Helicitite, (2012) 41: 75-85

Preliminary notes on the Cavernicolous Arthropod Fauna of Judbarra / Gregory Karst Area, northern Australia

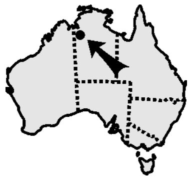
Timothy Moulds[1,3]* and Peter Bannink[2]

[1] The University of Adelaide, Environmental Biology Department, Insect Evolution and Ecology Laboratory, North Tce, Adelaide, South Australia, 5001.

[2] Centre for Tropical Agriculture, DERM, PO Box 156, Mareeba, Queensland, 4008.

[3] now at GHD, Terrestrial and Marine Ecology, 239 Adelaide Tce, Perth, Western Australia, 6004.

*Corresponding author Timothy.moulds@alumni.adelaide.edu.au



Abstract

The Judbarra / Gregory Karst Region is situated in the Judbarra / Gregory National Park, west of Timber Creek, Northern Territory. Several large joint controlled maze caves occur within the area, developed within and below a prominent dolomitic layer (the Supplejack Member). The caves are predominantly shallow in depth (< 15 m below the surface) but are occasionally developed deeper as multi-level systems, reaching the aquifer. Two biological surveys from the largest caves have revealed 56 morphospecies from 43 families, 19 orders, and 7 classes. All collecting was undertaken in the northern dry season (April to September) and consisted predominantly of opportunistic collecting.

The diversity of invertebrates collected from the Judbarra / Gregory karst comprised non-troglobionts (48 species, 86%), troglobionts (5 species, 9%), stygobionts (2 species, 3%), and trogloxenes (1 species, 2%).

Five of the species are considered to be potential troglobionts, and two potential stygobionts as indicated by troglomorphisms such as elongate appendages and reduced or absent eyes. The five troglobiont species are an isopod (Platyarthridae: *Trichorhina* sp.), a scorpion (Buthidae: *Lychas*? sp. nov.), a pseudoscorpion (Geogarypidae: *Geogarypus* sp. nov.), a millipede (Polydesmida: sp.), and a planthopper (Meenoplidae: sp.). The two stygobiont species are a hydrobiid snail (Hydrobiidae: sp.), and an amphipod (Amphipoda: sp.). The troglobiont scorpion is only the second collected from a cave environment from continental Australia.

Keywords: Biospeleology; troglobiont; stygobiont; scorpion; tropical.

Introduction

Australia's numerous tropical karst areas (Webb et al., 2003; Figure 1) have been the subject of biological studies over the past few decades, with the number of studies increasing during the last decade, mainly within the calcrete and alluvial aquifers of the Pilbara and Yilgarn regions of Western Australia (Guzik et al., 2008; Humphreys, 2008). Among the most notable studies on the invertebrate diversity and evolution in tropical Australia is the extensive work on the Cape Range of Western Australia (Harvey et al., 1993; Humphreys, 1991; Humphreys, 1993; Humphreys, 2000; Humphreys & Shear, 1993) and the Undara lava tubes and Chillagoe tower karst in northern Queensland (Roth, 1988; Roth, 1990; Hoch & Howarth, 1989a; Hoch & Howarth, 1989b; Howarth & Stone, 1990), with both these areas found to be rich in subterranean-adapted invertebrates including numerous endemic species. Other karst areas receiving biological study include the Ningbing and Jeremiah Hills near Kununurra (Humphreys, 1995), Barrow Island (Hoffman, 1994; Humphreys, 2000, 2002), and Pilbara aquifers (Karanovic, 2006). A new genus and several species of bathynellids have been described from the far eastern Kimberley near Lake Argyle and surrounding areas (Cho et al., 2005). Stygofauna from the alluvial aquifers associated with the Ord River irrigation scheme have also been sampled (Humphreys, 1999). Some groups of stygofauna are notably absent from the Kimberley, including tainisopid and phreatoicid isopods, and atyid shrimps (Page et al., 2008; Humphreys, 2008).

There are few studies of cave fauna in the Northern Territory, with previous research incorporating arthropod diversity within broader management plans for Cutta Cutta and Kintore Cave Reserves near Katherine (Hamilton-Smith et al., 1974; Hamilton-Smith et al., 1989; Parks and Wildlife Commission of the Northern Territory 2000); a taxonomic study (Dumont & Maas, 1985) describes new species endemic to Cutta Cutta Cave and the immediate karst area, but does not discuss the Tindall karst in its entirety. A more recent study, investigating the stygofauna of the Ngalia Basin calcrete aquifers, west of Alice Springs in the Northern Territory, revealed the presence of stygobitic dytiscid diving beetles, isopods and bathynellids (Balke et al., 2004; Taiti & Humphreys, 2001; Watts & Humphreys, 2006; Cho et al., 2006).

Here we report on the invertebrate fauna of Bullita Cave in the Northern Territory, situated in the Judbarra / Gregory National Park, west of Timber Creek. The cave is a shallow, joint controlled maze cave, situated in a monsoonal climate, experiencing dry winters and wet summers (Martini & Grimes, 2012). Bullita Cave and the karst of the Judbarra / Gregory National Park were first discovered by Europeans and explored in 1990 (Storm & Smith, 1991) and exploration has continued

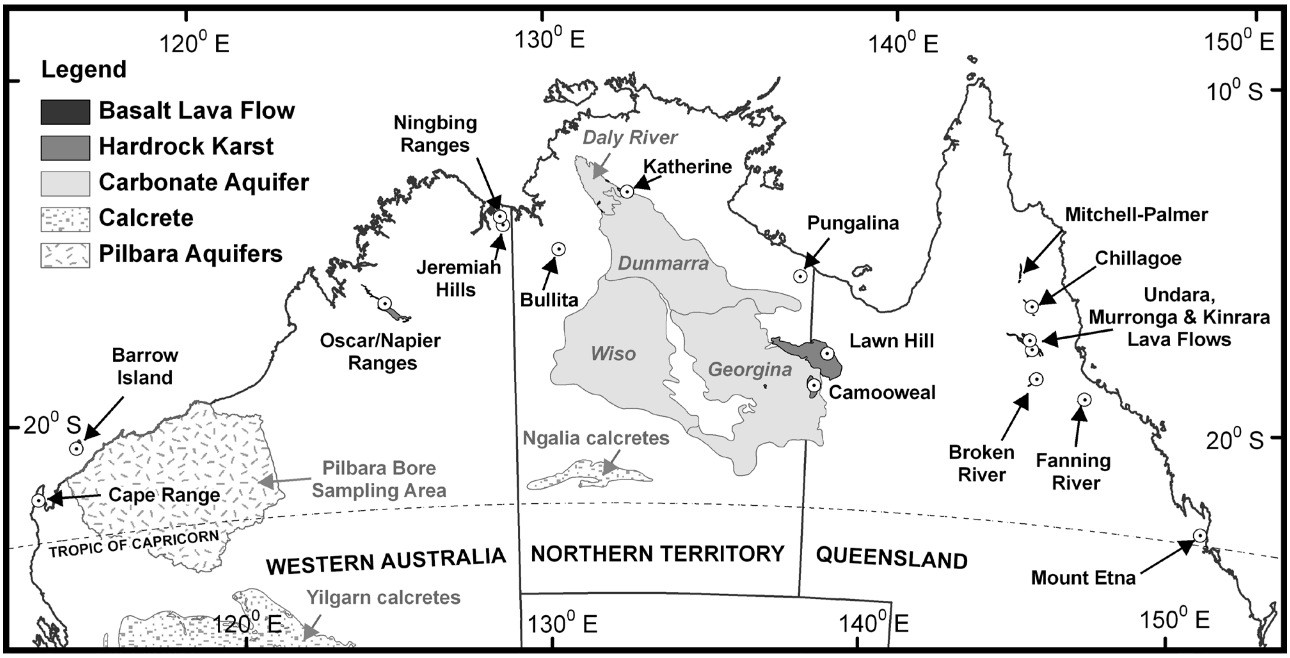


Figure 1: Major karst and basalt areas in northern Australia. Major carbonate aquifer basins are shown in light grey

throughout much of the intervening 20 years (Kershaw, 2012), although they were known to the Aboriginal people of the area previously. The discovery of Judbarra / Gregory Karst Area presented an opportunity to investigate the subterranean fauna of a new and totally unexplored karst area in tropical Australia.

Initially cave invertebrates were collected during expeditions held between 1991 and 1994 by members of the Top End Speleological Society (TESS) and Canberra Speleological Society (CSS). Additional sampling was undertaken in 2006 by Timothy Moulds as a dedicated biospeleological survey of the karst region, including both the Central Karst Area (Bullita Cave) and the Dingo Block (Northern Karst Area), situated to the north of Limestone Creek (Figure 2).

Methods

Invertebrate Sampling

Opportunistic sampling was undertaken between 1991 and 1994 and a fauna survey in 2006, all undertaken in the northern dry season (April to September). Collecting was undertaken in three different cave systems within the Judbarra / Gregory Karst area: the Central karst area (BAA 22 and BAA 35); the Dingo System (BAA 38) located to the north of Limestone Gorge; and BAA 4, a limestone block located to the east of the Dingo Block (Figure 2). Specimens were collected using forceps, aspirators and wet paint brushes, and aquatic fauna were collected using hand held dip nets. Sampling was undertaken at multiple locations and microhabitats in each cave to provide a broad representation of the invertebrates present and to enable some comparison of diversity, community structure and ecology between caves and ultimately with other karst areas. Cave micro-habitats investigated included cave entrance areas, cave passages, sediment banks, near sumps, and bat guano deposits. Aquatic sampling sites included gour pools and permanent sumps.

Specimens were assigned categories of cave dependence based upon degree of morphological adaptation to the cave environment (troglomorphisms).

All material has been lodged with the Northern Territory Museum of Arts and Sciences (NTMAS), and the Western Australian Museum (WAM).

Temperature and humidity were recorded at the collection sites in BAA 4, BAA 35 and BAA 38, using a whirling hygrometer.

Results

The combined surveys for the Judbarra / Gregory karst area have recorded 56 morphospecies from 43 families, 19 orders, and 7 classes (Table 1). The species collected are predominantly non-troglobionts (48 species, 86%), troglobionts (5 species, 9%), stygobionts (2 species, 3%), and trogloxenes (1 species, 2%) (Figure 3). Specimens that showed obvious troglomorphisms were classified as troglobionts or stygobionts, while other species were assigned non-troglobiont status as the distinction between accidental and troglophile was unable to be determined without extensive surface collecting.

Five of the species are potentially troglobionts, and two are potentially stygobionts due to troglomorphisms such as elongate appendages and reduced or absent eyes. The five troglobiont species are an isopod (Platyarthridae: *Trichorhina* sp.), a scorpion (Buthidae: *Lychas*? sp. nov.), a pseudoscorpion (Geogarypidae: *Geogarypus* sp. nov.), a millipede (Polydesmida: sp.), and planthopper nymphs (Meenoplidae: sp.). The *Trichorhina* isopod, polydesmid millipede and planthopper nymphs are white to a very

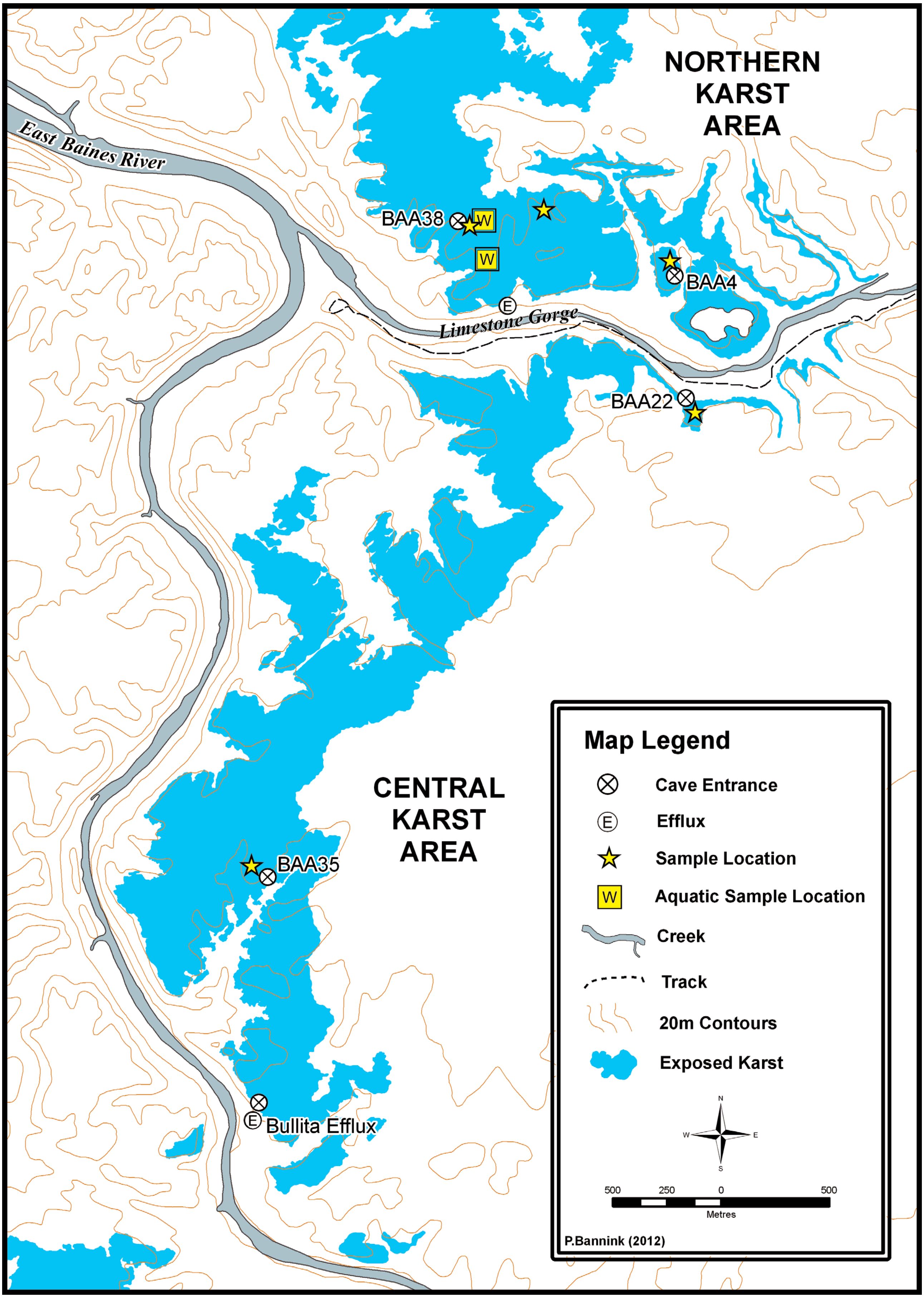


Figure 2: Location of cave invertebrate sampling sites

Table 1: Invertebrates recorded from the Judbarra / Gregory Karst

Class	Order	Taxa	Species	BAA 4 (E of Dingo)	BAA 22 (Bullita)	BAA 35 (Bullita)	BAA 38 (Dingo)	Classification	Cave Zone	Acquisition / ID Number	Museum
Gastropoda		Hydrobiidae	sp.				+	Stygobiont	Deep	BAA27:12	MAGNT *
		Pupillidae	*Gyliotrachela australis australis*				+	NT[1]	Transition	P007838	MAGNT
		Pupillidae	*Pupoides pacificus*			+	+	NT	Transition	P007841	MAGNT
		Pupillidae	*Gastrocopta cf. pediculus*				+	NT	Transition	P007842	MAGNT
		Pupillidae	*Gastrocopta macrodon*				+	NT	Transition	P007837	MAGNT
		Subulinidae	*Eremopeas interioris*			+	+	NT	Transition	P007836	MAGNT
		Endodontidae	*Discocharopa aperta*				+	NT	Transition	P007840	MAGNT
		Endodontidae	*Charopa* sp.				+	NT	Transition	P007840	MAGNT
		Helicarionidae	*Westracystis lissus*			+	+	NT	Transition	P007835	MAGNT
		Helicodiscidae	*Stenopylis coarctata*				+	NT	Transition	P007839	MAGNT
		Camaenidae	*Mesodontrachia aff. fitzroyana*	+	+	+	+	NT	Transition	P007834	MAGNT
		Camaenidae	*Torresitrachia* sp.			+	+	NT	Transition	P037764	MAGNT
Crustacea	Isopoda	Oniscoidea	sp.			+	+	NT	Transition	BAA27:11	MAGNT *
		Platyarthridae	*Trichorhina* sp.				+	Troglobiont	Deep	BAA27:66	MAGNT *
	Amphipoda		sp.				+	Stygobiont	Deep	BAA27:04	MAGNT *
	Decapoda	Sundatelphusidae	*Holthuisiana transversa*		+			NT	Transition	BAA27:01	MAGNT *
Arachnida	Araneae	Pholcidae	*Panjange* sp.				+	NT	Transition	BAA27:36	MAGNT *
		Pholcidae	*Psilochorus* sp.	+		+	+	NT	Transition	BAA27:44	MAGNT *
		Tetragnathidae	*Mesida* sp.		+		+	NT	Entrance	BAA27:07	MAGNT *
		Nesticidae	sp.		+		+	NT	Entrance	BAA27:14	MAGNT *
		Lycosidae	sp.		+	+		NT	Transition	BAA35:15	MAGNT *
		Uloboridae	*Philoponella* sp.			+		NT	Transition	BAA35:01	MAGNT *
		Ctenidae	sp.	+			+	NT	Transition	A000473	MAGNT
		Sparassidae	sp.	+	+	+	+	NT	Transition	BAA04:16	MAGNT *
		Araneidae	*Argiope?* sp.		+	+	+	NT	Entrance	A000332	MAGNT
		Theridiidae	sp.		+		+	NT	Entrance	BAA27:35	MAGNT *
		Hersilidae	sp.	+			+	NT	Entrance	BAA27:72	MAGNT *
		Amaurobiidae ?	sp.	+			+	NT	Transition	BAA27:14	MAGNT *
		Family: ?	sp.	+				NT	Transition	BAA04:10	MAGNT *
	Scorpionida	Buthidae	*Lychas* sp. nov.		+			Troglobiont?	Deep	T80206	WAM
	Pseudoscorpionida	Geogarypidae	*Geogarypus* sp. nov.			+		Troglobiont?	Transition	T82731	WAM
Chilopoda	Scolopendrida		sp.		+		+	NT	Transition	BAA27:64	MAGNT *
	Geophilida		sp.			+		NT	Twilight	BAA35:19	MAGNT *
	Scutigerida		sp.		+		+	NT	Deep	BAA27:03	MAGNT *
Diplopoda	Polydesmida		sp.				+	Troglobiont	Deep	BAA27:19	MAGNT *
Collembola	Collembola	Entomobryidae	sp.		+		+	NT	Twilight	BAA27:34	MAGNT *
Insecta	Blattodea	Blattellidae	*Blatella* sp. A		+		+	NT	Transition	BAA27:02	MAGNT *
			sp. B			+		NT	Transition	BAA35:12	MAGNT *
			sp. C			+		NT	Twilight		MAGNT *
	Orthoptera	Gryllidae	*Endacusta* sp.	+	+	+	+	Trogloxene	Transition	BAA04:12	MAGNT *
	Hemiptera	Reduviidae (Harpactorinae)	sp. A	+	+		+	NT	Transition	BAA04:03	MAGNT *
			sp. B				+	NT	Transition	BAA27:41	MAGNT *

[1] NT– Non Troglobiont.
The specimens collected are located at the Western Australian Museum (WAM) and the Museums and Art Galleries of the Northern Territory (MAGNT). The symbol (*) indicates the specimen has not yet been provided with an accession number and the collection number has been provided instead.

Table 1: Invertebrates recorded from the Judbarra / Gregory Karst

Class	Order	Taxa	Species	BAA 4 (E of Dingo)	BAA 22 (Bullita)	BAA 35 (Bullita)	BAA 38 (Dingo)	Classification	Cave Zone	Acquisition / ID Number	Museum
		Reduviidae (Emesinae)	*Pirites*? sp.		+	+	+	NT	Transition	BAA35:13	MAGNT *
			sp. B			+		NT	Twilight	BAA35:10	MAGNT *
		Largidae	*Physopelta australis*				+	NT	Twilight	BAA27:22	MAGNT *
		Lygaeidae	*Euander* sp.			+		NT	Twilight	BAA35:16	MAGNT *
		Anthocoridae	sp.				+	NT	Entrance	BAA35:17	MAGNT *
		Meenoplidae	sp.			+	+	Troglobiont	Deep	BAA27:46	MAGNT *
	Coleoptera	Curculionidae	sp.				+	NT	Entrance	BAA27:73	MAGNT *
		Cerambycidae	*Dihammus mixtus*				+	NT	Entrance	BAA27:17	MAGNT *
		Staphylinidae	*Ochthephilum* sp.				+	NT	Entrance	BAA27:20	MAGNT *
		Trogidae	*Omorgus* sp.		+			NT	Transition	BAA22:04	MAGNT *
		Family:?	sp.				+	NT	Entrance	BAA35:20	MAGNT *
	Lepidoptera	Gelechioidea	sp.	+			+	NT	Transition	BAA27:61	MAGNT *
	Hymenoptera	Formicidae	sp.		+	+	+	NT	Twilight	BAA27:48	MAGNT *
	Diptera	Muscoidea	sp.				+	NT	Twilight	BAA27:21	MAGNT *

[1] NT– Non Troglobiont.
The specimens collected are located at the Western Australian Museum (WAM) and the Museums and Art Galleries of the Northern Territory (MAGNT). The symbol (*) indicates the specimen has not yet been provided with an accession number and the collection number has been provided instead.

pale yellow in colour and eyeless which indicates troglobiont status. The status of the planthopper nymphs remains uncertain as no adult specimens were collected to confirm the presence of troglomorphisms. The degree of troglomorphisms varies between taxa with the pseudoscorpion potentially a troglobiont although this remains uncertain (M. Harvey, pers. comm., June 2011). The two potential stygobiont species were collected from a sump in BAA 38 and are a hydrobiid snail (Hydrobiidae: sp.), and an amphipod (Amphipoda: sp.).

The majority of species were recorded from the Transition Zone (31 species, 55%), followed by the Entrance Zone (10 species, 18%), Twilight Zone (8 species, 14%) and the Deep Cave Zone (7 species, 13%) (Figure 4).

The cave invertebrates collected were mostly insects (20 species, 36%), followed by arachnids (15 species, 26%), gastropods (12 species, 21%), crustaceans (4 species, 7%), centipedes (3 species, 5%) and millipedes and collembolan each represented by a single species (Figure 5).

Cave environmental conditions

Measurements of the cave environments showed that air temperatures were fairly constant throughout the cave, with variations generally less than a degree in most parts of the cave (Table 2). However, due to the generally open nature of the caves in this area with multiple entrances, and numerous grikes and daylight holes (Figure 6), much of the cave forms part of the twilight zone where daily fluctuations of temperature and humidity may be greater. Humidity is lower near entrances as would be expected, and higher deeper into caves near sumps where the permanent to semi-permanent water ensures humidity remains at or near saturated levels. The higher humidity areas are generally where the troglobiont species were recorded. Due to the open nature of much of the Judbarra / Gregory Karst, humidities are often lower than would be expected when compared to other tropical karst, such as Cape Range (Humphreys, 1991) and in Katherine (Tindall Limestone), where humidity is saturated, or nearly so, within a few metres of cave entrances.

Discussion

The diversity of invertebrates collected from the Judbarra / Gregory karst is quite high considering the lack of systematic collecting undertaken within the system. The entrance and twilight zones are habitats for approximately one third of all species recorded. These zones are relatively large and common throughout the Central karst due to the predominance of open grikes in the Judbarra / Gregory karst (Martini and Grimes 2012). The highest diversity of species was from the Transition Zone, (which comprises the majority of all dark zone) due to air movement through the predominantly open

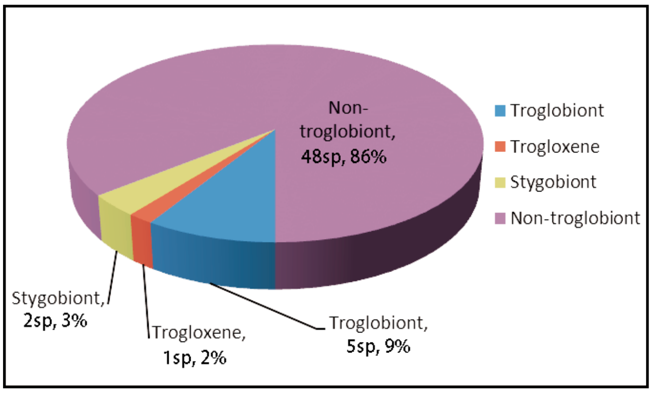


Figure 3: Ecological classification of invertebrates from the Judbarra / Gregory Karst (number of species and percent composition).

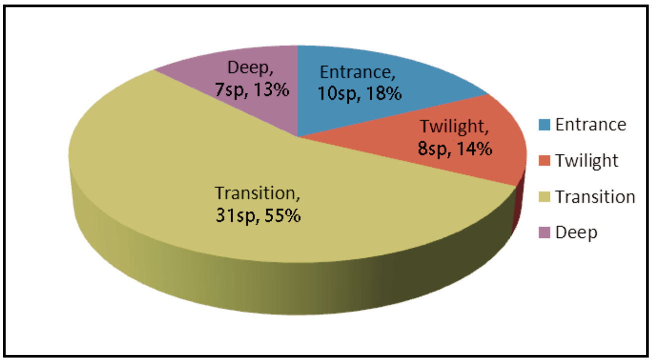


Figure 4 Location of invertebrates from the Judbarra / Gregory Karst (number of species and percent composition).

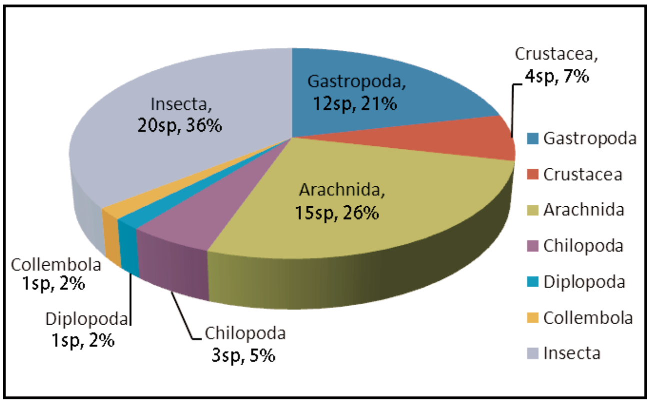


Figure 5: Composition of Judbarra / Gregory Karst invertebrates by Class (number of species and percent composition).

karst area substantially reducing the amount of deep cave zone.

The diversity of species recorded showed insects to be the most diverse with 20 species, although 12 of these are considered to be accidentals and therefore of little interest when determining the true diversity of the Judbarra / Gregory Karst invertebrate fauna. Only a single insect species is classified as a troglobiont (Meenoplidae sp.). The next most diverse group was arachnids with 15 species, predominantly comprised of spiders (13 species) that included several families (Sparassidae, Ctenidae, Lycosidae) commonly encountered as troglophiles in tropical karst areas in Australia (Moulds, unpub. data). The arachnid fauna of the Judbarra / Gregory also contains what may be only the second species of troglobiont scorpion on the Australian mainland, collected from the deep zone of BAA 22. The Gastropoda were the third group that dominated the invertebrate diversity of Judbarra / Gregory karst, comprising 12 species that, apart from a single species, were collected from the Dingo Cave system (BAA 38). It is highly likely that many of these species occur more widely across the Judbarra / Gregory Karst area, as they have not been as extensively sought beyond this one karst block.

Terrestrial molluscs are commonly found in limestone regions in northern Australia, usually amongst the leaf litter of remnant monsoon vine rainforest. Snail shells are commonly encountered within cave sediments, probably deposited during wet season floods. Eleven species of terrestrial snail shells were found, located within the entrance, twilight, and transition zones of the caves. Two of these, *Gyliotrachela* sp. and *Mesodontrachia* sp., appear to be new species endemic to the area (V. Kessner, pers. comm.). The other nine species have been reported from various regions of northern Australia (Solem, 1981, 1982, 1984, 1985, 1989). The shell of a twelfth species of gastropod was located in the sump regions of BAA 38. It has been identified as belonging to the aquatic family Hydrobiidae (W. Ponder, pers. comm.), although no live specimens have yet been collected; thus it can not be confirmed as a definite stygobiont until live specimens become available for examination. Members of this family are found in streams in southern and eastern Australia, but isolated populations have been recorded from mound springs in the Lake Eyre basin and stygobiont species from Ngalia Basin, NT. This specimen would represent the northern extent of known distribution of this family.

One species of terrestrial isopod from the superfamily Oniscoidea was located within the transition zone, and was often found in association with fig leaf litter and is considered to be a troglophile. A second, minute (5 mm), blind, white specimen, collected in the deep cave zone of BAA 38, belongs to the family Platyarthridae and appears to be a troglobiont. *Trichorhina australiensis*, Wahrberg 1922, is the only other recorded species from this family on the Australian continent (H. Dalens pers. comm.), although approximately thirteen troglomorphic taxa are currently being described from calcretes of the Yilgarn region in Western Australia (S. Javidkar, pers. comm. 2011).

The subterranean waters located in BAA 38 contained an undescribed freshwater amphipod. In recent years the diversity of subterranean amphipods has been found to be much larger than originally thought, with field surveys in the Pilbara and Yilgarn regions of Western Australia discovering numerous undescribed species (Barnard & Williams ,1995; Finston et al., 2004; Finston et al., 2007; Cooper et al., 2007; Bradford et al., 2010). Little

Table 2: Temperature and humidity records from the caves

Cave No	System	Date	Cave Zone	Distance (m)	Air Temp °C	Humidity (RH%)
BAA38	Dingo	28/09/93	Transition	100 (H)	24.0	75
BAA38	Dingo	29/06/92	Deep (sump)	150 (H)	23.0	90
BAA38	Dingo	12/06/93	Twilight	20 (H)	24.0	45
BAA38	Dingo	06/07/93	Entrance	8 (V)	24.0	40
BAA38	Dingo	08/07/93	Deep (sump)	32 (V)	24.0	95
BAA38	Dingo	16/10/93	Deep (sump)	32 (V)	22.5	90
BAA04	E of Dingo	01/09/91	Transition	8 (V)	23.0	70
BAA35	Bullita	23/06/94	Transition	8 (V)	24.0	75
BAA35	Bullita	09/07/93	Transition	8 (V)	24.5	70

(H) = Horizontal distance into cave from an entrance (V) = Vertical distance into cave from an entrance

Figure 6: Roots and leaf litter beneath skylights in Frontyard section of Bullita Cave. [A. Pryke]

comment can be made regarding this species until it is described and placed within a taxonomic framework.

The common freshwater crab *Holthuisana transversa*, occurs widely within rivers across northern Australia (Bishop, 1963), and has been collected from Grants Cave (KAB17) near Katherine, Northern Territory (P. Bannink unpub. data), caves of the east Kimberley (Humphreys, 1995), Niggle Cave (C15) near Camooweal, and northern Queensland (Iken, 1980). A population of this species was observed in BAA 22 over three consecutive years in cave passage sediments annually flooded at Limestone Gorge. This species is expected to be present in numerous karst systems in northern Australia where suitable habitat is present; it is considered a troglophile.

The presence of a troglobiont scorpion within the Judbarra / Gregory Karst is extremely significant, as only two subterranean-adapted scorpions have previously been described from Australia. A very troglomorphic species, *Aops oncodactylus* (Urodacidae) was recently described from Barrow Island, a limestone island off the coast of Western Australia (Volschenk & Pendrini, 2008) that was connected to the mainland in recent geological time. The other most proximal troglobiont scorpion to Australia is *Liocheles polisorum* from Christmas Island in the Indian Ocean, an isolated seamount. The single specimen exhibits reduced eyes, elongate appendages and generally reduced pigmentation (E. Volschenk, pers. comm. 2011). The specimen was collected from a vertical piece of moist flowstone in the deep zone of BAA22 (Figure 2). This species represents the 23rd cavernicolous and troglomorphic scorpion in the world and the second from mainland Australia (Volschenk & Pendrini, 2008; Lourenço & Pham, 2010; Lourenço &

Pham, 2012). Mexico presently has 57%, or 13 species of the world's troglomorphic cavernicolous scorpions, now followed by Australia with 13% (3 species), and Vietnam 9% (2 species).

Only a single species of pseudoscorpion has been recorded from Judbarra / Gregory karst, despite the numerous areas examined over multiple years. This is surprising as this order is very commonly found in subterranean habitats in all climatic zones of Australia (Edward & Harvey, 2008; Harvey, 1991; Moulds, 2004; Moulds et al., 2007). Two specimens of a geogarypid (*Geogarypus* sp. nov.) were collected from the surface of vertical walls in the southern portion of the Central karst area (Figure 2). This represents an undescribed species that may potentially be a troglobiont as it possesses elongate appendages, especially the chelal fingers, and reduced pigmentation, although it does not have reduced eyes (M. Harvey, pers. comm. 2011).

Several species of reduviid hemipterans were collected from multiple caves within the karst region. These are predatory species that prey upon invertebrates. Two of the reduviids belong to the subfamily Harpactorinae which is commonly encountered in caves throughout the Northern Territory (P. Bannink, unpub. data). A further two emesine reduviids were found, including a large (8 cm) troglophile (*Pirites* sp.?) which has also been reported from the Kimberley (T. Moulds, unpub. data), Cape Range (W. Humphreys, pers. comm.) and Queensland (Howarth 1988). *Physopelta australis* (family Largidae) is an accidental, and was found congregating in large numbers at the entrance to BAA 38.

Multiple specimens of a pale meenoplid homopteran (planthopper) have been collected in the deep sump passages of BAA 38 and from moist drip holes within large sediment banks where tree roots were exposed in BAA 35. No adult specimens were recorded, thus the species can not be confirmed as a troglobiont. This is the only potential troglobiont species recorded from the Judbarra / Gregory karst that is known from multiple caves and indeed karst blocks. Troglobiont planthoppers feed on the sap from subterranean tree roots, and have been recorded from numerous karst areas in Australia including Cape Range (Hoch, 1993), Undara, and Chillagoe (Hoch & Asche, 1988). Troglobiont species from this family have been collected from caves in the Katherine area (Tindall Limestone) (P. Bannink, unpub. data).

The only orthopteran collected is an undescribed species of gryllid cricket, *Endacusta* sp. nov. (G. Brown, pers. comm.). Twenty one species of *Endacusta* have been described in Australia, four of which have been recorded from the Northern Territory, including *E. major* (Alice Springs), *E. koopinya*, *E. pardalus* and *E. paraboora* (Otte & Alexander, 1983). Members of the Top End Speleological Society have observed and collected several undescribed species from this genus from caves in Katherine and the Ningbing Ranges in Western Australia (unpub. records), while other *Endacusta* species have been recorded from Chillagoe in Queensland (Sullivan, 1984).

Three species of cockroach from the family Blattellidae were collected. These species were commonly associated with leaf litter and organic detritus in the caves and all appear to be accidentals or troglophiles, being encountered near entrances and showing no evidence of troglomorphism. The relatively commonly encountered family of troglobiont cockroaches from northern Australia subterranean environments (Pilbara, Cape Range, Undara and Chillagoe amongst others), the Nocticolidae, have so far not been observed in the Judbarra / Gregory karst region.

Conclusions

The majority of species do not exhibit any troglomorphisms and were found in the vicinity of cave entrances and twilight zones. Seven potential troglobiontic and stygobiontic species have been collected including a hydrobid snail, a buthid scorpion, a geogarypid pseudoscorpion, a polydesmid millipede, a platyarthrid isopod, an amphipod, and a meenoplid planthopper. This is a significant number of troglomorphic species to be found from limited collecting in an extensive tropical cave system, and further collecting, especially if undertaken in a co-ordinated and systematic manner, will undoubtedly reveal additional species. The majority of these species are known from single records, and further investigation may increase their known local distribution.

The absence of formal descriptions for many of the species collected from the Judbarra / Gregory Karst hampers the ability to provide meaningful comparisons with other nearby karst areas. The only nearby karst area where any general subterranean biological knowledge exists is Cutta Cutta Cave, in Tindall Limestone near Katherine, and in the east Kimberley (Humphreys, 1995). It could be expected that some of the troglomorphic species may share affinities with the Katherine karst area, due to the general similarities with epigean invertebrate fauna and similar troglophilic species encountered in both areas. The further identification and description of new taxa from the Judbarra / Gregory karst remains important so that the significance and degree of endemism can be more accurately determined.

Acknowledgments

We would like to recognise the Traditional Owners of the Limestone Gorge area of Judbarra / Gregory National Park. This survey would not have been possible without the endless amount of voluntary assistance given by members of the Top End Speleological Society (Karen Magraith, Guy Bannink and Bruce Swain), and the Canberra Speleological Society, who explored and mapped many of the cave systems, and collected many of the specimens. TESS would also like to thank the Parks and Wildlife Commission of the Northern Territory for permitting access to the karst region, and local resident rangers Keith Claymore (1991-1993) and Andrew Hartwick (1994-1996) for their logistic support. A special thanks to Arthur Clarke for providing a summary of his unpublished data, Dr A. Wells, Dr G. Brown, Dr R. Willan and Dr A.J. Bruce of the Northern Territory Museum of Arts and Sciences for their patience and assistance in dealing with the material and also to Mr V. Kessner for identifying the terrestrial gastropods. Dr Mark Harvey and Dr Erich Volschenk provided identification and notes on the pseudoscorpion and scorpion material respectively. The two referees provided excellent suggestions which greatly improved this paper. The authors would like to thank Dr Susan White and Ken Grimes for the opportunity to publish this paper in the Judbarra / Gregory Special Issue of Helictite.

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Sparassid Spider, in Odyssey block of Bullita Cave System. [K. Grimes]