

Recent Fauna of the Cave Križna jama in Slovenia

by

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Zusammenfassung

Die Križna jama ist eine Höhle in SW-Slowenien und hat eine Gesamtlänge von ca. 8 km die von mehreren Ursprüngen mit Wasser versorgt werden. Es fehlt ihr aber ein Strom eines permanenten (!) Schwindebaches. Daher ist diese Höhle oligotroph und ihre Fauna besteht überwiegend aus Troglobionten. Die meisten nicht-troglobionten Tiere leben terrestrisch und nahe dem Eingang. Wir konnten insgesamt 32 aquatische und 18 landlebende troglobionte Taxa feststellen, was eine der artenreichsten troglobiotischen Faunen der Welt darstellt. Die Križna jama ist Typlokalität für acht aquatische und drei landlebende troglobionte Arten.

Schlüsselwörter: Höhlenfauna, unterirdische Biodiversität, Dinarischer Karst

Summary

Križna jama is a cave in SW Slovenia, with 8 km of corridors, fed by different waters, but without a permanent sinking stream. The cave is therefore generally oligotrophic and its fauna consists mainly of troglobionts; most non-troglobionts are terrestrial and limited to the entrance area. We could list 32 aquatic and 18 terrestrial troglobiotic species which is one of the richest troglobiotic faunas in the world. This cave is the type locality for eight aquatic and three terrestrial troglobiotic taxa.

Keywords: cave fauna, subterranean biodiversity, Dinaric karst

Izvleček

Križna jama na jugozahodu Slovenije ima približno 8 km hodnikov, ki jih napajajo različne vode, vendar je brez stalne ponikalnice. Zato je jama na splošno oligotrofna, njeno favno pa sestavljajo predvsem troglobionti; največ ne-troglobiontov je kopenskih in omejenih na območje vhoda. Našteti so 32 vodnih in 18 kopenskih troglobiot-skih vrst, kar predstavlja eno najbogatejših troglobiot-skih favn na svetu. Ta jama je tudi tipska lokaliteta za 8 vodnih in za 3 kopenske troglobiot-ske taksone.

Ključne besede: jamska favna, podzemeljska biotska pestrost, Dinarski kras

1. Introduction

Križna jama is a cave of more than 8 km of corridors, of which only a small part are hydrologically inactive, with only sparse pools of percolated water. Streams of different origin flow in the remaining parts of the cave, but none of them is a permanent sinking river bringing underground much food and aquatic fauna from the surface. The streams flow mainly from the inner parts towards the entrance area where they sink into a lower, less accessible level.

The stream in the main corridor (Glavni rov) is at low water levels partitioned by low sinter dams into a series of 'clear lakes', mainly with a sandy bottom. During a rainy event, this stream may rise within some hours by a couple of meters and become highly turbid. Such a strong torrent makes inner parts of the cave inaccessible; thus, some details of the hydrological situation within the cave are unknown. The origin of the main channel and its stream is at Kalvarija, where two channels merge. From the right channel (called Blata) a small brook is flowing between high loam deposits and with a loamy or sandy-loamy bottom. This brook originates from some brooklets of percolated waters and the intermittent sinking brook

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Bloščica-Farovščica (KOGOVŠEK et al., 2008). More in detail, hydrographical situation in the cave is quite complicated (PRELOVŠEK, 2007).

The cave is in a comparatively natural status, although the influence from the Bloke Plateau can sometimes be felt, turning the clear lakelets turbid. Recently, a weak influence from the periodical sinking stream Farovščica was traced (KOGOVŠEK et al., 2008). A detailed geomorphological and hydrographical description of the cave is given by POHAR (this volume).

No ecological investigations have been done in the cave. Data given are results of numerous visits since 1850 (WOLF, 1938) till now, as well as some detailed faunistic reviews of ourselves (started in 1970ies). Very rich data are given by JOSEPH (1882). He is mentioning the cave as Mrzla jama, a name more used in the past. Križna jama = Mrzla jama pod Križno goro (cadastral number 0065) is one of 11 registered caves in Slovenia (JZS 2008) called »mrzla jama« (= »cold cave« !); to make the confusion perfect, there are two more within the reach of some kilometers to Križna jama (Mrzla jama pri Ložu c.n. 0079 and Mrzla jama pri Bločicah c.n. 1176). In modern times, most data for Gastropoda have been given by KUŠČER (1928, 1932) and BOLE (1967, 1979); for Oligochaeta by Sp. KARAMAN (1978) and MARTINEZ-ANSEMIL et al. (1997); for Malacostraca by St. KARAMAN (1952) and STROUHAL (1928); for Coleoptera by JEANNEL (1924, 1928), MUELLER (1923) and PRETNER (unpublished). SKET (1986) published a popular paper regarding distribution of fauna within the cave. One has to note that WOLF (1934–1938) is imputing Joseph also some data which could not be found in the cited paper (JOSEPH, 1882).

2. Results

2.1. Faunal List

The cave fauna recorded up to now from Križna jama (excluding taxa identified at the family or higher level) includes 36 aquatic and 47 terrestrial species (Tab. 1). At least 32, i.e. close to 90% of aquatic species (or races) are troglolobiotic; much higher is the number of non-troglolobiotic species (mainly troglonexes) in the terrestrial fauna, with only 18 troglolobiotic species. Križna jama is the type locality for 8 aquatic and 3 terrestrial troglolobiotic taxa.

The first author to report species from the cave was JOSEPH (1882); unfortunately, some of the taxa he described have never been mentioned again; since Joseph is a very unreliable author (St. KARAMAN, 1950), such data are marked in the list with 'J'. To report an example for aquatic fauna, the first subterranean copepod from Križna jama was cited by Joseph as "*Cyclops hyalinus*". Apart from the fact that the name established for this species by Joseph is not valid, being pre-occupied by *Cyclops hyalinus* REHBERG 1880, the old-fashioned original description allows only to recognize that it refers to a cyclopoid copepod: several species are present in the cave (CHAPPUIS, 1933; PETKO-

VSKI, 1983 and present researches), and Joseph's citation has no scientific meaning.

The genus *Lessinocamptus* is reported here for the first time from Slovenia: the only described species are known from the Lessinian mountains (Central Pre-Alps in Italy: STOCH, 1997). Several groups need to be studied in detail and taxonomic problems still remain; in this context the list is far from being exhaustive. As regards Oligochaeta, Sp. Karaman, in her doctoral dissertation dealing mainly with the material from the Postojna-Planina Cave System, could see only few specimens of *Spirosperma* and *Rhyacodrilus* spp. from Križna jama, therefore a confusion with the later (MARTINEZ-ANSEMIL et al., 1997) described species is not to be excluded. Ostracods are present in most of aquatic habitats in the cave, but the material is still in study. Citations of Collembola and Diptera need to be re-examined and completed. The list of some well-studied taxa may be incomplete as well (for example for Copepoda and Araneae); also the Coleoptera, the most well-known group in Slovenian caves, need to be checked in detail.

2.2. Distribution of Terrestrial Fauna

The entrance corridor of Križna jama is very wide, the daylight penetrates here far inside. The parietal fauna has not been paid a special attention, but it is composed of usual members, mainly subtroglolobiles: the lepidopterans *Scoliopteryx libatrix* and *Triphosa dubitata* are very common on the walls during winter; the cave-cricket *Troglophilus* sp. and the Trichoceridae dipterans (both not identified at species level) are present as well. In the humus rich bottom, enriched by decaying wood and other debris, probably eutroglolophilous millipeds *Brachydesmus* sp. (in the past identified as *B. subterraneus*) and the extremely generalist mite *Schwiebea cavernicola* may be numerous; less common are the beetles *Laemostenus elongatus* and *Laemostenus schreibersii*.

In the corridors between the entrance and the first lake (Prvo jezero) are relatively (!) common three species of beetles. *Bathyscymorphus trifurcatus* and *Typhlotrechus bilimeki* may occur very close to the entrance but often hidden on the bottom, while *Leptodirus hochenwartii* is more lucifugous and may be dwelling on exposed cave walls deeper in the cave. The other coleopterans are very rare.

In deeper parts of the cave, behind the first lake, the terrestrial fauna is even much scarcer. Some specimens may be met where occasional organic debris accumulate or at the water edge, but even to usual baits (of putrescent meat) only single individuals are coming. Most common are Collembola and Diplura. Inhabitants of these parts of the cave are also the large woodlice *Titanethes* sp., the spiders *Stalita* and *Parastalita*, the beetles *Leptodirus* and *Typhlotrechus*; extremely rare are the pseudoscorpion *Neobisium*, the millipedes *Brachydesmus* and *Attemsia* and tiny snails of the genus *Zospeum*. All these animals may be found also closer to the entrance. Any other terrestrial animal can occasionally, very rarely, be met in different places within the cave.

Areas close to the entrance of Križna jama are recognized as a particularly important hibernating sites of the lesser horseshoe bat *Rhinolophus hipposideros*. This species never forms such dense agglomerations as some others, which is also reflected by the distribution of guano deposits. Besides this one, at least six additional bat species (PRESETNIK in CKFF et al., 2008) occur in this cave; they are much less numerous. The bat tick *Ixodes vespertilionis* may be seen here.

2.3. Distribution of Aquatic Fauna

In puddles on loam and in small limestone pools (gours), fed by percolated water, some specimens of small crustaceans may be found. The small niphargid *Niphargus wolfi* and the larger *N. stygius* are quite common in these habitats, together with several oligochaetes and copepods like *Elaphoidella* spp., *Speocyclops infernus*, *Acanthocyclops kieferi*. Some others may be vehiculated from the subterranean river in the puddles during the floods. Similarly scarce is also the fauna of larger waters in Pisani rov. In those parts of the corridor Blata, where the bottom consists of a very loose silt mixed with some sand, the large troglobiotic oligochaete *Delaya bureschi* is comparatively common and so are unidentified, probably semi-terrestrial Enchytraeidae. In lower parts of the stream in Blata and in the main corridor below this (i.e. around Kalvarija), the stocky amphipod *Niphargus orcinus* and the isopod *Monolistra racovitzai* are comparatively densely present. However, *N. orcinus*, *Belgrandiella* spp. and *Trichodrilus ptujensis* can equally be met along Blata and Glavni rov, together with several copepod species closely linked to karstic waters, like *Acanthocyclops troglophilus* and *Dia-cyclops charon*.

In Stransko jezero, we can find small amounts of organic debris coming from surface (particles of fallen leaves and similar). The population of aquatic snails is the richest on stones here, although they occur also elsewhere and their empty shells may be found deposited in calm places further down in the cave stream. Beside numerous prosobranch species, one can find here also *Zospeum exiguum*, an aquatic species of the otherwise terrestrial genus of pulmonates. The slender amphipod *Niphargus stygius* is also most common in Stransko jezero and in Blata below it.

3. Discussion

Although no exact measurements were done, Križna jama may be classified as oligotrophic and obvious food scarcity was noted throughout the cave, in the water and outside it. The only exception is the wide entrance corridor, which is also naturally illuminated, thus being outside the real cave environment. This is probably the main reason (compare SKET, 1977) why there are so few non-troglobiotic elements present. Plecopteran larvae were found in the main stream, but once this was a group

of very young ones (still unidentifiable), another time a single grown up (still larval) nemourid. The low number of aquatic troglonexes, the near absence of eutroglophiles and the very high number of troglobionts is usually considered as a good indicator of a good quality of the subterranean waters.

The troglobiotic fauna does not occur in high density as well, but it is very diversified. CULVER & SKET (2000) were able to list for the entire world 20 cave systems with 20 or more troglobiotic animal species; six of them host 40–84 species. Križna jama appeared with 50 troglobiotic species among the richest caves in the Dinarides and in the world.

Being within the Ljubljana drainage system, this cave is devoid of the cave tube worm (*Marifugia cavatica* ABSOLON & HRABE), present in most other parts of the Slovenian karst. More surprising is the absence or probable absence in this rich cave of two holodinaric elements which are otherwise present also in most parts of the Ljubljana drainage: the cave salamander *Proteus* and the cave shrimp *Troglocaris*. *Proteus* is however mentioned by JOSEPH (1882), under FITZINGER's (1850) name *Hypochthon freyeri*. One has to note that Fitzinger described this supposed species from the far away locality in Dolenjsko, and that neither Fitzinger nor any other author does mention *Proteus* for Križna jama later. Therefore, the locality was listed by SKET (1997) as 'most probably erroneous'. On the other hand, there are some more reliable localities in the vicinity, among them even the spring Štebrk (FITZINGER, 1850; SKET, 1997) which is hydrographically linked with Križna jama (KOGOVŠEK et al., 2008). Thus, we cannot exclude the presence of *Proteus* also in Križna jama. But no *Troglocaris* was ever reported from the wider Lož area (SKET & ZAKŠEK, 2008:fig. 2). The reason for this deficiency might be the same as for the absence in the neighboring Cerknjsko jezero of any Thiaridae, Neritidae and Unionidae (BOLE, 1979).

Biogeographical relationships of some aquatic troglobionts here are trans-Dinaric (i.e. their distribution ranges extend beyond the Dinaric region); however, some endemics are present as well. Most oligochaeta can be considered ecological generalists, present in karstic and interstitial waters of a wide part of Europe; perhaps, part of this fact may be due to a poor taxonomic practice. For example the tubificid worm *Tubifex pescei* is known from southern Italy as well; within Haplotaxidae, *Delaya bureschi* is present in Croatia, Romania, Bulgaria, Macedonia and dubitatively in Greece; within Lumbriculidae, *Trichodrilus strandi* is known from France to Slovakia. As far as we know, *Rhyacodrilus omodeoi* is endemic.

The gastropod genus *Belgrandiella* is distributed in NW Dinarides and in Southern Alps. Three co-occurring species are evidently a result of an intense speciation in the Cerknica-Vrhnik area (BOLE, 1967); their sympatry may well be of a secondary origin, while the flock encompasses a total of 7 species. *Zospeum exiguum* is a narrow endemic of this area (BOLE, 1979); surprisingly, it is an aquatic species of a terrestrial (or sometimes amphibious) genus. Most of the copepods inhabiting groundwater habitats

	AQUATIC		TERRESTRIAL
	CILIATA		GASTROPODA
**	<i>Lagenophrys monolistræ</i> STAMMER 1935	**	<i>Zospeum kusceri</i> A.J. WAGNER 1912
		**	<i>Zospeum isselianum</i> POLLONERA 1886
	TURBELLARIA		PSEUDOSCORPIONES
**	<i>Dendrocoelum</i> cf. <i>spelaeum</i> (KENK 1924)	**	<i>Neobisium (Blothrus) spelaeum spelaeum</i> (SCHIOEDTE 1848)
**	<i>Stygodyticola hadzii</i> MATJAŠIČ 1958	**	<i>Chthonius (Globochthonius) spelaeophilus spelaeophilus</i> HADŽI 1930
	GASTROPODA		ARANEAE
**	<i>Belgrandiella superior</i> (KUŠČER 1932)	**	<i>Stalita taenaria</i> SCHIOEDTE 1848 [Plate 1:5+7]
**T	<i>Belgrandiella crucis</i> (KUŠČER 1928)	**	<i>Parastalita stygia</i> (JOSEPH 1882)
**T	<i>Belgrandiella schleschi</i> (KUŠČER 1932)	**	<i>Troglohyphantes excavatus</i> FAGE 1919
**	<i>Paladilhiopsis</i> sp.	**	<i>Meta menardi</i> (LATREILLE 1804)
**	<i>Hauffenia michleri</i> KUŠČER 1932	**	<i>Metellina merianae</i> (SCOPOLI 1763)
**T	<i>Zospeum exiguum</i> KUŠČER 1932		
	OLIGOCHAETA		ACARI
**	<i>Delaya bureschi</i> (MICHAELSEN 1924) [Plate 1:1]		<i>Eugamasus loricatus</i> WANKEL 1861
**	<i>Trichodrilus strandi</i> HRABE 1936		<i>Schwiebea cavernicola</i> VITZTHUM 1932
**	<i>Trichodrilus ptujensis</i> HRABE 1963	?	<i>Ixodes vespertilionis</i> KOCH 1844
**	<i>Trichodrilus pragensis</i> VEJDOVSKY 1876		
**T	<i>Rhyacodrilus omodeoi</i> MARTINEZ-ANSEMIL, SAMBUGAR & GIANI 1997		ISOPODA
?	<i>Rhyacodrilus maculatus</i> SP. KARAMAN 1977	**	<i>Titanethes albus</i> (C. KOCH, 1841)
**	<i>Rhyacodrilus sketi</i> SP. KARAMAN 1974	**	<i>Androniscus stygius tschamerei</i> STROUHAL 1935 [Plate 2:5]
**	<i>Stylodrilus heringianus</i> CLAPARÉDE 1862		DIPLOPODA
**	<i>Tubifex pescei</i> (DUMNICKA 1981)	**	<i>Attemsia falcifera</i> VERHOEFF 1899 (= <i>Attemsia pretneri</i> STRASSER 1933)
	<i>Spirosperma velutinus</i> (GRUBE 1879)		<i>Brachydesmus</i> sp.
?	<i>Buchholzia</i> sp. (Enchytraeidae)		
	OSTRACODA		COLLEMBOLA
**	<i>Sphaeromicola stammeri</i> KLIE 1930	J	<i>Arrhopalites pygmaea</i> (WANKEL 1860) (= <i>Dicyrtoma</i> p.)
?	Ostracoda gg. spp.	J	<i>Sminthurus niveus</i> JOSEPH 1882
	COPEPODA	J	<i>Sminthurus longicornis</i> JOSEPH 1882
**	<i>Elaphoidella jeanneli</i> (CHAPPUIS 1928)	J	<i>Tritomurus scutellatus</i> FRAUENFELD 1854
**	<i>Elaphoidella stammeri</i> CHAPPUIS 1936	J	<i>Dicyrtoma spelaea</i> n.n.?
**T	<i>Lessinocamptus</i> n. sp. STOCH unpubl.	J	<i>Heteromurus albus</i> n.n.?
**	<i>Bryocamptus (Rheocamptus) balcanicus</i> s.l. (KIEFER 1933)	?	Collembola gg. spp.
*	<i>Megacyclops viridis</i> s.l. (JURINE 1820)		DIPLURA
**	<i>Acanthocyclops kieferi</i> (CHAPPUIS 1925)	**	<i>Plusiocampa (Stygiocampa) nivea</i> (JOSEPH 1882)
**	<i>Acanthocyclops troglophilus</i> (KIEFER 1932)		ORTHOPTERA
**	<i>Diacyclops languidoides goticus</i> (KIEFER 1931)		<i>Troglophilus</i> sp.
**	<i>Diacyclops charon</i> (KIEFER 1930)		
**	<i>Speocyclops infernus</i> (KIEFER 1930)		COLEOPTERA
**T	<i>Niphargus orcinus</i> JOSEPH 1868 [Plate 1:6]	**	<i>Machaerites ravasinii</i> (J. MUELLER 1922)
**	<i>Niphargus wolffi</i> SCHELLENBERG 1933	J	<i>Atheta spelaea</i> (ERICHSON 1840) (? = <i>Homalota</i> s.)
**T	<i>Niphargus stygius valvasori</i> S. KARAMAN 1952 [Plate 1:4]	**T	<i>Bathyscimorphus trifurcatus</i> JEANNEL 1924 [Plate 2:4]
*	<i>Synurella ambulans</i> F. MÜLLER 1846	**	<i>Bathysciotes k. khevenhuelleri</i> (MILLER 1852) [Plate 2:3]
		**	<i>Leptodirus h. hochenwartii</i> SCHMIDT 1832 [Plate 1:3]

Table 1: List of species recorded from Križna jama. T – Križna jama is the type locality of the taxon; ** – supposedly troglolobiotic species; * – troglolobiotic population (race).

AQUATIC		TERRESTRIAL	
	ISOPODA	**J	<i>Aphaobius milleri</i> (SCHMIDT 1855) [Plate 2:2]
**T	<i>Monolistra racovitzai</i> STROUHAL 1928 [Plate 1:2]	J	<i>Orotrechus globulipennis</i> (SCHAUM 1860) = <i>Anophtthalmus globulipennis</i> SCHMIDT = <i>A. longicornis</i> MOTSCHULSKY
	PLECOPTERA	**T	<i>Typhlotrechus bilimeki frigans</i> JEANNEL 1928 [Plate 2:6]
	Nemouridae g. sp. – larvae	**T	<i>Anophtthalmus heteromorphus</i> (J. MUELLER 1923)
			<i>Laemostenus elongatus</i> DEJEAN 1828
			<i>Laemostenus schreibersii</i> KUSTER 1846
			LEPIDOPTERA
			<i>Triphosa dubitata</i> (LINNAEUS 1758)
			<i>Scoliopteryx libatrix</i> (LINNAEUS 1758)
			DIPTERA
			<i>Phoridae</i> g. sp.
			<i>Trichoceridae</i> g. sp
		J	<i>Gymnomus troglodytes</i> LOEW 1863
		J	<i>Nycteribia latreillii</i> (LEACH 1817)
		J	<i>Nycteribia frauenfeldii</i> KOLENATI
			CHIROPTERA
			<i>Rhinolophus hipposideros</i> (BECHSTEIN 1800) [Plate 2:1]
			<i>Rhinolophus ferrumequinum</i> (SCHREBER 1774)
			<i>Myotis myotis</i> (BORKHAUSEN 1797)
			<i>Myotis daubentonii</i> (KUHLE 1819)
			<i>Eptesicus serotinus</i> (SCHREBER 1774)
			<i>Barbastella barbastellus</i> (SCHREBER 1774)
			<i>Miniopterus schreibersii</i> (KUHLE 1819) [Plate 2:7]

Table 1, continued: List of species recorded from Križna jama. T – Križna jama is the type locality of the taxon; ** – supposedly troglobiotic species; * – troglobiotic population (race).

in Križna jama are Balkanic or Dinaric elements, like the species complex *Bryocamptus balcanicus* s.l., *Acanthocyclops troglophilus* and *Diacyclops charon*. *Acanthocyclops kieferi*, *Diacyclops languidoides goticus* (so named from the “Gothic hall” [Gotska dvorana] of Postojna-Planina cave system, its type locality) and *Speocyclops infernus* are troglobionts more widely distributed in Southern Europe. Three strictly endemic harpacticoid copepods are found in Križna jama: *Elaphoidella stammeri* is endemic to Slovenian cave waters, while *Elaphoidella jeanneli* was recently found (unpublished data) in caves of Croatia and in the Carso/Kras in Italy; a new, highly specialized, species of the genus *Lessinocamptus* was recently discovered in the subterranean brook of Glavni rov. Only three described species are known from the Lessinian mountains (Central Pre-Alps in Italy).

Among malacostracans, the eutroglophilous *Synurella ambulans* is very widely distributed in Europe, which includes several slightly troglomorphic and troglobiotic populations-races in Dinarides and elsewhere. Troglomorphic is also the population found in Križna jama (alike the so-called *S. jugoslavica subterranea* S. KARAMAN 1932). The NW merodinaric elements are represented by *Niphargus orcinus*, while the distribution of *N. stygius* and

Monolistra racovitzai is limited to western Slovenia and neighbouring parts of NE Italy.

Interesting is the presence of *Sphaeromicola stammeri* and *Stygodyticola hadzii*, epizoans or exterior parasites hosted by the crustaceans of the genus *Monolistra* and *Niphargus* respectively. *Stygodyticola hadzii* is a holodinaric element (sensu SKET & ZAGMAJSTER, 2006), present on niphargid amphipods also in Hercegovina.

Also the terrestrial fauna is biogeographically diversified. *Zospeum kusceri* was found scattered over Slovenia, *Z. isselianum* inhabits all karst regions in Slovenia, i.e. the Dinaric, Alpine and isolated karst. All beetles are members either of Dinaric-Alpine (*Anophtthalmus*, *Orotrechus*) or of NW-merodinaric genera (*Aphaobius*, *Typhlotrechus*) while their local species are endemic to SW Slovenia or have a narrower distribution area. *Machaerites ravasini*, *Bathyscymorphus trifurcatus*, *Bathysciotes khevenhuelleri* are SW Slovenian, such are also the spider *Stalita taenaria* and the pseudoscorpion *Neobisium spelaeum*; except for *B. trifurcatus*, they are present in NE Italy as well. *Anophtthalmus heteromorphus* seems to be endemic to the Križna jama area. NW merodinaric are also the trichoniscid woodlouse genus *Titanethes*, the beetle species *Leptodirus hochenwartii* and its entire genus, and the spider *Parastalita stygia*.

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PLATE 1

Fig. 1 *Delaya bureschi*

Fig. 2 *Monolistra racovitzai*

Fig. 3 *Leptodirus hochenzwartii*

Fig. 4 *Niphargus stygius*

Fig. 5 *Stalita taenaria*, detail

Fig. 6 *Niphargus orcinus*

Fig. 7 *Stalita taenaria*

Not to scale.

PLATE 1



PLATE 2

Fig. 1 *Rhinolophus hipposideros*

Fig. 2 *Aphaobius* sp.

Fig. 3 *Bathysciotes* sp.

Fig. 4 *Bathyscimorphus* sp.

Fig. 5 *Titanethes albus*

Fig. 6 *Typhlotrechus bilimeki*

Fig. 7 *Miniopterus schreibersii*

Not to scale.

PLATE 2



