

TWO NEW FAIRY SHRIMP OF THE GENUS *STREPTOCEPHALUS*
(BRANCHIOPODA: ANOSTRACA) FROM NORTH AMERICA

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A B S T R A C T

Two new species of fairy shrimp from North America, *Streptocephalus henridumontis* and *Streptocephalus thomasbowmani*, are diagnosed and figured. A brief account on the conservation status of the New World species of the genus and an updated species identification key are included. *Streptocephalus thomasbowmani* n. sp., endemic to New Mexico, U.S.A., is morphologically similar to *S. dorotheae*. *Streptocephalus henridumontis* n. sp., whose populations occur along the Sonoran desert in northwestern México and southwestern United States, is morphologically similar to *S. mackini*. The peduncle of the antennal distal outgrowth of the two new species is of the long type. *Streptocephalus thomasbowmani* has uniramous ovaries, whereas *S. henridumontis* has biramous ovaries. With the inclusion of the new taxa, the number of species of the genus recorded from the American continent is 15. Seven (*S. dorotheae*, *S. henridumontis*, *S. linderi*, *S. mackini*, *S. sealii*, *S. similis*, and *S. texanus*) have a wide geographical distribution and seem to be under no immediate threat. Conversely, eight species have a restricted distribution. Thus, *S. antillensis*, *S. kargesi*, and *S. potosinensis* can be considered as Critically Endangered (CE), and *S. thomasbowmani*, *S. guzmani*, *S. mattoxi*, *S. moorei*, and *S. woottoni* as Endangered species (EN), following the IUCN red list criteria.

The genus *Streptocephalus* Baird, 1852, occurs in all continents except in Antarctica (Belk and Brtek, 1995, 1997; Maeda-Martínez *et al.*, 1995b; Herbert and Timms, 2000). In the New World, it is distributed from the Canadian provinces of Alberta and Saskatchewan in the north to Belize and the Caribbean islands of Barbuda and Desirade in the south. To date, 13 species have been recognized for this area (Maeda-Martínez *et al.*, 1995a, 2002). One species is endemic to Mona Island, Puerto Rico (Mattox, 1950), but the other 12 species occur mostly in México and the southern United States (Creaser, 1930; Moore, 1958, 1966; Belk, 1975; Spicer, 1985; Eng *et al.*, 1990; Maeda-Martínez *et al.*, 1995a, 2002).

The taxonomy of the New World streptocephalids has been studied by Packard (1883), Daday (1910), Creaser (1930), and Moore (1966). Keys to species have been elaborated by Mackin (1942), Dexter (1959), and Belk (1975), and for taxa of the U.S.A. by Pennak (1953, 1978, 1989). The most recent systematic review, which included an updated diagnosis, phylogeny, and scanning electron microscope (SEM) figures of the 13 species, was published by Maeda-Martínez *et al.* (1995a).

In the genus *Streptocephalus*, the male second antenna is a uniramous, two-jointed appendage. From the distal end of the antennal basal joint, a typical distal outgrowth is borne, which consists of a peduncle that terminates in a scleroid cheliform structure (the so-called ‘hand’). On the basis of the length of the peduncle of the antennal distal outgrowth, the *Streptocephalus* species were sorted into three categories; those with short, intermediate, and long peduncles (Maeda-Martínez *et al.*, 1995b). Using the length of the peduncle plus the morphology of the frontal appendage and ovaries, Maeda-Martínez *et al.* (1995b) distinguished nine species groups, of which only three are represented by the 13 New World species; 1) the *dendyi* group, with a short antennal peduncle, frontal appendage simple and short, and unir-

amous ovaries, with only one species, *Streptocephalus kargesi* Spicer, 1985; 2) the *sealii* group, with an intermediate antennal peduncle, frontal appendage simple and short, and uniramous ovaries, represented by three species, *S. sealii* Ryder, 1879, *S. similis* Baird, 1852, and *S. woottoni* Eng, Belk, and Eriksen, 1990; and 3) the *torvicornis* group, including two subgroups, 3a) the *torvicornis* subgroup, with a long antennal peduncle, frontal appendage simple and short, and uniramous ovaries, represented by two species, *S. guzmani* Maeda-Martínez *et al.*, 1995a, and *S. mattoxi* Maeda-Martínez *et al.*, 1995a; and 3b) the *mackini* subgroup, with a long antennal peduncle, frontal appendage simple and short, and biramous ovaries, represented by seven species, *S. antillensis* Mattox, 1950, *S. dorotheae* Mackin, 1942, *S. linderi* Moore, 1966, *S. mackini* Moore, 1966, *S. moorei* Belk, 1973, *S. potosinensis* Maeda-Martínez *et al.*, 1995a, and *S. texanus* Packard, 1871. However, these species groups were not supported by a recent molecular study (Daniels *et al.*, 2004).

In this paper, we present the diagnosis of two new species. One of them has populations in the Sonoran desert region of northwestern México and southwestern United States, and exhibits an antennal morphology similar to *S. mackini*. The second one is endemic to New Mexico, U.S.A., and exhibits an antennal morphology similar to *S. dorotheae*. Thus, the present study included an extensive examination of *S. dorotheae* and *S. mackini* material including type specimens. Finally, we summarize the conservation status of the New World species of *Streptocephalus* and present an updated species identification key.

MATERIALS AND METHODS

The material examined came from collections deposited at the National Museum of Natural History, Smithsonian Institution, U.S.A. (USNM);

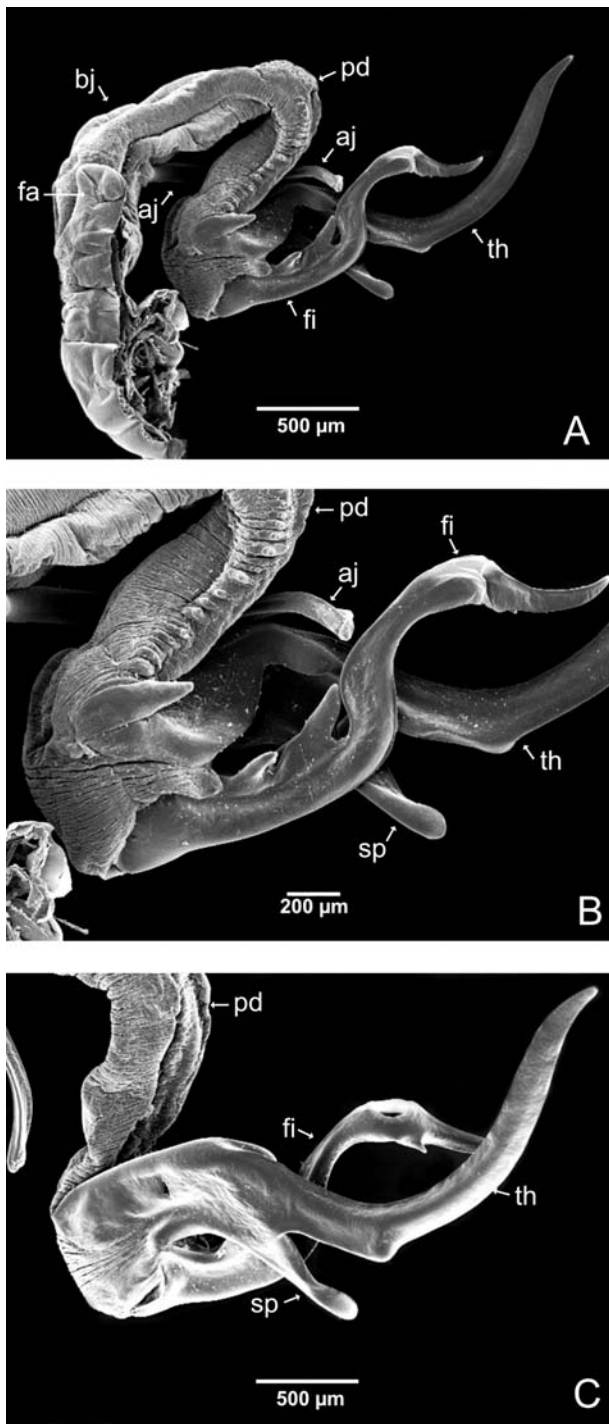


Fig. 1. *Streptocephalus henridumontis* new species (paratype), male, SEM photographs. A, Left antenna in inner view; B, hand of left antenna in inner view; C, hand of right antenna in lateral view. aj = apical joint, bj = basal joint, fa = frontal appendage, fi = finger, pd = peduncle, sp = spur, th = thumb.

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microscope. The standard length is the distance from the anterior margin of head to the posterior margin of telson between cercopods. Morphological terminology follows Maeda-Martínez *et al.* (1995b). Terminology for cyst description follows Gilchrist (1978) and Mura (1992). For scanning electron micrographs, fixed specimens were critical-point dried, coated with gold, and analyzed under a JEOL (SEM) at 10 kV. The conservation status of the species was evaluated according to the IUCN Red List Categories and Criteria (2001).

SYSTEMATICS

Streptocephalidae Daday, 1910

Streptocephalus Baird, 1852

Streptocephalus henridumontis n. sp. Maeda-Martínez and Obregón-Barboza Figs 1 A–C, 3 C–D

Streptocephalus mackini Moore.—Maeda-Martínez, 1991 (in part); Campoy-Favela and Quijada-Mascareñas, 1993; Maeda-Martínez *et al.*, 1995a (in part).

Streptocephalus sp.—Maeda-Martínez *et al.*, 1997; Maeda-Martínez *et al.*, 2002.

Streptocephalus dumontii Daniels *et al.* 2004. (*Nomen nudum.*)

Type Locality.—Km 1.5 to Querobabi, Federal highway No. 15, Hermosillo-Santa Ana, Sonora, México.

Type Material.—Holotype male, standard length 13.3 mm, cercopods 1.4 mm, total length 14.7 mm. Allotype female, standard length 12.4 mm, cercopods 1.6 mm, total length 14.0 mm. Paratypes: 20 males, standard length 11.7–14.0 mm; 20 females, standard length 10.6–12.7 mm; CIB-205, collected 06 September 1996 by A.M. Maeda-Martínez, H. García-Velazco, C. Orozco-Medina, and M. Prieto-Salazar.

Diagnosis.—Male: Frontal appendage simple, short, usually bilobed at tip; second antennae with peduncle of distal outgrowth of long type, without pulvinus, but with series of about 12 conical protuberances on inner side of distal part; inner dorsal side of base of hand with spiniform structure anteriorly directed; spur triangle-shaped, apex with swollen digitiform prolongation; lateral lamella with acute angle between distal part of thumb and spur; inner lamella medioventrally produced forming cavity; distal part of thumb geniculate, with pronounced elbow on ventral side, dorsal margin inerm, apex acuminate; finger bigeniculate, 2 teeth on inner dorsal side of proximal part; distal tooth broad at base, its anterior margin anterodorsally prolonged forming digitiform structure; proximal tooth shorter, subacuminate and anteriorly oblique; dorsal lamella of finger narrow at first geniculation, with straight border at second geniculation; apex of finger acuminate, with subapical swollen part armed with ventrolateral spiniform structure; genitalia without linguiform outgrowths; cercopods separate, setose along inner and lateral borders; anus terminal.

Female. Ovaries biramous, variably extending from thoracic segments 4–8 to abdominal segments 4–6; brood-pouch ends at abdominal segments 6–7.

Cyst. Spherical, ornamented by ribs forming polygonal areas; shell composed of single spongy cortex.

Differential Diagnosis.—*Streptocephalus henridumontis* is morphologically similar to *S. mackini*. Both species have a long antennal peduncle, frontal appendage simple and short, and biramous ovaries. Their main differences are (1) the distal tooth of finger in *S. henridumontis* has its anterior margin anterodorsally prolonged forming a semirectangular

digitiform structure (Fig. 1 A, B), in *S. mackini* the distal tooth is acuminate (Maeda-Martínez *et al.*, 1995a, fig. 10 C); (2) the dorsal lamella of the finger in *S. henridumontis* is narrow at the first geniculation, and shows a straight border at the second geniculation (Fig. 1 A, B), in *S. mackini* the dorsal lamella is broad at the first geniculation, and its border is curved to the apex of finger (Maeda-Martínez *et al.*, 1995a, fig. 10 C); (3) the spiniform structure at the apex of the finger in *S. henridumontis* is ventrolaterally inserted (Fig. 1 C), in *S. mackini* the same structure is in lateral position (Maeda-Martínez *et al.*, 1995a, fig. 10 D, E).

Molecular Information.—Sequences of fragments of the mitochondrial DNA 12S rRNA and Cytochrome oxidase subunit I (COI), and of the nuclear DNA 5.8S-ITS-1-18S of *S. henridumontis* are deposited in the GenBank (accession numbers: AY519779, AY519829, and AY519847) (Daniels *et al.*, 2004). Molecular phylogenetic analyses of nine New World *Streptocephalus* species showed that *S. henridumontis* is genetically more related to other forms (e.g., *S. texanus*) than to *S. mackini* (Daniels *et al.*, 2004).

Distribution.—*Streptocephalus henridumontis* is recorded from the Mexican states of Baja California (Norte), Sinaloa, and Sonora. In the U.S.A., this species is known from Arizona and New Mexico (Fig. 4).

Conservation Status.—Given its extent of occurrence (Fig. 4), *Streptocephalus henridumontis* appears under no immediate threat (Least Concern).

Etymology.—The species is named in honor of Prof. Dr. Henri J. Dumont in recognition to his contributions to the knowledge of the biology and biodiversity of the Crustacea Branchiopoda.

Streptocephalus thomasbowmani n. sp. Maeda-Martínez
and Obregón-Barboza
Figs 2 A–D and 3 A–B

Streptocephalus bowmani Daniels *et al.* 2004. (*Nomen nudum.*)

Type Locality.—10 miles W of Lordsburg, Hidalgo County, New Mexico, U.S.A.

Type Material.—Holotype male, standard length 12.0 mm, cercopods 1.6 mm, total length 13.6 mm. Allotype female, standard length 13.5 mm, cercopods 1.4 mm, total length 14.9 mm. Paratypes: 22 males, standard length 10.3–14.7 mm; 15 females, standard length 11.9–14.0 mm; USNM Acc. No. 30597, collected 13 August 1955 by J. E. Lynch.

Diagnosis.—Male: Frontal appendage simple, short, and bilobed at tip; second antennae with peduncle of distal outgrowth of long type, without pulvinus, but with series of about 8 conical protuberances on inner side of distal part; inner dorsal side of base of hand with spiniform structure, anteriorly directed; spur triangle-shaped, apex with digitiform prolongation; lateral lamella with acute angle between distal part of thumb and spur; inner lamella medioventrally produced, forming cavity; inner margin of proximal part forming deep cleft; distal part of thumb geniculate, forming pronounced elbow on ventral side, dorsal margin inerm, apex acuminate; finger bigeniculate, 2 teeth on inner dorsal side of proximal part, proximal one a small acute tooth

medially directed, distal one a long digitiform tooth dorsally directed; 1 stout tooth on lateral side; dorsal lamella of finger narrow at first and second geniculation; apex of finger acuminate; genitalia without linguiform outgrowths; cercopods setose along inner and lateral borders; anus terminal.

Female. Ovaries uniramous extending from genital segment 1 to abdominal segments 5–7; brood-pouch ending on abdominal segments 5–6.

Cyst. Spherical, with surface ornamented by ribs forming polygonal areas; shell with subcortical space present, outer cortex and inner alveolar layer not completely separated from one another.

Differential Diagnosis.—*Streptocephalus thomasbowmani* is morphologically similar to *S. dorotheae*. Both species have a long antennal peduncle, and frontal appendage simple and short; however, *S. thomasbowmani* has uniramous ovaries, whereas *S. dorotheae* has biramous ovaries. The most important differences in antennal morphology between these species are found in the finger; *S. thomasbowmani* has a stout tooth on the lateral side (Fig. 2 D) and a narrow dorsal lamella at first geniculation (Fig. 2 B, C); in *S. dorotheae* the finger has no tooth in the lateral side, and the dorsal lamella is wide at first geniculation (Maeda-Martínez *et al.*, 1995a, fig. 8 A–C).

Molecular Information.—Sequences of fragments of the mitochondrial DNA 12S rRNA and Cytochrome oxidase subunit I (COI), and of the nuclear DNA 5.8S-ITS-1-18S of *S. thomasbowmani* are deposited in the GenBank (accession numbers: AY519781, AY519825, and AY519846) (Daniels *et al.*, 2004). Molecular phylogenetic analyses of nine New World *Streptocephalus* species showed that *S. thomasbowmani* is genetically more related to other forms (e.g., *S. guzmani*) than to *S. dorotheae* (Daniels *et al.*, 2004).

Distribution.—*Streptocephalus thomasbowmani* is endemic to New Mexico, U.S.A. It is known only from the type locality (Fig. 4).

Conservation Status.—We assess *S. thomasbowmani* as an Endangered species (EN) because its distribution range is less than 5000 km², it exists at no more than five locations, and exhibits extreme fluctuations in the number of mature individuals.

Etymology.—The species is named in memory of Dr. Thomas E. Bowman in recognition to his contributions to the knowledge of the Crustacea.

DISCUSSION

The morphological similarity of the two new species with previously described species caused their misidentification in the past. The original lot of *Streptocephalus thomasbowmani* n. sp. was labeled by its collector as *S. dorotheae*. Given that the last species was previously reported with biramous ovaries (Maeda-Martínez *et al.*, 1995a), a careful examination of the original lot allowed us to realize that such material represented a new, undescribed species with females having uniramous ovaries. We confirmed that females of the type material of *S. dorotheae* (Santa Fe,

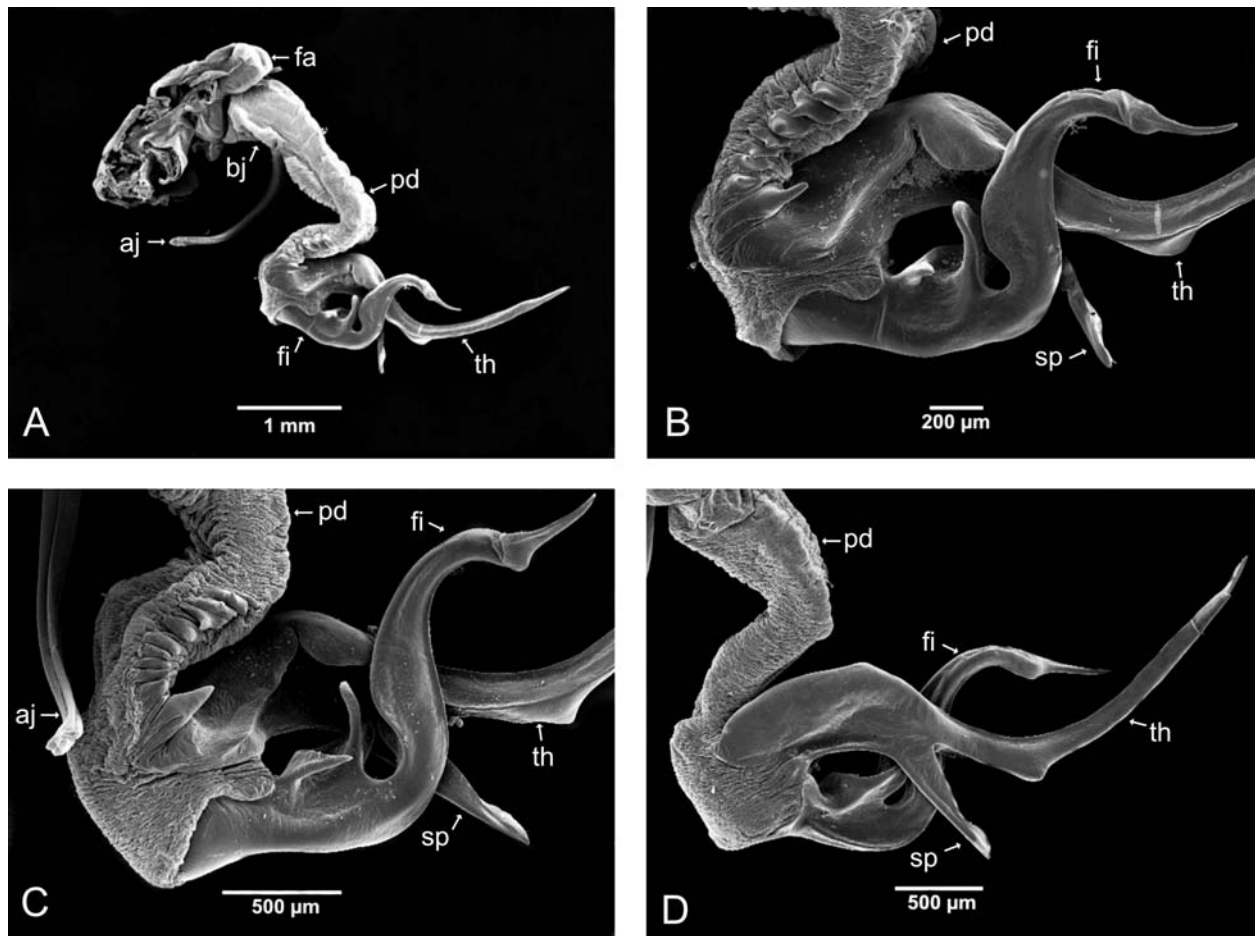


Fig. 2. *Streptocephalus thomasbowmani*, new species (paratypes), males, SEM photographs. A, Left antenna in inner view; B and C, hand of left antenna in inner view of two different individuals; D, hand of right antenna in lateral view. aj = apical joint, bj = basal joint, fa = frontal appendage, fi = finger, pd = peduncle, sp = spur, th = thumb.

New Mexico, U.S.A., USNM 79019) have biramous ovaries. The uniramous condition of the ovary can be considered as the plesiomorphic state of that organ given that it is exhibited by most of the species of the genus (Maeda-Martínez *et al.*, 1995a, b). The biramous condition (apomorphic state) seems to have evolved only in the New World *Streptocephalus*, specifically in the new species *S. henridumontis* and in the eight species of the *mackini* subgroup proposed by Maeda-Martínez *et al.* (1995a, 2002). However, the monophyly of the species group with biramous ovaries is not supported by the molecular analyses of Daniels *et al.* (2004), who reported *S. guzmani*, *S. thomasbowmani*, and *S. woottoni* with uniramous ovaries in monophyly with *S. henridumontis* and *S. texanus* with biramous ovaries.

Streptocephalus henridumontis was mistakenly reported as *S. mackini* by Maeda-Martínez (1991), Campoy-Favela and Quijada-Mascareñas (1993), and Maeda-Martínez *et al.* (1995a) for the Mexican states of Sinaloa and Sonora. The consistency of the differential characteristics exhibited by *S. henridumontis* populations across the Sonoran desert is the morphological evidence that this form is a separate species. Our extensive revision revealed the occurrence of males of *S. henridumontis* and *S. mackini* in the same pool at

the same time in a site in Cochise, County, Arizona, U.S.A. (D. Belk's collection DB-99). Such a co-occurrence and the molecular analyses of Daniels *et al.* (2004) confirm the validity of *S. henridumontis*.

Although the structural morphology of cross-sectioned cyst shells has been studied in a few anostracans (Gilchrist, 1978; De Walsche *et al.*, 1991; Lee *et al.*, 1994; Rosowski *et al.*, 1997; Hill and Shepard, 1997), interspecies differences have been found within the genera *Branchinecta* (Obregón-Barboza *et al.*, 2002) and *Streptocephalus* (De Walsche *et al.*, 1991). De Walsche *et al.* (1991) reported the cyst shell of the Indian *Streptocephalus dichotomus* Baird, 1860, was composed of an outer cortex and two inner alveolar layers, and that of the Arabian *Streptocephalus torvicornis* (Waga, 1842) with a single spongy cortex. Differences in the cyst-shell structure is also found between the new species; *S. thomasbowmani* exhibits a bilayered cyst-shell, whereas *S. henridumontis* has a single "spongy" cyst shell (Fig. 3).

Comparing their geographical distributions, *S. thomasbowmani* is known from one locality in New Mexico, U.S.A., whereas *S. dorotheae* has a wider distribution, occurring in the Mexican states of Baja California Sur and Sonora (Maeda-Martínez *et al.*, 2002), and in the western states of

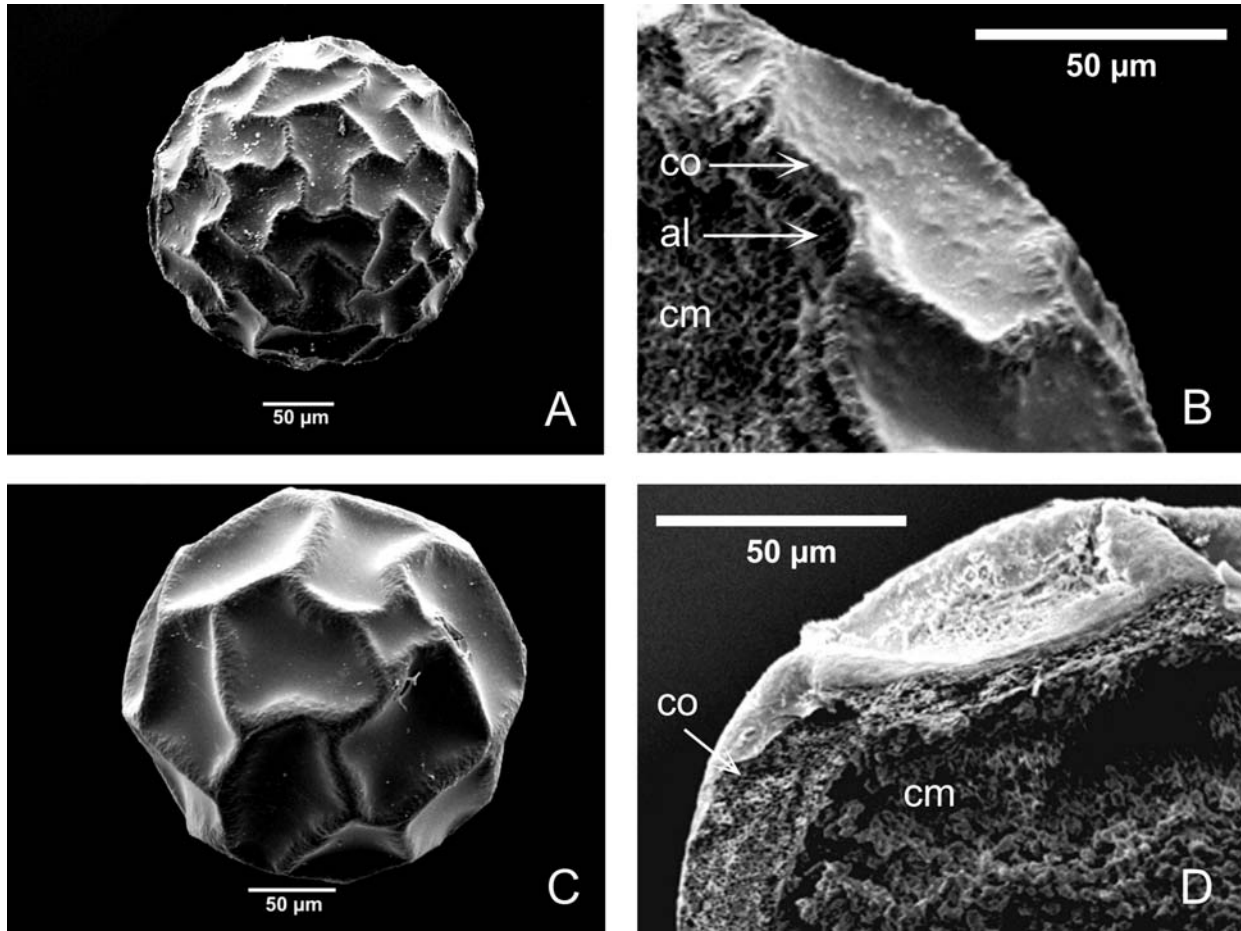


Fig. 3. A, B, cyst of *Streptocephalus thomasbowmani* new species (paratype); C, D, cyst of *Streptocephalus henridumontis* new species (paratype). A, C, whole cyst; B, D, cross section of cracked cyst. al = alveolar layer, cm = yolk particles and embryonic cells, co = outer cortex.

the U.S.A. in Arizona, New Mexico, Oklahoma, Texas, Utah, and Wyoming (Mackin, 1942; Koehn and Cole, 1964; Maynard and Romney, 1975; Belk, 1975, 1983) (Fig. 4). *Streptocephalus henridumontis* and *S. mackini* are widely distributed species; however, *S. henridumontis* occurs mostly in the Sonora desert, with records in the south in a Mexican tropical area in the southern part of the state of Sinaloa (22°46' N, 105°40' W), through Sonora and Baja California (Norte), México, and Arizona and New Mexico, U.S.A., in the north. *Streptocephalus mackini*, the most common Anostracan species in México (Maeda-Martínez, 1991), occurs mostly in the Chihuahua desert, with records in the south from Oaxaca, through Central Mexico, and Arizona, New Mexico, and Texas, U.S.A., in the north (Maeda-Martínez et al., 2002).

The long mountainous chain Sierra Madre Occidental, which separates the Chihuahuan and Sonoran deserts in northern México, appears to function as a geographical barrier between the southern populations of *S. henridumontis* and *S. mackini*; however, the northern ranges of these species overlap in the states of Arizona and New Mexico (Fig. 4), just in the area where the deserts mentioned above are in contact (MacMahon and Wagner, 1985).

The discovery of *S. henridumontis* and *S. thomasbowmani* brings the number of *Streptocephalus* species recorded

from North America to 15. Seven of these (*S. dorotheae*, *S. henridumontis*, *S. linderi*, *S. mackini*, *S. sealii*, *S. similis*, and *S. texanus*) show a wide geographical distribution and seem to be under no immediate threat (Least Concern) (Table 1). Conversely, eight species have a restricted distribution, all of them recorded from only one or few locations. Thus *S. antillensis*, *S. kargesi*, and *S. potosinensis* are considered as Critically Endangered (CE), and *S. thomasbowmani*, *S. guzmani*, *S. mattoxi*, *S. moorei*, and *S. woottoni* as Endangered species (EN). *Streptocephalus moorei*, *S. guzmani*, and *S. woottoni* were listed in the IUCN Red List (IUCN, 1996).

Key to the New World species of *Streptocephalus*

Note.—Morphological identification of the species can be done only on adult male second antenna; however, given its relevance, the type of ovaries is also included in the key.

- 1. Thumb without spur; finger without teeth; ovaries uniramous: *S. kargesi* Spicer, 1985
- Thumb with spur; finger with teeth on dorsal side of proximal part: 2
- 2. Male with spinose cercopods; ovaries uniramous: 3
- Male with setose cercopods: 4

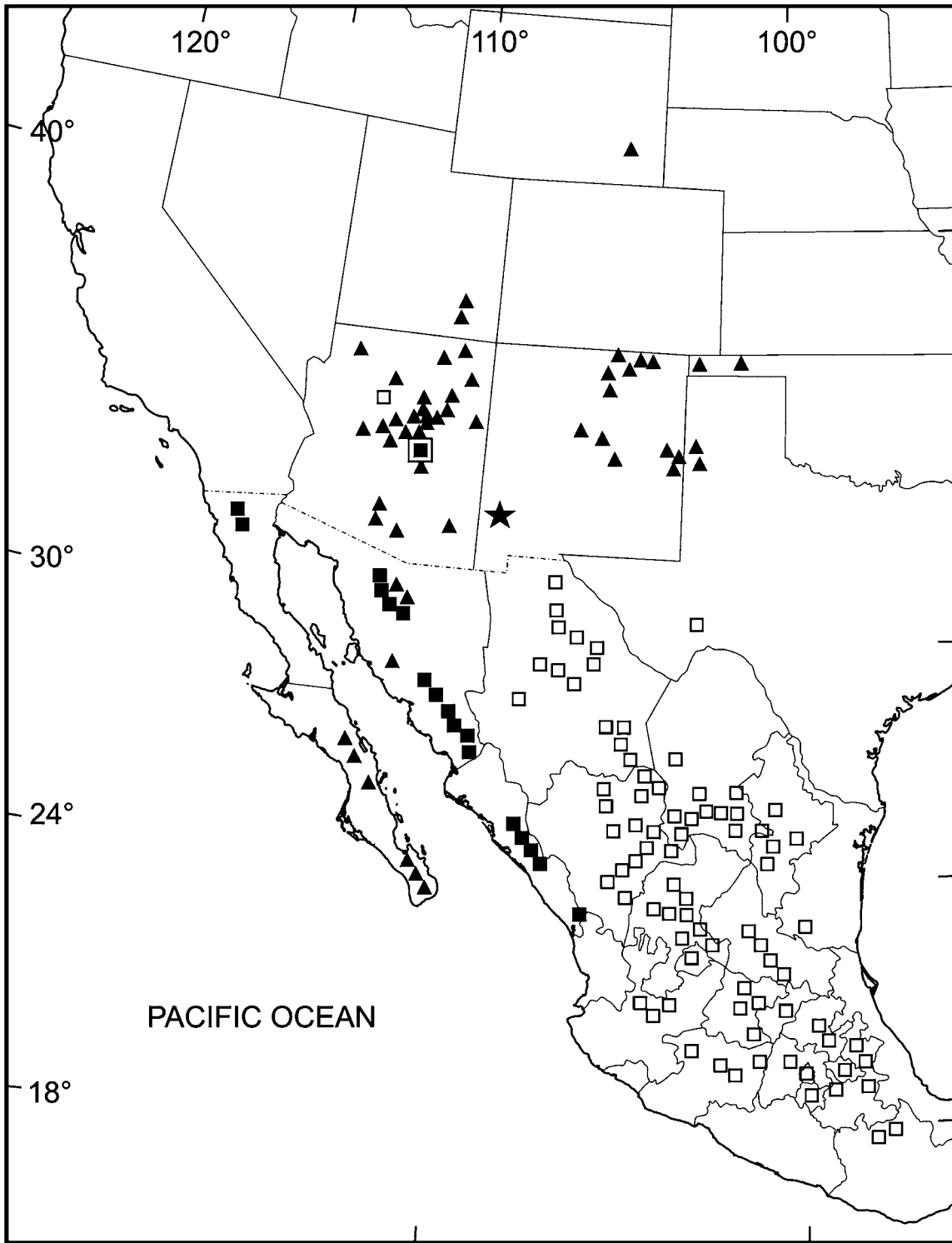


Fig. 4. Geographical distribution of *Streptocephalus dorotheae* (triangles), *S. henridumontis* n. sp. (closed squares), *S. mackini* (open squares), and *S. thomasbowmani* n. sp. (star).

- 3. Finger with two teeth on inner dorsal side of proximal part; genitalia with a pair of linguiform lateral outgrowths on base of penes: *S. sealii* Ryder, 1879
- Finger with three teeth on inner dorsal side of proximal part; genitalia without a pair of linguiform lateral outgrowths on base of penes: *S. similis* Baird, 1852

- 4. Genitalia with a pair of linguiform lateral outgrowths on base of penes; ovaries uniramous: *S. woottoni* Eng, Belk, and Eriksen, 1990
- Genitalia without a pair of linguiform lateral outgrowths on base of penes: 5
- 5. Dorsal margin of thumb crenate or spinose: 6

Table 1. General distribution and conservation status of the New World *Streptocephalus* species.

<i>Streptocephalus</i>	Distribution	Conservation status	Reference
<i>antillensis</i>	Endemic to Mona Island, Puerto Rico	Critically endangered	Maeda-Martínez <i>et al.</i> (1995a)
<i>dorotheae</i>	Widely distributed in two northwestern states of México, and six western states of the U.S.A.	Under no immediate threat	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>guzmani</i>	Endemic to Coahuila, México	Endangered	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>henridumontis</i>	Widely distributed in three northwestern states of México, and two southwestern states of the U.S.A.	Under no immediate threat	This study
<i>kargesi</i>	Endemic to Veracruz, México	Critically endangered	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>linderi</i>	Coahuila, Nuevo León, and Tamaulipas, México; Texas, U.S.A.	Under no immediate threat	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>mackini</i>	Widely distributed in México, and Arizona, New Mexico, and Texas, U.S.A.	Under no immediate threat	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>mattoxi</i>	Endemic to Kenedy County, Texas, U.S.A.	Endangered	Maeda-Martínez <i>et al.</i> (1995a)
<i>moorei</i>	Chihuahua, México, and New Mexico, U.S.A.	Endangered	Maeda-Martínez <i>et al.</i> (2005)
<i>potosinensis</i>	Endemic to San Luis Potosí, México	Critically endangered	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>sealii</i>	Widely distributed: México, U.S.A., and Canada	Under no immediate threat	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>similis</i>	Widely distributed: Belize, Hispaniola, Puerto Rico, Jamaica, México, and U.S.A.	Under no immediate threat	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>texanus</i>	Widely distributed: Barbuda, Desirade, México, and U.S.A.	Under no immediate threat	Maeda-Martínez <i>et al.</i> (1995a, 2002)
<i>thomasbowmani</i>	Endemic to New Mexico, U.S.A.	Endangered	This study
<i>woottoni</i>	Endemic to northern Baja California, México, and southern California, U.S.A.	Endangered	Eng, Belk, and Eriksen (1990); Simovich (1998); Maeda-Martínez <i>et al.</i> (1995a, 2002)

- Dorsal margin of thumb inerm: 8
- 6. Dorsal margin of thumb crenate; ovaries uniramous:
S. mattoxi Maeda-Martínez, Belk, Obregón-Barboza, and Dumont, 1995
- Dorsal margin of thumb spinose; ovaries biramous: 7
- 7. Finger with a single hump-like tooth on inner dorsal side of proximal part; dorsolateral side of base of hand, with long anteriorly curved process: *S. moorei* Belk, 1973
- Finger with two teeth on inner dorsal side of proximal part; dorsolateral side of base of hand, without a long process:
S. antillensis Mattox, 1950
- 8. Finger with a small hump-like proximal tooth on inner dorsal side of proximal part; peduncle without spiniform protuberances on inner side; ovaries uniramous:
S. guzmani Maeda-Martínez, Belk, Obregón-Barboza, and Dumont, 1995
- Finger with a well-developed proximal tooth; peduncle with spiniform protuberances on inner side: 9
- 9. Finger with proximal tooth larger than distal tooth: 10
- Finger with proximal tooth smaller than distal tooth: 11
- 10. Distal tooth of finger spatulate; ovaries biramous:
S. potosinensis Maeda-Martínez, Belk, Obregón-Barboza, and Dumont, 1995
- Distal tooth of finger with an anterior cuspid; ovaries biramous:
S. linderi Moore, 1966
- 11. Apex of finger without a lateral process: 12
- Apex of finger with a lateral process; biramous ovaries: 13
- 12. Finger with stout tooth on the lateral side; finger with a narrow dorsal lamella at first geniculation; uniramous ovaries:
S. thomasbowmani n. sp.
- Finger without a tooth on the lateral side; finger with a wide dorsal lamella at first geniculation; biramous ovaries:
S. dorotheae Mackin, 1942
- 13. Apex of finger with a lamellar process:
S. texanus Packard, 1871
- Apex of finger with a spiniform process: 14
- 14. Distal tooth of finger with anterior margin anterodorsally prolonged forming a semirectangular digitiform structure; dorsal lamella of finger narrow at first geniculation, and forms a straight border at second geniculation: *S. henridumontis* n. sp.
- Distal tooth of finger acuminate; dorsal lamella of finger broad at first geniculation, and forms a curved border at second geniculation:
S. mackini Moore, 1966

MATERIAL EXAMINED

Streptocephalus dorotheae Mackin, 1942.—MEXICO: BAJA CALIFORNIA SUR: Club Campestre, La Paz, 28.09.95, A. Maeda, CIB-097, 15 males, 05 females; 04.10.95, A. Maeda, CIB-099, 08 males, 13 females. El Comitán, La Paz-San Juan de la Costa, 11.09.96, A. Maeda, CIB-229, 37 males, 40 females. El Sargento junction, State highway La Paz-San Juan de los Planes, 25.09.94, A. Maeda, E. Serviere, CIB-087, 90 males, 51 females; 11.12.94, A. Maeda, H. Obregón, CIB-089, 04 males, 06 females. Km 64, Federal highway No. 1, Cabo San Lucas-La Paz, 24.11.85, A. Maeda, UJED-183, 02 males. Km 11, Federal highway No. 1, La Paz-Todos Santos, 22.12.94, A. Maeda, H. Obregón, H. García, CIB-106, 28 males, 44 females. Km 12.8, Federal highway No. 1, La Paz-Todos Santos, 04.02.95, A. Maeda, H. Obregón, CIB-127, 25 males, 184 females. Km 13, Federal highway No. 1, La Paz-Todos Santos, 22.12.94, A. Maeda, H. Obregón, H. García, CIB-108, 34 males, 40 females. Km 19, Federal highway No. 1, La Paz-Todos Santos, 07.10.95, A. Maeda, F. J. Encarnación, CIB-126, 75 males, 03 females; 07.10.95, A. Maeda, F. J. Encarnación, CIB-129: 250 males, 87 females. Km 20, Federal highway No. 1, La Paz-Todos Santos, 22.12.97, A. Maeda, H. Obregón, CIB-103, 09 males, 04 females; 07.10.95, A. Maeda, F. J. Encarnación, CIB-130, 74 males, 360 females. Km 36, Federal highway No.1, Loreto-Santa Rosalía, 11.09.96, A. Maeda, CIB-223, 77 males, 154 females. Km 37, Federal

highway No. 1, Loreto-Santa Rosalía, 11.09.96, A. Maeda, CIB-224, 106 males, 115 females. Km 47, Federal highway No. 1, Loreto-Santa Rosalía, 11.09.96, A. Maeda, CIB-225, 01 males, 02 females. Km 55, Federal highway No. 1, Loreto-Santa Rosalía, 11.09.96, A. Maeda, CIB-226, 243 males, 338 females. Km 107, Federal highway No. 1, Insurgentes-Loreto, 11.09.96, A. Maeda, CIB-227, 10 males, 07 females. SONORA: Km 5.5 Querobabi, Federal highway No. 15, Hermosillo-Santa Ana, 06.09.96, A. Maeda, CIB-207, 01 males, 02 females. Km 121, Federal highway No. 15, Hermosillo-Santa Ana, 2 km S Benjamín Hill, 06.09.96, A. Maeda, CIB-203, 212 males, 507 females. Km 142, Federal highway No. 15, Hermosillo-Santa Ana, 05.09.96, A. Maeda, CIB-182, 423 males, 570 females. UNITED STATES OF AMERICA: ARIZONA: Navajo County, 18.08.73, D. Belk, DB-191, 20 males, 14 females. 18.4 km (11.5 mi) E Flagstaff, highway 66, Coconino County, 02.09.57, W.G. Moore, USNM-184652, 04 males, 05 females.

Streptocephalus henridumontis n. sp.—MEXICO: BAJA CALIFORNIA (NORTE): Km 80, Federal highway No. 3, Ensenada-San Felipe, 10.08.96, P. Guzmán, H. García, CIB-084, 23 males, 16 females. Km 81, Federal highway No. 3, El Chorrillo Ensenada-San Felipe, 10.08.96, H. García, P. Guzmán, CIB-082, 24 males, 111 females; 10.08.96, P. Guzmán, H. García, CIB-083, 03 males, 04 females. SINALOA: Km 110, Federal highway No. 15, Culiacán-Guasave, 05.10.96, A. Maeda, CIB -170, 03 males, 03 females. Km 21, Rancho La Posta, Federal highway No. 15, Culiacán-Los Mochis, 20.11.85, A. Maeda, UJED-180, 30 males, 15 females; 20.11.85, A. Maeda, UJED-182, 16 males, 11 females. Km 90, Federal highway No. 15, Culiacán-Los Mochis, 20.11.85, A. Maeda, UJED-184, 16 males, 08 females; 20.11.85, A. Maeda, UJED-187, 06 males, 09 females. Km 153, Federal highway No. 15, Culiacán-Los Mochis, 05.10.96, A. Maeda, CIB-166, 03 males, 04 females. Tepic-Mazatlán, Km 187, Escuinapa, 06.10.96, A. Maeda, CIB-171, 21 males, 36 females. 01 Km S La Abuya de Higuera, Federal highway No. 15, Mazatlán-Culiacán, 20.11.85, A. Maeda, UJED-181, 11 males, 45 females. SONORA: Ejido La Sangre, road to Ejido San José, Federal highway No. 2, Altar-Santa Ana, 05.09.96, A. Maeda, CIB-178, 09 males, 17 females. Ejido San José, Federal highway No. 2, Altar-Santa Ana, 05.09.96, A. Maeda, CIB-181, 10 males, 13 females. Km 82, Federal highway No. 15, Empalme-Cd. Obregón, 07.09.96, A. Maeda, CIB-218, 05 males, 02 females. Km 108, Federal highway No. 15, Empalme-Cd Obregón, 07.09.96, A. Maeda, CIB-215, 05 males, 16 females. 03 Km E Empalme, Federal highway No. 15, Empalme-Cd. Obregón, 07.09.96, A. Maeda, CIB-213, 06 males, 18 females. Km 16, Federal Highway No. 15, Esperanza-Los Hornos, Cd. Obregón-Guaymas, 08.09.96, A. Maeda, CIB-220, 74 males, 122 females. Km 210, Federal highway No. 15, Hermosillo-Guaymas /Cd. Obregón, 07.09.96, A. Maeda, CIB-210, 171 males, 140 females. Km 121, Federal highway No.15, Hermosillo-Santa Ana, 2 km S Benjamín Hill, 06.09.96, A. Maeda, CIB-204, 23 males, 29 females. Km 142, Federal highway No. 15, Hermosillo-Santa Ana, 05.09.96, A. Maeda, CIB-183, 79 males, 35 females. Km 145.5, Federal highway No. 15, Hermosillo-Santa Ana, 06.09.96, A. Maeda, CIB-202, 09 males, 08 females. Km 146, Federal highway No. 15, Hermosillo-Santa Ana, 06.09.96, A. Maeda, CIB-184, 183 males, 158 females. Km 1.5 road to Querobabi, Federal highway No. 15, Hermosillo-Santa Ana, 06.09.96, A. Maeda, CIB-205, 233 males, 104 females. Km 5 road to Querobabi, Federal highway No. 15, Hermosillo-Santa Ana, 06.09.96, A. Maeda, CIB-206, 29 males, 32 females. Km 5.5 road to Querobabi, Federal highway No. 15, Hermosillo-Santa Ana, 06.09.96, A. Maeda, CIB-208, 13 males, 21 females. Km 6 in Querobabi, Federal highway No. 15, Hermosillo-Santa Ana, 06.09.96, A. Maeda, CIB-209, 04 males, 09 females. Km 43.8, Federal highway Los Hornos-Rosario, 08.09.96, A. Maeda, CIB-222, 33 males, 68 females. Km 118, Federal highway No. 15, Navajoa-Los Mochis, 04.10.96, A. Maeda, CIB-193, 02 males, 04 females. Km 141, Federal highway No. 15, Navajoa-Los Mochis, 04.10.96, A. Maeda, CIB-190, 03 males, 08 females. Km 4.8, highway Navajoa-Alamos, 03.10.96, A. Maeda, CIB-186, 04 males, 09 females; 03.10.96, A. Maeda, CIB-188, 76 males, 44 females. Road to Ejido San José, junction to San Agustín, Federal highway No. 2, Altar-Santa Ana, 05.09.96, A. Maeda, CIB-177, 334 males, 424 females. Road to Ejido San José, junction to San Armando, Federal highway No. 2, Altar-Santa Ana, 05.09.96, A. Maeda, CIB-176, 92 males, 78 females. Road to Ejido San José, Federal highway No. 2, Altar-Santa Ana, 2 Km N Ejido la Sangre, 05.09.96, A. Maeda, CIB-179, 10 males, 03 females. Road to Ejido San José, Federal highway No. 2, Altar-Santa Ana, 200 meters N Ejido la Sangre, 05.09.96, A. Maeda, CIB-180, 71 males, 66 females. 3.2 km W Alamos, 01.09.65, R. Hartland-Rowe, USNM-184654,

05 males, 01 females. UNITED STATES OF AMERICA: ARIZONA: Maricopa County, 14.10.71, D. Belk, DB-015, 06 males, 02 females. Pinal County, 05.09.71, D. Belk, DB-022, 02 males, 01 female. Cochise County, 05.08.72, D. Belk, DB-100, 08 males, 04 females. NEW MEXICO: Hidalgo County, 21.09.70, D. Belk, DB-702, 04 males, 02 females.

Streptocephalus mackini Moore, 1966.—MEXICO: AGUASCALIENTES: Aguascalientes, 03.08.63, P. J. Spangler, USNMAcc.253913, 02 males, 02 females. Junction to San Antonio de Peñuelas, Federal highway No. 45, Aguascalientes-Encarnación de Díaz, 17.07.85, A. Maeda, FCB-99, 41 males, 59 females. CHIHUAHUA: Ejido Ignacio Allende, state highway No. 28, Cuauhtemoc-Oscar Soto Maynes, 20.09.85, A. Maeda, FCB-127, 37 males, 31 females. Junction Estación Rellano-Los Sauces, Federal highway No. 49, Escalón-Jiménez, ND, A. Maeda, UJED-065, 04 males. Junction to Rancho La Peña, 35 km W Chihuahua, state highway No. 16, Chihuahua-General Trías, 17.09.85, A. Maeda, FCB-142, 17 males, 07 females. Junction to Zatevo, 34 km W Chihuahua, state highway No. 16, Chihuahua-General Trías, 19.09.85, A. Maeda, FCB-150, 65 males, 35 females. Km 126, Federal highway No. 16, Chihuahua-La Junta, 18.09.85, A. Maeda, FCB-126, 04 males, 16 females. Km 19, Federal highway, No. 45, Jiménez-Cd. Camargo, 16.09.85, A. Maeda, UJED-060, 100 males, 50 females; 16.09.85, A. Maeda, UJED-158, 28 males, 30 females. Km 47, Federal highway No. 45, Jiménez-Cd. Camargo, 16.09.85, A. Maeda, FCB-112, 55 males, 45 females. Km 50, Federal highway No. 45, Jiménez-Cd. Camargo, 16.09.85, A. Maeda, UJED-166, 20 males, 06 females. Km 88, state highway No. 10, Buenaventura-El Sueco, 20.09.85, A. Maeda, UJED-192, 15 males, 08 females. Km 91, 10 km W Cuauhtémoc, state highway No. 10, Cuauhtémoc-La Junta, 19.08.84, A. Maeda, FCB-149, 81 males, 11 females. La Peñita, 12 km N Gómez Farías, state highway No. 28, Gómez Farías-Buenaventura, 20.09.85, A. Maeda, FCB-143, 55 males, 45 females. Rancho Arroyo Seco, Tomochic-Basaseachic, 18.09.85, A. Maeda, FCB-111, 14 males, 25 females. Rancho El Retiro, 10 km N Chihuahua, Federal highway No. 45, Chihuahua-Cd. Juárez, 21.09.85, A. Maeda, FCB-146, 42 males, 41 females. 0.5 km E Boquiachic, state highway No. 10, La Junta-Basaseachic, 18.09.85, A. Maeda, FCB-164, 03 males, 05 females. 01 km W Pedernales, state highway No. 10, Cuauhtémoc-La Junta, 18.09.85, A. Maeda, FCB-117, 55 males, 45 females. 07 km NW Soto Maynes, state highway No. 28, Cuauhtémoc-Zaragoza, 20.09.85, A. Maeda, FCB-156, 37 males, 63 females. 08 km N Cerro Campana, 29.06.60, ND, USNM-Acc.305974, 01 male. 13 km S Buenaventura, state highway No. 28, Gómez Farías-Buenaventura, 20.09.85, A. Maeda, FCB-148, 43 males, 77 females. 72 km S Ciudad Juárez, 15.08.55, J. E. Lynch, USNM-Acc.294523, 29 males. COAHUILA: Colonia Aviación, International airport, Torreón, 25.12.82, A. Maeda, UJED-221, 02 males. Ejido Jalisco, state highway Torreón-Jimúlco, 04.07.82, A. Maeda, FCB-56, 23 males, 77 females. El Dorado, 80 km W Saltillo, Federal highway No. 40, Saltillo-Paila, 17.07.81, A. Maeda, FCB-031, 13 males. Km 241, Federal highway No. 30, Monclova-San Pedro, 30.10.81, A. Maeda, FCB-067, 54 males, 46 females. Km 241, Federal highway No. 30, Monclova-San Pedro, 30.10.81, A. Maeda, UJED-155, 150 males, 100 females. Km 132 W Saltillo, Federal highway No. 40, Torreón-Paila, 17.06.83, A. Maeda, UJED-165, 13 males. Km 160, Federal highway No. 40, Torreón-Paila, 16.10.85, A. Maeda, UJED-067, 84 males. La Herradura, Ejido La Puerta, Km 06, state highway La Rosa-General Cepeda, 22.09.85, A. Maeda, FCB-120, 57 males, 43 females. Parque Beisbol Infantil, Torreón Jardín, 11.06.86, A. Maeda, UJED-071, 02 males, 01 female. Presa Cerro Bola, Federal highway No. 40, Torreón-Paila, 16.11.85, A. Maeda, UJED-178, 200 males; UJED-179, 100 females. Puente El Refugio, Cerro Bola, 70 km E Torreón, Federal highway No. 40, Torreón-Paila, 16.11.85, A. Maeda, UJED-051, 150 males; 11.11.85, A. Maeda, UJED-233, 200 males; 11.09.85, A. Maeda, UJED-243, 118 males. San Rafael de los Milagros, 165 km W Saltillo, Federal highway No. 40, Torreón-Paila, 29.10.85, A. Maeda, UJED-257, 38 males. Saucillo, Viesca, 15.05.81, A. Maeda, FCB-017, 53 males. Plan de Ayala, 30 km W Saltillo, Federal highway No. 40, Saltillo-La Rosa, 06.06.84, A. Maeda, UJED-064, 07 males. 12 km N Saltillo, Federal highway No. 47, 12.08.88, S. Contreras, FCB-215, 05 males, 04 females. 28.9 km S Paredón, Ramos Arizpe, 15.05.81, E. Liner, FCB-017, 53 males, USNM120436, 02 males, 02 females. DISTRITO FEDERAL: Distrito Federal, 1925, A. L. Herrera, USNM059392, 01 male, 01 female. DURANGO: El Berrendo, Federal highway No. 45, La Zarca-Parral, 15.09.85, A. Maeda, FCB-135, 03 males, 03 females. El Ranchito, Covadonga, 22 km NW Peñón Blanco, Peñón Blanco-Nazas, 10.08.87, A. Maeda, UJED-145, 63 males, 37 females. El Tapado, Las Lilas, road to Laboratory of Reserva de la Biósfera de Mapimí, 12.08.88, A. Maeda,

UJED-169, 56 males, 71 females. Junction to Ejido Arturo Bernal-Rancho Viborillas, Federal highway No. 40, Francisco I. Madero-Durango, 16.07.85, A. Maeda, UJED-050, 73 males, 27 females. Junction to Rancho El Chorro, Federal highway No. 40, Francisco I. Madero, 16.07.85, A. Maeda, UJED-068, 32 males, 58 females. Junction to Pedriceña, Federal highway No. 49, Lerdo-Cuencamé, 08.07.85, A. Maeda, UJED-049, 115 males, 260 females. Km 158, Federal highway No. 40, El Salto-Mazatlán, Pueblo Nuevo, 29.10.96, A. Maeda, CIB-142, 12 males, 41 females. Km 38, Federal highway No. 45, La Zarca-Parral, 15.09.85, A. Maeda, FCB-136, 04 males, 02 females. Km 268, Federal highway No. 45, Zacatecas-Durango, 16.07.85, A. Maeda, 16.07.85, A. Maeda, FCB-077, 75 males, 13 females. La Flor, road to Laboratorio de la Reserva de la Biósfera de Mapimí, 12.08.88, A. Maeda, UJED-154, 17 males, 01 female. León Guzmán, Federal highway No. 49, Lerdo-Cuencamé, 10.09.83, A. Maeda, UJED-073, 37 males, 63 females. Los Remedios creek, road to Laboratorio de la Reserva de la Biósfera de Mapimí, 12.08.88, A. Maeda, UJED-170, 04 males, 05 females. Sombretillo, 04.07.82, A. Maeda, FCB-066, 53 males, 47 females. 50 meters E Laboratorio de la Reserva de la Biósfera de Mapimí, 12.08.88, A. Maeda, UJED-157, 04 males. 0.5 km E Mapimí, Federal highway No. 30, Mapimí-La Zarca, 14.09.85, A. Maeda, FCB-116, 06 males. 01 km N Yerbaniz, Federal highway No. 49, Yerbaniz-Cuencamé, 08.07.85, A. Maeda, UJED-056, 24 males, 76 females. 3.6 km N Nieves, Federal highway No. 45, La Zarca-Parral, 15.09.85, A. Maeda, FCB-162, 15 males, 85 females. 10 km N Peñón Blanco, Las Cruces-Peñón Blanco-Covadonga, 16.07.85, A. Maeda, 07.10.84, A. Maeda, UJED-050, 39 males, 01 females. ESTADO DE MEXICO: Rancho Viejo, Federal highway No. 190, México-Puebla, 20.07.85, A. Maeda, FCB-105, 95 males, 05 females. 46.6 km N Toluca, 12.07.40, L. M. Stanford, USNMAcc.305974, 03 males, 01 female. GUANAJUATO: Km 40, Federal highway No. 57, Querétaro-San Luis Potosí, 26.10.96, A. Maeda, CIB-143, 554 males, 384 females. Km 53, Federal highway No. 57, Querétaro-San Luis Potosí, 26.10.96, A. Maeda, CIB-144, 22 males, 80 females. Km 63, Federal highway No. 57, Querétaro-San Luis Potosí, Ejido San Antonio Primero, 26.10.96, A. Maeda, CIB-145, 807 males, 775 females. Km 89, Federal highway No. 57, Querétaro-San Luis Potosí, 29.02.96, M. Elías, J. Ciros, CIB-395, 21 males, 01 females. Km 96, Federal highway No. 57, Querétaro-San Luis Potosí: 26.10.96, A. Maeda, CIB-147, 415 males, 1316 females; 26.10.96, A. Maeda, CIB-148, 844 males, 2052 females; 26.10.96, A. Maeda, CIB-146, 202 males, 616 females; 26.10.96, A. Maeda, CIB-149, 445 males, 594 females. 8 km N Ojo de Agua, 04.08.58, E. Liner, USNM120434, 05 males, 04 females. 10 km S Guanajuato, Federal highway Guanajuato-Irapuato, 17.07.85, A. Maeda, FCB-092, 47 males, 09 females. HIDALGO: Km 30, Federal highway No.130, Pachuca-Tulancingo, 25.10.96, A. Maeda, CIB-151, 01 male. San Sebastián Tenoxtitlan, Federal highway No. 45, Querétaro- Huichapan, 01.10.96, M. Elías, J. Ciros, CIB-396, 16 males, 18 females; 01.10.97, M. Elías, J. Ciros, CIB-398, 13 males, 22 females. 05 Km E Tulancingo, Federal highway No. 130, Pachuca-Tulancingo, 25.10.96, A. Maeda, CIB-150, 18 males, 23 females. JALISCO: Km 50, 15 km SE Tequila, Federal highway No. 15, 30.12.87, A. Maeda, UJED-054, 08 males, 40 females. 1.6 km NW Magdalena, 09.07.60, E. Liner, USNM120444, 15 males, 15 females. 16 km N Chapala, 31.07.63, USNMAcc.253913, 01 male, 01 female. MICHOACAN: Caratacua, Km 70, Federal highway No. 15, Morelia-Zacapu, 07.10.96, A. Maeda, CIB-153, 83 males, 169 females. Km 19, junction to Capula, Federal highway No. 15, Morelia-Quiroga, 07.10.96, A. Maeda, CIB-155, 201 males, 148 females. Km 23, Federal highway No. 15, Morelia-Quiroga, 07.10.96, A. Maeda, CIB-154, 38 males, 76 females. Km 116, Federal highway No. 15, Toluca-Cd. Hidalgo, 08.10.96, A. Maeda, CIB-156, 143 males, 352 females. Km 371, Federal highway No.51 "D", México-Guadalajara (Maxipista), 07.10.96, A. Maeda, CIB-152, 01 male. NUEVO LEON: Junction to Villa de García-Monterrey-Col. López Mateos, Federal highway No. 40, Saltillo-Nuevo Laredo, 13.09.85, A. Maeda, FCB-161, 05 males, 08 females. 6.4 km S Galeana, 03.07.60, E. Liner, USNM120435, 06 males, 04 females. OAXACA: Km 71, Federal highway No. 125, Tehuacán-Oaxaca, 12.10.96, A. Maeda, CIB-159, 755 males, 100 females. Km 72, Salto del Tigre, Federal highway No. 125, Tehuacán-Huajapan, 12.10.96, A. Maeda, CIB-158, 02 males, 06 females. Km 201, Federal highway No. 190, Izúcar de Matamoros-Oaxaca, 12.10.96, A. Maeda, CIB-157, 76 males, 103 females. PUEBLA: Acatzingo, 21.05.49, G. Alvarez, USNM120439, 01 male, 01 female. Ahuazotepec, Federal highway No. 119, Zacatlán-Huachinango, 21.07.85, A. Maeda, FCB-098, 74 males, 26 females. Aquixtla, Federal highway No. 119, 12.07.85, A. Maeda, FCB-107, 67 males, 33 females. Enselada, Federal highway No. 105, Pachuca-Tampico, 22.07.85, A. Maeda, FCB-068, 26 males, 65 females. Km 64,

Federal highway No. 29, Tehuacán-Cd. Serdán, 12.10.96, A. Maeda, CIB-172, 10 males, 06 females. Km 8.4, Federal highway No. 129, Zacatepec-Oriental, Laguna de Totolcingo, 13.10.96, A. Maeda, CIB-174, 02 males, 01 female. Km 10.5, Federal highway No. 129, Zacatepec-Oriental, Laguna de Totolcingo, 13.10.96, A. Maeda, CIB-175, 15 males, 19 females. Km 38, Federal highway No. 140, Zacatepec-El Seco, 13.10.96, A. Maeda, CIB-173, 35 males, 17 females. Presa Zevastopol, Federal highway No. 119, 21.07.85, A. Maeda, FCB-014, 07 males, 08 females. QUERÉTARO: San Javier Las Tuzas, Federal highway No. 120, Querétaro-Jalpan de Serra, 02.10.96, M. Elías, J. Ciros, CIB-401, 13 males, 09 females; 27.11.96, M. Elías, J. Ciros, CIB-402, 23 males, 17 females. 16 km N Querétaro, 04.08.58, E. Liner, USNM120443, 01 male, 02 females. SAN LUIS POTOSÍ: Rancho Las Jarillas, Villa de Guadalupe, 29.09.96, A. Maeda, CIB-405, 34 males, 26 females. Villa Zaragoza, 29.02.96, M. Elías, J. Ciros, CIB-400, 02 males, 17 females. 4.8 km S Ventura, 04.07.60, E. Liner, USNM120440, 06 males, 06 females. 08 km NE Villa de Reyes, Federal highway San Luis Potosí-Villa de Reyes, ND, S. Contreras, FCB-168, 53 males, 47 females. TLAXCALA: Apizaco, Federal highway 119, Apizaco-Tlaxco, 20.07.85, A. Maeda, FCB-108, 39 males, 61 females. ZACATECAS: El Rosario, Federal highway No. 45, Durango-Sombretete, 16.07.85, A. Maeda, FCB-089, 40 males, 41 females. Flores Magón, Federal highway No. 45, Durango-Sombretete, 16.07.85, A. Maeda, FCB-080, 15 males, 09 females. Junction to Villa de Coss, Federal highway No. 54, Zacatecas-Saltillo, 27.07.68, S. Contreras, FCB-211, 79 males, 21 females. Km 70, junction to Cuauhtemoc, Federal highway No. 45, Zacatecas-Aguascalientes, 17.07.85, A. Maeda, FCB-085, 64 males, 36 females. Km 18.5, Federal highway No. 49, Fresnillo-Río Grande, 200 meters N Tropic of Cancer Monument, 05.07.87, A. Maeda, UJED-167, 06 males, 08 females. Km 27.5, Federal highway No. 49, Fresnillo-Cuencamé: 27.10.96, A. Maeda, CIB-200, 280 males, 3361 females; 27.10.96, A. Maeda, CIB-201, 315 males, 48 females. Km 64, Federal highway No. 49, San Luis Potosí-Zacatecas, 21.10.96, A. Maeda, CIB-098, 78 males, 26 females. Km 68, Federal highway No.49, San Luis Potosí-Zacatecas, 26.10.96, A. Maeda, CIB-199, 56 males, 04 females. 5.4 km N Transcosco, 13.07.64, E. Liner, H. Hundee, USNM120438, 10 males. 07 km N Villanueva, Federal highway No. 54, Villanueva-San José la Palma, 02.02.83, A. Maeda, UJED-058, 102 males, 33 females. UNITED STATES OF AMERICA: ARIZONA: Yavapai County, 26.06.72, D. Belk, DB-90, 09 males, 10 females; 26.06.72, D. Belk, DB-91, 09 males, 08 females. 7.3 mi W Flagstaff, Coconino County, 05.10.63, W. G. Moore, USNM120446, 05 males. Coconino County, ND, Denton, Belk, DB-107, 05 males, 08 females. 15.1 mi S Kansas Settlement road on AZ/86, 01.09.73, D. Belk, USNM149357, 10 males. NEW MEXICO: Otero County, 14.09, D. Belk, DB-859, 11 males, 08 females. 0.6 mi NE of state line on US80, Hidalgo County, 05.08.72, D. Belk, USNM152339 (DB099), 22 males. Lordsburg, 11.09.37, J. L. Lynch, USNMAcc.305974, 03 males. TEXAS: Galberson County, 23.09.86, D. Belk, DB-716, 10 males, 01 females. Hudspeth County, 11.09.86, D. Belk, DB-712, 08 males, 05 females. 12 mi SW Sheffield, Terrell County, 11.06.52, W. G. Moore, USNM120445, 10 males. 05 mi W Van Horn, Culberson County, 10.09.37, ND, USNMAcc.294523, 03 males, 03 females.

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LITERATURE CITED

Baird, W. 1852. Monograph of the family Branchiopodidae, a family of crustaceans belonging to the division Entomostraca, with a description of a new genus and species of the family, and two new species belonging to

- the family Limnadiadae.—Proceedings of the Zoological Society of London 20: 18–30. (Repeated verbatim in 1854, in *Annals and Magazine of Natural History*, Second series, 14: 216–229.)
- Belk, D. 1973. *Streptocephalus moorei* n. sp., a new fairy shrimp (Anostraca) from Mexico.—*Transactions of the American Microscopical Society* 92: 507–512.
- . 1975. Key to the Anostraca (fairy shrimps) of North America.—*The Southwestern Naturalist* 20: 91–103.
- . 1983. New fairy shrimp distribution records among collections at the California Academy of Sciences.—*The Southwestern Naturalist* 28: 380–381.
- , and J. Brtek. 1995. Checklist of the Anostraca.—*Hydrobiologia* 298: 315–353.
- , and ———. 1997. Supplement to 'Checklist of the Anostraca'.—*Hydrobiologia* 359: 243–245.
- Campoy-Favela, J., and A. Quijada-Mascareñas. 1993. Additional distribution records of fairy shrimp (Anostraca) from Sonora, México.—*The Southwestern Naturalist* 38: 85–86.
- Creaser, E. P. 1930. The North American phyllopods of the genus *Streptocephalus*.—*Occasional Papers of the Museum of Zoology University of Michigan* 9: 1–10.
- Daday, E. 1910. Monographie systematique des phyllopedes anostraces.—*Annales des Sciences Naturelles, Neuvieme serie, Zoologie* 11: 91–489.
- Daniels, S. R., M. Hamer, and D. C. Rogers. 2004. Molecular evidence suggests an ancient radiation for the fairy shrimp genus *Streptocephalus* (Branchiopoda: Anostraca).—*Biological Journal of the Linnean Society* 82: 313–327.
- Dexter, R. W. 1959. Anostraca. Pp. 559–571 in W. T. Edmonson, ed. *Fresh Water Biology*. Wiley, New York.
- De Walsche, C., N. Munuswamy, and H. J. Dumont. 1991. Structural difference between the cyst walls of *Streptocephalus dichotomus* (Baird), *S. torvicornis* (Waga), and *Thamnocephalus platyurus* (Packard) (Crustacea: Anostraca), and a comparison with other genera and species.—*Hydrobiologia* 212: 195–202.
- Eng, L. L., D. Belk, and C. H. Eriksen. 1990. Californian Anostraca: distribution, habitat, and status.—*Journal of Crustacean Biology* 10: 247–277.
- Gilchrist, B. M. 1978. Scanning electron microscope studies of the egg shell in some Anostraca (Crustacea: Branchiopoda).—*Cell and Tissue Research* 193: 337–351.
- Herbert, B., and B. V. Timms. 2000. A new species of *Streptocephalus* (*Parastreptocephalus*) (Crustacea: Anostraca: Streptocephalidae) from north Queensland, Australia.—*Memoirs of the Queensland Museum* 45: 385–390.
- Hill, R. E., and W. D. Shepard. 1997. Observation on the identification of California anostracan cysts.—*Hydrobiologia* 359: 113–123.
- IUCN. 1996. 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland. 10 + 368 pp.
- IUCN. 2001. IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, United Kingdom. 2 + 30 pp.
- Koehn, R. K., and G. A. Cole. 1964. Checklist of the Branchiopoda (Anostraca) of Arizona with records of *Artemia salina* and *Streptocephalus dorotheae*.—*The Southwestern Naturalist* 9: 315–316.
- Lee, K. W., M. A. Gouthro, D. Belk, and J. R. Rosowski. 1994. Ultrastructure features of the tertiary envelope in the cyst of the brine shrimp *Artemia franciscana* (Anostraca). Pp. 362–363 in G. W. Bailey and A. J. Garratt-Reed, eds. *Proceedings of the 52nd Annual Meeting of the Microscopy Society of America*. San Francisco Press, Inc., San Francisco, U.S.A.
- Mackin, J. G. 1942. A new species of phyllopod crustacean from the southwestern shortgrass prairies.—*Proceedings of the United States National Museum* 92: 33–39.
- MacMahon, J. A., and F. H. Wagner. 1985. The Mojave, Sonoran and Chihuahuan deserts of North America. Pp. 105–202 in M. Evenari, I. Noy-Meir, and D. W. Goodall, eds. *Ecosystems of the World, 12A, Hot Deserts and Arid Shrublands*. Elsevier Science Publishers B. V., Amsterdam, The Netherlands.
- Maeda-Martínez, A. M. 1991. Distribution of species of Anostraca, Notostraca, Spinicaudata, and Laevicaudata in Mexico.—*Hydrobiologia* 212: 209–219.
- , D. Belk, H. Obregón-Barboza, and H. J. Dumont. 1995a. Diagnosis and phylogeny of the New World Streptocephalidae (Branchiopoda: Anostraca).—*Hydrobiologia* 298: 15–44.
- , ———, ———, and ———. 1995b. A contribution to the systematics of the Streptocephalidae (Branchiopoda: Anostraca).—*Hydrobiologia* 298: 203–232.
- , H. Obregón-Barboza, and H. García-Velazco. 1997. New records of large branchiopods (Branchiopoda: Anostraca, Notostraca and Spinicaudata) in Mexico.—*Hydrobiologia* 359: 63–68.
- , ———, ———, and M. A. Prieto Salazar. 2002. Branchiopoda Anostraca. Pp. 305–322 in J. Llorente-Bousquets, and J. J. Morrone, eds. *Biodiversidad, Taxonomía y Biogeografía de Artrópodos de México*. Universidad Nacional Autónoma de México, México.
- , D. C. Rogers, and R. D. Worthington. 2005. First records of the fairy shrimp *Streptocephalus moorei* Belk, 1973 (Branchiopoda: Anostraca) from the United States.—*Journal of Crustacean Biology* 25: 000–000.
- Mattox, N. T. 1950. A new species of phyllopod of the genus *Streptocephalus* from Mona Island, Puerto Rico.—*Journal of the Washington Academy of Sciences* 40: 413–415.
- Maynard, S. S., and S. V. Romney. 1975. The occurrence of four new anostracans (Crustacea) phyllopods in Utah, multispecies records, and some notes on their ecology.—*Utah Academy Proceedings* 52: 6–11.
- Moore, W. G. 1958. On the occurrence of *Streptocephalus similis* Baird in Mexico and the United States.—*Journal of the Washington Academy of Sciences* 48: 169–175.
- . 1966. New World fairy shrimps of the genus *Streptocephalus* (Branchiopoda, Anostraca).—*The Southwestern Naturalist* 11: 24–48.
- Mura, G. 1992. Pattern of egg shell morphology in thamnocephalids and streptocephalids of the New World (Anostraca).—*Crustaceana* 62: 300–311.
- Obregón-Barboza, H., A. M. Maeda-Martínez, H. García-Velazco, and H. J. Dumont. 2002. *Branchinecta oterosanvicentei* n. sp. (Branchiopoda: Anostraca), a new fairy shrimp from the Chihuahuan desert, with a proposal for the conservation of the Branchinectidae of México.—*Hydrobiologia* 467: 45–56.
- Packard, A. S. 1871. Preliminary notice of North American Phyllopoda.—*American Journal of Science and Arts*, 3rd series, 2(102): 108–113.
- . 1883. A monograph of the phyllopod Crustacea of North America, with remarks on the Order Phyllocarida.—*Twelfth Annual Report of the United States Geological and Geographical Survey of the Territories for 1878*: 295–592.
- Pennak, R. W. 1953. *Fresh-water Invertebrates of the United States*. Ronald Press, New York. 9 + 769 pp.
- . 1978. *Fresh-water Invertebrates of the United States*. 2nd edition. Wiley, New York. 15 + 803 pp.
- . 1989. *Fresh-water Invertebrates of the United States*, 3rd edition. Wiley, New York. 16 + 628 pp.
- Rosowski, J. R., D. Belk, M. A. Gouthro, and K. W. Lee. 1997. Ultrastructure of the cyst shell and underlying membranes of the brine shrimp *Artemia franciscana* Kellogg (Anostraca) during postcystic development, emergence, and hatching.—*Journal of Shellfish Research* 16: 233–249.
- Ryder, J. A. 1879. Description of a new branchiopod.—*Proceedings of the Academy of Natural Sciences of Philadelphia* 1879: 200–202.
- Spicer, G. S. 1985. A new state record of *Streptocephalus texanus* Packard (Anostraca) from Mexico.—*The Southwestern Naturalist* 27: 244–245.
- Waga, M. 1842. Nouvelle espèce de crustacés du genre des *Branchipes*.—*Annales de la Société Entomologique de France* 11: 261–263.

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