

TRABAJOS ORIGINALES

**Notes on *Halicyclops* (Copepoda, Cyclopoida, Cyclopidae) from Colombia and the western Caribbean: a new record with a key to species of Group "B" sensu Rocha (1991)**

**Notas sobre *Halicyclops* (Copepoda, Cyclopoida, Cyclopidae) de Colombia y el Caribe occidental: un nuevo registro con una clave para las especies del Grupo "B" sensu Rocha (1991)**

Juan M. Fuentes-Reinés <sup>1\*</sup> and Eduardo Suárez-Morales <sup>2</sup>

1 Universidad del Magdalena, Grupo de Investigación en Biodiversidad y Ecología Aplicada, A. A. 731 Santa Marta, Colombia.

2 El Colegio de la Frontera Sur, Unidad Chetumal, A.P. 424, 77014 Chetumal, Quintana Roo, México

\* Corresponding author.

Email Juan M. Fuentes: [juanfuentesreines@gmail.com](mailto:juanfuentesreines@gmail.com)

Email Eduardo Suárez: [esuarez@ecosur.mx](mailto:esuarez@ecosur.mx)

---

**Abstract**

Three species of brackish waters microcrustaceans are herein recorded; they belong to the cyclopoid copepod genus *Halicyclops* and were collected from a coastal system in northern Colombia: *H. exiguus* Kiefer, 1934, *H. venezuelaensis* Lindberg, 1954, and *H. hurlberti* Rocha, 1991. The former has intraspecific variations that deserve further study. The finding of the latter species, previously known from the Eastern Tropical Pacific, represents a new record for Colombia and the Caribbean Sea Basin in the Northwestern Tropical Atlantic. With the finding of *H. hurlberti* the number of species of *Halicyclops* known from the Neotropical region and Colombia increases to 20 and 5, respectively. The regional diversity of the genus is probably underestimated. A key to species of the genus belonging to group "B" sensu Rocha (1991) is also provided.

**Keywords:** *Halicyclops*; Caribbean Sea; distribution; brackish water crustaceans; taxonomy.

**Resumen**

Se registran tres especies de microcrustáceos de aguas salobres; son copépodos ciclopoides del género *Halicyclops* procedentes de un sistema costero en el norte de Colombia: *H. exiguus* Kiefer, 1934, *H. venezuelaensis* Lindberg, 1954 y *H. hurlberti* Rocha, 1991. La primera especie tiene una variación intraespecífica que merece estudios más profundos. El hallazgo de la última especie es conocida sólo en el Pacífico Tropical Oriental, representa un registro nuevo para Colombia y la cuenca del Mar Caribe en el Atlántico tropical noroccidental. Con el hallazgo de *H. hurlberti*, la cantidad de especies de *Halicyclops* reconocidas en la región Neotropical y Colombia aumenta a 20 y 5, respectivamente. La diversidad regional del género probablemente está subestimada. Se proporciona una clave para las especies del género que pertenecen al grupo "B" sensu Rocha (1991).

**Palabras claves:** *Halicyclops*; Mar Caribe; distribución; crustáceos de aguas salobres; taxonomía.

---

**Citation:**

Fuentes-Reinés J.M. & E. Suárez-Morales. 2018. Notes on *Halicyclops* (Copepoda, Cyclopoida, Cyclopidae) from Colombia and the western Caribbean: a new record with a key to species of Group "B" sensu Rocha (1991). *Revista peruana de biología* 25(2): 141 - 146 (Mayo 2018). doi: <http://dx.doi.org/10.15381/rpb.v25i2.14688>

**Received:** 06/12/2017

**Accepted:** 26/02/2018

**Published online:** 30/05/2018

**Author contributions.** JFR collected the samples; JFR and ES identified the specimens, JFR and ES wrote the text.

**Conflict of interest.** The authors declare that they have no conflict of interest.

**Journal home page:** <http://revistasinvestigacion.unmsm.edu.pe/index.php/rpb/index>

© Los autores. Este artículo es publicado por la Revista Peruana de Biología de la Facultad de Ciencias Biológicas, Universidad Nacional Mayor de San Marcos. Este es un artículo de acceso abierto, distribuido bajo los términos de la Licencia Creative Commons Atribución-NoComercial-CompartirIgual 4.0 Internacional. (<http://creativecommons.org/licenses/by-nc-sa/4.0/>), que permite el uso no comercial, distribución y reproducción en cualquier medio, siempre que la obra original sea debidamente citadas. Para uso comercial, por favor póngase en contacto con [editor.revperubiol@gmail.com](mailto:editor.revperubiol@gmail.com).

## Introduction

The cyclopoid copepod *Halicyclops* is a cosmopolitan genus represented by free-living planktonic forms (Chang 2012, Ueda and Nagai 2012); members of this genus dwell in a wide range of habitats, having been recorded from shallow coastal environments, including brackish coastal habitats and estuaries (Suárez-Morales and Fuentes-Reinés 2014, Fuentes-Reinés and Suárez-Morales 2015), salt marshes (Chang 2012), anchialine caves (Rocha et al. 2000), inland waters with increased salinity (Karanovic 2004), and fresh water (Rocha 1995a, Defaye & Dussart 1988, Fuentes-Reinés et al. 2013, Luong 2016). A few species are known to live loosely associated with benthic invertebrates (Humes 1947).

According to Walter and Boxshall (2017) the genus currently contains 99 valid species and 13 subspecies, but the genus is in need of revision. In the Neotropical region 19 valid species have been recorded (Rocha 1995a, Rocha et al. 1998, Suárez-Morales and Fuentes-Reinés 2014). Of these, only three species are hitherto known from Colombia: *H. venezuelaensis* Lindberg, 1954, *H. exiguus* Kiefer, 1934, and the recently described *H. gaviariai* Suárez-Morales and Fuentes-Reinés 2014. The first species is known from Ciénaga Grande de Santa Marta, Magdalena and Laguna Navío Quebrado (Fuentes-Reinés et al. 2013, Fuentes-Reinés and Suárez-Morales 2015) whereas the other two only from the Laguna Navío Quebrado, La Guajira, (Suárez-Morales and Fuentes-Reinés 2014, Fuentes-Reinés and Suárez-Morales 2015).

During a survey of the plankton community of the Ciénaga Grande de Santa Marta, in the Colombian coast of the Caribbean, three species of the genus *Halicyclops* were collected: *H. exiguus*, *H. venezuelaensis*, and *H. hurlberti* Rocha, 1991. The aim of this paper is to provide additional morphologic data of these taxa and report the first occurrence of the latter species in the Caribbean. A key to the species of the genus (*sensu* Rocha, 1991) including *H. hurlberti*, is also provided.

## Material and methods

Plankton samples were taken monthly from the Ciénaga Grande de Santa Marta, Colombia (10°52'11.25"N; 74°19'31.64"W) from January to October 2017, mainly in the littoral areas with vegetation (mangrove) but also from open water. One thousand nine hundred forty-four (1944) liters of water were taken using a bucket of 25 L, filtered with a zooplankton net (45 µm), and preserved in 70% ethanol.

Water salinity was measured with a WTW 3111 conductivity meter. Copepods were sorted from the original samples and then processed for taxonomical identification. Dissected specimens and appendages were mounted in glycerine and sealed with Canada balsam. Digital photographs were taken using a Kodak Easy Share C140 camera attached to a compound Olympus CX22 microscope. The specimens were measured in lateral position, from the anterior end of the rostral area to the posterior margin of the caudal ramus.

The specimens examined were deposited at the Museo de Colecciones Biológicas at the Universidad del Atlántico (UARC), Colombia. Morphological terminology follows Huys and Boxshall (1991). The following abbreviations are used in the descriptive section: P1–P6= first to sixth swimming legs, EXP= exopod, ENP= endopod, aps = apical seta, ins= Inner seta, Fig = Figure, UARC = Universidad del Atlántico Región

Caribe, µm = micron

## Taxonomy

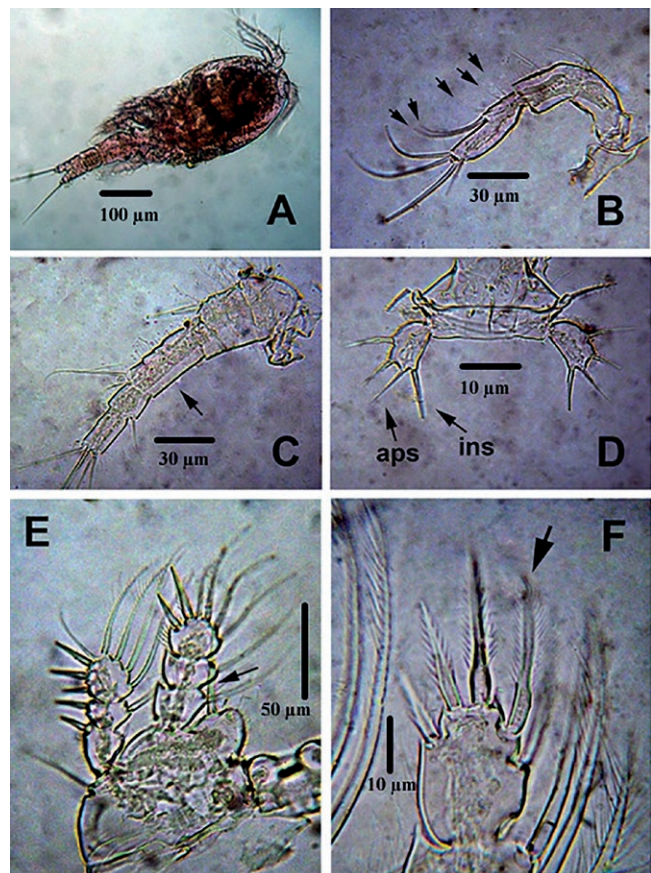
ORDER CYCLOPOIDA BURMEISTER, 1834  
FAMILY CYCLOPIDAE DANA, 1846  
SUBFAMILY HALICYCLOPINAE KIEFER, 1927  
GENUS *HALICYCLOPS* NORMAN, 1903

### *Halicyclops exiguus* Kiefer, 1934

Figures 1A-E

**Material examined.** Three adult females (UARC359-367M), Ciénaga Grande de Santa Marta, Colombia, coll. J.M. Fuentes Reinés.

**Remarks.** The specimens from Colombia share the diagnostic features from specimens of *H. exiguus* previously reported from the adjacent Guajira department in Colombia (Fuentes-Reinés and Suárez-Morales 2015). Body robust, compact anteriorly (Fig. 1A). Body length, excluding caudal setae 490 µm ( $n=3$ ). This species can be easily separated from its congeners by a combination of the following characteristics that are present in our specimens: 1) last segment of antenna with five lateral setae (arrows in Fig. 1B), length/wide ratio about 3.0 (Fig. 1B), 2) fourth segment of female antennule less than twice as long as wide (Fig. 1C), 3) female P5 exopod elongate, inner spine (ins) and apical seta (aps) as long as or longer than the segment (Fig. 1D), 4) Inner basipodal spine of P1 (arrow in Fig. 1E) reaching at least midlength of third endopod of P1, 5) P4ENP3



**Figure 1.** *Halicyclops exiguus*, Female. A. Habitus, B. Antenna, C. Antennule, D. P5. E. P1. F. P4ENP3



with proximal inner seta (arrow in Fig. 1F) not reaching tip of inner apical spine.

In the specimens from Santa Marta examined the inner proximal seta of P4ENP3 does not reach beyond the apical inner seta (Fig. 1F), but in the specimens reported by Kiefer (1934, Abb. 3) from Haiti, Collado et al. (1984, fig. 7) from Costa Rica, and Fuentes-Reinés and Suárez-Morales (2015, fig. 2e) from another Colombian locale, the inner proximal seta of P4ENP3 does reach beyond the apical element. This character appears to be variable in the species.

**Distribution.** Hitherto, this species has been recorded only from the Neotropical region; it has been reported in Haiti (Kiefer 1934) (but see Rocha et al. 1998), Costa Rica (Collado et al. 1984), French Guiana (Defaye and Dussart 1988), and Brazil (Rocha and Iliffe 1993). In Colombia this species has been reported in La Guajira department (Fuentes-Reinés-Suárez-Morales 2015); the present record represents a modest range expansion in the country, which now includes the Magdalena Department. It is also the second record of the species in the Caribbean coast of Colombia.

***Halicyclops venezuelaensis* Lindberg, 1954**

(Figs 2A-D, 3A, B)

**Material examined.** One adult female (UARC353-358M), Ciénaga Grande de Santa Marta, Colombia, coll. J.M. Fuentes Reinés.

**Remarks.** The specimen examined bears the diagnostic features of *H. venezuelaensis* as described by Lindberg (1954), Rocha (1995b) and Fuentes-Reinés et al. (2013). Body robust

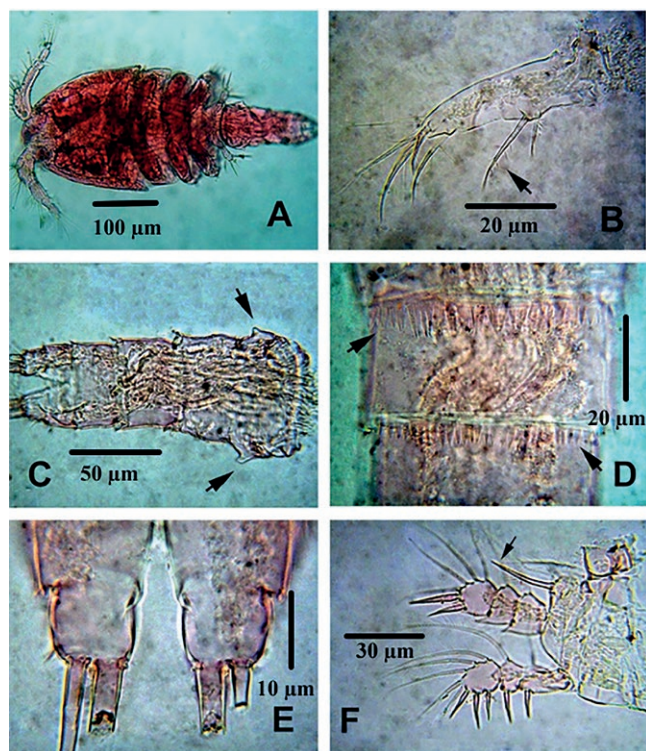
(Fig. 2A); length excluding caudal setae: 616  $\mu$ m. It can be easily recognized by a combination of characters including: 1) the long proximal seta on the first segment of maxilliped (arrow in Fig. 2B), 2) genital double-somite with lateral protuberances (Fig. 2C, arrowed), 3) ventral margins of urosomites ornamented with large spines (arrows in Fig. 2D), 4) caudal ramus subquadrate, as long as wide (Fig. 2E), 5) inner basipodal spine of P1 (arrow in Fig. 2F) reaching beyond second endopodal segment, 6) P4ENP3 about 1.5 times as long as wide, inner apical spine (arrow in Fig. 3A) slightly longer than segment, 7) P5 EXP about 1.7 times as long wide, innermost spiniform seta (arrow in Fig. 3B) being the longest element of the exopod. The Colombian specimens bear subtle morphological discrepancies with the Belizean specimens reported by Rocha (1995b); in the Colombian populations (Fig. 2F, Fuentes-Reinés et al., 2013, fig. 8D) the inner basipodal spine of P1 almost reaches the insertion point of inner seta of P1ENP3 whereas the same spine is shorter in the Belizean population, reaching the proximal margin of P1ENP2 (Rocha 1995b, fig. 29).

**Distribution.** This species appears to have a high tolerance to salinity variations, it has been recorded in brackish and freshwater habitats (Rocha 1995b, Fuentes-Reinés et al. 2013, Fuentes-Reinés and Suárez Morales 2015). It has been known to occur in the Venezuelan Caribbean coast, where it was originally described, but also in Belize, Mexico and Colombia (Lindberg 1954, Rocha 1995b, Suárez-Morales and Reid 2003).

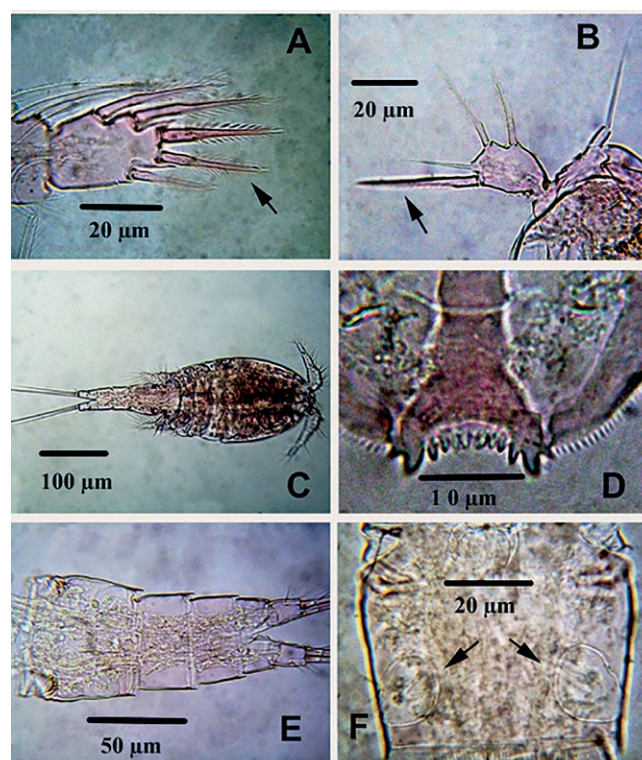
***Halicyclops hurlberti* Rocha, 1991**

(Figures 3C-F, 4, 5)

**Material examined.** Two adult females (UARC335-343M), Ciénaga Grande de Santa Marta, Colombia, coll. J.M. Fuentes



**Figure 2.** *Halicyclops venezuelaensis*. Adult female. A. Habitus. B. Maxilliped. C-D. urosome, ventral view. E. Caudal rami. F. P1.



**Figure 3.** *Halicyclops venezuelaensis*. Adult female. A. P4ENP3. B. P5. C-F. *H. hurlberti*, adult female. C. Habitus. D. Labrum. E. Urosome. F. Genital double somite

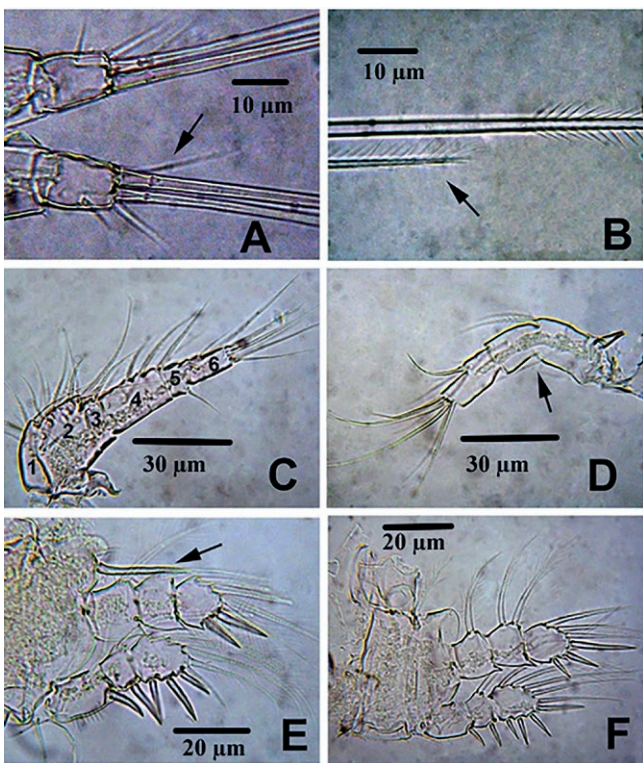


Reinés.

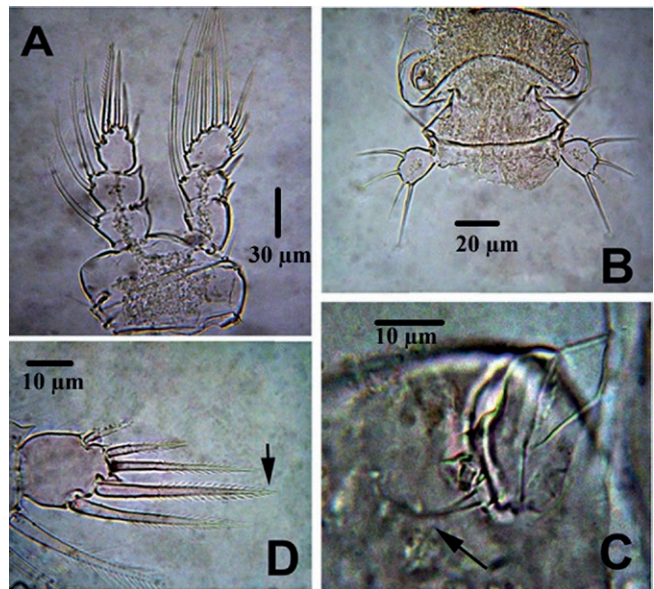
**Remarks.** The female specimens examined were assignable to *H. hurlberti* following the diagnostic characters presented by Rocha (1991) and Gómez and Rocha (2005). Habitus as in figure 3C, body relatively long, compact anteriorly, cephalosome with large rounded dorsal integumental window and length/wide ratio = 1.1. Body length, excluding caudal setae = 588-602 µm (average = 595 µm, *n* = 2). Labrum with 7-8 small medial teeth set between large lateral teeth (Fig. 3D). Urosome with four segments, genital double somite subquadrate, lacking lateral medial protrusions and with rounded integumental window on each side of posterior half (arrows in Fig. 3F), lateral margins not produced (Fig. 3E-F), caudal rami about 1.4 as long as wide (Fig. 4A), outer seta as long as ramus, dorsal seta (arrow in Fig. 4A) 1.5 times longer than ramus and three times longer than lateral seta, middle inner seta about 2 times as long as middle outer seta, the latter ornamented only with setules (arrow in Fig. 4B)

Antennules 6-segmented, fourth segment 1.6 times as long as wide (Fig. 4C). Antenna consisting of 4 segments (Fig. 4D), coxa reduced, unarmed, basis with two setae at inner corner; seta representing EXP present (arrow in Fig. 4D). ENP 2-segmented. Proximal endopodal segment with single seta on middle inner margin. Length/wide ratio of terminal endopodal segment ratio about 1.9 times as long as wide armed with 5 inner setae and 7 apical setae plus short spinule on proximal outer margin.

P1-P4 EXP and ENP 3-segmented (Figs 4E, F; 5A). Inner basipodal spine of P1 (arrow in Fig. 4E) reaching midlength of P1 ENP3. P2-P3 similar to each other in size and armature (Fig. 4F). P4 ENP3 about 1.6 times as long as wide; inner apical



**Figure 4.** *Halicyclops hurlberti*, adult female. A. Caudal ramus. B. Setae IV-V of caudal ramus. C. Antennule. D. Antenna. E. P1. F. P2



**Figure 5.** *Halicyclops hurlberti*, adult female. A. P4. B. P5. C. P6. D. P4ENP3.

spine about 1.6 as long as segment and 1.7 times as long as outer apical spine. Proximal inner seta overpassing the inner apical spine (Fig. 5A). P5 unsegmented, EXP elongate, 1.4 times as long as wide, bearing 3 spines, all of them longer than segment, plus one flexible seta 1.2 times as long as segment (Fig. 5B). P6 represented by a small seta (arrow in Fig. 5C).

*Halicyclops hurlberti* belongs to the group of species “B” of *Halicyclops* with a 3443 spine formula but Rocha (1991) recognized a subgroup of species sharing the following characteristics: 1) caudal setae bearing only heteronomously distributed setules, 2) fourth segment of female antennule less than twice as long as wide, 3) inner spine of the second basipodite of P1 reaching at least midlength of P1ENP3. *Halicyclops hurlberti* is included in this group together with other 13 species: *H. sinensis*, Kiefer, 1928, *H. canui* Lindberg, 1941, *H. pilifer* Lindberg, 1949, *H. blachei* Lindberg, 1952, *H. crassicornis* Herbst, 1955, *H. coulli* Herbst, 1977, *H. laminifer* Herbst, 1982, *H. glaber* Rocha, 1983, *H. pilosus* Rocha, 1984, *H. dussarti* Rocha, 1995, *H. ramirezi* Menu-Marque and Sorrain, 2007, *H. continentalis* Ueda and Nagai, 2009, and *H. setiformis* Ueda and Nagai, 2012. Of these, seven are known from the Neotropical region.

Among the group of species recognized by Rocha (1991), *H. hurlberti* is closest to *H. coulli* but they can be easily distinguished by: 1) the proximal inner seta of P4ENP3 overpasses the inner apical spine in *H. coulli* (Herbst, 1977, Abb. 6) whereas in *H. hurlberti* it is as long as the inner apical spine (Fig. 5D, Rocha, 1991, fig. 6; Gómez and Rocha, 2005, fig. 12A), 2) the distal and proximal inner setae of P4ENP3 are thicker than the apical spines in *H. hurlberti* (Fig. 5D, Rocha 1991, fig. 6, Gómez and Rocha 2005, fig. 12A) whereas in *H. coulli* they are equally thick (Herbst 1977, Abb. 6), 3) inner basipodal spine of P1 reaching at least midlength of the P1ENP3 in *H. hurlberti* (Fig. 4E, Rocha 1991, fig. 4, Gómez and Rocha 2005, fig. 11B), whereas in *H. coulli* it reaches the distal margin of P1ENP3 (Herbst 1977, Abb. 5).

The specimens from Colombia show some subtle differences

with respect to the descriptions by Rocha (1991) and Gómez and Rocha (2005); thus allows an expansion of the morphological knowledge of this species: 1) the caudal rami length/width ratio is about 1.4 in the Colombian specimen while in the Mexican and USA is 1.1 and 1.25, respectively (Rocha 1991, fig. 2, Gómez and Rocha 2005, fig. 2A,C); 2) the two subdistal inner setae of P2-3ENP3 barely reach beyond the distal end of the apical spines in the Colombian specimens (Fig. 2F), whereas in the USA specimens, the inner setae goes well beyond the distal end of the apical spines (Rocha 1991, fig. 5). Overall, we consider that these differences are within the intraspecific range and reveal affinities between the Colombian and Mexican populations.

Among the species known from Colombia, *H. hurlberti* closely resembles *H. gaviariai* in the following characters: 1) they share the same spine formula of P1-P4EXP3; 2) Both of them lack strong processes on the genital double-somite 3) the proximal inner seta of P4ENP3 overpassing tip of inner apical spine, 4) the length/wide ratio of fourth segment of antennule is less than 3. They can be separated by: 1) the P1 inner basipodal spine reaches the distal margin of P1 ENP2 in *H. gaviariai* (Suárez-Morales and Fuentes-Reinés fig. 2A) whereas in *H. hurlberti* this spine is longer, reaching midlength of P1 ENP3 (Fig. 4E, Rocha 1991 fig 4, Gómez and Rocha 2005, fig. 11B) 2) length/wide ratio which is 1.56 in *H. gaviariae* vs. 1.4 in *H. hurlberti* and relative length of the spines of P5EXP, 3) the number of large lateral teeth (1 vs. 2 in *H. hurlberti*?) of the labrum, 4) the thickness of distal inner spines and apical spines of P4ENP3.

**Distribution.** Hitherto, *Halicyclops hurlberti* has been reported only from the Tihuana Estuary in the state of California, in the USA Pacific (Rocha 1991) and from an estuarine system in the state of Sinaloa, in the Mexican Pacific (Gómez and Rocha 2005). Its finding in this area of Colombia represents a geographic range extension of this species from the Eastern Tropical Pacific to the Guajira province *sensu* Morrone (2014) in the western Caribbean.

**Habitat.** The northern Ciénaga Grande de Santa Marta is a shallow swamp (depth 0.5-1.5m), with temperature during the sampling period 31.2 °C, pH = 8.9, salinity = 15PSU and dissolved oxygen = 7.86mg/L.

**Key to the species of *Halicyclops* belonging to Group “B” sensu Rocha (1991)**

- 1A. Spine formula 2-3-3-3 *H. canui* Lindberg, 1941
- 1B. Spine formula 3-4-3-2 2A
- 1C. Spine formula 3-4-3-3 3A
- 1D. Spine formula 3-4-4-3 4A
- 2A. L/W of the P4ENP3 is about 1.5-1.7, serration of urosomal dorsal frills is almost equally coarse on the second through fourth somites *H. setiformis* Ueda and Nagai, 2012
- 2B. L/W of the P4ENP3 is about 1.1, serration of urosomal dorsal frills is very fine on the second and third somites compared to the fourth somite *H. blachei* Lindberg, 1952
- 3A. Genital double-somite with round lateral processes, fourth urosomite with squarely produced hyaline frill along the posterodorsal margin *H. laminifer* Herbst 1982
- 3B. Genital double-somite with triangular lateral processes, fourth urosomite without squarely produced hyaline frill along the posterodorsal

- margin *H. continentalis* Ueda and Nagai, 2009
- 4A. Genital double somite without lateral process 5
- 4B. Genital double somite with lateral process 6
- 5A. Spine inserted at inner corner of leg 1 basis of P1ENP goes beyond of P1ENP3, proximal inner seta overpassing the inner apical spine, the proximal and distal setae and the apical spines are equal in thickness *H. coulli* Herbst 1977
- 5B. Spine inserted at inner corner of leg 1 basis of P1ENP reaching midlength of P1ENP3, proximal inner seta is as long as the inner apical spine, the proximal and distal inner setae of P4ENP3 are thicker than apical spines *H. hurlberti*
- 6A. Caudal ramus divergent *H. pilifer* Lindberg, 1949
- 6B. Caudal ramus no divergent 7
- 7A. P4ENP3 without inner setae *H. glaber* Rocha 1983
- 7B. P4ENP3 with inner setae 8
- 8A. P4ENP3 inner setae very short, not reaching the midlength of inner apical spine of P4EN3 9
- 8B. P4ENP3 inner setae at least reaching midlength or beyond inner apical spine of P4EP3 10
- 9A. Posterior margin of genital double somite with larger denticulate hyaline membrane *H. ramirezi* Menu Marque and Sorarrain, 2007
- 9B. Posterior margin of genital double somite without larger denticulate hyaline membrane *H. crassicornis* Herbst, 1955
- 10A. Spine inserted at inner corner of leg 1 basis of P1ENP goes beyond of P1ENP3 *H. pilosus* Rocha, 1984
- 10B. Spine inserted at inner corner of leg 1 basis of P1ENP reaching midlength of P1EN3 11
- 11A. Urosomites with coarsely serrate frills *H. sinensis* Kiefer, 1928
- 11B. Urosomites with fine serrate frills *H. dussarti* Rocha, 1995

**Acknowledgements**

We are indebted to Dr. Samuel Gómez (Universidad Nacional Autónoma de México, Instituto de Ciencias del Mar y Limnología, Mexico) for kindly providing useful taxonomic literature during the development of this work and for confirming the identification of *Halicyclops hurlberti*.

**Literature cited**

Chang C.Y. 2012. Discovery of *Halicyclops continentalis* (Cyclopidae, Halicyclopinae) from estuaries and salt marshes on the west coast of South Korea. *Animal Systematics, Evolution and Diversity* 28: 12–19. <http://dx.doi.org/10.5635/ASED.2012.28.1.012>

Collado C., D. Defaye, B.H. Dussart, & C.H. Fernando. 1984. The freshwater Copepoda (Crustacea) of Costa Rica with notes on some species. *Hydrobiologia*, 119: 89-99. <https://doi.org/10.1007/BF00011948>

Defaye D. & B.H. Dussart. 1988. Compléments à la faune des Crustacés Copépodes des eaux intérieures de Guyane française. *Revue d'Hydrobiologie tropicale* 21: 109–125.

Fuentes-Reinés J.M. & E. Suárez-Morales. 2015. Checklist of planktonic copepoda from a Colombian coastal lagoon with record of *Halicyclops exiguus* Kiefer. *Bol. Invest. Mar. Cost.* 44(2): 369-389

Fuentes-Reinés J.M., E. Zopyy de Roa & R. Torres. 2013. Calanoida and Cyclopoida (Copepoda: Crustacea) from Ciénaga Grande de Santa Marta, Colombia. *Métodos en Ecología y Sistemática* 8(2): 54–103

Gómez S. & C.E.F. Rocha. 2005. A new species of *Kristensenia* Por, 1983 and a new record and illustrated supplementary description of *Halicyclops hurlberti* Rocha, 1991 from Mexico.



- Journal of Natural History, 39(2):133–152. <https://doi.org/10.1080/00222930410001663320>
- Herbst H.V. 1977. Ein neuer Halicyclops aus Nordamerika. *Gewasser und Abwasser* 62/63: 121–126.
- Humes A.G. 1947. A new cyclopoid copepod from a Bornean crustacean. *Transactions of the American Microscopical Society* 66: 293–301.
- Huys R. & G.A. Boxshall. 1991. *Copepod Evolution*. The Ray Society, London, 468 pp
- Karanovic T. 2004. Subterranean Copepoda from arid Western Australia. *Crustaceana Monographs* 3: 1366.
- Kiefer F. 1934. Neue Ruderfusskrebse von der Insel Haiti. *Zool. Anz.*, 108: 227–233.
- Loung T.D., L.D. Minh & H.T. Hai. 2016. A new species of the genus *Halicyclops* (Copepoda, Cyclopoida, Cyclopidae) from freshwater in central Vietnam. *TAP CHI SINH HOC* 2016, 38(4): 449–457. DOI: 10.15625/0866-7160/v38n4.9032.
- Morrone J. J. 2014. Biogeographical regionalisation of the Neotropical región. *Zootaxa* 3282: 1–110. DOI: 10.11646/zootaxa.3782.1.1.
- Rocha C.E.F. 1991. A new species of *Halicyclops* (Copepoda, Cyclopidae) from California, and a revision of some *Halicyclops* material in the collection of the US Museum of Natural History. *Hydrobiologia* 226:29–37. <https://doi.org/10.1007/BF00007777>
- Rocha C.E.F. 1995a. Two new species of *Halicyclops* (Copepoda, Cyclopoida) from the Amazon Basin, Brazil. *Hydrobiologia* 315: 167–175. <https://doi.org/10.1007/BF00051947>
- Rocha C.E.F. 1995b. Copepods of the genus *Halicyclops* (Cyclopidae) from Belize. *Hydrobiologia* 308:1–11.
- Rocha C.E.F. & T.M. Iliffe. 1993. New cyclopoids (Copepoda) from anchialine caves in Bermuda. *Sarsia* 78: 43–56. <https://doi.org/10.1080/00364827.1993.10413521>
- Rocha C.E.F., T.M. Iliffe, J.W. Reid & E. Suárez-Morales. 1998. A new species of *Halicyclops* (Copepoda, Cyclopoida, Cyclopidae) from Cenotes of the Yucatan Peninsula, Mexico, with identification key for the species of the genus from the Caribbean region and adjacent areas. *Sarsia* 83: 387–399. <https://doi.org/10.1080/00364827.1998.10413698>
- Rocha, C.E.F., T.M. Iliffe, J.W. Reid & E. Suárez-Morales. 2000. Prehencocyclops, a new genus of the subfamily Halicyclopininae (Copepoda, Cyclopoida, Cyclopidae) from cenotes of the Yucatan Peninsula, Mexico. *Sarsia* 85: 119–140. <https://doi.org/10.1080/00364827.2000.10414562>
- Suárez-Morales E. J.M & Fuentes-Reinés. 2014. A new species of *Halicyclops* (Copepoda, Cyclopoida, Cyclopidae) from a lagoon system of the Caribbean coast of Colombia. *ZooKeys* 459: 35–47. <https://doi.org/10.3897/zookeys.459.7972>
- Suárez-Morales E. & J. W. Reid. 2003. An updated checklist of the continental copepod fauna of the Yucatan Peninsula., Mexico, with notes on its regional associations. *Crustaceana* 76 (8): 977–992.
- Ueda H. & H. Nagai. 2012. Two new species of *Halicyclops* (Crustacea: Copepoda: Cyclopidae) from Honshu with a key to the species of the genus in Japan. *Species Diversity* 17: 97–107.
- Walter T.C. & G. Boxshall. 2017. World of Copepods database. Available at <http://www.marinespecies.org/aphia.php?p=taxdetails&id=106433> on 15 October 2017