



**VERTEBRATE FAUNA OF THE HONMAN RIDGE-
BREMER RANGE DISTRICT,
GREAT WESTERN WOODLANDS,
WESTERN AUSTRALIA**

S. Duncan, B.J. Traill and C. Watson

June 2006



THE WILDERNESS SOCIETY

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Front Cover Image:

Western Pygmy Possum *Cercartetus concinnus*

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EXECUTIVE SUMMARY

This study assesses the significance of the Honman Ridge-Bremer Range district for native wildlife. We also make an initial assessment of the large-scale ecological processes and connections that are essential to the maintenance of these species in the study area. Threats to the fauna of the district are outlined, and brief recommendations are made on requirements for maintaining and protecting the fauna in the study area.

The study forms part of broader work by The Wilderness Society documenting the natural values of the Great Western Woodlands and the natural processes that maintain those values. This contributes toward the Gondwana Link vision which aims for the long-term protection and restoration of country in south-western Australia, from Kalgoorlie to the Karri forests. The Honman Ridge-Bremer Range district is of particular concern as it lies in an active mining area.

The study area lies in the south-west of the Great Western Woodlands region. This region is the largest and most intact block of temperate eucalypt woodland remaining in Australia. On a continental scale it is the largest area of intact temperate habitat of any type remaining in Australia. Internationally the Great Western Woodlands almost certainly retain the largest temperate heathlands and woodlands remaining on Earth. It has been globally recognised as contributing toward a biodiversity hotspot for its exceptional richness of endemic plants and the degree to which they are under threat.

As part of this study a field survey was conducted in mid November 2005. Standard methods for surveying vertebrate groups were used.

The fauna of the study area was found to be diverse with 26 reptile, 63 bird and 12 mammal species being detected during this brief survey, or recorded recently by others. Of these species, we judged nineteen to be of conservation significance. This number includes species that are relatively abundant in the study area but which are declining or threatened in remnants of temperate woodlands elsewhere in Australia.

Ecological processes in the study area appeared to be highly intact. This includes maintenance of top order predators (Dingoes/Dogs), keystone species such as fruit dispersing Emus, and large populations of mobile nectarivores. The intact nature of the ecological processes is likely to arise from the highly intact character of the study area. The Great Western Woodlands have had relatively little clearing, and to date, few invasive weeds.

The fauna conservation value of the Honman Ridge-Bremer Range district is significant in two respects. First, viewed in isolation, the study area maintains

populations of a range of fauna species of inherent conservation value. Second, the study area, as part of the larger Great Western Woodlands, retains most or all of its key ecological processes and connections. These processes support the long-term maintenance of the natural communities, including fauna, in the study area.

Mining exploration, mining, weeds, and inappropriate fire regimes pose immediate threats to the fauna of the study area. These threats are interrelated, since the amount of human traffic and disturbance directly influences the risk of weed invasion and the extent and frequency of burning.

Our recommendations for the long-term maintenance of the fauna of the study area are that:

1. The Honman Ridge-Bremer Range study area be considered for protection in a conservation reserve. This was also the recommendation of a previous review of the flora of the area.
2. An ecological fire management plan based on the best available science be prepared for the study area, as part of the broader Great Western Woodlands, and be actively implemented.
3. A weed management plan for the Great Western Woodlands be prepared. This should give high priority to quarantine measures such as compulsory wash-down facilities for all vehicles and include a well resourced 'rapid response' program to identify new weeds becoming established in the region and to eradicate them before they become widespread.
4. Any Dingo control programs in the study area be terminated. For the broader Great Western Woodlands, an appropriate policy should be established that maintains stable Dingo populations in the region as a whole while protecting the interests of farmers in adjacent wheatbelt lands.
5. Mining exploration activities conform to rigorous exploration codes which minimise vegetation destruction and prevent weed establishment in all areas.

INTRODUCTION

To the south-east of the wheatbelt in Western Australia lies a very large and distinct area of intact native vegetation - the 'Great Western Woodlands'. This region contains over 18 million hectares (180,000 square kilometres) of temperate and semi-arid eucalypt woodland and temperate sandplain heathland. It once stretched over 32 million hectares of south-west Western Australia, forming a distinct bioregion between the semi-arid Acacia scrubs of the inland and the wetter coastal forests of the far south-west.

Over fourteen million hectares of this bioregion has now been cleared to form the current wheatbelt. In eastern Australia the pattern has been similar, with approximately 85% of the original 65 million hectares of temperate woodland being cleared since European settlement (Robinson & Traill 1996; Hobbs & Yates 2000). In both east and west these cleared areas now form Australia's wheatbelts.

The Great Western Woodlands region includes by far the largest and most intact block of temperate eucalypt woodland remaining in Australia. On a continental scale it is the largest area of intact temperate habitat of any type remaining in Australia (Thackway & Lesslie 2005; Hobbs & Yates 2000).

Internationally the Great Western Woodlands region almost certainly has the largest temperate heathlands and woodlands remaining on Earth. It has been globally recognised as contributing towards the 'Southwest Australia biodiversity hotspot' for its dual attributes of exceptional richness of endemic plants, which also are considered under extreme threat (e.g. Myers 1988).

The Wilderness Society is documenting the natural values of the Great Western Woodlands and the natural processes and connections that maintain those values. This documentation contributes to the Gondwana Link vision, which aims for the long-term protection and restoration of country in south-western Australia, from Kalgoorlie to the Karri forests. As part of this program, ecologists at The Wilderness Society identified a gap in the knowledge of fauna in the region, this being in the Honman Ridge-Bremer Range district.

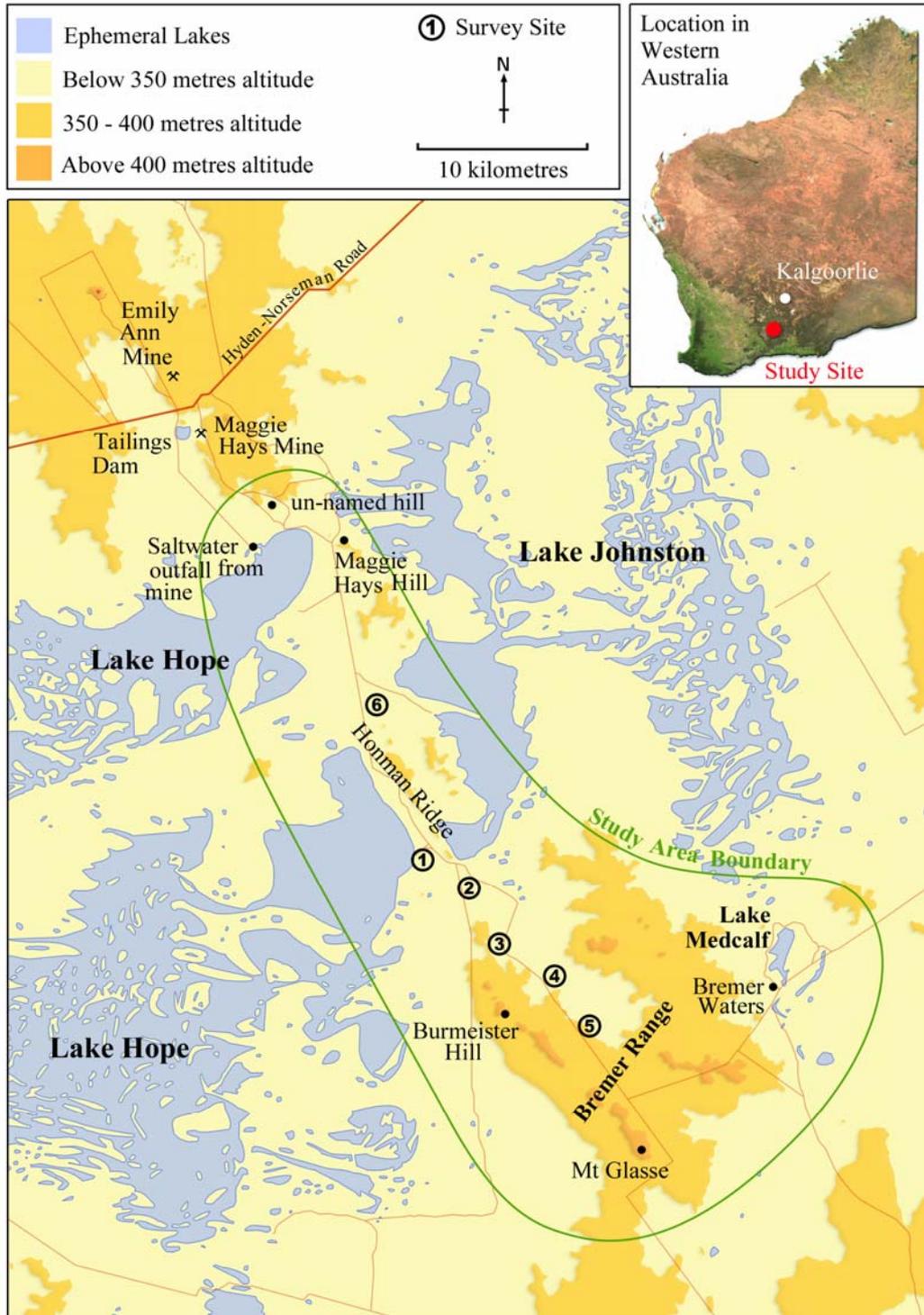
There have been a number of flora and fauna surveys throughout the Great Western Woodlands. These include systematic survey work by the Western Australian (WA) Herbarium and WA Museum and a range of surveys associated with environmental impact statements for mines in the area. Previous field work by the WA Herbarium (Hall *et al.* 1990) had identified that the vegetation types on the banded ironstone and greenstone geology of the Honman Ridge-Bremer Range district were not well represented in existing conservation reserves.

Additionally, a lack of information on the vertebrate fauna (mammals, birds, reptiles, frogs) present in the Honman Ridge-Bremer Range district was of particular concern as this district lies on one of the highly mineralised 'greenstone' belts that run through the Great Western Woodlands. Intensive mineral exploration activity continues in the region, and there are now two active mines just to the north of the Honman Ridge-Bremer Range district. Such activities have the potential to threaten some of the natural values of the area.

The purpose of this study is to assess the significance of the Honman Ridge-Bremer Range district for native vertebrates. We also make an initial assessment of the large scale ecological processes and connections that are essential to maintaining these species in the study area. Threats to the fauna of the district are outlined, and brief recommendations are made for the maintenance and protection of fauna in the study area.

LOCALITY MAP

Locality map for the vertebrate survey of the Honman Ridge – Bremer Range district in the Great Western Woodlands, Western Australia.



DESCRIPTION OF STUDY AREA

The Honman Ridge-Bremer Range study area of approximately 40 000 ha lies in the south-west of the Great Western Woodlands, in and around 32° 30' S, 120° 40' E. It is located 170 km east of the town of Hyden and 110 km west of Norseman (see map). The boundaries of the study area were chosen to include the distinct geomorphological features of the Honman Ridge and the Bremer Range.

CLIMATE

The area has cool winters and hot dry summers (How *et al.* 1988). Mean annual rainfall at the nearest sites with meteorological records is 336 mm at Hyden and 275 mm at Norseman. Annual evapotranspiration is high (2230 mm at Hyden, 2150 mm at Norseman).

GEOLOGY AND GEOMORPHOLOGY

The Bremer Range and Honman Ridge form distinct low ranges in the generally very low relief of the Great Western Woodlands.

The Bremer Range, which forms the southern part of the study area, comprises undulating uplands with low rounded hills and associated broad valleys. In the north of the study area the Honman Ridge and associated low hills form a prominent low range separating Lake Johnston and Lake Hope. The salt lakes and associated saline landscapes of Lake Hope, Lake Johnston and Lake Medcalf form the boundaries of much of the study area.

The underlying geology of the region has been mapped and described in detail (Gower & Bunting 1976). The underlying rocks of the Honman Ridge and the Bremer Range are primarily Archaean (aged 2500-3700 million years) mafic and ultramafic rocks, generally referred to as greenstone, that have undergone various degrees of metamorphism. Through this the Honman Banded Ironstone Formation (of the same age) forms a band that runs roughly north to south. Aeolian deposits from the salt lakes have formed lunettes and flat sheets of gypsiferous soil on their borders.

These features correspond with the following broad landform units (*sensu* How *et al.* 1988) found in the Great Western Woodlands: Undulating Plain, Broad Valleys, Hills (banded ironstone formation) and Salt Lake Features.

VEGETATION

The study area is dominated by eucalypt woodlands, including areas of mallee type eucalypts. The only other widespread vegetation types are the samphire and

chenopod shrublands that border the salt lakes on gypsum soils. Other vegetation types that occur over more limited areas are distinctive tall shrubland on greenstone hills in the northern part of the study area and granitic shrubland on small and scattered areas of outcropping granite.

To the south and west of the Bremer Range, sandplain heathlands dominate. The areas to the north and east are largely woodlands.

Gibson & Lyons (1998) provide extensive floristic details of the Bremer Range section of the study area. Their survey found exceptional diversity of both eucalypt and understorey species in the Bremer Range. Woodland types vary with minor changes in slope in the undulating uplands of the range.

HUMAN HISTORY

The study area is part of the traditional lands of the Ngadju nation. No specific information on their traditional use of country could be located in the time available for this study.

The Great Western Woodlands region in general is notable for the lack of widespread habitat loss and degradation since European invasion and settlement. Clearing has been restricted to that associated with roads, mines and mineral exploration. Only parts of the region have been grazed regularly by introduced stock. Extensive wood cutting for the Kalgoorlie mines occurred in central parts of the Great Western Woodlands but not in the study area. However, some disturbances to the vegetation and fauna have taken place in the study area since the arrival of Europeans, and these are detailed briefly below.

PREVIOUS DISTURBANCE TO FLORA AND FAUNA

Fire

We were unable to find any records of the pre-European fire history of the study area, such as details of any fire management practices of the Ngadju. Accounts of fires since European settlement appear to be almost as sparse. Much of the southern part of the study area was burnt by an intense wildfire 2-3 years prior to this survey, completely burning the canopy in most of the affected area. As a result, at the time of the survey large areas had only dead standing taller trees with a young dense understorey of regrowth.

Mining & Mineral Exploration

The study area has been subject to mining exploration activities for at least several decades. Most of the area has a network of vehicle tracks, bulldozed survey lines, old drill sites, old sampling pits, dumped rubbish and various other disturbances from mining exploration.

Just to the north of the study area are two operational mines, 'Maggie Hays' (open pit) and 'Emily-Ann' (underground). Woodlands have been cleared to accommodate the mines and associated roads, processing plants, tailings dams and residential quarters. Mine de-watering facilities dump waste water into Lake Hope.

Grazing by stock

The northern part of the study area was part of a grazing lease in the 1950s. It is understood that stock were introduced but the lease was abandoned soon after. We could find no recognisable impacts on the vegetation due to stock grazing.

Invasive species

Weeds

The study area has few introduced weed species. From our observations those present are not abundant and are unlikely to have yet caused any major detrimental effects in the study area.

Feral animals

The introduced Red Fox, and possibly Cat, are likely to have been major contributors to the extinction of many medium sized native mammals in the study area and the broader Great Western Woodlands region. How *et al.* (1988) note the work of Baynes in identifying mammal remains from the Peak Charles cave deposits. Peak Charles, 60 km south-east of the study area, is a granite peak surrounded by mallee woodlands and heathlands. Baynes identified ten mammals now likely to be extinct throughout the Great Western Woodlands: Red-tailed Phascogale, *Phascogale calura*, Dibbler, *Parantechinus apicalis*, Southern Brown Bandicoot, *Isodon obesulus*, Western Barred Bandicoot, *Perameles bougainville*, Brush-tailed Possum *Trichosurus vulpecula*, Brush-tailed Bettong, *Bettongia penicillata*, Black-footed Rock-Wallaby, *Petrogale lateralis*, Heath Mouse, *Pesudomys shortridgei*, Lesser Stick-nest Rat *Leporillus apicalis*, and Bush Rat, *Rattus fuscipes*. These species were found in cave deposits that also contained the bones of the introduced House Mouse and European Rabbit, indicating that these major and depressing losses were likely to have occurred relatively recently. Foxes and cats may also contribute to continuing reductions in populations of ground dwelling vertebrates such as Malleefowl.

Rabbits are present in apparently low numbers throughout much of the study area. They may have selectively removed some native herbs through overgrazing in favoured areas.

Feral Honey bees were found in the study area, but we do not know how long they have been there. They compete with native vertebrates and invertebrates for nectar and tree hollows. We were unable to determine whether commercial apiarists have used the study area for honey production.

The current and potential future effects of continuing disturbances in the study area are discussed later in this report.

METHODOLOGY

This report discusses data from a specific fauna survey of the study area undertaken by The Wilderness Society from 13 to 19 November 2005 as well as from previous biological surveys in the broader Great Western Woodlands. The fauna work was led by Susie Duncan and Barry Trill and habitat descriptions of survey sites were undertaken by Christine Watson.

WILDERNESS SOCIETY SURVEY

Trapping and surveys

Intensive live-trapping and bird censuses were conducted at six sites in the study area (see map). The sites were selected to reflect the diversity of vegetation types of the area. The following section details the vegetation at each of the survey sites.

Pitfall traps and Elliott box traps were used at all six sites. At each site a single pitfall cluster was put in place, comprising five pitfall traps (20 litre buckets dug into the ground) arranged in a cross pattern, with a central bucket plus buckets at the ends of four 5m arms. Each outer bucket was linked to the central bucket by a length of 30 cm high flywire, which worked as a drift fence to guide small ground animals into the buckets. Each site had a cluster in place for six nights, with the exception of Site 6, which had a cluster in place for five nights.

In addition, 15 Elliott box traps were set in a line at each site, with traps approximately 5 m apart. These traps were baited with a mixture of peanut butter and rolled oats. Each site had the traps in place for 5 nights, making a total of 75 Elliott trap nights per site.

Scats (faecal droppings) from predators (dingoes/dogs, foxes, cats) were collected opportunistically, especially along tracks. The hair, feathers and bones were analysed by Barbara Triggs, an expert in scat analysis, to determine the animal species present in the scats.

Bird numbers were censused by 10 minute surveys in areas of one hectare around the trap sites. Six surveys were conducted at each site. All birds seen or heard in the one hectare areas during the surveys were recorded as on site. Species recorded outside the survey periods and/or in the same habitat outside the survey areas were recorded as present, but no counts were made

Given the limited time to survey all vertebrate groups adequately, we decided not to undertake a specific survey of bats. Previous surveys in the southern part of the Great Western Woodlands found only species that were relatively common and widespread. It is therefore unlikely that there are any bats in the study area with specialised habitat requirements or localised distributions requiring special management or protection.

Habitat Description of survey sites

The vegetation classification below follows Muir (1977).

Site 1 – Open Woodland over Dwarf Scrub C of saltbush

Eucalyptus salmonophloia forms an **Open Woodland** over **Open Scrub** of *Santalum acuminatum* and *Eremophila intestans*, and a **Dwarf Scrub C** of *Atriplex sp.* and **Open Dwarf Scrub D** of *Frankenia sp.* with **Very Open Herbs** *Carpobrotus sp.* *Calandrinia eremaea* and **Very Open Low Grass** of *Aira caryophylla* and *Austrodanthonia sp.*

Trees	Tall Shrubs	Low shrubs	Ground flora
<i>Eucalyptus salmonophloia</i>	<i>Santalum acuminatum</i> <i>Eremophila intestans</i> <i>Pittosporum phylliraeoides</i>	<i>Atriplex sp</i> <i>Enchylaena tomentosa</i> <i>Frankenia sp</i>	<i>Aira caryophylla</i> <i>Austrodanthonia sp</i> <i>Austrostipa sp</i> <i>Calandrinia eremaea</i> <i>Carpobrotus sp.</i> <i>Crassula colorata</i> <i>Senecio sp.</i>

Site 2 – Low Woodland

*Eucalyptus melanoxylo*n and *E. transcontinentalis* form **Low Woodland A** above **Low Scrub B** of *Eremophila scoparia* with *Acacia camptoclada*, *Santalum acuminatum* and *Alyxia buxifolia*, *Eremophila glabra*, *Senna artemisioides*, *Dodonaea viscosa subsp. Angustissima*, and *Scaevola spinescens*. An **Open Dwarf Scrub C** of *Ptilotus obovatus*, *Enchylaena tomentosa*, *Halgania andromedifolia* occurs above an **Open Dwarf Scrub D** of *Ptilotus holosericeus*.

Trees	Tall Shrubs	Low shrubs	Ground flora
<i>Eucalyptus melanoxylo</i> n <i>E. transcontinentalis</i>	<i>Acacia camptoclada</i> <i>Alyxia buxifolia</i> <i>Eremophila scoparia</i> <i>Eremophila interstans</i> <i>Santalum acuminatum</i>	<i>Eremophila glabra</i> <i>Dodonaea viscosa subsp. Angustissima</i> <i>Scaevola spinescens</i> <i>Senna artemisioides</i> <i>Olearia muellerii</i>	<i>Atriplex sp.</i> <i>Enchylaena tomentosa</i> <i>Halgania andromedifolia</i> <i>Ptilotus holosericeus</i> <i>Ptilotus obovatus</i>

Site 3 - Low Woodland over Low Scrub B of false bluebush

Low Woodland A of *Eucalyptus flocktoniae* and *E. melanoxylon*, with a lesser presence of *Eucalyptus cylindrocarpa* over **Open Scrub** of *Melaleuca pauperiflora* over **Low Scrub B** predominantly of *Cratystylis conocephala* with lesser occurrence of *Eremophila rugosa*, *Exocarpos sparteus*, and an **Open Dwarf Scrub C** of *Olearia muelleri*, *Scaevola bursarifolia* and *Westringia rigida*.

Trees	Tall Shrubs	Low shrubs	Ground flora
<i>Eucalyptus flocktoniae</i> <i>E. melanoxylon</i> <i>E. cylindrocarpa</i>	<i>Melaleuca pauperiflora</i>	<i>Cratystylis conocephala</i> <i>Eremophila rugosa</i> <i>Exocarpos sparteus</i> <i>Olearia muelleri</i> <i>Scaevola bursarifolia</i>	<i>Eremophila</i> with red flowers, <i>Westringia rigida</i> , <i>Zygophyllum apiculatum</i>

Site 4 - Open Tree Mallee over Hummock Grassland of spinifex

Mid-Dense Hummock Grass of *Triodia scariosa* with **Open Tree Mallee** of eucalypts over **Open Scrub** of *Melaleuca pauperiflora*, *Eremophila intestans* and *Santalum sp.* And **Open Low Scrub B and C** of *Acacia deficiens*, *A. camptoclada*, *Dodonaea sp.*, and *Olearia muelleri* with **Open Dwarf Scrub D** of *Grevillea huegii*, *Eremophila clavata* and *Westringia rigida*

Trees	Tall Shrubs	Low shrubs	Ground flora & smaller shrubs
<i>Eucalyptus melanoxylon</i> <i>E. tenuis</i> <i>E. cylindriflora</i> <i>E. cylindrocarpa</i>	<i>Melaleuca pauperiflora</i> <i>Santalum sp.</i> <i>Alyxia buxifolia</i> <i>Eremophila intestans</i> <i>Billardiera sp. creeper</i>	<i>Triodia scariosa</i> <i>Acacia deficiens</i> <i>Acacia camptoclada</i> , <i>Dodonaea sp.</i> <i>Exocarpos sp.</i> <i>Olearia muelleri</i> <i>Halgania rigida</i>	<i>Grevillea huegii</i> <i>Eremophila clavata</i> <i>Westringia rigida</i>

Site 5 – Dense Tree Mallee (2-3 year post-fire)

Dense Tree Mallee regrowth of *Eucalyptus flocktoniae*, and *E. eremophila* over an **Open Low Scrub B** of *Melaleuca pauperiflora*, *Eremophila rugosa*, *Acacia burkittii*, *Dodonaea lobulata*, *Cassyltha racemosa*, **Open Dwarf Scrub C & D** of *Acacia pachypoda*, *A. poliochroa*, *A. erinacea*, & *Westringia rigida* & *Eremophila sp.*

Trees	Tall Shrubs	Low shrubs	Ground flora
<i>Eucalyptus flocktoniae</i> <i>E eremophila</i> <i>E. calcareana</i>	<i>Cassyltha racemosa</i> <i>Eremophila rugosa</i> <i>Dodonaea lobulata</i> <i>Melaleuca pauperiflora</i>	<i>Acacia burkittii</i> <i>A. erinacea</i> <i>A. pachypoda</i> <i>A. poliochroa</i>	<i>Westringia rigida</i> & <i>Eremophila</i> species

Site 6 – Low Woodland

Low Woodland A of *Eucalyptus tenuis* and *E. salicola* over **Open Low Scrub A** of *Grevillea oncogyne*, *Alyxia buxifolia* and *Eremophila intestans* and **Open Tall Sedges** *Lepidosperma sp.*

Trees	Tall Shrubs	Low shrubs	Ground flora
<i>Eucalyptus tenuis</i> <i>E. salicola</i>	<i>Grevillea oncogyne</i> <i>Alyxia buxifolia</i> <i>Eremophila intestans</i> <i>Daviesia benthamii</i> <i>Cassinia sp.</i>	<i>Lepidosperma sp.</i> Sedge <i>Olearia muelleri</i>	<i>Lepidosperma sp.</i> <i>Gahnia sp.</i> <i>Westringia rigida</i> <i>Austrodanthonia sp.</i> <i>Austrostipa sp.</i>

Opportunistic surveys

In addition to site-specific surveys, observations were made opportunistically throughout the study area. Particular effort was made to observe birds and to roll logs and search in leaf litter for reptiles. Predator scats were collected for identification of prey by hair analysis. On four nights we spotlighted from vehicles and on foot along tracks for nocturnal species.

Weather conditions

Conditions were generally favourable for the survey. The spring had been moderately wet prior to the survey, and ground cover was abundant. However, the

salt lakes were dry at the commencement of the survey except for a small area on Lake Hope to the north of the study area where excess water from the Maggie Hays mine is dumped.

It was warm to hot during the day, though cool at night for most of the week. The coolness may have reduced the extent of reptile activity at night. A storm front on the fourth day produced a few millimetres of rain, which increased humidity and put a small amount of surface water on Lake Johnston.

PREVIOUS SURVEYS

Systematic fauna and flora surveys of the Great Western Woodlands were carried out by the Western Australian (WA) Museum, the Department of Conservation and Land Management, and the WA Herbarium during the 1980s (e.g. 'Biological survey of the Eastern Goldfields' How *et al.* 1988). These excellent surveys detailed the broad distribution of fauna and flora in this region. However, as noted in the introduction, these surveys covered a huge area, were necessarily selective in the sites they chose, and did not survey the fauna of the Honman Ridge–Bremer Range study area. The detailed flora survey in the study area, was conducted by the WA Herbarium (Gibson & Lyons 1998) at a later date.

Additionally, specific fauna surveys have been carried out just to the north of the study area, in and around the Maggie Hays and Emily-Ann mine sites, between 1996 and 1997 (Brearley *et al.* 1998).

Results from all these surveys are assessed in this report to assist in determining the ecological significance of the study area.

TAXONOMY AND STATUS

Vertebrate taxonomy for our findings follows Clayton *et al.* (2006). Conservation status conforms to the listings used in that report unless otherwise stated in our text.

SURVEY RESULTS AND DISCUSSION

WILDERNESS SOCIETY SURVEY

Twenty-six reptile species, 63 bird species, and 12 mammal species (four introduced mammals) were recorded during our survey.

A full annotated species list is given in the Appendix. The trapping and bird survey data showing species found at specific sites is detailed in Tables 1 and 2. Table 3 contains the data from analysis of predator scats.

As found elsewhere in the Great Western Woodlands, the fauna of the Honman Ridge-Bremer Range study area was a mixture of temperate and arid species. Fauna included temperate species with distributions extending westwards into the south-west forests and western part of the woodlands zone (Red Wattlebird, Western Brush Wallaby, Gould's Hooded Snake); species with largely arid-zone distributions extending well to the east and north (White-fronted Honeyeater, Southern Ningau, Thorny Devil, Crested Dragon); and some ubiquitous species found throughout southern Australia (Willy Wagtail, Emu, Echidna, Sand Monitor). Importantly, there were also sizeable populations of a number of species that are restricted to the temperate eucalypt woodland zone, for example Yellow-plumed Honeyeater, Gilbert's Whistler and Regent Parrot.

The mammal fauna was moderately diverse, although a number of species of smaller mammal were probably missed due to the limited duration of the survey. Notably, signs of Dingoes were widespread and abundant. Dingoes are extinct in virtually all other temperate woodland areas of Australia.

The short survey duration may also have resulted in some of the more cryptic reptile species being missed. The finding of two Carpet Pythons, along with records from other surveys immediately to the north, indicates that this significant species may be moderately common in the study area. The absence of frogs is a reflection of the season and the lack of surface water at the time of our survey.

Since there were relatively few records for each reptile and mammal species encountered, we cannot make meaningful comments on the habitat use or requirements of any reptiles or mammals in the survey area.

The study area supports an excellent diversity of bird species. The *Eucalyptus flocktoniae* and *E. eremophila* that were flowering profusely at the time of the survey attracted large numbers of nectar feeding Purple-crowned Lorikeets and honeyeaters. In addition, the study area supports populations of a large number of resident woodland passerine birds such as Yellow-plumed Honeyeater, Rufous Treecreeper, Shy Heathwren and Crested Bellbird, which are declining in the highly cleared wheatbelt area. There was no long-standing water in the salt lakes at the time of our survey, and only one waterbird was recorded (and it was long

dead!). The lakes when full, however, are known to provide habitat for a number of waterbirds. This is discussed further in our list of significant species below.

A range of individual birds showed particular habitat requirements or patchy distributions. Details of these are given in the annotated species lists in the Appendix.

PREVIOUS SURVEYS

Previous surveys at Maggie Hays and Emily-Ann mines and surrounds were completed in 1996 and 1997 (Brearley *et al.* 1998). This was immediately to the north of our study area (see map).

Fauna surveys at four sites (Peak Charles, McDermid Rock, Lake Cronin, and Frank Hann National Park) were completed in the broader Hyden-Lake Johnston region between 1978 and 1981 (How *et al.* 1988). These effectively covered much of the southern part of the Great Western Woodlands.

Tables 4-6 compare the species found in these surveys with those found in the Honman Ridge-Bremer Range study area.

The other surveys, particularly the intensive and wide-ranging Goldfields Biological Surveys (How *et al.* 1988), found a number of species not observed in ours. In part these are species with preferences for habitats not found in our study area. Otherwise these additional species were missed because of the short duration of our survey and its restriction to one season.

However, the broad results are similar. Species recorded throughout the southern part of the Great Western Woodlands are a mixture of temperate zone and arid zone species. Most medium sized ground mammals (e.g. Brush-tailed Bettong) were not recorded in any recent surveys and are highly likely to be extinct throughout the region. However, bird and reptile communities remain intact. There appear to be sizeable populations of many specialist temperate woodland species.

TAXA OF CONSERVATION SIGNIFICANCE KNOWN OR LIKELY TO OCCUR IN THE STUDY AREA

There are a number of species populations occurring, or likely to be occurring, in the study area that are of particular conservation significance due to their rarity, threatened status or other attributes. These are listed here with their formal threatened status, if any, and a brief description of their habitat and the importance of the population in the study area.

Lake Cronin Snake *Paraplocephalus atriceps*

Conservation Status

Commonwealth Environment Protection and Biodiversity Conservation Act: *Vulnerable*

Western Australian Wildlife Conservation Act: *Rare or likely to become extinct*

This snake is known from only seven specimens, all recorded between Lake Cronin, 70 km north-west of the study area, and the Maggie Hays Mine area immediately to the north of it. The snake was not recorded during our survey. However, a single Lake Cronin Snake was collected in *Eucalyptus longicornis*-*E. salmonophloia* woodland during the Maggie Hays Mine environmental survey. This habitat is found in our study area, and it is highly possible that this rare and apparently very localised species occurs there.

The ecology of the species is not known.

Carpet Python *Morelia spilota imbricata*

Conservation Status

Western Australian Wildlife Conservation Act: *Specially Protected Fauna*

Two individuals were found in the study area.

Carpet Pythons are large snakes that feed mainly on small and medium sized mammals and occasionally on other vertebrates. Populations of Carpet Pythons in south-west Western Australia have suffered declines due to habitat loss and possibly predation by foxes.

Square-tailed Kite *Lophoictinia isura*

Conservation Status

Listed as threatened in all states within its range except Western Australia

A single Square-tailed Kite was observed in the study area.

Square-tailed Kites are low-soaring raptors that take prey, especially nestling and fledgling birds, mostly from the canopy of woodlands and dry forest. They occur largely in temperate woodlands, and occasionally in forests. Natural population densities are very low, and there appear to be seasonal movements in some regions.

It is likely that this species occurs at very low densities throughout the study area and the Great Western Woodlands. Large areas of suitable habitat have been lost from the wheatbelt. The Great Western Woodlands is therefore possibly an important population centre for the species both in Western Australia and nationally. Although not listed as threatened in Western Australia, this species is listed as threatened in all other states where it occurs.

Peregrine Falcon *Falco peregrinus*

Conservation Status

Western Australian Wildlife Conservation Act: *Specially Protected Fauna*

A pair of Peregrine Falcons was seen in the study area.

Peregrine Falcons are specialised raptors that mainly take largish birds on the wing. They are widespread and can survive major habitat clearing and disturbances as long as sufficient prey and nest sites are available. In Australia cleared regions such as the wheatbelt usually have prey such as Galahs and Crested Pigeons in moderate or high abundance. Peregrine Falcons do not build nests, but use cliffs, other raptor nests, ledges on tall buildings or large tree hollows as nest sites.

It is likely that the study area would support, or partly support, a single breeding pair.

Malleefowl *Leipoa ocellata*

Conservation Status

2004 IUCN Red List of Threatened Species: *Vulnerable*

Commonwealth Environment Protection and Biodiversity Conservation Act: *Vulnerable*

Western Australian Wildlife Conservation Act: *Rare or likely to become extinct*

A probable record from a predator scat was made during our survey. The species is also recorded from a block in the centre of the study area in the Birds Australia Atlas database.

Throughout Australia Malleefowl have declined drastically, especially in the temperate part of their habitat. Much of their habitat has been lost from the wheatbelt regions of Australia and Saunders & Ingram (1995) note that this species is declining in the south-west wheatbelt of Western Australia. The status of the population in the study area and the broader Great Western Woodlands is poorly known.

Banded Stilt *Cladorhynchus leucocephalus*

Conservation Status

Not listed as threatened

Banded Stilts breed only on inland salt lakes during rare flood events. They retreat to the coast during the long and irregular dry periods between spells of heavy inland rainfall.

This species was recorded from a block that includes part of Lake Johnston, in the Birds Australia Atlas database. Both Lakes Hope and Johnston provide large areas of suitable habitat for this species when filled. It is listed as of conservation

significance here, due to its specialised breeding ecology and the large area of potential habitat available in the study area.

Hooded Plover *Thinornis rubicollis*

Conservation Status

2004 IUCN Red List of Threatened Species: *Lower Risk (near threatened)*

Action Plan for Australian Birds: *Near threatened*

Brearley *et al.* (1998) reported a 'significant post-breeding flock' of Hooded Plovers on north Lake Hope in 1996.

Hooded Plovers live on southern coastal beaches and on the inland salt lakes of south-west Western Australia. They feed on invertebrates. The species is highly susceptible to disturbance while nesting.

The salt lakes of our study area could potentially provide breeding habitat when full. Brearley *et al.* (1998) expressed concern that de-watering of the mines could alter the hydrology of the lake and potentially affect this species.

White-browed Babbler *Pomatostomus superciliosus ashbyi*

Conservation Status

Action Plan for Australian Birds: *Near threatened*

One family of White-browed Babblers was found in the study area.

White-browed Babblers are medium sized birds which mostly feed on insects taken from the ground. They live in family groups and roost communally. The far south-western Western Australian subspecies *ashbyi* is listed as near threatened due to habitat loss and fragmentation in its core range in the wheatbelt. Saunders & Ingram (1995) note its decline there. This subspecies grades into the inland subspecies *superciliosus* in the Great Western Woodlands. We are not certain of the taxonomy of the population in the study area, and it is not clear how widespread the species is in this district.

Shy Heathwren *Hylacola cauta whitlocki*

Conservation Status

Action Plan for Australian Birds: *Near threatened*

One pair of Shy Heathwrens was found in the study area.

Shy Heathwrens are small insectivorous birds that live in areas of woodland with dense heathy understory. The subspecies *whitlocki* only lives in heathy woodlands of the south-west of Western Australia. Much of their habitat has been lost from the

south-west wheatbelt, and Saunders & Ingram (1995) note a declining population there.

Although only one pair was observed, this bird is fairly cryptic. It is likely that the study area has many more individuals in the large areas of suitable habitat present.

Crested Bellbird *Oreoica gutturalis gutturalis*

Conservation Status

Action Plan for Australian Birds: *Near threatened*

Crested Bellbirds were heard and seen throughout the study area.

These thrush-sized birds live in temperate and arid zone woodlands. They are insectivores that feed on the ground and in trees. Densities are usually low for an insectivore of this size, with a pair of birds apparently using hundreds of hectares of habitat.

The southern temperate sub-species *gutturalis* has become extinct over much of its former range and appears especially susceptible to extinction in isolated woodland remnants of less than 80 000 hectares (Garnett & Crowley 2000; Traill & Duncan 2000). Saunders & Ingram (1995) note that the population is declining in the Western Australian wheatbelt.

The birds in the study area are likely to be part of an important population of this species in the Great Western Woodlands.

Other Declining Woodland Birds

Conservation Status

Not listed as threatened

Saunders and Ingram (1995) found that 95 bird species had definitely declined in the Western Australian wheatbelt – nearly half of the 195 species they recorded. Most of these species also have populations further inland in the arid zone or in the better conserved wetter forests of the far south-west of Western Australia. However, a number of species have distributions largely or totally restricted to temperate eucalypt woodlands in Western Australia. These were located in what is now the wheatbelt and areas further east in the Great Western Woodlands. Conservation of the Great Western Woodlands is potentially vital for many of these species which are declining in the wheatbelt due to habitat loss (Saunders & Ingram 1995; Robinson & Traill 1996).

In the study area we found nine taxa of birds that are regarded as declining and which in south-west Western Australia have distributions largely or totally limited to temperate woodland areas (Blakers *et al.* 1984, Schodde & Mason 1999). Of these, subspecies *whitlocki* of the Shy Heathwren and sub-species *ashbyi* of the White-browed Babbler are formally listed as threatened and are discussed in more

detail above. The remaining seven species are: Purple-crowned Lorikeet, Regent Parrot, Southern Scrub-Robin, Gilbert's Whistler, Chestnut-backed Quail-thrush (subspecies *fordianum*), Purple-gaped Honeyeater and Yellow-plumed Honeyeater.

These species remain widespread and in some cases highly abundant in the study area and the broader Great Western Woodlands. The retention of these species in their natural abundances in the study area is of particular conservation significance as these species are now increasingly absent or rare over much of the wheatbelt. The intact woodlands of the Great Western Woodlands are crucial to their long-term conservation.

Western Brush Wallaby *Macropus irma*

Conservation Status

2004 IUCN Red List of Threatened Species: *Lower Risk (near threatened)*

The single specimen was seen in recently burnt habitat at the southern end of the study area.

The Western Brush Wallaby is a medium sized wallaby that lives only in the south-west of Western Australia. It is a grazer, and its preferred habitat is woodland with thickets and open flats.

The study area is at the far eastern edge of its range. Predation by foxes and habitat loss have been implicated in its decline (Strahan 1995). We can make no assessment of how common the species is in the study area or how important the study area is for its conservation.

Dingo *Canis lupus dingo*

Conservation Status

Not listed as threatened

The Dingo is in the unusual position of being both legally persecuted and a threatened taxon in much of its original range.

It is possible that the apparently dense Dingo/Dog populations in the study area are mostly pure Dingo and not feral Dogs (*C. lupus familiaris*), with which Dingoes interbreed. The one animal seen appeared to be a pure Dingo. If the population in the study area and the surrounding districts is purebred or largely purebred Dingo, then it is of conservation significance. Dingoes are extinct in most, if not all, other temperate woodland areas in southern Australia (Menkhorst & Knight 2001; B.J. Traill personal observation), and rare and declining throughout all southern Australia (Strahan 1995). Any pure Dingo population in the study area and surrounding Great Western Woodlands is of conservation significance.

Dingoes are generalist top order predators that usually feed on larger herbivores. The Dingo/Dog scats collected in the area indicate that Western Grey Kangaroos, Rabbits and Echidnas are the main prey.

Recent research has indicated their importance as a keystone species regulating herbivore populations and possibly populations of introduced predators. This is discussed further under 'Ecological Processes'.

ECOLOGICAL PROCESSES

Individual species, and complete natural communities, rely upon ecological processes and long distance ecological connections that provide necessary abiotic and biotic interactions for species to survive (Soule *et al.* 2004). For example, in semi-arid and arid areas such as the Great Western Woodlands, long dry periods occur irregularly. Many species (e.g. Banded Stilt) have developed dispersal patterns to and from distant regions to ensure access to food and other resources necessary for their survival.

It is beyond the scope of this report to exhaustively identify and assess all the ecological processes and long distance connections that operate within the Honman Ridge-Bremer Range study area, and between the study area and other districts and regions.

Here we simply identify and briefly describe the major connections and processes that we judge important for fauna in the study area. To identify those relevant to the study area we used as a guide the seven types of large scale processes and connectivity identified by Soule *et al.* (2004) in Australian landscapes:

1. Strongly interactive species
2. Hydroecology
3. Long-distance biological movement
4. Disturbance regimes
5. Climate change and variability
6. Coastal zone fluxes
7. Maintenance of evolutionary processes.

We then compared these with the known requirements of the species found in the study area.

Each of the identified major processes and connections operating in the study area is described briefly here, along with the identification of fauna species that are involved with them. Long-term conservation of many or most of the fauna in the study area will require the maintenance and protection of these connections and processes.

STRONGLY INTERACTIVE SPECIES

Dingo/Dog

Top order predators such as Dingoes and Feral Dogs (both called Dingoes here for simplicity) are often significant ‘trophic regulators’, controlling the abundance and distribution of herbivore prey and some smaller predators.

There is significant evidence from a number of studies that Dingoes can reduce the abundance of large kangaroos and rabbits (Newsome 2001; Newsome *et al.* 2001). This may be important in reducing grazing pressure on woodlands in the study area and the broader Great Western Woodlands.

There is also some evidence that Dingoes may similarly affect the abundance and distribution of smaller introduced predators- cats and foxes (Newsome *et al.* 2001; Soule & Mackey, unpubl. report). If so, this would assist in the maintenance of populations of some reptiles, birds and small mammals that could be reduced by cat or fox predation in the Great Western Woodlands. Control of cat and fox populations by Dingoes is of particular significance since Dingoes are now absent from all other southern temperate woodlands due to campaigns to remove them from sheep rangelands and more closely settled country.

Dingo control activities in the Great Western Woodlands would threaten these interactions.

Emu

Emus are likely to be important dispersers of seeds of fruit bearing plants in the region. Their diet incorporates a wide range of fruit, such as that of emu-bushes (*Eremophila* spp.), quandongs (*Santalum* spp.) and saltbushes (*Maireana* spp.) (Marchant & Higgins 1990). Emus can transport seeds, including large ones such as those of the quandong, over long distances. As such they could play a key role in ensuring effective dispersal of seeds to suitable new habitats and consequent flows of genetic material between populations of the transported plant species (McGrath & Bass 1999).

STRONGLY INTERACTIVE SPECIES/LONG DISTANCE BIOLOGICAL MOVEMENTS

Nectarivorous birds (honeyeaters & lorikeets)

Australian temperate woodlands and heathlands have an unusually high proportion of plants, mostly Myrtaceae and Proteaceae, that have flowers designed to attract pollinating nectarivorous birds and mammals. The proportion of birds and mammals that are highly nectar dependent is much higher in most temperate woodlands and heathlands than in wetter temperate forests.

Nectar production is seasonal for a given plant species. Highly nectarivorous woodland birds therefore usually undertake systematic movements throughout the year to find nectar in a range of habitats. In addition large areas of any one habitat may be required by these birds, to deal with the patchy nature of flowering of a single plant species in a region within and between years.

Pollination by vertebrates ensures fertilisation of seeds of the host plant and allows for gene flow, potentially over long distances. This assists in maintaining healthy populations of those plant species.

In the woodlands of the study area and the Great Western Woodlands as a whole, certain eucalypt species are the principal nectar producers favoured by vertebrates. The south-west corner of the Great Western Woodlands alone, contains more than 200 eucalypt species (CALM Florabase) and this exceptional diversity provides a wide range of nectar resources for vertebrates throughout most of the year. This diversity is complemented by the wide range of nectar producing shrubs of the sandplain heathlands of the Great Western Woodlands.

Maintenance of the extraordinary plant diversity of the study area and the broader Great Western Woodlands region therefore relies partly on retaining large populations of mobile nectarivorous birds to pollinate the plants. Important species include the Purple-crowned Lorikeet, White-fronted Honeyeater, Tawny-crowned Honeyeater and Red Wattlebird. While some other nectarivorous birds such as Yellow-plumed Honeyeaters are essentially resident, the highly mobile species are known to move in large numbers over long distances to find rich nectar sources. However, the movements and precise requirements of these species are not well known in south-west Western Australia.

During the survey very large numbers of honeyeaters and lorikeets were feeding on flowering *Eucalyptus flocktoniae* and *E. eremophila* in much of the unburnt part of the study area. In particular, Purple-crowned Lorikeets and Red Wattlebirds were highly abundant, with populations in the thousands at the time of the study.

Protection of abundant year-round habitat of such nectarivores is important in maintaining both the high honeyeater and lorikeet populations of the Great Western Woodlands and the exceptionally diverse flora that relies on their pollination services.

HYDROECOLOGY/LONG-DISTANCE BIOLOGICAL MOVEMENT

Waterbirds

As inland waterbodies in Australia are mostly ephemeral, waterbirds often make significant long distance movements to utilise habitat following inland rains. Ephemeral inland waterbodies in arid and semi-arid areas are known to be important in maintaining populations of a number of Australian waterbirds (Kingsford 1995). Even though inland wetlands fill rarely and irregularly, they may provide very resource-rich breeding habitat when full.

The large salt lakes in the study area provide waterbird habitat when full. The food chains of the lakes are documented as fairly simple, with algae, brine shrimps and ostrocods multiplying after water inflows (Brearley *et al.* 1998). However, we were unable to find any data on the regularity with which Lake Hope, Lake Johnston, Lake Medcalf and their associated claypans fill. Similarly, there is very little data on waterbird use.

Brearley *et al.* (1998) noted the use of Lake Hope by Red-capped Plover and Hooded Plover (a significant species), during one of their surveys. Banded Stilt have also been recorded. All these species could breed on the lakes, and also use coastal habitat.

Lakes Hope and Johnston are large and are positioned at the end of paleo drainage lines that may deliver occasional floodwaters. The salt lakes of the study area could be important for the long-term maintenance of regional or statewide populations of Hooded Plover, Red-capped Plover, Banded Stilt and possibly other waterbirds.

DISTURBANCE REGIMES

Fire

Fire is a key factor affecting the structure and floristics of woodland communities in the region. It is a necessary ecological process upon which many species depend for regeneration and maintenance of suitable habitat. However, ecologically inappropriate fire regimes can be detrimental to fauna species and natural communities.

Much of the southern part of the study area was burnt 2-3 years prior to this study. Following such a fire fauna are affected as resources such as food and shelter increase or decline for different species following the burning of a particular habitat. The responses of individual species are complex and depend on the intensity and seasonality of fires and interval of time between fires. Of possible importance for some fauna is a mosaic of different fire ages to ensure the long-term availability of resources.

The preferred regimes for the maintenance of ecological communities in the Great Western Woodlands are poorly known. Further research is required to ensure that appropriate fire regimes are identified for maintaining the vegetation types in the study area and the Great Western Woodlands as a whole. A well resourced and active fire management plan is then required to implement the findings.

SIGNIFICANCE OF THE STUDY AREA FOR FAUNA

The fauna conservation value of the Honman Ridge-Bremer Range district is significant in two respects. First, viewed in isolation, the study area maintains populations of a range of fauna species of inherent conservation value. Second, the study area, as part of the Great Western Woodlands, retains most or all of its key ecological processes and connections. These processes support the long-term maintenance of the natural communities, including fauna, in the study area. These two points are discussed further below.

SPECIES OF CONSERVATION SIGNIFICANCE

The fauna of the study area is diverse, a similar result to that found in other surveys elsewhere in the southern part of the Great Western Woodlands.

We found sixteen taxa of conservation significance in the study area. Another three significant species we judged likely to occur there. For most of these species we have little information on their exact status in the study area. For any one taxon further work would be required to determine the importance of the study area for its long-term conservation. With the likely exception of the locally endemic Lake Cronin Snake, all the species of significance have broad distributions extending outside the Great Western Woodlands.

The intact bird and reptile communities are of particular note. They include many species that are declining or threatened both in the remnant woodlands of the wheatbelt of south-west Western Australia and in the highly cleared and fragmented woodlands of eastern Australia. Some of these species, such as Yellow-plumed Honeyeater, Gilbert's Whistler and Chestnut Quail-thrush, are restricted to woodland habitat. The study area and the Great Western Woodlands are extremely important for the long-term protection of these specialist woodland species at regional, state and national levels.

Because of its position in this intact region, the study area, of approximately 40 000 hectares, retains many fauna species highly sensitive to the effects of clearing and the resultant fragmentation of habitat. For some of these species the large area of available habitat in the study area and the Great Western Woodlands may be required for long-term maintenance of populations. Some, such as Emu, Yellow-plumed Honeyeater and Crested Bellbird appear to require large or very large areas to form viable populations (Traill & Duncan 2000).

Nearby sub-fossil records indicate that many small to medium sized mammals have become extinct in the study area since European settlement. This is probably due to fox predation and perhaps to changed fire regimes. However, the presence of a

healthy Dingo/Dog population in the area may have helped maintain populations of some slightly less sensitive species by suppressing fox and cat numbers.

INTACT ECOLOGICAL PROCESSES

As outlined in the introduction, the Great Western Woodlands is the largest remaining area of temperate woodland in Australia. The region is unfragmented, has had relatively little clearing, and to date has few invasive weeds.

Consequently the region appears to retain a range of intact ecological processes such as maintenance of top order predators (Dingoes/Dogs), a population of Emus, which disperse large fruit, and large populations of mobile nectarivores.

The retention of these ecological processes in the study area and the Great Western Woodlands is of great conservation significance. In *all* other Australian temperate woodlands, these ecological processes have been largely lost or highly disrupted due to clearing and consequent fragmentation and degradation of habitat (Hobbs & Yates 2000). This has been a major contributor to the ongoing wave of extinctions occurring in woodland fauna and other signs of ecosystem decay in what are now the wheatbelts of south-eastern and south-western Australia (e.g. Robinson & Traill 1996).

THREATS TO FAUNA

There are a number of active and potential threats to the fauna of the area. These threats are described briefly here, along with the works required to ameliorate or avert them.

MINING EXPLORATION

The study area lies in a major area of mineralisation. As a result it has been subject to intensive mining exploration activities for several decades. There is now a maze of old and new tracks and gridlines, old drill sites, soil sample pits and other disturbances to soil and vegetation. These disturbances could present a threat to fauna in a number of ways.

The introduction of weeds by mining machinery and vehicles can lead to significant changes in the vegetation. This major threat is described further in the next section.

Road traffic associated with exploration directly kills animals. During our survey we found a number of reptiles road-killed by mining exploration traffic, including a significant species, the Carpet Python. Many species have low density populations in these woodlands, so those vulnerable to road-kill may experience a notable decline in population.

Some exploration activities create traps for fauna. We found a blind snake drowned in the sump of a hole dug in Lake Johnston as a watering point for drilling work. We also found a number of old unplugged drilling holes that are now long-term lethal pit-traps for reptiles and small ground mammals.

A tighter environmental code for exploration works, combined with protection of sensitive areas, would help ameliorate such problems.

MINING

If a mine were established in the study area, there would be significant impacts on the fauna. Consequences include: those directly related to the clearing of vegetation, increased weed introductions, increased kills of fauna by traffic, and changes to habitat from altered hydrology and drainage. The extent of these effects on fauna would depend on the size, type and location of the mine.

Any mine in the study area would have a major negative impact on fauna. The extent of its effects would depend on how well the impacts could be restricted to the immediate footprint of the mine site.

WEEDS

Introduced weed species are one of the major threats to the long-term conservation of the Great Western Woodlands. While the region is currently relatively weed free, this should not lead to complacency. New weeds continue to enter the country, and increasing traffic into the Great Western Woodlands will lead to further weed invasions. These may include species with the potential to be highly invasive, spreading into undisturbed bushland.

In the study area there are currently few weeds, and Gibson & Lyons (1998) recorded only eight weed species in the area during their intensive flora survey. We found no widespread species.

However, one species we found during our survey, the Maltese Star Thistle (*Centaurea melitensis*), occurred in dense patches at several locations. This thistle has the potential to be invasive in the woodlands of the study area. Action is required to isolate and eradicate the current populations.

The current mining exploration traffic in the study area will inevitably lead to continued introduction of weed propagules. Mining exploration is especially likely to lead to weed introductions since activities such as drilling and pushing grid lines create disturbed soil, which is highly receptive to weed establishment. Earth-moving machinery exacerbates this problem because it readily imports soil and associated weed seeds from previous jobs in other areas. However, even occasional vehicular traffic (e.g. tourists) can bring in new and potentially virulent weeds.

Compulsory wash-down facilities for vehicles, particularly heavy ones, entering the Great Western Woodlands would be highly desirable.

In addition, funding for regular inspections for new weed incursions is required in the Great Western Woodlands, with resources available to quickly eradicate new infestations before they spread and become impossible to eradicate or control.

FIRE

See discussion of fire under 'Ecological Processes'.

CONCLUSIONS

The fauna of the Honman Ridge-Bremer Range district is diverse, with 26 reptile, 63 bird and 12 mammal species (four introduced mammals) detected during our brief survey, or recorded by others. Of these species, we judged nineteen to be of conservation significance. This number includes species that are relatively abundant in the study area but which are declining or threatened in the remnant wheatbelt woodlands of the south-west of Western Australia and, in some cases, in the highly cleared and fragmented woodlands of eastern Australia.

The conservation significance of the study area also lies in its intact nature. It is within the largest remaining temperate eucalypt woodland in Australia. The region appears to retain most or all of its key ecological processes and connections, upon which a range of fauna species depend.

Mining exploration, mining, weeds, and inappropriate fire regimes pose immediate threats to the fauna of the study area. These threats are interrelated, since the amount of human traffic and disturbance directly influences the risk of weed invasion and the extent and frequency of burning.

RECOMMENDATIONS

Our recommendations for maintenance of the fauna of the study area are that:

1. The study area be considered for protection in a conservation reserve. Hall *et al.* (1990) recommended that the Bremer Range be placed in a conservation reserve to protect the exceptional plant diversity of the area.
2. An ecological fire management plan based on the best available science be prepared for the study area, as part of the broader Great Western Woodlands, and be actively implemented.
3. A weed management plan for the Great Western Woodlands be prepared. This should give high priority to quarantine measures such as compulsory wash-down facilities for all vehicles and include a well resourced 'rapid response' program to identify new weeds becoming established in the region and to eradicate them before they become widespread.
4. Any Dingo control programs in the study area be terminated. For the broader Great Western Woodlands, an appropriate policy should be established that maintains stable Dingo populations in the region as a whole while protecting the interests of farmers in adjacent wheatbelt lands.
5. Mining exploration activities conform to rigorous exploration codes which minimise vegetation destruction and prevent weed establishment in all areas.

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TABLE 1

Trapping results

The small vertebrate fauna captured at each of six survey sites and elsewhere in the Honman Ridge-Bremer Range study area. For each survey site the number of captures are shown followed by the capture method. **p=pitfall**, **e=Elliott**, **s=sighted/hand-captured** in the same habitat proximal to the trap-site as a result of direct searches, spotlighting or incidental observations.

Species	Survey Site (see Methodology for habitat description)					
	1	2	3	4	5	6
Marbled Gecko <i>Christinus marmoratus</i>	1p	s				
Wheat-belt Stone Gecko <i>Dipoldactylus granariensis</i>	2p	1p,s	1p	1p	4p	2p
Tree Dtella <i>Gehyra variegata</i>		s	s			
Bynoe's Gecko <i>Heteronotia binoei</i>				s	3p	
Reticulated Velvet Gecko <i>Oedura reticulata</i>		s				
Crested Dragon <i>Ctenophorus cristatus</i>		s				
Thorny Devil <i>Moloch horridus</i>			s			
Western Bearded Dragon <i>Pogona minima</i>				1p		
Western Heath Dragon <i>Rankinia adalaidensis</i>					3p	
Callose-palmed Shinning-skink <i>Cryptoblepharus plagiocephalus</i>			1p			
Southern Mallee Ctenotus <i>Ctenotus atlas</i>				2p		
Barred Wedge snout Ctenotus <i>Ctenotus schomburgkii</i>			3p		1p	2p
Bright Crevice-skink <i>Egernia richardii</i>			s		1e	
Southwestern Earless Skink <i>Hemiergis initialis initialis</i>			s	s		
Lowlands Earless Skink					s	

Species	Survey Site (see Methodology for habitat description)					
	1	2	3	4	5	6
<i>Hemiergis peronii</i>						
Shrubland Morethia Skink <i>Morethia obscura</i>	2p,s					
Carpet Python <i>Morelia spilota imbricata</i>		s				
Gould's Hooded Snake <i>Parasuta gouldii</i>					s	
Little Long-tailed Dunnart <i>Sminthopsis dolichura</i>					1p	
Western Pygmy Possum <i>Cercartetus concinnus</i>	1p	1p	1p	2p		2p
House Mouse <i>Mus musculus</i>	2e					
European Rabbit <i>Oryctolagus cuniculus</i>	s					
Pitfall trap days	30	30	30	30	30	25
Elliott trap days	75	75	75	75	75	75

TABLE 2

Bird Survey results

Birds recorded at each of six survey sites in the Honman Ridge-Bremer Range study area. Each site had six ten-minute surveys, conducted in the early morning or late afternoon.

x = recorded outside the survey periods and/or just off-site in similar habitat

wdy = with dependent young

idy = including dependent young

Species	Study Site (see Methodology for habitat descriptions)					
	1	2	3	4	5	6
Emu	x					
Australian Hobby				x		
Brown Falcon					x	
Peregrine Falcon		x				x
Collared Sparrowhawk			1			
Wedge-tailed Eagle		x				
Little Eagle			x			
Common Bronzewing	1					
Purple-crowned Lorikeet	2	2	105	36		5
Regent Parrot	1 wdy	x	4			x wdy
Australian Ringneck			1			
Horsfield's Bronze-Cuckoo					x	
Southern Boobook		x				
Tawny Frogmouth						x
Australian Owlet-nightjar		x				
Rainbow Bee-eater		x		1		2
Rufous Treecreeper		1	2	x		
Striated Pardalote	1	1			2	2
Redthroat						1
Weebill		x		1	3	1
Inland Thornbill						2
Chestnut-rumped Thornbill		x				
Yellow-rumped Thornbill						5
White-eared Honeyeater					x	
Yellow-plumed Honeyeater	1	5	11	5		11 idy
Yellow-throated Miner	4					
Brown-headed Honeyeater		1		8	1	1
Red Wattlebird	2	3	3	x	x	1

Species	Study Site (see Methodology for habitat descriptions)					
	1	2	3	4	5	6
Brown Honeyeater				2	2	
White-fronted Honeyeater				1		2
Tawny-crowned Honeyeater					1	
Western Yellow Robin				1		
Jacky Winter		1				
Varied Sittella		9		5		5
Gilbert's Whistler			x	1		
Golden Whistler					x	1
Grey Shrike-thrush		x	4	x		x
Crested Bellbird		x				x
Willie Wagtail						1
Magpie-Lark	x					
Grey Butcherbird	x	3				
Pied Butcherbird	x					
Australian Magpie	x					
Grey Currawong						3 idy
Dusky Woodswallow		1	2	1		
Black-faced Cuckoo-shrike	x	2		1		2
Australian Raven	x					
Australian Pipit	x					

TABLE 3

Records from predator scats

Vertebrate fauna recorded in predator scats in the Honman Ridge-Bremer Range study area. Twenty-five scats were analysed (dingo/dogs and foxes).

Prey species recorded in scat	Number of dingo/dog scats in which prey species was recorded	% occurrence in total number of dingo/dog scats	Number of fox scats in which prey species was recorded	% occurrence in total number of fox scats
Short-beaked Echidna <i>Tachyglossus aculeatus</i>	2	8%		
Southern Ningai <i>Ningai yvonnae</i>			1	4%
Unidentified macropod, mostly large <i>Macropus</i> species.	5	20%		
Western Grey Kangaroo <i>Macropus fuliginosus</i>	5	20%		
House Mouse <i>Mus musculus</i>			3	12%
Rabbit <i>Oryctolagus cuniculus</i>	3	12%	1	4%
Malleefowl <i>Leipoa ocellata</i> (probable)	1	4%		
Other material (reptile scales, unidentifiable bones, insects).	2	8%	2	8%
Total number of scats	18		7	

TABLE 4

Reptiles and frogs in the southern Great Western Woodlands

Reptiles and frogs recorded in the Honman Ridge-Bremer Range district (HR) and five other documented survey areas in the southern part of the Great Western Woodlands. Data for Lake Cronin (LC), McDermid Rock (MR), Frank Hann National Park (FH) and Peak Charles (PC) from How *et al.* (1988). Data for Emily-Ann and Maggie Hays Mines (MH) from Brearley *et al.* (1998). Common names are used only where the species was recorded in the Honman Ridge-Bremer Range survey.

FAMILY Species	LC	MR	FH	PC	MH	HR
GEKKONIDAE						
Marbled Gecko <i>Christinus marmoratus</i>		•	•		•	•
Clawless Gecko <i>Crenadactylus ocellatus</i>	•	•	•	•	•	•
Wheat-belt Stone Gecko <i>Diplodactylus granariensis</i>	•	•	•	•	•	•
<i>Diplodactylus intermedius</i>		•				
Main's Ground Gecko Diplodactylus maini	•	•	•	•	•	•
<i>Diplodactylus pulcher</i>		•				
<i>Diplodactylus spinigerus</i>	•		•			
Tree Dtella <i>Gehyra variegata</i>	•	•	•	•	•	•
Bynoe's Gecko <i>Heteronotia binoei</i>	•				•	•
Reticulated Velvet Gecko <i>Oedura reticulata</i>	•	•	•	•	•	•
Underwoodisaurus milii	•	•			•	
PYGOPODIDAE						
Delma butleri					•	
Delma fraseri	•	•			•	
Lialis burtonis	•			•	•	
Pygopus lepidopodus		•		•	•	
AGAMIDAE						
Crested Dragon <i>Ctenophorus cristatus</i>	•	•	•	•	•	•
Ctenophorus isolepis		•				
<i>Ctenophorus maculatus</i>	•	•	•	•		
<i>Ctenophorus ornatus</i>		•	•	•		

FAMILY	LC	MR	FH	PC	MH	HR
Species						
<i>Ctenophorus salinarum</i>	•	•	•	•	•	
Thorny Devil <i>Moloch horridus</i>	•	•		•	•	•
W. Bearded Dragon <i>Pogona minima</i>						•
Pogona minor	•	•	•	•	•	
W. Heath Dragon <i>Rankinia adelaidensis</i>	•		•			•
SCINCIDAE						
Callose-palmed Shinning-skink <i>Cryptoblepharus plagioccephalus</i>	•	•	•	•	•	•
Southern Mallee Ctenotus <i>Ctenotus atlas</i>	•	•			•	•
Ctenotus impar	•		•	•		
Barred Wedge snout Ctenotus <i>Ctenotus schomburgkii</i>	•	•	•	•	•	•
Ctenotus xenopleura		•				
<i>Cyclodomorphus melanops elongatus</i>	•	•			•	
Egernia formosa					•	
Egernia inornata		•			•	
Egernia multiscutata	•	•				
Bright Crevice Skink <i>Egernia richardii</i>	•	•	•			•
Southwestern Earless Skink <i>Hemiergis initialis</i>		•		•	•	•
Lowlands Earless Skink <i>Hemiergis peronii</i>			•	•		•
Lerista distinguenda	•		•	•	•	
Lerista muelleri		•			•	
Southern Robust Slider <i>Lerista picturata</i>		•			•	•
<i>Menetia greyii</i>	•	•	•	•	•	
Woodland Morethia Skink <i>Morethia butleri</i>	•	•	•		•	•
Shrubland Morethia Skink <i>Morethia obscura</i>	•	•	•	•	•	•
W.Blue-tongue <i>Tiliqua occipitalis</i>	•		•		•	•
Tiliqua rugosa		•	•		•	
VARANIDAE						
Gould's Goanna <i>Varanus gouldii</i>	•	•		•	•	•
Varanus rosenbergi			•	•	•	
TYPHLOPIDAE						

FAMILY	LC	MR	FH	PC	MH	HR
Species						
Southern Blind Snake	•			•	•	•
<i>Ramphotyphlops australis</i>						
<i>Ramphotyphlops hamatus</i>					•	
BOIDAE						
Carpet Python				•	•	•
<i>Morelia spilota imbricata</i>						
ELAPIDAE						
<i>Denisonia atriceps</i>	•				•	
Black-naped Snake	•					•
<i>Neelaps bimaculatus</i>						
Notechis curtis			•	•		
<i>Gould's Hooded Snake</i>	•				•	•
Parasuta gouldii						
Pseudechis australis	•				•	
Pseudonaja affinis	•	•	•	•	•	
Pseudonaja modesta		•				
<i>Rhinoplocephalus nigriceps</i>					•	
<i>Simoselaps bertholdi</i>		•	•			
<i>Simoselaps semifasciata</i>		•			•	
FROGS						
<i>Heleioporus albopunctatus</i>	•		•			
<i>Limnodynastes dorsalis</i>	•		•	•		
Myobatrachus gouldii			•	•		
<i>Neobatrachus centralis</i>	•	•				
<i>Neobatrachus sp.1</i>			•	•		
<i>Neobatrachus sp.2</i>					•	
<i>Neobatrachus pelobatoides</i>	•	•				
<i>Neobatrachus sutor</i>	•					
<i>Pseudophryne guentheri</i>			•			
<i>Pseudophryne occidentalis</i>	•	•		•	•	
<i>Ranidella pseudinsignifera</i>	•					

TABLE 5
Birds in the southern Great Western Woodlands

Birds recorded in the Honman-Ridge-Bremer Range district (HR) and five other documented survey areas in the southern part of the Great Western Woodlands. Data for Lake Cronin (LC), McDermid Rock (MR), Frank Hann National Park (FH) and Peak Charles (PC) from How *et al.* (1988). Data for Emily-Ann and Maggie Hays Mines (MH) from Brearley *et al.* (1998).

Species	LC	MR	FH	PC	MH	HR
Emu <i>Dromaius novaehollandiae</i>	•	•	•	•	•	•
Mallee-fowl <i>Leipoa ocellata</i>	•	•		•		•
Black Swan <i>Cygnus atratus</i>	•					
Australian Shelduck <i>Tadorna tadornoides</i>	•				•	•
Pink-eared Duck <i>Malacorhynchus membranaceus</i>	•					
Australian Wood Duck <i>Chenonetta jubata</i>	•					
Pacific Black Duck <i>Anas superciliosa</i>	•					
Grey Teal <i>Anas gracilis</i>	•					
Australasian Grebe <i>Tachybaptus novaehollandiae</i>	•					
Hoary-headed Grebe <i>Poliiocephalus poliocephalus</i>	•					
White-necked Heron <i>Ardea pacifica</i>	•					
White-faced Heron <i>Egretta novaehollandiae</i>	•					
Australian Kestrel <i>Falco cenchroides</i>	•		•	•	•	
Australian Hobby <i>Falco longipennis</i>	•			•	•	•
Brown Falcon <i>Falco berigora</i>	•	•	•	•	•	•
Peregrine Falcon <i>Falco peregrinus</i>				•		•

Species	LC	MR	FH	PC	MH	HR
Square-tailed Kite <i>Lophoictinia isura</i>	•	•	•	•		•
Brown Goshawk <i>Accipiter fasciatus</i>		•				
Collared Sparrowhawk <i>Accipiter cirrocephalus</i>	•	•		•	•	•
Wedge-tailed Eagle <i>Aquila audax</i>				•	•	•
Little Eagle <i>Hieraaetus morphnoides</i>	•	•	•	•		•
Australian Bustard <i>Otis australis</i>	•		•			
Eurasian Coot <i>Fulica atra</i>	•					
Black-winged Stilt <i>Himantopus himantopus</i>	•					
Red-capped Plover <i>Charadrius ruficapillus</i>	•				•	
Hooded Plover <i>Thinornis rubricollis</i>					•	
Red-necked Stint <i>Calidris ruficollis</i>					•	
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	•				•	
Common Bronzewing <i>Phaps chalcoptera</i>	•	•	•	•	•	•
Brush Bronzewing <i>Phaps elegans</i>			•	•		
Crested Pigeon <i>Ocyphaps lophotes</i>			•		•	
Short-billed Black-Cockatoo <i>Calyptorhynchus latiorstris</i>	•					
Galah <i>Cacatua roseicapilla</i>	•					
Purple-crowned Lorikeet <i>Glossopsitta porphyrocephala</i>	•	•	•		•	•
Western Rosella <i>Platycercus icterotis</i>	•		•	•	•	
Regent Parrot <i>Polytelis anthopeplus</i>	•		•	•	•	•
Australian Ringneck <i>Barnardius zonarius</i>	•	•	•	•	•	•

Species	LC	MR	FH	PC	MH	HR
Mulga Parrot <i>Psephotus varius</i>		•	•			
Elegant Parrot <i>Neophema elegans</i>	•		•			
Pallid Cuckoo <i>Cuculus pallidus</i>	•		•	•	•	
Fan-tailed Cuckoo <i>Cuculus flabelliformis</i>	•	•	•	•		
Black-eared Cuckoo <i>Chalcites osculans</i>			•	•		
Horsfield's Bronze-Cuckoo <i>Chrysococcyx basalis</i>	•		•	•		•
Southern Boobook <i>Ninox boobook</i>	•	•	•	•	•	•
Tawny Frogmouth <i>Podargus strigoides</i>	•	•	•	•	•	•
Australian Owlet-nightjar <i>Aegotheles cristatus</i>	•	•		•	•	•
Spotted Nightjar <i>Eurostopodus argus</i>	•		•		•	
Sacred Kingfisher <i>Todiramphus sanctus</i>					•	•
Red-backed Kingfisher <i>Todirhamphus pyrrhopygius</i>					•	
Rainbow Bee-eater <i>Merops ornatus</i>	•	•		•	•	•
Rufous Treecreeper <i>Climacteris rufus</i>	•	•	•		•	•
Blue-breasted Fairy-wren <i>Malurus pulcherrimus</i>	•	•		•		
White-winged Fairy-wren <i>Malurus leucopterus</i>						•
Spotted Pardalote <i>Pardalotus punctatus</i>	•	•	•			
Striated Pardalote <i>Pardalotus striatus</i>	•	•	•	•	•	•
Shy Heathwren <i>Calamanthus cautus</i>	•		•	•		•
Striated Fieldwren <i>Calamanthus fuliginosus</i>	•	•	•			
Redthroat <i>Pyrrholaemus brunneus</i>	•	•	•		•	•
White-browed Scrubwren <i>Sericornis frontalis</i>	•			•		

Species	LC	MR	FH	PC	MH	HR
Weebill <i>Smicronis brevirostris</i>	•	•	•	•	•	•
Western Gerygone <i>Gerygone fusca</i>	•				•	
Inland Thornbill <i>Acanthiza apicalis</i>	•	•	•	•	•	•
Chestnut-rumped Thornbill <i>Acanthiza uropygialis</i>	•	•	•			•
Yellow-rumped Thornbill <i>Acanthiza chrysorrhoa</i>	•	•	•	•		•
Southern Whiteface <i>Aphelocephala leucopsis</i>				•		
Singing Honeyeater <i>Lichenostomus virescens</i>		•	•	•		•
White-eared Honeyeater <i>Lichenostomus leucotis</i>	•	•	•	•	•	•
Purple-gaped Honeyeater <i>Lichenostomus cratitius</i>	•	•	•	•	•	•
Yellow-plumed Honeyeater <i>Lichenostomus ornatus</i>	•	•	•	•	•	•
Yellow-throated Miner <i>Manorina flavigula</i>	•	•	•	•		•
Brown-headed Honeyeater <i>Melithreptus brevirostris</i>	•	•	•	•	•	•
Spiny-cheeked Honeyeater <i>Acanthagenys rufogularis</i>		•		•	•	•
Red Wattlebird <i>Anthochaera carunculata</i>	•	•	•	•	•	•
Brown Honeyeater <i>Lichmera indistincta</i>	•	•	•	•	•	•
New Holland Honeyeater <i>Phylidonyris novaehollandiae</i>				•		
White-cheeked Honeyeater <i>Phylidoyris nigra</i>				•	•	
White-fronted Honeyeater <i>Phylidonyris albifrons</i>	•	•		•	•	•
Tawny-crowned Honeyeater <i>Glyciphila melanops</i>	•	•	•	•		•
Crimson Chat <i>Epthianura tricolor</i>					•	
White-fronted Chat <i>Epthianura albifrons</i>	•	•				
Western Yellow Robin <i>Eopsaltria griseogularis</i>	•	•	•			•
Hooded Robin <i>Petroica cucullata</i>	•	•	•			

Species	LC	MR	FH	PC	MH	HR
Jacky Winter <i>Microeca fascinans</i>	•	•	•			•
Red-capped Robin <i>Petroica goodenovii</i>	•	•	•	•	•	•
Southern Scrub-robin <i>Drymodes brunneopygia</i>	•	•	•	•		•
White-browed Babbler <i>Pomatostomus superciliosus</i>	•	•		•		•
Chestnut-backed Quail-thrush <i>Cinclosoma castanotum</i>	•	•		•	•	•
Varied Sittella <i>Daphoenositta chrysoptera</i>	•	•		•		•
Gilbert's Whistler <i>Pachycephala inornata</i>						•
Golden Whistler <i>Pachycephala pectoralis</i>	•	•	•	•		•
Rufous Whistler <i>Pachycephala rufiventris</i>		•	•		•	
Grey Shrike-thrush <i>Colluricincla harmonica</i>	•	•	•	•	•	•
Crested Bellbird <i>Oreoica gutturalis</i>	•	•	•	•		•
Western Shrike-tit <i>Falcunculus frontatus</i>	•					
Grey Fantail <i>Rhipidura albiscapa</i>	•		•			
Grey Fantail <i>Rhipidura fuliginosa</i>	•		•			
Willie Wagtail <i>Rhipidura leucophrys</i>	•	•	•	•	•	•
Magpie-Lark <i>Grallina cyanoleuca</i>						•
Grey Butcherbird <i>Cracticus torquatus</i>	•	•	•	•	•	•
Pied Butcherbird <i>Cracticus nigrogularis</i>		•			•	•
Australian Magpie <i>Gymnorhina tibicen</i>			•	•		•
Grey Currawong <i>Strepera versicolor</i>		•	•	•	•	•
Masked Wood-swallow <i>Artamus personatus</i>				•		
Black-faced Wood-swallow <i>Artamus cinerus</i>	•					
Dusky Woodswallow <i>Artamus cyanopterus</i>	•	•	•	•	•	•

Species	LC	MR	FH	PC	MH	HR
Black-faced Cuckoo-Shrike <i>Coracina novaehollandiae</i>	•	•	•	•	•	•
White-winged Triller <i>Lalage sueurii</i>	•					
Little Crow <i>Corvus bennetti</i>		•	•			
Australian Raven <i>Corvus coronoides</i>		•	•		•	•
<i>Corvus</i> sp.				•		
Fairy Martin <i>Hirundo ariel</i>		•				
Tree Martin <i>Hirundo nigricans</i>	•	•	•	•	•	•
Silvereye <i>Zosterops lateralis</i>	•	•	•	•		•
Brown Songlark <i>Cincloramphus cruralis</i>			•			
Mistletoebird <i>Dicaeum hirundinaceum</i>	•	•		•		
Australian Pipit <i>Anthus australis</i>	•	•	•	•	•	•

TABLE 6

Mammals in the southern Great Western Woodlands

Mammals recorded in the Honman Ridge-Bremer Range district (HR) and five other documented survey areas in the southern part of the Great Western Woodlands. Data for Lake Cronin (LC), McDermid Rock (MR), Frank Hann National Park (FH) and Peak Charles (PC) from How *et. al.* (1988). Data for Emily-Ann and Maggie Hays Mines (MH) from Brearley *et al.* (1998).

Species	LC	MR	FH	PC	MH	HR
Short-beaked Echidna <i>Tachyglossus aculeatus</i>	•	•	•		•	•
Western Quoll <i>Dasyurus geoffroii</i>			•			
Southern Ningau <i>Ningau yvonneae</i>	•	•				•
Fat-tailed Dunnart <i>Sminthopsis crassicaudata</i>		•				
Little Long-tailed Dunnart <i>Sminthopsis dolichura</i>		•				•
Gilbert's Dunnart <i>Sminthopsis gilberti</i>	•		•			
White-tailed Dunnart <i>Sminthopsis granulipes</i>	•		•	•		
Western Pygmy Possum <i>Cercartetus concinnus</i>	•	•	•	•	•	•
Honey Possum <i>Tarsipes rostratus</i>			•	•		
Western Grey Kangaroo <i>Macropus fuliginosus</i>	•	•	•	•	•	•
Western Brush Wallaby <i>Macropus irma</i>			•			•
Euro <i>Macropus robustus</i>	•				•	?
Sothern Freetail-bat <i>Mormopterus planiceps</i>	•	•	•			
White-striped Freetail-bat	•	•	•	•	•	•

Species	LC	MR	FH	PC	MH	HR
Tadarida australis						
Lesser Long-eared Bat <i>Nyctophilus geoffroyi</i>	•	•			•	
Greater Long-eared Bat <i>Nycyophilus timoriensis</i>		•			•	
Gould's Wattled Bat <i>Chalinolobus gouldii</i>	•	•	•		•	
Chocolate Wattled Bat <i>Chalinolobus morio</i>			•		•	
<i>Inland Broad-nosed Bat</i> Scotorepens balstoni		•				
Southern Forest Bat <i>Vespadelus regulus</i>	•	•	•	•	•	
Mitchell's Hopping Mouse <i>Notomys mitchelli</i>	•	•	•	•		
Ash-grey Mouse <i>Pseudomys albocinereus</i>	•	•	•	•	•	
Bolam's Mouse <i>Pseudomys bolami</i>	•	•			•	
House Mouse <i>Mus musculus</i>	•	•	•	•	•	•
Dingo/Dog <i>Canis lupus</i>	•	•			•	•
Red Fox <i>Vulpes vulpes</i>	•	•			•	•
Cat <i>Felis catus</i>		•		•	•	•
Rabbit <i>Oryctolagus cuniculus</i>	•	•		•	•	•

APPENDIX

ANNOTATED SPECIES LIST

Annotated list of vertebrates recorded in the Honman Ridge-Bremer Range district.

*Significant species that are discussed in more detail in the text.

Reptiles

STATUS

All figures are estimates for the period of the survey

Scarce:	1 – 2 individuals observed.
Uncommon:	3 - 5 individuals
Common:	6 – 20 individuals
Abundant:	more than 20 individuals

Marbled Gecko *Christinus marmoratus*

Common - Under bark and timber in woodland in Honman Ridge area.

Clawless Gecko *Crenadactylus ocellatus*

Scarce - One found under timber in Honman Ridge area.

Wheat-belt Stone Gecko *Dipoldactylus granariensis*

Common - Widespread. Captured in pitfalls in all vegetation types sampled.

Main's Ground Gecko *Diplodactylus maini*

Uncommon - Several found on ground in Honman Ridge and northern part of Bremer Range while spotlighting.

Tree Dtella *Gehyra variegata*

Scarce - Two individuals found on trees while spotlighting.

Bynoe's Gecko *Heteronotia binoei*

Common - Widespread under timber, rocks and found at night spotlighting.

Reticulated Velvet Gecko *Oedura reticulata*

Uncommon - Found in woodland while spotlighting.

Crested Dragon *Ctenophorus cristatus*

Common - In woodland at northern end of Bremer Range.

Thorny Devil *Moloch horridus*

Uncommon - Four individuals seen in woodland from throughout the study area.

Western Bearded Dragon *Pogona minima*

Common - Observed regularly throughout the study area.

Western Heath Dragon *Rankinia adalaidensis*

Uncommon - Three individuals pit-trapped at the recently burnt Site 5.

Callose-palmed Shinning-skink *Cryptoblepharus plagiocephalus*

Scarce - Two captured in woodland.

Southern Mallee Ctenotus *Ctenotus atlas*

Scarce - Two captured at Site 4, where spinifix present.

Barred Wedge snout Ctenotus *Ctenotus schomburgkii*

Common - Captured in pit-traps at 3 sites.

Bright Crevice-skink *Egernia richardii*

Uncommon - Two observed in fallen timber in northern part of the study area. One trapped in recently burnt woodland at Site 5 and one observed at Site 3.

Southwestern Earless Skink *Hemiergus initialis initialis*

Scarce - Two captured in leaf litter in woodland, one at Site 3, one at Site 4 (Museum specimen).

Lowlands Earless Skink *Hemiergus peronii*

Scarce - One captured in leaf litter in recently burnt woodland at Site 5.

Southern Robust Slider *Lerista picturata*.

Scarce - One under a log in woodland on Honman Ridge.

Woodland Morethia Skink *Morethia butleri*

Scarce - One trapped in woodland on deep sand at Site 6. Three found under log in woodland at northern end of Lake Hope.

Shrubland Morethia Skink *Morethia obscura*

Uncommon - Two trapped and one observed in chenopod woodland at Site 1.

Western Blue-tongue *Tiliqua occipitalis*

Scarce - One road killed animal in southern part of study area.

Gould's Goanna *Varanus gouldii*

Common - Diggings and tracks of individuals highly likely to be this species observed throughout study area. One individual specifically identified as *V. gouldii*.

Southern Blind Snake *Ramphotyphlops australis*

Scarce - One found dead in a water pump hole dug by mining exploration contractors on edge of Lake Johnston.

***Carpet Python** *Morelia spilota imbricata*

Scarce - Two seen. One a road kill at southern end of Honman Ridge at Site 2 (specimen lodged with WA Museum). One on road approximately one kilometre south-east of Site 2.

Black-naped Snake *Neelaps bimaculatus*

Scarce - One in woodland at night, 1.4 km south of Site 6.

Gould's Hooded Snake *Parasuta gouldii*

Scarce - One a road kill at site 5 in recently burnt woodland.

Birds

STATUS

All figures are estimates for the total period of the survey

Scarce:	3 or less individuals.
Uncommon:	4 - 50 individuals.
Common:	50 – 100 individuals.
Abundant:	more than 100 individuals.

***Emu** *Dromaius novaehollandiae*

Uncommon - Tracks and scats widespread throughout all habitats. Breeding - one male and 9 chicks observed in the northern part of the study area.

*** Malleefowl** *Leipoa ocellata*

Recorded as a 'probable' in a dog/fox scat found at the northern end of the Honman Ridge area near Site 6. Recorded in the Birds Australia Bird Atlas database as a recent record from a block in the centre of the study area.

Australian Shelduck *Tadorna tadornoides*

Scarce - One long dead bird found adjacent to Lake Johnston.

Australian Hobby *Falco longipennis*

Scarce - A single bird seen twice over woodland.

Brown Falcon *Falco berigora*

Uncommon - Several birds seen in and over woodlands throughout the study area.

***Peregrine Falcon** *Falco peregrinus*

Scarce - A pair of birds seen occasionally over and near Honman Ridge.

***Square-tailed Kite** *Lophoictinia isura*

Scarce - One seen soaring low over woodland in the Bremer Range at 32deg 28' 51"S, 120deg 40' 33"E.

Collared Sparrowhawk *Accipiter cirrhocephalus*
Scarce - One observed in woodland in Bremer Range.

Wedge-tailed Eagle *Aquila audax*
Scarce - One pair over Honman Ridge and one individual seen over Lake Medcalf.
An old nest on the Honman Ridge area.

Little Eagle *Hieraaetus morphnoides*
Scarce - One seen flying over woodland in the Bremer Range.

Common Bronzewing *Phaps chalcoptera*
Uncommon - Several observations of single birds and pairs, mostly in northern part of the study area.

***Purple-crowned Lorikeet** *Glossopsitta porphyrocephala*
Abundant - Large parties throughout all woodland areas, with concentrations feeding on flowering *Eucalyptus flocktoniae* and *E. eremophila*. Several thousand birds likely to have been resident in the study area during the survey.

***Regent Parrot** *Polytelis anthopeplus*
Uncommon - In small groups throughout woodland areas. Breeding (two parties of dependent young).

Australian Ringneck *Barnardius zonarius*
Uncommon - Throughout woodland areas.

Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*
Scarce - One heard in recently burnt woodland in Bremer Range.

Southern Boobook *Ninox novaeseelandiae*
Scarce - One heard in woodland at southern end of Honman Ridge.

Tawny Frogmouth *Podargus strigoides*
Scarce - One seen in woodland in northern part of study area.

Australian Owlet-nightjar *Aegotheles cristatus*
Scarce - One heard in woodland at southern end of Honman Ridge.

Sacred Kingfisher *Todiramphus sanctus*
Scarce - One seen in woodland in northern part of study area.

Rainbow Bee-eater *Merops ornatus*
Common - In small flocks throughout woodlands.

Rufous Treecreeper *Climacteris rufa*
Uncommon - In pairs patchily distributed throughout woodlands.

White-winged Fairy-wren *Malurus leucopterus*
Scarce - Two birds in treeless chenopod shrubland on edge of Lake Hope.

Striated Pardalote *Pardalotus striatus*

Common - Throughout woodlands.

***Shy Heathwren** *Hylacota cauta*

Scarce - One pair in shrubby woodland at north end of Honman Ridge.

Redthroat *Pyrrholaemus brunneus*

Common - Widespread in shrubby woodland.

Weebill *Smicrornis brevirostris*

Common - Throughout woodlands, except in areas with high densities of Yellow-plumed Honeyeaters.

Inland Thornbill *Acanthiza apicalis*

Uncommon - In pairs patchily distributed in shrubby woodlands.

Chestnut-rumped Thornbill *Acanthiza uropygialis*

Uncommon - Small parties in shrubby woodland on the Honman Ridge.

Yellow-rumped Thornbill *Acanthiza chrysorrhoa*

Uncommon - Small parties patchily distributed in open areas throughout the study area.

Singing Honeyeater *Lichenostomus virescens*

Scarce - One seen in open woodland at edge of Lake Medcalf.

White-eared Honeyeater *Lichenostomus leucotis*

Scarce - Three observations in woodland with dense understorey, scattered throughout the study area.

***Purple-gaped Honeyeater** *Lichenostomus cratitius*

Uncommon - Seen only in tall shrubland of unnamed hill between Maggie Hays mine and Maggie Hays Hill.

***Yellow-plumed Honeyeater** *Lichenostomus ornatus*

Abundant - Dominant bird in most unburnt woodlands. Breeding (dependent young).

Yellow-throated Miner *Manorina flavigula*

Uncommon - A colony in open Salmon Gum woodland next to Lake Hope.

Brown-headed Honeyeater *Melithreptus brevirostris*

Common - In small parties in most woodland areas, including recently burnt sites.

Spiny-cheeked Honeyeater *Acanthagenys rufogularis*

Scarce - Two seen in open woodland on edge of Lake Medcalf.

Red Wattlebird *Anthochaera carunculata*

Abundant - In moderate densities throughout all woodlands, with highest concentration in areas with flowering *Eucalyptus flocktoniae* and *E. eremophila*.

Brown Honeyeater *Lichmera indistincta*

Common - Patchily distributed throughout woodlands.

White-fronted Honeyeater *Phylidonyris albifrons*

Uncommon - Patchily distributed throughout woodlands.

Tawny-crowned Honeyeater *Phylidonyris melanops*

Scarce - One party of 3 birds in recently burnt woodland.

Western Yellow Robin *Eopsaltria griseogularis*

Uncommon - Pairs or single birds observed at several sites in woodland with tall shrubs in the understorey. Breeding (dependent young).

Jacky Winter *Microeca leucophaea*

Scarce - One pair in woodland at southern end of Honman Ridge.

Red-capped Robin *Petroica goodenovii*

Scarce - On edge of lake in open woodland at Lake Medcalf.

***Southern Scrub-robin** *Drymodes brunneopygia*

Scarce - A pair in tall shrubland of unnamed hill between Maggie Hays mine and Maggie Hays Hill.

***White-browed Babbler** *Pomatostomus superciliosus*

Uncommon - One party seen in woodland to north of study area. One party in woodland in Bremer Range.

***Chestnut-backed Quail-thrush** *Cinclosoma castanotum*

Scarce - Two observations of single birds in woodland with shrubby and bluebush understorey in Bremer Range.

Varied Sittella *Daphoenositta chrysoptera*

Common - Seen in small parties throughout woodlands.

***Gilbert's Whistler** *Pachycephala inornata*

Scarce - Two observations in woodlands in Bremer Range

Golden Whistler *Pachycephala pectoralis*

Scarce - Three observations of single birds in woodlands in Bremer Range.

Grey Shrike-thrush *Colluricincla harmonica*

Uncommon - In pairs in low densities throughout woodlands

***Crested Bellbird** *Oreoica gutturalis*

Scarce - Observed at three sites in woodlands.

Willie Wagtail *Rhipidura leucophrys*
Uncommon - Seen at two sites in open woodland.

Magpie-Lark *Grallina cyanoleuca*
Scarce - A pair seen once in woodland on Honman Ridge.

Grey Butcherbird *Cracticus torquatus*
Uncommon - Pairs and single birds on Honman Ridge and in northern part of the study area.

Pied Butcherbird *Cracticus nigrogularis*
Scarce - One pair observed on Honman Ridge.

Australian Magpie *Gymnorhina tibicen*
Scarce - One pair in open woodland near Lake Hope.

Grey Currawong *Strepera versicolor*
Uncommon - Pairs patchily distributed throughout woodlands. Breeding- with dependent young.

Dusky Woodswallow *Artamus cyanopterus*
Uncommon - Small parties throughout woodlands. Breeding - nest building.

Black-faced Cuckoo-Shrike *Coracina novaehollandiae*
Uncommon - Single birds and pairs throughout woodlands.

Australian Raven *Corvus coronoides*
Uncommon - Pairs and single birds mostly in more open woodland and open shrublands around the lakes.

Tree Martin *Hirundo nigricans*
Uncommon - Several over lake and woodland at northern part of Lake Hope.

Silvereeye *Zosterops lateralis*
Uncommon - Small parties in granitic shrubland on Honman Ridge.

Australian Pipit *Anthus australis*
Uncommon - In treeless chenopod shrubland around Lakes Hope and Medcalf .

MAMMALS

Short-beaked Echidna *Tachyglossus aculeatus*.

Found in two dingo/dog scats picked up in Honman Ridge section of the study area.

Southern Ningau *Ningaui yvonneae*

One in a fox scat collected from south-east side of Lake Medcalf.

Little Long-tailed Dunnart *Sminthopsis dolichura*

One caught in pitfall in 2-3 year post-fire regenerating woodland.

Western Pygmy Possum *Cercartetus concinnus*

Caught in pitfalls across all vegetation types sampled except for 2-3 year post-fire regenerating woodland.

Western Grey Kangaroo *Macropus fuliginosus*

Widespread, most commonly observed in open woodlands and chenopod shrublands. Common in dingo/dog scats.

Western Brush Wallaby *Macropus irma*

One seen in southern part of the study area at 32° 32' 07"S; 120° 43' 39"E

?Euro *Macropus robustus*

Droppings in rock shelters on ridges in the northern part of the study area are likely to have been from Euro.

White-striped Mastiff Bat *Nyctinomus australis*.

Heard throughout the study area.

House Mouse *Mus musculus*.

Two caught in Elliott traps in open woodland with chenopod shrub layer.

Dingo/Dog *Canis lupus*

Widespread, scats collected in all vegetation types. One subadult, a pure Dingo, seen at Lake Medcalf.

Red Fox *Vulpes vulpes*.

Widespread, scats collected at four sites spread across the study area.

Cat *Felis catus*.

Tracks seen at one site at northern end of Bremer Range.

Rabbit *Oryctolagus cuniculus*.

Widespread, animals and droppings commonly seen in chenopod shrublands, occasionally elsewhere. Found in dingo/dog and fox scats. Several sick and dying individuals suffering from myxomatosis.