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HANCOCK PROSPECTING PTY LTD
REMOTE BOREFIELD AND PIPELINE
SHORT RANGE ENDEMIC SURVEY

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PRELIMINARY REPORT

HANCOCK PROSPECTING PTY LTD

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EXECUTIVE SUMMARY

Hancock Prospecting Pty Ltd (HPPL) proposes to construct a remote borefield and pipeline in order to supply water to the Roy Hill projects. A survey was carried out by *ecologia* Environment from 1st – 3rd November 2009 within the proposed remote borefield and from 20th – 23rd November 2009 within the proposed pipeline corridor.

Sampling methods included hand foraging (focusing on mygalomorph spiders, scorpions, snails, centipedes, millipedes, and centipedes), leaf litter collection and litter sifting (pseudoscorpions, snails, millipedes, centipedes, scorpions, isopods and worms) and pitfall trapping (scorpions).

A total of 147 specimens were collected including snails, pseudoscorpions, scorpions and centipedes. All specimens have been lodged with the Western Australian Museum for detailed taxonomic identification.

As the specimens collected are yet to be identified, the presence of short range endemic species cannot be concluded. However, based on the sites selected during this survey, the proposed areas for development of a remote borefield and pipeline do not appear to contain habitat considered to promote short range endemism.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Hancock Prospecting Pty Ltd (HPPL) proposes to construct a remote borefield and pipeline in order to supply water to the Roy Hill projects.

1.2 OBJECTIVES

The objectives of this survey were to provide:

- an inventory of the short range endemic (SRE) invertebrate fauna species occurring in the study area, incorporating published and unpublished records; and
- an analysis of the areas affected by the proposal and assess them in the context of SRE habitats.

1.3 OVERVIEW OF SHORT-RANGE ENDEMISM IN INVERTEBRATES

Endemism refers to the restriction of a species distribution to a single area, whether it be at the continental, national or a more local level (Allen *et al.* 2002). Short-range endemism, also referred to as narrow-range endemism (Ponder and Colgan 2002), refers to particularly small distributions of 10,000 km^2 (100 km x 100 km) or less (Harvey 2002). Short-range endemic species typically have poor dispersal capabilities (i.e. flightless) and display specific or specialised environmental preferences (Harvey 2002). Flightless invertebrates constitute most of the known short-range endemic taxa (Harvey 2002; Ponder and Colgan 2002; Monod and Volschenk 2004; Volschenk and Prendini 2008). The potential short-range endemic groups listed in this review are not exhaustive. Invertebrates are historically understudied and invertebrate surveys frequently uncover new species. Reliable taxonomic evaluation of these species has begun only relatively recently and thus the availability of literature relevant to short range endemic invertebrates is still scarce. It must be also stressed that the precautionary principle, as adopted by the EPA/DEC under Section 4a of the *Environmental Protection Act 1986*, was used as the guiding principle of this literature review.

In the Pilbara region of Western Australia, invertebrate taxa known to contain species with range restricted distributions, include (but are not limited to):

trap-door spiders (Mygalomorphae)

selenopid spiders (family Selenopidae)

scorpions (Scorpiones)

pseudoscorpions (Pseudoscorpiones)

millipedes (Diplopoda)

land snails (Mollusca)

worms (Megascolecidae)

schizomids (Schizomida)

centipedes (Chilopoda)

1.4 PROCESSES PROMOTING SHORT RANGE ENDEMISM

Short-range endemism results from one or more biological processes which act to isolate a species. Environmental and biological processes contributing to the ability of a species to disperse influence not only the distribution of a species, but also the tendency for differentiation and speciation (Ponder and Colgan 2002).

Isolated populations of plants and animals tend to differentiate both morphologically and genetically as they are influenced by different selective pressures over time. Additionally, a 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 is determined by the relative magnitude of these factors, with migration generally being the strongest determinant. Migration is hindered by poor dispersal ability of a taxon as well as geographical barriers to dispersal. Thus, those taxa that exhibit short-range endemism are generally characterised by poor dispersal ability, low growth rates, low fecundity and reliance on habitat types that are discontinuous (Harvey 2002).

Habitats may contain short range endemics when 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. Similarly, habitats such as mountains, aquifers, lakes and caves are essentially islands exhibiting unique environmental conditions in comparison to the surrounding landscape. For this reason, these isolated habitats are often referred to as island habitats and they frequently sustain short range endemic species

The historical connections between habitats are also important in determining species distributions and often explain patterns that are otherwise inexplicable by present conditions. Many short-range endemics are considered to be relictual taxa (remnants of species that have become extinct elsewhere) which are confined to certain habitats, and in some cases, single geographic areas (Main 1996). Relictual taxa include extremely old species that can be traced to Gondwanan periods (180-65 million years ago) and these may have very restrictive biology (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 the populations of fauna occurring in these areas (Hill 1994). With the onset of progressively dryer and more seasonal climatic conditions since that time, suitable habitats have become increasingly fragmented. Relictual species generally persist in habitats characterised by permanent moisture and shade, maintained by high rainfall and/or prevalence of fog. This may be induced by topography or coastal proximity, areas associated with freshwater courses (e.g. swamps or swampy headwater of river systems), caves, 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.

2 METHODS

The methodology for the fauna survey was developed based on the principles outlined in EPA Guidance Statement 20: *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western* (EPA 2006). Several foraging techniques were used to collect specimens from a wide range of taxa.

2.1 SITE SELECTION

Twelve sites were selected from within the borefield area and ten sites along the pipeline corridor (Table 2.1). All sites were initially chosen from aerial photography. Site preference was based on areas of raised geography and dense vegetation and thus more likely to promote short range endemism. Once on site, locations of each site were refined and more specific habitats were identified and sampled.

2.2 FORAGING METHODS

2.2.1 Litter sifting

At each site within the remote borefield, each team member conducted two litter sifts for a total of four sifts at each site. Within the pipeline corridor, each member conducted three litter sifts for a total of six sifts at each site. This method focused on pseudoscorpions, snails, millipedes, centipedes, scorpions, isopods and worms.

2.2.2 Hand foraging

At all sites an approximately 100 m² quadrat was searched. Team members were looking specifically for mygalomorph and scorpion burrows, snails, centipedes, millipedes, and centipedes.

2.2.3 Pitfall trapping

In areas where hand foraging located scorpion burrows, a dry pitfall trap was installed at the burrow entrance. These traps were left over night and collected the following morning.

2.2.4 Leaf litter collection

At sites within the remote borefield, a 1 m² quadrat of leaf litter was collected into zip locked bags and taken back to *ecologia's* Perth laboratory where they were dried under Tullgren funnels to extract invertebrates (Brady 1969; Upton 1991).

2.3 LABORATORY METHODS

Samples were processed under a Leica S6 microscope with each taxon being placed into a separate vial containing 70 % ethanol and assigned a unique identification code for tracking. All vials were labelled with the date, site, GPS coordinates and the name of the collector(s).

Table 2.1 – Locations of survey sites. Datum is GDA94, MGA zone 50K.

Site ID	North	East
Pipeline Corridor		
01	804612	7495213
02	804673	7493700
03	804704	7492954
04	804778	7492820
05	803244	7488528
06	802707	7490669
07	801973	7484526
08	800562	7482340
09	800090	7481344
10	799323	7480259
Remote Borefield		
01	790147	7471017
02	791607	7471220
03	793889	7470861
04	796321	7469579
05	791641	7477300
06	796856	7476520
07	802783	7475008
08	802541	7473670
09	799511	7475672
10	789894	7457970
11	799004	7480018
12	794910	7476538

3 RESULTS

3.1 FIELD OBSERVATIONS

None of the sites visited during this survey displayed unique geography. The habitat within both the remote borefield and pipeline corridor was a continuous floodplain except where rivers cut across the pipeline corridor (Table 3.1, 3.2). Vegetation consisted predominantly of outcrops of Acacia with Eucalyptus present alongside riverbanks. These patches of vegetation provided limited shaded habitat and did not appear unique to the areas within the proposed development.

All sites visited during this survey displayed varying degrees of habitat disturbance. The most common was disturbance by cattle (Table 3.1, 3.2), resulting in trampling of the surface soil and covering the ground and the vegetation in dust to a level beyond invertebrate habitation. Sites within the pipeline corridor were also subject to dust from vehicles passing along the Marble bar road.

3.2 SPECIMENS COLLECTED

Specimens collected have been identified in house by ecologia scientists. These identifications stand at family level as specialist knowledge is required for further identification. The specimens have been submitted to the Western Australian Museum for a complete taxonomic identification.

3.2.1 Pseudoscorpions

3.2.1.1 Family Olpiidae

Thirty three specimens of the family Olpiidae were collected from within the remote borefield (Table 3.3). A total of 42 specimens were collected from within the pipeline corridor (Table 3.4).

3.2.1.2 Family Atemnidae

A single specimen of the family Atemnidae was collected from the remote borefield (Table 3.3). Three specimens were collected from the pipeline corridor (Table3.4).

3.2.2 Snails

3.2.2.1 Family Pupillidae

Thirty one specimens of the family Pupillidae were collected from within the remote borefield. Thirty five specimens were collected from the pipeline corridor.

3.2.3 Scorpions

3.2.3.1 Family Buthidae

A single specimen from the family Buthidae was collected from the pipeline corridor.

3.2.4 Centipedes

3.2.4.1 Family Scolopendridae

A single specimen of the Scolopendridae family was collected from within the pipeline corridor.

Table 3.1 – Site information from area within the remote borefield.

				Disturbance Type			
Site	Habitat	Drainage	Dominant tree	Minor Erosion Channels	Livestock Tracks	Surface Dust from Vehicles	Surface Dust from Livestock
01	Plain	Floodplain	Mulga		x		x
02	Plain	Floodplain	Mulga		x		x
03	Plain	Floodplain	Mulga		x		x
04	Plain	Floodplain	Acacia		x		x
05	Plain	Floodplain	Mulga		x		
06	Plain	Floodplain	Mulga		x		
07	Plain	Floodplain	Acacia		x		
08	Plain	Floodplain	Mulga		x		
09	Plain	Floodplain	Mulga	x	x		
10	Plain	Floodplain	Mulga		x		x
11	Plain	Floodplain	Mulga		x		x
12	Plain	Floodplain	Mulga		x		

Table 3.2 – Site information from area within the pipeline corridor.

				Disturbance Type			
Site	Habitat	Drainage	Dominant tree	Minor Erosion Channels	Livestock Tracks	Surface Dust from Vehicles	Surface Dust from Livestock
01	Plain	River Bank	Eucalyptus	x	x	x	
02	Plain	Floodplain	Acacia		x	x	x
03	Plain	River Bank	Eucalyptus		x	x	x
04	Plain	River Bank	Eucalyptus	x	x	x	x
05	Plain	Floodplain	Acacia		x		x
06	Plain	Floodplain	Acacia		x	x	x
07	Plain	Floodplain	Acacia		x	x	x
08	Plain	Floodplain	Mulga		x	x	x
09	Plain	Floodplain	Acacia		x	x	x
10	Plain	Floodplain	Acacia		x		x

Table 3.3 – Specimens collected from sites within the remote borefield.

	Site Number												
Family	01	02	03	04	05	06	07	08	09	10	11	12	Total
Atemnidae	-	-	-	-	-	-	-	1	-	-	-	-	1
Olpiidae	-	2	3	8	1	3	3	2	3	3	4	1	33
Pupillidae	-	-	-	24	-	-	-	7	-	-	-	-	31

Table 3.4 – Specimens collected from within the pipeline corridor.

	Site Number										
Family	01	02	03	04	05	06	07	08	09	10	Total
Atemnidae	-	-	1	-	-	-	-	1	1	-	3
Buthidae	-	-	1	-	-	-	-	-	-	-	1
Olpiidae	3	12	3	2	7	3	1	3	6	2	42
Pupillidae	2	6	8	-	5	-	12	-	2	-	35
Scolopendridae	-	1	-	-	-	-	-	-	-	-	1

4 DISCUSSION

All specimens collected from the remote borefield and pipeline corridor are currently lodged with the Western Australian Museum for complete taxonomic identification, therefore it cannot be stated wether any of the specimens belong to SRE species. However, the areas involved in the proposals have none of the key features typical of areas which promote short range endemism.

Prospective SRE habitat is considered to be island-like, with significant barriers that prevent dispersal. An example of such a habitat could be a rocky outcrop or a hill casting a shadow on a particular area throughout most of the day, creating a relatively cooler microclimate that would be prospective as an SRE habitat. However, none of the areas within the proposed remote borefield or pipeline corridor appeared to sustain suitable island habitats for SRE species. The land was consistently level throughout the proposed impact areas and the vegetation was similar to much of the surrounding area.

Sites where the Fortescue River crosses the pipeline corridor were included in the survey to determine wether the change in land form was likely to cause an island effect. There may be such an effect in areas outside of the corridor where disturbance from passing vehicles and livestock is reduced, but within the proposed corridor as well as the remote borefield, cattle disturbance is very prominent and highly unlikely to promote short range endemism.

From the results of this survey available thus far, the proposed remote borefield and pipeline do not contain any areas that are considered to promote the isolation of invertebrate species and thus seem unlikely to harbour SRE species. In addition, the pipeline corridor follows existing, heavily used roads and tracks, which cause high impact to the surrounding area, and it is, therefore, unlikely that any SRE species would survive there. It is important to note, however, that this conclusion is yet to be confirmed by the identifications of the collected species by the WA Museum.

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