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Hancock Prospecting Pty Ltd – Roy Hill Short-range Endemic Desktop Survey

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**Hancock Prospecting Pty Ltd – Roy Hill
Short-range Endemic Desktop Survey**

HANCOCK PROSPECTING PTY LTD

29 March 2009

Hancock Prospecting Pty Ltd
Short-range Endemic Invertebrate Desktop Study

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Executive Summary

The proposed Roy Hill Project is located in the Pilbara, approximately 277 km south east from Port Hedland and 100 km north of Newman at the south eastern end of the Chichester Range. Roy Hill consists of a collection of five tenements owned by Hancock Prospecting Pty Ltd since 1993. Hancock Prospecting Pty Ltd has identified 1.6 billion tones of mineralization from preliminary geological analysis, possibly becoming Australia's largest undeveloped Marra Mamba resource.

Hancock Prospecting Pty Ltd commissioned *ecologia* Environment (*ecologia*) to undertake a baseline biological desktop study of the invertebrate fauna of the Roy Hill project area as part of the environmental impact assessment for the project. The primary objective of this study was to provide sufficient information with which to assess previous surveys undertaken at Roy Hill (*ecologia* 2006, 2008) and to guide further survey work at Roy Hill.

The paucity of knowledge and lack of extensive invertebrate survey work in the area of Roy Hill prompted database searches of the eastern Pilbara region: between 22-23°S, and 118-120°E (WGS84). Families and genera known to contain short-range endemic species were targeted from this area in searches of the Malacology and Terrestrial Invertebrate Databases of the Western Australian Museum.

Search results identified records of Trapdoor spiders, Pseudoscorpions, Scorpions Millipedes, Centipedes and Snails from the eastern Pilbara. Previous survey work by *ecologia* also collected a new species of isopod crustacean from the area. Very few short-range endemic invertebrate groups were recognised in previous *ecologia* surveys at Roy Hill. Two possible explanations for this are identified: Insufficient sampling and extensive environmental degradation, which independently, or in conjunction would explain the absence of short-range endemic groups from previous survey.

Additional targeted searches are recommended to augment the survey work previously undertaken.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Roy Hill 1 Project is located in the Pilbara approximately 277 km south east from Port Hedland and 100 km north of Newman at the south eastern end of the Chichester Range. Roy Hill consists of a collection of five tenements owned by Hancock Prospecting Pty Ltd since 1993. Hancock Prospecting Pty Ltd has identified 1.6 billion tones of mineralization from preliminary geological analysis, possibly becoming Australia's largest undeveloped Marra Mamba resource.

The purpose of this desktop survey is to provide:

- A literature review of short-range endemism and its significance
- A summary of previous SRE findings at Roy Hill
- Search for short-range endemic arthropods and mollusc taxa from the Western Australian Museums databases.
- Conservation values of the short-range endemic fauna of and in the vicinity of the proposed project area

1.2 SURVEY OBJECTIVES

Hancock Prospecting Pty Ltd commissioned *ecologia* Environment (*ecologia*) to undertake a baseline biological desktop study of the invertebrate fauna of the Roy Hill project area as part of the environmental impact assessment for the project.

The primary objective of this study was to provide sufficient information with which to assess previous surveys undertaken at Roy Hill (*ecologia* 2006, 2008) and to guide further survey work at Roy hill.

Specifically, the objectives of this survey were to satisfy the requirements documented in EPA's Guidance Statement 56 (EPA 2004) and Position Statement No. 3 (EPA 2002), thus providing:

- a review of background information (including literature and database searches);
- an inventory of Short-range endemic (short-range endemic) fauna species occurring in the area proposed for development, incorporating recent published and unpublished records;
- an inventory of species of biological and conservation significance recorded or likely to occur within the project area and surrounds, and;
- a review of regional and biogeographically significance, including the conservation status of species recorded in the project area.

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Figure 1.1 Location of project area in relation to the Pilbara region.



1.3 OVERVIEW OF SHORT-RANGE ENDEMISM IN THE ROY HILL PROJECT AREA

Endemism refers to the restriction of species to a particular area, whether it be at the continental, national or local level (Allen *et al.* 2002). Short-range endemism refers to endemic species with restricted ranges, which in Western Australian is currently defined as less than 10,000 km² (100 km x 100 km) (Harvey 2002). Such taxa are usually invertebrates, as they are more likely to have poor dispersal capabilities and possess a more defined or restrictive biology that promotes their isolation and eventual speciation. The potential short-range endemic groups listed in this review are not exhaustive. Invertebrates are historically understudied and in many cases lack formal descriptions. Reliable taxonomic evaluation of these species has begun only relatively recently and thus the availability of literature relevant to short-range endemics is still scarce (Lunney and Ponder 1999).

1.3.1 Processes promoting short-range endemism

Short-range endemism is influenced by numerous processes which generally contribute to the isolation of the species (Harvey 2002). Several factors, including the ability and opportunity to disperse, life history, physiology, habitat requirements, habitat availability, biotic and abiotic interactions, and historical conditions, influence not only the distribution of a taxon, but also the tendency for differentiation and speciation (Harvey 2002; Ponder and Colgan 2002).

Isolated populations of both plants and animals tend to differentiate both morphologically and genetically as they are influenced by different selective pressures over time. The combination of novel mutations and genetic drift promote the accumulation of genetic differences between isolated populations. Conversely, the maintenance of genetic similarity is promoted by a lack of isolation through migration between the populations, repeated mutation and balancing selection (Wright 1943). The level of differentiation and speciation between populations will be determined by the relative magnitude of these factors, with the amount of migration generally being the strongest determinant. Migration is hindered by poor dispersal ability of the taxon as well as geographical barriers to dispersal. Taxa that exhibit short-range endemism are generally characterised by poor dispersal, low growth rates, low fecundity and reliance on habitat types that are discontinuous (Harvey 2002).

A number of habitats in Australia contain short-range endemics because they are surrounded by geographic barriers. Islands are a classic example, where terrestrial fauna are surrounded by a marine environment which impedes migration and thus gene flow. Habitats such as mountains, aquifers, lakes and caves are essentially islands exhibiting unique environmental conditions relative to their surrounding habitats (Harvey 2002; Johnson *et al.* 2004).

The historical connections of habitats are also important in determining species distributions and often explain patterns that are otherwise inexplicable by current conditions. Many short-range endemics are considered to be relictual taxa (remnants of species that went extinct elsewhere) and are confined to certain habitats, and in some cases, single geographic areas (Main 1996). Relictual taxa include species that evolved

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prior to the breakup of Gondwana supercontinent (180-65 million years ago) and have a very restrictive biology in contemporary times (Harvey 2002). In Western Australia, relictual taxa generally occur in fragmented populations, from lineages reaching back to historically wetter periods. For example, during the Miocene period (from 25 million to 13 million years ago), the aridification of Australia resulted in the contraction of many areas of moist habitat and the fragmentation of populations of fauna occurring in these areas (Hill 1994). With the onset of progressively dryer and more seasonal climatic conditions, suitable habitats have become increasingly fragmented. Relictual species now generally persist in habitats characterised by permanent moisture and shade, maintained by high rainfall and/or prevalence of fog, whether induced by topography or coastal proximity, or areas associated with freshwater courses (e.g. swamps or swampy headwater of river systems), caves, or microhabitats associated with southern slopes of hills and ranges, rocky outcrops, deep litter beds, or various combinations of these features (Main 1996, 1999). As a result, these habitats support only small, spatially isolated populations, which are further restricted by their low dispersal powers typical for all short-range endemic species.

1.3.2 Current knowledge of the Short-range endemic species in Roy Hill and eastern Pilbara

Groups or organisms which display short-range endemism include (but are not limited to) molluscs (e.g. Camaenid land snails), Onychophora (velvet worms), millipedes, some arachnids (scorpions, pseudoscorpions and schizomids) and some crustaceans (isopods) (Harvey 2002). The current state of knowledge on short-range endemism of particular species in Australia, and the Roy Hill region, is relatively poor. The paucity of published surveys in the area makes assessing the distribution of short-range endemic fauna in and around the Roy Hill area reliant on the results of previous environmental surveys as well as data from the Western Australian Museum.

Two previous surveys for Short-range endemics have been undertaken at Roy Hill by *ecologia* (2006, 2008). *Ecologia* (2006) undertook a pitfall trapping survey over seven days, comprising five pitfall trapping nights and seven days of foraging (*ecologia* 2006). Short-range endemic species were identified in the survey and a summary of the relevant species discovered is listed in Table 1.1.

In a separate survey, *ecologia* (2008) undertook an intensive foraging survey to determine if suitable habitat was present that could support trapdoor spiders. That survey detected a single sub adult specimen of *Conothele*. Species level identification could not be made as the only specimen detected was a sub adults and identification is only possible with adult males.

Table 1.1 Summary list of short-range endemic species and taxa discovered by ecologia (2006) survey.

Order	Family	Identification	Short-range endemic status
SCORPIONES	Urodacidae	<i>Urodacus</i> sp.	unknown
	Buthidae	<i>Lychas</i> sp.	unknown
ISOPODA	Philoscidae	<i>Laevophiloscia</i> sp.	unknown
SCOLOPENDROMORPHA	Cryptopidae	<i>Cryptops spinipes?</i>	unknown
GEOPHILOMORPHA	unknown	unknown	unknown

1.4 Climate

Roy Hill is situated in the Pilbara region of Western Australia and experiences an arid tropical climate with two distinct seasons; a hot summer from October to April and a mild winter from May to September Figure 1.2 (McKenzie *et al.* 2002). Annual evaporation exceeds rainfall by as much as 500 mm per year. Seasonally low but unreliable rainfall, together with high temperatures and high diurnal temperature variations are also characteristic climatic features of the region. This region has in the past experienced no rainfall in any month of the year, which is typical of a desert climate (Beard 1975). Within the Pilbara, the temperature range is large and maxima are high. Summer maximum temperatures have reached 46°C at Newman, with a mean maximum of 31.3°C (Table 2.1). Light frosts occasionally occur during July and August. The climate experienced throughout the year is usually very dry since high temperature and humidity seldom occur simultaneously.

The Newman Bureau of Meteorology Weather station is nearest to Roy Hill, located *ca* 87km SSW of Roy Hill (23°21'29.07"S, 119°44'6.08"E). Weather data are presented here for the Newman area and while these will not be identical to those at Roy Hill, it is proximal enough to Roy Hill for general patterns applicable to Roy Hill.

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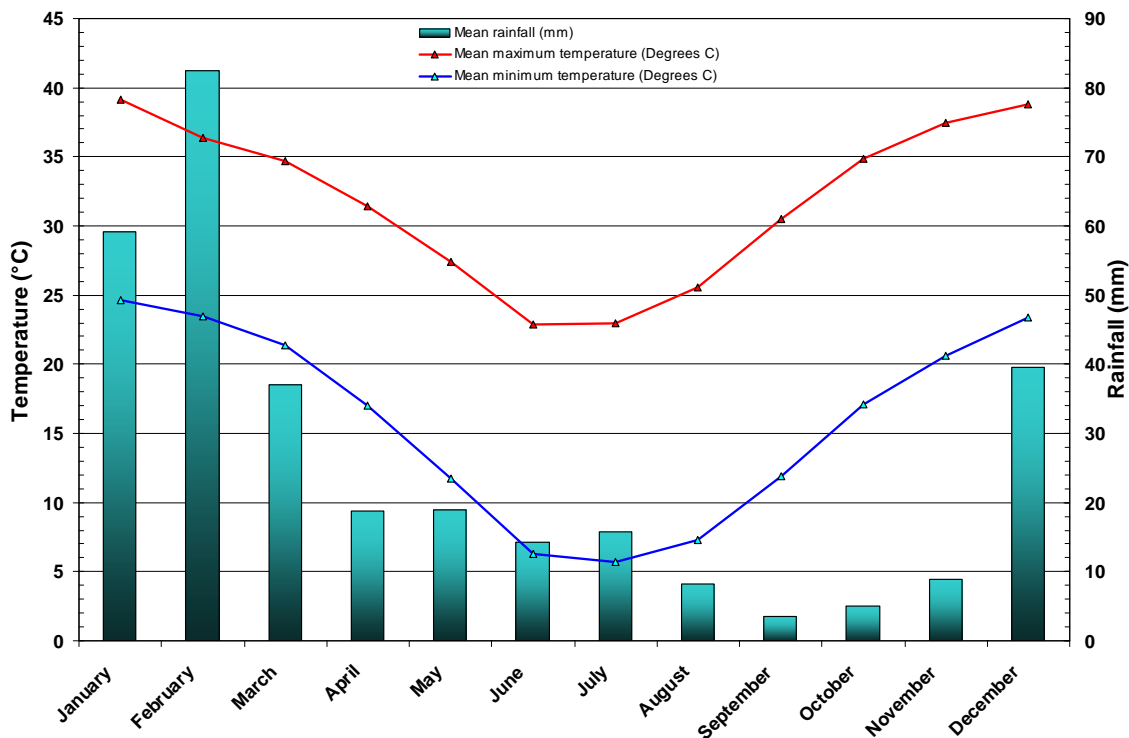


Figure 1.2 Newman weather summary: Mean monthly temperatures (maximum and minimum) and rainfall plotted. Data from 1996-2008 records of the Australian Bureau of Meteorology: <http://www.bom.gov.au/climate/averages>.

1.5 Biogeography

The project is based in the Pilbara biogeographic region of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell 1995). The Pilbara region is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. The Pilbara is divided into four sub regions: Roubourne, Hamersley, Fortescue and Chichester, Figure 1.3.

The Roy Hill study falls within the Fortescue subregion at the foot-slope of the Chichester Range (Chichester subregion). Both sub regions contain small areas of national parks. The Chichester subregion contains areas of the Millstream–Chichester National Park and Mungarooona nature reserve. The total reserved area of Chichester is 6.56%. The Fortescue subregion contains portions of the Millstream–Chichester and Karijini national parks. The total reserved area of Fortescue Plains is 0.79%. The areas of national parks are located on the western sections of both sub regions, not directly involved with the Roy Hill project area. The Fortescue Marsh itself is recognized as a wetland of national significance (DIWA listings). A threatening process of the system as identified by is changed hydrology. Roy Hill project work up flow of the marsh may have possible implication upon the hydrology.

Chichester subregion: area is 9,044,560 ha. It is the northern section of the Pilbara Craton. It features Archaean granite and basalt plains including significant basaltic ranges. The plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummocks grasslands. *Eucalyptus leucophloia* tree steppes occur on ranges. The climate is Semi-desert-tropical and receives 300mm of rainfall annually.

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Fortescue subregion: area is 2,041,914 ha: alluvial plains and river frontage. Alluvial plains characterised by salt marsh, mulga-bunch grass and short grass communities. Drainage lines are fringed by Rivergum woodlands. Permanent water springs in the central Fortescue are fed by an extensive calcrete aquifer supporting large permanent wetlands. Climatic conditions are semi desert tropical, with average rainfall of 300 mm, falling mainly during summer cyclonic events.

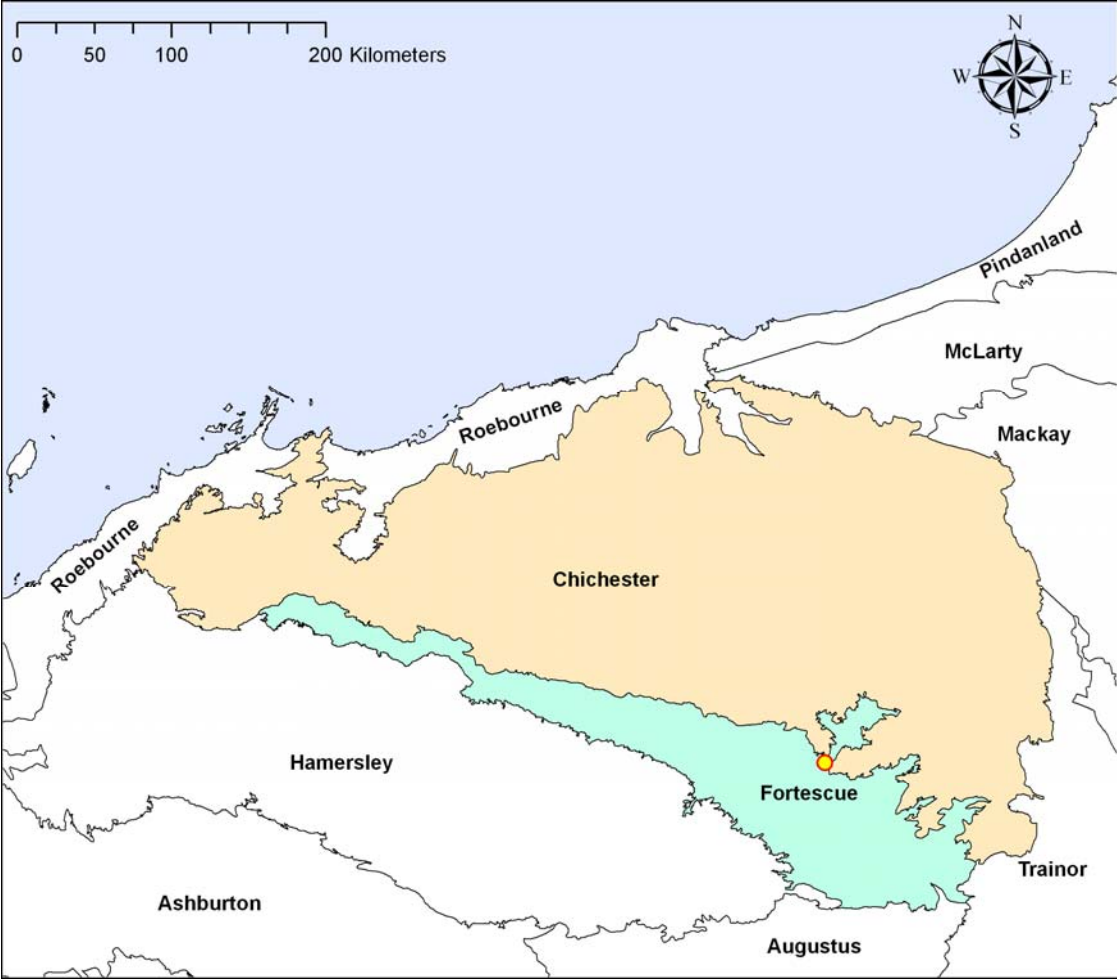


Figure 1.3 Map of the Pilbara region of Western Australia: indicating the Pilbara IBRA subregions; the location of Roy Hill indicated with a circle and its position relative to the Fortescue and Chichester subregions (shaded).

2 METHODS

Database searches: Ideally a short-range endemic study would be undertaken locally in the Roy Hill area; however, invertebrate diversity in this area is very poorly known and so a more regional approach was taken and surveyed. Taxa known to contain short-range endemics, were searched within the Malacology and Terrestrial Invertebrate electronic databases of the Western Australian Museum. A relatively large area was searched,

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between 22°S and 23°S, and 118°E to 120°E (WGS84), an area comprising the eastern Chichester range, eastern Fortescue Valley, and Eastern Hamersley Range. The list of species discovered within this area therefore represents a list of species with the potential to be present. Results of this search are presented in Table 3.1-Table 3.4.

3 RESULTS

3.1 SUBCLASS ARACHNIDA: ARACHNIDS

3.2 Order Araneae: Spiders

3.2.1 Infraorder Mygalomorphae: Trap-door Spiders

Mygalomorph or trapdoor spiders are moderate to large sized burrowing spiders (Brusca and Brusca 1990). The taxonomy of many Mygalomorph families and genera are incompletely known, making it impossible to make definitive comment on the conservation status of these groups. Representatives of the families Barychelidae, Ctenizidae, Dipluridae, Idiopidae, and Nemesiidae are known from the eastern Pilbara region and are likely to contain short-range endemic species. Eastern Pilbara species and morphospecies occurring within these families are listed in table Table 3.1. Most of the mygalomorph species identified from the eastern Pilbara are undescribed.

3.2.2 Infraorder Areneomorphae: Web building spiders

3.2.2.1 Family Selenopidae Simon: Selenopid Spiders

Members of the spider family Selenopidae have recently been identified as having short-range distributions (Mark Harvey pers. com.). Selenopid records are absent from the area under investigation; however, their preferred habitats (rocky hill slopes) are widespread throughout the Chichester and Hamersley ranges, and their absence from these regions may be an artefact of poor sampling.

3.2.3 Order Schizomida: Schizomids

Schizomids are small arachnids that require high humidity environments (Brusca and Brusca 1990). The only schizomids known from the Pilbara region are all subterranean. The dry surface conditions at Roy Hill make it extremely unlikely for epigeal schizomids to be present in the eastern Pilbara.

3.2.4 Order Pseudoscorpiones: Pseudoscorpions

Six families of pseudoscorpion are recorded from the East Pilbara region Table 3.2. Of the families identified, the most likely to be present within habitats identified at Roy Hill are: Chernetidae, Garypidae and Olpiidae. The internal taxonomy of these families is poorly resolved and presently under investigation at the Western Australian Museum.

3.2.5 Order Scorpiones: Scorpions

Three putative short-range endemic species from each of the genera *Lychas* Koch, and *Urodacus* Peters, were identified from the WAM database search, Table 3.3. These six species are only known from very small or patchy samples from the Pilbara region

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(Volschenk Pers. obs.). Their conservation status is hampered by lack of biological and geographical knowledge

3.3 SUBCLASS CRUSTACEA: CRUSTACEANS

3.3.1 Order Isopoda; Superfamily Oniscoidea: Slaters, Woodlice

All terrestrial Isopods belong to the suborder Oniscoidea (Brusca and Brusca 1990). *Ecologia* (2006) uncovered one undescribed species of *Laevophiloscia* Wahrberg (family Philosciidae Kinahan) from the north-western part of the tenement. Relatively little is known of the isopods from the Pilbara region.

3.4 SUBCLASS MYRIAPODA: MILLIPEDES AND CENTIPEDES

3.4.1 Class Chilopoda

Few centipedes are considered to be short-range endemics with the main species recognised from the family Cryptopidae and the Order Geophilomorpha. The taxonomic status of both of these groups is unresolved and problematic, and presently not receiving research in Australia. While cryptopids and geophilids are known from the Pilbara region they are presently too poorly known for short-range endemic species to be identified clearly (Volschenk Pers. Obs).

3.4.2 Class Diplopoda

Order Polydesmida: contains numerous short-range endemic species in Western Australia. The genus *Antichiropus* Attems, presently contains more than 150 morphospecies, of which only one is not a short-range endemic: *Antichiropus variabilis* Attems (pers. com. M.S. Harvey). The Western Australian Museum has records of five putative species of *Antichiropus* from the eastern Pilbara, Table 3.4.

3.5 PHYLUM MOLLUSCA: MOLLUSCS

3.5.1 Family Camaenidae Pilsbry and Family Bulimulidae Tryon

In the eastern Pilbara, two families of terrestrial snails are recognized as having species that are characterized by short-range endemism: Camaenidae and Bulimulidae. Camaenidae is Australia's most diverse terrestrial snail family with more than 400 described species (Ponder 1997; Solem 1997; Johnson *et al.* 2004). The camaenid genera *Rhagada* and *Quistrachia*, are present within the eastern Pilbara, and several undescribed species are suspected Table 3.5 (C. Whisson and S. Slack-Smith pers. com.). Bulimulidae is also a diverse family with all Australian species belonging to the genus *Bothriembryon*. This genus is recorded from the eastern Pilbara (Table 3.5); however, the taxonomy of this group is unresolved. Several undescribed cryptic species are suspected to be present within the eastern Pilbara region. Little work on the Western Australian fauna subsequent to Solem (1988).

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TAXON	FAMILY	Identification
Mygalomorphae (Trapdoor Spiders)	Barychelidae	<i>Synothele</i> sp.
		<i>Synothele</i> 'cloudbreak'
		<i>Synothele</i> karara Raven
		<i>Synothele</i> sp 3
		<i>Aureococrypta</i> 'chichester'
		<i>Aureococrypta</i> 'chittering'
		<i>Aureococrypta</i> katersi Raven
	Ctenizidae	* <i>Conothele</i> sp.
	Dipluridae	<i>Cethegus</i> 'cloudbreak'
	Idiopidae	<i>Anidiops</i> sp.
		<i>Aqanippe</i> sp.
		<i>Aqanippe</i> 'cloudbreak'
		<i>Aqanippe</i> ?occidentalis Hogg
	Nemesiidae	Gen. sp. undetermined
		? <i>Aname</i> sp.
		<i>Aname</i> 'biota'
		<i>Aname</i> sp.
<i>Teyl</i> sp.		

Table 3.1 Database search results for putative short-range endemic Mygalomorphae from between 22-23°S, and 118-120°E (WGS84) of the Terrestrial Arthropods Department of the Western Australian Museum. One specimen of *Conothele* (*) was also detected during *ecologia's* 2008 survey.

TAXON	FAMILY	Identification
Pseudoscorpiones (Pseudoscorpions)	Atemnidae	<i>Paratemnoides</i> sp.
		<i>Oratemnus</i> sp.
	Chernetidae	<i>Haplochernes</i> sp.
		<i>Haplochernes</i> sp.1
		<i>Haplochernes</i> sp.2
		cf <i>Cordylochernes dingo</i> Harvey
	Chthoniidae	<i>Tyrannochthonius aridus</i> Edward & Harvey
		<i>Laqynochthonius</i> 'packsaddle'
		<i>Austrochthonius</i> sp.
	Garypidae	<i>Synsphyronus heptatrachus</i> Harvey
		<i>Synsphyronus gracilis</i> Harvey
		<i>Synsphyronus</i> sp.8/1
		<i>Synsphyronus</i> sp.8/2
		<i>Synsphyronus</i> sp.
	Olpiidae	<i>Austrohorus</i> sp.
		<i>Beierolpium</i> sp.1
		<i>Beierolpium</i> sp.8/3
		<i>Beierolpium</i> sp.
		<i>Indolpium</i> sp.
		<i>Euryolpium</i> sp.
		<i>Xenolpium</i> sp.1
		<i>Xenolpium</i> sp.2
Sternophoridae	<i>Afrosterophorus</i> sp.	
	<i>Afrosterophorus</i> sp.1	

Table 3.2 Database search results for putative short-range endemic pseudoscorpions from between 22-23°S, and 118-120°E (WGS84) of the Arachnid and Myriapod Department of the Western Australian Museum.

TAXON	FAMILY	Identification
Scorpiones (Scorpions)	Buthidae	<i>Lychas 'gracilimanus'</i>
		<i>Lychas 'prendinii'</i>
		<i>Lychas 'marandoo'</i>
	Urodacidae	<i>Urodacus sp.4</i>
		<i>Urodacus 'cloudbreak'</i> cf <i>Urodacus armatus</i> Pocock

Table 3.3 Database search results for putative short-range endemic scorpions from between 22-23°S, and 118-120°E (WGS84) of the Arachnid and Myriapod Department of the Western Australian Museum.

TAXON	FAMILY	Identification
Polydesmida (Polydesmid Millipedes)	Paradoxosomatidae	? <i>Antichiropus</i> sp.
		<i>Antichiropus</i> sp.
		<i>Antichiropus 'area C'</i>
		<i>Antichiropus 'chichester'</i>

Table 3.4 Database search results for putative short-range endemic millipedes from between 22-23°S, and 118-120°E (WGS84) of the Arachnid and Myriapod Department of the Western Australian Museum.

TAXON	FAMILY	Identification
Pulmonata	Bulimulidae	<i>Bothriembryon</i> spp.
		<i>Quistrachia</i> sp.
	Camaenidae	<i>Rhaagada richardsoni</i>
		<i>Rhaagada</i> sp.

Table 3.5 Database search results for putative short-range endemic molluscs from between 22-23°S, and 118-120°E (WGS84) of the Malacology Department of the Western Australian Museum.

4 DISCUSSION

The searches of the Western Australian Museum databases indicate the presence of several invertebrate families and genera known to contain short-range endemic species from the eastern Pilbara. The complete absence of some groups (pseudoscorpions and mygalomorph spiders) from *ecologia's* (2006) survey is rather surprising and may be explained in two ways, independently or in combination:

1) Insufficient sampling

- a) The period of pitfall trapping (seven nights) is likely to have been insufficient. Contemporary surveys typically sample for a minimum of one month. Pitfall trapping is done mainly to record the presence of mygalomorph spiders, males of which become active shortly after rains and commence searching for females. *Ecologia* (2006) made no report of local rainfall during that survey; therefore, it is unlikely to have effectively surveyed for trapdoor spiders.
- b) The foraging methodology was also limited to detecting moderate to large sized invertebrates. Small invertebrates such as pseudoscorpions are better sampled using litter searching techniques such as sifting, a technique not undertaken by *ecologia* (2006).

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2) Extensive environmental degradation

Ecologia (2008) also assessed the habitat on the tenement, finding extensive damage from fire and cattle. The extent of impact from cattle was found to be so great that doubts were cast on the suitability of most of the habitat to support trapdoor spiders. Persistent trapdoor spiders are likely to be isolated to small patches unaffected by the extreme grazing pressure. Follow up surveys would need to identify and target areas least impacted on by cattle.

Ecologia (2006) recognised the presence of short-range endemic groups; however, those taxa were not demonstrated outside of the proposed area of development, they were inferred. No follow-up surveys were subsequently undertaken to gain support for these inferences. Subsequent surveys should aim to collect representatives of these taxa, as well as the *Conothele* sp. identified from *ecologia* (2008), from outside of the area of proposed development to support any claims of widespread distributions.

4.1 SURVEY LIMITATIONS

The greatest limitation to this survey is the poor state knowledge of the invertebrate fauna of the eastern Pilbara. The taxonomy of certain taxa (such as the Geophilomorpha and Cryptopidae) is poorly resolved and is compounded by the lack of regional expertise. Owing to logistical constraints, a database search of crustaceans in the Western Australian Museum was not undertaken.

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Appendix 1

Legislative Framework



Short-range Endemic Invertebrate Desktop Study

The Environmental Protection Act 1986 is “an Act to provide for an Environmental Protection Authority, for the prevention, control and abatement of environmental pollution, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing.” Section 4a of this Act outlines five principles that are required to be addressed to ensure that the objectives of the Act are addressed. Three of these principles are relevant to native fauna and flora:

- The Precautionary Principle
Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- The Principles of Intergenerational Equity
The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
- The Principle of the Conservation of Biological Diversity and Ecological Integrity
Conservation of biological diversity and ecological integrity should be a fundamental consideration.

Projects undertaken as part of the Environmental Impact Assessment (EIA) process are required to address guidelines produced by the EPA, in this case Guidance Statement 56: Terrestrial Fauna Surveys for Environmental Impact in Western Australia (EPA 2004), and principles outlined in the EPA’s Position Statement No. 3 Terrestrial Biological Surveys as an element of Biodiversity Protection (EPA 2002).

Native fauna in Western Australia are protected at a Federal level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and at a State level under the *Wildlife Conservation Act 1950* (WC Act).

The EPBC Act was developed to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance, to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and to promote the conservation of biodiversity. The EPBC Act includes provisions to protect native species (and in particular prevent the extinction, and promote the recovery, of threatened species) and ensure the conservation of migratory species. In addition to the principles outlined in Section 4a of the EP Act, Section 3a of the EPBC Act includes a principle of ecologically sustainable development dictating that decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.

The WC Act was developed to provide for the conservation and protection of wildlife in Western Australia. Under Section 14 of this Act, all fauna and flora within Western Australia is protected; however, the Minister may, via a notice published in the *Government Gazette*, declare a list of fauna taxa identified as likely to become extinct, or is rare, or otherwise in need of special protection. The current listing was gazetted on [insert date].