The Short-Range Endemic Invertebrate Fauna from the Mt Gibson region, Western Australia: the millipedes

Report to ATA Environmental

August 2005

Mark S. Harvey

Department of Terrestrial Invertebrates, Western Australian Museum,
Locked Bag 49, Welshpool DC, Western Australia 6986, Australia

Short-Range Endemism

The terrestrial invertebrate fauna of inland Australia contains a plethora of species, and just the arthropods were recently estimated to consist of more than 250,000 species (Yeates et al., 2002). The vast majority of these are found within the Insecta and Arachnida, although significant numbers of millipedes are to be expected. For many years, the prospect of including invertebrates in assessments of biological systems subject to alteration proved daunting, and were largely ignored as being too diverse and too difficult to comprehend to satisfy the rapid turn-around needed for environmental surveys.

In a recent publication, the issue of Short-Range Endemism in the Australian invertebrate fauna was examined (Harvey, 2002), and series of major groups were nominated as having a very high proportion of individual species that satisfied a certain set of criteria. The main criterion nominated for inclusion as a Short-Range Endemic (SRE) was that the species had a naturally small range of less than 10,000 km^2. Harvey (2002) found that those species possessed a series of ecological and life-history traits, including:

- poor powers of dispersal;
- confinement to discontinuous habitats;
- usually highly seasonal, only active during cooler, wetter periods;
- low levels of fecundity.

The Western Australian fauna contains a number of SRE taxa, including millipedes, land snails, trap-door spiders, some pseudoscorpions, slaters, and onychophorans. The semi-arid zone of the mid-west region has representatives of all of these groups, with the exception of onychophorans, which are restricted to the high rainfall regions of south-western WA.

Millipedes of the genus *Antichiropus*

Millipedes are an extremely diverse group of animals, with nine different orders represented in Australia (Harvey & Yen, 1989). The most abundant millipede group in

Western Australia is the genus *Antichiropus*. This genus was first named in 1911 for seven species (Attems, 1911), and additional species were added by Jeekel (1982) and Shear (1992). As the result of large field surveys and taxonomic work at the Western Australian Museum, the genus is now known to consist of over 100 species, ranging as far north as Cape Range and Barlee Range, and extending onto the Nullarbor Plain and the Eyre Peninsula in South Australia (Fig. 1). With the exception of *Antichiropus variabilis*, which inhabits the jarrah forests of south-western WA, all species of the genus are known to be SRE's, and many are know from only a few hundred square kilometres (Harvey et al., 2000; Harvey, 2002).

Although the vast majority of *Antichiropus* species currently lack a taxonomic description and scientific name, I have spent the past decade comparing different species of the genus and assigning temporary codes to each of the species. The distinction between species is largely based upon differences in the structure of the male gonopods. These are modified legs on the seventh abdominal segment that are used to store sperm prior to mating. After courtship, the male mounts the female and inserts the gonopods into her genital orifice, transferring a sperm packet. The sperm then becomes mobilised and swims along the genital duct before fertilising the eggs. The shape of the gonopod of each *Antichiropus* species is different, making the identification of individual species a relatively simple task. These differences in gonopod morphology have been used in millipede taxonomy for 150 years, and have been shown to be good indicators of valid biological species.

The Mt Gibson region has been known to accommodate species of *Antichiropus* that have not been found elsewhere. Surveys in the early 2000's found representatives of three species occurring on the rocky slopes of Mt Gibson, as well as on the flat country surrounding the higher terrain.

The 2005 survey was conducted using two techniques. The first involved visual searching of likely SRE habitats in the Mt Gibson area. Millipedes and other SRE's can be found under rocks, logs, and other debris lying on the ground. They were collected using jewellers forceps directly into 75% ethanol, labelled and transported to the Western Australian Museum for identification. Pitfall traps were also used. The traps, 2 litre ice-cream containers, were dug into the ground so that the top was flush with the

soil. Approximately 500 ml of ethylene glycol was poured into the container, and were left in situ. They were cleared every two weeks, with the trapped animals transferred to 75% ethanol, labelled and transported to the Western Australian Museum for identification.

Each adult male millipede was studied in detail. A gonopod was sometimes removed from the specimen to facilitate close examination of the morphology. The dissected gonopod was then returned to the vial with the remainder of the specimen for future reference.

Five different species of *Antichiropus* were identified from the Mt Gibson region. Each are discussed in detail:

***Antichiropus* 'Mt Gibson 1'**

The species *Antichiropus* 'Mt Gibson 1' has been found in a variety of locations within the Mt Gibson region, in wooded and rocky situations (Figures 3 and 4).

***Antichiropus* 'Mt Gibson 2'**

The species *Antichiropus* 'Mt Gibson 2' has been found on Mt Gibson Station in the vicinity of the western shores of Lake Moore (Figure 3). It has not been found on the rocky slopes.

***Antichiropus* 'Mt Gibson 3'**

The species *Antichiropus* 'Mt Gibson 3' occurs at several locations with the Mt Gibson area (Figures 3 and 4), and is nearly as widely distributed as *Antichiropus* 'Mt Gibson 1'. They occasionally occur sympatrically.

***Antichiropus* 'Mt Gibson 4'**

The species *Antichiropus* 'Mt Gibson 4' was found at only a single location (Figures 3 and 4), at a site called "Ironestone Slope, Iron Hill west facing". The species is quite distinct from all other members of the genus *Antichiropus*, including those recorded from outside of the Mt Gibson area.

***Antichiropus* 'PM1'**

The species *Antichiropus* ‘PM1’ is widely distributed in the northern wheatbelt, occurring in a NW-SE line from East Yuna Nature Reserve in the north-west to Lake Ninnan Shire Reserve in the south-east (Figure 5). A single specimen of this species was found at Mt Gibson in the sand plain area (denoted by an arrow in Figure 5). It was not found on the rocky slopes. This concords with previous records of this species which are mostly from wooded regions on sand-plains.

Other millipedes

Many samples from the Mt Gibson area contained millipedes of the family Siphonotidae. These small, slender millipedes, sometimes known as ‘beaked millipedes’ due to their pointed mouthparts, are difficult to identify to species level due to unresolved issues regarding their taxonomy. The male genitalia requires careful dissection and slide mounting for examination, and the Western Australian Museum’s entire collection of Siphonotidae is currently on loan to a researcher in Victoria, making comparisons between the Mt Gibson specimens and other Western Australian siphonotids a difficult task.

Conservation significance of the millipede fauna

The presence of five species of *Antichiropus* within the Mt Gibson region is not particularly surprising, as multiple species of this highly diverse genus are known from small regions elsewhere in Western Australia. All five species are clearly short-range endemics (SREs) as defined by Harvey (2002).

Two species, *Antichiropus* PM1 and *Antichiropus* Mt Gibson 2, are found away from the rocky slopes of the mines-site, and *Antichiropus* PM1 is found to widespread throughout the northern wheatbelt. Neither of these species will appear to be directly impacted by the proposed development. Two other species, *Antichiropus* Mt Gibson 1 and *Antichiropus* Mt Gibson 3, occur within the proposed mining zone but also occur outside of this area. Although individual populations will be affected by the development, other populations will be unaffected, thus reducing the likelihood of total extinction of either species. The fifth species, *Antichiropus* Mt Gibson 4, was found at only a single location, “Iron Hill west facing”, which is located outside of the impact zone. The discovery of a species from only a single location is not unusual and I would expect that further populations would be uncovered if subsequent surveys were conducted in the region.

In summary, no species of *Antichiropus* occur solely within the impact zone of the proposed mining development. Some species occur within the impact zone, but they also occur in other areas not presently targeted for mining.

REFERENCES

Attems, C.G. (1911). Myriopoda exkl. Scolopendridae. *In* Die Fauna Südwest-Australiens. (W. Michaelsen & R. Hartmeyer eds). Vol. **3**: 147-204. Gustav Fischer, Jena.

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

Harvey, M.S., A. Sampey, P.L.J. West & J.M. Waldock (2000). The Chilopoda and Diplopoda of the southern Carnarvon Basin, Western Australia. *Records of the Western Australian Museum, Supplement* **61**: 323-333.

Harvey, M.S. & A.L. Yen (1989). *Worms to wasps: an illustrated guide to Australia's terrestrial invertebrates*. Oxford University Press, Melbourne.

Jeekel, C.A.W. (1982). Millipedes from Australia, 1: Antichiropodini from South Australia (Diplopoda, Polydesmida, Paradoxosomatidae). *Bulletin Zoologisch Museum, Universiteit van Amsterdam* **8**: 121-132.

Shear, W.A. (1992). A new genus and two new species of millipedes from the Cape Range, Western Australia (Diplopoda, Polydesmida, Paradoxosomatidae). *Records of the Western Australian Museum* **15**: 777-784.

Yeates, D.K., M.S. Harvey & A.D. Austin (2004). New estimates for terrestrial arthropod species-richness in Australia. *Records of the South Australian Museum, Monograph Series* **7**: 231-241.

Appendix 1. Location data and Western Australian Museum registration numbers for all *Antichiropus* species from the Mt Gibson region.

REGNO	GENUS	SPECIES	SITE	LATITUDE	LONGITUDE	LATDEC	LONGDEC	DTFR	DTTO	COLLTOR	COLLMETH	HABIT
65492	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, Banded Ironestone Ridge, Mt Gibson east facing (site 10)	29°35`38"S	117°11`16"E	-29.5939	117.1878	30/04/2005	11/05/2005	Harvey,M.S.;Thompson,S.	wet pitfall traps	
65493	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, Banded Ironestone Ridge, Extension Hill east facing (site MTGIB2)	29°34`27"S	117°09`39"E	-29.5742	117.1609	30/04/2005	11/05/2005	Harvey,M.S.;Thompson,S.	wet pitfall traps	
65495	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, Banded Ironstone Ridge, Extension Hill west facing	29°34`33"S	117°09`38"E	-29.5758	117.1606	30/04/2005	11/05/2005	Harvey,M.S.;Thompson,S.	wet pitfall traps	
65519	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, Extension Hill			-29.58038	117.16177	10/05/2005		Harvey,M.S.;Thompson,S.		under rock
65520	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, Iron Hill			-29.60218	117.17235	10/05/2005		Harvey,M.S.;Thompson,S.		under rock
65521	Antichiropus	`Mt Gibson 1`	Mt Gibson Station, @	29°47`00"S	117°23`18"E	-29.7833	117.3883	24/08/2001		Baynes,A.		york gum woodland on yellow sandy loam
65522	Antichiropus	`Mt Gibson 1`	Mt Gibson Station, site 7	29°42`09"S	117°18`23"E	-29.7025	117.3064	20/08/2001	31/08/2001	Biological Survey	dry pitfall traps	mixed bowgada/Allocasuarina on yellow gravelly sand
65523	Antichiropus	`Mt Gibson 1`	Mt Gibson Station, site 6	29°43`35"S	117°18`28"E	-29.7263	117.3078	20/08/2001	31/08/2001	Biological Survey	dry pitfall traps	bowgada/Melaleuca shrubland on deep red sands
65531	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, Banded Ironstone Ridge, Extension Hill west facing	29°34`33"S	117°09`38"E	-29.5758	117.1606	31/05/2005	11/06/2005	Thompson,S.		wet pitfall traps
65533	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, woodlands 1 (A) impact site	29°34`09"S	117°10`36"E	-29.5692	117.1767	30/05/2005	11/06/2005	Thompson,S.		wet pitfall traps
65535	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, @ Banded Ironstone Range, Iron Hill west facing	29°36`10"S	117°10`20"E	-29.6028	117.1722	30/04/2005	11/05/2005	Thompson,S.		wet pitfall traps
65536	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, @ Ironstone Slopes, Iron Hill east	29°36`08"S	117°10`27"E	-29.6022	117.1742	01/06/2005	11/06/2005	Thompson,S.		wet pitfall traps

			facing									
65537	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, @ Ironstone Slopes, Extension Hill, east facing	29°34`32"S	117°09`49"E	-29.5756	117.1636	01/06/2005	11/06/2005	Thompson,S.		wet pitfall traps
65539	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, @ Ironstone Slopes, Mt Gibson east facing	29°34`38"S	117°09`35"E	-29.5772	117.1597	31/05/2005	11/06/2005	Thompson,S.		wet pitfall traps
65547	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, @ Ironstone Slopes, Mt Gibson west facing	29°35`36"S	117°10`55"E	-29.5933	117.1819	31/05/2005	11/06/2005	Thompson,S.		wet pitfall traps
65548	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, @ Ironstone Slopes, Extension Hill, west facing	29°34`38"S	117°09`35"E	-29.5772	117.1597	31/05/2005	11/06/2005	Thompson,S.		wet pitfall traps
65549	Antichiropus	`Mt Gibson 1`	Mt Gibson iron-ore mine, @ Ironstone Slopes, Iron Hill east facing	29°36`08"S	117°10`27"E	-29.6022	117.1742	31/05/2005	11/06/2005	Thompson,S.		wet pitfall traps
65497	Antichiropus	`Mt Gibson 2`	Mt Gibson Station, site 11	29°34`52"S	117°24`15"E	-29.5811	117.4042	20/08/2001	31/08/2001	Biological Survey	dry pitfall traps	
65498	Antichiropus	`Mt Gibson 2`	Mt Gibson Station, site 11	29°34`52"S	117°24`15"E	-29.5811	117.4042	20/08/2001	31/08/2001	Biological Survey	dry pitfall traps	
65499	Antichiropus	`Mt Gibson 2`	Mt Gibson Station, @	29°38`07"S	117°29`38"E	-29.6353	117.4939	28/08/2001		Baynes,A.		sheoak/wattle woodland, found dead on rocky slope
65500	Antichiropus	`Mt Gibson 3`	Mt Gibson Station, site 9	29°41`13"S	117°21`37"E	-29.6869	117.3603	20/08/2001	31/08/2001	Biological Survey	dry pitfall traps	malle woodland on rocky red loamy clay
65516	Antichiropus	`Mt Gibson 3`	Mt Gibson Station, site 6	29°43`35"S	117°18`28"E	-29.7263	117.3078	20/08/2001	31/08/2001	Biological Survey	dry pitfall traps	bowgada/Melaleuca shrubland on deep red sands
65517	Antichiropus	`Mt Gibson 3`	Mt Gibson Station, site B	29°41`58"S	117°24`11"E	-29.6994	117.4031	20/08/2001	31/08/2001	Biological Survey	dry pitfall traps	mallee woodland on white sandy clay
65518	Antichiropus	`Mt Gibson 3`	Mt Gibson Station, site 10	29°41`07"S	117°23`43"E	-29.6853	117.3953	20/08/2001	31/08/2001	Biological Survey	dry pitfall traps	York gum woodland on red loamy clay
65524	Antichiropus	`Mt Gibson 3`	Mt Gibson Station, @	29°34`52"S	117°24`15"E	-29.5811	117.4042	15/11/2001		Mead,J.;Baynes,A.		dead at base of pitline 11 fence
65525	Antichiropus	`Mt Gibson 3`	Mt Gibson Station, @	29°37`12"S	117°10`24"E	-29.4533	117.1733	27/09/2001		Harvey,M.S.;Main,B.Y.		dead on ground
65526	Antichiropus	`Mt Gibson 3`	Mt Gibson Station, @	29°36`38"S	117°10`53"E	-29.6106	117.1814	27/09/2001		Harvey,M.S.;Main,B.Y.		dead on ground
65527	Antichiropus	`Mt Gibson 3`	Mt Gibson iron-ore mine, @			-29.59972	117.19755	10/05/2005		Harvey,M.S.;Thompson,S.		
65528	Antichiropus	`Mt Gibson 3`	Mt Gibson iron-ore mine, @			-29.57576	117.16069	09/05/2005		Harvey,M.S.;Thompson,S.		under rock
65529	Antichiropus	`Mt Gibson 3`	Mt Gibson iron-ore mine, @			-29.57576	117.16069	10/05/2005		Harvey,M.S.;Thompson,S.		under rock

65532	Antichiropus	`Mt Gibson 3`	Mt Gibson iron-ore mine, Banded Ironstone Ridge, Extension Hill west facing	29°34`33"S	117°09`38"E	-29.5758	117.1606	31/05/2005	11/06/2005	Thompson,S.		wet pitfall traps
65534	Antichiropus	`Mt Gibson 3`	Mt Gibson iron-ore mine, Banded Ironstone Ridge, Extension Hill west facing	29°35`43"S	117°11`14"E	-29.5953	117.1872	01/06/2005	11/06/2005	Thompson,S.		wet pitfall traps
65538	Antichiropus	`Mt Gibson 3`	Mt Gibson iron-ore mine, @ Ironstone Slopes, Extension Hill, east facing	29°34`32"S	117°09`49"E	-29.5756	117.1636	01/06/2005	11/06/2005	Thompson,S.		wet pitfall traps
65494	Antichiropus	`Mt Gibson 4`	Mt Gibson iron-ore mine, Ironestone Slope, Iron Hill west facing	29°36`13"S	117°10`17"E	-29.6036	117.1714	30/04/2005	11/05/2005	Harvey,M.S.;Thompson,S.	wet pitfall traps	
65496	Antichiropus	`PM1`	Mt Gibson iron-ore mine, sandplains 3 (C) impact site (S. of road)	29°34`34"S	117°07`34"E	-29.5761	117.1261	30/04/2005	11/05/2005	Harvey,M.S.;Thompson,S.	wet pitfall traps	

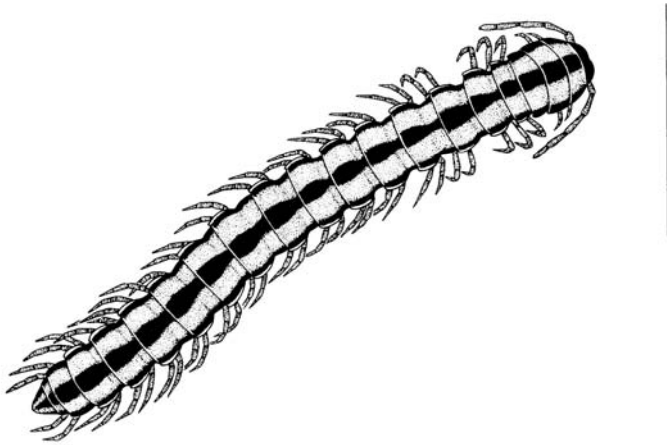

Figure 1. Line drawing of an *Antichiropus* species.

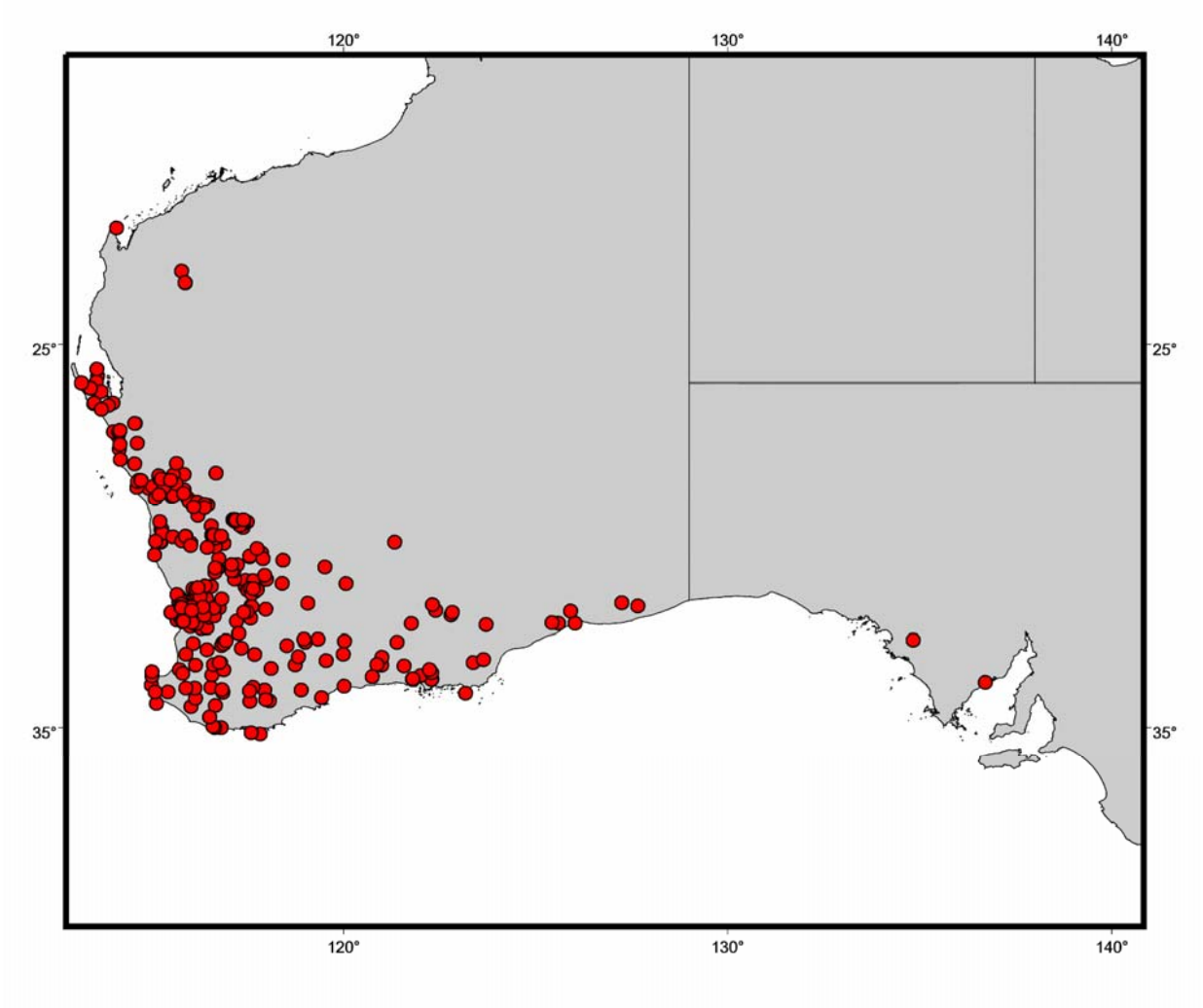

Fig. 2. Known distribution of the genus *Antichiropus*.

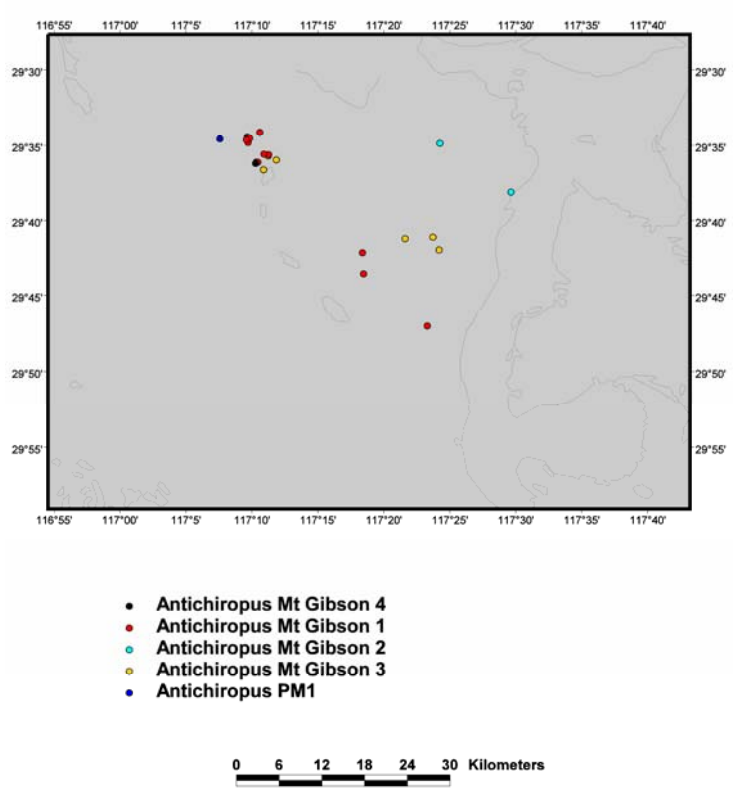

Figure 3. Recorded distributions of *Antichiropus* species in the Mt Gibson region.

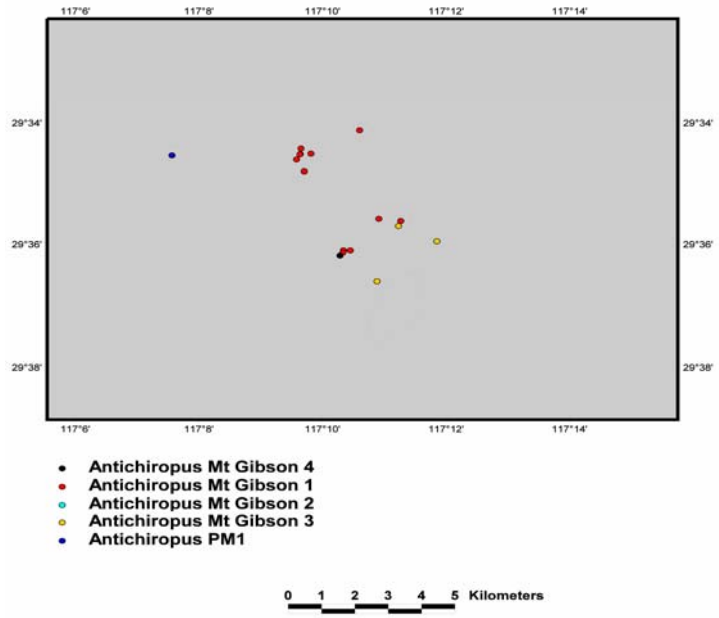

Figure 4. Recorded distributions of *Antichiropus* species in the proposed Mt Gibson mine zone.

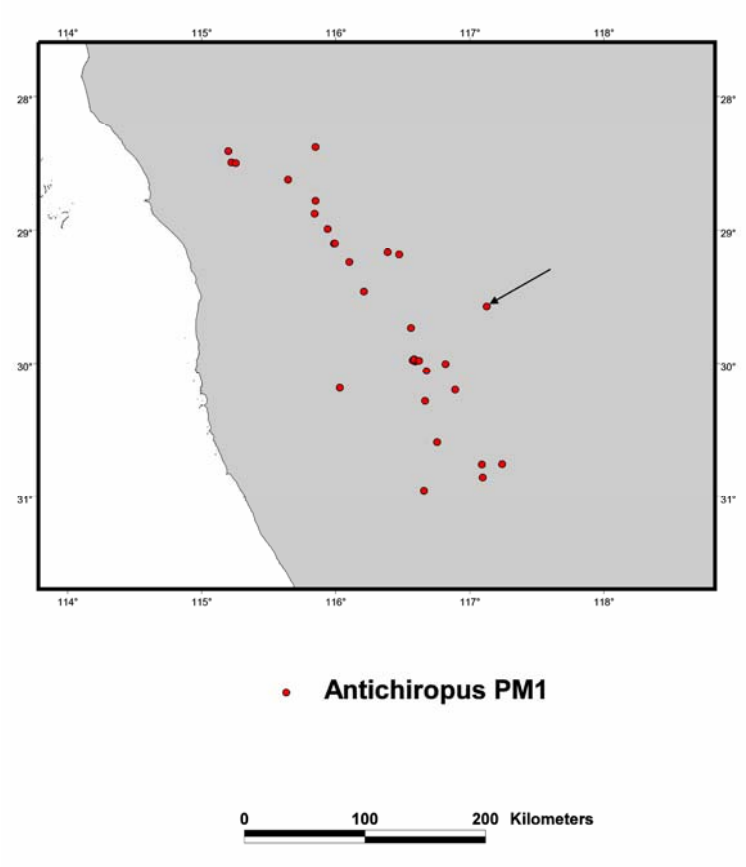

Figure 5. Known distribution of *Antichiropus* ‘PM1’. Arrow denotes the Mt Gibson collecting site.

PRINTED: Thu 23 Mar 06

CHECKED BY: MS

DRAWN BY: EDS 20-03-06

DATUM: MGA

MGM-2005-004/BUGS/MGM-5-4-BUGS-wkplan01.dgn

Legend

- Cadastral Boundary
- Topographic Contour (m AHD, 5m interval)
- Survey Site Location

E59/1179
M59/339
G59/30
L 3114/ 602 NINGHL 04280
L 3114/ 602 NINGHL 04280
6 730 000mN
Hematite Stockpile
Hematite Conveyor
Existing Airstrip
L59/63
ROM Pad
Co-located Waste Dump/ Dry Tailings Storage Facility
Extension Hill North
Reserve 36657 NINGHL 04219
L 398/ 616 NINGHL 03572
L 398/ 616 NINGHL 04282
VCL
Extension Hill
Extension Hill South
L 398/ 616 NINGHL 03572
6 728 000mN
G59/32
Proposed Airstrip
L 398/ 616 NINGHL 03543
L 398/ 616 NINGHL 03544
L 398/ 616 NINGHL 04282
L59/67
L 398/ 616 NINGHL 04282
L 398/ 616 NINGHL 03572
6 726 000mN
G59/34
Camp Services Corridor
Iron Hill North
Iron Hill East
Mt Gibson
LGE 1288242 NINGHL 04397 Reserve 17367
L59/68
Northern Highway
Iron Hill
M59/609
M59/550
Iron Hill South
Mt Gibson South
Camp Area
G59/33
LGE 1288242 NINGHL 04397 Reserve 17367
L59/69
G59/35
G59/31
Great
LGE 1288242 NINGHL 04397 Reserve 17367
512 000mE
514 000mE
516 000mE
518 000mE

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

metres

0 250 500 750 1000

SCALE 1 : 30 000 at A3

SOURCE: Mount Gibson Iron Pty Ltd, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE PROJECT
INVERTEBRATE INVESTIGATIONS

SURVEY LOCATIONS

WORKPLAN 1