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Environmental
Sciences

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30 April 2014

Stuart Hawkins
Director / Consulting Scientist
Globe Environments Australia Pty Ltd
for and on behalf of
Cliffs Asia Pacific Iron Ore Pty Ltd
Via email

Dear Stuart

Results of Supplementary Short-Range Endemic Invertebrate Fauna Survey of the Southern Koolyanobbing Range.

Background
Biota Environmental Sciences completed a survey for short-range endemic (SRE) invertebrate fauna at the southern Koolyanobbing Range during 2009, the results of which are outlined in Biota (2012). During this survey, a total of 18 taxa/morphotypes of SRE invertebrate fauna were recorded, comprising one land snail taxon, five millipede taxa and 12 mygalomorph morphotypes.

During 2013, Biota undertook additional survey on the southern Koolyanobbing Range to supplement the previous results, specifically targeting potential SRE millipedes and mygalomorph spiders. No millipedes were recorded, however 14 mygalomorph spiders representing 10 putative morphospecies were collected. This letter reports on the mygalomorph spiders collected, to be considered an addendum to the original SRE invertebrate fauna survey (Biota 2012).

Methodology
The supplementary SRE invertebrate fauna survey was undertaken during April 2013 and October 2013. The timing of the supplementary SRE invertebrate fauna survey coincided with a vertebrate fauna survey of the southern Koolyanobbing Range (Biota 2014).

The supplementary SRE invertebrate fauna survey was planned and conducted in accordance with the EPA Guidance Statement 20 document *Sampling Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (EPA 2009), and was consistent with the methodology of the original SRE invertebrate fauna survey as outlined in Biota (2012). For the mygalomorph spiders, burrows were located visually and excavated for the collection of the spider, with the spider preserved in 70% ethanol, with one leg removed and placed in 100% ethanol to enable any future molecular studies, if required. Searches for millipedes were undertaken by raking through leaf litter and debris, with any specimens collected to be stored in 70% ethanol.

The supplementary SRE invertebrate fauna survey was undertaken by Roy Teale, Dr Victoria Cartledge, Michael Greenham, David Keirle and Chris Cole, all of Biota. All personnel hold appropriate qualifications and/or have sufficient experience in the collection and identification or SRE invertebrate fauna.

As outlined in Biota (2014), the temperatures during the April 2013 survey period ranged between approximately 17°C to 33°C (mean minimum and mean maximum), with the temperatures during the October 2013 survey period being cooler at between approximately 13°C to 30°C. No rainfall fell during either survey period, however notably higher than average rainfall was received in the months leading to the April 2013 survey period.

Limitations

There were no limitations to the field survey component of the supplementary SRE invertebrate fauna survey which would have affected the specimens obtained.

With regards to the identification of the mygalomorph spiders collected, consistent with that outlined in Biota (2012), morphological identification of female and juvenile mygalomorph spiders using morphology alone is an inherent limitation, and even for male specimen the identification is limited by both few formally described species and the absence of a robust State reference collection.

Results

Fourteen mygalomorph spiders representing 10 putative morphospecies were collected by the supplementary SRE invertebrate fauna survey. No millipedes were recorded.

Of the 10 mygalomorph morphotypes collected, possibly five represent the same types as collected during the original SRE invertebrate fauna survey (Biota 2012). Table 1 summarises the morphotypes found during the supplementary SRE invertebrate fauna survey and compares the likelihood of similarity with those collected during the original SRE invertebrate fauna survey. Figure 1 shows the geographic distributions of the morphotypes from both the original and supplementary SRE invertebrate fauna surveys.

Discussion

Circumscribing the broader distribution (and hence SRE status) of the recorded mygalomorph spiders is difficult without definitive assignment to putative species. Consistent with that outlined in Biota (2012), species-level identification of female and juvenile mygalomorph spiders is difficult using morphology alone, and determining species-level identifications of males is easier with formally described species (very few in WA) or where there is a robust reference collection. This limitation could potentially be overcome by genetic sequencing of the collected specimens.

The DNA bar-coding completed for specimens collected as part of the Deception Deposit (Helix 2011), located approximately 120km north of the Koolyanobbing Range, provide some insights into general patterns of distribution of mygalomorph spiders. For example, members of the genus *Cethegus* assigned to a single lineage by the molecular study were detected from sites approximately 193 km apart, lineages within the Nemesiidae were detected up to 16 km apart, and specimens within the Idiopidae were recorded from sites 20 km apart.

The results of the Deception Deposit study, and other genetic studies examined by Biota, suggest that whilst many putative mygalomorph species will qualify as SRE invertebrate fauna, most SRE invertebrate fauna examined to date exhibit ranges that extend beyond the disturbance footprint of a typical mining proposal. We consider it likely that, consistent with the results of the Deception Deposit study, putative species are likely to have a distribution that is at least along the length of the Koolyanobbing Range (for those species restricted to rocky environments) and likely to be much broader for those species occupying the adjacent plains.

References

Biota Environmental Sciences (2012). A Short Range Endemic Survey of the Southern Koolyanobbing Range. Unpublished report for Cliffs Asia Pacific Iron Ore Pty Ltd.

Biota Environmental Sciences (2014). Southern Koolyanobbing Range Vertebrate Fauna Survey. Unpublished report for Cliffs Asia Pacific Iron Ore Pty Ltd.

Environmental Protection Authority (2009) Sampling Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia. EPA Guidance Statement 20.

Helix Molecular Solutions (2011). Report on the molecular systematics of Mygalomorphae from Deception. Unpublished report for Cliffs Asia Pacific Iron Ore Pty Ltd.

Yours sincerely,

Biota Environmental Sciences Pty Ltd

Roy Teale
Zoologist / Director

Table 1: Morphospecies assignment of mygalomorph spiders collected during the supplementary SRE invertebrate fauna survey († designates those specimens that may correspond to morphospecies collected during the original SRE invertebrate fauna survey).

Field number	mE	mN	Family	Genus	M/F/Juv.	Morphotype*
M20130412.SKR08-01	750016	6581674	Barychelidae	*Idiommata*?	male	B1
M20131026.SKR5F-1	745317	6584318	Barychelidae	*Synothele*†	male	B2
M20131024.SKR03-2	746152	6585142	Dipluridae	*Cethegus*†	juv. or F	D1
M20130412.MYG01-01	746437	6584659	Idiopidae	*Aganippe*†	juv. or f	I1
M20130412.MYG01-02	746437	6584659	Idiopidae	*Aganippe*†	juv. or f	I1
M20131024.SKR03-1	746152	6585142	Idiopidae	*Aganippe*†	juv. or f	I1
M20130413.SKR04-01	743919	6586566	Nemesiidae	*Aname*†	juv. or f	N1
M20131025.SKR03-1	746152	6585142	Nemesiidae	*Aname*?†	juv. or f	N2
M20131026.SKR06-1	745744	6584494	Nemesiidae	*Teyl*	male	N3
M20131027.SKR03-1	746152	6585142	Nemesiidae	*Teyl*?	juv. or f	N4
M20131024.SKR03-3	746152	6585142	Nemesiidae		juv. or f	N5
M20130409.SKR08-01	750016	6581674	Theraphosidae	[Not *Selenotholus*]#	male	T1
M20130411.SKR04-01	743919	6586566	Theraphosidae	[Not *Selenotholus*]#	male	T1
M20130414.SKR03-01	746152	6585142	Theraphosidae	[Not *Selenotholus*]#	male	T1

*These morphotypes codes are based on family and a sequential number. They are relevant to the 847 survey only and are not designed to signify any similarity with other reports.
#*Selenotholus* spp. have a recurved fovea, this species has a straight fovea.

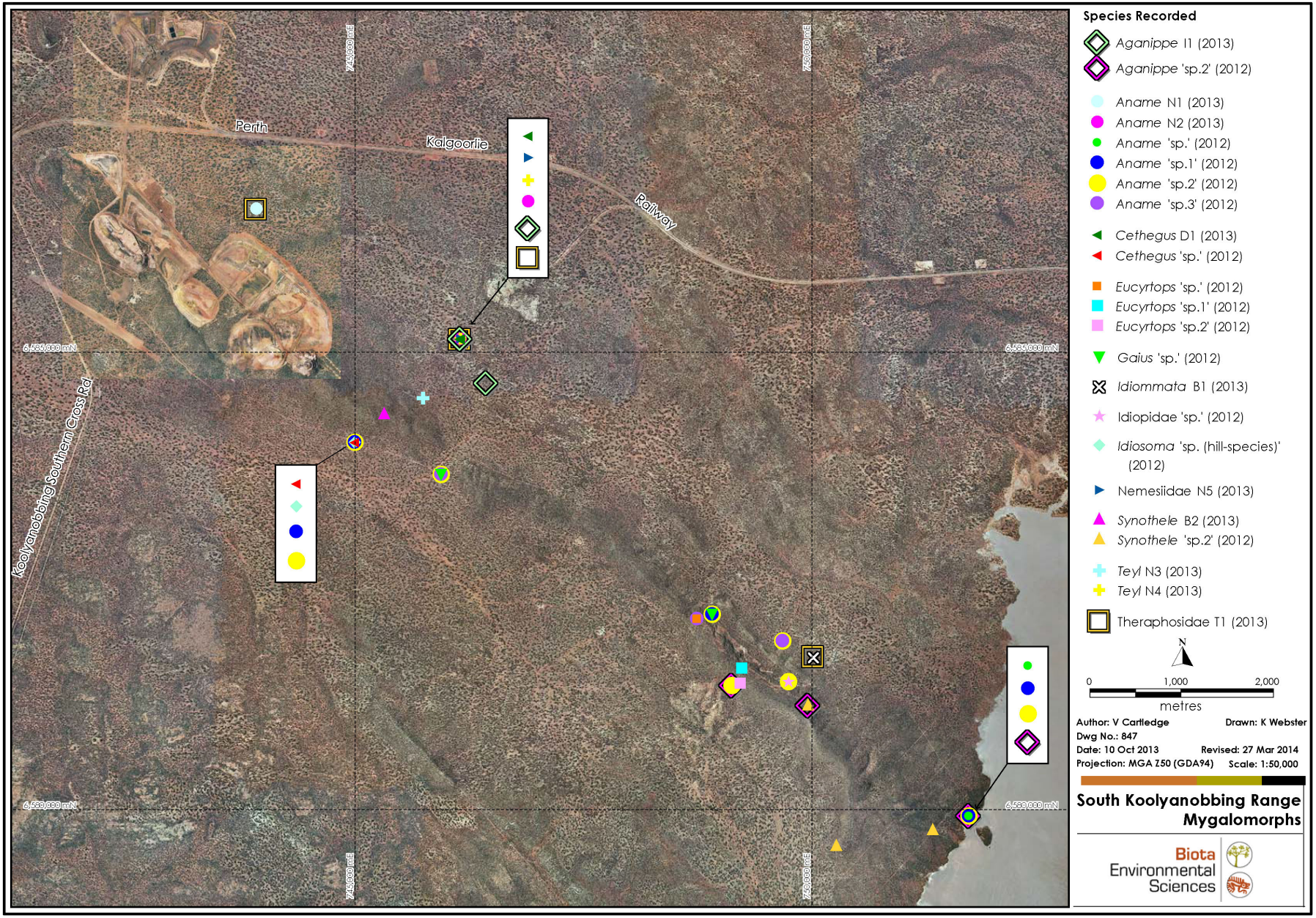

Figure 1: **Distribution map of mygalomorph morphotypes collected during the original and supplementary SRE invertebrate fauna surveys of the Southern Koolyanobbing Range.**