7491558	9/7/04	16/7/04	7	10	70				
FMN19	WGS84	245178	7481577	9/7/04	16/7/04	7					10	70
FMN30	WGS84	247110	7486932	9/7/04	16/7/04	7	10	70				
FMR01	WGS84	198275	7498585	3/7/04	9/7/04	6	10	60				
FMR07	WGS84	240987	7481466	11/7/04	16/7/04	5	10	50				
FMR08	WGS84	240488	7482800	11/7/04	16/7/04	5	10	50				
FMR10	WGS84	217119	7488654	5/7/04	11/7/04	6	10	60				
FMR11	WGS84	209369	7491954	4/7/04	10/7/04	6	10	60	25	150		
FMR12	WGS84	208085	7492489	4/7/04	10/7/04	6	10	60	25	150		
FMR13	WGS84	215834	7490308	5/7/04	11/7/04	6	10	60				
FMR14	WGS84	795176	7512309	2/7/04	9/7/04	7	10	70				
FMR15	WGS84	788219	7515876	2/7/04	9/7/04	7	10	70				
FMR16	WGS84	784075	7518055	2/7/04	9/7/04	7	10	70				
FMR17	WGS84	781126	7519418	2/7/04	9/7/04	7	10	70				
FMR18	WGS84	773246	7522657	3/7/04	9/7/04	6	10	60				
								1960		400		70

3.4.3 Avifauna Sampling

The avifauna of the FMG Stage B rail corridor and mine areas was sampled using a combination of techniques, which included:

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

All but two of the systematic trapping sites were sampled for birds. The two sites not sampled were:

- FMG02, a Triodia hillslope, which was considered likely to be very similar to FMG01 in terms of its avifauna; and
- FMG03, a colluvial site, which was considered similar to FMG05.

All unbounded area searches at systematic trapping sites were of 40 min duration and the number of surveys conducted at each systematic sampling site varied between one and five (Table 3.3). The number varied due both to logistical constraints brought about by rainfall and poor road access, and the degree to which new habitats were likely to yield previously unrecorded species.

Fourteen additional sites were sampled for avifauna during the survey.

In total, six sites were surveyed in the proposed Mindy Mindy study area between 31st March and 3rd April 2004, and 44 sites were surveyed in the Stage B rail corridor and associated tenements between the 6th July and 15th July 2004 (five sites at Christmas Creek, six at Mount Lewin, eight at Mount Nicholas and 25 in the rail corridor). A combined total of 103 censuses and 58.5 hours were conducted at these sites (Table 3.2).

Table 3.2: Details of systematic avifauna survey effort for the FMG Stage B rail corridor and mine area surveys, showing the dates and times of all unbounded area searches conducted.

Site	Date	Start time	Finish time	Length of survey (mins)
Censuses at systematic trapping grids				
FMG01	2/4/04	12:08	12:48	0:40
	3/4/04	7:13	7:53	0:40
	31/3/04	6:25	7:05	0:40
	1/4/04	10:10	10:50	0:40
FMG04	31/3/04	6:27	7:07	0:40
	1/4/04	9:30	10:10	0:40
	3/4/04	6:30	7:10	0:40
FMG05	31/3/04	7:15	7:55	0:40
	1/4/04	7:55	8:35	0:40
	2/4/04	11:06	11:46	0:40
	3/4/04	9:20	10:00	0:40
FMG06	31/3/04	7:17	7:57	0:40
	1/4/04	8:35	9:15	0:40
	3/4/04	8:32	9:12	0:40
FMG07	31/3/04	8:10	8:50	0:40
	1/4/04	6:10	6:50	0:40
	2/4/04	10:10	10:50	0:40
FMG08	31/3/04	8:20	9:00	0:40
	1/4/04	7:00	7:40	0:40
FMC01	6/7/04	12:37	13:17	0:40
	7/7/04	11:21	12:01	0:40
	7/7/04	12:50	13:30	0:40
	8/7/04	14:05	14:45	0:40

Table 3.2: continued.

Site	Date	Start time	Finish time	Length of survey (mins)
FMC02	6/7/04	15:22	16:02	0:40
	8/7/04	11:50	12:30	0:40
	9/7/04	12:50	13:30	0:40
FMC03	7/7/04	13:55	14:35	0:40
	8/7/04	10:36	11:16	0:40
	10/7/04	13:00	13:40	0:40
FMC04	7/7/04	13:00	13:40	0:40
	8/7/04	7:55	8:35	0:40
FMC05	7/7/04	14:16	14:56	0:40
	8/7/04	9:13	9:53	0:40
	9/7/04	11:27	12:07	0:40
FML01	10/7/04	10:05	10:45	0:40
	13/7/04	11:20	12:00	0:40
FML02	13/7/04	12:15	12:55	0:40
FML03	13/7/04	9:50	10:30	0:40
FML04	13/7/04	14:00	14:40	0:40
FML05	10/7/04	8:10	8:50	0:40
	11/7/04	9:06	9:46	0:40
	13/7/04	8:00	8:40	0:40
FML06	10/7/04	7:20	8:00	0:40
	11/7/04	8:09	8:49	0:40
	13/7/04	7:10	7:50	0:40
FMN03	11/7/04	8:55	9:35	0:40
	12/7/04	11:10	11:50	0:40
	15/7/04	11:10	11:50	0:40
FMN05	12/7/04	10:15	10:55	0:40
FMN13	13/7/04	11:40	12:20	0:40
FMN14	13/7/04	10:44	11:24	0:40
	15/7/04	9:55	10:35	0:40
FMN18	13/7/04	8:16	8:56	0:40
	14/7/04	8:30	9:10	0:40
FMN19	12/7/04	12:45	13:25	0:40
FMN30	12/7/04	15:19	15:59	0:40
	15/7/04	8:40	9:20	0:40
FMR01	6/7/04	11:25	12:05	0:40
	8/7/04	13:50	14:30	0:40
FMR07	6/7/04	7:22	8:02	0:40
	13/7/04	9:34	10:14	0:40
FMR08	14/7/04	10:00	10:40	0:40
FMR10	8/7/04	10:30	11:10	0:40
	9/7/04	7:16	7:56	0:40
	10/7/04	7:42	8:22	0:40
FMR11	7/7/04	6:40	7:20	0:40
	8/7/04	8:40	9:20	0:40
FMR12	6/7/04	9:40	10:20	0:40
	7/7/04	7:32	8:12	0:40
	8/7/04	7:45	8:25	0:40
FMR13	6/7/04	8:34	9:14	0:40
	7/7/04	9:45	10:25	0:40
	8/7/04	11:30	12:10	0:40
	9/7/04	8:19	8:59	0:40
	14/7/04	11:53	12:33	0:40
FMR14	6/7/04	8:18	8:58	0:40
	7/7/04	7:35	8:15	0:40
	8/7/04	15:35	16:15	0:40
FMR15	6/7/04	9:35	10:15	0:40
	7/7/04	8:55	9:35	0:40
FMR16	6/7/04	10:33	11:13	0:40
	7/7/04	9:41	10:21	0:40
FMR17	6/7/04	11:33	12:13	0:40
	7/7/04	11:00	11:40	0:40
	6/7/04	14:06	14:46	0:40
	8/7/04	15:17	15:57	0:40

Table 3.2: continued.

Site	Date	Start time	Finish time	Length of survey (mins)
FMR18	7/7/04	12:05	12:45	0:40
	8/7/04	12:54	13:34	0:40
	9/7/04	14:35	15:15	0:40
Censuses at other locations				
FMRMM	21/7/04	11:30	12:30	1:00
FMR57	21/7/04	13:15	14:15	1:00
FMR59	21/7/04	14:15	14:55	0:40
FMR58	21/7/04	15:20	16:20	1:00
FMR61	22/7/04	8:10	9:10	1:00
FMR60	22/7/04	9:11	9:31	0:20
FMR63	22/7/04	10:04	11:04	1:00
FMR65	22/7/04	15:05	16:05	1:00
FMR67	23/7/04	7:40	8:20	0:40
FMR69	23/7/04	8:40	9:40	1:00
FMR71	23/7/04	9:50	10:50	1:00
FMR73	23/7/04	11:30	12:10	0:40
FMR75	23/7/04	12:22	13:22	1:00
FMNMC001	13/7/04	14:16	15:06	0:50
No. of sites	**50**			
No. of surveys	**103**			
No. of hours	**71.50**			

3.4.4 Bat Survey Methodology

Bat fauna were surveyed between the 5/7/04 and 6/7/04 using an Anabat II ultrasonic detector connected to a CF ZCAIM unit (Titley Electronics, Ballina, NSW). Bat species can be distinguished from each other using the characteristics of their echolocation calls, which are recorded and transformed by the Anabat equipment.

Two detector units were available for the survey, and each was placed in a different site for one night, giving a total of four sites surveyed. Significant logistical constraints prevented a more comprehensive survey, which requires trapping and replication. Two trapping grids were surveyed: FMR18 and FMC02. Kulkinbah Creek (near FMR01) and the camp at Edenholme Bore were also surveyed. In addition, four sites were surveyed for bats during the FMG Stage A survey (Biota 2004c) and 31 sites were surveyed for bats during the Hope Downs surveys (Biota 2002, 2004a and 2004b).

Flash cards from the CF ZCAIM were downloaded daily and the sequences were interpreted using a value of five seconds maximum time between calls and a minimum line length of five. Calls were identified by comparing the values of three variables measured from pulses using Analyze software (Jolly 1996a, 1996b, 1997) with those reference calls published by McKenzie and Muir (2000) from the Carnarvon Basin. Only sequences consisting of regularly spaced pulses, each with a clean, well-defined low frequency component, were included in the analysis. Furthermore, only search mode calls were considered for analysis. All calls were calibrated with a tone of 40 kHz and divided down by a factor of 8.

The three variables analysed were:

- **Dur**: the duration of the pulse; the time from the first to the last data point of each pulse.
- **Fmax**: the highest detected frequency. This can be variable depending on the type of call produced and whether the bat detector is able to detect and transform the higher frequency components of a pulse (affected by several factors).
- **Fend**: the minimum frequency calculated from the model. This parameter is superior to minimum pulse frequency since it is calculated from the model that uses all data points. Fend is usually highly correlated with the minimum pulse frequency and can therefore be used in comparison with the reference calls of McKenzie and Muir (2000).

To determine species identification, the three variables Dur, Fend, and Fmax were entered into the discriminant function from McKenzie and Muir (2000; Figure 3.4). Species polygons were calculated from the extremes of the intraspecific variation given in that study as conservative estimates of each species' range. A subjective interpretation of the association of the new test cases with the species polygons was undertaken to allocate the identifications.

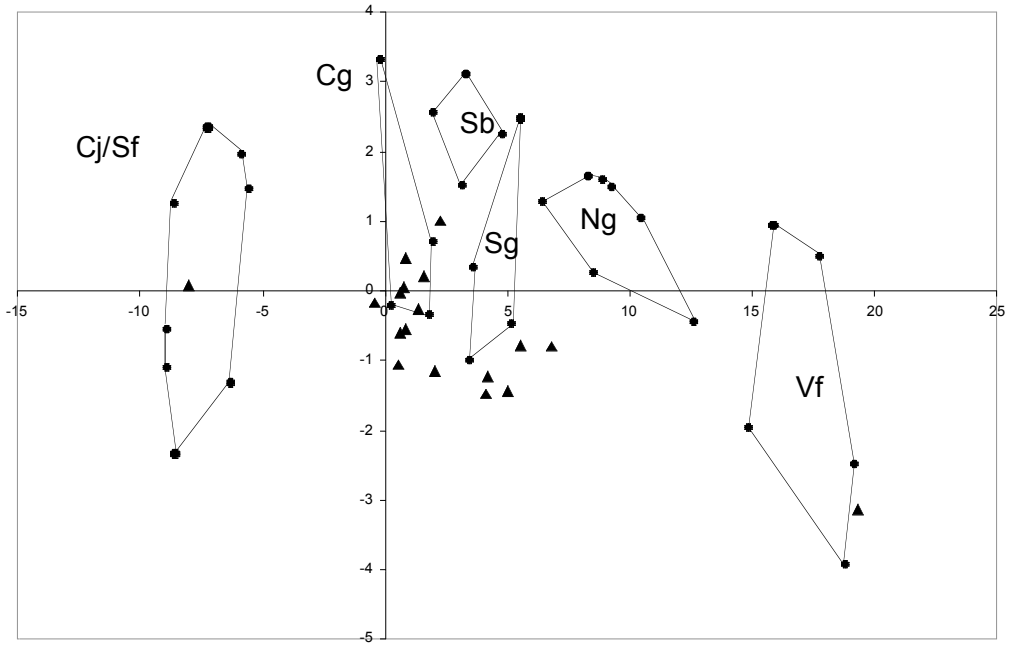

Figure 3.4: Scatterplot of points calculated by entering in values of three variables from the recorded sequences into the discriminant functions of McKenzie and Muir (2000) (closed triangles), and compared with their species variation (closed circles). Species codes are: Cj/Sf: *Chaerephon jobensis*/*Saccolaimus flaviventris*; Cg: *Chalinolobus gouldii*; Sb: *Scotorepens balstoni*; Sg: *S. greyii*; Ng: *Nyctophilus gouldii*; Vf: *Vespadelus finlaysoni*.

3.4.5 Invertebrate Sampling

Targeted invertebrate groups were sampled through opportunistic and systematic collections during the survey. Prior to field work, WA Museum staff were consulted to confirm invertebrate groups of interest and to identify any specific curation methods (eg. the preservation of Wolf Spiders for DNA analyses).

Invertebrate groups targeted during the survey included:

- Araneae (Spiders, in particular Trapdoor and Wolf Spiders);
- Pseudoscorpionida (Pseudoscorpions);
- Scorpionida (Scorpions);
- Diplopoda (Millipedes); and
- Pulmonata (Land snails).

Specimens from these groups were collected from pit-traps and curated in 70% ethanol at each of the systematic fauna sites. 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. The remaining two groups (millipedes and land snails) were searched for whilst raking and sieving leaf litter and other debris. All specimens from the above groups will be resolved taxonomically as far as possible using the resources of the WA Museum, with the work primarily undertaken by Ms Karen Edward.

3.4.6 Non-systematic Sampling

A range of non-systematic activities was completed as part of the fauna survey to ground-truth the remainder of the study area and provide a general coverage of the survey area. These included:

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

3.4.7 Taxonomy

The taxonomy and nomenclature used in this document are based on Aplin and Smith (2001) for reptiles and frogs, Johnstone (2001) for birds and How et al. (2001) for mammals. Invertebrate taxonomy is based on nomenclature provided by the WA Museum.

3.5 Habitats of the Study Area

Fauna habitat classification was developed on the basis of the dominant landform and vegetation type (Table 3.3). They do not cover all habitats available to the entire assemblage of invertebrate and vertebrate fauna, as this would be difficult to resolve and logistically impracticable to sample. Rather, the classifications provide a convenient framework within which to summarise species occurrence in the annotated lists and associated tables. Photographs of representative trapping grids are provided below.

Habitat classification is linked with vegetation descriptions (as provided in Biota 2004d) to provide context within the study area (Table 3.3). This is in turn linked with Land System mapping to provide a broad regional context (Table 3.4). A summary of each of the Land Systems is given in Section 2.2.3.

Plate 3.1: Site FMC01

Plate 3.2: Site FMC02

Plate 3.3: Site FMC03

Plate 3.4: Site FMC04

Plate 3.5: Site FMC05

Plate 3.6: Site FML01

Plate 3.7: Site FMLO2

Plate 3.8: Site FML03

Plate 3.9: Site FML04

Plate 3.10: Site FML05

Plate 3.11: Site FML06

Plate 3.12: Site FMN03

Plate 3.13: Site FMN05

Plate 3.14: Site FMN14

Plate 3.15: Site FMN18

Plate 3.16: Site FMN19

Plate 3.17: Site FMN30

Plate 3.18: Site FMR01

Plate 3.19: Site FMR07

Plate 3.20: Site FMR08

Plate 3.21: Site FMR10

Plate 3.22: Site FMR11

Plate 3.23: Site FMR12

Plate 3.24: Site FMR13

Plate 3.25: Site FMR14

Plate 3.26: Site FMR15

Plate 3.27: Site FMR16

Plate 3.28: Site FMR18

Table 3.3: Habitat types and corresponding vegetation descriptions for each of the FMG Stage B fauna trapping grids. Sites are grouped according to whether they are associated with the Chichester Range, Fortescue Valley or Hamersley Range.

Site Code	Habitat Descriptor	Vegetation Code	Vegetation Description
Chichester Range			
Vegetation of Stony Plains and Hills			
FML03	*Triodia* stony plain (sluggish drainage)	Ch13	*Triodia brizoides, T. longiceps* mid-dense hummock grassland
FMN19	*Triodia* hilltop	Ch17	*Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland
FMC04	Low stony hill	Ch17	*Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland
FMC05	Low stony hill	Ch17	*Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland
FML05	Stony flat	Ch17	*Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland
FML06	*Triodia* flat	Ch17	*Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland
FML02	*Triodia* hillslope	Ch17	*Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland
FMN03	*Triodia* hillslope	Ch17	*Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland
FMC01	*Triodia* stony plain	Ch17	*Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland
FMN30	Footslope	Ch20	*Grevillea wickhamii* tall shrubland over *Acacia adsurgens, A. ancistrocarpa* shrubland over *Triodia* aff. *basedowii* mid-dense hummock grassland
Vegetation of Minor Creeklines and Floodplains			
FML04	Broad valley	Cc20	*Corymbia* spp. scattered low trees over *Acacia coriacea* subsp. *pendens, A. ancistrocarpa, A. tenuissima* tall open shrubland over *Triodia epactia* mid-dense hummock grassland and open tussock grasses
Fortescue Valley			
Mulga Dominated Vegetation			
FMN05	Mulga	Fa20	*Acacia catenulata, A. aneura* low open forest over *Eremophila forrestii* subsp. *forrestii, Sida* sp. unisexual open shrubland with open annual grassland
FMN13	*Triodia* footslopes of low hills	Fa26	*Acacia aneura, A. catenulata* tall open shrubland over *Eremophila forrestii* open shrubland over *Triodia* aff. *basedowii* mid-dense hummock grassland
FMN14	*Triodia epactia* drainage	Fa25	*Acacia aneura* low open woodland over *Themeda triandra* open tussock grassland and *Eragrostis leptocarpa, E. tenellula* annual grassland
FMN18	Mulga	Fa19	*Acacia aneura* low woodland over *Acacia rhodophloia* high shrubland over *Eremophila forrestii* subsp. *forrestii, Dodonaea petiolaris, Sida* sp. unisexual open shrubland over open grassland
FMR13	Creekline (mulga)	Fa14	*Acacia aneura* low open forest to low woodland over **Cenchrus ciliaris* tussock grassland
FMR17	Mulga grove	Fa11	*Acacia aneura* low closed forest over *Eremophila lanceolata* low open shrubland over *Aristida contorta, Enneapogon polyphyllus* open annual grassland and *Goodenia prostrata* very open herbland

Table 3.3: continued.

Site Code	Habitat Descriptor	Vegetation Code	Vegetation Description
Fortescue Valley (continued)			
Vegetation of Sandy Plains			
FML01	*Eulalia tussock* grassland	Fp1	*Acacia ancistrocarpa, A. coriacea, A. melleodora* scattered tall shrubs over *Triodia schinzii* closed hummock grassland
FMR07	*Triodia* sandplain (*T. schinzii*)	Fp2	*Acacia ancistrocarpa, A. coriacea, A. melleodora* scattered tall shrubs over *Triodia lanigera* closed hummock grassland
FMR08	*Triodia* sandplain (*T. schinzii*)	Fp2	*Acacia ancistrocarpa, A. coriacea, A. melleodora* scattered tall shrubs over *Triodia lanigera* closed hummock grassland
FMR10	*Triodia* sandplain (*T. epactia*)	Fp4	*Corymbia hamersleyana* scattered low trees over *Acacia ancistrocarpa, A. adsurgens* shrubland over *Triodia epactia* mid-dense hummock grassland
Vegetation of Creeklines and Drainage Areas			
FMC02	Drainage	Fc12	*Acacia pruinocarpa, A. tetragonophylla, A. aneura, Atalaya hemiglauca* tall shrubland over *Triodia longiceps* hummock grassland
FMC03	Drainage (low scrub)	Fc9	*Acacia aneura* scattered low trees over *Acacia pyrifolia, Grevillea wickhamii* tall open scrub over *Indigofera monophylla* open heath over *Enneapogon polyphyllus* open annual grassland
FMR01	Creekline (*Acacia coriacea*)	Fc5	*Acacia coriacea* subsp. *pendens* low woodland over *Hakea lorea* subsp. *lorea, Acacia tetragonophylla, A. pyrifolia, Atalaya hemiglauca* tall open shrubland over **Cenchrus ciliaris* closed tussock grassland
Fortescue Valley			
Vegetation of Cracking Clays			
FMR11	Tussock grassland on cracking clay	Fx11	Mixed herbland and annual grassland
FMR12	Tussock grassland on cracking clay	Fx12	*Eragrostis setifolia* closed tussock grassland
FMR14	Tussock grassland on cracking clay	Fx10	*Acacia synchronicia* tall open shrubland over *Aristida latifolia* open tussock grassland and *Ptilotus gomphrenoides var. gomphrenoides, Chloris pectinata* open annual herbland / grassland
FMR15	Tussock grassland on cracking clay	Fx10	*Acacia synchronicia* tall open shrubland over *Aristida latifolia* open tussock grassland and *Ptilotus gomphrenoides var. gomphrenoides, Chloris pectinata* open annual herbland / grassland
FMR16	Tussock grassland on cracking clay	Fx10	*Acacia synchronicia* tall open shrubland over *Aristida latifolia* open tussock grassland and *Ptilotus gomphrenoides var. gomphrenoides, Chloris pectinata* open annual herbland / grassland
FMR18	Snakewood tall shrubland	Fx1	*Acacia xiphophylla* open scrub over *Cassia sturtii* shrubland to low open heath over *Eragrostis xerophila* open tussock grassland

Table 3.3: continued.

Site Code	Habitat Descriptor	Vegetation Code	Vegetation Description
Hamersley Range			
Vegetation of Low Hills and Colluvial Fans			
FMG01	*Triodia* hillslope	Hh6	*Acacia inaequilatera* scattered tall shrubs over *Triodia wiseana* mid-dense hummock grassland
FMG02	*Triodia* hillslope (narrowly incised drainage)	Hh5	*Eucalyptus leucophloia* scattered trees over *Acacia inaequilatera*, *Hakea chordophylla* scattered tall shrubs over *Acacia hilliana* low open shrubland over *Triodia* aff. *basedowii* mid-dense hummock grassland.
FMG03	Broad valley (colluvial)	Hp7	*Corymbia hamersleyana, Eucalyptus gamophylla* scattered low trees over *Acacia dictyophleba, A. ancistrocarpa* tall shrubland to tall open shrubland over *Triodia schinzii, T. pungens* mid-dense hummock grassland
FMG04	Breakaway	Hc7a	*Corymbia hamersleyana* scattered low trees over *Acacia pyrifolia* tall shrubland over *Triodia pungens* mid-dense hummock grassland
FMG05	Broad valley (colluvial)	Hp7	*Corymbia hamersleyana, Eucalyptus gamophylla* scattered low trees over *Acacia dictyophleba, A. ancistrocarpa* tall shrubland to tall open shrubland over *Triodia schinzii, T. pungens* mid-dense hummock grassland
FMG06	*Triodia* hillslope	Hh5	*Eucalyptus leucophloia* scattered trees over *Acacia inaequilatera, Hakea chordophylla* scattered tall shrubs over *Acacia hilliana* low open shrubland over *Triodia* aff. *basedowii* mid-dense hummock grassland
FMG07	*Triodia* hillslope	Hh4	*Corymbia hamersleyana*, *Eucalyptus gamophylla* scattered low trees over *Acacia pachyacra, Petalostylis cassioides* tall open shrubland over *Triodia lanigera (T. pungens)* mid-dense hummock grassland
FMG08	Stony plain	Hh4	*Corymbia hamersleyana*, *Eucalyptus gamophylla* scattered low trees over *Acacia pachyacra, Petalostylis cassioides* tall open shrubland over *Triodia lanigera (T. pungens)* mid-dense hummock grassland

Table 3.4: Association between Land Systems mapped within the FMG Stage B study area and vegetation types identified for this study (see Biota 2004d).
Vegetation types in which we established fauna trapping grids are denoted with an "*".

Land System	Main Associated Vegetation Types of this Study (colour-coded as follows: Mulga-dominated; low stony hills and plains; creeklines; cracking clays; sandplain)
Boolgeeda	Fa1, Fa1a, Fa16, Fa20*, Fa21, Fa22, Fa23, Fa25*, Fa26*; Ch17, Ch20, Ch31; Cc20; Hh4
Brockman	Fa1a, Fa15; Fx11*, Fx12*
Capricorn	Ch24
Divide	Fp1*, Fp2*, Fp3, Fp4*
Elimunna	Fa1a
Jamindie	Fa1, Fa1a, Fa11*, Fa12, Fa13, Fa14*, Fa17, Fa18, Fa24; Fc6, Fc7, Fc8, Fc9*, Fc10, Fc12*; Fx10
McKay	Ch2, Ch13*, Ch14, Ch16, Ch17*, Ch20*, Ch22, Ch23, Ch24, Ch25, Ch26, Ch27, Ch28, Ch29, Ch31, Ch32, Ch33; Cc20*, Cc21, Cc22; Fc7
Newman	Ch16, Ch17, Ch18, Ch19, Ch21, Ch30, Ch31; Cc19; Fc7, Fc11; Hh4*, Hh5*, Hh5b, Hh6*, Hh13, Hh14, Hp7*; Hc7a, Hc16, Hc17, Hc23, Hc24, Hc25, Hc26
River	Single mapped occurrence of this land system within the study area comprises Fc5*; likely to be additional occurrences linked to Cc18, Fc4 and Hc22 if mapped at a finer scale
Rocklea	Ch15
Turee	Fa1, Fa1a, Fa11*, Fa14*; Fx1*, Fx10*, Fx12*; Fc5, Fc6
Wona	Ch24
Washplain	Fa1, Fa1a, Fa10, Fa19*, Fa20*, Fa25*, Fa27

3.6 Limitations of the Study

3.6.1 Limitations of the Field Survey

Sampling was targeted around the nominal centerline of the proposed Stage B rail corridor and the mine areas as indicated by FMG at the time of survey. Some additional areas were added as the project developed (eg. south of Christmas Creek and north of Mt Lewin), and these have not been directly sampled.

Parts of the rail corridor were remote from access tracks that would have permitted regular checking of fauna traps. These locations were not ground-truthed, rather habitat types were inferred based on the vegetation mapping derived from aerial photography.

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 apparent within the corridor. Rainfall events during the Mindy Mindy survey (April 2004) meant that some traps had to be closed early. Not all sections of the study area were therefore ground-truthed or equally sampled for fauna.

The habitats targeted for bat sampling during this survey were watercourses where bats might congregate and be easily encountered. The survey methods were biased towards those species that frequent such habitats and which can be readily identified using the

Anabat system. In addition, the frequent rain meant that bat detectors could be deployed on only a relatively small number of nights. This meant that some species could have been missed, although most of these would have been previously recorded during the FMG Stage A or Hope Downs surveys.

Sampling of the study area reported in this document comprised a single survey phase (a second is proposed for 2005) and it is possible that additional fauna species would be recorded if the sites were revisited at other times of the year. In particular, reptiles were undersampled during the July survey.

Terrestrial invertebrate sampling was targeted at specific groups, and was largely opportunistic or secondary to the main systematic sampling effort. Given the WA Museum's ongoing relocation, it was not possible to complete identifications of the collected invertebrates in the timeframe for finalising this report.

Fish were not systematically sampled. Data presented here are based on data collected during the Hope Downs surveys, literature reviews, consultation and opportunistic sightings.

3.6.2 Fauna Habitat Classification and Assessment of Conservation Significance

See discussion under 3.4.

4.0 Vertebrate Fauna Inventory

4.1 Overview

The survey recorded a combined total of 178 vertebrate taxa from the proposed FMG Stage B rail corridor and mine areas. Table 4.1 provides a summary of the number of species recorded from each major vertebrate group during the survey.

Table 4.1: Number of fauna species recorded during the survey of the proposed FMG Stage B rail corridor and mine areas.

Fauna Group	Total Species
Fish	0
Amphibians	2
Reptiles	42
Avifauna	105
Non-volant mammals	23
Bats	6
Total:	178

4.2 Fish

4.2.1 Species Assemblage

Sampling of freshwater fishes was not undertaken at any creeks or river systems within the rail corridor proposed by Fortescue Metals Group, since recent surveys of the area provide a comprehensive inventory (Morgan et al. 2003; Biota 2002, 2004a and b; S. Creagh, Streamtec Ecological Consultants, pers. comm.). A list of freshwater fishes that occur in the Pilbara, as well as many marine/estuarine species that inhabit Pilbara freshwaters, is given below (this does not include the two stygobionts restricted to the Cape Range Peninsula and Barrow Island).

4.2.2 Annotated List

ANGUILLIDAE (Freshwater Eels)

Indian Short-finned Eel – *Anguilla bicolor*
Not included in the Pilbara fauna by Allen et al. (2002), but shown to be present in the lower – middle reaches of the Fortescue, Yule and De Grey Rivers by Morgan et al. (2003). This species spends the majority of its life in freshwater, but leaves to spawn in deep waters near Sumatra. Occupies rocky pools, brackish estuaries and tidal flats, and is widespread in the Indo-West Pacific (Allen et al. 2002).

CLUPEIDAE (Herrings)

Bony Bream – *Nematolosa erebi*
This species is widespread in Australia, and is found throughout many of the rivers in the Pilbara, including the Ashburton, Robe, Fortescue, De Grey and other small drainages (Morgan et al. 2003).

ARIIDAE (Fork-tailed Catfishes)

Lesser Salmon Catfish or Blue Catfish – *Arius graeffei*
Lives in freshwaters rivers and lagoons, brackish estuaries and coastal marine waters, and widespread across northern Australia and southern New Guinea (Allen et al. 2002). Mainly found in the lower reaches of rivers between the Ashburton and De Grey Rivers, and occurs in the middle reaches of the De Grey River (Morgan et al. 2003).

PLOTOSIDAE (Eel-tailed Catfishes)

Hyrtl's Tandan – *Neosilurus hyrtlii*

A common species that occurs in a wide variety of freshwater habitats, and has a similar distribution to that of *Nematolosa erebi*. It is possible that this taxon might comprise more than one species, as represented by the many geographical populations (Allen et al. 2002). It is present in most drainages of the Pilbara, including upper reaches (Morgan et al. 2003).

Neosilurus sp.

Recent surveys by Morgan et al. (2003) recorded a possible new species of *Neosilurus* from the Robe River.

ATHERINIDAE (Hardeyheads/Silversides)

Murchison River Hardyhead – *Craterocephalus cuneiceps*

This species of Hardyhead inhabits slow-flowing streams and isolated pools between the De Grey and Greenough Rivers (Allen et al. 2002), but is only present in the De Grey catchment north of the Gascoyne River (ie. is absent from the middle of its range; Morgan et al. 2003). It is endemic to Western Australia, and the Pilbara Drainage Division (see Morgan et al. 2003 for the limits of this drainage division).

MELANOTAENIIDAE (Rainbowfish)

Western Rainbowfish – *Melanotaenia australis*

This species occupies a disjunct distribution in the Pilbara and Kimberley of Western Australia, separated by the Great Sandy Desert, and was until recently a subspecies of *M. splendida* (Allen et al. 2002). It occupies rivers, creeks, swamps, marshy lagoons and lakes (Allen et al. 2002). It is widespread in the Pilbara, including in the upper reaches of watercourses (Morgan et al. 2003), and has been observed at White Springs in the Chichester Range (Biota 2004b). Would be expected in the rivers and creeks within the study area.

TERAPONTIDAE (Grunters)

Barred Grunter – *Amniataba percoides*

Widely distributed across northern Australia, and throughout the Pilbara with the exception of the De Grey catchment. It is found in the upper reaches of the Fortescue and Ashburton, and inhabits still pools and fast flowing streams (Allen et al. 2002; Morgan et al. 2003). It has been observed at White Springs (Biota 2004b), and would be expected in waterways within the current study area.

Fortescue Grunter – *Leiopotherapon aheneus*

Endemic to the Pilbara, and previously thought to be restricted to the Fortescue catchment until specimens were captured recently from the Ashburton and Robe Rivers (Allen et al. 2002; Morgan et al. 2003). Included as a Priority 4 in the CALM Priority Fauna List (as of 5 August 2002). This species has not been recorded in the upper reaches of the Fortescue catchment.

Spangled Perch – *Leiopotherapon unicolor*

Widespread in Australia, and throughout the Pilbara, including upper reaches (Allen et al. 2002; Morgan et al. 2003). This species was observed in the White Springs area (Biota 2004b), and is likely to be present in waterways within the current study area.

GOBIIDAE (Gobies)

Flathead Goby – *Glossogobius giurus*

Flathead gobies are found across northern Australia and are widespread in the Indo-West Pacific, inhabiting clear to turbid streams with rock, sand or gravel beds. Adults inhabit freshwater, and larvae are mostly marine (Herbert and Peters 1995 cited in Morgan et al. 2003; Allen et al. 2002; but see Morgan et al. 2003 who mention that larvae, juvenile and adults were captured in freshwater). They have been found in the lower-middle reaches of the Ashburton, Fortescue and Maitland Rivers in the Pilbara (Morgan et al. 2003).

ELEOTRIDAE (Gudgeons)

Empire Gudgeon – *Hypseleotris compressa*

Throughout the Pilbara, but mainly in lower reaches according to Allen et al. (2002), although they show a distribution throughout the Pilbara. Also present in other parts of northern Australia, the east coast and New Guinea (Allen et al. 2002). Despite its disjunct distribution in north-western Australia (as illustrated by Allen et al. 2002), no mention is made of the possibility of genetic subdivision. Morgan et al. (2003) make no mention of this species. A search of the WA Museum FaunaBase returned two locations in the Pilbara where *H. compressa* had been collected, although none were in the upper reaches of the Fortescue catchment (in the Robe River near Pannawonica, and near the coast adjacent to the mouth of the De Grey River).

4.3 Herpetofauna

4.3.1 Species Assemblage

Two frog and 42 reptile species were recorded from the trapping sites established within the FMG Stage B study area (see Table 3.1 for the list of sites). With the exception of *Varanus caudolineatus,* all of these species were also recorded during the surveys associated with FMG Stage A (Biota 2004c) and the proposed Hope Downs rail (Biota 2002, 2004a and 2004b).

The FMG Stage B survey yielded a total of 405 records across 46 taxa. In the above species tally, no attempt has been made to separate *Lerista muelleri* into separate types, as this work is as yet unpublished (Laurie Smith, WA Museum, pers. comm.).

The following section provides an annotated list of the herpetofauna recorded from the FMG Stage B rail corridor and mine areas, with site by species matrices provided in Tables 4.2 to 4.7. A list of vouchered specimens is given in Appendix 1.

4.3.2 Annotated List

HYLIDAE (Tree Frogs)

A total of three individuals from just one species was recorded from this family during the FMG Stage B survey. This represents 0.7% of all individuals and 2.3% of all species recorded during the survey.

Cyclorana maini

Only recorded from the Mindy Mindy study area during the current survey. Single individuals were recorded from *Triodia* hillslopes (FMG01), broad valleys (FMG03) and stony plains (FMG08).

MYOBATRACHIDAE (Australian Ground Frogs)

Four individuals from one species were recorded from this family during the FMG Stage B survey. This represents 1% of all individuals and 2.3% of all species recorded during the survey.

Notaden nichollsi

Only recorded from the Stage B rail corridor, from two sites (FMR07 and FMR08) established in *Triodia* sandplain at the eastern end of the corridor.

CHELIDAE (Freshwater Tortoises)

Though not recorded during the survey, carapaces of several individuals were noted at the Mt Nicholas camp.

Chelodina steindachneri

Apparently seen in large numbers at the Mt Nicholas Camp following heavy rains associated with Cyclone Fay.

Table 4.2: The reptiles recorded at each of the systematic trapping sites during the survey of the Mindy Mindy study area. The number of reptiles and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for the study area.

Scientific Name	Total for Mindy Mindy	FMG01		FMG03		FMG05		FMG07		FMG08	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Cyclorana maini	3	1	3.33	1	5.00			1	2.00	1	2.00
Notaden nichollsi	0										
Chelodina steindachneri	0										
Ctenophorus c. caudicinctus	5	4	13.33					1	2.00		
Ctenophorus i. isolepis	1					1	3.33				
Ctenophorus reticulatus	0										
Lophognathus longirostris	0										
Pogona minor	0										
Diplodactylus conspicillatus	1					1	3.33				
Diplodactylus stenodactylus	9	1	3.33	1	5.00	2	6.67	3	6.00	2	4.00
Diplodactylus wombeyi	0										
Gehyra punctata	0										
Gehyra variegata	0										
Heteronotia binoei	0										
Strophurus elderi	0										
Strophurus wellingtonae	0										
Delma haroldi	0										
Delma nasuta	0										
Delma tincta	0										
Delma pax	0										
Lialis burtonis	0										
Pygopus n. nigriceps	0										
Carlia munda	3	1	3.33							2	4.00
Ctenotus ariadnae	2									2	4.00
Ctenotus duricola	3	2	6.67					1	2.00		
Ctenotus hanloni	0										
Ctenotus helenae	0										
Ctenotus aff. *helenae*	1	1	3.33								
Ctenotus pantherinus ocellifer	0										
Ctenotus piankai	0										
Ctenotus saxatilis	1							1	2.00		
Ctenotus serventyi	1					1	3.33				
Cyclodomorphus m. melanops	0										
Lerista muelleri	0										
Menetia greyii	1									1	2.00
Morethia ruficauda exquisita	0										
Varanus acanthurus	0										

Scientific Name	Total for Mindy Mindy	FMG01		FMG03		FMG05		FMG07		FMG08	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Varanus caudolineatus	0										
Varanus giganteus	0										
Ramphotyphlops ammodytes	0										
Demansia psammophis cupreiceps	0										
Pseudechis australis	0										
Pseudonaja modesta	0										
Suta punctata	0										
No. of species	**12**	**6**	**6**	**2**	**2**	**4**	**4**	**5**	**5**	**5**	**5**
No. of individuals	**33**	**10**	**33.33**	**2**	**10.00**	**5**	**16.67**	**8**	**16.00**	**8**	**16.00**

AGAMIDAE (Dragons)

A total of 123 individuals of five species were recorded from this family during the FMG survey. This represents 31.9% of all individuals and 11.4% of all herpetofauna species recorded during the survey.

Ctenophorus caudicinctus caudicinctus

Recorded from all of the mine areas and the Stage B rail corridor. The most commonly recorded reptile species during the surveys, with a total of 72 individuals either trapped or sighted. Typically recorded from stony or rocky habitats with an understorey dominated by *Triodia*. Most common on *Triodia* low stony hills (FMC04, 9 records; FMC05, 6 records), *Triodia* hillslopes (FMG01, 4 records; FMG07, 2 records; FML02, 7 records; FMN03, 6 records), *Triodia* stony plains (FMC01, 7 records; FML05, 6 records), *Triodia* hilltops (FMN19, 3 records) and colluvial *Triodia* (FMC02, 6 records; FMC03, 4 records; FML06, 7 records). Scattered records from more clayey substrates such as mulga (FMN05, 1 record; FMR17, 2 records) and snakewood (FMR18, 1 record).

Ctenophorus isolepis isolepis

The fifth most commonly reported reptiles with 20 individuals seen or trapped. Recorded from the length of the surveyed area. Most commonly recorded from sandy substrates including *Triodia* sandplain (FMR07, 2 records; FMR08, 3 records; FMR10, 2 records) and *Eulalia* tussock grassland (FML01, 5 records), but also from loams in broad valleys (FMG05, 1 record; FML04, 1 record) and from loams with a surface scatter of stones (FML05, 6 records).

Ctenophorus reticulatus

Single specimen hand collected from mulga (*Acacia aneura*) on clay adjacent to FMC01.

Lophognathus longirostris

Most records from creeklines (FMR01 (Kulkinbah Creek), 5 records; FMR13 (Kondy Creek), 2 records) and minor drainages (FMC02 5 records; FMN14, 1 record). Also recorded from mulga woodland (FMR16, 1 record).

Pogona minor

Single individual recorded from the mulga grove at FMR17.

GEKKONIDAE (Geckoes)

A total of 91 individuals of eight species were recorded from this family during the FMG Stage B survey. This represents 23.6% of all individuals and 18.1% of all herpetofauna species recorded during the survey.

Diplodactylus conspicillatus

Three records of this species, including two from the *Eulalia* tussock grassland (FML01) and one from similar habitat in a broad valley at FMG05.

Diplodactylus stenodactylus

Recorded from clay loams and stony substrates including *Triodia* footslopes of low hills (FMN13, 2 records; FMN30, 1 record), tussock grasslands in broad valleys (FMG03, 1 record; FMG05, 2 records), *Triodia* stony plains (FMG08, 2 records) and *Triodia* hillslopes (FMG01, 1 record; FMG07, 3 records).

Diplodactylus wombeyi

Particularly common on the low stony *Triodia* hillslope at FMC04, which yielded six records of this typically uncommon species. A single individual also recorded from the *Triodia* hillslope at FML02.

Gehyra punctata

Single specimen hand collected from under rocks at FML02 (*Triodia* hillslope).

Table 4.3: The reptiles recorded at each of the systematic trapping sites during the survey of the Christmas Creek study area. The number of reptiles and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for the study area.

Scientific Name	Total for Christmas Creek	FMC01		FMC02		FMC03		FMC04		FMC05	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Cyclorana maini	0										
Notaden nichollsi	0										
Chelodina steindachneri	0										
Ctenophorus c. caudicinctus	33	8		6		4		9		6	
Ctenophorus i. isolepis	0										
Ctenophorus reticulatus	1	1									
Lophognathus longirostris	5			5							
Pogona minor	0										
Diplodactylus conspicillatus	0										
Diplodactylus stenodactylus	0										
Diplodactylus wombeyi	6							6			
Gehyra punctata	0										
Gehyra variegata	22	5		2		12				3	
Heteronotia binoei	1			1							
Strophurus elderi	0										
Strophurus wellingtonae	8			3		2		1		2	
Delma haroldi	0										
Delma nasuta	0										
Delma tincta	0										
Delma pax	6	2		1		2				1	
Lialis burtonis	0										
Pygopus n. nigriceps	0										
Carlia munda	9	5		1						3	
Ctenotus ariadnae	0										
Ctenotus duricola	0										
Ctenotus hanloni	0										
Ctenotus helenae	0										
Ctenotus aff. *helenae*	0										
Ctenotus pantherinus ocellifer	6	5						1			
Ctenotus piankai	0										
Ctenotus saxatilis	8			5		3		1			
Ctenotus serventyi	0										
Cyclodomorphus m. melanops	2			2							
Lerista muelleri	7	3				2				2	
Menetia greyii	4	2				2					
Morethia ruficauda exquisita	0										
Varanus acanthurus	0										

Scientific Name	Total for Christmas Creek	FMC01		FMC02		FMC03		FMC04		FMC05	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Varanus caudolineatus	0										
Varanus giganteus	0										
Ramphotyphlops ammodytes	1					1					
Demansia psammophis cupreiceps	0										
Pseudechis australis	0										
Pseudonaja modesta	0										
Suta punctata	0										
No. of species	**15**	**8**	**8**	**9**	**9**	**8**	**8**	**5**	**5**	**6**	**6**
No. of individuals	**130**	**31**	**51.67**	**26**	**52.00**	**28**	**56.00**	**18**	**36.00**	**17**	**42.50**

Gehyra variegata
The second most commonly recorded reptile with 49 individuals captured or trapped. Most commonly recorded from mulga (FMR17, 3 records; FMN05, 3 records; FMN18, 8 records; FMR16, 4 records; FMR58, 1 record; FMR61, 1 record), and creeklines or drainage lines dominated by *Acacia* species (FMC03, 12 records; FMR13, 2 records; FMC02, 2 records). Also recorded from a variety of other habitats supporting tall shrubs or trees with loose bark or hollows, including low stony hills (FMC05, 3 records), *Triodia* stony plains (FMC01, 5 records), *Triodia* sandplain (FMR10, 4 records), snakewood (FMR18, 1 record) and *Triodia* flats (FMC06, 2 records).

Heteronotia binoei
Just two records of this species; one individual from the drainage line at FMC02 and one from the *Triodia* stony plain at FML05.

Strophurus elderi
Captured in *Triodia* sandplain (FMG07, n=1; FMG08, n=1), with two individuals also captured on *Triodia* hillslopes (FMN03).

Strophurus wellingtonae
Most captures from the Christmas Creek study area. Recorded from *Triodia* low stony hills (FMC04, n=1; FMC05, n=2), drainage lines (FMC02, n=3; FMC03, n=2), *Triodia* hillslopes (FMC02, n=1) and *Triodia* sandplains (FMR10, n=1).

PYGOPODIDAE (Legless lizards)

A total of 20 individuals of six species were recorded from this family during the FMG Stage B survey. This represents 5.2% of all individuals and 13.6% of all species recorded during the survey.

Delma haroldi
Single record of this species from a *Triodia* hillslope at FMN03.

Delma nasuta
Recorded from creeklines (FMR13 (Kondy Creek), 2 records) and *Triodia* sandplains (1 record).

Delma pax
Most captures came from either creeklines (FMR01 (Kulkinbah Creek), 2 records) or drainage lines (FMC02, 1 record; FMC03, 2 records; FMN14, 1 record). Also recorded from footslopes (FMN30, 1 record), low stony hills (FMC05, 1 record) and *Triodia* stony plains (FMC01, 2 records).

Delma tincta
Two records of this species; a single individual captured from each of *Triodia* sandplain (FMR08) and tussock grassland on cracking clay (FMR12).

Lialis burtonis
Single individual recorded from amongst *Triodia epactia* in a drainage line (FMN14) and a further two individuals recorded from a colluvial *Triodia* flat (FML06).

Pygopus n. nigriceps
Single record of this species from a colluvial *Triodia* flat (FMN13).

SCINCIDAE (Skinks)

A total of 130 individuals of 14 species was recorded from this family during the FMG Stage B survey. This represents 33.7% of all individuals and 31.8% of all species recorded during the survey.

Table 4.4: The reptiles recorded at each of the systematic trapping sites during the survey of the Mount Lewin study area. The number of reptiles and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for the study area.

Scientific Name	Total for Mount Lewin	FML01		FML02		FML03		FML04		FML05		FML06	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Cyclorana maini	0												
Notaden nichollsi	0												
Chelodina steindachneri	0												
Ctenophorus c. caudicinctus	20			7	11.67					6	10.00	7	11.67
Ctenophorus i. isolepis	12	5	8.33					1	1.67	6	10.00		
Ctenophorus reticulatus	0												
Lophognathus longirostris	0												
Pogona minor	0												
Diplodactylus conspicillatus	2	2	3.33										
Diplodactylus stenodactylus	1											1	1.67
Diplodactylus wombeyi	1			1	1.67								
Gehyra punctata	1			1	1.67								
Gehyra variegata	2											2	3.33
Heteronotia binoei	1					1	1.67						
Strophurus elderi	0												
Strophurus wellingtonae	1			1	1.67								
Delma haroldi	0												
Delma nasuta	0												
Delma tincta	0												
Delma pax	0												
Lialis burtonis	2											2	3.33
Pygopus n. nigriceps	0												
Carlia munda	0												
Ctenotus ariadnae	0												
Ctenotus duricola	0												
Ctenotus hanloni	0												
Ctenotus helenae	0												
Ctenotus aff. *helenae*	2											2	3.33
Ctenotus pantherinus ocellifer	5					1	1.67			2	3.33	2	3.33
Ctenotus piankai	0												
Ctenotus saxatilis	2			1	1.67							1	1.67
Ctenotus serventyi	0												
Cyclodomorphus m. melanops	1					1	1.67						
Lerista muelleri	0												
Menetia greyii	0												
Morethia ruficauda exquisita	0												

Scientific Name	Total for Mount Lewin	FML01		FML02		FML03		FML04		FML05		FML06	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Varanus acanthurus	0												
Varanus caudolineatus	0												
Varanus giganteus	0												
Ramphotyphlops ammodytes	0												
Demansia psammophis cupreiceps	0												
Pseudechis australis	0												
Pseudonaja modesta	0												
Suta punctata	0												
No. of species	**14**	**2**	**2**	**5**	**5**	**3**	**3**	**1**	**1**	**3**	**3**	**7**	**7**
No. of individuals	**52**	**7**	**11.67**	**11**	**18.33**	**3**	**5.00**	**1**	**1.67**	**14**	**23.33**	**17**	**28.33**

Carlia munda
Most commonly recorded from *Triodia* stony plains (FMC01, 5 records), *Triodia* on low stony hills (FMC05, 3 records) and tussock grasslands on stony plains (FMG08, 2 records). Less commonly recorded from drainage lines (FMC02, 1 record), mulga groves (FMR17, 1 record) and *Triodia* hillslopes (FMG01, 1 record).

Ctenotus ariadnae
Two records of this species from the tussock grassland on stony plain at FMG08.

Ctenotus duricola
Recorded from *Triodia* hillslopes (FMG01, 1 record; FMG07, 2 records).

Ctenotus hanloni
Two records of this taxa, both from the *Triodia schinzii* sandplain at the eastern end of the proposed rail corridor (FMG07 and FMG08).

Ctenotus helenae
Recorded on two occasions; one specimen from *Triodia* sandplain (FMR07) and another from colluvial *Triodia* along the drainage line at FMN14.

Ctenotus aff. *helenae*
Recorded from the length of the study area in a range of habitat types, including colluvial *Triodia* in drainage lines (FMN14, 1 record), footslopes (FMN13, 1 record; FMN30, 4 records) and flats (FML06, 2 records), *Triodia* hillslopes (FMG01, 1 record; FML06, 2 records) and *Triodia* sandplains (FMR10, 2 records).

Ctenotus pantherinus ocellifer
This species was the third most commonly recorded reptile with 22 records, and accounted for 17.7% of all skink records. Recorded from a range of habitats with an understorey dominated by *Triodia* species, including colluvial footslopes (FMN13, 4 records; FMN30, 2 records), low stony hills (FMC04, 1 record), mulga low woodlands (FMN05, 2 records), *Triodia* flats (FML06, 2 records), *Triodia* hillslopes (FMN03, 2 records), *Triodia* sandplains (FMR10, 1 record) and *Triodia* stony plains (FMC01, 5 records; FML03, 1 record; FML05, 2 records).

Ctenotus piankai
Single capture from *Triodia schinzii* sandplain (FMR10) at the eastern end of the Stage B rail corridor.

Ctenotus saxatilis
Commonly recorded species with all records from *Triodia*-dominated habitats, including drainage lines (FMC02, 5 records; FMC03, 3 records), hilltops (FMN19, 1 record), low stony hills (FMC04, 1 record), colluvial flats (FMC06, 1 record), hillslopes (FMG07, 1 record; FML02, 1 record) and sandplains (FMR10, 1 record).

Ctenotus serventyi
One individual captured from a drainage line with a tussock grassland understorey in the Mindy Mindy study area (FMG05).

Cyclodomorphus melanops melanops
During the current survey, this species was often raked from beneath dead litter, particularly dead *Triodia* along windrows of tracks (seven records versus three from pit traps). Most records from creeklines (FMR13, 5 records) and drainage lines (FMC02, 2 records; FMN14, 1 records), but scattered records also from footslopes (FMN13, 1 record) and *Triodia* stony plains (FMC03, 1 record).

Table 4.5: The reptiles recorded at each of the systematic trapping sites during the survey of the Mount Nicholas study area. The number of reptiles and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for the study area.

Scientific Name	Total for Mount Nicholas	FMN03		FMN05		FMN13		FMN14		FMN18		FMN19		FMN30	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Cyclorana maini	0														
Notaden nichollsi	0														
Chelodina steindachneri	0														
Ctenophorus c. caudicinctus	10	6	8.57	1	1.43							3	4.29		
Ctenophorus i. isolepis	0														
Ctenophorus reticulatus	0														
Lophognathus longirostris	1							1	1.43						
Pogona minor	0														
Diplodactylus conspicillatus	0														
Diplodactylus stenodactylus	3					2	2.86							1	1.43
Diplodactylus wombeyi	0														
Gehyra punctata	0														
Gehyra variegata	11			3	4.29					8	11.43				
Heteronotia binoei	0														
Strophurus elderi	2	2	2.86												
Strophurus wellingtonae	0														
Delma haroldi	1	1	1.43												
Delma nasuta	0														
Delma tincta	0														
Delma pax	2							1	1.43					1	1.43
Lialis burtonis	1							1	1.43						
Pygopus n. nigriceps	1					1	1.43								
Carlia munda	0														
Ctenotus ariadnae	0														
Ctenotus duricola	0														
Ctenotus hanloni	0														
Ctenotus helenae	1							1	1.43						
Ctenotus aff. *helenae*	5					3	4.29	1	1.43					1	1.43
Ctenotus pantherinus ocellifer	10	2	2.86	2	2.86	4	5.71							2	2.86
Ctenotus piankai	0														
Ctenotus saxatilis	1											1	1.43		
Ctenotus serventyi	0														
Cyclodomorphus m. melanops	2					1	1.43	1	1.43						
Lerista muelleri	0														
Menetia greyii	0														
Morethia ruficauda exquisita	2	1	1.43									1	1.43		

Scientific Name	Total for Mount Nicholas	FMN03		FMN05		FMN13		FMN14		FMN18		FMN19		FMN30	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Varanus acanthurus	1											1	1.43		
Varanus caudolineatus	0														
Varanus giganteus	1													1	1.43
Ramphotyphlops ammodytes	0														
Demansia psammophis cupreiceps	0														
Pseudechis australis	0														
Pseudonaja modesta	0														
Suta punctata	0														
No. of species	**17**	**5**	**5**	**3**	**3**	**5**	**5**	**6**	**6**	**1**	**1**	**4**	**4**	**5**	**5**
No. of individuals	**55**	**12**		**6**		**11**		**6**		**8**		**6**		**6**	

Lerista muelleri
The fourth most commonly recorded reptile with 20 individuals captured or trapped. Recorded from a variety of habitats where leaf litter provided suitable microhabitat. Recorded primarily from mulga (FMR16, 8 records; FMR17, 2 records) and *Triodia*-dominated habitats on low stony hills (FMC05, 2 records), stony plains (FMC01, 3 records) and drainage lines (FMC03, 2 records), but with scattered records from snakewood (FMR18, 1 record) and tussock grassland on cracking clay (FMR12, 2 records; FMR15, 1 record).

Members of this species complex were recorded from the length of the study area. Vouchered specimens are being compared to type-specimens to determine which of the newly described species they represent.

Menetia greyii
The sixth most commonly recorded reptile with 19 records. Most records from *Triodia* sandplains (FMR07, 4 records; FMR08, 1 record; FMR10, 1 record), though also recorded from *Triodia* drainage lines (FMC03, 2 records), mulga (FMR17, 1 record; FMR16, 3 records), snakewood (FMR18, 1 record), *Triodia* stony plain (FMC01, 2 records), tussock grassland on stony plains (FMG08, 1 record) and tussock grassland on cracking clay (FMR12, n=2).

Morethia ruficauda exquisita
Six records of this species with most records coming from rocky areas on *Triodia* hilltops (FMN14, 1 record; FMN34, 3 records), but also from *Triodia* hillslopes (FMG07, 1 record; FMR59, 1 record).

VARANIDAE (Monitors)

Four individuals of three species were recorded from this family during the FMG Stage B survey. This represents 1% of all individuals and 6.8% of all species recorded during the survey.

Varanus acanthurus
Single record from the breakaway on the *Triodia* hilltop at FMN19.

Varanus caudolineatus
Single record from a hollow in a dead mulga tree at FMR63.

Varanus giganteus
Two records; one from the breakaway on a *Triodia* hilltop at FMN34 and the second from colluvial *Triodia* on the footslope at FMN30.

TYPHLOPIDAE (Blind snakes)

Two individuals from one species were recorded from this family during the FMG Stage B survey. This represents 0.5% of all individuals and 2.3% of all species recorded during the survey.

Ramphotyphlops ammodytes
Two records, including one from colluvial *Triodia* in the drainage line at FMC03 and the second from the mulga grove at FMR17.

ELAPIDAE (Elapid snakes)

Eight individuals of four species were recorded from this family during the FMG Stage B survey. This represents 2.1% of all individuals and 9% of all species recorded during the survey.

Demansia psammophis cupreiceps
Three records of this species; two from tussock grassland on cracking clay (FMR11 and FMR15) and one seen opportunistically in mulga along a small drainage line in the Christmas Creek study area.

Table 4.6: The reptiles recorded at each of the systematic trapping sites during the survey of the eastern section of the Stage B rail corridor. The number of reptiles and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for that section of the rail corridor.

Scientific Name	Total for eastern Rail Corridor	FMR07		FMR08		FMR10		FMR11		FMR12		FMR13	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Cyclorana maini	0												
Notaden nichollsi	4	2	2.86	2	2.86								
Chelodina steindachneri	0												
Ctenophorus c. caudicinctus	0												
Ctenophorus i. isolepis	7	2	2.86	3	4.29	2	3.33						
Ctenophorus reticulatus	0												
Lophognathus longirostris	2											2	3.33
Pogona minor	0												
Diplodactylus conspicillatus	0												
Diplodactylus stenodactylus	0												
Diplodactylus wombeyi	0												
Gehyra punctata	0												
Gehyra variegata	6					4	6.67					2	3.33
Heteronotia binoei	0												
Strophurus elderi	2			1	1.43	1	1.67						
Strophurus wellingtonae	1					1	1.67						
Delma haroldi	0												
Delma nasuta	3	1	1.43									2	3.33
Delma tincta	2			1	1.43					1	1.67		
Delma pax	0												
Lialis burtonis	0												
Pygopus n. nigriceps	0												
Carlia munda	0												
Ctenotus ariadnae	0												
Ctenotus duricola	0												
Ctenotus hanloni	2	1	1.43	1	1.43								
Ctenotus helenae	1	1	1.43										
Ctenotus aff. *helenae*	2					2	3.33						
Ctenotus pantherinus ocellifer	1					1	1.67						
Ctenotus piankai	1					1	1.67						
Ctenotus saxatilis	1					1	1.67						
Ctenotus serventyi	0												
Cyclodomorphus m. melanops	5											5	8.33
Lerista muelleri	2									2	3.33		

Scientific Name	Total for eastern Rail Corridor	FMR07		FMR08		FMR10		FMR11		FMR12		FMR13	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Menetia greyii	8	4	5.71	1	1.43	1	1.67			2	3.33		
Morethia ruficauda exquisita	0												
Varanus acanthurus	0												
Varanus caudolineatus	0												
Varanus giganteus	0												
Ramphotyphlops ammodytes	0												
Demansia psammophis cupreiceps	1							1	1.67				
Pseudechis australis	0												
Pseudonaja modesta	0												
Suta punctata	0												
No. of species	**18**	**6**	**6**	**6**	**6**	**9**	**9**	**1**	**1**	**3**	**3**	**4**	**4**
No. of individuals	**51**	**11**	**15.71**	**9**	**12.86**	**14**	**23.33**	**1**	**1.67**	**5**	**8.33**	**11**	**18.33**

Table 4.7: The reptiles recorded at each of the systematic trapping sites during the survey of the western section of the Stage B rail corridor. The number of reptiles and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for that section of the rail corridor.

Scientific Name	Total for western Rail Corridor	FMR01		FMR15		FMR16		FMR17		FMR18	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Cyclorana maini	0										
Notaden nichollsi	0										
Chelodina steindachneri	0										
Ctenophorus c. caudicinctus	3							2	2.86	1	1.67
Ctenophorus i. isolepis	0										
Ctenophorus reticulatus	0										
Lophognathus longirostris	6	5	8.33			1	1.43				
Pogona minor	1							1	1.43		
Diplodactylus conspicillatus	0										
Diplodactylus stenodactylus	0										
Diplodactylus wombeyi	0										
Gehyra punctata	0										
Gehyra variegata	8					4	5.71	3	4.29	1	1.67
Heteronotia binoei	0										
Strophurus elderi	0										
Strophurus wellingtonae	0										
Delma haroldi	0										
Delma nasuta	0										
Delma tincta	0										
Delma pax	2	2	3.33								
Lialis burtonis	0										
Pygopus n. nigriceps	0										
Carlia munda	1							1	1.43		
Ctenotus ariadnae	0										
Ctenotus duricola	0										
Ctenotus hanloni	0										
Ctenotus helenae	0										
Ctenotus aff. *helenae*	0										
Ctenotus pantherinus ocellifer	0										
Ctenotus piankai	0										
Ctenotus saxatilis	0										
Ctenotus serventyi	0										
Cyclodomorphus m. melanops	0										
Lerista muelleri	12			1	1.43	8	11.43	2	2.86	1	1.67
Menetia greyii	5					3	4.29	1	1.43	1	1.67

Scientific Name	Total for western Rail Corridor	FMR01		FMR15		FMR16		FMR17		FMR18	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Morethia ruficauda exquisita	0										
Varanus acanthurus	0										
Varanus caudolineatus	0										
Varanus giganteus	0										
Ramphotyphlops ammodytes	1							1	1.43		
Demansia psammophis cupreiceps	1			1	1.43						
Pseudechis australis	0										
Pseudonaja modesta	0										
Suta punctata	2							2			
No. of species	**11**	**2**	**2**	**2**	**2**	**4**	**4**	**8**	**8**	**4**	**4**
No. of individuals	**42**	**7**	**11.67**	**2**	**2.86**	**16**	**22.86**	**13**	**18.57**	**4**	**6.67**

Pseudechis australis
Single individual seen in open mulga near FMR13.

Pseudonaja modesta
Single animal found at the camp site near Edenholme Bore.

Suta punctata
Three records of this species including two from the mulga grove at FMR17. No habitat data were recorded for the third record.

4.3.4 Discussion

The survey recorded 44 species of herpetofauna from the combined study area. The survey of the FMG Stage B rail corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas mine areas added only one described species of herpetofauna to the tally recorded during previous surveys of the Hope Downs rail corridor (Biota 2002, 2004a and 2004b) and the FMG Stage A rail corridor (Biota 2004c). This species, the varanid *Varanus caudolineatus*, has been recorded from elsewhere in the southern Pilbara and Goldfields bioregions and is not considered threatened, though it is poorly collected with just 37 specimens lodged with the WA Museum. A type of *Lerista* "*muelleri*" not previously recorded by us in the Pilbara was also collected (see below).

The low number of herpetofauna (species richness) is indicative of winter sampling and it is expected that this number will be significantly boosted (by up to 20 species) during the seasonal survey planned for 2005.

Regional Endemism and Restricted Taxa
One of the forms of *Lerista "muelleri"* collected from the heavy cracking clays along the Stage B rail corridor represents a type of *Lerista* "*muelleri*" that has so far only been collected from the vicinity of Roy Hill Station (Mr Laurie Smith, WA Museum, pers. comm. 2004).

Diplodactylus wombeyi was the only herpetofauna endemic to the Pilbara recorded during the current survey. This uncommonly recorded species occurs across much of the Pilbara, where it appears to prefer rocky hilltops.

A number of additional species endemic or nearly endemic to the Pilbara may occur within the project area, including *Nephrurus wheeleri cinctus, Delma elegans, Lerista zietzi*, *Ctenotus rubicundus, Varanus pilbarensis*, *V.* sp. nov. (pilbara), *Demansia rufescens*, *Acanthophis wellsi*, *Ramphotyphlops ganei* and *R. pilbarensis*. *Diplodactylus savagei* is considered a "near endemic" to the Pilbara bioregion and recent surveys suggest it may comprise two different forms whose taxonomic status is uncertain (Dr Paul Doughty, WA Museum, pers. comm. 2004). *Diplodactylus stenodactylus* is recognised as a species complex with a number of new taxa recognised from and possibly confined to the Pilbara (Mr Laurie Smith, pers comm. 2004). Whilst the taxonomic status of the Pilbara forms of *Ctenotus* affin. *robustus*, *Ctenotus* affin. *uber johnstonei*, *Egernia formosa* and *Tympanocryptis cephala* is unclear, these taxa may also be found to be confined (or nearly so) to the Pilbara bioregion.

The trapping along the Stage B rail corridor is the first such survey of herpetofauna along the northern flank of the Fortescue Valley. Some of the habitats encompassed by the proposed corridor (cracking clays, tussock grasslands, sandplains) have been poorly sampled elsewhere in the Pilbara, or are known to support uncommon or restricted species, or taxa whose taxonomic status is unresolved (eg. *Ctenotus* aff. *robustus*, *C.* affin. *uber johnstonei*, *Diplodactylus mitchelli* and a form of *Tympanocryptis cephala*). CALM has recently completed the first phase of the Pilbara Bioregion survey and whilst results are not yet complete, trapping at sites further to the east (eg. RHNE study sites) recorded a number of taxa additional to those recorded by us. These species included

Tympanocryptis cephala, *Caimanops amphiboluroides*, *Proablepharus reginae* and *Notoscincus ornatus*.

4.4 Birds

4.4.1 Species Assemblage

The survey recorded 7978 individuals of 105 bird species in the combined study area of the FMG Stage B rail corridor and mine areas. This included 1835 individuals of 49 species of non-passerines and 6143 individuals of 56 species of passerines. The most speciose families were the Meliphagidae (10 species), Accipitridae (9 species), Psittacidae (7 species), Acanthizidae (7 species), Falconidae (5 species) and Columbidae (5 species).

In the Mindy Mindy study area alone we recorded a total of 1239 individuals of 48 species, which included 609 individuals of 18 species of non-passerines and 630 individuals of 30 species of passerines. In the rail corridor and Christmas Creek, Mt Lewin and Mt Nicholas mine areas we recorded 6739 individuals of 99 species, including 1226 individuals of 46 species of non-passerines and 5513 individuals of 53 species of passerines.

When both surveys are combined, the most abundant species were the Zebra Finch (2190 individuals), Masked Woodswallow (420 individuals), Budgerigar (415 individuals), Variegated Fairy-wren (347 individuals), Singing Honeyeater (308 individuals) and Fork-tailed Swift (304 individuals). In the Mindy Mindy study area, the most abundant species were the Fork-tailed Swift (304 individuals), Zebra Finch (155 individuals), Budgerigar (147 individuals), Diamond Dove (113 individuals), Brown Honeyeater (77 individuals) and Grey-headed Honeyeater (47 individuals). In the rail corridor and Christmas Creek, Mt Lewin and Mt Nicholas mine areas the most abundant species were the Zebra Finch (2035 individuals), Masked Woodswallow (420 individuals), Singing Honeyeater (294 individuals), Spiny-cheeked Honeyeater (288 individuals), Budgerigar (268 individuals) and Black-faced Woodswallow (224 individuals).

4.4.2 Annotated List

Tables 4.8 to 4.16 tabulate the bird records from each site. Each species is discussed individually in the following annotated list.

DROMAIIDAE (Emus)

Assuming each secondary sign recorded equated to one individual, 14 individuals of one species were recorded from this family during the combined surveys. This represents 0.2 % of all records and 1.0 % of all species recorded during those surveys.

Emu – *Dromaius novaehollandiae*

Frequent. Recorded from all of the mine areas and the rail corridor. All records were from secondary signs, namely tracks (n=8) and scats (n=2). Recorded from a variety of habitats, including *Triodia* hillslopes (FMG01), colluvial *Triodia* (FML06), mulga (FMN18), *Triodia* sandplain (FMR08, FMR10 and FMR65), *Acacia* shrubland over stony *Triodia* flats (FMC01) and *Eulalia* tussock grassland (FML01), but records are probably biased towards those habitats where tracks are easily recorded.

PHASIANIDAE (Quails and pheasants)

A total of 26 individuals of two species were recorded from this family during the combined surveys. This represents 0.3 % of all individuals and 1.9 % of all species recorded during those surveys.

Stubble Quail – *Coturnix pectoralis*

Uncommon. Only recorded from the rail corridor, particularly from cracking clay (FMR 12). Seen in pairs (n=1) and a group of three (n=1).

Brown Quail – *Coturnix ypsilophora australis*
Common but restricted. Only recorded from the rail corridor, from Kulkinbah Creek (FMR01) and mixed mulga and cracking clay (FMR17). Recorded singly (n=1), in a group of six (n=1) and a group of 14 (n=1).

ANATIDAE (Ducks)

One individual of one species was recorded from this family during the combined surveys. This represents <0.1 % of all individuals and 1.0 % of all species recorded during those surveys.

Australian Shelduck – *Tadorna tadornoides*
Rare. Only recorded from the rail corridor, from a single record of an individual seen in a drainage line (FMRMM) on 21st July.

ARDEIDAE (Herons)

Four individuals of three species were recorded from this family during the combined surveys. This represents 0.1 % of all individuals and 2.9 % of all species recorded during those surveys.

White-faced Heron – *Ardea* (*Egretta*) *novaehollandiae*
Rare. Only recorded from the rail corridor, from a single individual seen along Kondy Creek (FMR13) on 10th July.

White-necked Heron – *Ardea pacifica*
Scarce. The only records were single individuals seen along creeklines in the eastern rail corridor on 27th June and in the Mount Lewin study area on 8th July.

Great Egret – *Ardea alba*
Rare. One record from the Christmas Creek study area, of an individual seen flying over a creekline (FMC02) on 5th July.

THRESKIORNITHIDAE (Ibis and spoonbills)

Eight individuals of one species were recorded from this family during the combined surveys. This represents 0.1 % of all individuals and 1.0 % of all species recorded during those surveys.

Straw-necked Ibis – *Threskiornis spinicollis*
Uncommon. A single record from the rail corridor, of a group of eight seen flying over Kondy Creek (FMR13) on 8th July.

ACCIPITRIDAE (Raptors)

A total of 67 individuals of nine species were recorded from this family during the combined surveys. This represents 0.8 % of all individuals and 8.6 % of all species recorded during those surveys.

(Australian) Black-shouldered Kite – *Elanus caeruleus axillaris*
Scarce. The only records are single birds in *Acacia* shrubland on cracking clay (FMR14) on 7th July and in *Acacia* drainage lines among cracking clay in the eastern rail corridor on the same day.

Black-breasted Buzzard – *Hamirostra melanosternon*
Scarce. Recorded from the rail corridor and Mt Lewin study area, from single birds seen over mixed *Acacia* shrubland and cracking clay in the east-central rail corridor on 5th July and over stony colluvial *Triodia* (FML05) on 13th July.

Black Kite – *Milvus migrans affinis*
Scarce. Only recorded from the rail corridor, from single birds seen over Kondy Creek (FMR13) on 8th July and over *Triodia* sandplain (FMR10) on 10th July.

Whistling Kite – *Haliastur sphenurus*
Frequent. Recorded from the rail corridor and all of the mine areas except Mindy Mindy, from a wide variety of habitats including *Triodia* hilltops (FMC04), *Triodia* sandplains (FMR10), colluvial *Triodia* (FML06), *Acacia* shrubland over stony *Triodia* flats (FMC01), mulga (FMN18), mixed mulga and cracking clay (FMR11), *Acacia* shrubland on cracking clay (FMR14) , cracking clay (FMR12) and Kondy Creek (FMR13). Mainly recorded singly (n=11) but also recorded in groups of three (n=1) and from calls (n=2).

Spotted Harrier – *Circus assimilis*
Frequent. Recorded from the rail corridor and all of the mine areas except Mt Nicholas. Recorded over a wide variety of habitats including *Triodia* hilltops (FMC04), *Triodia* hillslopes (FMG01 and FML02), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* flats (FMC01), mulga along drainage lines (FMC05), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR12 and FMR15), drainage lines (FMG05) and Kulkinbah Creek (FMR01). Recorded singly (n=13).

Brown Goshawk – *Accipiter fasciatus fasciatus*
Frequent. Recorded from the rail corridor and all of the mine areas except Mindy Mindy. Recorded from a wide variety of habitats including colluvial *Triodia* (FML06 and FMN14), cracking clay (FMR12), gorges (FMR71), drainage lines (FMRMM), creeklines (FMC02) and Kondy Creek (FMR13). Recorded singly (n=12), in pairs (n=1) or groups of three (n=1).

Collared Sparrowhawk – *Accipiter cirrocephalus cirrocephalus*
Uncommon. Recorded from the rail corridor and Mt Nicholas study area, from *Triodia* hilltops (FMNMC001), mulga (FMN18) and snakewood (FMR18). Recorded singly (n=2) and in pairs (n=1).

Wedge-tailed Eagle – *Aquila audax*
Frequent. Recorded from the rail corridor and all of the mine areas except Christmas Creek. Recorded over a wide variety of habitats including *Triodia* hilltops (FMG04 and FMN19), *Triodia* hillslopes (FMG01), colluvial *Triodia* (FML06), *Triodia* sandplains (FMR07), mulga (FMR16), mixed mulga and cracking clay (FMR11), cracking clay (FMR12 and FMR15), snakewood (FMR18) and drainage lines (FMRMM). Recorded singly (n=9) and in pairs (n=2)

Little Eagle – *Aquila* (*Hieraaetus*) *morphnoides morphnoides*
Uncommon. Recorded from the Mindy Mindy and Mt Nicholas study areas over *Triodia* hilltops (FMG04), *Triodia* hillslopes (FMG01) and mulga (FMN18). Recorded singly (n=3).

Table 4.8: The birds recorded at each of the systematic sites during the survey of the Mindy Mindy study area. The number of birds and the recording rate (birds hr^{-1}) are shown for each site as well as the total for the study area.

Common Name	Total for Mindy Mindy	FMG01		FMG04		FMG05		FMG06		FMG07		FMG08	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Emu	1	1	0.38										
Stubble Quail	0												
Brown Quail	0												
Australian Shelduck	0												
White-faced Heron	0												
White-necked Heron	0												
Great Egret	0												
Straw-necked Ibis	0												
Black-shouldered Kite	0												
Black-breasted Buzzard	0												
Black Kite	0												
Whistling Kite	0												
Spotted Harrier	2	1	0.38			1	0.38						
Brown Goshawk	0												
Collared Sparrowhawk	0												
Wedge-tailed Eagle	3	1	0.38	2	1.00								
Little Eagle	2	1	0.38	1	0.50								
Brown Falcon	5	1	0.38	2	1.00	2	0.75						
Australian Hobby	0												
Black Falcon	0												
Peregrine Falcon	0												
Australian Kestrel	0												
Australian Bustard	0												
Little Button-quail	8					5	1.88		0.00	1	0.50	2	1.50
Inland Dotterel	0												
Common Bronzewing	0												
Crested Pigeon	0												
Spinifex Pigeon	4	2	0.75							2	1.00		
Diamond Dove	113	1	0.38	2	1.00	103	38.63	6	3.00	1	0.50		
Peaceful Dove	0												
Galah	5	3	1.13									2	1.50
Little Corella	0												
Cockatiel	0												
Australian Ringneck	3	2	0.75							1	0.50		
Budgerigar	147	21	7.88	26	13.00	54	20.25	31	15.50	12	6.00	3	2.25
Bourke's Parrot	0												

Common Name	Total for Mindy Mindy	FMG01		FMG04		FMG05		FMG06		FMG07		FMG08	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Elegant Parrot	0												
Pallid Cuckoo	5	2	0.75	2	1.00	1	0.38						
Black-eared Cuckoo	0												
Horsfield's Bronze Cuckoo	4					3	1.13	1	0.50				
Pheasant Coucal	0												
Southern Boobook	0												
Tawny Frogmouth	0												
Australian Owlet-nightjar	1			1	0.50								
Fork-tailed Swift	304	22	8.25			63	23.63	20	10.00	14	7.00	185	138.75
Blue-winged Kookaburra	0												
Red-backed Kingfisher	0												
Sacred Kingfisher	0												
Rainbow Bee-eater	2					2	0.75						
Variegated Fairy-wren	33	21	7.88			9	3.38	3	1.50				
White-winged Fairy-wren	18			1	0.50	11	4.13	4	2.00			2	1.50
Rufous-crowned Emu-wren	0												
Striated Grasswren	8							2	1.00	6	3.00		
Red-browed Pardalote	7	1	0.38			2	0.75	2	1.00	1	0.50	1	0.75
Striated Pardalote	1									1	0.50		
Redthroat	0												
Weebill	43	9	3.38	11	5.50	3	1.13	5	2.50	9	4.50	6	4.50
Western Gerygone	0												
Inland Thornbill	0												
Chestnut-rumped Thornbill	0												
Slaty-backed Thornbill	0												
Southern Whiteface	0												
Spiny-cheeked Honeyeater	0												
Yellow-throated Miner	8	3	1.13			2	0.75			2	1.00	1	0.75
Singing Honeyeater	14	2	0.75	1	0.50	7	2.63					4	3.00
Grey-headed Honeyeater	47	5	1.88	1	0.50	17	6.38	7	3.50	8	4.00	9	6.75
White-plumed Honeyeater	0												
Black-chinned Honeyeater	8					7	2.63	1	0.50				
Brown Honeyeater	77	8	3.00			48	18.00	9	4.50	3	1.50	9	6.75
Black Honeyeater	23					19	7.13	3	1.50			1	0.75
Pied Honeyeater	8					8	3.00						
Crimson Chat	1							1	0.50				
Red-capped Robin	0												
Hooded Robin	0												

Common Name	Total for Mindy Mindy	FMG01		FMG04		FMG05		FMG06		FMG07		FMG08	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Grey-crowned Babbler	0												
White-browed Babbler	0												
Chestnut-breasted Quail-thrush	0												
Varied Sittella	0												
Crested Bellbird	8					3	1.13	1	0.50	2	1.00	2	1.50
Rufous Whistler	12	3	1.13	1	0.50	5	1.88	1	0.50			2	1.50
Grey Shrike-thrush	11	1	0.38	5	2.50	1	0.38			1	0.50	3	2.25
Magpie-lark	0												
Grey Fantail	0												
White-tailed Fantail	0												
Willie Wagtail	10	2	0.75			2	0.75			5	2.50	1	0.75
Black-faced Cuckoo-shrike	18	1	0.38	3	1.50	6	2.25	6	3.00	2	1.00		
Ground Cuckoo-shrike	0												
White-winged Triller	30					21	7.88	4	2.00	5	2.50		
Masked Woodswallow	0												
Black-faced Woodswallow	32			3	1.50	13	4.88	6	3.00	8	4.00	2	1.50
Grey Butcherbird	1							1	0.50				
Pied Butcherbird	19	7	2.63	2	1.00	3	1.13	1	0.50	4	2.00	2	1.50
Australian Magpie	6			2	1.00	4	1.50						
Little Crow	0												
Torresian Crow	10	2	0.75	3	1.50	2	0.75					3	2.25
Singing Bushlark	0												
Australian Pipit	0												
Zebra Finch	155	14	5.25	12	6.00	86	32.25	30	15.00	11	5.50	2	1.50
Painted Finch	8	2	0.75	3	1.50	3	1.13						
Mistletoebird	0												
Tree Martin	8					7	2.63	1	0.50				
Fairy Martin	0												
Spinifex-bird	1	1	0.38										
Rufous Songlark	5					5	1.88						
Brown Songlark	0												
No. of species	**46**	**28**	**28**	**20**	**20**	**34**	**34**	**23**	**24**	**21**	**21**	**20**	**20**
No. of individuals	**1239**	**140**	**52.50**	**84**	**42.00**	**528**	**198.00**	**146**	**73.00**	**99**	**49.50**	**242**	**181.50**

FALCONIDAE (Falcons)

A total of 92 individuals of five species were recorded from this family during the combined surveys. This represents 1.2 % of all individuals and 4.8 % of all species recorded during those surveys.

Brown Falcon – *Falco berigora berigora*
Common. Recorded from the rail corridor and all of the mine areas. Recorded from a wide variety of habitats including *Triodia* hilltops (FMG04, FMN19), *Triodia* hillslopes (FMG01, FMN03), colluvial *Triodia* (FML03, FML05, FML06, FMN13 and FMN14), alluvial *Triodia* (FMC04), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMR69), mulga (FMN05), snakewood (FMR18), *Eulalia* tussock grassland (FML01), drainage lines (FMG05), cracking clay (FMR12 and FMR15) and Kondy Creek (FMR13). Primarily recorded singly (n=34), but also in pairs (n=2), in groups of three to six (n=3) or by call (n=1).

Australian Hobby – *Falco longipennis longipennis*
Uncommon. Only recorded from the rail corridor and Mt Lewin study area, from *Triodia* sandplains (FMR10), colluvial *Triodia* (FML06), mulga (FMR63) and mulga along drainage lines (FMR60). Recorded singly (n=3) and in pairs (n=1).

Black Falcon – *Falco subniger*
Rare. One record from the rail corridor, of a single bird seen in a *Triodia* sandplain (FMR10) on 10th July.

Peregrine Falcon – *Falco peregrinus macropus*
Scarce. Only recorded from the rail corridor, from *Triodia* sandplains (FMR10), *Acacia* shrubland on cracking clay (FMR14) and cracking clay (FMR12). Recorded singly (n=3).

Australian (Nankeen) Kestrel – *Falco cenchroides cenchroides*
Common. Recorded from the rail corridor and all of the mine areas except Mindy Mindy. Recorded from a wide variety of habitats including *Triodia* hilltops (FMC04, FMN19 and FMNMC001), *Triodia* hillslopes (FMN30), colluvial *Triodia* (FML03, FML05 and FMN13), *Triodia* sandplains (FMR07, FMR08, FMR10 and FMR65), mulga (FMN05, FMR63), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR12 and FMR15), drainage lines (FMC03), creeklines (FMR57) and Kondy Creek (FMR13). Mainly recorded singly (n=21), but also in pairs (n=4), groups of four (n=1) or by call (n=1).

OTIDIDAE (Bustards)

A total of 21 individuals of one species were recorded from this family during the combined surveys. This represents 0.3 % of all individuals and 1.0 % of all species recorded during those surveys.

Australian Bustard – *Ardeotis australis*
Common but only recorded in the rail corridor and Christmas Creek and Mt Nicholas study areas. Recorded from a variety of habitats including *Triodia* hilltops (FMN19), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01), *Acacia* shrubland on cracking clay (FMR14), mixed mulga and cracking clay (FMR17), cracking clay (FMR15), snakewood (FMR18), creeklines (FMC02 and FMR63). Recorded singly (n=5), in pairs (n=3), in groups of three (n=2) or from feathers (n=4).

TURNICIDAE (Button-quails)

A total of 58 individuals of one species were recorded from this family during the combined surveys. This represents 0.7 % of all individuals and 1.0 % of all species recorded during those surveys.

Little Button-quail – *Turnix velox*
Very common. Recorded from the rail corridor and all of the mine areas in a wide variety of habitats including *Triodia* hilltops (FMG07), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN14), *Triodia* sandplains (FMR07, FMR10 and

FMR65), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05, FMR16, FMR18 and FMR63), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), *Eulalia* tussock grassland (FML01), drainage lines (FMC03 and FMG05), creeklines (FMC02), burnt grassland (FMG08) and Kondy Creek (FMR13).

CHARADRIIDAE (Plovers)

Nine individuals of one species were recorded from this family during the combined surveys. This represents 0.1 % of all individuals and 1.0 % of all species recorded during those surveys.

Inland Dotterel – *Peltohyas* (*Charadrius*) *australis*

Uncommon and localised. The sole record is a group of nine birds seen on gibber plains in the Christmas Creek section of the rail corridor on 8th July.

COLUMBIDAE (Pigeons)

A total of 311 individuals of five species were recorded from this family during the combined surveys. This represents 3.9 % of all individuals and 4.8 % of all species recorded during those surveys.

Common Bronzewing – *Phaps chalcoptera*

Scarce. Only recorded from the rail corridor and Mt Nicholas study area, where single birds were seen on *Triodia* hillslopes (FMN30) on 15th July and in *Acacia* shrubland over stony *Triodia* (FMR69) on 23rd July.

Crested Pigeon – *Ocyphaps lophotes*

Very common. Recorded from the rail corridor and all of the mine areas except Mindy Mindy. Recorded in a wide variety of habitats including *Triodia* hilltops (FMC04), *Triodia* hillslopes (FML02, FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN14), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMR69), *Acacia* shrubland on cracking clay (FMR14), mulga (FMN05, FMR16 and FMR63), mulga along drainage lines (FMC05), mixed mulga and cracking clay (FMR11 and FMR17), snakewood (FMR18), *Eulalia* tussock grassland (FML01), gorges (FMR71) and Kulkinbah Creek (FMR01). Recorded singly (n=33), in pairs (n=14) and flocks of four to 13 (n=4).

Spinifex Pigeon – *Geophaps plumifera*

Uncommon, recorded only from the Mindy Mindy study area. Two birds were seen on a *Triodia* hilltop (FMG07) on 31st March, with another two birds on a *Triodia* hillslope (FMG01) on 2nd April.

Diamond Dove – *Geopelia cuneata*

Very common. Recorded from the rail corridor and all of the mine areas; particularly common at Mindy Mindy. Recorded from a wide variety of habitats including *Triodia* hilltops (FMG04, FMG06, FMG07, FMC04 and FMR73), *Triodia* hillslopes (FMG01 and FMN03), colluvial *Triodia* (FML05, FML06, FMN13 and FMN14), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01), *Acacia* shrubland on cracking clay (FMR14), mulga (FMN05 and FMN18), mulga along drainage lines (FMC05), gorges (FMR71), drainage lines (FMG05 and FMRMM) and Kondy Creek (FMR13). Recorded singly (n=36), in pairs (n=18), groups of three to four (n=10), flocks of five to 15 (n=9) or by call (n=9).

Peaceful Dove – *Geopelia striata placida*

Frequent. Only recorded from the rail corridor and the Christmas Creek study area, where detected in *Acacia* shrubland over stony *Triodia* (FMC01), *Triodia* hilltops (FMC04) and Kulkinbah Creek (FMR01). Recorded singly (n=1), in pairs (n=1), in groups of three to four (n=2) or by call (n=4).

Table 4.9: The birds recorded at each of the systematic sites during the survey of the Mount Nicholas study area. The Number of birds and the recording rate (birds hr^{-1}) are shown for each site as well as the total for the study area.

Common Name	Total for Mt Nicholas	FMN03		FMN05		FMN13		FMN14		FMN18		FMN19		FMN30		FMNMC001	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Emu	1									1	0.75						
Stubble Quail	0																
Brown Quail	0																
Australian Shelduck	0																
White-faced Heron	0																
White-necked Heron	0																
Great Egret	0																
Straw-necked Ibis	0																
Black-shouldered Kite	0																
Black-breasted Buzzard	0																
Black Kite	0																
Whistling Kite	1									1	0.75						
Spotted Harrier	0																
Brown Goshawk	1							1	0.75								
Collared Sparrowhawk	3									2	1.50					1	1.20
Wedge-tailed Eagle	1											1	1.50				
Little Eagle	1									1	0.75						
Brown Falcon	7	1	0.50	1	1.50	1	1.50	3	2.25			1	1.50				
Australian Hobby	0																
Black Falcon	0																
Peregrine Falcon	0																
Australian Kestrel	6			1	1.50	2	3.00					1	1.50	1	0.75	1	1.20
Australian Bustard	1											1	1.50				
Little Button-quail	15	3	1.50	5	7.50			3	2.25	3	2.25			1	0.75		
Inland Dotterel	0																
Common Bronzewing	1													1	0.75		
Crested Pigeon	20	11	5.50	5	7.50			2	1.50					2	1.50		
Spinifex Pigeon	0																
Diamond Dove	39	4	2.00	1	1.50	7	10.50	19	14.25	8	6.00						
Peaceful Dove	0																
Galah	5									5	3.75						
Little Corella	0																
Cockatiel	1									1	0.75						
Australian Ringneck	3	1	0.50	2	3.00												
Budgerigar	115	11	5.50	23	34.50	1	1.50	36	27.00	10	7.50	6	9.00	28	21.00		
Bourke's Parrot	0																
Elegant Parrot	0																
Pallid Cuckoo	8	2	1.00	1	1.50					2	1.50	1	1.50	2	1.50		
Black-eared Cuckoo	0																
Horsfield's Bronze Cuckoo	10	2	1.00	1	1.50			4	3.00	2	1.50			1	0.75		
Pheasant Coucal	0																

Common Name	Total for Mt Nicholas	FMN03		FMN05		FMN13		FMN14		FMN18		FMN19		FMN30		FMNMC001	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Southern Boobook	0																
Tawny Frogmouth	0																
Australian Owlet-nightjar	0																
Fork-tailed Swift	0																
Blue-winged Kookaburra	0																
Red-backed Kingfisher	1													1	0.75		
Sacred Kingfisher	0																
Rainbow Bee-eater	0																
Variegated Fairy-wren	34	1	0.50	8	12.00	3	4.50	4	3.00	14	10.50			4	3.00		
White-winged Fairy-wren	0																
Rufous-crowned Emu-wren	4	4	2.00														
Striated Grasswren	2															2	2.40
Red-browed Pardalote	0																
Striated Pardalote	0																
Redthroat	2									2	1.50						
Weebill	0																
Western Gerygone	8							1	0.75	7	5.25						
Inland Thornbill	0																
Chestnut-rumped Thornbill	12			2	3.00					10	7.50						
Slaty-backed Thornbill	5			3	4.50					2	1.50						
Southern Whiteface	5									5	3.75						
Spiny-cheeked Honeyeater	95	12	6.00	8	12.00	5	7.50	2	1.50	10	7.50	1	1.50	57	42.75		
Yellow-throated Miner	20	3	1.50	3	4.50	3	4.50	3	2.25					5	3.75	3	3.60
Singing Honeyeater	79	15	7.50	5	7.50	8	12.00	6	4.50	2	1.50	1	1.50	35	26.25	7	8.40
Grey-headed Honeyeater	0																
White-plumed Honeyeater	15	1	0.50	3	4.50	2	3.00	2	1.50					7	5.25		
Black-chinned Honeyeater	0																
Brown Honeyeater	7	1	0.50	1	1.50							2	3.00	2	1.50	1	1.20
Black Honeyeater	7					2	3.00							5	3.75		
Pied Honeyeater	0																
Crimson Chat	6			3	4.50									3	2.25		
Red-capped Robin	7			2	3.00					5	3.75						
Hooded Robin	2									2	1.50						
Grey-crowned Babbler	8			2	3.00			4	3.00	2	1.50						
White-browed Babbler	6									6	4.50						
Chestnut-breasted Quail-thrush	3													2	1.50	1	1.20
Varied Sittella	0																
Crested Bellbird	11	2	1.00	1	1.50	1	1.50	2	1.50	2	1.50			3	2.25		
Rufous Whistler	26	1	0.50	1	1.50	1	1.50	3	2.25	18	13.50	1	1.50	1	0.75		
Grey Shrike-thrush	2					1	1.50			1	0.75						
Magpie-lark	0																
Grey Fantail	1									1	0.75						
White-tailed Fantail	1									1	0.75						

Common Name	Total for Mt Nicholas	FMN03		FMN05		FMN13		FMN14		FMN18		FMN19		FMN30		FMNMC001	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Willie Wagtail	6	2	1.00	1	1.50									2	1.50	1	1.20
Black-faced Cuckoo-shrike	2													2	1.50		
Ground Cuckoo-shrike	5											4	6.00	1	0.75		
White-winged Triller	42	1	0.50	2	3.00			6	4.50	10	7.50			23	17.25		
Masked Woodswallow	336	10	5.00			45	67.50	180	135.00					95	71.25	6	7.20
Black-faced Woodswallow	68	22	11.00	4	6.00	1	1.50	19	14.25					22	16.50		
Grey Butcherbird	8	2	1.00	1	1.50	1	1.50	1	0.75	2	1.50			1	0.75		
Pied Butcherbird	6	1	0.50	1	1.50			2	1.50			1	1.50			1	1.20
Australian Magpie	2											2	3.00				
Little Crow	0																
Torresian Crow	1											1	1.50				
Singing Bushlark	0																
Australian Pipit	6			1	1.50			1	0.75			1	1.50	1	0.75	2	2.40
Zebra Finch	130	47	23.50	13	19.50	9	13.50	19	14.25	18	13.50	5	7.50	5	3.75	14	16.80
Painted Finch	0																
Mistletoebird	1					1	1.50										
Tree Martin	0																
Fairy Martin	0																
Spinifex-bird	4	4	2.00														
Rufous Songlark	13			5	7.50	1	1.50	4	3.00	1	0.75			2	1.50		
Brown Songlark	7			4	6.00							2	3.00	1	0.75		
No. of species	**61**	**25**	**25**	**31**	**31**	**19**	**19**	**24**	**24**	**32**	**32**	**17**	**17**	**30**	**30**	**12**	**12**
No. of individuals	**1245**	**164**	**82.00**	**114**	**171.0**	**95**	**142.5**	**327**	**245.3**	**157**	**117.8**	**32**	**48.00**	**316**	**237.0**	**40**	**48.00**

PSITTACIDAE (Parrots)

A total of 759 individuals of seven species were recorded from this family during the combined surveys. This represents 9.5 % of all individuals and 6.7 % of all species recorded during those surveys.

Galah – *Cacatua roseicapilla assimilis*
Abundant. Recorded from the rail corridor and all of the mine areas. Recorded from a wide variety of habitats including *Triodia* hillslopes (FMG01), colluvial *Triodia* (FML05 and FML06), alluvial *Triodia* (FML03), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01, FMR69), mulga (FMN18, FMR58, FMR63 and FMR67), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR12 and FMR15), burnt grassland (FMG08), drainage lines (FMC03), creeklines (FMR57), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded singly (n=4), in pairs (n=21), flocks of three and four (n=9), flocks of five to 30 (n=10) or by call (n=12).

Little Corella – *Cacatua sanguinea westralensis*
Uncommon. Only recorded from the rail corridor and Mt Lewin study area; a flock of eight was seen over *Acacia* shrubland on cracking clay (FMR14) on 6th July, and a pair was seen over colluvial *Triodia* (FML06) on 10th July.

Cockatiel – *Nymphicus hollandicus*
Very common. Recorded from the rail corridor and the Mt Lewin and Mt Nicholas study areas. Recorded from a variety of habitats such as colluvial *Triodia* (FML05), *Triodia* sandplains (FMR10), mulga (FMN18), mulga along drainage lines (FMR60), snakewood (FMR61), *Eulalia* tussock grassland (FML01), cracking clay (FMR12) and Kondy Creek (FMR13). Recorded singly (n=1), in pairs (n=2), flocks of four to 28 (n=6) or by call (n=4).

Australian Ringneck – *Platycercus* (*Barnadius*) *zonarius zonarius*
Common. Recorded from the rail corridor and all of the mine areas, from a variety of habitats including *Triodia* hilltops (FMC04 and FMG07), *Triodia* hillslopes (FMG01 and FMN03), colluvial *Triodia* (FML06), *Acacia* shrubland over stony *Triodia* (FMC01 and FMR69), mulga (FMN05 and FMR63), mulga along drainage lines (FMC05 and FMR60), cracking clay (FMR12), drainage lines (FMRMM), creeklines (FMC02 and FMR57), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded singly (n=7), in pairs (n=13), groups of three to four (n=3) or by call (n=4).

Budgerigar – *Melopsittacus undulatus*
Abundant. Recorded from the rail corridor and all of the mine areas; particularly abundant at Mindy Mindy and Mt Nicholas. Recorded in a very wide range of habitats including *Triodia* hilltops (FMC04, FMG04, FMG06, FMG07 and FMN19), *Triodia* hillslopes (FMG01, FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FML03 and FMN14), *Triodia* sandplains (FMR07, FMR10 and FMR65), *Acacia* shrubland over stony *Triodia* (FMC01 and FMR69), mulga (FMN05, FMN18, FMR16 and FMR58), mixed mulga and cracking clay (FMR11), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR12), snakewood (FMR18), *Eulalia* tussock grassland (FML01), burnt grassland (FMG08), drainage lines (FMC03 and FMG05) and Kondy Creek (FMR13). Recorded singly (n=16), in pairs (n=27), groups of three to four (n=15), flocks of five to 28 (n=23) or by call (n=43).

Bourke's Parrot – *Neophema* (*Neopsephotus*) *bourkii*
Uncommon. The only records are from the Mt Lewin study area, where four birds were seen in mulga on 7th July and three birds were seen in colluvial *Triodia* (FML06) on 11th July.

Elegant Parrot – *Neophema elegans*
Vagrant; far outside its normal range. The only record is a single bird, seen in a drainage line (FMC03) in the Christmas Creek study area on 10th July.

CUCULIDAE (Cuckoos)

A total of 67 individuals of four species were recorded from this family during the combined surveys. This represents 0.8 % of all individuals and 3.8 % of all species recorded during those surveys.

Pallid Cuckoo – *Cuculus pallidus*

Common. Recorded from the rail corridor and all of the mine areas, from a variety of habitats including *Triodia* hilltops (FMC04, FMG04 and FMN19), *Triodia* hillslopes (FMG01, FMN03 and FMN30), colluvial *Triodia* (FML05), *Triodia* sandplains (FMR10), mulga (FMN05, FMN18 and FMR16), mulga along drainage lines (FMC05), mixed mulga and cracking clay (FMR17), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR12) and drainage lines (FMG05). Recorded primarily by call (n=23) but also seen singly (n=2) and in pairs (n=1).

Black-eared Cuckoo – *Chrysococcyx osculans*

Rare. The sole record is a bird seen in *Acacia* shrubland on cracking clay (FMR14) in the rail corridor on 7th July.

Horsfield's Bronze-Cuckoo – *Chrysococcyx basalis*

Common. Recorded from the rail corridor and all of the mine areas, from a variety of habitats including *Triodia* hilltops (FMC04 and FMG06), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FML05 and FML06), alluvial *Triodia* (FMN14), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05, FMN18 and FMR16), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR15), snakewood (FMR18 and FMR61), drainage lines (FMG05), creeklines (FMC02) and Kondy Creek (FMR13). Recorded primarily by call (n=25) but also seen singly (n=4) and in pairs (n=2).

Pheasant Coucal – *Centropus phasianus highami*

Scarce. The only records are from a single bird heard in *Acacia* shrubland on cracking clay (FMR14) in the rail corridor on 6th and 7th July.

STRIGIDAE (Typical Owls)

One individual of one species was recorded from this family during the combined surveys. This represents <0.1 % of all individuals and 1.0 % of all species recorded during those surveys.

Boobook Owl (Southern Boobook) – *Ninox novaeseelandiae boobook*

Rare. Only recorded from the Christmas Creek study area, where a bird was flushed from mulga along a drainage line (FMC05) on 7th July. Nocturnal birds were infrequently sampled during the surveys, so the species almost certainly occurs in other parts of the study area as well and is probably more common than the single record suggests.

PODARGIDAE (Frogmouths)

A total of three individuals of one species were recorded from this family during the combined surveys. This represents <0.1 % of all individuals and 1.0 % of all species recorded during those surveys.

Tawny Frogmouth – *Podargus strigoides brachypterus*

Rare. Only recorded from the Christmas Creek study area; a group of three birds was flushed from groved mulga on 7th July. Nocturnal birds were infrequently sampled during the surveys, so the species almost certainly occurs in other parts of the study area as well and is probably more common than the single record suggests.

Table 4.10: The birds recorded at each of the systematic sites during the survey of the Mt Lewin study area. The number of birds and the recording rate (birds hr^{-1}) are shown for each site as well as the total for the study area.

Common Name	Total for Mt Lewin	FML01		FML02		FML03		FML05		FML06	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Emu	2	1	0.75							1	0.50
Stubble Quail	0										
Brown Quail	0										
Australian Shelduck	0										
White-faced Heron	0										
White-necked Heron	0										
Great Egret	0										
Straw-necked Ibis	0										
Black-shouldered Kite	0										
Black-breasted Buzzard	1							1	1.50		
Black Kite	0										
Whistling Kite	1									1	0.50
Spotted Harrier	1			1	1.50						
Brown Goshawk	1									1	0.50
Collared Sparrowhawk	0										
Wedge-tailed Eagle	1									1	0.50
Little Eagle	0										
Brown Falcon	25	1	0.75			9	13.50	14	21.00	1	0.50
Australian Hobby	1									1	0.50
Black Falcon	0										
Peregrine Falcon	0										
Australian Kestrel	3					1	1.50	2	3.00		
Australian Bustard	0										
Little Button-quail	7	1	0.75					1	1.50	5	2.50
Inland Dotterel	0										
Common Bronzewing	0										
Crested Pigeon	22	4	3.00	2	3.00			1	1.50	15	7.50
Spinifex Pigeon	0										
Diamond Dove	10							7	10.50	3	1.50
Peaceful Dove	0										
Galah	74					2	3.00	2	3.00	70	35.00
Little Corella	2									2	1.00
Cockatiel	44	5	3.75					39	58.50		
Australian Ringneck	7									7	3.50
Budgerigar	35	6	4.50			3	4.50	4	6.00	22	11.00
Bourke's Parrot	3									3	1.50
Elegant Parrot	0										

Common Name	Total for Mt Lewin	FML01		FML02		FML03		FML05		FML06	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Pallid Cuckoo	3							3	4.50		
Black-eared Cuckoo	0										
Horsfield's Bronze Cuckoo	4							1	1.50	3	1.50
Pheasant Coucal	0										
Southern Boobook	0										
Tawny Frogmouth	0										
Australian Owlet-nightjar	0										
Fork-tailed Swift	0										
Blue-winged Kookaburra	0										
Red-backed Kingfisher	4	1	0.75					3	4.50		
Sacred Kingfisher	0										
Rainbow Bee-eater	0										
Variegated Fairy-wren	6									6	3.00
White-winged Fairy-wren	5	5	3.75								
Rufous-crowned Emu-wren	0										
Striated Grasswren	0										
Red-browed Pardalote	0										
Striated Pardalote	0										
Redthroat	0										
Weebill	4			2	3.00	2	3.00				
Western Gerygone	1					1	1.50				
Inland Thornbill	0										
Chestnut-rumped Thornbill	0										
Slaty-backed Thornbill	0										
Southern Whiteface	0										
Spiny-cheeked Honeyeater	19					1	1.50	10	15.00	8	4.00
Yellow-throated Miner	3							3	4.50		
Singing Honeyeater	35	1	0.75	2	3.00	6	9.00	10	15.00	16	8.00
Grey-headed Honeyeater	0										
White-plumed Honeyeater	1					1	1.50				
Black-chinned Honeyeater	0										
Brown Honeyeater	4					3	4.50	1	1.50		
Black Honeyeater	1	1	0.75								
Pied Honeyeater	0										
Crimson Chat	25	3	2.25							22	11.00
Red-capped Robin	0										
Hooded Robin	0										
Grey-crowned Babbler	4									4	2.00
White-browed Babbler	0										

Common Name	Total for Mt Lewin	FML01		FML02		FML03		FML05		FML06	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Chestnut-breasted Quail-thrush	0										
Varied Sittella	0										
Crested Bellbird	12	2	1.50					5	7.50	5	2.50
Rufous Whistler	8	1	0.75			1	1.50	2	3.00	4	2.00
Grey Shrike-thrush	0										
Magpie-lark	1							1	1.50		
Grey Fantail	0										
White-tailed Fantail	0										
Willie Wagtail	8					1	1.50	1	1.50	6	3.00
Black-faced Cuckoo-shrike	2	1	0.75							1	0.50
Ground Cuckoo-shrike	0										
White-winged Triller	12									12	6.00
Masked Woodswallow	0										
Black-faced Woodswallow	23	6	4.50			8	12.00	2	3.00	7	3.50
Grey Butcherbird	4							3	4.50	1	0.50
Pied Butcherbird	5									5	2.50
Australian Magpie	0										
Little Crow	0										
Torresian Crow	3							1	1.50	2	1.00
Singing Bushlark	2	1	0.75	1	1.50						
Australian Pipit	0										
Zebra Finch	249	8	6.00			5	7.50	212	318.00	24	12.00
Painted Finch	1							1	1.50		
Mistletoebird	0										
Tree Martin	0										
Fairy Martin	0										
Spinifex-bird	0										
Rufous Songlark	5					1	1.50	3	4.50	1	0.50
Brown Songlark	0										
No. of species	**47**	**17**	**17**	**5**	**5**	**15**	**15**	**26**	**26**	**31**	**31**
No. of individuals	**694**	**48**	**36.00**	**8**	**12.00**	**45**	**67.50**	**333**	**499.50**	**260**	**130.00**

AEGOTHELIDAE (Owlet-nightjars)

One individual of one species was recorded from this family during the combined surveys. This represents <0.1 % of all individuals and 1.0 % of all species recorded during those surveys.

Australian Owlet-nightjar – *Aegotheles cristatus cristatus*

Rare. Only recorded from the Mindy Mindy study area, where one bird was flushed from rocks on a *Triodia* hilltop (FMG04) on 31st March. Nocturnal birds were infrequently sampled during the surveys, so the species almost certainly occurs in other parts of the study area as well and is probably more common than the single record suggests.

APODIDAE (Swifts)

A total of 304 individuals of one species were recorded from this family during the combined surveys. This represents 3.8 % of all individuals and 1.0 % of all species recorded during those surveys.

Fork-tailed Swift – *Apus pacificus pacificus*

Abundant. Only recorded from the Mindy Mindy study area, in association with storm fronts arising from ex-tropical Cyclone Fay. Recorded from a variety of habitats including *Triodia* hilltops (FMG06 and FMG07), *Triodia* hillslopes (FMG01), drainage lines (FMG05) and burnt grassland (FMG08), but likely over any habitat. Not recorded from the rail corridor or other mine areas, however these areas were surveyed when this migratory species is absent from Australia; it is likely to occur in other parts of the study area under suitable meteorological conditions. Recorded in pairs (n=2), small flocks of three to seven (n=9) or larger flocks of 20 to over 100 (n=5).

HALCYONIDAE (Woodland Kingfishers)

A total of 31 individuals of three species were recorded from this family during the combined surveys. This represents 0.4 % of all individuals and 2.9 % of all species recorded during those surveys.

Blue-winged Kookaburra – *Dacelo leachii leachii*

Frequent. Only recorded from the rail corridor, where it occurred in *Triodia* sandplains (FMR10), mixed mulga and cracking clay (FMR11), *Acacia* shrubland on cracking clay (FMR14), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded singly (n=1), in pairs (n=2) or by call (n=8).

Red-backed Kingfisher – *Todiramphus pyrropygia*

Frequent. Recorded from the rail corridor and all of the mine areas except Mindy Mindy. Found in *Triodia* hilltops (FMC04), *Triodia* hillslopes (FMN30), colluvial *Triodia* (FML05), *Triodia* sandplains (FMR10), *Eulalia* tussock grassland (FML01), cracking clay (FMR15), creeklines (FMR57), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded singly (n=8), in pairs (n=1) or by call (n=3).

Sacred Kingfisher – *Todiramphus sanctus sanctus*

Rare. Only recorded from the rail corridor, where the sole record is a bird seen along Kondy Creek (FMR13) on 8th July.

MEROPIDAE (Bee-eaters)

A total of 38 individuals of one species were recorded from this family during the combined surveys. This represents 0.5 % of all individuals and 1.0 % of all species recorded during those surveys.

Rainbow Bee-eater – *Merops ornatus*

Common. Recorded from the rail corridor and the Mindy Mindy and Christmas Creek study areas, from a variety of habitats including *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMR16 and FMR63), mulga along drainage lines (FMR60), mixed mulga and cracking clay (FMR17), snakewood (FMR61), creeklines (FMC02 and FMR57), drainage

lines (FMC03 and FMG05), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded singly (n=4), in pairs (n=7), flocks of six (n=1) or by call (n=14).

MALURIDAE (Fairy-wrens)

A total of 568 individuals of four species were recorded from this family during the combined surveys. This represents 7.1 % of all individuals and 3.8 % of all species recorded during those surveys.

Variegated Fairy-wren – *Malurus lamberti assimilis*

Abundant. Recorded from the rail corridor and all of the mine areas in a very wide range of habitats, including *Triodia* hilltops (FMC04), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FMN13), alluvial *Triodia* (FMN14), *Triodia* sandplains (FMR07 and FMR10), *Acacia* shrubland over stony *Triodia* (FMC01 and FMR69), mulga (FMN05, FMN18, FMR16, FMR58, FMR63 and FMR67), mulga along drainage lines (FMC05 and FMR60), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), gorges (FMR71), drainage lines (FMC03 and FMRMM), creeklines (FMC02) and Kondy Creek (FMR13). Recorded singly (n=5), in pairs (n=11), groups of three (n=24), groups of four (n=27), groups of five to six (n=17), groups of seven to 12 (n=3) or by call (n=2).

White-winged Fairy-wren – *Malurus leucopterus leuconotus*

Abundant. Recorded from the rail corridor and all of the mine areas except Mt Nicholas. Occurred in a very wide range of habitats including *Triodia* hilltops (FMC04 and FMR73), *Triodia* sandplains (FMR07, FMR10 and FMR65), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMR16 and FMR67), mulga along drainage lines (FMC05), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR12 and FMR15), snakewood (FMR18 and FMR61), *Eulalia* tussock grassland (FML01), drainage lines (FMC03) and creeklines (FMC02 and FMR57). Recorded singly (n=1), in pairs (n=2), groups of three (n=15), groups of four (n=12), groups of five to six (n=16), groups of eight to 10 (n=2) or by call (n=3).

Rufous-crowned Emu-wren – *Stipiturus ruficeps*

Uncommon and local. Only recorded from the Mt Nicholas study area, where three birds were seen on a *Triodia* hillslope (FMN03) on 12th July and a bird was heard at the same site on 15th July.

Striated Grasswren – *Amytornis striatus whitei*

Uncommon. Recorded from the Mindy Mindy and Mt Nicholas study areas from *Triodia* hilltops (FMG06, FMG07, FMNMC001). Recorded in pairs (n=2) or by call (n=3).

PARDALOTIDAE (Pardalotes)

A total of 21 individuals of two species were recorded from this family during the combined surveys. This represents 0.3 % of all individuals and 1.9 % of all species recorded during those surveys.

Red-browed Pardalote – *Pardalotus rubricatus*

Frequent. Recorded from the rail corridor and the Mindy Mindy and Christmas Creek mine areas. Recorded from *Triodia* hilltops (FMG06 and FMG07), *Triodia* hillslopes (FMG01), drainage lines (FMC03 and FMG05), creeklines (FMC02, FMR57 and FMR–MM), mulga along drainage lines (FMR63), gorges (FMR71), burnt grassland (FMG08) and Kondy Creek (FMR13). Recorded primarily by call (n=18) but also seen singly n=2).

Striated Pardalote – *Pardalotus striatus murchisoni*

Rare. Only recorded from the Mindy Mindy study area, where the only record is a single bird heard on a *Triodia* hilltop (FMG07) on 31st March.

Table 4.11: The birds recorded at each of the systematic sites during the survey of the Christmas Creek study area. The number of birds and the recording rate (birds hr^{-1}) are shown for each site as well as the total for the study area.

Common Name	Total for Christmas Creek	FMC01		FMC02		FMC03		FMC04		FMC05	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Emu	3	3	1.13								
Stubble Quail	0										
Brown Quail	0										
Australian Shelduck	0										
White-faced Heron	0										
White-necked Heron	0										
Great Egret	1			1	0.50						
Straw-necked Ibis	0										
Black-shouldered Kite	0										
Black-breasted Buzzard	0										
Black Kite	0										
Whistling Kite	2	1	0.38					1	0.75		
Spotted Harrier	3	1	0.38					1	0.75	1	0.50
Brown Goshawk	5			5	2.50						
Collared Sparrowhawk	0										
Wedge-tailed Eagle	0										
Little Eagle	0										
Brown Falcon	2							2	1.50		
Australian Hobby	0										
Black Falcon	0										
Peregrine Falcon	0										
Australian Kestrel	3					1	0.50	2	1.50		
Australian Bustard	3	1	0.38	2	1.00						
Little Button-quail	11	1	0.38	2	1.00	8	4.00				
Inland Dotterel	0										
Common Bronzewing	0										
Crested Pigeon	10					1	0.50	9	6.75		
Spinifex Pigeon	0										
Diamond Dove	3	1	0.38					1	0.75	1	0.50
Peaceful Dove	5	3	1.13					2	1.50		
Galah	5	1	0.38			4	2.00				
Little Corella	0										
Cockatiel	0										
Australian Ringneck	6	3	1.13	1	0.50			1	0.75	1	0.50
Budgerigar	43	12	4.50			5	2.50	26	19.50		
Bourke's Parrot	0										

Common Name	Total for Christmas Creek	FMC01		FMC02		FMC03		FMC04		FMC05	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Elegant Parrot	1					1	0.50				
Pallid Cuckoo	3							2	1.50	1	0.50
Black-eared Cuckoo	0										
Horsfield's Bronze Cuckoo	5	1	0.38	2	1.00			2	1.50		
Pheasant Coucal	0										
Southern Boobook	1									1	0.50
Tawny Frogmouth	0										
Australian Owlet-nightjar	0										
Fork-tailed Swift	0										
Blue-winged Kookaburra	0										
Red-backed Kingfisher	1							1	0.75		
Sacred Kingfisher	0										
Rainbow Bee-eater	11	3	1.13	2	1.00	6	3.00				
Variegated Fairy-wren	137	42	15.75	23	11.50	36	18.00	5	3.75	31	15.50
White-winged Fairy-wren	37			3	1.50	11	5.50	15	11.25	8	4.00
Rufous-crowned Emu-wren	0										
Striated Grasswren	0										
Red-browed Pardalote	5			2	1.00	3	1.50				
Striated Pardalote	0										
Redthroat	5			1	0.50	2	1.00			2	1.00
Weebill	16			4	2.00			2	1.50	10	5.00
Western Gerygone	7			2	1.00	1	0.50			4	2.00
Inland Thornbill	2	2	0.75								
Chestnut-rumped Thornbill	65	31	11.63	2	1.00	13	6.50			19	9.50
Slaty-backed Thornbill	6	2	0.75							4	2.00
Southern Whiteface	0										
Spiny-cheeked Honeyeater	104	5	1.88	5	2.50	79	39.50	8	6.00	7	3.50
Yellow-throated Miner	40					3	1.50	9	6.75	28	14.00
Singing Honeyeater	74	3	1.13	7	3.50	30	15.00	17	12.75	17	8.50
Grey-headed Honeyeater	0										
White-plumed Honeyeater	34	23	8.63	11	5.50						
Black-chinned Honeyeater	0										
Brown Honeyeater	42			2	1.00	28	14.00	5	3.75	7	3.50
Black Honeyeater	0										
Pied Honeyeater	0										
Crimson Chat	0										
Red-capped Robin	2	1	0.38							1	0.50
Hooded Robin	0										

Common Name	Total for Christmas Creek	FMC01		FMC02		FMC03		FMC04		FMC05	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Grey-crowned Babbler	6	4	1.50							2	1.00
White-browed Babbler	31	8	3.00	4	2.00	8	4.00			11	5.50
Chestnut-breasted Quail-thrush	2							2	1.50		
Varied Sittella	0										
Crested Bellbird	9	4	1.50	1	0.50	1	0.50	1	0.75	2	1.00
Rufous Whistler	39	17	6.38	10	5.00	2	1.00	1	0.75	9	4.50
Grey Shrike-thrush	5	5	1.88								
Magpie-lark	3	3	1.13								
Grey Fantail	0										
White-tailed Fantail	7	1	0.38							6	3.00
Willie Wagtail	7	4	1.50	1	0.50	1	0.50	1	0.75		
Black-faced Cuckoo-shrike	3	1	0.38	2	1.00						
Ground Cuckoo-shrike	0										
White-winged Triller	0										
Masked Woodswallow	0										
Black-faced Woodswallow	14	8	3.00	2	1.00			4	3.00		
Grey Butcherbird	9	4	1.50	2	1.00	1	0.50			2	1.00
Pied Butcherbird	3			1	0.50			2	1.50		
Australian Magpie	0										
Little Crow	0										
Torresian Crow	5			4	2.00			1	0.75		
Singing Bushlark	1					1	0.50				
Australian Pipit	2	1	0.38					1	0.75		
Zebra Finch	338	43	16.13	137	68.50	86	43.00	25	18.75	47	23.50
Painted Finch	0										
Mistletoebird	8	1	0.38	7	3.50						
Tree Martin	0										
Fairy Martin	0										
Spinifex-bird	1			1	0.50						
Rufous Songlark	5	1	0.38	1	0.50	2	1.00	1	0.75		
Brown Songlark	0										
No. of species	**56**	**35**	**35**	**31**	**31**	**25**	**25**	**29**	**29**	**24**	**24**
No. of individuals	**1201**	**245**	**91.88**	**250**	**125.00**	**334**	**167.00**	**150**	**112.50**	**222**	**111.00**

ACANTHIZIDAE (Scrubwrens, gerygones and thornbills)

A total of 255 individuals of seven species were recorded from this family during the combined surveys. This represents 3.2 % of all individuals and 6.7 % of all species recorded during those surveys.

Redthroat – *Pyrrholaemus brunneus*

Uncommon. Recorded from the Christmas Creek and Mt Nicholas study areas, where found in mulga (FMN18), mulga along drainage lines (FMC05), creeklines (FMC02) and drainages lines (FMC03). Recorded singly (n=5) or in pairs (n=1).

Weebill – *Smicrornis brevirostris*

Very common. Recorded from the rail corridor and all of the mine areas except Mt Nicholas; particularly common at Mindy Mindy. Recorded from *Triodia* hilltops (FMC04, FMG04, FMG06, FMG07, FMR73 and FMR75), *Triodia* hillslopes (FMG01 and FML02), alluvial *Triodia* (FML03), *Acacia* shrubland over stony *Triodia* (FMR69), mulga (FMR63), mulga along drainage lines (FMC05 and FMR60), gorges (FMR71), creeklines (FMC02, FMR57), drainage lines (FMG05) and burnt grassland (FMG08). Recorded primarily by call (n=28), but also seen singly (n=3), in pairs (n=11) or in groups of three (n=5).

Western Gerygone – *Gerygone fusca*

Common. Recorded from the rail corridor and all of the mine areas except Mindy Mindy. Found in colluvial *Triodia* (FMN13), *Acacia* shrubland over stony *Triodia* (FMR69), mulga (FMN18 and FMR16), mulga along drainage lines (FMC05), mixed cracking clay and mulga (FMR17), *Eulalia* tussock grassland (FML01), gorges (FMR71), creeklines (FMC02) and drainages lines (FMC03). Recorded primarily by call (n=16) but also singly (n=6) and in pairs (n=2).

Inland Thornbill – *Acanthiza apicalis*

Scarce. Only recorded from the Christmas Creek study area, where the sole record is a pair of birds seen in *Acacia* shrubland over stony *Triodia* (FMC01) on 6th July.

Chestnut-rumped Thornbill – *Acanthiza uropygialis*

Very common. Recorded from the rail corridor and the Christmas Creek and Mt Nicholas study areas. Found in *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05, FMN18, FMR16, FMR58, FMR63 and FMR67), mulga along drainage lines (FMC05), snakewood (FMR18 and FMR61), creeklines (FMC02), drainages lines (FMC03) and Kondy Creek (FMR13). Recorded singly (n=14), in pairs (n=33), groups of three (n=6) or groups of four (n=7).

Slaty-backed Thornbill – *Acanthiza robustirostris*

Frequent. Recorded from the Christmas Creek and Mt Nicholas study areas, from *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05 and FMN18) and mulga along drainage lines (FMC05). Recorded singly (n=4), in pairs (n=2) and groups of three (n=1).

Southern Whiteface – *Aphelocephala leucopsis castaneiventris*

Uncommon and local. Recorded only from the Mt Nicholas study area, where found only in mulga (FMN18). Recorded singly (n=3) or in pairs (n=1).

MELIPHAGIDAE (Honeyeaters)

A total of 1177 individuals of 10 species were recorded from this family during the combined surveys. This represents 14.8 % of all individuals and 9.5 % of all species recorded during those surveys.

Spiny-cheeked Honeyeater – *Acanthagenys rufogularis*

Abundant. Recorded from the rail corridor and all of the mine areas except Mindy Mindy, although it is likely to occur in the latter during suitable conditions. Recorded from a wide variety of habitats including *Triodia* hilltops (FMC04 and FMN19), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FML03 and FMN14), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01 and

FMR69), mulga (FMN05, FMN18, FMR16, FMR58, FMR63 and FMR67), mulga along drainage lines (FMC05 and FMR60), mixed mulga and cracking clay (FMR11), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR15), snakewood (FMR61), creeklines (FMC02 and FMR57), drainage lines (FMC03 and FMRMM) and Kondy Creek (FMR13). Most often recorded by call (n=115) or seen singly (n=105) but also seen in pairs (n=12), in groups of three to four (n=7) and in groups of five to six (n=3).

Yellow-throated Miner – *Manorina flavigula*
Very common. Recorded from the rail corridor and all of the mine areas in a wide range of habitats including *Triodia* hilltops (FMC04, FMG07, FMNMC001 and FMR59), *Triodia* hillslopes (FMG01, FMN03 and FMN30), colluvial *Triodia* (FML05 and FMN13), alluvial *Triodia* (FMN14), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMR69), mulga (FMN05), mulga along drainage lines (FMC05), mixed mulga and cracking clay (FMR17), *Acacia* shrubland on cracking clay (FMR14), burnt grassland (FMG08), gorges (FMR71), creeklines (FMR57), drainage lines (FMC03, FMG05 and FMRMM), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded mostly in pairs (n=8) or in groups of three (n=11) but also seen singly (n=1), in groups of four (n=2), flocks of seven to 14 (n=4) or recorded by call (n=9).

Singing Honeyeater – *Lichenostomus virescens*
Abundant. Recorded from the rail corridor and all of the mine areas in a very wide range of habitats including *Triodia* hilltops (FMC04, FMG04, FMN19, FMNMC001 and FMR73), *Triodia* hillslopes (FMG01, FML02, FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FML03 and FMN14), *Triodia* sandplains (FMR07, FMR08 and FMR10), *Acacia* shrubland over stony *Triodia* (FMC01 and FMR69), mulga (FMN05, FMN18, FMR16, FMR63 and FMR67), mulga along drainage lines (FMC05), mixed mulga and cracking clay (FMR11), *Acacia* shrubland on cracking clay (FMR14), cracking clay (FMR12), snakewood (FMR18 and FMR61), *Eulalia* tussock grassland (FML01), burnt grassland (FMG08), gorges (FMR71), creeklines (FMC02 and FMR57), drainage lines (FMC03, FMG05 and FMRMM) and Kondy Creek (FMR13). Recorded at 37 of the 50 sites surveyed systematically, with most of the sites where it was not recorded being sampled for an hour or less. Recorded primarily by call (n=154) or seen singly (n=82), less commonly seen in pairs (n=29), in groups of three (n=2) or groups of four (n=3).

Grey-headed Honeyeater – *Lichenostomus keartlandi*
Common. Recorded from the rail corridor and Mindy Mindy mine area; far more common in the latter. Recorded from *Triodia* hilltops (FMG04, FMR59 and FMR75), *Triodia* hillslopes (FMG01, FMG06 and FMG07), burnt grassland (FMG08), gorges (FMR71) and drainage lines (FMG05). Recorded singly (n=12), in pairs (n=7), in groups of three (n=2), flocks of eight (n=1) or by call (n=17).

White-plumed Honeyeater – *Lichenostomus penicillatus*
Very common. Recorded from the rail corridor and all of the mine areas except Mindy Mindy. Most common in *Triodia* hillslopes (FMN03 and FMN30), *Acacia* shrubland over stony *Triodia* (FMC01), creeklines (FMC02), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13) with scattered individuals recorded in colluvial *Triodia* (FMN13), alluvial *Triodia* (FML03, FMN14), mulga (FMN05), mulga along drainage lines (FMR60) and cracking clay (FMR12). Recorded primarily by call (n=44) or seen singly (n=34), less commonly seen in pairs (n=14), in groups of three (n=3) or groups of four to five (n=2).

Black-chinned Honeyeater – *Melithreptus gularis laetior*
Uncommon. Only recorded from the Mindy Mindy study area, where recorded in drainage lines (FMG05) and adjacent *Triodia* hilltops (FMG06). Recorded by call (n=4) with one record of a group of three (n=1).

Table 4.12: The birds recorded at each of the systematic sites during the survey of the eastern part of the Stage B rail corridor. The number of birds and the recording rate (birds hr^{-1}) are shown for each site as well as the total for that part of the rail corridor.

Common Name	Total for eastern Rail Corridor	FMR07		FMR08		FMR10		FMR11		FMR12		FMR13		FMR65	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Emu	2			1	1.50	1	0.50							1	1.00
Stubble Quail	5									5	2.50				
Brown Quail	0														
Australian Shelduck	0														
White-faced Heron	0														
White-necked Heron	0														
Great Egret	0														
Straw-necked Ibis	8											8	2.40		
Black-shouldered Kite	0														
Black-breasted Buzzard	0														
Black Kite	2					1	0.50					1	0.30		
Whistling Kite	11					1	0.50	1	0.75	1	0.50	8	2.40		
Spotted Harrier	2					1	0.50			1	0.50				
Brown Goshawk	6									2	1.00	4	1.20		
Collared Sparrowhawk	0														
Wedge-tailed Eagle	3	1	0.75					1	0.75	1	0.50				
Little Eagle	0														
Brown Falcon	11					6	3.00			2	1.00	3	0.90		
Australian Hobby	1					1	0.50								
Black Falcon	1					1	0.50								
Peregrine Falcon	2					1	0.50			1	0.50				
Australian Kestrel	10	1	0.75	1	1.50	2	1.00			2	1.00	4	1.20	2	2.00
Australian Bustard	3					3	1.50								
Little Button-quail	12	1	0.75			2	1.00	4	3.00			5	1.50	3	3.00
Inland Dotterel	0														
Common Bronzewing	0														
Crested Pigeon	23					21	10.50	2	1.50						
Spinifex Pigeon	0														
Diamond Dove	15					6	3.00					9	2.70		
Peaceful Dove	0														
Galah	66					29	14.50	2	1.50	26	13.00	9	2.70		
Little Corella	0														
Cockatiel	10					2	1.00			2	1.00	6	1.80		
Australian Ringneck	6									1	0.50	5	1.50		
Budgerigar	22	4	3.00			8	4.00	5	3.75	1	0.50	4	1.20	21	21.00
Bourke's Parrot	0														

Common Name	Total for eastern Rail Corridor	FMR07		FMR08		FMR10		FMR11		FMR12		FMR13		FMR65	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Elegant Parrot	0														
Pallid Cuckoo	3					2	1.00			1	0.50				
Black-eared Cuckoo	0														
Horsfield's Bronze Cuckoo	3					1	0.50	1	0.75			1	0.30		
Pheasant Coucal	0														
Southern Boobook	0														
Tawny Frogmouth	0														
Australian Owlet-nightjar	0														
Fork-tailed Swift	0														
Blue-winged Kookaburra	13					3	1.50	2	1.50			8	2.40		
Red-backed Kingfisher	3					2	1.00					1	0.30		
Sacred Kingfisher	1											1	0.30		
Rainbow Bee-eater	1											1	0.30		
Variegated Fairy-wren	46	5	3.75			15	7.50	6	4.50			20	6.00		
White-winged Fairy-wren	47	3	2.25			14	7.00	6	4.50	24	12.00			1	1.00
Rufous-crowned Emu-wren	0														
Striated Grasswren	0														
Red-browed Pardalote	3											3	0.90		
Striated Pardalote	0														
Redthroat	0														
Weebill	0														
Western Gerygone	0														
Inland Thornbill	0														
Chestnut-rumped Thornbill	4											4	1.20		
Slaty-backed Thornbill	0														
Southern Whiteface	0														
Spiny-cheeked Honeyeater	10					1	0.50	1	0.75			8	2.40		
Yellow-throated Miner	4					3	1.50					1	0.30		
Singing Honeyeater	21	3	2.25	1	1.50	3	1.50	6	4.50	1	0.50	7	2.10		
Grey-headed Honeyeater	0														
White-plumed Honeyeater	44									2	1.00	42	12.60		
Black-chinned Honeyeater	0														
Brown Honeyeater	0														
Black Honeyeater	9	3	2.25	6	9.00										
Pied Honeyeater	2	2	1.50												
Crimson Chat	25	5	3.75	20	30.00										
Red-capped Robin	1							1	0.75						
Hooded Robin	0														

Common Name	Total for eastern Rail Corridor	FMR07		FMR08		FMR10		FMR11		FMR12		FMR13		FMR65	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Grey-crowned Babbler	25					8	4.00			4	2.00	13	3.90		
White-browed Babbler	5											5	1.50		
Chestnut-breasted Quail-thrush	0														
Varied Sittella	0														
Crested Bellbird	14					3	1.50	4	3.00			7	2.10		
Rufous Whistler	24					3	1.50	5	3.75	1	0.50	15	4.50		
Grey Shrike-thrush	4							1	0.75			3	0.90		
Magpie-lark	7					2	1.00	1	0.75	2	1.00	2	0.60		
Grey Fantail	0														
White-tailed Fantail	0														
Willie Wagtail	20					5	2.50	3	2.25	3	1.50	9	2.70		
Black-faced Cuckoo-shrike	14					1	0.50	1	0.75	1	0.50	11	3.30		
Ground Cuckoo-shrike	0														
White-winged Triller	4					4	2.00								
Masked Woodswallow	70					70	35.00								
Black-faced Woodswallow	41	2	1.50			24	12.00	2	1.50	9	4.50	4	1.20		
Grey Butcherbird	2							2	1.50						
Pied Butcherbird	9					3	1.50	2	1.50			4	1.20		
Australian Magpie	1					1	0.50								
Little Crow	22									22	11.00				
Torresian Crow	9					1	0.50	4	3.00	1	0.50	3	0.90		
Singing Bushlark	44					1	0.50	6	4.50	37	18.50				
Australian Pipit	7							6	4.50	1	0.50				
Zebra Finch	457	30	22.50	6	9.00	164	82.00	27	20.25	99	49.50	131	39.30	5	5.00
Painted Finch	0														
Mistletoebird	1											1	0.30		
Tree Martin	0														
Fairy Martin	0														
Spinifex-bird	3					2	1.00					1	0.30		
Rufous Songlark	6			1	1.50	3	1.50					2	0.60		
Brown Songlark	8	3	2.25							5	2.50			1	1.00
No. of species	**62**	**13**	**13**	**7**	**7**	**41**	**41**	**26**	**26**	**28**	**28**	**39**	**39**	**7**	**7**
No. of individuals	**1258**	**63**	**47.25**	**36**	**54.00**	**425**	**212.50**	**102**	**76.50**	**258**	**129.00**	**374**	**112.20**	**34**	**34.00**

Brown Honeyeater – *Lichmera indistincta indistincta*
Very common. Recorded from the rail corridor and all of the mine areas, from a wide range of habitats including *Triodia* hilltops (FMC04, FMG01, FMG06, FMG07, FMN19, FMNMC001, FMR59 and FMR75), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FML05), alluvial *Triodia* (FML03), *Acacia* shrubland over stony *Triodia* (FMR69), mulga (FMN05 and FMR58), mulga along drainage lines (FMC05), burnt grassland (FMG08), gorges (FMR71), creeklines (FMC02 and FMR57) and drainage lines (FMC03 and FMG05). Most often recorded by call (n=62), singly (n=49) or in pairs (n=21), less commonly in groups of three (n=3) or groups of four (n=5).

Black Honeyeater – *Certhionyx niger*
Common. Recorded from the rail corridor and all of the mine areas except Christmas Creek. Found on *Triodia* hilltops (FMG06), *Triodia* hillslopes (FMN30), colluvial *Triodia* (FMN13), *Triodia* sandplains (FMR07 and FMR08), *Eulalia* tussock grassland (FML01), drainage lines (FMG05) and burnt grassland (FMG08). Recorded singly (n=13), in pairs (n=4) or by call (n=19).

Pied Honeyeater – *Certhionyx variegatus*
Uncommon. Recorded from the Mindy Mindy mine area, where a group of eight was seen in a drainage line (FMG05) on 30th March, and from the rail corridor, where two females were seen on a *Triodia* sandplain (FMR07) on 13th July.

Crimson Chat – *Epthianura tricolor*
Common. Recorded from the rail corridor and all of the mine areas except Christmas Creek. Recorded from *Triodia* hilltops (FMG06), *Triodia* hillslopes (FMN30), colluvial *Triodia* (FML06), *Triodia* sandplains (FMR07 and FMR08), mulga (FMN05) and *Eulalia* tussock grassland (FML01). Recorded singly (n=6), in pairs (n=4), groups of three to four (n=5) or flocks of eight to 20 (n=2).

PETROICIDAE (Robins)

A total of 21 individuals of two species were recorded from this family during the combined surveys. This represents 0.3 % of all individuals and 1.9 % of all species recorded during those surveys.

Red-capped Robin – *Petroica goodenovii*
Frequent. Recorded from the rail corridor and the Christmas Creek and Mt Nicholas mine areas. Detected in a variety of *Acacia*-dominated habitats such as *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05, FMN18 and FMR16), mulga along drainage lines (FMC05) and mixed mulga and cracking clay (FMR11). Recorded singly (n=7), in pairs (n=2) or by call (n=3).

Hooded Robin – *Petroica* (*Melanodryas*) *cucullata*
Uncommon. Recorded from the rail corridor and the Mt Nicholas mine area from mulga (FMN18), mixed mulga and cracking clay (FMR11) and snakewood (FMR18).

POMATOSTOMIDAE (Babblers)

A total of 111 individuals of two species were recorded from this family during the combined surveys. This represents 1.4 % of all individuals and 1.9 % of all species recorded during those surveys.

Grey-crowned Babbler – *Pomatostomus temporalis rubeculus*
Common. Recorded from the rail corridor and all of the mine areas except Mindy Mindy, from a wide range of habitats including colluvial *Triodia* (FML06 and FMN14), *Triodia* sandplain (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05 and FMN18), mulga along drainage lines (FMC05), cracking clay (FMR12), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded primarily by call (n=13) but also seen in pairs (n=2), in groups of three (n=1) and in groups of four (n=3).

White-browed Babbler – *Pomatostomus superciliosus*

Very common. Recorded from the rail corridor and the Christmas Creek and Mt Nicholas mine areas, from *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN18, FMR16 and FMR58), mulga along drainage lines (FMC05), snakewood (FMR18 and FMR61), creeklines (FMC02), drainage lines (FMC03) and Kondy Creek (FMR13). Recorded singly (n=1), in groups of three (n=5), groups of four (n=5), groups of five (n=4) and groups of nine (n=1).

CINCLOSOMATIDAE (Quail-thrushes)

Six individuals of one species were recorded from this family during the combined surveys. This represents 0.1 % of all individuals and 1.0 % of all species recorded during those surveys.

Chestnut-breasted Quail-thrush – *Cinclosoma castaneothorax marginatum*

Uncommon. Only recorded from the Christmas Creek and Mt Nicholas mine areas, where recorded solely from *Triodia* hilltops (FMC04, FMN30 and FMNMC001). Recorded singly (n=3) or in pairs (n=1).

NEOSITTIDAE (Sittellas)

Three individuals of one species were recorded from this family during the combined surveys. This represents <0.1 % of all individuals and 1.0 % of all species recorded during those surveys.

Varied Sittella – *Daphoenositta chrysoptera pileata*

Scarce. The only record is a group of three birds seen in mixed mulga and cracking clay (FMR17) in the rail corridor on 6th July.

PACHYCEPHALIDAE (Whistlers and shrike-thrushes)

A total of 268 individuals of three species were recorded from this family during the combined surveys. This represents 3.4 % of all individuals and 2.9 % of all species recorded during those surveys.

Crested Bellbird – *Oreoica gutturalis*

Very common. Recorded from the rail corridor and all of the mine areas, in a very wide range of habitats including *Triodia* hilltops (FMC04, FMG06, FMG07 and FMR59), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FMN14), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01 and FMR69), mulga (FMN05, FMN18, FMR16, FMR58, FMR63 and FMR67), mulga along drainage lines (FMC05), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), *Eulalia* tussock grassland (FML01), burnt grassland (FMG08), creeklines (FMC02), drainage lines (FMC03, FMG05 and FMRMM) and Kondy Creek (FMR13). Recorded primarily by call (n=68) but also seen singly (n=13).

Rufous Whistler – *Pachycephala rufiventris rufiventris*

Very common. Recorded from the rail corridor and all of the mine areas, in a very wide range of habitats including *Triodia* hilltops (FMC04, FMG04, FMG06, FMN19 and FMR73), *Triodia* hillslopes (FMG01, FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FML03 and FMN14), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01 and FMR69), mulga (FMN05, FMN18, FMR16, FMR58, FMR63 and FMR67), mulga along drainage lines (FMC05), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18 and FMR61), cracking clay (FMR12), *Eulalia* tussock grassland (FML01), burnt grassland (FMG08), gorges (FMR71), creeklines (FMC02), drainage lines (FMC03, FMG05 and FMRMM), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded primarily by call (n=89) or seen singly (n=54); less commonly seen in pairs (n=9) and groups of three (n=1).

Table 4.13: The birds recorded at each of the systematic sites during the survey of the east – central part of the Stage B rail corridor. The number of birds and the recording rate (birds hr^{-1}) are shown for each site as well as the total for that part of the rail corridor.

Common Name	Total for east-central Rail Corridor	FMR01		FMR14		FMR15		FMR16		FMR17		FMR18	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Emu	0												
Stubble Quail	0												
Brown Quail	21	15	11.25							6	2.25		
Australian Shelduck	0												
White-faced Heron	0												
White-necked Heron	0												
Great Egret	0												
Straw-necked Ibis	0												
Black-shouldered Kite	1			1	0.50								
Black-breasted Buzzard	0												
Black Kite	0												
Whistling Kite	1			1	0.50								
Spotted Harrier	5	1	0.75	3	1.50	1	0.75						
Brown Goshawk	0												
Collared Sparrowhawk	1											1	0.50
Wedge-tailed Eagle	4					1	0.75	1	0.75			2	1.00
Little Eagle	0												
Brown Falcon	3					2	1.50					1	0.50
Australian Hobby	0												
Black Falcon	0												
Peregrine Falcon	1			1	0.50								
Australian Kestrel	5			1	0.50	4	3.00						
Australian Bustard	13			3	1.50	8	6.00			1	0.38	1	0.50
Little Button-quail	8			1	0.50			1	0.75	2	0.75	4	2.00
Inland Dotterel	0												
Common Bronzewing	0												
Crested Pigeon	15	1	0.75	6	3.00			1	0.75	6	2.25	1	0.50
Spinifex Pigeon	0												
Diamond Dove	9			9	4.50								
Peaceful Dove	9	9	6.75										
Galah	43	9	6.75	14	7.00	16	12.00			4	1.50		
Little Corella	8			8	4.00								
Cockatiel	0												
Australian Ringneck	14	14	10.50										
Budgerigar	30			20	10.00			7	5.25			3	1.50

Common Name	Total for east-central Rail Corridor	FMR01		FMR14		FMR15		FMR16		FMR17		FMR18	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Bourke's Parrot	0												
Elegant Parrot	0												
Pallid Cuckoo	6			2	1.00			1	0.75	3	1.13		
Black-eared Cuckoo	1			1	0.50								
Horsfield's Bronze Cuckoo	9			3	1.50	1	0.75	1	0.75	1	0.38	3	1.50
Pheasant Coucal	2			2	1.00								
Southern Boobook	0												
Tawny Frogmouth	0												
Australian Owlet-nightjar	0												
Fork-tailed Swift	0												
Blue-winged Kookaburra	3	1	0.75	2	1.00								
Red-backed Kingfisher	2	1	0.75			1	0.75						
Sacred Kingfisher	0												
Rainbow Bee-eater	12	8	6.00					1	0.75	3	1.13		
Variegated Fairy-wren	65			5	2.50			11	8.25	5	1.88	44	22.00
White-winged Fairy-wren	75			20	10.00	18	13.50	4	3.00	8	3.00	25	12.50
Rufous-crowned Emu-wren	0												
Striated Grasswren	0												
Red-browed Pardalote	0												
Striated Pardalote	0												
Redthroat	0												
Weebill	0												
Western Gerygone	8							1	0.75	7	2.63		
Inland Thornbill	0												
Chestnut-rumped Thornbill	25							15	11.25			10	5.00
Slaty-backed Thornbill	0												
Southern Whiteface	0												
Spiny-cheeked Honeyeater	19			4	2.00	6	4.50	3	2.25			6	3.00
Yellow-throated Miner	7	1	0.75	1	0.50					2	0.75	3	1.50
Singing Honeyeater	57			21	10.50	9	6.75	9	6.75	12	4.50	6	3.00
Grey-headed Honeyeater	0												
White-plumed Honeyeater	26	26	19.50										
Black-chinned Honeyeater	0												
Brown Honeyeater	0												
Black Honeyeater	0												
Pied Honeyeater	0												
Crimson Chat	0												

Common Name	Total for east-central Rail Corridor	FMR01		FMR14		FMR15		FMR16		FMR17		FMR18	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Red-capped Robin	5							5	3.75				
Hooded Robin	3									2	0.75	1	0.50
Grey-crowned Babbler	3	3	2.25										
White-browed Babbler	14							5	3.75			9	4.50
Chestnut-breasted Quail-thrush	0												
Varied Sittella	3									3	1.13		
Crested Bellbird	18			6	3.00			6	4.50	3	1.13	3	1.50
Rufous Whistler	37	2	1.50	5	2.50			10	7.50	10	3.75	10	5.00
Grey Shrike-thrush	1			1	0.50								
Magpie-lark	3					1	0.75					2	1.00
Grey Fantail	0												
White-tailed Fantail	1							1	0.75				
Willie Wagtail	20			4	2.00	6	4.50			6	2.25	4	2.00
Black-faced Cuckoo-shrike	15	3	2.25	8	4.00			1	0.75	3	1.13		
Ground Cuckoo-shrike	0												
White-winged Triller	24			10	5.00	7	5.25			5	1.88	2	1.00
Masked Woodswallow	14									14	5.25		
Black-faced Woodswallow	73	3	2.25	11	5.50	2	1.50			33	12.38	24	12.00
Grey Butcherbird	6			1	0.50			1	0.75			4	2.00
Pied Butcherbird	11	1	0.75	2	1.00	3	2.25	1	0.75	3	1.13	1	0.50
Australian Magpie	3			3	1.50								
Little Crow	0												
Torresian Crow	6	1	0.75	1	0.50	2	1.50			2	0.75		
Singing Bushlark	131			104	52.00	7	5.25	5	3.75	7	2.63	8	4.00
Australian Pipit	0												
Zebra Finch	725	56	42.00	378	189.00	31	23.25	10	7.50	133	49.88	117	58.50
Painted Finch	0												
Mistletoebird	9	3	2.25	5	2.50							1	0.50
Tree Martin	0												
Fairy Martin	0												
Spinifex-bird	0												
Rufous Songlark	26	1	0.75	18	9.00	2	1.50	1	0.75	3	1.13	1	0.50
Brown Songlark	13			9	4.50	2	1.50			2	0.75		
No. of species	**57**	**20**	**20**	**38**	**38**	**21**	**21**	**24**	**24**	**28**	**28**	**28**	**28**
No. of individuals	**1672**	**159**	**119.25**	**695**	**347.50**	**130**	**97.50**	**102**	**76.50**	**289**	**108.38**	**297**	**148.50**

Grey Shrike-thrush – *Colluricincla harmonica rufiventris*
Common. Recorded from the rail corridor and all of the mine areas except Mt Lewin. Found on *Triodia* hilltops (FMG04 and FMG07), *Triodia* hillslopes (FMG01), colluvial *Triodia* (FMN13), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN18), mixed mulga and cracking clay (FMR11), *Acacia* shrubland on cracking clay (FMR14), burnt grassland (FMG08), drainage lines (FMG05) and Kondy Creek (FMR13). Recorded primarily by call (n=11) or seen singly (n=5); less commonly seen in pairs (n=1) and groups of five (n=1).

DICRURIDAE (Monarchs and fantails)

A total of 105 individuals of four species were recorded from this family during the combined surveys. This represents 1.3 % of all individuals and 3.8 % of all species recorded during those surveys.

Magpie-lark – *Grallina cyanoleuca*
Frequent. Recorded from the rail corridor and the Christmas Creek and Mt Lewin mine areas, where detected in colluvial *Triodia* (FML05), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01), mulga along drainage lines (FMR60), mixed mulga and cracking clay (FMR11), cracking clay (FMR12 and FMR15), snakewood (FMR18) and Kondy Creek (FMR13). Recorded singly (n=2), in pairs (n=4), in groups of three (n=1) or by call (n=2).

Grey Fantail – *Rhipidura fuliginosa preissi*
Rare. The only record is a single bird seen in mulga (FMN18) in the Mt Nicholas study area on 13th July.

White-tailed Fantail – *Rhipidura* (*fuliginosa*) *albicauda*
Uncommon. Recorded from the rail corridor and the Christmas Creek and Mt Nicholas mine areas from *Acacia*-dominated habitats such as *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN18 and FMR16) and mulga along drainage lines (FMC05). Recorded singly (n=9).

Willie Wagtail – *Rhipidura leucophrys*
Very common. Recorded from the rail corridor and all of the mine areas, from habitats including *Triodia* hilltops (FMC04, FMG07 and FMR73), *Triodia* hillslopes (FMG01, FMN03 and FMN30), colluvial *Triodia* (FML05 and FML06), alluvial *Triodia* (FML03), *Acacia* shrubland over stony *Triodia* (FMC01 and FMR69), mulga (FMN05 and FMR67), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18 and FMR61), cracking clay (FMR12 and FMR15), burnt grassland (FMG08), gorges (FMR71), creeklines (FMC02 and FMR57), drainage lines (FMC03, FMG05 and FMRMM) and Kondy Creek (FMR13). Recorded singly (n=45), in pairs (n=3) or by call (n=29).

CAMPEPHAGIDAE (Cuckoo-shrikes and trillers)

A total of 176 individuals of three species were recorded from this family during the combined surveys. This represents 2.2 % of all individuals and 2.9 % of all species recorded during those surveys.

Black-faced Cuckoo-shrike – *Coracina novaehollandiae*
Common. Recorded from the rail corridor and all of the mine areas, from a wide range of habitats such as *Triodia* hilltops (FMG04, FMG06 and FMG07), *Triodia* hillslopes (FMG01 and FMN30), colluvial *Triodia* (FML06), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMR16 and FMR63), mulga along drainage lines (FMR60), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR61), cracking clay (FMR12), *Eulalia* tussock grassland (FML01), gorges (FMR71), creeklines (FMC02), drainage lines (FMG05), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded primarily by call (n=24) but also seen singly (n=8), in pairs (n=9) and groups of three (n=3).

Table 4.14: The birds recorded at each of the systematic sites during the survey of the west – central part of the Stage B rail corridor. The number of birds and the recording rate (birds hr^{-1}) are shown for each site as well as the total for that part of the rail corridor.

Common Name	Total for west-central Rail Corridor	FMR57		FMR58		FMR59		FMR60		FMR61		FMR63	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Emu	0												
Stubble Quail	0												
Brown Quail	0												
Australian Shelduck	0												
White-faced Heron	0												
White-necked Heron	0												
Great Egret	0												
Straw-necked Ibis	0												
Black-shouldered Kite	0												
Black-breasted Buzzard	0												
Black Kite	0												
Whistling Kite	0												
Spotted Harrier	0												
Brown Goshawk	0												
Collared Sparrowhawk	0												
Wedge-tailed Eagle	0												
Little Eagle	0												
Brown Falcon	0												
Australian Hobby	3							1	3.00			2	2.00
Black Falcon	0												
Peregrine Falcon	0												
Australian Kestrel	5	1	1.00									4	4.00
Australian Bustard	1											1	1.00
Little Button-quail	1											1	1.00
Inland Dotterel	0												
Common Bronzewing	0												
Crested Pigeon	1											1	1.00
Spinifex Pigeon	0												
Diamond Dove	0												
Peaceful Dove	0												
Galah	5	2	2.00	2	2.00							1	1.00
Little Corella	0												
Cockatiel	18							9	27.00	9	9.00		
Australian Ringneck	5	1	1.00					3	9.00			1	1.00
Budgerigar	1			1	1.00								

Common Name	Total for west-central Rail Corridor	FMR57		FMR58		FMR59		FMR60		FMR61		FMR63	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Bourke's Parrot	0												
Elegant Parrot	0												
Pallid Cuckoo	0												
Black-eared Cuckoo	0												
Horsfield's Bronze Cuckoo	1									1	1.00		
Pheasant Coucal	0												
Southern Boobook	0												
Tawny Frogmouth	0												
Australian Owlet-nightjar	0												
Fork-tailed Swift	0												
Blue-winged Kookaburra	0												
Red-backed Kingfisher	2	2	2.00										
Sacred Kingfisher	0												
Rainbow Bee-eater	12	2	2.00					4	12.00	5	5.00	1	1.00
Variegated Fairy-wren	9			4	4.00			2	6.00			3	3.00
White-winged Fairy-wren	14	5	5.00							9	9.00		
Rufous-crowned Emu-wren	0												
Striated Grasswren	0												
Red-browed Pardalote	2	1	1.00									1	1.00
Striated Pardalote	0												
Redthroat	0												
Weebill	3	1	1.00					1	3.00			1	1.00
Western Gerygone	0												
Inland Thornbill	0												
Chestnut-rumped Thornbill	17			6	6.00					6	6.00	5	5.00
Slaty-backed Thornbill	0												
Southern Whiteface	0												
Spiny-cheeked Honeyeater	11	4	4.00	3	3.00			1	3.00	2	2.00	1	1.00
Yellow-throated Miner	11	9	9.00			2	3.00						
Singing Honeyeater	10	6	6.00							2	2.00	2	2.00
Grey-headed Honeyeater	3					3	4.50						
White-plumed Honeyeater	3							3	9.00				
Black-chinned Honeyeater	0												
Brown Honeyeater	16	11	11.00	2	2.00	3	4.50						
Black Honeyeater	0												
Pied Honeyeater	0												
Crimson Chat	0												

Common Name	Total for west-central Rail Corridor	FMR57		FMR58		FMR59		FMR60		FMR61		FMR63	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Red-capped Robin	1											1	1.00
Hooded Robin	0												
Grey-crowned Babbler	0												
White-browed Babbler	9			1	1.00					8	8.00		
Chestnut-breasted Quail-thrush	0												
Varied Sittella	0												
Crested Bellbird	5			2	2.00	1	1.50					2	2.00
Rufous Whistler	7			2	2.00					4	4.00	1	1.00
Grey Shrike-thrush	0												
Magpie-lark	1							1	3.00				
Grey Fantail	0												
White-tailed Fantail	0												
Willie Wagtail	2	1	1.00							1	1.00		
Black-faced Cuckoo-shrike	4							2	6.00	1	1.00	1	1.00
Ground Cuckoo-shrike	0												
White-winged Triller	0												
Masked Woodswallow	0												
Black-faced Woodswallow	5	4	4.00									1	1.00
Grey Butcherbird	4			1	1.00							3	3.00
Pied Butcherbird	7	4	4.00			2	3.00	1	3.00				
Australian Magpie	0												
Little Crow	0												
Torresian Crow	1							1	3.00				
Singing Bushlark	0												
Australian Pipit	0												
Zebra Finch	66	14	14.00	1	1.00			26	78.00	3	3.00	22	22.00
Painted Finch	0												
Mistletoebird	0												
Tree Martin	0												
Fairy Martin	0												
Spinifex-bird	0												
Rufous Songlark	0												
Brown Songlark	0												
No. of species	**35**	**16**	**16**	**11**	**11**	**5**	**5**	**13**	**13**	**12**	**12**	**21**	**21**
No. of individuals	**266**	**68**	**68.00**	**25**	**25.00**	**11**	**16.50**	**55**	**165.00**	**51**	**51.00**	**56**	**56.00**

Ground Cuckoo-shrike – *Coracina maxima*
Uncommon. Only recorded from the Mt Nicholas study area. The only records are a group of four birds seen on a *Triodia* hilltop (FMN19) on 12th July and a single bird on a *Triodia* hillslope (FMN30) on 15th July.

White-winged Triller – *Lalage tricolor*
Very common. Recorded from the rail corridor and all of the mine areas except Christmas Creek, from *Triodia* hilltops (FMG06 and FMG07), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FML06), alluvial *Triodia* (FMN14), *Triodia* sandplains (FMR10), mulga (FMN05 and FMN18), mixed mulga and cracking clay (FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), cracking clay (FMR15) and drainage lines (FMG05). Recorded mostly singly (n=25) and in pairs (n=16), but also seen in groups of three (n=2), groups of four (n=3), flocks of six to 12 (n=4) or recorded by call (n=4).

ARTAMIDAE (Woodswallows)

A total of 676 individuals of two species were recorded from this family during the combined surveys. This represents 8.5 % of all individuals and 1.9 % of all species recorded during those surveys.

Masked Woodswallow – *Artamus personatus*
Abundant. Recorded from the rail corridor and the Mt Nicholas study area; particularly abundant in the latter. Recorded from *Triodia* hilltops (FMNMC001), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FMN13), alluvial *Triodia* (FMN14), *Triodia* sandplains (FMR10) and mixed mulga and cracking clay (FMR17). Seen in flocks of six to 30 (n=6) or in flocks of 70 to 150 (n=3).

Black-faced Woodswallow – *Artamus cinereus melanops*
Abundant. Recorded from the rail corridor and all of the mine areas, from a very wide range of habitats including *Triodia* hilltops (FMC04, FMG04, FMG06 and FMG07), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FML03 and FMN14), *Triodia* sandplains (FMR07 and FMR10), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05 and FMR63), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), cracking clay (FMR12 and FMR15), *Eulalia* tussock grassland (FML01), burnt grassland (FMG08), creeklines (FMC02 and FMR57), drainage lines (FMG05), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Mostly recorded singly (n=39) or in pairs (n=26) but also seen in groups of three (n=12), groups of four to six (n=8), flocks of eight to 10 (n=4), flocks of 12 to 14 (n=3) and by call (n=8).

CRACTICIDAE (Butcherbirds and magpies)

A total of 116 individuals of three species were recorded from this family during the combined surveys. This represents 1.5 % of all individuals and 2.9 % of all species recorded during those surveys.

Grey Butcherbird – *Cracticus torquatus torquatus*
Common. Recorded from the rail corridor and all of the mine areas, from a range of habitats including *Triodia* hilltops (FMG06), *Triodia* hillslopes (FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FMN14), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05, FMN18, FMR16, FMR58, FMR63 and FMR67), mulga along drainage lines (FMC05), mixed mulga and cracking clay (FMR11), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), creeklines (FMC02) and drainage lines (FMC03). Recorded by call (n=24) or seen singly (n=14) or in pairs (n=1).

Pied Butcherbird – *Cracticus nigrogularis*
Very common. Recorded from the rail corridor and all of the mine areas, from a very wide range of habitats including *Triodia* hilltops (FMC04, FMG04, FMG06, FMG07, FMN19, FMNMC001 and FMR59), *Triodia* hillslopes (FMG01 and FMN03), colluvial *Triodia* (FML06), alluvial *Triodia* (FMN14), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMR69), mulga (FMN05, FMR16 and FMR67), mulga along drainage lines (FMR60), mixed

mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), cracking clay (FMR15), burnt grassland (FMG08), creeklines (FMC02 and FMR57), drainage lines (FMG05 and FMRMM), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded primarily by call (n=51) but also seen singly (n=6), in pairs (n=2) and groups of three (n=1).

Australian Magpie – *Cracticus* (*Gymnorhina*) *tibicen tibicen*
Frequent. Recorded from the rail corridor and the Mindy Mindy and Mt Nicholas mine areas, from *Triodia* hilltops (FMG04 and FMN19), *Triodia* sandplains (FMR10), *Acacia* shrubland on cracking clay (FMR14) and drainage lines (FMG05). Recorded by call (n=4), seen in pairs (n=2) or in groups of three (n=1).

CORVIDAE

A total of 69 individuals of three species were recorded from this family during the combined surveys. This represents 0.9 % of all individuals and 1.9 % of all species recorded during those surveys.

Little Crow – *Corvus bennetti*
Common. Recorded only from the rail corridor, where the two records are a flock of 22 seen flying over cracking clay (FMR12) on 7th July and a flock of 11 seen in (FMR71) on 23rd July.

Western (Torresian) Crow - *Corvus orru ceciliae*
Common. Recorded from the rail corridor and all of the mine areas, from *Triodia* hilltops (FMC04, FMG04 and FMN19), *Triodia* hillslopes (FMG01,), colluvial *Triodia* (FML05 and FML06), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMR69), mulga along drainage lines (FMR60), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), cracking clay (FMR12 and FMR15), burnt grassland (FMG08), creeklines (FMC02), drainage lines (FMG05), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded primarily by call (n=12) or seen singly (n=13), but also seen in pairs (n=2) or in groups of three to four (n=2).

ALAUDIDAE

A total of 178 individuals of one species were recorded from this family during the combined surveys. This represents 2.2 % of all individuals and 1.0 % of all species recorded during those surveys.

Singing Bushlark – *Mirafra javanica*
Abundant. Recorded from the rail corridor and the Christmas Creek and Mt Lewin mine areas, where recorded from *Triodia* hillslopes (FML02), *Triodia* sandplains (FMR10), mulga (FMR16), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), cracking clay (FMR12 and FMR15) and *Eulalia* tussock grassland (FML01). Typically seen singly (n=73) but also seen in pairs (n=9), groups of three to four (n=4), flocks of five to 10 (n=4), flocks of 15 to 25 (n=2) or recorded by call (n=5).

MOTACILLIDAE

Fifteen individuals of one species were recorded from this family during the combined surveys. This represents 0.2 % of all individuals and 1.0 % of all species recorded during those surveys.

Australian Pipit – *Anthus australis australis*
Frequent. Recorded from the rail corridor and the Christmas Creek and Mt Nicholas mine areas, from *Triodia* hilltops (FMC04, FMN19 and FMNMC001), *Triodia* hillslopes (FMN30), alluvial *Triodia* (FML03 and FMN14), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05), mixed mulga and cracking clay (FMR11 and FMR17) and cracking clay (FMR12). Recorded singly (n=1) or in pairs (n=2).

Table 4.15: The birds recorded at each of the systematic sites during the survey of the of the western part of the Stage B rail corridor. The number of birds and the recording rate (birds hr^{-1}) are shown for each site as well as the total for that part of the rail corridor.

Common Name	Total for western Rail Corridor	FMR67		FMR69		FMR71		FMR73		FMR75		FMRMM	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Emu	0												
Stubble Quail	0												
Brown Quail	0												
Australian Shelduck	1											1	1.20
White-faced Heron	0												
White-necked Heron	0												
Great Egret	0												
Straw-necked Ibis	0												
Black-shouldered Kite	0												
Black-breasted Buzzard	0												
Black Kite	0												
Whistling Kite	0												
Spotted Harrier	0												
Brown Goshawk	4					3	3.00					1	1.20
Collared Sparrowhawk	0												
Wedge-tailed Eagle	1											1	1.20
Little Eagle	0												
Brown Falcon	1			1	1.00								
Australian Hobby	0												
Black Falcon	0												
Peregrine Falcon	0												
Australian Kestrel	0												
Australian Bustard	0												
Little Button-quail	1	1	1.50										
Inland Dotterel	0												
Common Bronzewing	1			1	1.00								
Crested Pigeon	3			1	1.00	2	2.00						
Spinifex Pigeon	0												
Diamond Dove	8					2	2.00	5	7.50			1	1.20
Peaceful Dove	0												
Galah	3	1	1.50	2	2.00								
Little Corella	0												
Cockatiel	0												
Australian Ringneck	3			1	1.00							2	2.40
Budgerigar	1			1	1.00								
Bourke's Parrot	0												

Common Name	Total for western Rail Corridor	FMR67		FMR69		FMR71		FMR73		FMR75		FMRMM	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Elegant Parrot	0												
Pallid Cuckoo	0												
Black-eared Cuckoo	0												
Horsfield's Bronze Cuckoo	0												
Pheasant Coucal	0												
Southern Boobook	0												
Tawny Frogmouth	0												
Australian Owlet-nightjar	0												
Fork-tailed Swift	0												
Blue-winged Kookaburra	0												
Red-backed Kingfisher	0												
Sacred Kingfisher	0												
Rainbow Bee-eater	0												
Variegated Fairy-wren	17	2	3.00	4	4.00	3	3.00					8	9.60
White-winged Fairy-wren	10	9	13.50					1	1.50				
Rufous-crowned Emu-wren	0												
Striated Grasswren	0												
Red-browed Pardalote	3					1	1.00					2	2.40
Striated Pardalote	0												
Redthroat	0												
Weebill	12			3	3.00	4	4.00	1	1.50	4	4.00		
Western Gerygone	2			1	1.00	1	1.00						
Inland Thornbill	0												
Chestnut-rumped Thornbill	3	3	4.50										
Slaty-backed Thornbill	0												
Southern Whiteface	0												
Spiny-cheeked Honeyeater	30	2	3.00	4	4.00							24	28.80
Yellow-throated Miner	14			3	3.00	8	8.00					3	3.60
Singing Honeyeater	18	1	1.50	5	5.00	1	1.00	3	4.50			8	9.60
Grey-headed Honeyeater	6					3	3.00			3	3.00		
White-plumed Honeyeater	0												
Black-chinned Honeyeater	0												
Brown Honeyeater	34			2	2.00	6	6.00			1	1.00	25	30.00
Black Honeyeater	0												
Pied Honeyeater	0												
Crimson Chat	0												
Red-capped Robin	0												
Hooded Robin	0												

Common Name	Total for western Rail Corridor	FMR67		FMR69		FMR71		FMR73		FMR75		FMRMM	
		No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr	No.	No./hr
Grey-crowned Babbler	0												
White-browed Babbler	0												
Chestnut-breasted Quail-thrush	0												
Varied Sittella	0												
Crested Bellbird	4	1	1.50	2	2.00							1	1.20
Rufous Whistler	11	3	4.50	3	3.00	4	4.00	1	1.50				
Grey Shrike-thrush	0												
Magpie-lark	0												
Grey Fantail	0												
White-tailed Fantail	0												
Willie Wagtail	7	1	1.50	2	2.00	1	1.00	2	3.00			1	1.20
Black-faced Cuckoo-shrike	1					1	1.00						
Ground Cuckoo-shrike	0												
White-winged Triller	0												
Masked Woodswallow	0												
Black-faced Woodswallow	0												
Grey Butcherbird	6	3	4.50	3	3.00								
Pied Butcherbird	4	1	1.50	1	1.00							2	2.40
Australian Magpie	0												
Little Crow	11					11	11.00						
Torresian Crow	1			1	1.00								
Singing Bushlark	0												
Australian Pipit	0												
Zebra Finch	65	5	7.50	2	2.00	18	18.00	3	4.50			37	44.40
Painted Finch	22			8	8.00	10	10.00			4	4.00		
Mistletoebird	0												
Tree Martin	0												
Fairy Martin	0												
Spinifex-bird	6	2	3.00	2	2.00							2	2.40
Rufous Songlark	0												
Brown Songlark	0												
No. of species	**33**	**14**	**14**	**22**	**22**	**17**	**17**	**7**	**7**	**4**	**4**	**16**	**16**
No. of individuals	**314**	**35**	**52.50**	**53**	**53.00**	**79**	**79.00**	**16**	**24.00**	**12**	**12.00**	**119**	**142.80**

PASSERIDAE

A total of 2221 individuals of two species were recorded from this family during the combined surveys. This represents 27.8 % of all individuals and 1.9 % of all species recorded during those surveys.

Zebra Finch – *Taeniopygia guttata castanotis*

Very abundant. Recorded from all of the mine areas and the rail corridor; particularly abundant in the latter. Recorded from a very wide range of habitats including *Triodia* hilltops (FMC04, FMG04, FMG06, FMG07, FMN19, FMNMC001 and FMR73), *Triodia* hillslopes (FMG01, FMN03 and FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FML03 and FMN14), *Triodia* sandplains (FMR07, FMR08, FMR10 and FMR65), *Acacia* shrubland over stony *Triodia* (FMC01 and FMR69), mulga (FMN05, FMN18, FMR16, FMR58, FMR63 and FMR67), mulga along drainage lines (FMC05 and FMR60), mixed mulga and cracking clay (FMR11 and FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18 and FMR61), cracking clay (FMR12 and FMR15), *Eulalia* tussock grassland (FML01), burnt grassland (FMG08), gorges (FMR71), creeklines (FMC02 and FMR57), drainage lines (FMC03, FMG05 and FMRMM), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Ubiquitous and recorded from 40 of the 50 sites surveyed systematically. Recorded singly (n=29), in pairs (n=111), in groups of three (n=54), groups of four (n=49), flocks of five to 10 (n=90), flocks of 11 to 30 (n=33), flocks of 31 to 50 (n=4) or by call (n=114).

Painted Finch – *Emblema pictum*

Common. Recorded from the rail corridor and the Mindy Mindy and Mt Lewin mine areas, from *Triodia* hilltops (FMG04 and FMR75), *Triodia* hillslopes (FMG01), colluvial *Triodia* (FML05), *Acacia* shrubland over stony *Triodia* (FMR69), gorges (FMR71) and drainage lines (FMG05). Recorded singly (n=8), in pairs (n=4), in groups of four (n=2) or by call (n=7).

DICAEIDAE

Nineteen individuals of one species were recorded from this family during the combined surveys. This represents 0.2 % of all individuals and 1.0 % of all species recorded during those surveys.

Mistletoebird – *Dicaeum hirundinaceum hirundinaceum*

Frequent. Recorded from the rail corridor and the Christmas Creek and Mt Nicholas mine areas, from colluvial *Triodia* (FMN13), *Acacia* shrubland over stony *Triodia* (FMC01), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), creeklines (FMC02), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded singly (n=6) or by call (n=13).

HIRUNDINIDAE

A total of 34 individuals of two species were recorded from this family during the combined surveys. This represents 0.4 % of all individuals and 1.9 % of all species recorded during those surveys.

Tree Martin – *Hirundo* (*Cecropis*) *nigricans nigricans*

Uncommon. Only recorded from the Mindy Mindy study area, where seen over *Triodia* hilltops (FMG06) and drainage lines (FMG05). Recorded singly (n=2) or in flocks of six (n=1).

Fairy Martin – *Hirundo* (*Cecropis*) *ariel*

Common. Recorded from a number of nests in the Mount Lewin tenement and a flock of 25 birds seen flying over cracking clay in the rail corridor on 10th July.

SYLVIIDAE

A total of 104 individuals of three species were recorded from this family during the combined surveys. This represents 1.3 % of all individuals and 2.9 % of all species recorded during those surveys.

Table 4.16: The number of species and the total number of birds recorded in each section of the FMG Stage B study area. The total number of each species is also shown for the entire study area.

Common Name	Grand Total	Total for Mindy Mindy	Total for Mt Nicholas	Total for Mt Lewin	Total for Christmas Creek	Total for eastern Rail Corridor	Total for east-central Rail Corridor	Total for west-central Rail Corridor	Total for western Rail Corridor	Opportunistic
Emu	14	1	1	2	3	2		1		4
Stubble Quail	5					5				
Brown Quail	21						21			
Australian Shelduck	1								1	
White-faced Heron	1									1
White-necked Heron	2									2
Great Egret	1				1					
Straw-necked Ibis	8					8				
Black-shouldered Kite	2						1			1
Black-breasted Buzzard	2			1						1
Black Kite	2					2				
Whistling Kite	16		1	1	2	11	1			
Spotted Harrier	13	2		1	3	2	5			
Brown Goshawk	17		1	1	5	6			4	
Collared Sparrowhawk	5		3				1			1
Wedge-tailed Eagle	13	3	1	1		3	4		1	
Little Eagle	4	2	1							1
Brown Falcon	54	5	7	25	2	11	3		1	
Australian Hobby	5			1		1		3		
Black Falcon	1					1				
Peregrine Falcon	3					2	1			
Australian Kestrel	34		6	3	3	10	5	7		
Australian Bustard	21		1		3	3	13	1		
Little Button-quail	66	8	15	7	11	12	8	4	1	
Inland Dotterel	9									9
Common Bronzewing	2		1						1	
Crested Pigeon	94		20	22	10	23	15	1	3	
Spinifex Pigeon	4	4								
Diamond Dove	197	113	39	10	3	15	9		8	
Peaceful Dove	14				5		9			
Galah	206	5	5	74	5	66	43	5	3	
Little Corella	10			2			8			
Cockatiel	73		1	44		10		18		
Australian Ringneck	47	3	3	7	6	6	14	5	3	
Budgerigar	415	147	115	35	43	22	30	22	1	

Common Name	Grand Total	Total for Mindy Mindy	Total for Mt Nicholas	Total for Mt Lewin	Total for Christmas Creek	Total for eastern Rail Corridor	Total for east-central Rail Corridor	Total for west-central Rail Corridor	Total for western Rail Corridor	Opportunistic
Bourke's Parrot	7			3						4
Elegant Parrot	1				1					
Pallid Cuckoo	28	5	8	3	3	3	6			
Black-eared Cuckoo	1						1			
Horsfield's Bronze Cuckoo	36	4	10	4	5	3	9	1		
Pheasant Coucal	2						2			
Southern Boobook	1				1					
Tawny Frogmouth	3									3
Australian Owlet-nightjar	1	1								
Fork-tailed Swift	304	304								
Blue-winged Kookaburra	16					13	3			
Red-backed Kingfisher	13		1	4	1	3	2	2		
Sacred Kingfisher	2					1				1
Rainbow Bee-eater	38	2			11	1	12	12		
Variegated Fairy-wren	347	33	34	6	137	46	65	9	17	
White-winged Fairy-wren	207	18		5	37	47	75	15	10	
Rufous-crowned Emu-wren	4		4							
Striated Grasswren	10	8	2							
Red-browed Pardalote	20	7			5	3		2	3	
Striated Pardalote	1	1								
Redthroat	7		2		5					
Weebill	78	43		4	16			3	12	
Western Gerygone	26		8	1	7		8		2	
Inland Thornbill	2				2					
Chestnut-rumped Thornbill	126		12		65	4	25	17	3	
Slaty-backed Thornbill	11		5		6					
Southern Whiteface	5		5							
Spiny-cheeked Honeyeater	288		95	19	104	10	19	11	30	
Yellow-throated Miner	107	8	20	3	40	4	7	11	14	
Singing Honeyeater	308	14	79	35	74	21	57	10	18	
Grey-headed Honeyeater	56	47						3	6	
White-plumed Honeyeater	123		15	1	34	44	26	3		
Black-chinned Honeyeater	8	8								
Brown Honeyeater	180	77	7	4	42			16	34	
Black Honeyeater	40	23	7	1		9				
Pied Honeyeater	10	8				2				
Crimson Chat	57	1	6	25		25				

Common Name	Grand Total	Total for Mindy Mindy	Total for Mt Nicholas	Total for Mt Lewin	Total for Christmas Creek	Total for eastern Rail Corridor	Total for east-central Rail Corridor	Total for west-central Rail Corridor	Total for western Rail Corridor	Opportunistic
Red-capped Robin	16		7		2	1	5	1		
Hooded Robin	5		2				3			
Grey-crowned Babbler	46		8	4	6	25	3			
White-browed Babbler	65		6		31	5	14	9		
Chestnut-breasted Quail-thrush	6		3		2					1
Varied Sittella	3						3			
Crested Bellbird	81	8	11	12	9	14	18	5	4	
Rufous Whistler	164	12	26	8	39	24	37	7	11	
Grey Shrike-thrush	23	11	2		5	4	1			
Magpie-lark	15			1	3	7	3	1		
Grey Fantail	1		1							
White-tailed Fantail	9		1		7		1			
Willie Wagtail	80	10	6	8	7	20	20	2	7	
Black-faced Cuckoo-shrike	59	18	2	2	3	14	15	4	1	
Ground Cuckoo-shrike	5		5							
White-winged Triller	112	30	42	12		4	24			
Masked Woodswallow	420		336			70	14			
Black-faced Woodswallow	256	32	68	23	14	41	73	5		
Grey Butcherbird	40	1	8	4	9	2	6	4	6	
Pied Butcherbird	64	19	6	5	3	9	11	7	4	
Australian Magpie	12	6	2			1	3			
Little Crow	33					22			11	
Torresian Crow	36	10	1	3	5	9	6	1	1	
Singing Bushlark	178			2	1	44	131			
Australian Pipit	15		6		2	7				
Zebra Finch	2190	155	130	249	338	457	725	71	65	
Painted Finch	31	8		1					22	
Mistletoebird	19		1		8	1	9			
Tree Martin	8	8								
Fairy Martin	26									26
Spinifex-bird	15	1	4		1	3			6	
Rufous Songlark	60	5	13	5	5	6	26			
Brown Songlark	29		7			8	13	1		
No. of species	**105**	**46**	**61**	**47**	**56**	**62**	**57**	**35**	**33**	**13**
No. of individuals	**7978**	**1239**	**1306**	**741**	**1257**	**1320**	**1729**	**335**	**347**	**55**

Spinifexbird – *Eremiornis carteri*
Frequent. Recorded from the rail corridor and all of the mine areas except Mt Lewin, from *Triodia* hillslopes (FMG01, FMN03 and FMN30), *Triodia* sandplains (FMR10), *Acacia* shrubland over stony *Triodia* (FMR69), mulga (FMR67), gorges (FMR71), creeklines (FMC02) and Kondy Creek (FMR13). Recorded singly (n=5), in pairs (n=1) or by call (n=8).

Rufous Songlark – *Cincloramphus mathewsi*
Common. Recorded from the rail corridor and all of the mine areas, from *Triodia* hilltops (FMC04), *Triodia* hillslopes (FMN30), colluvial *Triodia* (FML05, FML06 and FMN13), alluvial *Triodia* (FML03 and FMN14), *Triodia* sandplains (FMR08 and FMR10), *Acacia* shrubland over stony *Triodia* (FMC01), mulga (FMN05, FMN18 and FMR16), mixed mulga and cracking clay (FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18), cracking clay (FMR15), creeklines (FMC02), drainage lines (FMC03 and FMG05), Kulkinbah Creek (FMR01) and Kondy Creek (FMR13). Recorded singly (n=34), in pairs (n=3) or by call (n=20).

Brown Songlark – *Cincloramphus cruralis*
Common. Recorded from the rail corridor and the Mt Nicholas study area, from *Triodia* hilltops (FMN19), *Triodia* hillslopes (FMN30), *Triodia* sandplains (FMR07 and FMR65), mulga (FMN05), mixed mulga and cracking clay (FMR17), *Acacia* shrubland on cracking clay (FMR14), snakewood (FMR18) and cracking clay (FMR12 and FMR15). Recorded singly (n=15), in pairs (n=4), in groups of three (n=1) or by call (n=3).

4.4.3 Discussion

The survey recorded 105 species of avifauna from the survey areas. The survey of the FMG Stage B rail corridor and associated mine areas added 11 species of avifauna to the tally recorded during previous surveys of the Hope Downs rail corridor (Biota 2002, 2004a and 2004b) and the FMG Stage A rail corridor (Biota 2004c). One additional species (the Elegant Parrot) probably reflects the ever-present potential for vagrancy in a highly mobile group of organisms such as birds. An additional three species (the Australian Shelduck, Black Falcon and Inland Dotterel) are rare in the east Pilbara and are likely to be missed during any given survey. A further four species (the Bourke's Parrot, Redthroat, Southern Whiteface and Ground Cuckoo-shrike) are primarily mulga species and were probably recorded for the first time because mulga habitats are far more extensive in this study area than in previous study areas further to the west. It is not clear why the last two species (Brown Quail and Black-chinned Honeyeater) were recorded for the first time during this survey, but stochastic events predict that some uncommon species will only be recorded infrequently.

The relatively high proportion of species recorded for the first time suggests that the species inventory is unlikely to be complete for the FMG Stage B study area. This is in contrast to the herpetofauna and mammals, where far fewer species were recorded for the first time, and probably reflects the great fluctuations in avifaunal composition and abundance with seasonal conditions and the ability of birds to move large distances. It is expected that the seasonal survey planned for 2005 would add additional species and ensure that the species inventory is more complete.

4.5 Non-Volant Mammals

4.5.1 Species Assemblage

The survey recorded 23 species of non-volant mammals, comprising one member of the family Tachyglossidae (echidnas), eight Dasyuridae (carnivorous marsupials), three Macropodidae (kangaroos and wallabies), five native and one introduced Muridae (murid rodents), two Equidae (horses and donkeys), one Camelidae (camels), one Felidae (cats) and one Canidae (dogs).

4.5.2 Annotated List

Tables 4.17 to 4.22 of this annotated list tabulate the mammal records from each trapping grid. Each species is discussed individually in the following.

TACHYGLOSSIDAE (Echidnas)

Assuming each secondary sign equated to one individual, one individual of one species was recorded from this family during the combined surveys. This represents 0.3 % of all records and 4.2 % of all species recorded during those surveys.

Echidna *Tachyglossus aculeatus*

This species was recorded from several diggings near about the base of the breakaway at FMN34 in the Mt Nicholas study area.

DASYURIDAE (Carnivorous marsupials)

Assuming each secondary sign equated to one individual, a total of 68 individuals of eight species were recorded from this family during the combined surveys. This represents 20.1 % of all records and 29.2 % of all species recorded during those surveys.

Mulgara *Dasycercus cristicauda*

Diggings, scats and tracks were observed in the *Triodia schinzii* sandplain in the vicinity of FMR08 in the rail corridor. A search through the area located a number of recent diggings, though actual burrows were not located.

Little Red Kaluta *Dasykaluta rosamondae*

A single individual recorded from the *Triodia schinzii* sandplain in the rail corridor at FMR07.

Northern Quoll *Dasyurus hallucatus*

A single record of a scat belonging to this species seen at the breakaway at FMN34 in the Mt Nicholas study area.

Pilbara Ningaui *Ningaui timealeyi*

During the current survey this species was recorded on four occasions from *Triodia longiceps* on calcareous loams at FML03 in the Mt Lewin study area.

Planigale *Planigale* sp

Recorded from the rail corridor. Confined to clay soils, with most records coming from the tussock grasslands on cracking clay (FMR11, 3 records; FMR12, 1 record; FMR14, 3 records; and FMR15, 2 records), but also from snakewood (FMR18, 1 record) and mulga woodland (FMR16, 4 records).

Striped-faced Dunnart *Sminthopsis macroura*

Second most commonly trapped mammal with 42 records. Recorded from the rail corridor and all of the mine areas except Mindy Mindy. Found in a range of habitats, though most records were from clay substrates particularly tussock grassland on cracking clay (FMR11, 4 records; FMR12, 10 records; FMR14, 2 records; FMR15, 2 records) and mulga associations (FMN05, 1 record; FMN18, 2 records; FMR16, 4 records; FMR17, 3 records). Also recorded from clay loams in creeklines (FMR01, 5 records; FMR13, 1 record), drainage lines (FMC03, 2 records) or adjacent habitats including broad valleys (FML04, 1 record), *Triodia* footslopes (FMN30, 3 records) and *Triodia* sandplains (FMR10, 2 records)

Lesser Hairy-footed Dunnart *Sminthopsis youngsoni*

Recorded from six sites spread through the rail corridor and all of the mine areas except Christmas Creek. Habitats included broad valleys (FMG05, 1 record), *Eulalia* tussock grassland (FML01, 1 record), footslopes (FMN30, 1 record), *Triodia* hillslopes (FMG02, 1 record) and *Triodia* sandplain (FMR08, 1 record; FMR10, 1 record).

Long-tailed Dunnart *Sminthopsis longicaudata*

Single capture at FMN03 in the Mt Nicholas study area, from spinifex hummock grassland on low stony hillslope habitat.

THYLACOMYIDAE (Bilbies)

Not recorded during the FMG Stage B survey but one species from this family is known from the region.

Bilby *Macrotis lagotis*

Not recorded during the FMG Stage B survey, however one individual was recently collected from Mulga Downs (Dr Peter Kendrick, CALM Karratha, pers. comm.).

MACROPODIDAE (Kangaroos and wallabies)

A total of 52 individuals of three species were recorded from this family during the combined surveys. This represents 15.4 % of all records and 12.5 % of all species recorded during those surveys.

Euro *Macropus robustus*

Thirteen records of this species from the Mindy Mindy and Mt Nicholas study areas. All were from rocky habitats, including breakaways (FMG04, 3 records), *Triodia* hilltops (FMN19, 6 records) and *Triodia* hillslopes (FMG01, 1 record; FMG06, 2 records; FMG07, 1 record).

Red Kangaroo *Macropus rufus*

Recorded on 38 occasions from the rail corridor and the Mt Lewin and Mt Nicholas mine areas. Typically from sandplain habitats (FMR10, 8 records), colluvial *Triodia* flats (FML06, 9 records), mulga groves (FMR17, 2 records; FMR58, 3 records; FMR61, 5 records) and tussock grasslands on cracking clay (FMR11, 3 records; FMR12, 4 records; FMR14, 1 record). Also recorded from mulga woodland (FMN05, 1 record) and creeklines (FMR13, 2 records).

Rothschild's Rock Wallaby - *Petrogale rothschildi*

A single individual was recorded from the Mindy Mindy study area on 2nd April, from the breakaway at FMG04.

MURIDAE (Murid rodents)

Assuming each secondary sign equated to one individual, a total of 129 individuals of six species were recorded from this family during the combined surveys. This represents 38.2 % of all records and 25.0 % of all species recorded during those surveys.

Short-tailed Mouse *Leggadina lakedownensis*

This species was recorded on 11 occasions from the rail corridor and the Christmas Creek mine area, from a broader range of habitats than previously noted. Most commonly recorded from tussock grasslands on cracking clay (FMR11, 3 records; FMR12, 2 records) but also recorded from creeklines (FMR01, 1 record), mulga groves (FMR17, 1 record), mulga woodlands (FMR16, 2 records), *Triodia* sandplain (FMR10, 1 record) and *Triodia* stony plain (FMC01, 1 record).

House Mouse *Mus musculus*

Trapped on 26 occasions from the rail corridor and all of the mine areas. Typically from habitat types located low in the landscape, including creeklines (FMR01, 1 record), drainage lines (FMC02, 1 record; FMC03, 5 records; FMN14, 2 records), broad valleys (FMG03, 1 record; FMG05, 1 record; FML04, 1 record), mulga groves (FMR17, 1 record), mulga woodlands (FMN05, 1 record; FMN18, 2 records, FMR17, 1 record), snakewood (FMR18, 1 record), *Triodia* sandplain (FMR10, 2 records) and tussock grassland on cracking clay (FMR14, 1 record). Also scattered records from adjacent habitats such as *Triodia* footslopes (FML06, 2 records, FMN13, 1 record, FMN30, 1 record) and *Triodia* hillslopes (FMC05, 1 record; FMG01, 1 record).

Western Pebble-mound Mouse *Pseudomys chapmani*

Recorded from the Mindy Mindy and Mt Lewin mine areas. Mounds (including active ones) were recorded from *Triodia* hillslopes (FMG01, 2 records; FMG06, 7 records; FMG07, 7 records; FML02, 1 record) and from *Triodia* dominated stony plains (FML03, 1 records).

Table 4.17: The mammals recorded at each of the systematic sites during the survey of the Mindy Mindy study area. The number of mammals and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for the study area.

Scientific Name	Total for Mindy Mindy	FMG01		FMG02		FMG03		FMG04		FMG05		FMG06		FMG07		FMG08	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Tachyglossus aculeatus	0																
Dasycercus cristicauda	0																
Dasykaluta rosamondae	0																
Dasyurus hallucatus	0																
Ningaui timealeyi	0																
Planigale sp.	0																
Sminthopsis macroura	0																
Sminthopsis youngsoni	2			1	10.00					1	3.33						
Sminthopsis longicaudata	0																
Macropus robustus	7	1	N/A					3	N/A			2	N/A	1	N/A		
Macropus rufus	0																
Petrogale rothschildi	1							1	N/A								
Leggadina lakedownensis	0																
Mus musculus	3	1	3.33			1	5.00			1	3.33						
Pseudomys chapmani	16	2	N/A									7	N/A	7	N/A		
Pseudomys desertor	3	2	6.67							1	3.33						
Pseudomys hermannsburgensis	16									6	20.00			4	8.00	6	12.00
Pseudomys sp. Hamersley	2			2	20.00												
Canis lupus	2													1	N/A	1	N/A
Felis catus	1									1	N/A						
Camelus dromedarius	0																
Equus asinus	0																
Equus caballus	0																
No. of species	**10**	**4**	**4**	**2**	**2**	**1**	**1**	**2**	**2**	**5**	**5**	**2**	**2**	**4**	**4**	**2**	**2**
No. of individuals	**53**	**6**	**10.00**	**3**	**30.00**	**1**	**5.00**	**4**	**N/A**	**10**	**30.00**	**9**	**N/A**	**13**	**8.00**	**7**	**12.00**

Table 4.18: The mammals recorded at each of the systematic trapping sites during the survey of the Christmas Creek study area. The number of mammals and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for the study area.

Scientific Name	Total for Christmas Creek	FMC01		FMC02		FMC03		FMC04		FMC05	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Tachyglossus aculeatus	0										
Dasycercus cristicauda	0										
Dasykaluta rosamondae	0										
Dasyurus hallucatus	0										
Ningaui timealeyi	0										
Planigale sp.	0										
Sminthopsis macroura	2					2	4.00				
Sminthopsis youngsoni	0										
Sminthopsis longicaudata	0										
Macropus robustus	0										
Macropus rufus	0										
Petrogale rothschildi	0										
Leggadina lakedownensis	1	1	1.67								
Mus musculus	7			1	2.00	5	10.00			1	2.50
Pseudomys chapmani	0										
Pseudomys desertor	3			3	6.00						
Pseudomys hermannsburgensis	5					1	2.00	1	2.00	3	7.50
Pseudomys sp. Hamersley	0										
Canis lupus	0										
Felis catus	0										
Camelus dromedarius	0										
Equus asinus	0										
Equus caballus	0										
No. of species	**5**	**1**	**1**	**2**	**2**	**3**	**3**	**1**	**1**	**2**	**2**
No. of individuals	**18**	**1**	**1.67**	**4**	**8.00**	**8**	**16.00**	**1**	**2.00**	**4**	**10.00**

Table 4.19: The mammals recorded at each of the systematic trapping sites during the survey of the Mt Lewin study area. The number of mammals and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for the study area.

Scientific Name	Total for Mt Lewin	FML01		FML02		FML03		FML04		FML05		FML06	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Tachyglossus aculeatus	0												
Dasycercus cristicauda	0												
Dasykaluta rosamondae	0												
Dasyurus hallucatus	0												
Ningaui timealeyi	4					4	6.67						
Planigale sp.	0												
Sminthopsis macroura	1							1	1.67				
Sminthopsis youngsoni	1	1	1.67										
Sminthopsis longicaudata	0												
Macropus robustus	0												
Macropus rufus	9											9	N/A
Petrogale rothschildi	0												
Leggadina lakedownensis	0												
Mus musculus	3							1	1.67			2	3.33
Pseudomys chapmani	2			1	N/A	1	N/A						
Pseudomys desertor	2			1	1.67							1	1.67
Pseudomys hermannsburgensis	13	1	1.67	1	1.67			8	13.33	3	5.00		
Pseudomys sp. Hamersley	0												
Canis lupus	0												
Felis catus	2	2	N/A										
Camelus dromedarius	4	3	N/A							1	N/A		
Equus asinus	41									1	N/A	40	N/A
Equus caballus	0												
No. of species	**11**	**4**	**4**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**4**	**4**
No. of individuals	**82**	**7**	**3.33**	**3**	**3.33**	**5**	**6.67**	**10**	**16.67**	**5**	**5.00**	**52**	**5.00**

Table 4.20: The mammals recorded at each of the systematic sites during the survey of the Mt Nicholas study area. The number of mammals and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for the study area.

Scientific Name	Total for Mt Nicholas	FMN03		FMN05		FMN13		FMN14		FMN18		FMN19		FMN30	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Tachyglossus aculeatus	0														
Dasycercus cristicauda	0														
Dasykaluta rosamondae	0														
Dasyurus hallucatus	0														
Ningaui timealeyi	0														
Planigale sp.	0														
Sminthopsis macroura	6			1	1.43					2	2.86			3	4.29
Sminthopsis youngsoni	1													1	1.43
Sminthopsis longicaudata	1	1	1.43												
Macropus robustus	6											6	N/A		
Macropus rufus	1			1	N/A										
Petrogale rothschildi	0														
Leggadina lakedownensis	0														
Mus musculus	7			1	1.43	1	1.43	2	2.86	2	2.86			1	1.43
Pseudomys chapmani	0														
Pseudomys desertor	6							3	4.29	2	2.86			1	1.43
Pseudomys hermannsburgensis	15	5	7.14	3	4.29	4	5.71							3	4.29
Pseudomys sp. Hamersley	0														
Canis lupus	0														
Felis catus	0														
Camelus dromedarius	0														
Equus asinus	0														
Equus caballus	0														
No. of species	**8**	**2**	**2**	**4**	**4**	**2**	**2**	**2**	**2**	**3**	**3**	**1**	**1**	**5**	**5**
No. of individuals	**43**	**6**	**8.57**	**6**	**7.14**	**5**	**7.14**	**5**	**7.14**	**6**	**8.57**	**6**	**N/A**	**9**	**12.86**

Table 4.21: The mammals recorded at each of the systematic trapping sites during the survey of the western section of the Stage B rail corridor. The number of mammals and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for that section of the rail corridor.

Scientific Name	Total for western rail corridor	FMR07		FMR08		FMR10		FMR11		FMR12		FMR13	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Tachyglossus aculeatus	0												
Dasycercus cristicauda	0												
Dasykaluta rosamondae	1	1	1.43										
Dasyurus hallucatus	0												
Ningaui timealeyi	0												
Planigale sp.	4							3	5.00	1	1.67		
Sminthopsis macroura	17					2	3.33	4	6.67	10	16.67	1	1.67
Sminthopsis youngsoni	1					1	1.67						
Sminthopsis longicaudata	0												
Macropus robustus	0												
Macropus rufus	17					8	N/A	3	N/A	4	N/A	2	N/A
Petrogale rothschildi	0												
Leggadina lakedownensis	6					1	1.67	3	5.00	2	3.33		
Mus musculus	2					2	3.33						
Pseudomys chapmani	0												
Pseudomys desertor	2	1	1.43	1	1.43								
Pseudomys hermannsburgensis	7	3	4.29	4	5.71								
Pseudomys sp. Hamersley	0												
Canis lupus	2					1	N/A					1	N/A
Felis catus	0												
Camelus dromedarius	1			1	N/A								
Equus asinus	10					10	N/A						
Equus caballus	0												
No. of species	**12**	**3**	**3**	**3**	**3**	**7**	**7**	**4**	**4**	**4**	**4**	**3**	**3**
No. of individuals	**70**	**5**	**7.14**	**6**	**7.14**	**25**	**10.00**	**13**	**16.67**	**17**	**21.67**	**4**	**1.67**

Table 4.22: The mammals recorded at each of the systematic trapping sites during the survey of the eastern section of the Stage B rail corridor. The number of mammals and the trapping rate (individuals 100 trap nights^{-1}) are shown for each site as well as the total for that section of the rail corridor.

Scientific Name	Total for eastern rail corridor	FMR01		FMR14		FMR15		FMR16		FMR17		FMR18	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Tachyglossus aculeatus	0												
Dasycercus cristicauda	0												
Dasykaluta rosamondae	0												
Dasyurus hallucatus	0												
Ningaui timealeyi	0												
Planigale sp.	10			3	4.29	2	2.86	4	5.71			1	1.67
Sminthopsis macroura	16	5	8.33	2	2.86	2	2.86	4	5.71	3	4.29		
Sminthopsis youngsoni	0												
Sminthopsis longicaudata	0												
Macropus robustus	0												
Macropus rufus	3			1	N/A					2	N/A		
Petrogale rothschildi	0												
Leggadina lakedownensis	4	1	1.67					2	2.86	1	1.43		
Mus musculus	4	1	1.67	1	1.43					1	1.43	1	1.67
Pseudomys chapmani	0												
Pseudomys desertor	0												
Pseudomys hermannsburgensis	0												
Pseudomys sp. Hamersley	0												
Canis lupus	3			1	N/A	2	N/A						
Felis catus	1									1	1.43		
Camelus dromedarius	0												
Equus asinus	5	4	N/A									1	N/A
Equus caballus	5			5	N/A								
No. of species	**9**	**4**	**4**	**6**	**6**	**3**	**3**	**3**	**3**	**5**	**5**	**3**	**3**
No. of individuals	**51**	**11**	**11.67**	**13**	**8.57**	**6**	**5.71**	**10**	**14.29**	**8**	**8.57**	**3**	**3.33**

Desert Mouse *Pseudomys desertor*
Recorded from sites along the length of the study area (the geographic spread ranged from FMG01 in the west to FMN30 in the east). The understorey was typically dominated by *Triodia* species. Habitats included broad valleys (FMG05, 1 record), drainage lines (FMC02, 3 records; FMN14, 3 records), *Triodia* footslope (FMN30, 1 record), mulga woodland (FMN18, 2 records), colluvial *Triodia* flats (FML06, 1 record), *Triodia* hillslopes (FMG01, 2 records; FML02, 1 record) and *Triodia* sandplains (FMR07, 1 record; FMR08; 1 record).

Inland Sandy Mouse *Pseudomys hermannsburgensis*
The most commonly captured mammal during the current survey with 54 capture events. Recorded from most sites though less common in rocky habitats, creeklines and on heavy clays. Habitats where it was recorded include drainage lines (FMC03, 1 record; FMN14, 4 records), broad valleys (FMG05, 6 records; FML04, 8 records), *Triodia* sandplains (FMR07, 3 records; FMR08, 4 records), colluvial stony plains (FMG08, 6 records), colluvial *Triodia* stony plains (FML05, 3 records), *Eulalia* tussock grassland (FML01), mulga woodland (FMN05, 3 records), *Triodia* footslopes (FMN30, 3 records), *Triodia* hillslopes (FMG07, 4 records; FML02, 1 record; FMN03, 5 records) and *Triodia* hilltops (FMC04, 1 record; FMC05, 3 records).

?*Pseudomys* sp "Hamersley"
Two subtly different *Pseudomys* were collected from the *Triodia*-dominated hillslope at FMG02 in the Mindy Mindy mine area. The status of this taxon is uncertain.

CANIDAE (Dogs)

Thirteen individuals of one species were recorded from this family during the combined surveys. This represents 3.8 % of all records and 4.2 % of all species recorded during those surveys.

?Dingo *Canis lupus ?dingo*
Recorded on 13 occasions in the rail corridor, typically as lone animals, from a range of open habitats such as *Triodia* sandplains (FMR07, 1 record; FMR08, 1 record; FMR10, 1 record), tussock grassland on cracking clay (FMR14, 1 record; FMR15, 2 records), mulga (FMR63, 1 record), snakewood (FMR61, 2 records), drainage lines (FMRMM, 3 records) and creeklines (FMR13, 1 record). Whilst some animals resembled dingos, several also looked like domestic breeds of dog.

FELIDAE (Cats)

Eleven individuals of one species were recorded from this family during the combined surveys. This represents 3.3 % of all records and 4.2 % of all species recorded during those surveys.

Cat *Felis catus*
Recorded on four occasions in the rail corridor and the Mindy Mindy and Mt Lewin mine areas. Single animals were recorded from broad valleys (FMG05) and mulga woodlands (FMR17), two individuals were seen in *Eulalia* tussock grassland at FML01, and a family of seven (two adults and five young) were seen on cracking clays adjacent to FMR11.

BOVIDAE (Cattle)

We did not quantify the number of cattle, but the single species recorded from this family during the combined surveys represents 4.2 % of all species recorded during those surveys.

Cattle *Bos taurus*
No attempt was made to quantify the number of cattle within the project area other than to note that they occurred along the length of the study area, particularly in the creeks and on the flats.

CAMELIDAE (Camels)

Assuming each secondary sign equated to one individual, five individuals of one species were recorded from this family during the combined surveys. This represents 1.5 % of all records and 4.2 % of all species recorded during those surveys.

Camel *Camelus dromedarius*

Tracks of this species were recorded from a number of sandy sites in the eastern section of the proposed rail corridor and at Mt Lewin. A group of three was seen in *Eulalia* tussock grassland (FML01), and tracks were observed in stony colluvial *Triodia* (FML05) and on a *Triodia* sandplain (FMR08).

EQUIDAE (Horses and donkeys)

A total of 61 individuals of two species were recorded from this family during the combined surveys. This represents 18.0 % of all records and 8.3 % of all species recorded during those surveys.

Donkey *Equus asinus*

Evidence of this species was recorded throughout the eastern section of the study area with groups of up to 40 individuals regularly encountered. There were records of a herd of 40 from a colluvial *Triodia* flat (FML06) at Mt Lewin, a herd of 10 from *Triodia* sandplain (FMR10) and a group of four from Kulkinbah Creek (FMR01) in the rail corridor, and single individuals seen in stony colluvial *Triodia* (FML05) and mulga (FMR18) at Mt Lewin and in the rail corridor respectively.

Horse *Equus caballus*

A group of five individuals was noted in the rail corridor in a drainage line in the vicinity of FMR14 on 4th July.

4.5.3 Discussion

The survey recorded 23 species of non-volant mammals from the project area.

The survey of the FMG Stage B rail corridor and associated mine areas added three or four species of mammals to the tally recorded during previous surveys of the Hope Downs rail corridor (Biota 2002, 2004a and 2004b) and the FMG Stage A rail corridor (Biota 2004c). The exact number is unclear because of taxonomic uncertainty surrounding the identity of *Pseudomys* and *Planigale* species. It is possible that the two *Pseudomys* specimens from FMG02 represent the undescribed *Pseudomys* sp. "Hamersley", which has been recorded by us elsewhere in the Pilbara. The actual taxonomic status of these individuals is unclear (Norah Cooper, WA Museum, pers. comm. 2004). In Western Australia the genus *Planigale* has recently undergone a revision and two new species have been recognised in the Pilbara (Norah Cooper, pers. comm. 2004). The two species may separate on the basis of habitat type, with one preferring the self-mulching clays on the Chichester Plateau and the weakly gilgaied soils dominated by *Acacia xiphophylla*, whilst the second species may prefer the scree slopes of the Hamersley Plateau (Roy Teale, pers. obs.). We have not resolved the identity of the Planigales collected on during the Stage B survey.

One definite new species is the Horse, which is introduced and will not be considered further here.

The other definite new species is the Long-tailed Dunnart, which is considered a Priority 4 species by CALM. This species is rarely captured; it prefers rocky areas, which are extremely difficult to survey using pit-trapping. It may therefore be more common than the few, scattered records suggest, however on current evidence it appears to be an uncommon species. It is thus not surprising that it had not been recorded during the previous surveys in the locality. We have recorded this species on just one other occasion during our Pilbara surveys: a single individual was recorded from the Nammuldi / Silvergrass project area adjacent to Mt Brockman (source: Biota Database).

Regional Endemism and Restricted Taxa
The survey recorded two species of *Ningaui*: *N. timealeyi* and *N. ridei*. The former of these two species is considered a "near endemic" to the Pilbara Bioregion where it is widespread and common across a range of substrate types vegetated with *Triodia* spp. including *T. angusta, T. basedowii, T. brizoides, T. epactia, T. lanigera, T. longiceps, T. pungens* and *T. wiseana* (source: Biota Database). *Dasykaluta rosamondae* exhibits a distribution that closely mirrors *N. timealeyi* and like this species is found across a wide range of substrates dominated by *Triodia* spp including *T. basedowii*, *T. brizoides, T. epactia, T. lanigera, T. longiceps* and *T. wiseana* (source: Biota Database). *Sminthopsis macroura* is a widespread species across arid WA and according to Ms Norah Cooper (WA Museum, pers. comm. 2004) may be a species complex of at least two taxa, although this work is unresolved. Within the Hamersley subregion *S. macroura* is largely confined to clay soils particularly those dominated by *Acacia aneura*, where it is moderately common. However, it appears to be more abundant on the cracking clays associated with the Chichester Range. This species complex may support a Pilbara endemic. The other taxonomic anomalies discussed above ie *Pseudomys* sp. "Hamersley" and *Planigale* sp may also represent Pilbara endemics.

Conservation Significant Taxa
The survey recorded one Schedule 1 listed species (the Mulgara *Dasycercus cristicauda*) and three Priority 4 species (the Long-tailed Dunnart *Sminthopsis longicaudata,* Short-tailed Mouse *Leggadina lakedownensis* and the Western Pebble-mound Mouse *Pseudomys chapmani*). In addition a second Schedule 1 species (the Bilby *Macrotis lagotis*) is known from a recent (2004) record from Mulga Downs Station. All of these species are discussed further in Section 6.4.

4.6 Bats

4.6.1 Species Assemblage

A list of the bats likely to be encountered in the Pilbara is provided in Table 4.23 (compiled from the mammal database of the Western Australian Museum of Natural Sciences; Churchill 1998; McKenzie and Rolfe 1986).

During the FMG Stage B survey, a total of 12 sequences were of sufficient quality to be used for identification in the present survey. Three bat species were positively identified: *Chalinolobus gouldii*, *Scotorepens greyii* and *Tadarida australis*. A fourth species detected is one of two that cannot be distinguished using the three variables measured by McKenzie and Muir (2000). The occurrence of each species recorded is given in Table 4.24.

During the FMG Stage A survey a further 18 sequences were analysed, and during the Hope Downs surveys a further 881 sequences were of sufficient quality to be analysed. From these sequences, an additional seven species were identified, bringing the total for the combined surveys to 10 species, with a further two species that were probably recorded (*Saccolaimus flaviventris* and *Mormopterus beccarii*).

Including the additional species that are likely to occur in the FMG Stage B study area, the most speciose families were the Vespertilionidae and the Molossidae (four species each). The amount of precipitation was the most probable reason for the low number of sequences recorded during the FMG Stage B survey. Moisture damages the Anabat hardware so recorders could only be utilized on the relatively few rainless nights. This emphasizes the value of the work already conducted in the area by Biota, as it meant that most species in the area has already been recorded either within or adjacent to the FMG Stage B study area.

Table 4.23: Summary of bat species recorded in the Pilbara region (WA Museum Faunabase; Churchill 1998; McKenzie and Rolfe 1986; foraging habitats are summarised from Churchill (1998) and are not necessarily present in the Pilbara).

Common Name	*Genus species*	Roost habitats	Foraging habitat[1]	Food Preference	Aerial foraging niche
Black Flying-fox	*Pteropus alecto*	Among tree branches	Tropical and subtropical forests + woodlands	Blossoms, fruit and leaves	N/A
Little Red Flying-fox	*Pteropus scapulatus*	Among tree branches	Semi-arid to tropical eucalypt, monsoon + paperbark forests	Blossoms, fruit and leaves	N/A
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Tree hollows, other unusual roosts	Forest, woodland, grassland, desert	Predominantly beetles	Above tree canopy, open areas
Common Sheathtail-bat	*Taphozous georgianus*	Caves, boulder piles and mines	Forests, woodlands, grasslands	Predominantly beetles	Above tree canopy, open areas
Hill's Sheathtail-bat	*Taphozous hilli*	Caves, boulder piles and mines	Woodlands, shrublands, grasslands	Unknown	Above tree canopy, open areas
Ghost Bat	*Macroderma gigas*	Caves, boulder piles and mines	Rainforest, forest, woodland, grasslands, plains	Small vertebrates, grasshoppers	Sit-and-wait predator
Orange Leafnosed-bat	*Rhinonicteris aurantius*	Caves and mines, possibly boulder piles	Forests, woodlands, grasslands, gorges	Moths and beetles	Over grasses, over and beside shrubs
Gould's Wattled Bat	*Chalinolobus gouldii*	Tree hollows, foliage, buildings, under bark	Most habitats	Predominantly moths but a generalist	Within the lower level of canopy and along edges
Chocolate Wattled Bat	*Chalinolobus morio*	Tree hollows, buildings, under bark, bridges, martin nests	Forest, woodland, scrub	Predominantly moths but a generalist	Between canopy and understorey, forest trails
Arnhem Land Long-eared Bat	*Nyctophilus arnhemensis*	Under bark, among foliage of some trees	Mangroves, open forest, woodland, paperbark forest	Unknown	Within dense thickets and tunnel-like passages
Northwestern Long-eared bat	*Nyctophilus bifax daedalus*	Under bark, tree hollows, epiphytes and fig roots, foliage	Rainforest, monsoon forest, riverine paperbark forest	Predominantly moths	Edge of tree canopy, inside stands
Lesser Long-eared bat	*Nyctophilus geoffroyi*	Tree hollows, foliage, buildings, under bark	Various: forest, woodland, scrub	Predominantly moths but a generalist	Gleaner, in and around vegetation
Little Broad-nosed Bat	*Scotorepens greyii*	Mainly tree hollows, man-made structures	Monsoon and paperbark forest, woodland, grassland	Generalist	Around, against and inside vegetation, waterholes
Inland Broad-nosed Bat	*Scotorepens balstoni*	Mainly tree hollows, man-made structures	Forests, woodlands, grasslands	Generalist	Around, against and inside vegetation, waterholes
Finlayson's Cave Bat	*Vespadelus finlaysoni*	Caves, rock crevices and mines	Grassland, woodland, open forest near cavernous areas	Unknown	In and around vegetation

Common Name	*Genus species*	Roost habitats	Foraging habitat[1]	Food Preference	Aerial foraging niche
Northern Freetail-bat	*Chaerephon jobensis*	Tree hollows, caves and buildings	Monsoon and paperbark forests, woodland, savannah	Predominantly moths but a generalist	Above tree canopy
Beccari's Freetail-bat	*Mormopterus beccarii*	Tree hollows	Rainforest, woodland, grassland, watercourses	Moths and beetles	Above tree canopy, along watercourses, over water
Little Northern Freetail-bat	*Mormopterus loriae*	Spouts and crevices in mangroves	Restricted to mangroves and adjacent areas	Unknown	Above and beside forest canopy, along passages
White-striped Freetail-bat	*Tadarida australis*	Trees	Forest, woodland, scrub, urban	Moths and beetles	Open areas, above canopy, ground

Table 4.24: Occurrence of each species recorded at the fauna trapping sites.

Species	Kulkinbah Creek (near FMR01)	Campsite	FMR18
Chalinolobus gouldii	*		
?Nyctophilus geoffroyi	*		
Scotorepens greyii	*		*
?Scotorepens balstoni		*	
Chaerephon jobensis/ Saccolaimus flaviventris	*		
Tadarida australis		*	

4.6.2 Annotated List

PTEROPODIDAE (Flying-foxes)

Little Red Flying-fox *Pteropus scapulatus*

Not recorded during the FMG Stage B survey, however this species has been recorded previously from several sites close to the Mindy Mindy mine area. There are records during the Hope Downs surveys from Indee Homestead (Biota 2002), near Weeli Wolli Springs (HDKA002; Biota 2004a) and in date palms along Weeli Wolli Creek (WW2; Biota 2004a). This species may occur in the FMG Stage B study area in suitable habitat along watercourses.

MEGADERMATIDAE (False Vampire Bats)

Ghost Bat *Macroderma gigas*

Not recorded during the FMG Stage B survey, however there are three records from the Abydos Plain section of the Hope Downs rail corridor (two individuals were recorded from granite rocks piles adjacent to fauna site HAE6, and secondary signs were recorded from two locations further north; Biota 2002). There are also records from West Angelas (Biota 2004e) and Weeli Wolli Springs (Roy Teale, Biota, pers. obs.). Although this species is unlikely to roost in the FMG Stage B study area, it probably forages over the area.

EMBALLONURIDAE (Sheathtail Bats)

Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*

Three sequences attributable to either the Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris* (Emballonuridae) or the Northern Freetail Bat *Chaerephon jobensis* (Molossidae) were recorded from along Kulkinbah Creek (Figure 4.1). Both species are distributed widely across the north of Australia, and neither is regarded as rare or in need of special conservation measures. There were several probable records of this species during the Hope Downs surveys (Biota 2002, 2004a, 2004b) but, as the call of this species cannot be unequivocally identified, and no individuals were captured, its presence in the FMG Stage B study area is only probable rather than certain.

Common Sheathtail Bat *Taphozous georgianus*

Not recorded during the FMG Stage B survey, however this species was commonly recorded along the Hope Downs rail corridor (individuals were captured at two sites in the northern part of the corridor and the species was identified at an additional site; Biota 2002). The echolocation calls of this species cannot be reliably separated from those of *Mormopterus beccarii*, however calls probably belonging to this species were recorded at an additional four sites in the southern part of the Hope Downs rail corridor (Biota 2002). These records suggest that the species would be widespread throughout the FMG Stage B study area wherever there are suitable roost caves.

VESPERTILIONIDAE (Vespertilionid Bats)

Gould's Wattled Bat *Chalinolobus gouldii*

Two sequences attributable to this species were recorded along Kulkinbah Creek (Figure 4.5). It was also recorded at a variety of sites along the length of the FMG Stage A (Biota 2004c) and Hope Downs rail corridors (Biota 2002). This tree-roosting species is found in a variety of habitats throughout Australia (Churchill 1998), and is regarded as common.

Lesser Long-eared Bat *Nyctophilus geoffroyi*

During the FMG Stage B survey, a probable recording of this species was made along Kulkinbah Creek (Figure 4.2). This species was not recorded during the surveys of the FMG Stage A or Hope Downs rail corridors (see Biota 2004c), however the species is likely to be widespread in the study area.

Little Broad-nosed Bat *Scotorepens greyii*

During the FMG Stage B survey, the Little Broad-nosed Bat was recorded along Kulkinbah Creek and in snakewood at site FMR18 (Figure 4.3). This species roosts in trees, is found

in a variety of wooded habitats (Churchill 1998) and is a common species in the Pilbara. It was recorded at numerous sites along the entire Hope Downs rail corridor surveys (Biota 2002, 2004a).

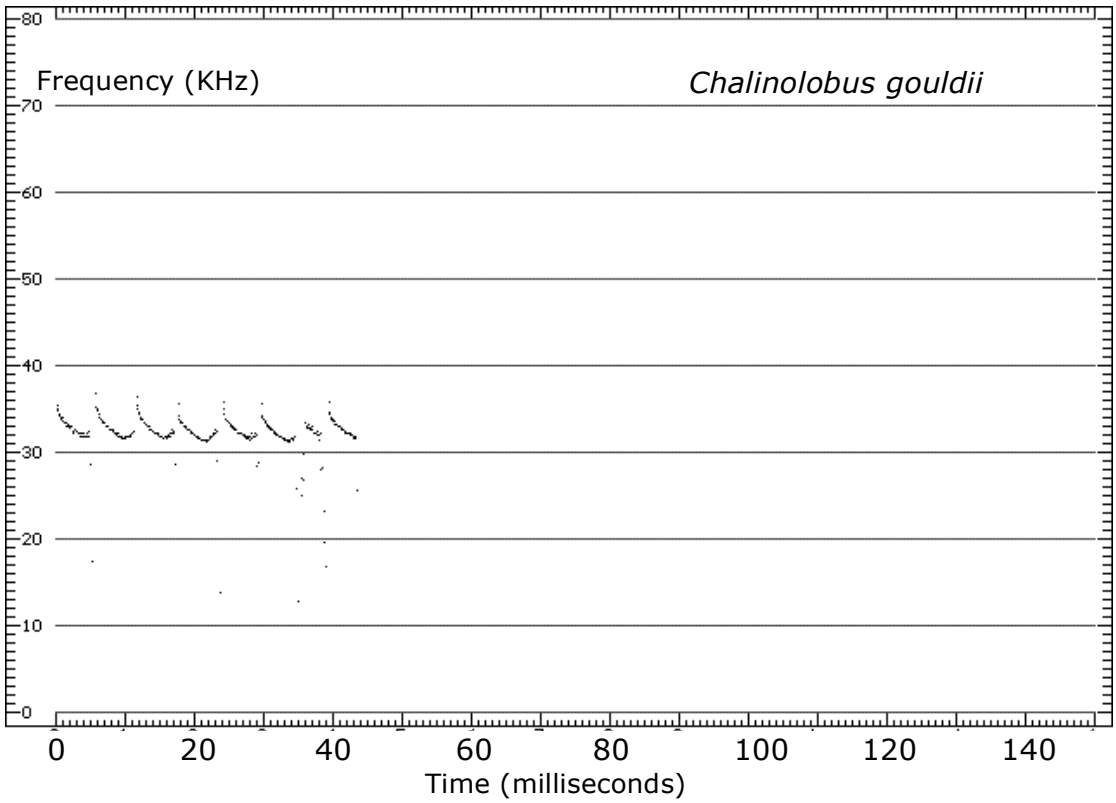

Figure 4.1: Search call mode of *Chalinolobus gouldii*.

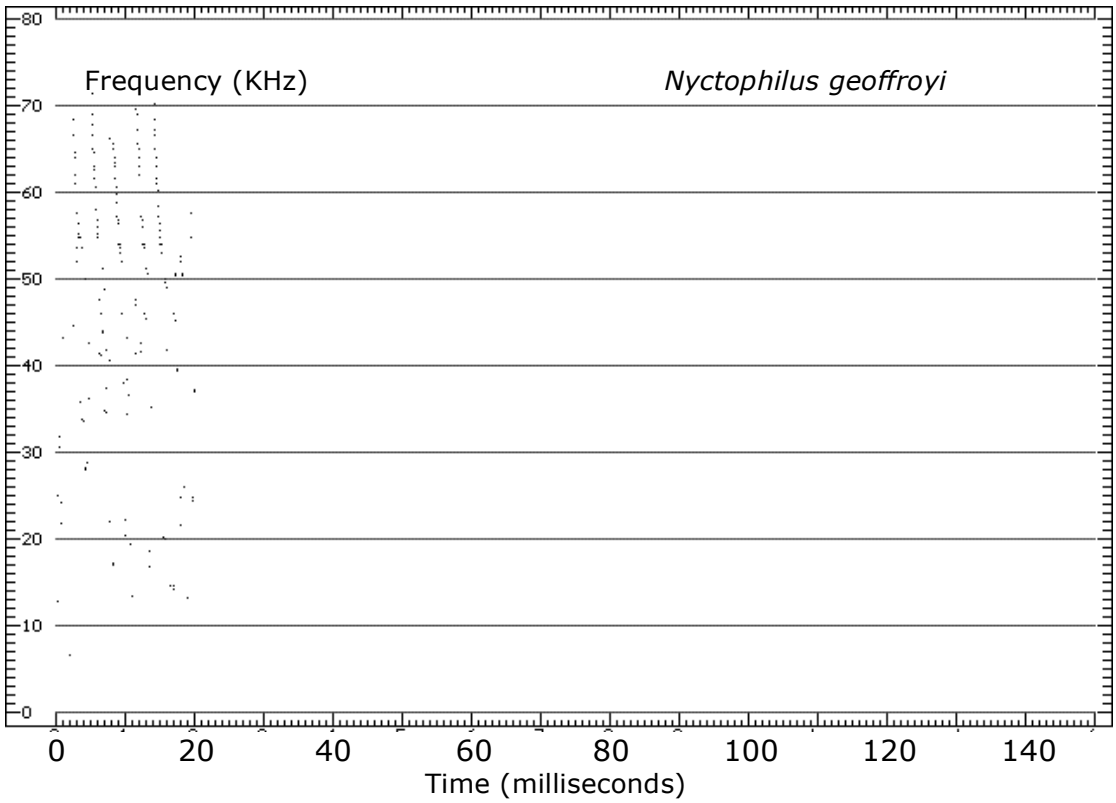

Figure 4.2: Search mode call of a probable *Nyctophilus geoffroyi*.

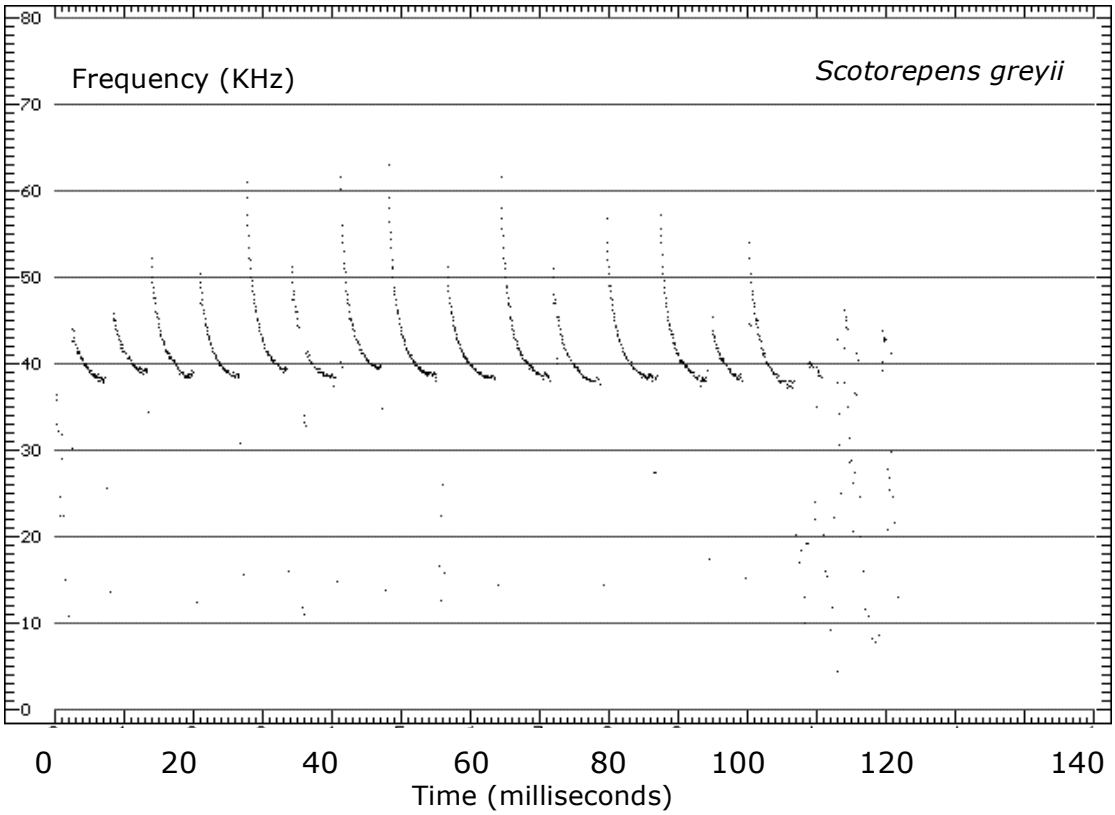

Figure 4.3: Search mode call of *Scotorepens greyii*.

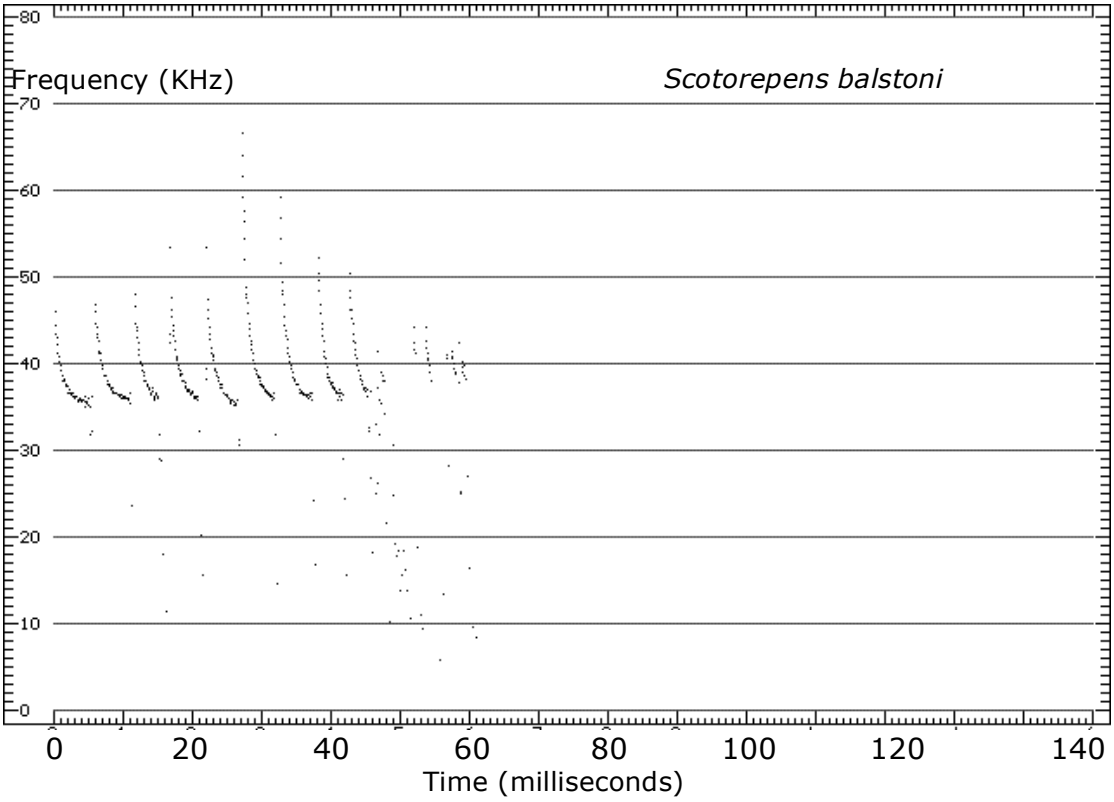

Figure 4.4: Possible call sequence of *Scotorepens balstoni*.

Inland Broad-nosed Bat *Scotorepens balstoni*
A probable call sequence of this species was recorded from the campsite near Edenholme Bore (Figure 4.4). This species was not recorded during either the FMG Stage A or Hope Downs rail corridor surveys but is likely to be widespread in the study area.

MOLOSSIDAE (Freetail bats)

Northern Freetail Bat *Chaerephon jobensis*
Three sequences attributable to either the Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris* (Emballonuridae) or the Northern Freetail Bat *Chaerephon jobensis* (Molossidae) were recorded along Kulkinbah Creek (Figure 4.5) during the FMG Stage B survey. Individuals of this tree-roosting species were recorded at numerous sites along the entire length of the Hope Downs rail corridor (Biota 2002, 2004a) and calls of the species were probably recorded during the FMG Stage A rail corridor survey.

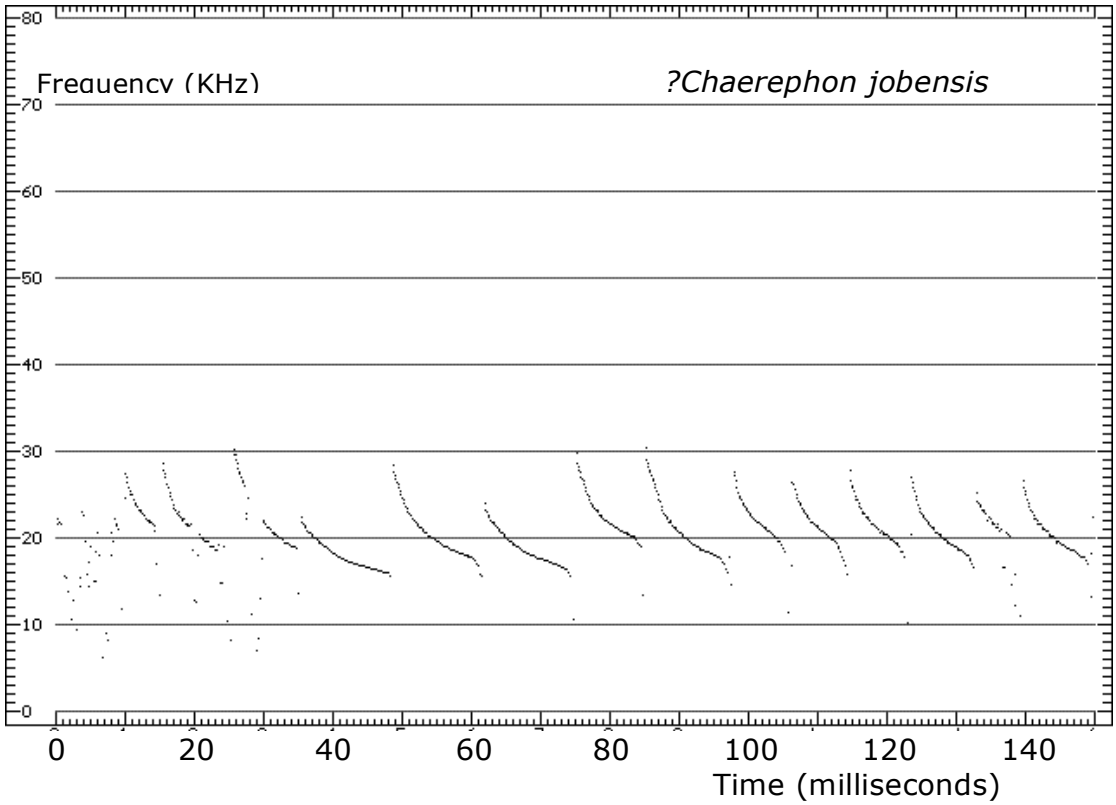

Figure 4.5: Search mode call of a probable *Chaerephon jobensis*.

Beccari's Freetail Bat *Mormopterus beccarii*
Not recorded during the FMG Stage B survey. Calls of Beccari's Freetail Bat are indistinguishable from those of *Taphozous georgianus* using the Anabat system, but calls belonging to either species were recorded at several creekline sites during the Hope Downs rail corridor surveys (Biota 2002, 2004a). While the habitat of these sites corresponds to the preferred habitat of *M. beccarii* (they are commonly encountered along watercourses in arid areas; Churchill 1998), there is still the possibility that the calls were from *T. georgianus* foraging above or nearby. This species is likely to occur within suitable habitat in the FMG Stage B study area.

White-striped Freetail Bat *Tadarida australis*
Two call sequences from this species were recorded at the campsite near Edenholme Bore during the FMG Stage B survey. There were also numerous records of this species during the Hope Downs rail corridor surveys (Biota 2002). This species is undoubtedly present throughout the FMG Stage B rail corridor and associated mine areas.

4.6.3 Discussion

There are three bat species of conservation significance in the Pilbara: the Orange Leaf-nosed Bat *Rhinonicteris aurantius* (Hipposideridae) (Schedule 1), Ghost Bat *Macroderma gigas* (Megadermatidae) (CALM Priority 4) and Little Northwestern Freetail Bat *Mormopterus loriae* (Molossidae) (CALM Priority 1; sometimes designated as subspecies *cobourgiana*: this genus is currently undergoing taxonomic revision; see Adams et al. 1988 and Churchill 1998 for further comments).

R. aurantius was not observed during the FMG Stage B survey, the FMG Stage A survey or the surveys conducted previously for the proposed Hope Downs rail corridor. Granite rockpiles might be used by this species (Armstrong 2001), however no such suitable habitat occurs in the FMG Stage B study area. This species is considered unlikely to occur in the study area.

M. gigas was recorded from three granite rockpiles and two railway culverts in the Hope Downs rail corridor, to the north-west of the current study area, and is also known from West Angelas and Weeli Wolli Springs. Suitable roosting habitat for this species was not observed during the FMG Stage B or FMG Stage A surveys, however it may well forage over the FMG Stage B study area.

M. loriae is regarded as almost entirely restricted to mangal and coastal riverine habitats and is therefore unlikely to be present as far inland as the FMG Stage B study area.

The present bat survey effort was not sufficient to detect all possible species that might occur within the study area. However, previous surveys in similar areas for the proposed FMG Stage A rail corridor and the Hope Downs rail corridor have recorded most of the species that would be expected. The most important observation from the present survey was that no habitats suitable for species of conservation significance were observed within the FMG Stage B rail corridor and associated mine areas.

5.0 Invertebrate Fauna Inventory Survey

5.1 Overview

The survey of the FMG Stage B project area recorded over 100 invertebrate taxa, many of which were not identified beyond family level and are not discussed here. The only taxa identified to genus or species level were those taxa belonging to groups known to include short-range endemics (eg. Mygalomorphs, Millipedes and Land Snails; see Harvey 2002), that were otherwise of conservation significance (eg. Buprestidae), or for which expertise was readily available at the WA Museum (eg. wolf spiders and other spider groups).

5.2.1 Millipedes

In general, this group is poorly studied taxonomically (Harvey 2002) and poorly collected (Harvey 2002, Hoffman 2003). With the exception of the pin-cushion millipedes (Polyxenida), which we have collected from a number of localities (including Barrow Island, near Mt Brockman, West Angelas, Yandicoogina and a number of localities along the FMG Stage A corridor), we rarely find millipedes in the Pilbara. Recently we collected a new genus of spirobolid millipede from the Burrup Peninsula (Hoffman 2003) and a juvenile Polydesmida from near Mt Brockman. According to Harvey (2002), the polydesmid millipedes are considered likely to harbour species that have narrow ranges. Within this family, it is the genus *Antechiropus* that has undergone the largest radiation and has some of the smallest documented distributions.

No millipedes were recorded during the Stage B survey work.

5.2.2 Terrestrial Molluscs (Land Snails)

In his review of the conservation status of Australia's non-marine molluscs, Ponder (1997) identifies over 900 described terrestrial land snails from 23 families, with the most speciose families being the Camaenidae (408 taxa), Helicarionidae (60 taxa), Pupillidae (41 taxa), Bulimulidae (31 taxa), Punctidae (23 taxa) and Pupinidae (19 taxa). There are 230 described taxa in Western Australia, with 201 of these restricted to this State (Ponder 1997). Within the Pilbara bioregion, the most conspicuous elements of this fauna are the *Rhagada* and *Quistrachia* species (Camaenidae), though several *Bothriembryon* species (Bulimulidae) are also known.

Genetic diversification may be expected to be greater amongst land snails than for more vagile insects and vertebrates. However, few genetic studies have been completed to support this (see Johnson et al. 2004). There is certainly extensive variation in shell morphology for *Rhagada* species from the Dampier Archipelago (including the Burrup Peninsula), with seven species described (Solem 1997) and several additional ones awaiting description (Dr Peter Kendrick, CALM, pers. comm. 2004; Ms Shirley Slack-Smith, WA Museum, pers. comm. 2004). Many of these taxa have very narrow distributions with some confined to single outcrops. Shell morphology of mainland *Rhagada* species within the Pilbara bioregion tend to be more conservative by comparison, and species tend to have larger non-overlapping distributions (eg. spanning a linear distance in excess of 200km) (Solem 1997, see also Johnson et al. 2004).

No live Camaenidae were collected during the survey, nor were any dead shells noted within the study area. *Rhagada* have been collected from beneath *Triodia longiceps* on calcareous soil on the western side of the Fortescue Marshes. Based on distribution maps (Ponder 1997) alone, the species may be *Rhagada richardsoni*, though new species are still being recorded for the inland Pilbara (Roy Teale, pers. obs. 2004, Dr Peter Kendrick,

CALM, pers. comm. 2004). It is therefore considered likely that at least this genus would occur within the FMG Stage B study area.

A collection of land snails was also made from the calcrete around Weeli Wolli Creek within the Hope Downs rail corridor (Biota 2004a). The snails were identified as belonging to two families; Bulimulidae (genus *Bothriembryon)* and Subulinidae (confirmed by Shirley Slack-Smith, Curator of Molluscs at the WA Museum). Within the genus *Bothriembryon,* two species were collected that appear to be segregated based on habitat preference, with one occurring in gorges and gullies, and the other on hilltops within the calcretes immediately adjacent to Weeli Wolli Springs (S. Slack-Smith, WA Museum, pers. comm.). Both species are currently undescribed. It is unlikely that these *Bothriembryon* species extend into the Mindy Mindy study area.

One species of land snail (family Pupillidae) was collected from Yandicoogina Creek during recent surveys (Biota unpublished data). Preliminary identification suggests that the specimens belong to the taxon *Pupoides* aff. *beltaianus* (Solem 1986). The taxonomic status of this taxon remains unresolved. If it is conspecific with *Pupoides beltaianus* from central Australia then it has a very broad distribution. If it is not conspecific, then the distribution extends from the northern Pilbara through to Shark Bay (Solem 1986).

5.2.3 Mygalomorph Spiders

Three species of mygalomorph spiders were recorded during the survey, represented by the following vouchered specimens:

- *Aganippe*? sp. (Idiopidae): site FMG08 (WAM T62547);
- *Synothele* sp. (Barychelidae): site FMC01 (WAM T62548); and
- *Missulena occatoria* (Actinopodidae): FML01 (WAM T62264).

Of the three species collected, only the Red-headed Mouse Spider *Missulena occatoria* has been formally described. Unlike most other mygalomorph spiders, this species' young balloon disperse and as such have a wide distribution across much of Australia.

The taxonomic status and distribution of the remaining two mygalomorph spiders is unresolved.

6.0 Conservation Significance

6.1 Approach to the Assessment

The fauna conservation value of the combined survey area of the FMG Stage B rail corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas mine areas is discussed in general terms in Section 6.2 and specifically for vertebrate and invertebrate fauna of conservation significance in Sections 6.4 and 6.6 respectively. Section 6.5 addresses known species complexes within the vertebrate fauna we recorded, and for which the conservation status is therefore unresolved. Section 6.3 describes the statutory framework under which species are assigned special protection.

The general conservation value of the study area considers the populations of all individual species within it. Species richness tends to vary primarily on the size of an area and the number of habitats present (which may reflect numerous factors including geology, soil type, landform, altitude and aspect). Seasonal timing is also clearly a factor in terms of recording the assemblage. As discussed above, this report documents only the first phase of a two phase survey and was carried out at an inopportune time to adequately record the reptile assemblage.

6.2 Overall Fauna Conservation Value

The current study recorded 175 taxa of terrestrial vertebrate fauna belonging to 58 families from the combined survey area of the FMG Stage B rail corridor and the Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas mine areas (see Section 4.0). The tally comprised two frogs, 42 reptiles, 105 birds, three bats and 23 non-volant mammals.

By comparison with other surveys in the region:

- The initial survey of the Hope Downs rail corridor between Weeli Wolli Siding and Port Hedland (Biota 2002) recorded 239 vertebrate taxa comprising six frogs, 73 reptiles, 125 birds, eight bats and 27 non-volant mammals;
- The survey of the Hamersley Range Extension to the Hope Downs rail corridor (Biota 2004a) recorded 140 vertebrate taxa comprising three frogs, 31 reptiles, three fish, 85 birds, four bats and 11 non-volant mammals; and
- The survey of the Chichester Range Addition to the Hope Downs rail corridor (Biota 2004b) recorded 147 vertebrate taxa comprising four frogs, 47 reptiles, four fish, 77 birds, five bats and 11 non-volant mammals.

The difference in tallies across these surveys can be attributed to the differing scales of the projects, trap effort and seasonal timing. The fauna species richness of the FMG Stage B study area would be comparable to other areas of a similar size. The conservation value of the study area for overall fauna is therefore considered to be moderate.

6.3 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 *Environment Protection and Biodiversity Conservation (EPBC) Act 1999.* Extant species listed under the *EPBC Act 1999* may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'conservation dependent'.

Migratory wader species are also protected under the *EPBC Act 1999*. This consists of those species identified 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).

Classification of rare and endangered fauna under the *Wildlife Conservation (Specially Protected Fauna) Notice 2004* 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 above.

In addition to the above classification, fauna are also recognised under four Priority levels:

- **Priority One** - Taxa with few, poorly known populations on threatened lands. Taxa which are known from 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.

6.4 Threatened Fauna Species from the FMG Stage B Study Area

Two species of Schedule fauna and four Priority listed species were recorded from the FMG Stage B study area during the current survey. A further three Schedule species and eight Priority species have either been recorded in adjacent areas during surveys for the Hope Downs project or FMG Stage A rail corridor, or are considered likely to occur in the area. These threatened fauna species are listed in Table 6.1 and discussed individually below.

Table 6.1: Species of State level conservation significance recorded from or likely to occur within the FMG rail corridor. The "*" denotes species recorded during the current survey.

Species	State Level	Federal Level
Night Parrot *Pezoporus occidentalis*	Schedule 1	Endangered
Mulgara *Dasycercus cristicauda**	Schedule 1	Vulnerable
Bilby *Macrotis lagotis*	Schedule 1	Vulnerable
Pilbara Olive Python *Liasis olivaceus barroni*	Schedule 1	Vulnerable
Peregrine Falcon *Falco peregrinus**	Schedule 4	-
Ramphotyphlops ganei	Priority 1	-
Ctenotus uber johnstonei	Priority 2	-
Lerista macropisthopus remota	Priority 2	-
Spectacled Hare-wallaby *Lagorchestes conspicillatus leichardti*	Priority 3	-
Grey Falcon *Falco hypoleucos*	Priority 4	-
Bush Stone-curlew *Burhinus grallarius*	Priority 4	-
Australian Bustard *Ardeotis australis**	Priority 4	-
Star Finch *Neochmia ruficauda subclarescens*	Priority 4	-
Long-tailed Dunnart *Sminthopsis longicaudata**	Priority 4	-
Short-tailed Mouse *Leggadina lakedownensis**	Priority 4	-
Western Pebble-mound Mouse *Pseudomys chapmani**	Priority 4	-
Ghost Bat *Macroderma gigas*	Priority 4	-

Night Parrot *Pezoporus occidentalis* (Schedule 1, 'Endangered')

Distribution: Night Parrots have been reported from every state on the Australian mainland. Apparently suitable habitat occurs, or has occurred, across most of inland Australia, 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 et al. 1999). There is an unconfirmed record from Moojarri Well, between the Fortescue Marshes and the FMG Stage B rail corridor.

Ecology: This species is listed as endangered under the *EPBC Act 1999*, and as Schedule 1 under the *Wildlife Conservation Notice 2004*. Night Parrots inhabit areas where there is dense, low vegetation, which provides them with shelter during the day. Most records come from hummock grasslands with spinifex (porcupine grass, *Triodia* species), from areas dominated by samphire or, particularly, where these two habitats are juxtaposed. It has been suggested that birds move into the grasslands when the *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 it is 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 grazing or rabbits, (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), however the relative importance of each of these factors is not clear.

Likelihood of occurrence: This species was not recorded during the FMG Stage B survey but almost certainly occurs in the study area. The area around the Fortescue Marshes contains suitable habitat and there is a reliable report from Moojarri Well, immediately to the south of the proposed Stage B rail corridor.

Mulgara *Dasycercus cristicauda* (Schedule 1, 'Vulnerable')
Distribution: The Mulgara is a medium sized (60-120 g) carnivorous marsupial occurring in suitable habitat across the arid zone of Western Australia.

Ecology: It is listed as vulnerable under the *EPBC Act 1999* (a referral has been lodged under this legislation), and as Schedule 1 under the *Wildlife Conservation Notice 2004.* This species apparently prefers mature spinifex associations on sandy substrates. Populations are thought to contract to core habitat areas during harsh years and have also been documented as undergoing rapid expansions in response to good conditions (Woolley 1992).

Likelihood of occurrence: Within the FMG Stage B study area, evidence of this species was recorded from the mixed *Triodia basedowii* / *Triodia schinzii* hummock grassland on sandplain at the eastern end of the proposed rail corridor. Several recent diggings and scats were noted in a small area of approximately 100m x 100m. Additional transects carried out in the vicinity of these diggings found no further evidence. It is considered highly likely that additional evidence of this species would be recorded within this vegetation type with further survey effort.

Bilby *Macrotis lagotis* (Schedule 1, 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.

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). Similar to the Mulgara, the species has been documented as showing temporary home ranges and relatively rapid changes in distribution in response to variation in habitat resources (Johnson 1995). Whilst fox and cat predation and the effect of rabbits and stock are thought to be the principal factors in the decline of this species, fire has also been suggested as an important factor in maintaining habitat diversity for this species (Johnson 1995).

Likelihood of occurrence: There were no Bilby records from the FMG Stage B study area, however the species is still considered a possibility for the area. A recent record has come from Mulga Downs Station (Dr Peter Kendrick, CALM Karratha, pers. comm.). The location of this record (0711250 m E; 7534400 m S) is to the south of the proposed rail corridor but is from habitat equivalent to that intersected by much of the corridor.

Pilbara Olive Python *Liasis olivaceus barroni* (Schedule 1, Vulnerable)
Distribution: Regarded as a Pilbara endemic, this subspecies has a known distribution that coincides roughly with the Pilbara bioregion (Environment Australia 2000).

Ecology: Shows a preference for rocky habitats near water, particularly rock pools. May shelter in deep rock crevices, with a diet that includes birds, reptiles and mammals as large as rock wallabies.

Likelihood of occurrence: Not recorded from the FMG Stage B study area. However, a sloughed skin was found in a cave above a pool of water near HDD05 in the Chichester Range during the Hope Downs rail surveys (Biota 2004b), and numerous records have come from both the Yandi and Marillana mines in the vicinity of Marillana Creek (Mr Noel Grovenor, pers. comm. 2004). This species could occur in suitable habitat throughout the

FMG Stage B study area, particularly in the Mindy Mindy mine area and at the western end of the rail corridor.

Peregrine Falcon *Falco peregrinus* (Schedule 4)
Distribution: The Peregrine Falcon has an almost cosmopolitan distribution. The only subspecies in Australia (*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).

Ecology: This species inhabits a wide range of habitats including forest, woodlands, wetlands and open country. 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 not typically 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 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: The species appears to be uncommon within the FMG Stage B study area; only three individuals were actually sighted, all within the rail corridor. There are also scattered records of individuals from both the FMG Stage A and Hope Downs surveys. The species is likely to be resident in the area as suitable prey species, such as parrots, are common.

Table 6.2: Distribution of Schedule fauna within the FMG Stage B study area.

Species	No. of Records (Locations)
Schedule 1 Fauna	
Mulgara *Dasycercus cristicauda*	Several (rail corridor: FMR08)
Schedule 4 Fauna	
Peregrine Falcon *Falco peregrinus*	3 (rail corridor: FMR10, FMR14, FMR12)

***Ramphotyphlops ganei* (Priority 1)**
Distribution: This blind snake is poorly collected, being represented by just seven specimens in the WA Museum collection. These records are mainly from the area surrounding Pannawonica, together with a record from north of Newman.

Ecology: This species is poorly known, but as for most blind snakes, individuals are likely to mostly inhabit topsoil, termitaria and ant nests. Blind snake diets typically consist of the eggs, larvae and pupae of ants (Storr et al. 2002).

Likelihood of occurrence: Not recorded during the current survey, however a single specimen of this species was recorded from a pitfall trap in *Triodia epactia* hummock grassland on a scree slope within the Chichester Range during the Hope Downs surveys (Biota 2004b). This species would be expected within comparable habitat within the FMG Stage B study area.

***Lerista macropisthopus remota* (Priority 2)**
Distribution: This subspecies has been recorded from the Robertson Range and Mundiwindi to the south of the Mount Nicholas mine area (Storr et al. 1999)

Ecology: No information has been recorded about this subspecies. The species typically inhabits leaf litter beneath a wide variety of shrubs and trees on a wide variety of soils (Storr et al. 1999), and there is no reason to suppose that this subspecies is any different.

Likelihood of occurrence: The subspecies occurs in the Robertson Range, about 50 km to the south of Mount Nicholas, and it seems likely that it also occurs in similar areas in the FMG Stage B study area.

***Ctenotus* (?affin.) *uber johnstonei* (Priority 2)**
Distribution: First recorded during the Hope Downs rail corridor surveys, this species was also recorded during the FMG Stage A survey. This taxon is only currently known from a few localities on the western plains surrounding the Fortescue Marshes.

Ecology: Little is known of this species and its taxonomic status is uncertain. It may belong with *Ctenotus uber johnstonei*, which is a Priority 2 species, or it may belong to an undescribed taxon, in which case it would have no official conservation status. However, even it is a new taxa, it is known from only three specimens and should be considered of conservation significance. During the FMG Stage A survey, an individual was pit-trapped from *Triodia* growing on dolerite hillslopes (FMG21) on 26th March and another was seen in snakewood *Acacia xiphophylla* over chenopods south of the Fortescue Marshes (FMG13) on 30th March. Previously recorded from *Acacia xiphophylla* scattered tall shrubs to high open shrubland over *Sclerolaena cuneata* herbland at HAC9 during the Hope Downs rail corridor survey.

Likelihood of occurrence: Has been recorded from two sites along the FMG Stage A rail corridor and would be likely in comparable habitats within the FMG Stage B study area.

Spectacled Hare-wallaby *Lagorchestes conspicillatus leichardti* (Priority 3)
Distribution: There are scattered records of this species from the Kimberley and Pilbara regions of Western Australia.

Ecology: Apparently prefers large spinifex (*Triodia*) clumps in which to shelter during the day.

Likelihood of occurrence: Not recorded from the FMG Stage B study area, nor during the surveys of the FMG or Hope Downs rail corridors. Several records are known from the vicinity of Chinnamon Creek, to the north-west of the FMG Stage B study area (Dr Peter Kendrick, CALM Karratha, pers. comm.). It is unlikely that this species occurs in the study area, however it could occur in suitable habitat with large *Triodia* clumps.

Grey Falcon *Falco hypoleucos* (Priority 4)
Distribution: The Grey Falcon is endemic to Australia, where it is widespread but rare throughout the arid zone. 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). The species may be either resident or nomadic but its movements are poorly understood. It breeds in trees, typically in the abandoned nests of crows and butcherbirds (Marchant and Higgins 1993). Eggs have been recorded in July and August but its breeding season is not certain.

Likelihood of occurrence: Not recorded during the current survey, however this species was recorded during the FMG Stage A survey from three individuals sighted in the

Chichester Range. It is likely to be a rare resident of suitable habitat within the FMG Stage B study area.

Bush Stonecurlew *Burhinus grallarius* (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). 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. This species was once found throughout most of the south-west of Western Australia, but has disappeared from many areas.

Ecology: 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). This species breeds from July to January. The eggs are either laid directly on the ground or in a small scrape (Johnstone and Storr 1998). This species is a terrestrial feeder and is quite wide-ranging in its diet. It feeds primarily on invertebrates, particularly beetles, but also eats small lizards, frogs, snakes, vegetation and seeds (Marchant and Higgins 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: Not recorded during the current survey. An adult with a chick was recorded during the FMG Stage A survey and an additional individual was seen during the Hope Downs surveys. This suggests that the species is likely to be an uncommon resident in suitable habitats within the FMG Stage B study area.

Australian Bustard *Ardeotis australis* (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.

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 breeds from March to September and the eggs are laid on bare, preferably stony, ground (Johnstone and Storr 1998).

Likelihood of occurrence: This species was frequently recorded in the FMG Stage B study area, with a total of 16 individuals being sighted within the rail corridor and a further five individuals sighted in the eastern mine areas. This species is probably nomadic in the study area but is likely to be present most of the time.

Star Finch *Neochmia ruficauda subclarescens* (Priority 4)
Distribution: This species is endemic to Australia where it occurs from the Pilbara through 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* species) and Buffel Grass (*Cenchrus ciliaris*) (Dr Mike Craig, Biota, 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: Not recorded during the current survey, but there were numerous records of this species from reedbeds along Coonarrie Creek and further north during the Hope Downs rail corridor surveys. The species is likely to occur in suitable habitat along watercourses that run through the FMG Stage B study area.

Long-tailed Dunnart *Sminthopsis longicaudata* (Priority 4)
Distribution: Inhabits rocky, rugged habitat from the Pilbara and adjacent upper Gascoyne region in the west, to the central Northern Territory and South Australia.

Ecology: Records have come from plateaus near breakaways and screes and rugged boulder strewn screes. Recently Mark Cowan has recorded moderate numbers (in excess of 50) in the Goldfields region from mostly stony substrates, particularly fractured/weathered mudstone/siltstone but also breakaways (Mark Cowan, CALM Kalgoorlie, pers. comm. 2004). We have only recorded two individuals from the Pilbara, the first from the bank of Caves Reek (near Mt Brockman) adjacent to a rugged scree, and the second during the current survey from spinifex hummock grassland on a low stony hillslope.

Likelihood of occurrence: This species was recorded from *Acacia aneura, A. adsurgens, G. wickhamii, Cassia glutinosa, C. luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland at FMN03 in the Mt Nicholas study area. This vegetation dominated the stony plains and low hills in the Christmas Creek, Mt Lewin and Mt Nicholas study areas. Recent survey work in the Pilbara has recorded this species from long-term invertebrate pits at a variety of sites (Dr Peter Kendrick, CALM Karratha, pers. comm. 2004).

Short-tailed Mouse *Leggadina lakedownensis* (Priority 4)
Distribution: Since 1997, the number of records of this species has increased substantially such that it has now been recorded from well over 20 locations (Armstrong et al. in prep). 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. In Western Australia the distribution includes the Pilbara and Kimberley regions.

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, CALM Karratha, pers. comm. 2003). 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). Along the Hope Downs rail corridor it was recorded from *Astrebla pectinata* tussock grassland. During the FMG Stage A survey, this species was recorded from *Astrebla pectinata*, *Aristida latifolia* tussock grassland on self-mulching clays within the Chichester Range.

Likelihood of occurrence: During the current survey this species was recorded from numerous sites within the rail corridor and mine area, primarily from tussock grasslands on cracking clay, but also from a range of other habitats.

Western Pebble-mound Mouse *Pseudomys chapmani* (Priority 4)
Distribution: This species is common to very common in suitable habitat within the Hamersley and Chichester sub-regions of the Pilbara bioregion.

Ecology: Well known for its behaviour of constructing extensive mounds of small stones covering areas from 0.5 to 9.0 square metres (Strahan 1995). This mound formation is most common on spurs and gentle slopes with suitable size class stones.

Likelihood of occurrence: Numerous mounds of this species were recorded from the Mindy Mindy study area, with a few also detected in the Mt Lewin study area. This species is probably present in suitable habitat (low stony hills) throughout the FMG Stage B study area.

Ghost Bat *Macroderma gigas* (Priority 4)
Distribution: Ghost Bats are widespread in tropical Australia. There were formerly some populations in subtropical areas as well, but these are now mostly extinct. The distribution of Ghost Bats is fragmented, with each population showing some genetic differentiation (Biota 2004f; Dr Kyle Armstrong, pers. comm. 2004).

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. Vocalisations audible to humans are used in their complex social interactions. 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 the 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 2002).

Likelihood of occurrence: Not recorded during the FMG Stage B survey, but Ghost Bats were recorded from several granite rockpiles along the Hope Downs rail corridor and this species is also known from West Angelas and Weeli Wolli Springs. The species is unlikely to roost in the FMG Stage B study area, but probably forages over it.

Table 6.3: Distribution of Priority fauna within the FMG Stage B study area.

Species	No. of Records (Locations)
Priority 4 Fauna	
Bush Stonecurlew *Burhinus grallarius*	14 (Mt Nicholas: FMN19; Christmas Creek: FMC01, FMC02; rail corridor: FMR10, FMR14, FMR15, FMR17, FMR18, FMR63)
Long-tailed Dunnart *Sminthopsis longicaudata*	1 (Mt Nicholas: FMN03)
Short-tailed Mouse *Leggadina lakedownensis*	11 (Christmas Creek FMC01; rail corridor: FMR01, FMR10, FMR11, FMR12, FMR16, FMR17)
Western Pebble-mound Mouse *Pseudomys chapmani*	16 (Mindy Mindy: FMG01, FMG06; Mt Lewin: FML02, FML03)

6.5 Other Vertebrate Species of Interest

The FMG Stage B fauna survey recorded five additional undescribed fauna taxa or anomalies:

- *Planigale* sp. was recorded from self-mulching clays in the Chichester Range; these specimens are part of a species complex and are still awaiting identification. Both Pilbara species are known from across the Pilbara bioregion;
- *Pseudomys* sp. 'Hamersley' was collected from the Mindy Mindy study area. Taxonomic resolution of this form is awaiting clarification, however it appears to have been collected from a number of localities in the Pilbara. Sites range from the

vicinity of Karratha and Tom Price in the west to the Mindy Mindy study area in the east;

- *Ctenotus* affin. *helenae* is well known and has been collected from a wide area of the Pilbara over the past few decades;
- The *Lerista muelleri* complex has been subject to revision by Mr Laurie Smith (WA Museum); all the individuals collected from the rail corridor appear to be forms of this species complex that have previously been recognised;
- The *Diplodactylus stenodactylus* species complex is currently under review, with possibly six new species occurring in the Pilbara bioregion (Mr Laurie Smith, WA Museum, pers. comm. 2004). We are uncertain as to the conservation status of those specimens recorded by us during the FMG Stage B survey.

6.6 Short Range Endemics

Many recent publications have highlighted taxonomic groups of invertebrates with naturally small distributions (less than 10,000 km^2) (general reference, Harvey 2002; freshwater snails, Ponder and Colgan 2002; land snails, Clark and Richardson 2002; mygalomorph spiders, York Main et al. 2000). These taxa are variously described as narrow range endemics or short-range endemics (see Harvey 2002) 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 millipedes, mygalomorph spiders, and freshwater and terrestrial molluscs (see Harvey 2002).

One of the fundamental problems with assessing the likely occurrence/distribution of Short Range Endemics in the Pilbara is the paucity of targeted collecting. This is compounded by a lack of taxonomic work on most taxa collected, a position further frustrated by the recent move of the WA Museum. As such, we are not currently in a position to identify to species level the majority of invertebrate fauna collected during the FMG Stage B survey.

Of those specimens collected that could be identified, two mygalomorph spiders are potential Short Range Endemic taxa:

- *Aganippe*? sp. (Idiopidae) from site FMG08 in the Mindy Mindy study area (WAM T62547); and
- *Synothele* sp. (Barychelidae) from site FMC01 in the Christmas Creek study area (WAM T62548).

7.0 Fauna Habitat Conservation Significance Assessment

7.1 Approach of the Assessment

The following assessment utilises the Land System framework (see Section 2.2.3) and the vegetation types described for the FMG Stage B study area (see Biota 2004d) to extrapolate the distribution of the fauna habitats identified for the study area within the wider region.

The arbitrary coding system used for the vegetation types is explained further in Biota (2004d). In brief, it incorporated:

- the initial letter of the physiographic unit: Chichester Range (C); Fortescue Valley (F); Hamersley Range (H);
- a lower case letter designating the habitat / vegetation type: stony plains, hills and ridges (h); creeks and floodplains (c); plains (p); Mulga-dominated vegetation (a); cracking clays (x); and
- a number to further separate vegetation types within each group.

In addition, comment is made as to whether the habitats linked with particular Land Systems are known to or likely to support fauna of conservation significance.

7.1.1 Boolgeeda Land System

The Boolgeeda Land System occurs widely through the Hamersley Range sub-region, with scattered occurrences through the Chichester Range sub-region, mainly further towards the coast. The small occurrences within the study area are at the end of the southeastern spread of this Land System.

Some 0.45% of the total area of the Boolgeeda Land System within the Pilbara occurs within the study area. The 3739 ha within the study area would represent a greater proportion of the southeastern section of this Land System, but still less than 10%. The study area therefore has low conservation value for the Boolgeeda Land System overall, and low to moderate conservation value for the southeastern section of this Land System.

Fourteen vegetation types were recorded from this Land System (Biota 2004d), including units from low stony hills and plains in the Chichester Range and Hamersley Range sub-regions, and Mulga-dominated units from the Fortescue Valley (see Table 3.4). The systematic trapping grids sampled three of these fourteen vegetation types (Fa20 at site FMN05, Fa25 at site FMN14 and Fa26 at site FMN13), none of which have been sampled elsewhere by us. The floristic analysis (Biota 2004d) indicates that these three vegetation types are so far only known locally.

No fauna of conservation significance were recorded from any of the sites within the vegetation types associated with this Land System.

7.1.2 Brockman Land System

While the Brockman Land System is widespread through the Fortescue Plains sub-region and extends into the Hamersley Range sub-region, it is represented by only 33 occurrences. The FMG Stage B study area is located at the eastern end of this Land System's distribution, and is therefore likely to support vegetation types that are atypical of the main area of the Brockman Land System.

The area of Brockman Land System within the study area is small (317.89 ha, or 0.43% of the total area mapped for the Pilbara). The small occurrences within the study area would also be a small proportion of the eastern section of the Brockman Land System. The study area thus has low to moderate conservation value for this Land System.

The vegetation types associated with this Land System were mainly two cracking clay vegetation units (Fx11 and Fx12), along with some groved Mulga (Fa15) and intergrove vegetation (Fa1a). The systematic trapping sites sampled two of these vegetation types (Fx11 at site FMR11 and Fx12 at site FMR12). These vegetation types appear to be locally common but probably restricted in the region (Biota 2004d).

The cracking clay vegetation types supported the Priority 4 species *Leggadina lakedownensis* as well as members of the *Planigale* species complex and *Sminthopsis macroura* (also thought to be a species complex). A poorly collected form of *Lerista muelleri* first collected from Roy Hill station was recorded from vegetation type Fx12 (as well as Fx10). The Schedule 4 Peregrine Falcon *Falco peregrinus* was recorded from site FMR12 within the vegetation type Fx12.

7.1.3 Capricorn Land System

The Capricorn Land System is widespread through the Chichester Range sub-region and also occurs in the Hamersley Range sub-region. An area at the westernmost end of the rail corridor is part of the southernmost occurrence of this Land System in the Chichester Range sub-region. However, it is possible that this area, or at least the section within the rail corridor, would be better mapped as the McKay Land System as it has a similar appearance on aerial photography to areas mapped as the latter.

Presuming the area is appropriately mapped as the Capricorn Land System, its isolation and location near the junction of the Chichester Range and Fortescue Plains sub-regions mean that this area is likely to support atypical vegetation for this Land System. The 138.98 ha of Capricorn Land System within the study area is 0.02% of the total area of this Land System, and would represent less than 10% of the southern occurrences in the Chichester Range. The study area is therefore considered to have low conservation value for the Capricorn Land System overall, and low to moderate conservation value for the southern Chichester Range section of this Land System.

The area of Capricorn Land System was mapped as vegetation type Ch24, which occurred broadly over the adjoining areas of McKay Land System. No systematic fauna trapping grids were established in this vegetation unit. Biota (2004d) found that in terms of floristic composition, the vegetation in the Capricorn Land System is not widespread but is fairly common locally.

7.1.4 Divide Land System

The Divide Land System is restricted to the eastern end of the Fortescue Plains sub-region but occurs as broad sandplains in this area. The 21183.73 ha of Divide Land System within the study area is located towards the centre of the distribution of this Land System, and is 4% of the total area of the Divide Land System. The study area thus has low conservation value for this Land System.

The sandplain vegetation types Fp1-Fp4 were strongly associated with the Divide Land System. The systematic trapping sites sampled three of these vegetation types (Fp1 at site FML01, Fp2 at sites FMR07 and FMR08, and Fp4 at site FMR10). The vegetation of the Divide Land System appears to be relatively common locally, but not widespread in the region (Biota 2004d).

Records of the Schedule 1 Mulgara *Dasycercus cristicauda* were recorded from vegetation type Fp2 adjacent to site FMR08. We recorded a single *Leggadina lakedownensis* from FMR10 (possibly a dispersing individual). A single record of the Schedule 4 Peregrine Falcon and three records of the Australian Bustard were also noted from FMR10.

7.1.5 Elimunna Land System

The Elimunna Land System has two centers of distribution, one north and one south of the Fortescue Marsh. Some 193.59 ha of Elimunna occurs within the study area, which is 0.03% of the total mapped for this Land System in the Pilbara, and would also represent a very small proportion of the northern occurrences of Elimunna. The study area thus has low conservation value for this Land System treated as a whole.

A single vegetation type (Fa1a) was mapped for this Land System. No systematic fauna trapping grids were established in this vegetation type. Biota (2004d) considered it likely that this Land System supports vegetation that is restricted in the region, but locally common.

7.1.6 Jamindie Land System

The main occurrence of this Land System within the Pilbara is in the Fortescue Valley, particularly on the northern side of the Fortescue Marsh but also on the southern side, with further occurrences in the south of the bioregion. As 10.65% of the total area of this Land System (and a greater proportion of the area of this unit within the Fortescue Valley) occurs in the study area, the study area has moderate to high conservation value for the Jamindie Land System.

Eight Mulga-dominated vegetation types and an intergrove vegetation unit were associated with this Land System, along with six creekline vegetation types and one cracking clay vegetation type (Table 3.4). The systematic trapping sites sampled four of these vegetation types (Fa11 at site FMR17, Fa14 at site FMR13, Fc9 at site FMC03 and Fc12 at site FMC02).

All of the Mulga-dominated vegetation, cracking clay vegetation and the majority of the creekline types were recorded at most from the combined FMG Stage A, FMG Stage B and Hope Downs rail corridor study areas, and some were restricted to the current study area alone (Biota 2004d). The Jamindie Land System therefore supports a variety of vegetation types, most of which are not widespread in the region but are locally common.

A poorly collected (though previously known) representative of the *Lerista muelleri* complex was recorded from vegetation type Fa11. One record of the Priority 4 species *Leggadina lakedownensis* was recorded from vegetation type Fa11 and members of the *Sminthopsis macroura* species complex were recorded from both Fa11 and Fa14. Two records of the Priority 4 listed Australian Bustard were made from vegetation type Fc12 and another was from Fa11.

7.1.7 McKay Land System

The McKay Land System is widespread through the Chichester Range sub-region, with fewer occurrences in the Hamersley Range. The occurrences within the study area are near the eastern end of the geographic range of this Land System, and may therefore be expected to support vegetation of different floristic composition to areas further west.

The 8175.34 ha of McKay Land System within the study area comprises 1.94% of the total area of this Land System, and would comprise a small amount of the eastern section of the McKay Land System. The study area thus has low conservation value for this Land System.

The main vegetation types associated with the McKay Land System were 17 units from low stony hills and plains of the Chichester Range sub-region. Four creekline vegetation types were also recorded (see Table 3.4). This Land System thus contained considerable variation in vegetation, some of which was identified as being restricted in distribution (Biota 2004d). The systematic trapping sites sampled four of these vegetation types (Ch13 at site FML03; Ch17 at sites FMN03, FMN19, FMC01, FMC04, FMC05, FML02, FML05 and FML06; Ch20 at site FMN30; and Cc20 at site FML04). The Ch17 vegetation type corresponding to stony plains and low hills in the Christmas Creek, Mt Lewin and Mt Nicholas study areas was the most intensively trapped vegetation type across the project area.

The potential Short Range Endemic mygalomorph spider *Synothele* sp. was recorded from the Ch17 vegetation type. Specimens from known species complexes including *Diplodactylus stenodactylus*, *Lerista muelleri* and *Menetia greyii* and therefore of uncertain conservation significance were also recorded from the Ch17 vegetation type. Also recorded from this vegetation type were the Priority 4 species *Leggadina lakedownensis*, *Sminthopsis longicaudata, Pseudomys chapmani* and Australian Bustard. *Diplodactylus stenodactylus* was also recorded from vegetation type Ch20. One record of *Pseudomys chapmani* was made within the Ch13 vegetation type and a member of the *Sminthopsis macroura* species complex was recorded from Cc20.

7.1.8 Newman Land System

The Newman Land System is widespread throughout the Hamersley Range, with relatively few occurrences in the Chichester Range, including a long narrow band along the northern edge of the study area. As the latter area is well separated from the main area of the Land System by the Fortescue Valley, it is likely to support different vegetation types.

The 12694.01 ha of Newman Land System within the study area is 0.87% of the total area of this Land System, but would represent approximately 10% of the area of this Land System north of the Fortescue Valley. The study area thus has low conservation value for the Newman Land System overall, but moderate conservation value for the section of this Land System north of the Fortescue Valley.

Vegetation types associated with the Newman Land System included 14 units from low stony hills and plains of the Chichester and Hamersley Range sub-regions and 10 creekline vegetation types occurring in all three sub-regions. This Land System thus included considerable variation in vegetation, some of which was identified as being restricted in distribution (Biota 2004d). The systematic trapping sites sampled four of these vegetation types (Hh4 at sites FMG07 and FMG08; Hh5 at sites FMG02, FMG06 (and HDA05 of the Hope Downs rail corridor); Hh6 at site FMG01; and Hp7 at sites FMG03 and FMG05. Hh5 is one of the few vegetation types that has also been trapped outside of the FMG Stage B study area; it was sampled during survey work for the Hamersley Range Extension to the Hope Downs rail corridor (Biota 2004d).

The poorly collected Pilbara endemics *Ctenotus rubicundus* (23 specimens in WA Museum) and *Varanus pilbarensis* (22 specimens in the WA Museum) were collected from vegetation type Hh5 as part of the Hope Downs assessment. Representatives of the *Diplodactylus stenodactylus* species complex were collected from each of the vegetation types. The Priority 4 listed *Pseudomys chapmani* was recorded from vegetation types Hh4, Hh5 and Hh6, whilst *Pseudomys* sp. "Hamersley" was recorded from Hh5. The potential Short Range Endemic mygalomorph spider *Aganippe*? sp was recorded from the Hh4 vegetation type.

7.1.9 River Land System

The River Land System is widespread throughout the Pilbara bioregion in major river systems. Some 0.61 ha of this Land System is mapped within the study area, which is less than 0.01% of the total mapped for the Pilbara. Although other areas of this Land System would be expected to occur in the study area if the mapping was undertaken at a finer scale, these would still be a very small proportion of the total area. The study area thus has low conservation value for the River Land System.

The single mapped occurrence of River Land System within the study area is associated with vegetation type Fc5, however some other vegetation types (particularly Cc18, Fc4 and Hc22) would probably be associated with this Land System if it was mapped at a finer scale. This Land System includes at least two vegetation types (Fc4 and Fc5) of restricted distribution in the region (Biota 2004d). The systematic trapping sites sampled vegetation type Fc5 at site FMR01.

The Priority 4 *Leggadina lakedownensis* was recorded from vegetation type Fc5, which was heavily infested with Buffel Grass *Cenchrus ciliaris*. Also recorded from this vegetation type were several individuals of the *Sminthopsis macroura* species complex.

7.1.10 Rocklea Land System

The Rocklea Land System is widespread throughout the Chichester Range, and also relatively frequent in the Hamersley Range. The occurrences in the vicinity of the study area are at the south-eastern end of the distribution of this Land System in the Chichester Range sub-region.

Some 0.79 ha of Rocklea Land System occurs within the study area, which is less than 0.01% of the total area of this Land System, and would also represent a very small proportion of the southeastern section. The study area thus has low conservation value for the Rocklea Land System.

The areas of Rocklea mapped within the study area were mainly vegetation type Ch15, which belongs to a floristic group that is relatively widespread in the region (Biota 2004d). No systematic fauna trapping grids were established in this vegetation unit.

7.1.11 Turee Land System

This Land System occurs predominantly in the vicinity of the Fortescue Marsh, with two small occurrences elsewhere (at the southernmost border of the bioregion). Given that one-fifth of the total area of Turee Land System mapped for the Pilbara bioregion occurs within the FMG Stage B study area, the study area has high conservation value for this Land System.

The main vegetation types defined for the FMG Stage B study (see Biota 2004d) that were associated with the Turee Land System were three Mulga-dominated units (Fa1, Fa11 and Fa14), the intergrove unit (Fa1a), three cracking clay units (Fx1, Fx10 and Fx12) and two creekline vegetation units (Fc5 and Fc6). Most of these units were recorded from more than one Land System, however Fx1 was only recorded from Turee. With the exception of a single site each from vegetation types Fc6 and Fx10, the remaining sites all occurred in floristic groups that were restricted to the FMG Stage A, FMG Stage B and Hope Downs rail corridor study areas (Biota 2004d). It therefore appears that the Jamindie Land System supports a variety of vegetation types, including several that are restricted in the region but relatively common in the local area. The systematic trapping sites sampled five of these vegetation types (Fa11 at site FMR17; Fa14 at site FMR13; Fx1 at site FMR18; Fx10 at sites FMR14, FMR15 and FMR16; and Fx12 at site FMR12).

The Schedule 4 Peregrine Falcon was recorded from vegetation types Fx10 and Fx12. The Priority 4 Australian Bustard was recorded from vegetation types Fa11, Fa14, Fx1 and Fx12. Individuals from the *Lerista muelleri* and *Menetia greyii* species complexes were recorded from vegetation types Fa11, Fx1, Fx10 and Fx12. The Priority 4 *Leggadina lakedownensis* was recorded from vegetation types Fa11, Fx10 and Fx12. Individuals of the *Planigale* and *Sminthopsis macroura* species complexes were recorded from all five vegetation types. The vegetation types / fauna habitats of the Turee Land System therefore support a number of fauna species of conservation significance.

7.1.12 Washplain Land System

The Washplain Land System is restricted to the south-eastern section of the Pilbara, where it occurs predominantly at the eastern end of the Fortescue Valley. The study area is located along the northern margin of the distribution of this Land System.

Some 4411.45 ha of Washplain Land System are mapped within the study area, which is 4.81% of the total mapped area of this Land System in the Pilbara, and would represent a substantial proportion (over 25%) of the northern sections of this Land System. The study area thus has low conservation value for the Washplain Land System overall, but high conservation value for the northern sections of this Land System.

Six vegetation types were associated with the Washplain Land System (Table 3.4), five of which were Mulga-dominated units. With the exception of the Mulga grove unit Fa1, these vegetation types were not recorded from any other Land Systems. All of the vegetation types are considered to be of very restricted distribution both in the region and in the local area (Biota 2004d). The systematic trapping sites sampled three of these vegetation types (Fa19 at site FMN18, Fa20 at site FMN05 and Fa25 at site FMN14).

Individuals from the *Sminthopsis macroura* species complex were recorded from vegetation types Fa19 and Fa20. In respect of the avifauna, a number of mulga specialists were recorded from these vegetation types, particularly Fa19.

7.1.13 Wona Land System

The Wona Land System occurs broadly throughout the basalt uplands of the southern section of the Chichester Range. The study area is located towards the eastern end of the distribution of this Land System.

A very small area of this Land System occurred at the westernmost end of the rail corridor. This area may be better mapped as McKay as it had a similar appearance to this Land System on aerial photography. Presuming the area is appropriately mapped as the Wona Land System, the area of 17.67 ha is less than 0.01% of the total area of this Land System, and would be a very small proportion of the eastern section. The study area thus has low conservation value for the Wona Land System.

The Wona Land System was mapped as vegetation type Ch24, which also occurred broadly over the adjoining areas of McKay Land System. Biota (2004d) found that in terms of floristic composition, the vegetation in the Wona Land System is not widespread but is fairly common locally.

No systematic fauna trapping grids were established in the Ch24 vegetation type.

7.1.14 Summary

The floristic analysis found that many of the mapped vegetation units within the FMG Stage B study area are locally restricted (Biota 2004d). At a broader level, several of the Land Systems (particularly Turee and Washplain) are locally restricted, while several

others that have a relatively broad distribution in the Pilbara are at the extremes of their range in the study area. In terms of terrestrial vertebrate fauna, a convenient habitat framework lies at a scale of resolution in between the vegetation mapping and Land System mapping, probably equivalent to the Land Unit level.

Unfortunately, no thematic mapping of Land Units is available. To some extent, the vegetation codes provide an insight into a broader level of habitat distribution (eg. "x" prefixes denote clays, "a" prefixes denote mulga, etc; see Section 7.1), and the distribution of some species can therefore be linked with these codes (eg. *Leggadina lakedownensis* is predominantly associated with cracking clay vegetation types, whilst *Diplodactylus wombeyi* is largely confined to hilltops). However, this classification is unsatisfactory as it is either too broad or fails to adequately define habitats across all fauna classes.

Significantly, none of the vertebrate fauna have distributions that are restricted to the study area. However, the Fortescue Valley has the potential to support species assemblages that may be uncommon elsewhere in the Pilbara bioregion, possibly a result of the interdigiting of a number of broad vegetation and soil types (particularly mulga and cracking clay).

The cracking clay vegetation types correspond to perhaps the most readily identifiable faunal assemblage of the study area, with many species not recorded in other habitat types or at least recorded relatively infrequently elsewhere. Species strongly associated with cracking clays include *Diplodactylus mitchelli*[1], *Tympanocryptis cephala*[2], *Ctenotus* affin. *robustus*, *Leggadina lakedownensis* and possibly one of the forms of *Planigale* collected. Whilst not apparently restricted to cracking clays, *Sminthopsis macroura* is recorded in much greater numbers from this habitat, as are several bird species (eg. the Singing Bushlark). It is quite conceivable that a large array of invertebrate taxa will also be confined to cracking clays.

Not enough is known of short-range endemics, either potentially occurring within the project area or recorded by this survey, to comment on the conservation significance of their habitats. Within the caveat that different taxonomic groups respond differently to different elements of the environment (McKenzie et al. 2002), it is plausible that distributions may coincide at least with the level of vegetation mapping provided in Biota (2004d). Rare and restricted vegetation types, perhaps indicating discrete substrate types, potentially support short range endemics sensitive to that component of the physical environment (eg. mygalomorph spiders; York Main et al. 2000).

The assessment of vegetation conservation significance is described in full in Biota (2004d), however, it considered factors such as the distribution of the associated Land System/s on which the vegetation type was found to occur, whether the floristic composition of the vegetation type was restricted in distribution, and some other attributes considered to affect conservation value. In the consideration of the floristic groups in particular, 52 of the 81 vegetation types were found to belong to floristic groups that were restricted or highly restricted in geographic distribution.

A number of vegetation types of particular conservation significance were identified within the study area, including:

The vegetation assessment identified a number of vegetation types of particular conservation significance within the study area, including:

- Vegetation type Fa10 was considered to be of Very High conservation significance. This unit occurred between Mt Lewin and Mt Nicholas and comprised Mulga-dominated vegetation of seasonally-wet broad drainage areas, which is an

[1] The Cape Range form represents a distinct taxon.
[2] A species complex.

uncommon habitat in the area. It was strongly associated with the Washplain Land System, which has a restricted distribution in the Pilbara, with the study area being located at the northern edge of this range. This vegetation was also in excellent condition, and is considered likely to support flora species of restricted distribution in the region.

- Seven vegetation types of High conservation significance were identified (Fa1, Fa13, Fa18, Fa19, Fa20, Fa25 and Fa27). These were all Mulga-dominated vegetation types that occurred mainly on restricted Land Systems (particularly Washplain and Jamindie). These vegetation types were also in very good condition, and considered likely to support restricted flora taxa.

- The survey also identified 20 vegetation types of Moderate to High conservation significance, 34 vegetation types of Moderate conservation significance, 18 vegetation types of Low to Moderate conservation significance and one vegetation type of Low conservation significance.

Given the very high conservation significance of one of the vegetation types identified, the high conservation significance of an additional seven vegetation types, and the apparently restricted or highly restricted geographic distribution of 44 of the remaining vegetation types, the study area is believed to have high to very high conservation value for vegetation and potentially for some fauna and faunal assemblages.

Vegetation types supporting Schedule fauna clearly have a degree of conservation significance imparted on them in terms of fauna habitats by the presence of these species. The following vegetation types supported fauna recorded by our survey that are either Schedule 1 or Schedule 4.

- Fp2 supported the Mulgara *Dasycercus cristicauda.*

- Fp4, Fx10 and Fx12 supported the Peregrine Falcon *Falco peregrinus*.

8.0 References

Adams M., T.R. Reardon, P.R. Baverstock and C.H.S. Watts (1988). Electrophoretic resolution of species boundaries in Australian Microchiroptera. IV. The Molossidae (Chiroptera). *Australian Journal of Biological Science* **41**: 315-326.

Allen G.R., S.H. Midgley and M. Allen (2002). Field guide to the freshwater fishes of Western Australia. *Records of the Western Australian Museum.* Supplement No. **63**: pp 51-74.

Aplin, K.P. and L.A. Smith (2001). Checklist of the frogs and reptiles of Western Australia. *Rec. West. Aust. Mus.* Suppl. No. **63**: pp 51 – 74.

Armstrong, K.N. (2001). The distribution and roost habitat of the orange leaf-nosed bat *Rhinonicteris aurantius*, in the Pilbara region of Western Australia. *Wildlife Research* 28: 95-104.

Armstrong K.N. and S.D. Anstee (2000). The ghost bat in the Pilbara: 100 years on. *Australian Mammalogy* **22**: 93-101.

Beard J.S. (1975). 'Pilbara. Explanatory notes to Sheet 5, 1:1 000 000 series vegetation survey of Western Australia'. University of Western Australia Press: Nedlands.

Biota Environmental Sciences (2002). Proposed Hope Downs Rail Corridor from Weeli Wolli Siding to Port Hedland - Vertebrate Fauna survey. Unpublished report for Hope Downs Management Services Pty. Ltd.

Biota Environmental Sciences (2004a). Hope Downs Rail Corridor Extension – Hamersley Range: Vertebrate Fauna Survey. Unpublished report for Hope Downs Management Services Pty. Ltd.

Biota Environmental Sciences (2004b). Hope Downs Additional Rail Corridor – Chichester Range: Vertebrate Fauna Survey. Unpublished report for Hope Downs Management Services Pty. Ltd.

Biota Environmental Sciences (2004c). Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor. Unpublished report for Fortescue Metals Group Ltd.

Biota Environmental Sciences (2004d). Vegetation and Flora Survey of the Proposed FMG Stage B Rail Corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas Mine Areas. Unpublished report for Fortescue Metals Group Ltd.

Biota Environmental Sciences (2004e). Monitoring of Ghost Bat Roosts at West Angelas – 2003. Unpublished report for Robe River Mining Co. Pty Ltd.

Biota Environmental Sciences (2004f). Genetic Structure of the Ghost Bat in the Pilbara: Alternative Approaches for Determining Roost Importance. Interim Report for Phases 1 and 2, September 2004. Unpublished report for Robe River Mining Co. Pty Ltd / Hamersley Iron Pty Ltd.

Cade T.J. (1982). *The Falcons of the World.* Collins, London.

Churchill S.K. (1998). *Australian bats.* Reed New Holland: Frenchs Forest, NSW

Clark, S.A. and B.J. Richardson (2002). Spatial analysis of genetic variation as a rapid assessment tool in conservation management of narrow-range endemics. *Invertebrate Systematics* **16**: 583-587.

Cooper N.K, M. Adams, C. Anthony and L.H. Schmitt (2003). Morphological and genetic variation in *Leggadina* (Thomas, 1910) with special reference to western Australian populations. *Records of the Western Australian Museum* **21**: 333-351

Department of Agriculture (authors unknown) (2002). Land Systems Mapping of the Pilbara region, WA. Draft mapping.

Environment Australia (2000). Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1, Summary Report. Environment Australia, November 2000.

Environment Australia (2001). A Directory of Important Wetlands in Australia. Third Edition. Environment Australia, Canberra.

Flannery T. (1990). The Bilby *Macrotis lagotis In*: *Australia's Vanishing Mammals: Endangered and Extinct Native Species.* WWF Press.

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

Halpern Glick Maunsell and Biota (2000). Austeel Biological Survey, Cape Preston. Unpublished report prepared for Austeel, Perth.

Harvey M.S. (2002). Short-range endemism among Australian fauna: some examples from non-marine environments. *Invertebrate Systematics* **16**: 555-570.

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

Hoffman R.L. (2003). A new genus and species of trigoniuline millipede from Western Australia (Spirobolida: Pachybolidae: Trigoniulinar). *Rec. of the West Aust Mus*. **22**: 17-22.

How, R.A., N.K. Cooper and J.L Bannister (2001). Checklist of the mammals of Western Australia. *Records of the Western Australian Museum* Suppl. No. **63**: pp 91 – 98.

Johnson J. (1995). The Bilby *Macrotis lagotis*. *In:* Strahan, R. (ed). (1995). *The Mammals of Australia.* Australian Museum / Reed Books.

Johnson G. and D.J. Baker-Gabb (1993). Bush Thick-knee in Northern Victoria (Part 1): Conservation and Management. Arthur Rylah Institute of Environmental Research Technical Report 129(A).

Johnson M.S. Z.R. Hamilton, C.E. Murphy, C.A. MacLeay, B. Roberts and P.G. Kendrick (2004). Evolutionary genetics of island and mainland species of Rhagada (Gastropoda: Pulmonata) in the Pilbara Region, Western Australia. *Aust. J. Zool*. **52**: 341-355.

Johnstone R.E. (2001). Checklist of the birds of Western Australia. *Records of the Western Australian Museum* Suppl. No. **63**: pp 75 – 90.

Johnstone R.E. and G.M. Storr (1998). Handbook of Western Australian Birds. Volume 1 - Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth WA.

Jolly S. (1996a). Analysis of Anabat files: Bat echolocation call recognition. *Australasian Bat Society Newsletter* **7**: 22-28.

Jolly S. (1996b). Analyze for Windows 95. Download available at http://members.ozemail.com.au/~jollys/

Jolly S. (1997). Analysis of Anabat files. *Australasian Bat Society Newsletter* **9**: 25-27.

McKenzie N.L. and J.K. Rolfe (1986). Structure of bat guilds in the Kimberley mangroves, Australia. *Journal of Animal Ecology* **55**: 401-420.

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

McKenzie N.L., G.J. Keighery, N. Gibson and J.K. Rolfe (2002). Patterns in biodiversity of terrestrial environments in the southern Carnarvon Basin, Western Australia. *Rec. West. Aust. Mus. Suppl. No*. **61**: 511-546

Marchant S. and P.J. Higgins (1993). *Handbook of Australian, New Zealand & Antarctic Birds Volume 2: Raptors to Lapwings.* Oxford University Press, South Melbourne.

Morgan D., H. Gill, M. Allen and M. Maddern (2003). Distribution and biology of fish in inland waters of the Pilbara (Indian Ocean) drainage division. Centre for Fish and Fisheries Research, Murdoch University, Perth, Western Australia. Natural Heritage Trust Project No. 003026.

Ponder W.F. (1997). Conservation status, threats and habitat requirements of Australian terrestrial and freshwater Mollusca. *Memiors of the Museum of Voctoria* **56**: 421-430.

Ponder W.F. and D.J. Colgan (2002). What makes a narrow-range taxon? Insights from Australian fresh-water snails. *Invertebrate Systematics* **16**: 571-582.

Solem A. (1986) Pupilloid land snails from the south and mid-west coasts of Australia. Journal of the Malacological Society of Australia 7(3-4): 95-124.

Solem A. (1997). Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae). VII Taxa from Dampierland through the Nullarbor. *Rec. West Aust. Mus. Suppl.* **50.**

Storr G.M. (1984). Birds of the Pilbara Region, Western Australia. *Records of the Western Australian Museum,* Supplement No. **16**.

Storr G.M., L.A. Smith and R.E. Johnstone (1999). Lizards of Western Australia I Skinks. Western Australian Museum, Perth, Western Australia.

Storr G.M., L.A. Smith and R.E. Johnstone (2002). *Snakes of Western Australia.* Western Australian Museum, Perth, Western Australia.

Strahan R. (1995). *The Mammals of Australia.* Reed Books, Chatswood.

Thorne A.M. and A.F. Trendall (2001). Geology of the Fortescue Group, Pilbara Craton, Western Australia. Geological Survey of Western Australia Bulletin 144, Department of Minerals and Energy.

Woolley P. (1995). The Mulgara *Dasycercus cristicauda In:* Strahan, R. (ed). (1995). *The Mammals of Australia.* Australian Museum / Reed Books.

York Main, B. A. Sampey and P.L.J. West (2000). Mygalomorph spiders of the southern Carnarvon Basin, Western Australia. *Records of the Western Australian Museum Supplement* No. **61**: 281-293.

Vouchered Specimens from the FMG B Survey

Appendix 1

BIOta

Survey	Date	Site	*Species Name*	Museum Number
FMG E-W Rail and Tenements	8/07/04	FMC01	*Leggadina lakedownensis*	M56509
FMG E-W Rail and Tenements	5/07/04	FMC02	*Pseudomys desertor*	M55139
FMG E-W Rail and Tenements	8/07/04	FMC02	*Pseudomys desertor*	M56510
FMG E-W Rail and Tenements	6/07/04	FMC03	*Mus musculus*	M55131
FMG E-W Rail and Tenements	7/07/04	FMC03	*Mus musculus*	M55137
FMG E-W Rail and Tenements	5/07/04	FMC03	*Pseudomys hermannsburgensis*	M55140
FMG E-W Rail and Tenements	5/07/04	FMC03	*Sminthopsis macroura*	M55141
FMG E-W Rail and Tenements	9/07/04	FMC04	*Pseudomys hermannsburgensis*	M56518
FMG E-W Rail and Tenements	6/07/04	FMC05	*Mus musculus*	M55129
FMG E-W Rail and Tenements	6/07/04	FMC05	*Pseudomys hermannsburgensis*	M55130
FMG E-W Rail and Tenements	7/07/04	FMC05	*Pseudomys hermannsburgensis*	M56503
FMG E-W Rail and Tenements	13/07/04	FML01	*Sminthopsis youngsoni*	M56537
FMG E-W Rail and Tenements	10/07/04	FML03	*Ningaui sp*	M56520
FMG E-W Rail and Tenements	10/07/04	FML03	*Pseudomys chapmani*	M56526
FMG E-W Rail and Tenements	11/07/04	FML03	*Ningaui sp*	M56530
FMG E-W Rail and Tenements	13/07/04	FML03	*Ningaui sp*	M56541
FMG E-W Rail and Tenements	13/07/04	FML04	*Pseudomys hermannsburgensis*	M56094
FMG E-W Rail and Tenements	11/07/04	FML04	*Pseudomys hermannsburgensis*	M56528
FMG E-W Rail and Tenements	11/07/04	FML04	*Pseudomys hermannsburgensis*	M56529
FMG E-W Rail and Tenements	14/07/04	FML06	*Pseudomys desertor*	M56542
FMG E-W Rail and Tenements	11/07/04	FMN03	*Pseudomys hermannsburgensis*	M56522
FMG E-W Rail and Tenements	11/07/04	FMN03	*Pseudomys hermannsburgensis*	M56523
FMG E-W Rail and Tenements	11/07/04	FMN03	*Pseudomys hermannsburgensis*	M56524
FMG E-W Rail and Tenements	15/07/04	FMN03	*Sminthopsis longicaudata*	M56543
FMG E-W Rail and Tenements	10/07/04	FMN05	*Sminthopsis macroura*	M56095
FMG E-W Rail and Tenements	11/07/04	FMN05	*Pseudomys hermannsburgensis*	M56521
FMG E-W Rail and Tenements	11/07/04	FMN13	*Pseudomys hermannsburgensis*	M56525
FMG E-W Rail and Tenements	12/07/04	FMN14	*Mus musculus*	M56527
FMG E-W Rail and Tenements	11/07/08	FMN14	*Mus musculus*	M56534
FMG E-W Rail and Tenements	13/07/04	FMN14	*Pseudomys desertor*	M56539
FMG E-W Rail and Tenements	12/07/04	FMN30	*Pseudomys desertor*	M56532
FMG E-W Rail and Tenements	13/07/04	FMN30	*Sminthopsis macroura*	M56538
FMG E-W Rail and Tenements	14/07/04	FMN30	*Sminthopsis youngsoni*	M56547
FMG E-W Rail and Tenements	14/07/04	FMN30	*Sminthopsis macroura*	M56548
FMG E-W Rail and Tenements	4/07/04	FMR01	*Sminthopsis macroura*	M55116
FMG E-W Rail and Tenements	5/07/04	FMR01	*Mus musculus*	M55120
FMG E-W Rail and Tenements	6/07/04	FMR01	*Sminthopsis macroura*	M55128
FMG E-W Rail and Tenements	5/07/04	FMR01	*Sminthopsis macroura*	M55146
FMG E-W Rail and Tenements	8/07/04	FMR01	*Leggadina lakedownensis*	M56507
FMG E-W Rail and Tenements	12/07/04	FMR07	*Pseudomys hermannsburgensis*	M56531
FMG E-W Rail and Tenements	12/07/04	FMR07	*Pseudomys hermannsburgensis*	M56533
FMG E-W Rail and Tenements	13/07/04	FMR07	*Pseudomys desertor*	M56540
FMG E-W Rail and Tenements	15/07/04	FMR07	*Dasykaluta rosamondae*	M56544
FMG E-W Rail and Tenements	12/07/04	FMR08	*Pseudomys hermannsburgensis*	M56535
FMG E-W Rail and Tenements	12/07/04	FMR08	*Pseudomys desertor*	M56536
FMG E-W Rail and Tenements	5/07/04	FMR10	*Sminthopsis youngsoni*	M55122

FMG E-W Rail and Tenements	6/07/04	FMR10	*Sminthopsis macroura*	M55124
FMG E-W Rail and Tenements	6/07/04	FMR10	*Mus musculus*	M55125
FMG E-W Rail and Tenements	6/07/04	FMR10	*Sminthopsis macroura*	M55142
FMG E-W Rail and Tenements	9/07/04	FMR10	*Mus musculus*	M56517
FMG E-W Rail and Tenements	6/07/04	FMR11	*Planigale sp*	M55126
FMG E-W Rail and Tenements	6/07/04	FMR11	*Planigale sp*	M55127
FMG E-W Rail and Tenements	5/07/04	FMR11	*Sminthopsis macroura*	M55143
FMG E-W Rail and Tenements	5/07/04	FMR11	*Sminthopsis macroura*	M55144
FMG E-W Rail and Tenements	5/07/04	FMR11	*Sminthopsis macroura*	M55145
FMG E-W Rail and Tenements	7/07/04	FMR11	*Leggadina lakedownensis*	M56502
FMG E-W Rail and Tenements	8/07/04	FMR11	*Leggadina lakedownensis*	M56506
FMG E-W Rail and Tenements	8/07/04	FMR11	*Planigale sp*	M56508
FMG E-W Rail and Tenements	8/07/04	FMR11	*Leggadina lakedownensis*	M56515
FMG E-W Rail and Tenements	5/07/04	FMR12	*Leggadina lakedownensis*	M55121
FMG E-W Rail and Tenements	6/07/04	FMR12	*Planigale sp*	M55135
FMG E-W Rail and Tenements	8/07/04	FMR12	*Leggadina lakedownensis*	M56512
FMG E-W Rail and Tenements	4/07/04	FMR14	*Planigale sp*	M55113
FMG E-W Rail and Tenements	4/07/04	FMR14	*Sminthopsis macroura*	M55114
FMG E-W Rail and Tenements	4/07/04	FMR14	*Mus musculus*	M55115
FMG E-W Rail and Tenements	6/07/04	FMR14	*Sminthopsis macroura*	M55132
FMG E-W Rail and Tenements	6/07/04	FMR14	*Planigale sp*	M55133
FMG E-W Rail and Tenements	8/07/04	FMR14	*Planigale sp*	M56505
FMG E-W Rail and Tenements	7/07/04	FMR15	*Planigale sp*	M55136
FMG E-W Rail and Tenements	6/07/04	FMR15	*Sminthopsis macroura*	M55138
FMG E-W Rail and Tenements	9/07/04	FMR15	*Planigale sp*	M56516
FMG E-W Rail and Tenements	3/07/04	FMR16	*Leggadina lakedownensis*	M55111
FMG E-W Rail and Tenements	3/07/04	FMR16	*Sminthopsis macroura*	M55112
FMG E-W Rail and Tenements	4/07/04	FMR16	*Planigale sp*	M55117
FMG E-W Rail and Tenements	4/07/04	FMR16	*Planigale sp*	M55118
FMG E-W Rail and Tenements	4/07/04	FMR16	*Sminthopsis macroura*	M55119
FMG E-W Rail and Tenements	5/07/04	FMR16	*Planigale sp*	M55123
FMG E-W Rail and Tenements	6/07/04	FMR16	*Sminthopsis macroura*	M55134
FMG E-W Rail and Tenements	8/07/04	FMR16	*Planigale sp*	M56513
FMG E-W Rail and Tenements	8/07/04	FMR16	*Sminthopsis macroura*	M56514
FMG E-W Rail and Tenements	9/07/04	FMR16	*Leggadina lakedownensis*	M56519
FMG E-W Rail and Tenements	8/07/04	FMR17	*Sminthopsis macroura*	M56504
FMG E-W Rail and Tenements	8/07/04	FMR18	*Mus musculus*	M56511
FMG E-W Rail and Tenements	8/07/04	FMC01	*Delma pax*	R158226
FMG E-W Rail and Tenements	8/07/04	FMC01	*Lerista muelleri*	R158227
FMG E-W Rail and Tenements	8/07/04	FMC01	*Lerista muelleri*	R158228
FMG E-W Rail and Tenements	6/07/04	FMC01	*Carlia munda*	R158242
FMG E-W Rail and Tenements	7/07/04	FMC01	*Menetia greyii*	R158243
FMG E-W Rail and Tenements	7/07/04	FMC01	*Carlia munda*	R158245
FMG E-W Rail and Tenements	6/07/04	FMC01	*Delma pax*	R158247
FMG E-W Rail and Tenements	7/07/04	FMC01	*Ctenophorus reticulatus*	R158258
FMG E-W Rail and Tenements	5/07/04	FMC02	*Gehyra variegata*	R157130
FMG E-W Rail and Tenements	4/07/04	FMC02	*Cyclodomorphus melanops melanops*	R158205
FMG E-W Rail and Tenements	4/07/04	FMC02	*Cyclodomorphus melanops melanops*	R158206

FMG E-W Rail and Tenements	4/07/04	FMC02	*Heteronotia binoei*	R158207
FMG E-W Rail and Tenements	4/07/04	FMC02	*Lophognathus longirostris*	R158208
FMG E-W Rail and Tenements	8/07/04	FMC02	*Strophurus wellingtonae*	R158232
FMG E-W Rail and Tenements	6/07/04	FMC02	*Delma pax*	R158248
FMG E-W Rail and Tenements	8/07/04	FMC02	*Strophurus wellingtonae*	R158257
FMG E-W Rail and Tenements	10/07/04	FMC02	*Strophurus wellingtonae*	R158266
FMG E-W Rail and Tenements	9/07/04	FMC02	*Ctenotus saxatilis*	R158273
FMG E-W Rail and Tenements	6/07/04	FMC03	*Delma pax*	R158214
FMG E-W Rail and Tenements	6/07/04	FMC03	*Gehyra variegata*	R158215
FMG E-W Rail and Tenements	6/07/04	FMC03	*Strophurus wellingtonae*	R158216
FMG E-W Rail and Tenements	7/07/04	FMC03	*Ramphotyphlops ammodytes*	R158221
FMG E-W Rail and Tenements	8/07/04	FMC03	*Delma pax*	R158231
FMG E-W Rail and Tenements	8/07/04	FMC03	*Strophurus wellingtonae*	R158234
FMG E-W Rail and Tenements	8/07/04	FMC03	*Lerista muelleri*	R158239
FMG E-W Rail and Tenements	8/07/04	FMC03	*Lerista muelleri*	R158240
FMG E-W Rail and Tenements	9/07/04	FMC03	*Menetia greyii*	R158264
FMG E-W Rail and Tenements	8/07/04	FMC04	*Diplodactylus wombeyi*	R157133
FMG E-W Rail and Tenements	8/07/04	FMC04	*Diplodactylus wombeyi*	R157134
FMG E-W Rail and Tenements	8/07/04	FMC04	*Diplodactylus wombeyi*	R157787
FMG E-W Rail and Tenements	4/07/04	FMC04	*Ctenotus saxatilis*	R158204
FMG E-W Rail and Tenements	6/07/04	FMC04	*Strophurus wellingtonae*	R158211
FMG E-W Rail and Tenements	9/07/04	FMC04	*Diplodactylus wombeyi*	R158271
FMG E-W Rail and Tenements	9/07/04	FMC04	*Diplodactylus wombeyi*	R158272
FMG E-W Rail and Tenements	9/07/04	FMC04	*Diplodactylus wombeyi*	R158279
FMG E-W Rail and Tenements	6/07/04	FMC05	*Strophurus wellingtonae*	R158212
FMG E-W Rail and Tenements	6/07/04	FMC05	*Carlia munda*	R158213
FMG E-W Rail and Tenements	8/07/04	FMC05	*Delma pax*	R158224
FMG E-W Rail and Tenements	8/07/04	FMC05	*Lerista muelleri*	R158225
FMG E-W Rail and Tenements	8/07/04	FMC05	*Carlia munda*	R158236
FMG E-W Rail and Tenements	8/07/04	FMC05	*Carlia munda*	R158237
FMG E-W Rail and Tenements	14/07/04	FML01	*Diplodactylus conspicillatus*	R157131
FMG E-W Rail and Tenements	13/07/04	FML01	*Diplodactylus conspicillatus*	R157152
FMG E-W Rail and Tenements	14/07/04	FML02	*Diplodactylus wombeyi*	R157136
FMG E-W Rail and Tenements	10/07/04	FML02	*Gehyra punctata*	R158267
FMG E-W Rail and Tenements	10/07/04	FML02	*Ctenophorus caudicinctus caudicinctus*	R158268
FMG E-W Rail and Tenements	13/07/04	FML03	*Heteronotia binoei*	R157146
FMG E-W Rail and Tenements	10/07/04	FML03	*Cyclodomorphus melanops melanops*	R158274
FMG E-W Rail and Tenements	15/07/04	FML06	*Diplodactylus stenodactylus*	R157788
FMG E-W Rail and Tenements	11/07/04	FML06	*Lialis burtonis*	R158280
FMG E-W Rail and Tenements	11/07/04	FML06	*Ctenotus aff. helenae*	R158281
FMG E-W Rail and Tenements	11/07/04	FML06	*Lialis burtonis*	R158282
FMG E-W Rail and Tenements	15/07/04	FMN03	*Strophurus elderi*	R157143
FMG E-W Rail and Tenements	13/07/04	FMN03	*Strophurus elderi*	R157147
FMG E-W Rail and Tenements	12/07/04	FMN03	*Menetia greyii*	R157155
FMG E-W Rail and Tenements	11/07/04	FMN03	*Delma haroldi*	R158278
FMG E-W Rail and Tenements	15/07/04	FMN13	*Pygopus nigriceps nigriceps*	R157142
FMG E-W Rail and Tenements	14/07/04	FMN13	*Diplodactylus stenodactylus*	R157150
FMG E-W Rail and Tenements	13/07/04	FMN13	*Ctenotus aff. helenae*	R157153

FMG E-W Rail and Tenements	13/07/04	FMN13	*Ctenotus aff. helenae*	R157154
FMG E-W Rail and Tenements	13/07/04	FMN14	*Lialis burtonis*	R157150
FMG E-W Rail and Tenements	13/07/04	FMN14	*Ctenotus helenae*	R157162
FMG E-W Rail and Tenements	13/07/04	FMN30	*Diplodactylus stenodactylus*	R157145
FMG E-W Rail and Tenements	12/07/04	FMN30	*Delma pax*	R157151
FMG E-W Rail and Tenements	30/06/04	FMR01	*Delma pax*	R158201
FMG E-W Rail and Tenements	14/07/04	FMR07	*Ctenotus hanloni*	R157135
FMG E-W Rail and Tenements	15/07/04	FMR07	*Menetia greyii*	R157139
FMG E-W Rail and Tenements	15/07/04	FMR07	*Menetia greyii*	R157140
FMG E-W Rail and Tenements	15/07/04	FMR07	*Delma nasuta*	R157141
FMG E-W Rail and Tenements	15/07/04	FMR07	*Menetia greyii*	R157144
FMG E-W Rail and Tenements	12/07/04	FMR07	*Notaden nichollsi*	R157157
FMG E-W Rail and Tenements	14/07/04	FMR07	*Notaden nichollsi*	R157158
FMG E-W Rail and Tenements	13/07/04	FMR07	*Ctenotus helenae*	R157161
FMG E-W Rail and Tenements	15/07/04	FMR08	*Ctenotus hanloni*	R157137
FMG E-W Rail and Tenements	13/07/04	FMR08	*Notaden nichollsi*	R157159
FMG E-W Rail and Tenements	13/07/04	FMR08	*Notaden nichollsi*	R157160
FMG E-W Rail and Tenements	29/06/04	FMR08	*Delma tincta*	R158202
FMG E-W Rail and Tenements	8/07/04	FMR10	*Ctenotus piankai*	R157132
FMG E-W Rail and Tenements	6/07/04	FMR10	*Strophurus wellingtonae*	R158209
FMG E-W Rail and Tenements	8/07/04	FMR10	*Strophurus elderi*	R158251
FMG E-W Rail and Tenements	8/07/04	FMR10	*Menetia greyii*	R158252
FMG E-W Rail and Tenements	8/07/04	FMR11	*Demansia psammophis cupreiceps*	R158244
FMG E-W Rail and Tenements	6/07/04	FMR12	*Menetia greyii*	R158210
FMG E-W Rail and Tenements	7/07/04	FMR12	*Menetia greyii*	R158241
FMG E-W Rail and Tenements	7/07/04	FMR12	*Lerista muelleri*	R158249
FMG E-W Rail and Tenements	10/07/04	FMR12	*Lerista muelleri*	R158270
FMG E-W Rail and Tenements	8/07/04	FMR12	*Delma tincta*	R158277
FMG E-W Rail and Tenements	8/07/04	FMR13	*Cyclodomorphus melanops melanops*	R158238
FMG E-W Rail and Tenements	7/07/04	FMR13	*Cyclodomorphus melanops melanops*	R158256
FMG E-W Rail and Tenements	10/07/04	FMR13	*Delma nasuta*	R158265
FMG E-W Rail and Tenements	9/07/04	FMR13	*Cyclodomorphus melanops melanops*	R158269
FMG E-W Rail and Tenements	9/07/04	FMR13	*Delma nasuta*	R158275
FMG E-W Rail and Tenements	6/07/04	FMR15	*Demansia psammophis cupreiceps*	R158219
FMG E-W Rail and Tenements	7/07/04	FMR15	*Lerista muelleri*	R158250
FMG E-W Rail and Tenements	7/07/04	FMR16	*Lerista muelleri*	R158217
FMG E-W Rail and Tenements	7/07/04	FMR16	*Lerista muelleri*	R158218
FMG E-W Rail and Tenements	7/07/04	FMR16	*Lerista muelleri*	R158229
FMG E-W Rail and Tenements	7/07/04	FMR16	*Lerista muelleri*	R158233
FMG E-W Rail and Tenements	7/07/04	FMR16	*Menetia greyii*	R158253
FMG E-W Rail and Tenements	7/07/04	FMR16	*Menetia greyii*	R158254
FMG E-W Rail and Tenements	9/07/04	FMR16	*Lerista muelleri*	R158261
FMG E-W Rail and Tenements	9/07/04	FMR16	*Lerista muelleri*	R158262
FMG E-W Rail and Tenements	9/07/04	FMR16	*Lerista muelleri*	R158263
FMG E-W Rail and Tenements	6/07/04	FMR17	*Ramphotyphlops ammodytes*	R158220
FMG E-W Rail and Tenements	7/07/04	FMR17	*Lerista muelleri*	R158223
FMG E-W Rail and Tenements	8/07/04	FMR17	*Lerista muelleri*	R158235

FMG E-W Rail and Tenements	7/07/04	FMR17	*Suta punctata*	R158246
FMG E-W Rail and Tenements	7/07/04	FMR17	*Menetia greyii*	R158255
FMG E-W Rail and Tenements	7/07/04	FMR17	*Pogona minor minor*	R158259
FMG E-W Rail and Tenements	9/07/04	FMR17	*Carlia munda*	R158260
FMG E-W Rail and Tenements	8/07/04	FMR18	*Lerista muelleri*	R158230

Records from WA Museum database search

Appendix 2

BIOta

Fishes collected between -22.15, 119.08 and -22.96, 120.59

Plotosidae
Neosilurus hyrtlii

Terapontidae
Amniataba percoids
Leiopotherapon unicolour

Amphibia collected between -22.15, 119.08 and -22.96, 120.59

Hylidae
Cyclorana maini
Litoria rubella

Myobatrachidae
Limnodynastes spenceri
Uperoleia russelli
Uperoleia sp

Reptiles collected between -22.15, 119.08 and -22.96, 120.59

Agamidae
Caimanops amphiboluroides
Ctenophorus caudicinctus caudicinctus
Ctenophorus isolepis gularis
Ctenophorus isolepis isolepis
Ctenophorus nuchalis
Ctenophorus reticulatus
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
Strophurus wellingtonae

Pygopodidae
Delma haroldi
Delma nasuta
Delma pax
Delma tincta
Lialis burtonis
Pygopus nigriceps

Scincidae
Carlia munda
Carlia triacantha
Cryptoblepharus carnabyi
Cryptoblepharus plagiocephalus
Ctenotus ariadnae
Ctenotus duricola
Ctenotus grandis titan
Ctenotus hanloni
Ctenotus helenae
Ctenotus pantherinus ocellifer
Ctenotus rutilans
Ctenotus saxatilis
Ctenotus schomburgkii
Ctenotus serventyi
Ctenotus uber
Cyclodomorphus melanops melanops
Egernia Formosa
Lerista bipes
Lerista labialis
Lerista Muelleri
Lerista neander
Lerista zietzi
Menetia greyii
Menetia sp
Menetia surda surda
Morethia ruficauda exquisite
Notoscincus ornatus ornatus
Proablepharus reginae
Tiliqua multifasciata

Typhlopidae
Ramphotyphlops ammodytes
Ramphotyphlops grypus
Ramphotyphlops waitii

Varanidae
Varanus acanthurus
Varanus brevicauda
Varanus caudolineatus
Varanus eremius
Varanus giganteus
Varanus gouldii
Varanus panoptes rubidus
Varanus pilbarensis
Varanus sp_nov_(pilbara)
Varanus tristis tristis

Birds collected between -22.15, 119.08 and -22.96, 120.59

Acanthizidae
Gerygone fusca mungi

Accipitridae
Circus assimilis

Alaudidae
Mirafra javanica horsfieldii

Artamidae
Artamus cinereus melanops
Artamus personatus

Columbidae
Geopelia striata placida
Phaps chalcoptera

Corvidae
Corvus orru cecilae

Meliphagidae
Epthianura tricolor
Lacustroica whitei
Lichenostomus penicillatus

Pachycephalidae
Pachycephala rufiventris rufiventris

Pardalotidae
Pardalotus rubricatus

Pomatostomidae
Pomatostomus temporalis rubeculus

Psittacidae
Cacatua roseicapilla assimilis

Ptilonorhynchidae
Ptilonorhynchus maculatus guttatus

Strigidae
Ninox connivens connivens
Ninox novaeseelandiae boobook

Turnicidae
Turnix velox

Mammals collected between -22.15, 119.08 and -22.96, 120.59

Canidae
Canis lupus familiaris

Dasyuridae
Dasykaluta rosamondae
Dasyurus hallucatus
Ningaui ridei
Ningaui timealeyi
Planigale sp
Sminthopsis macroura
Sminthopsis ooldea
Sminthopsis youngsoni

Emballonuridae
Saccolaimus flaviventris

Macropodidae
Macropus robustus erubescens
Macropus rufus
Macropus sp
Petrogale rothschildi

Molossidae
Chaerephon jobensis
Mormopterus beccarii

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

Phalangeridae
Trichosurus vulpecula arnhemensis

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