



## The southernmost South American record of the genus *Halicyclops* Norman, 1903 (Cyclopoida: Cyclopidae) with the description of a new species

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### Abstract

Species of the cyclopoid genus *Halicyclops* are widespread in coastal, estuarine and even fluvial environments worldwide. On the Atlantic coast of South America several species have been recorded as far south as the state of São Paulo in Brazil, at about 24°25'S. Specimens belonging to this genus have been collected from plankton samples from Laguna de Mar Chiquita, a coastal lagoon on the Argentinean coast at 37°40' S, 57°19' W. These do not fit the diagnosis of any of the known species, and are here described as a new species.

Both sexes of *Halicyclops ramirezi* sp. nov. are described and illustrated. It is distinguished by a combination of characters relating to (1) the last endopodal segment of P4, (2) shape and armature of P5, (3) size and spinulation of the spine on the basipodite of P1, and (4) length/width ratio of the fourth A1 segment. The presence of only one seta and three spines on the male P5 is also characteristic. The presence of *Halicyclops glaber* Rocha, 1983 is reported for the first time for Argentina in sediments of the same locality.

**Key words:** *Halicyclops*, new species, distribution, Argentina

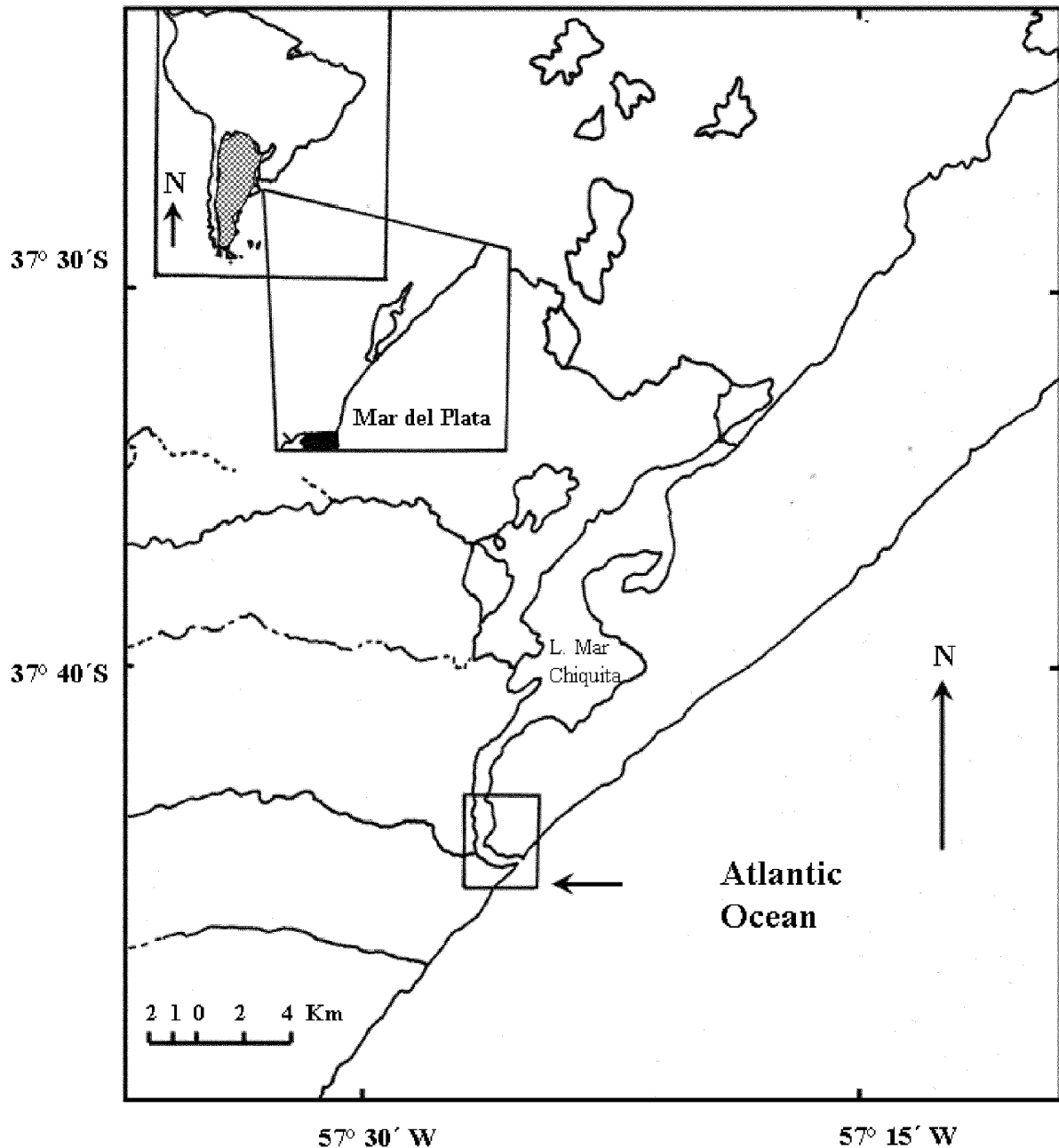
### Introduction

The species of the genus *Halicyclops* Norman, 1903 are widespread in coastal, estuarine and even fluvial environments all over the world and most knowledge of this genus in the Neotropical Region has been generated by the studies of Rocha (1983a, b, 1984, 1995a, b) and collaborators (Lotufo & Rocha 1993; Rocha et al. 1998). On the Atlantic coast of South America several species have been recorded as far south as the state of São Paulo in Brazil, at about 24°25'S (Rocha & Botelho 1998) but until now no species were known from Argentina. During a zooplankton survey in Laguna de Mar Chiquita, a coastal lagoon on the Argentinean coast, specimens of an unidentified species of *Halicyclops* were collected. Since the material was scarce, and they were presumed to be of benthic origin, intensive sampling of bottom epifauna was performed in the hope of obtaining more material. Large numbers of *Halicyclops* were caught, but to our disappointment they were all *Halicyclops glaber* Rocha, 1983. Thus the description of the new species is based upon the few specimens from the original plankton samples.

### Material and methods

Samples were obtained by towing a biconic Apstein plankton net with 335 µm mesh size, and additional samples were collected using a Hydrobios 80 µm mesh conical net. Samples were fixed in the field in 5% forma-

lin. Specimens were sorted under a stereomicroscope. *Halicyclops* specimens were rare and appeared only on three dates during the 2-year sampling period (Firpo 2002): samples were taken monthly from July 1998 to July 2000. Two sampling sites were located approximately 2 and 3 km upstream from the mouth of the lagoon (Fig. 1). Water temperature was measured with an alcohol thermometer and salinity was measured with a Aqua fauna refractometer. *Halicyclops* appeared in July 1998 in the more upstream station (winter, salinity 2 psu, temperature 6°C), December 1999 in the other site (end of spring, salinity 3 psu, temperature 6°C) and in both locations in April 2000 (end of autumn, salinities 10 and 8 psu respectively, temperature 15°C in both sites). This last date yielded all the specimens studied here.



**FIGURE 1.** Laguna Mar Chiquita, study area marked with arrow.

Specimens were examined in lactic acid in a depression slide and carefully rolled under a cover glass to observe the whole animal in different positions. This procedure was performed under a dissecting microscope and drawings were made with a drawing tube attached to a Wild M20 microscope. Measurements were made

on specimens placed in a lateral position, excluding caudal setae. Paratypes were dissected, stained with Chlorazol Black-e and their appendages drawn. Later these preparations were observed under a Leica DLMB microscope with phase contrast to elucidate certain doubtful setation details.

The material is deposited at the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Buenos Aires in the Invertebrate Collection (MACN-In). The holotype and allotype are preserved whole in 70% ethanol and the dissected paratypes mounted in polyvinyl-lactophenol preparations.

## Family Cyclopidae

### Subfamily Halicyclopinae Kiefer, 1927

#### Genus *Halicyclops* Norman, 1903

##### *Halicyclops ramirezi* sp. nov.

(Figs 2–28)

**Material examined.** 3 females and 3 males from Laguna Mar Chiquita (37°40'S, 57°19'W) (Fig. 1). Female holotype (MACN-In 36391), male allotype (MACN-In 36392) and four dissected paratypes (MACN-In 36393), two females and two males.

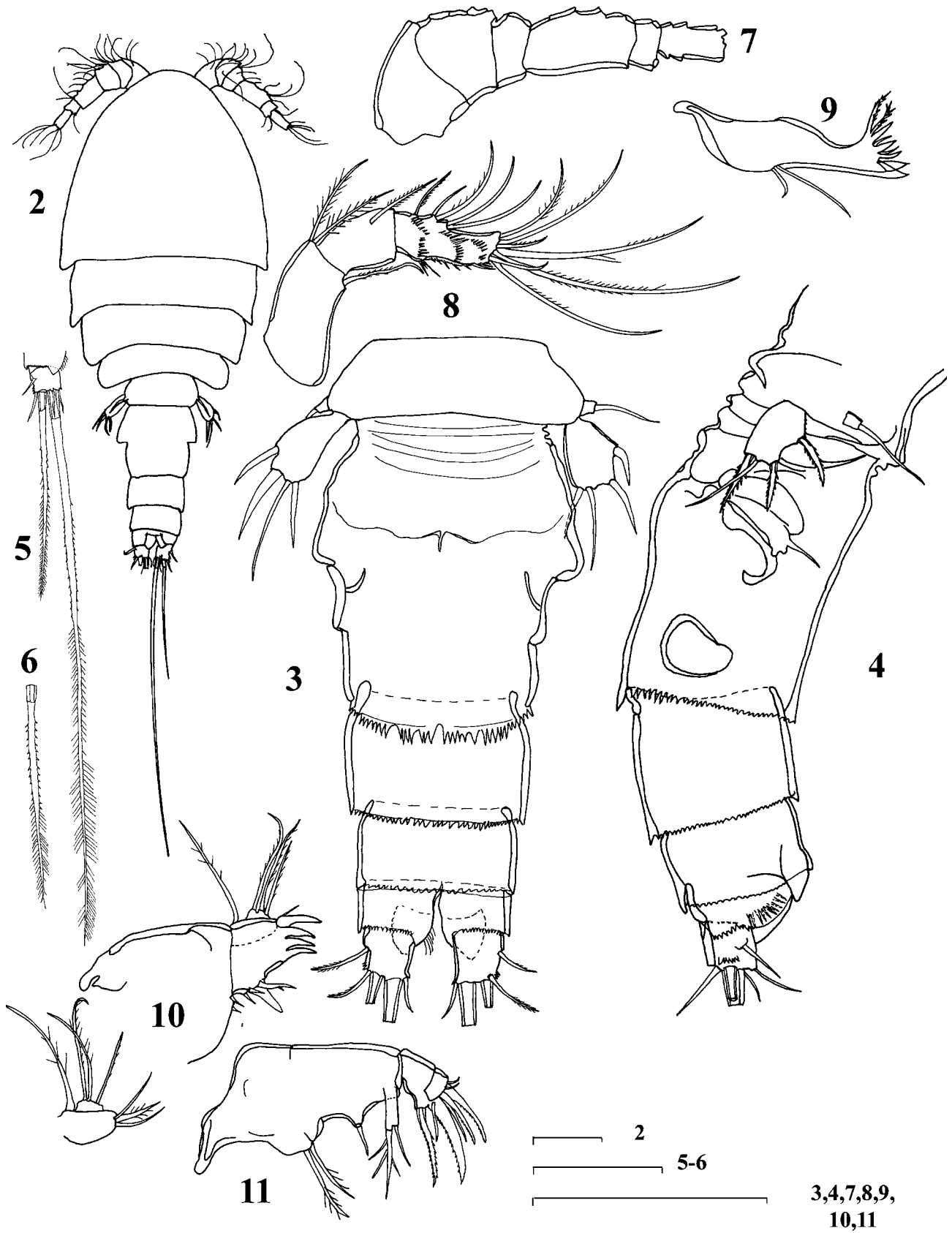
**Description. Female.** holotype total length, excluding caudal setae, 0.7 mm. Prosome: urosome ratio of holotype: 1.5. Postero-dorsal border of all prosomites smooth (Fig. 2). Genital double-somite (Fig. 3) as long as wide, with 2 large triangular protrusions located laterally in the anterior third, similar to those of *H. pilosus* Rocha, 1984 and small lateral integumentary windows on the posterior third. Such structures are present also in *H. venezuelaensis* Lindberg, 1954 (as illustrated by Rocha 1995a), but here are slightly triangular. Seminal receptacle not visible (Fig. 3). Copulatory pore located centrally at the proximal third of the somite. Posterior edges of urosomites with denticulate hyaline membrane, larger in genital double-somite and decreasing in size in 2 subsequent urosomites, with denticles far more conspicuous on ventral than on dorsal surface (Figs 3–4). Anal pseudopericulum unarmed and with rounded margin. Anal somite deeply incised, with distal edge smooth dorsally and denticulate ventrally. Anal area with semicircular row of long spinules on each side.

Caudal rami as long as wide (Fig. 3). Lateral seta inserted on a raised base located at end of slightly broader proximal third of caudal ramus, somewhat longer than or equal to the width of ramus itself. Dorsal seta with articulated base, inserted on distally-located papilla and longer than lateral seta. Outer apical seta longer and stiffer than inner apical seta. Inner median seta representing about 60% of total body length, 2.3–2.5 longer than outer median seta, with basal portion ornamented with sparse short setules and terminal portion with longer, more numerous setules on both sides, becoming gradually thinner towards apex. Outer median seta (Figs 5–6) also setulose, but setules shorter and not so densely packed.

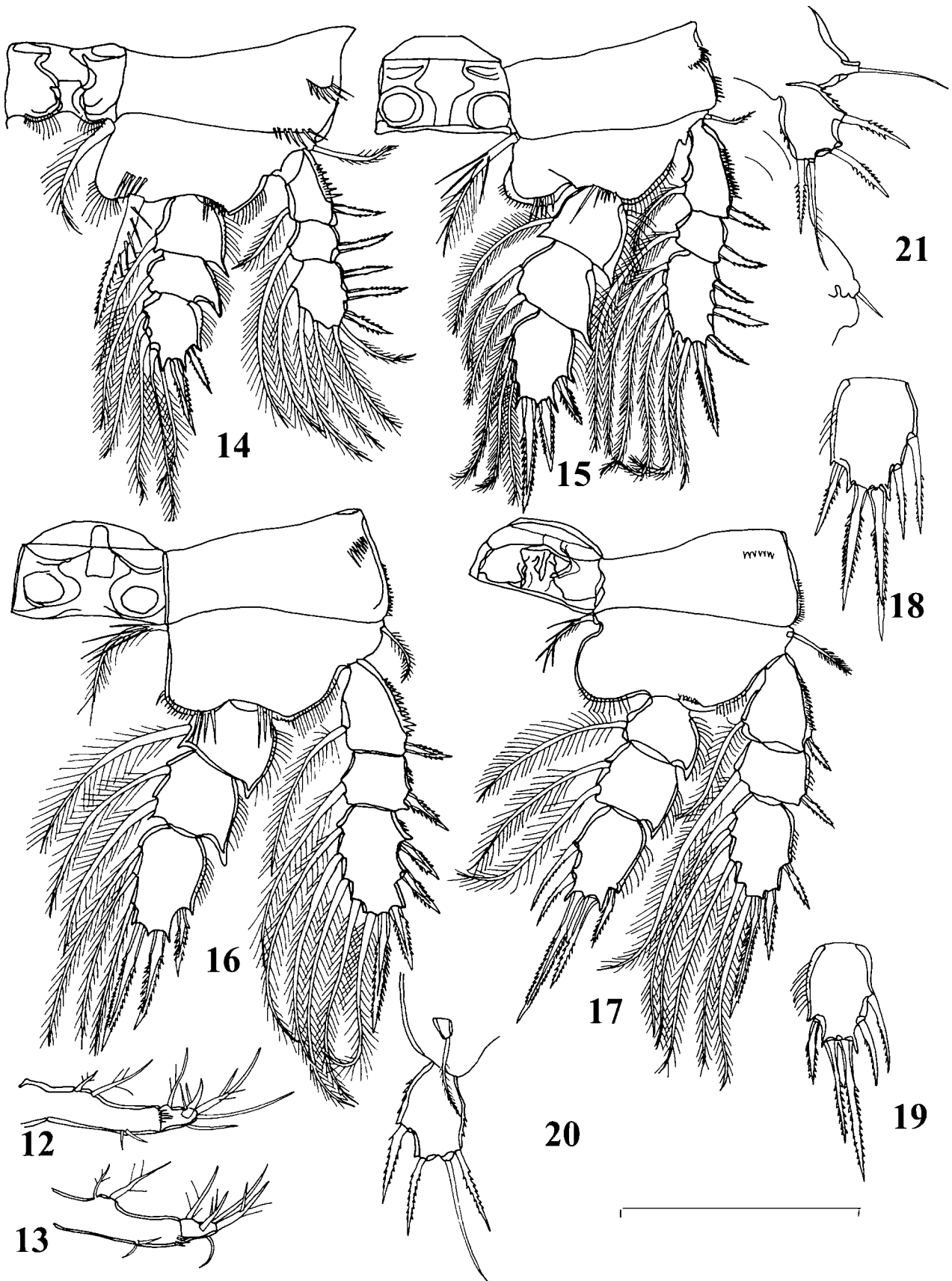
Antennule (Fig. 7) 6-segmented, with the same structure and armature as other species of genus, e.g. *H. venezuelaensis* (as redescribed by Rocha 1995a), *H. hurlberti* Rocha, 1991 and *H. tetracanthus* Rocha, 1995: 8, 12, 5 + spine, 6 + aesthetasc, 2, 10 + aesthetasc (Rocha 1995a). Fourth segment about 1.8 longer than wide, its anterior margin notched at insertion of each marginal seta.

Antenna (Fig. 8) 3-segmented. Reduced coxa unarmed, fused to basis; basis with 2 plumose setae at inner distal corner; exopod represented by hyaline, sparsely plumose seta, reaching base of terminal segment. Endopod 2-segmented; first segment bearing a single submarginal seta in distal third. Last segment bearing 5 setae along inner margin distributed 1-2-2 on 3 notches, and 7 setae of diverse lengths at tip; outer margin with transverse rows of spinules forming 3 arches.

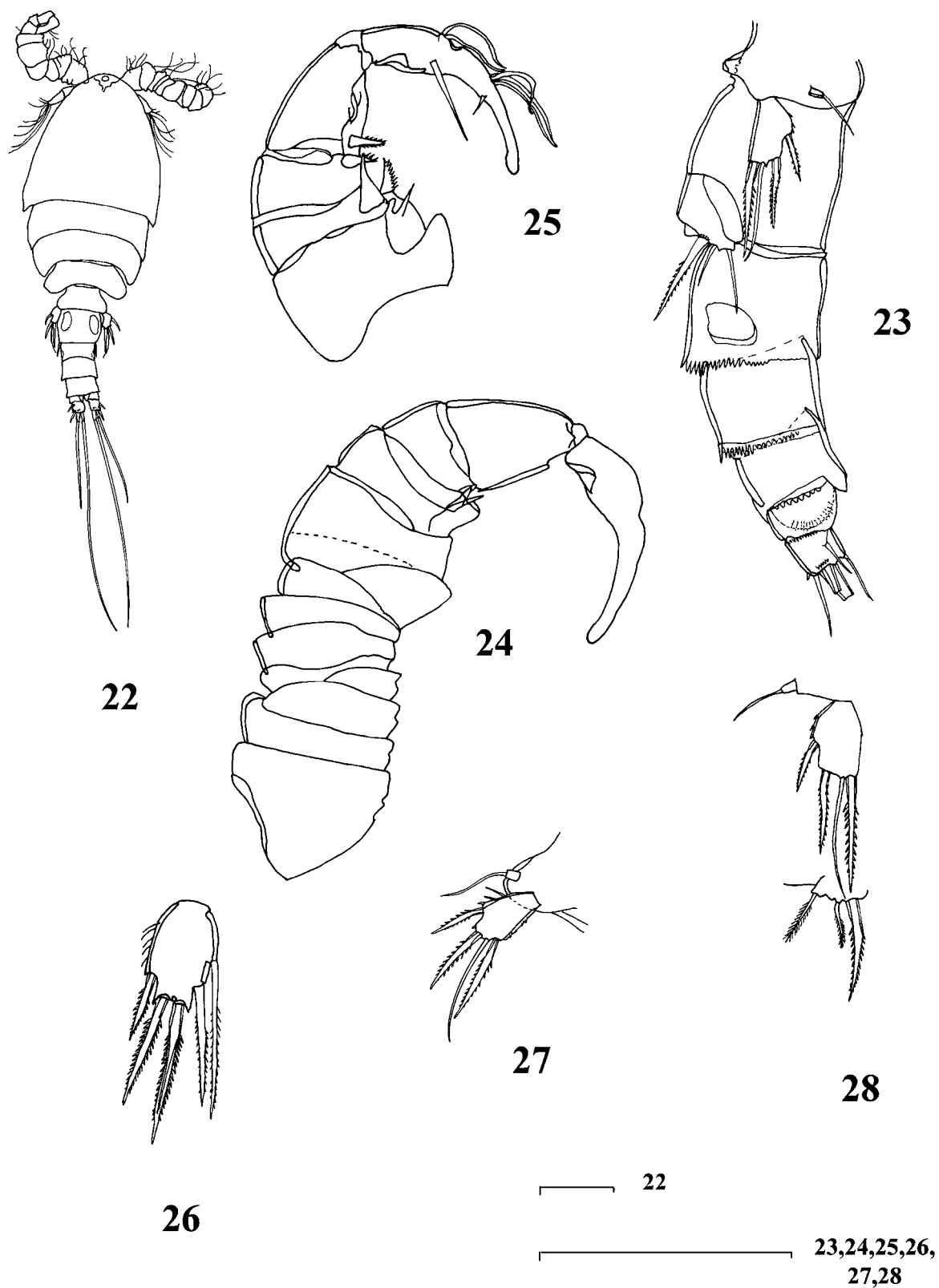
Mandible (Fig. 9) consisting of gnathobase provided with sharp toothed *pars incisiva* and reduced palp with 2 naked setae, the longest barely reaching base of teeth.



**FIGURES 2–11.** *Halicyclops ramirezi* sp. nov. female. 2: habitus, dorsal; 3: urosome, ventral; 4: urosome, lateral; 5: left furca and furcal setae, dorsal; 6: external apical seta of paratype; 7: antennule; 8: antenna; 9: mandibule; 10: maxillule, detail of palp; 11: maxilla. Figs 2–4 from holotype; 5–8, from paratype 1; 9–11 from paratype 2. Scale bars: 0.1 mm.



**FIGURES 12–21.** *Halicyclops ramirezi* **sp. nov.** female. 12: maxilliped; 13: maxilliped; 14: P1; 15: P2; 16: P3; 17: P4; 18: terminal endopodal segment of P4, whole specimen; 19: terminal endopodal segment of P4, permanent slide; 20: P5; 21: P5 and P6. Figs 13–15, 18, 20, from paratype 1; 12, 16–17, 19, 21 from paratype 2. Scale bars: 0.1 mm.



**FIGURES 22–28.** *Halicyclops ramirezi* sp. nov. male. 22: habitus, dorsal; 23: urosome, lateral; 24: antennule, dorsal; 25: antennule, detail of distal segments; 26: terminal endopodal segment of P4; 27: P5; 28: P5 and P6. Figs 22–23, 28 from allotype; 24–27 from paratype 3. Scale bars: 0.1 mm.

Maxillule (Fig. 10) comprising strong praecoxa and 2-segmented palp. Distal end of praecoxa bearing 4 strong, curved, claw-like spines, 3 fused to segment and the largest articulated and bearing a stiff setule; inner

surface bearing 7 conical spines of different lengths. Palp showing 4 spiny setae on proximal segment and 3 setae on distal one.

Maxilla (Fig. 11) consisting of 4 segments. Praecoxa fused to coxa and bearing 2 setae ornamented with stiff setules. Naked seta present on raised swelling on coxa; single coxal endite bearing naked seta and a strong distal seta, ornamented with 3 long, stiff setules. Basis produced into strong serrate claw, ornamented with strong serrated spine and thin seta. Unsegmented endopod carrying 2 spines, thin seta and 2 short hair-like setae.

Maxilliped (Figs 12–13) 2-segmented. Basal segment armed with 2 long spiny setae, 2 spinules on opposite edge and a row of spinules distally. Apical segment armed with 5 setae, 2 of which are ornamented with conspicuous stiff setules.

Swimming legs 1–4 (Figs 14–21) armature as in Table 1.

**TABLE 1.** Number of spines (Roman numerals), setae (Arabic numerals) and spine-like setae (underlined Arabic numerals) per segment of the swimming legs 1 to 4 of *Halicyclops ramirezi* sp. nov.

	Coxa	Basis	Exopod			Endopod		
			1	2	3	1	2	3
P1	0-1	1-I	I-1; I-1; III, 2, 3			0-1; 0-1; I, I+1, 3		
P2	0-1	1-0	I-1; I-1; III, I+1, 4			0-1; 0-2; I, II, 3		
P3	0-1	1-0	I-1; I-1; III, I+1, 4			0-1; 0-2; I, II, 3		
P4	0-1	1-0	I-1; I-1; II, I+1, 4			0-1; 0-2; I, II, <u>2</u>		

P1 (Fig. 14) basis with spine at inner corner reaching third endopodal segment and armed with very long, needle-like, stiff setules, arising in a helicoidal pattern.

P4 third endopodal segment (Figs 17–19) 1.4 longer than wide; inner apical spine 1.5 times longer than segment and on average 1.3 longer than outer apical spine: inner rim with 2 stiff, spine-like setae. Distal inner seta shorter than segment, not reaching tip of inner apical spine, almost even with external spine.

P5 (Fig. 20–21) exopod about 1.5 times longer than broad, bearing 3 spines and 1 seta. Seta slightly longer than inner spine, which is longest of the 3, almost as long as segment. Minute spinules present on external and internal margins. P6 located on dorsal side of lateral protrusions, represented by inner seta and 2 blunt protrusions (Fig. 21).

**Male** (Figs 22–28). Allotype (Figs 22–23) total length, excluding caudal setae, 0.53 mm. Only dimorphic traits described and illustrated. Prosome: urosome ratio of allotype about 1.7. Genital somite slightly wider than long (L/W= 0.85). Following urosomite with somewhat triangular integumentary windows in the posterior half. Inner median seta proportionally longer than in female, representing about 65% of total body length

Antennule (Fig. 24) 14-segmented; it ends in a spatulate tip when seen in dorsal view, and presenting a complicated set of serrate spines on inner edge of joint between 12<sup>th</sup> and 13<sup>th</sup> segments (Fig. 25).

Distal segment of P4 endopod (Fig. 26) slightly more slender than in female, 1.5 times longer than wide; inner finely-serrate spine-like setae much longer than in female, both surpassing by far tip of external seta. Distal inner seta longer than segment.

P5 (Figs 27–28) with same armature distribution as female; tiny spinules on external margin longer and more visible. Spines much longer than in female, longest around 1.4 times longer than segment.

P6 (Fig. 28) spine reaching almost to distal edge of the segment, with a row of minute spines at base; setae finely plumose, internal longer than middle one.

**Etymology.** The species is dedicated to Dr. Fernando César Ramírez, zooplanktologist at INIDEP (and previously at the Instituto de Biología Marina) at Mar del Plata, mentor to generations of Argentinean planktologists.

**Habitat.** *H. ramirezi* sp. nov. is known only from plankton samples taken at the type locality, where it is completely outnumbered by the benthic congener *H. glaber*. The few collected specimens appeared in samples considered to be close to freshwater, on account of their low conductivity. More detailed sampling is needed to detect microhabitat preferences of the new species in a complex environment with fluctuating salinity levels.

**Differential diagnosis.** *Halicyclops ramirezi* sp. nov. belongs to the group of species recognized by Rocha (1991) as sharing the following traits:

- caudal setae bearing only setules as ornaments and these heteronomously distributed,- fourth segment of female antennule less than twice as long as wide,- inner spine of the second basipodite of P1 reaching at least midlength of the third endopod of that swimming leg.

- In addition it shares with many species of this group the spine formula 3-4-4-3 for the last exopodal segment of P2–P4.

The new species most closely resembles *H. glaber* and *H. venezuelaensis*. The female can be readily distinguished from the former by the presence of two slender, finely serrate spines, on the inner margin of the third endopodal segment of P4, and from the latter by the shape of the genital double-somite, by the proportional lengths of the setae on the last endopodal segment of P4 and on the exopod of the P5. The male is easily distinguished from those of both species by the P5 armature, which consists in *H. ramirezi* of four elements (three spines and one seta) rather than five elements (three spines and two setae). The presence of small lateral integumentary windows in the last third of the genital double-somite of the female and the second urosomite of the male is a trait shared with *H. venezuelaensis*, from which the new species differs by the slightly triangular shape of these structures.

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