

New records of anchialine fauna from the Yucatan Peninsula, Mexico

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Abstract: New records for 17 species of crustaceans from anchialine systems in the Yucatan Peninsula, Mexico, are presented. The records come from explorations in Dzilam de Bravo, Yucatan, and from Puerto Aventuras and the Nohoch Nah Chich and Ox Bel Ha cave systems near Tulum in Quintana Roo, Mexico. For five of the 17 species dealt with here, the records presented constitute the second time those species are reported after their original descriptions. For the alpheid shrimp *Yagerocaris cozumel*, we present the first record of the species for continental Yucatan and for the atyid shrimp *Jonga serrei*, the second record from Mexico. Depth data are provided for all species.

Key words: Crustacea, anchialine, cenote, sinkhole, Yucatan, Quintana Roo

INTRODUCTION

The anchialine fauna of the Yucatan Peninsula, composed mainly of crustacean species, has been intensely studied for 25 years since the diving explorations of the Nohoch Nah Chich and Sac Actun systems in Quintana Roo began in 1987 (Gerard 2000). However, a few widely distributed species in the peninsula were described years before (*e.g.*, *Creaseria morleyi* and *Typhlatya pearsei* in 1936) because they could be captured from siphons inside caves with a dry initial section like Balan Canche Cave in Yucatan (Creaser 1936). Several publications have summarized what is known about the anchialine fauna of the Yucatan in different moments (Reddell 1981; Iliffe 1992, 1993; Alvarez and Iliffe 2008); in most cases a large proportion of the information has come from previous studies with very few new records appearing in each new occasion. For five species dealt with here the only previous records were those contained in the original description (*i.e.*, *Tuluweckelia cernua*, Holsinger 1990; *Metacirolana mayana*, Bowman 1987; *Typhlatya dzilamensis*, Alvarez *et al.* 2005; *Yagerocaris cozumel*, Kensley 1988; *Calliasmata nohochi*, Escobar-Briones *et al.* 1997); and for one species, the atyid *Jonga serrei* (Bouvier 1909), the record presented in this contribution is the second one for Mexico.

We present herein new records for 17 species from 7 cenotes (Figure 1). Although the distribution data are important to better define particular distribution ranges, these records, mostly obtained during 2013, are evidence of the current presence of the

species in a region that is being rapidly developed. The northeastern portion of the Yucatan Peninsula, where the Cancún-Tulum tourist corridor known as the “Riviera Maya” is located, is also the area where the largest anchialine systems are found. The rapid growth of the tourist infrastructure may compromise in the near future the preservation of these underground reservoirs. The northern coast of the peninsula is also being rapidly developed from the Port of Progreso to the east, where a number of cenotes are located. The periodic monitoring of anchialine species will become increasingly important in the future as the present period of intense urban development continues and compromises the availability of freshwater that is drawn from the same aquifer that constitutes the anchialine systems.

MATERIALS AND METHODS

Collection of organisms was conducted by cave divers using plankton nets or individually with glass vials. A Hydro-lab Multiparameter Sonde or a YSI Multiparameter Water Quality Analyzer were used to obtain water column profiles of temperature, salinity, pH and dissolved oxygen concentration. The depth at which every specimen was collected was recorded; all vials were numbered and after an organism was caught the depth was recorded for that vial, plankton tows were also conducted at depths that divers recorded above and below the halocline.

The localities where organisms were collected are referred to as “cenotes” or sinkholes; however, all organisms were collected from the aphotic (dark) zone of the submerged caves associated to each one of the cenotes mentioned. The records are arranged chronologically. Species identification was done with the aid of stereomicroscopes and in some cases using a compound microscope too. All specimens were collected under the scientific collector’s license issued to FA (FAUT 0104) by the Mexican environmental authority (SEMARNAT). All organisms are deposited in the National Crustacean Collection (CNCR) of the Institute of Biology, UNAM, Mexico City.

RESULTS

A summary of the species recorded, the number of specimens per species, the number of cenotes they were found in and if they were collected in freshwater or saltwater appears in Table 1. Following is an individual account for each species recorded.

Subphylum Crustacea
 Class Remipedia
 Order Nectiopoda
 Family Speleonectidae

Xibalbanus tulumensis (Yager, 1987)

(Figure 2A)

MATERIAL EXAMINED: 2 organisms; Cenote Muknal, 18 m depth, Tulum, Quintana Roo, Mexico; 31 July 2013, colls. T.M.

Iliffe, D. Brankovits; CNCR 28458, 28477. 1 organism, Cenote Bang, 20 m depth, Tulum, Quintana Roo, Mexico; 1 August 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 28495. 2 organisms; Cenote Odyssey, 13.4–14 m depth, Tulum, Quintana Roo, Mexico; 3 August 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 28441, 28443.

DISTRIBUTION: The known range of the species is from Cenote Crustacea, south of Puerto Morelos, to cenotes around Tulum, Quintana Roo, Mexico (Yager 1987; Alvarez and Iliffe 2008).

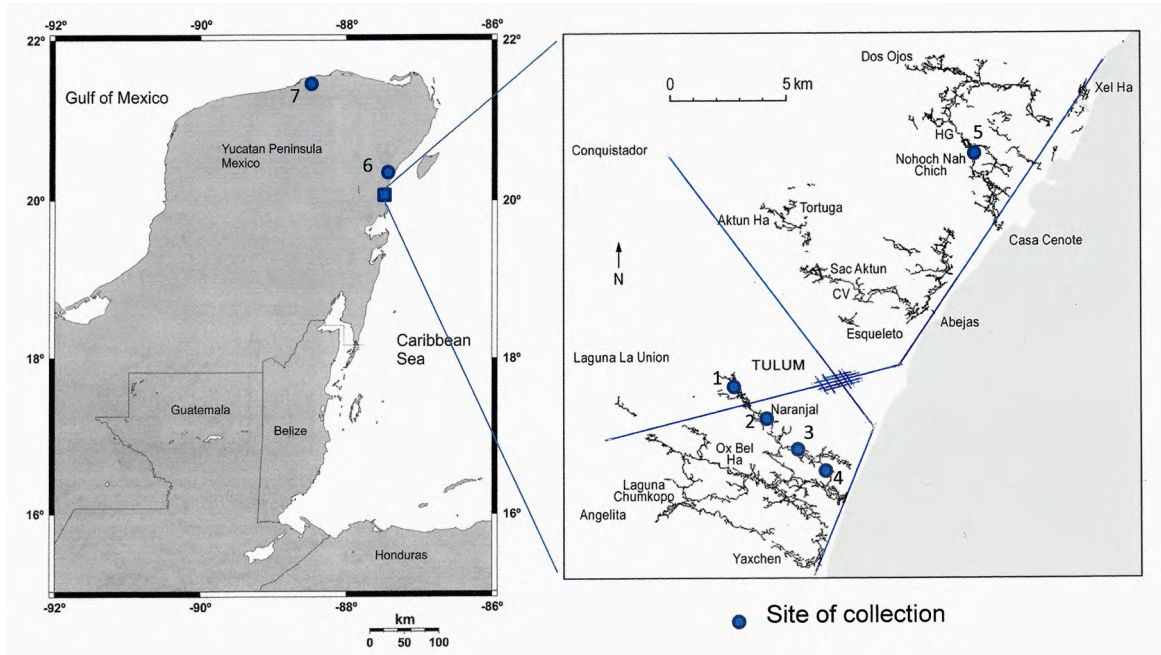


Figure 1. Map of the Yucatan Peninsula showing sites of collection: 1, Cenote Bang; 2, Cenote Muknal; 3, Cenote Odyssey; 4, Cenote Na’ach Wennen Ha; 5, Cenote Nohoch Nah Chich; 6, Cenote Eden; 7, Cenote Cervera.

Table 1. List of crustacean species and number of specimens collected from cenotes (caves) in the Yucatan Peninsula of Mexico. CB, Cenote Bang; CM, Cenote Muknal; CO, Cenote Odyssey; CW, Cenote Na’ach Wennen Ha; CN, Cenote Nohoch Nah Chich; CE, Cenote Eden; CC, Cenote Cervera.

Taxa	Salinity	CB	CM	CO	CW	CN	CE	CC	Total Specimens
Remipedia									
<i>Xibalbanus tulumensis</i> (Yager, 1987)	SW	1	2	2					5
Ostracoda									
<i>Humphreysella mexicana</i> (Kornicker and Iliffe, 1989)	SW	3	1						4
Thermosbaenacea									
<i>Tulumella unidens</i> Bowman and Iliffe, 1988	FW	6	9	6	22				43
Mysida									
<i>Antromysis cenotensis</i> Creaser, 1936	FW		4	10					14
<i>Stygiomysis cokei</i> Kallmeyer and Carpenter, 1996	FW		1		7				8
<i>Stygiomysis cf. holthuisi</i> (Gordon, 1958)	FW	2	1	1	4				8
Amphipoda									
<i>Mayaweckelia cenotocola</i> Holsinger, 1977	FW			1					1
<i>Tuluweckelia cernua</i> Holsinger, 1990	FW	4	1	3	10				18
Isopoda									
<i>Metacirolana mayana</i> (Bowman, 1987)	SW	3		6					9
<i>Creaseriella anops</i> (Creaser, 1936)	FW	6	8	3	1				18
Decapoda									
<i>Jonga serrei</i> (Bouvier, 1909)	FW					7			7
<i>Typhlatya dzilamensis</i> Alvarez, Iliffe and Villalobos, 2005	SW							2	2
<i>Typhlatya mitchelli</i> Hobbs and Hobbs, 1976	FW	5	10	9	11				35
<i>Typhlatya pearsei</i> Creaser, 1936	FW/SW	1		6	5				12
<i>Yagerocaris cozumel</i> Kensley, 1988	—						1		1
<i>Creaseria morleyi</i> (Creaser, 1936)	FW	1	2	1					4
<i>Calliasmata nohochi</i> Escobar-Briones, Camacho and Alcocer, 1997	SW		1						1

REMARKS: Previously known as *Speleonectes tulumensis* Yager, 1987, this species has now been placed in the new genus *Xibalbanus* based on a molecular phylogenetic analysis of the entire class Remipedia (Hoenemann et al. 2013). It occurs at depths below 12 m, beneath the halocline, at salinities above 32 ppt. The records presented herein correspond to cenotes 4 to 10 km inland from the coastline.

The species is listed in the Mexican Red List of Threatened Species (Semarnat 2010) as in danger of extinction; although it can be relatively common in a few cenotes, its distribution range is restricted to some cenotes in the Puerto Morelos–Tulum area.

Class Ostracoda

Family Thaumatocyprididae

Humphreysella mexicana (Kornicker & Iliffe, 1989)

(Figure 2B)

MATERIAL EXAMINED: 1 organism; Cenote Muknal, 7 m depth, Tulum, Quintana Roo, Mexico; 25 February 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 27888. 2 organisms; Cenote Bang, 17–22 m depth, Tulum, Quintana Roo, Mexico; 28 February 2013, coll. D. Brankovits; CNCR 27951, 27967. 1 organism; Cenote Bang, 18 m depth, Tulum, Quintana Roo, Mexico; 1 August 2013, coll. T.M. Iliffe; CNCR 28501.

DISTRIBUTION: The type locality is Cenote Cristal, Tulum, Quintana Roo, Mexico, but also known from Cenote Ponderosa in Puerto Aventuras, and Cenote 27 Steps in Akumal, Quintana Roo, Mexico (Kornicker and Iliffe 2000).

REMARKS: Previously known as *Danielopolina mexicana*, this species was reassigned to *Humphreysella* together with other species from around the Caribbean (Iglirkowska and Boxshall 2013). The present records expand the presence of this species into the Ox Bel Ha System, showing that it prefers moderate salinities near the halocline and cenotes that are 6 to 10 km inland from the coastline.

Class Malacostraca

Superorder Peracarida

Order Thermosbaenacea

Family Tulumellidae

Tulumella unidens Bowman & Iliffe, 1988

(Figure 2C)

MATERIAL EXAMINED: 2 organisms; Cenote Muknal, depth 13 m, Tulum, Quintana Roo, Mexico; 25 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27895, 27904. 6 organisms; Cenote Na'ach Wennen Ha, 5–9 m depth, Tulum, Quintana Roo, Mexico; 27 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27933–27935, 27939, 27948. 4 organisms; Cenote Bang, depth 10–25 m, Tulum, Quintana Roo, Mexico; 28 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27953, 27958, 27966, 27971. 2 organisms; Cenote Muknal, depth 16 m; Tulum, Quintana Roo, Mexico; 31 July 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28472, 28490. 1 organism, Cenote Odyssey, depth 13 m, Tulum, Quintana Roo, Mexico; 2 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28435. 12 organisms; Cenote Na'ach Wennen Ha, 5.2–10.1 m depth, Tulum, Quintana Roo, Mexico; 3 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28391, 28393, 28404, 28414, 28423. 5 organisms;

Cenote Muknal, depth 8.5–16 m; Tulum, Quintana Roo, Mexico; 4 December 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28472, 28490, 28613, 28616, 28617. 2 organisms; Cenote Bang, depth 10–11 m, Tulum, Quintana Roo, Mexico; 5 December 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28620, 28625. 5 organisms; Cenote Odyssey, depth 4.6–7.6 m, Tulum, Quintana Roo, Mexico; 7 December 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28583, 28592, 28593. 4 organisms; Cenote Na'ach Wennen Ha, depth 6–8.8 m, Tulum, Quintana Roo, Mexico; 8 December 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28540, 28552.

DISTRIBUTION: Cenotes Cristal, Calavera and Actun Ha, Tulum, Quintana Roo, Mexico (Bowman and Iliffe 1988; Alvarez and Iliffe 2008).

REMARKS: This species is locally abundant in cenotes around the town of Tulum, and is present throughout the Ox Bel Ha System in cenotes that range from 2 to 10 km from the coastline. Inside the caves, *T. unidens* is found at depths ranging from 4.6 to 25 m, always above the halocline.

Order Mysida

Family Mysidae

Antromysis cenotensis Creaser, 1936

(Figure 2D)

MATERIAL EXAMINED: 4 organisms; Cenote Muknal, depth 13–16 m, Tulum, Quintana Roo, Mexico; 25 February 2013; coll. T.M. Iliffe; CNCR 27885, 27892, 27908, 27911. 6 organisms; Cenote Odyssey, depth 14 m, Tulum, Quintana Roo, Mexico; 26 February 2013, coll. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27916, 27236. 4 organisms; Cenote Odyssey, depth 4.6 m, Tulum, Quintana Roo, Mexico; 2 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28446–28449.

DISTRIBUTION: Widely distributed in the central and northern portions of the Yucatan Peninsula (Reddell 1981; Alvarez and Iliffe 2008). Present in Quintana Roo from a number of cenotes in Sian Ka'an and the Tulum–Cobá region. In Yucatan it has been recorded from Grutas de Balancanché, Tinúm; and a number of cenotes that form the ring of cenotes around the city of Merida (Reddell 1981; Pérez-Aranda 1984c).

REMARKS: Although this species is listed in the Mexican Red List of Threatened Species (Semarnat 2010) as threatened, it is widely distributed and very abundant, often forming swarms of hundreds of organisms. *A. cenotensis* occurs preferentially above the halocline, from the surface to 16 m depths; however, it can occasionally be found below the halocline in moderate salinities.

Family Stygiomysidae

Stygiomysis cokei Kallmeyer & Carpenter, 1996

(Figure 2E)

MATERIAL EXAMINED: 3 organisms; Cenote Na'ach Wennen Ha, depth 7–8 m, Tulum, Quintana Roo, Mexico; 27 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27938, 27941, 27946. 1 organism; Cenote Muknal, depth 15.5 m, Tulum, Quintana Roo, Mexico; 31 July 2013; coll. T.M. Iliffe; CNCR 28478. 4 organisms; Cenote Na'ach Wennen Ha, depth 6–9.8 m, Tulum, Quintana Roo, Mexico; 3 August 2013; colls.

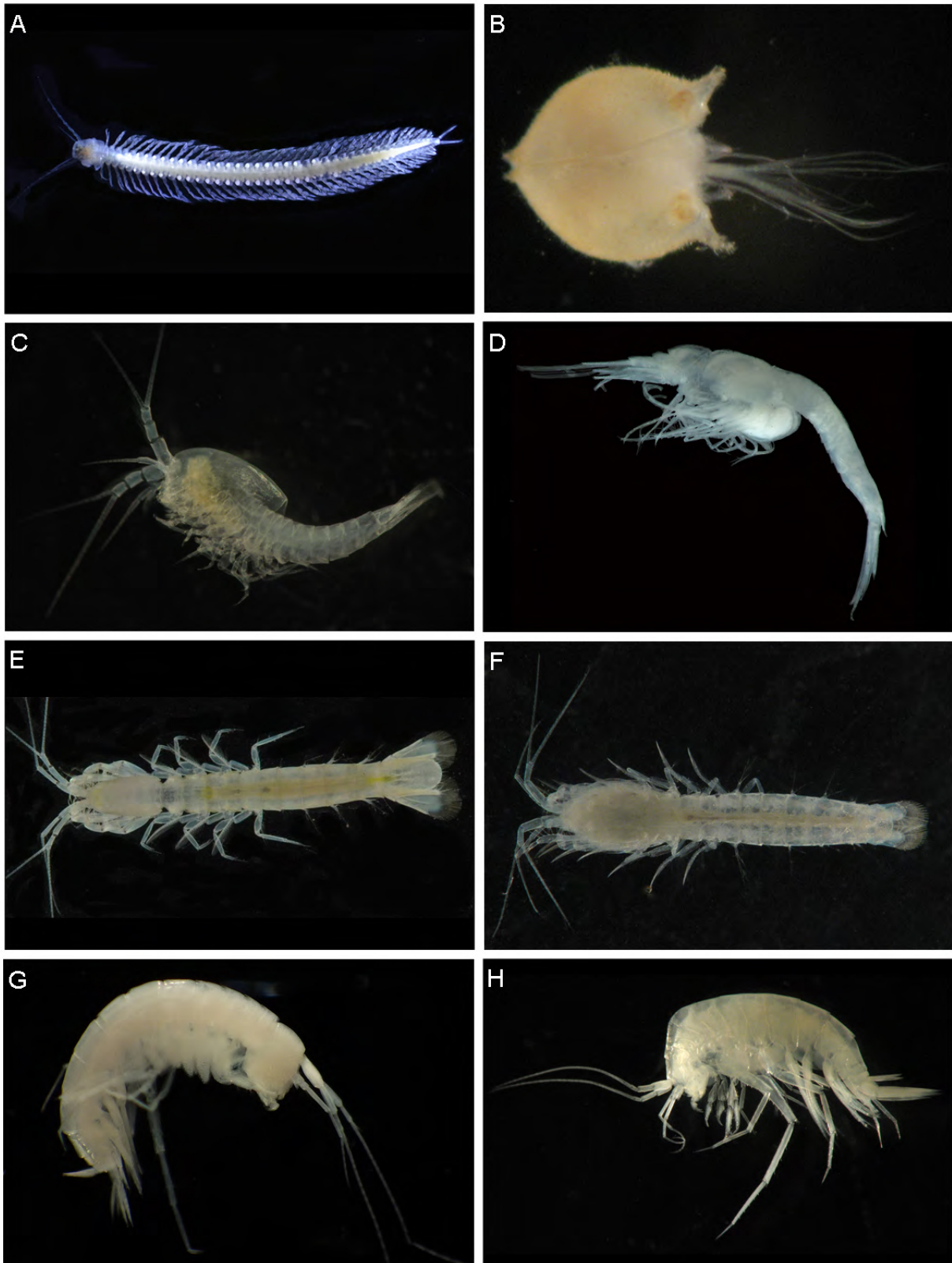


Figure 2. A, *Xibalbanus tulumensis* (Remipedia); B, *Humphreysella mexicana* (Ostracoda); C, *Tulumella unidens* (Thermosbaenacea); D, *Antromyysis cenotensis* (Mysida); E, *Stygiomysis cokei* (Mysida); F, *Stygiomysis cf. holthuisi* (Mysida); G, *Mayaweckelia cenoticola* (Amphipoda); *Tuluweckelia cernua* (Amphipoda).

T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28395, 28401, 28410.

DISTRIBUTION: In Quintana Roo: Cenotes Calavera, Escondido, Actun Ha, Cristal and Actun Ko; in Yucatan: Cenotes Pabakal, San Eduardo, Kankirixché, Mucuyché and Dzonotila (Pesce and Iliffe 2002).

REMARKS: The present records show that *S. cokei* occurs in low salinities (2–5 ppt) above the halocline in cenotes 2 to 4 km inland from the coastline.

Stygiomysis cf. holthuisi (Gordon, 1958)

(Figure 2F)

MATERIAL EXAMINED: 3 organisms; Cenote Na'ach Wennen Ha, depth 7–10 m, Tulum, Quintana Roo, Mexico; 27 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27932, 27937, 27945. 2 organisms; Cenote Bang, depth 13 m, Tulum, Quintana Roo, Mexico; 28 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27968, 27976. 1 organism; Cenote Muknal, depth 15.2 m, Tulum, Quintana Roo, Mexico; 31 July 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28482. 1 organism; Cenote Odyssey, depth 14.6 m, Tulum, Quintana Roo, Mexico; 2 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28445. 1 organism; Cenote Na'ach Wennen Ha, depth 8.2 m, Tulum, Quintana Roo, Mexico; 3 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28394.

DISTRIBUTION: *Stygiomysis holthuisi* was described from material collected in St. Martin, Lesser Antilles (Gordon 1958), and was subsequently reported from Puerto Rico, Anguilla and the Bahamas (Bowman *et al.* 1984). Pesce and Iliffe (2002) reported the species from cenotes in Quintana Roo (Escondido and Casa Cenote) and Yucatan (Mucuyché), Mexico.

REMARKS: The organisms identified as *Stygiomysis holthuisi* from the Yucatan Peninsula agree well, but not completely, with the description of the species. Pesce and Iliffe (2002) had already pointed out several differences seen in the Yucatan organisms, to which we could add a larger uropod length in relation to the telson length. It seems very possible that a new species will be erected to accommodate the Yucatan specimens.

Order Amphipoda

Family Hadziidae

Mayaweckelia cenoticola Holsinger, 1977

(Figure 2G)

MATERIAL EXAMINED: 1 organism; Cenote Odyssey, depth 6.1 m, Tulum, Quintana Roo, Mexico; 7 December 2013; coll. T.M. Iliffe; CNCR 28596.

DISTRIBUTION: Along the northern portion of the Yucatan Peninsula (Holsinger 1977; Reddell 1981).

REMARKS: Although this species has been regarded as common in other parts of the Yucatan Peninsula, it is rare in the Ox Bel Ha System, appearing only once at moderate depth in freshwater.

Tuluweckelia cernua Holsinger, 1990

(Figure 2H)

MATERIAL EXAMINED: 7 organisms; Cenote Na'ach Wennen Ha, depth 6–9 m, Tulum, Quintana Roo, Mexico; 27

February 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 27928, 27940, 27942, 27943, 27947, 27949. 2 organisms; Cenote Bang, depth 12–14 m, Tulum, Quintana Roo, Mexico; 28 February 2013; coll. T.M. Iliffe; CNCR 27961, 27970. 1 organism; Cenote Muknal, depth 12.8 m, Tulum, Quintana Roo, Mexico; 31 July 2013; colls. T.M. Iliffe; CNCR 28479. 2 organisms; Cenote Bang, depth 8–16 m, Tulum, Quintana Roo, Mexico; 1 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28497, 28498. 1 organism; Cenote Odyssey, depth 8.8 m, Tulum, Quintana Roo, Mexico; 2 August 2013; coll. D. Brankovits; CNCR 28433. 3 organisms; Cenote Na'ach Wennen Ha, depth 4–10.1 m, Tulum, Quintana Roo, Mexico; 3 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28387, 28400, 28422. 2 organisms; Cenote Odyssey, depth 9.1–13.7 m, Tulum, Quintana Roo, Mexico; 7 December 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 28580, 28611.

DISTRIBUTION: In Quintana Roo in the following cenotes around Tulum: Calavera, Aktun Ha, Escondido, Mojarra and Cristal (Holsinger 1990).

REMARKS: The records presented herein are the first to be published about *T. cernua* after Holsinger (1990). The species is common in the Ox Bel Ha System; it is clearly a freshwater species occurring always above the halocline to depths of 16 m.

Order Isopoda

Family Cirolanidae

Metacirolana mayana (Bowman, 1987)

(Figure 3A)

MATERIAL EXAMINED: 1 organism; Cenote Bang, depth 19 m, Tulum, Quintana Roo, Mexico; 28 February 2013, coll. T.M. Iliffe; CNCR 27954. 2 organisms; Cenote Bang, depth 19–21 m, Tulum, Quintana Roo, Mexico; 1 August 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 28499, 28504. 3 organisms; Cenote Odyssey, depth 14–15 m, Tulum, Quintana Roo, Mexico; 2 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28439, 28451, 28456. 3 organisms; Cenote Odyssey, depth 15 m, Tulum, Quintana Roo, Mexico; 7 December 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28599, 28604, 28608.

DISTRIBUTION: Known from Quebrada Cave in Chankanaab Park, Cozumel and Cenote Calavera, Tulum, Quintana Roo, Mexico (Bowman 1987).

REMARKS: The records presented herein are the first to be published after Bowman (1987) original description of the species. *Metacirolana mayana* was always collected at or below the halocline in salinities of 32 ppt or higher.

Creaseriella anops (Creaser, 1936)

(Figure 3E)

MATERIAL EXAMINED: 7 organisms; Cenote Muknal, 8–16 m depths, Tulum, Quintana Roo, Mexico; 25 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27874, 27899, 27902, 27903, 27909, 27910, 27912. 2 organisms; Cenote Odyssey, depth 13–14 m, Tulum, Quintana Roo, Mexico; 26 February 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 27917, 27920. 1 organism; Cenote Na'ach Wennen Ha, depth 8 m, Tulum, Quintana Roo, Mexico; 27 February 2013, coll. D. Brankovits; CNCR 27927. 5 organisms; Cenote Bang, depth 12–17 m, Tulum, Quintana Roo, Mexico; 28 February 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 27956, 27957, 27960, 27962, 27973. 1 organism; Cenote Bang,

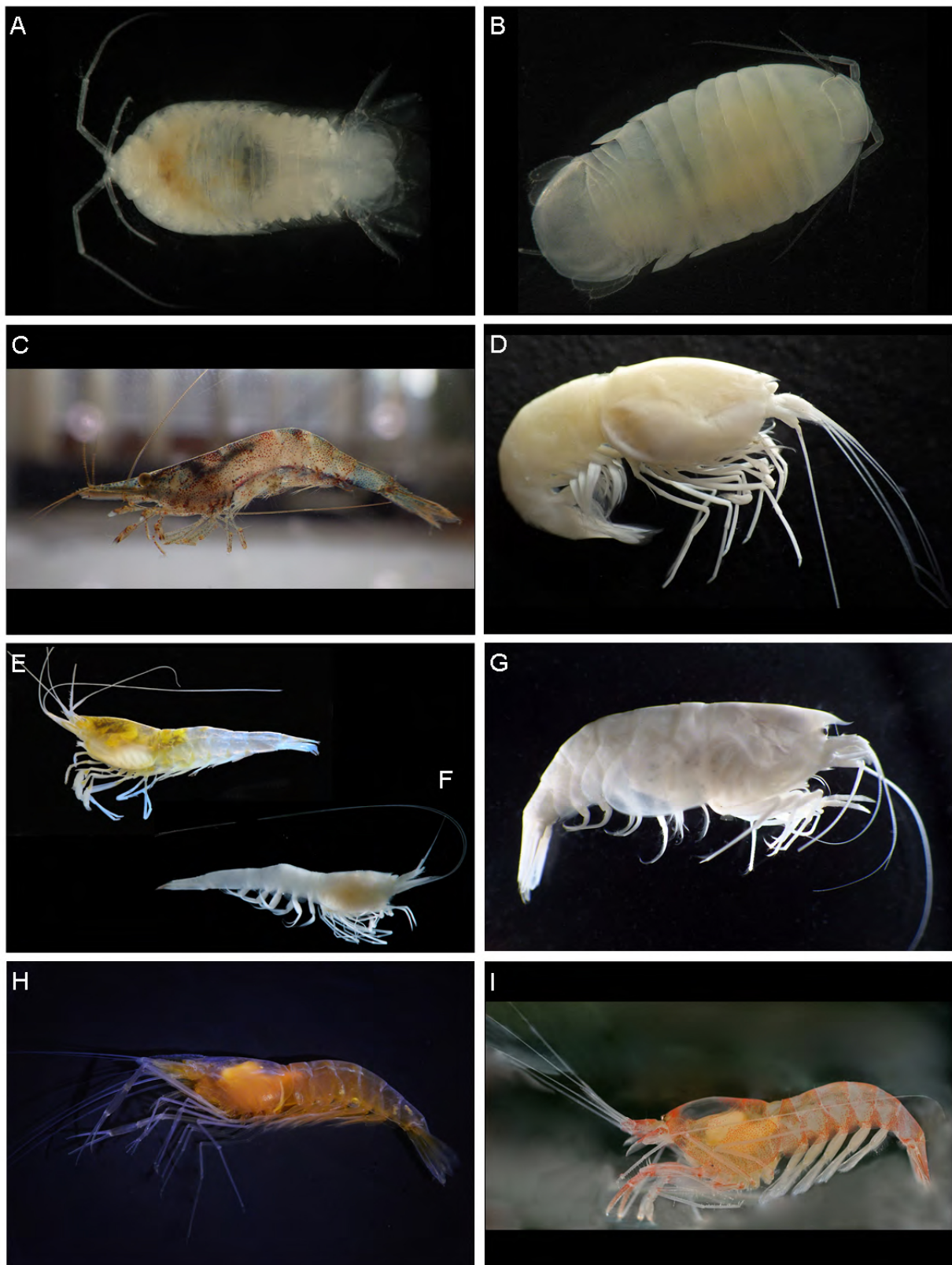


Figure 3. A, *Metacirolana mayana* (Isopoda); B, *Creaseriella anops* (Isopoda); C, *Jonga serrei* (Atyidae); D, *Typhlatya dzilamensis* (Atyidae); E, *Typhlatya mitchelli* (Atyidae); F, *Typhlatya pearsei* (Atyidae); G, *Yagerocaris cozumel* (Alpheidae); H, *Creaseria morleyi* (Palaemonidae); I, *Calliasmata nohochi* (Hip-polytidae).

depth 5 m, Tulum, Quintana Roo, Mexico; 1 August 2013; coll. D. Brankovits; CNCR 28491. 1 organism; Cenote Odyssey, depth 15 m, Tulum, Quintana Roo, Mexico; 2 August 2013; coll. T.M. Iliffe; CNCR 28440. 1 organism; Cenote Muknal, depth 10 m, Tulum, Quintana Roo, Mexico; 8 December 2013; coll. D. Brankovits; CNCR 28615.

DISTRIBUTION: Throughout the central and northern portions of the Yucatan Peninsula, Mexico (Pérez-Aranda 1984b; Alvarez and Iliffe 2008).

REMARKS: *Creaseriella anops* is listed in Mexican Red List of Threatened Species (Semarnat 2010) as threatened; however, the species is usually common within its range and depending on the sampling method, it can be abundant. It was present in all cenotes studied in the Ox Bel Ha System.

Order Decapoda
Family Atyidae

Jonga serrei (Bouvier, 1909)
(Figure 3C)

MATERIAL EXAMINED: 7 organisms; Cenote Nohoch Nah Chich, depth 0–8 m, Quintana Roo, Mexico; 28 June 2014; colls. T.M. Iliffe, J.L. Villalobos, S. Benitez; CNCR 29150.

DISTRIBUTION: Cuba, Jamaica, Puerto Rico, Dominica, Barbados, Costa Rica and Mexico (Chace and Hobbs 1969; Alvarez and Iliffe 2008).

REMARKS: Alvarez and Iliffe (2008) first reported this species from Cenote del Mar, south of Tulum, Quintana Roo. The present record is the second for the species in Mexico. Although considered to be a coastal species, the two records from Mexico are from caves. The organisms collected are pigmented with normal eyes, not showing any obvious adaptation to cave life, and, as pointed out by Alvarez and Iliffe (2008), the Mexican organisms are larger (26 mm of total length (TL)) than those previously reported from around the Caribbean (15 mm TL). In Cenote Nohoch Nah Chich, this species occurs in the cave entrance in semi-darkness and inside the cave.

Typhlatya dzilamensis Alvarez, Iliffe & Villalobos, 2005
(Figure 3D)

MATERIAL EXAMINED: 2 organisms; Cenote Cervera, depth 10–12 m, Dzilam de Bravo, Yucatan, Mexico; 6 December 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 29057.

DISTRIBUTION: Only known from two cenotes in the town of Dzilam de Bravo, Yucatan and one from Buya Uno, a marine cave 300 m offshore from the town in the Gulf of Mexico (Alvarez *et al.* 2005).

REMARKS: The record presented herein represents the second time the species is collected. The first collections of the species used to describe it were made in 2002 (Alvarez *et al.* 2005). *Typhlatya dzilamensis* was collected again in the type locality at depths ranging between 10–12 m in fully marine water, while *T. mitchelli* was also found at depths shallower than 4 m in freshwater.

Typhlatya mitchelli Hobbs & Hobbs, 1976
(Figure 3E)

MATERIAL EXAMINED: 5 organisms; Cenote Muknal, depth 9–11 m, Tulum, Quintana Roo, Mexico; 25 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27866, 27891,

27893, 27894, 27906. 2 organisms; Cenote Odyssey, depth 10 m, Tulum, Quintana Roo, Mexico; 26 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27915, 27918. 4 organisms; Cenote Na'ach Wennen Ha, depth 7–8 m, Tulum, Quintana Roo, Mexico; 27 February 2013, colls. T.M. Iliffe, D. Brankovits; CNCR 27929, 27931, 27944, 27950. 2 organisms; Cenote Na'ach Wennen Ha, depth 8–13 m, Tulum, Quintana Roo, Mexico; 28 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27955, 27963. 3 organisms; Cenote Muknal, depth 8–11 m, Tulum, Quintana Roo, Mexico; 31 July 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28470, 28476, 28486. 2 organisms; Cenote Bang, depth 14–18 m, Tulum, Quintana Roo, Mexico; 1 August 2013; colls. T.M. Iliffe, D. Brankovits; 28492, 28493. 5 organisms; Cenote Odyssey, depth 4.6–10.4 m, Tulum, Quintana Roo, Mexico; 2 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28432, 28434, 28436, 28437, 28450. 4 organisms; Cenote Na'ach Wennen Ha, depth 4.2–10.1 m, Tulum, Quintana Roo, Mexico; 3 August 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28402, 28403, 28405, 28415. 2 organisms; Cenote Muknal, depth 7.3–8.5 m, Tulum, Quintana Roo, Mexico; 4 December 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 28614, 28618. 3 organisms; Cenote Bang, depth 9–16 m, Tulum, Quintana Roo, Mexico; 5 December 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28624, 28630, 28634. 2 organisms; Cenote Odyssey, depth 6–9 m, Tulum, Quintana Roo, Mexico; 7 December 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 28584, 28586. 1 organism; Cenote Na'ach Wennen Ha, depth 7.9 m, Tulum, Quintana Roo, Mexico; 8 December 2013; coll. T. Winkler; CNCR 28572.

DISTRIBUTION: Throughout the Yucatan Peninsula, from the western portion at Maxacaná, south of Merida, Yucatan, to the cenotes between Akumal and Tulum, Quintana Roo; to the north it occurs near Tizimin, Yucatan, Mexico (Pérez-Aranda 1984a; Alvarez and Iliffe 2008).

REMARKS: This species is listed in the Mexican Red List of Threatened Species (Semarnat 2010) as threatened; however, similar to other anchialine species, it is very common within its range. It occurs from the surface in cave pools to depths of 18 m, always in freshwater. *T. mitchelli* is considered as a common species in the Ox Bel Ha System.

Typhlatya pearsei Creaser, 1936
(Figure 3F)

MATERIAL EXAMINED: 2 organisms; Cenote Odyssey, depth 13–15 m, Tulum, Quintana Roo, Mexico; 26 February 2013; colls. T.M. Iliffe, D. Brankovits, B. Phillips; CNCR 27921, 27925. 1 organism; Cenote Na'ach Wennen Ha, depth 8 m, Tulum, Quintana Roo, Mexico; 27 February 2013; coll. D. Brankovits; CNCR 27930. 1 organism; Cenote Bang, depth 12 m, Tulum, Quintana Roo, Mexico; 28 February 2013; coll. D. Brankovits; CNCR 27969. 2 organisms; Cenote Na'ach Wennen Ha, depth 6.9–8.2 m, Tulum, Quintana Roo, Mexico; 3 August 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 28397, 28417. 4 organisms; Cenote Odyssey, depth 4–14 m, Tulum, Quintana Roo, Mexico; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28581, 28585, 28590, 28602. 2 organisms; Cenote Na'ach Wennen Ha, depth 6.4–8.8 m, Tulum, Quintana Roo, Mexico; 8 December 2013; colls. T.M. Iliffe, D. Brankovits, T. Winkler; CNCR 28541, 28574.

DISTRIBUTION: Widely distributed in the northern portion of the Yucatan Peninsula. It occurs from Champoton, Campeche, to Telchac Puerto in the northern coast of Yucatan, to the cenotes in the area of Tulum and Akumal, Quintana Roo (Perez-Aranda 1983b).

REMARKS: This species is listed in Mexican Red List of Threatened Species (Semarnat 2010) as threatened; however, this is the species of *Typhlatya* in the Yucatan Peninsula with the largest distribution range. It occurs in freshwater above the halocline to depths of 15 m.

Family Alpheidae

Yagerocaris cozumel Kensley, 1988 (Figure 3G)

MATERIAL EXAMINED: 1 organism; Cenote Eden, Solidaridad, Quintana Roo, Mexico; 30 July 2006; coll. T.M. Iliffe; CNCR 24869.

DISTRIBUTION: Previously known from Cenote Aerolito which is the type locality of the species, and Cueva la Quebrada, Chankanaab Park; both sites in the island of Cozumel, Quintana Roo, Mexico (Kensley 1988).

REMARKS: The present record extends the distribution of the species to continental Yucatan, since it was previously considered an insular species from the island of Cozumel (Alvarez and Iliffe 2008). The present record is also the first one to appear since the description of the species by Kensley (1988).

Family Palaemonidae

Creaseria morleyi (Creaser, 1936) (Figure 3H)

MATERIAL EXAMINED: 1 organism; Cenote Bang, depth 16 m, Tulum, Quintana Roo, Mexico; 28 February 2013; coll. D. Brankovits; CNCR 27959. 2 organisms; Cenote Muknal, depth 14–15 m, Tulum, Quintana Roo, Mexico; 31 July 2013; colls. T.M. Iliffe, D. Brankovits; CNCR 28464, 28467. 1 organism; Cenote Na'ach Wennen Ha, depth 10 m, Tulum, Quintana Roo, Mexico; 3 August 2013; coll. T.M. Iliffe; CNCR 28425.

DISTRIBUTION: Widely distributed in the northern section of the Yucatan Peninsula in Yucatan and Quintana Roo. The species has been recorded from many cenotes composing the “Ring of Cenotes” around the City of Merida, but also from the cenotes along the coast of Quintana Roo (Perez-Aranda 1983a; Botello and Alvarez 2006, 2010).

REMARKS: This species is listed in Mexican Red List of Threatened Species (Semarnat 2010) as threatened. *C. morleyi* is one of the species with the widest distribution in the Yucatan Peninsula, it occurs mostly in freshwater at shallow depths to 16 m.

Family Hippolytidae

Calliasmata nohochi Escobar-Briones, Camacho & Alcocer, 1997 (Figure 3I)

MATERIAL EXAMINED: 1 organism; Cenote Muknal, depth 18 m, Tulum, Quintana Roo, Mexico; 31 July 2013; coll. T.M. Iliffe; CNCR 28483.

DISTRIBUTION: Previously known only from two caves: Cenote Crack House (type locality), in the Nohoch Nah Chich

System; and Cenote Escondido, in the Ox Bel Ha System.

REMARKS: This is a very rare species that has been collected only three times, the material from the first two collections is mentioned in the description of the species (Escobar-Briones *et al.* 1997). The new record comes from Cenote Muknal, which is also part of the Ox Bel Ha System, to the southeast of Cenote Escondido.

DISCUSSION

Until now, 45 anchialine species of crustaceans from the Yucatan Peninsula have been recognized (Alvarez and Iliffe 2008; Alvarez *et al.* 2012; Neiber *et al.* 2012; Boxshall *et al.* 2014); other anchialine fauna include an undescribed species of gastropod, one or possibly two echinoderms (Solís-Marín and Laguarda-Figuera 2010) and two species of fish (Alvarez and Iliffe 2008). We estimate that 31, out of the known 45 crustacean species, could have been collected during the present survey as they are widely distributed in Quintana Roo or have more ample distribution ranges. The other 14 species are known only from their type locality in the states of Yucatan and Campeche or are restricted to the island of Cozumel. We report on 17 species, 55% of the possible 31 species, however no copepods are included in this paper as they will be treated in an upcoming contribution on anchialine plankton.

Regarding the identity of the organisms collected, all could be readily identified to species, except the mysid shrimp referred to here as *Stygiomysis* cf. *holthuisi*. In this case, several characters do not agree completely with the original description; a comparative study with samples from other locations in the Yucatan Peninsula and from around the Caribbean region would be necessary to determine if this is a wide ranging species with a significant degree of morphological variation or a species complex. In the case of *Jonga serrei*, even when the closest records are those from Cuba and Costa Rica, no significant variation from the description was noted.

Our results confirm a wide distribution for several species, a pattern that is consistent with the degree of connectivity that has become apparent in the anchialine systems of the eastern portion of Quintana Roo, where cenotes, kilometers of passageways, and new connections between systems, are being discovered and explored each year (Bauer-Gottwein *et al.* 2011). The records presented herein expand the distribution ranges of 9 of the 17 reported species and represent for five species the second time they are collected after their original description. Six of the 17 species reported herein are included in the Mexican Red List of Threatened Species (Semarnat 2010). Considering the new records, the hadziid *Tuluweckelia cernua*, the cirolanid *Metacirrolana mayana*, the atyid *Typhlatya dzilamensis*, the alpheid *Yagerocaris cozumel*, and the hippolytid *Calliasmata nohochi*, should be included in the Red List due to their confirmed reduced distribution range and/or to the low numbers that have been collected that suggest very small natural populations.

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