

**Redescription of the Holotype of
Argulus floridensis Meehan, 1940
(Arthropoda, Crustacea, Argulidae)**

William J. Poly

*Aquatic Biodiversity Research Institute, 11205 Schroeder Road, Saint Marys, OH 45885, USA;
Department of Ichthyology, California Academy of Sciences, 55 Music Concourse Drive,
Golden Gate Park, San Francisco, CA 94118, USA; wpoly@calacademy.org*

The holotype male of *Argulus floridensis* Meehan, 1940 is redescribed and illustrated in greater detail to provide new morphological and meristic information that will aid in identification of other specimens.

KEYWORDS: Crustacea, Branchiura, Argulidae, morphology, taxonomy

Meehan (1940) revised the taxonomy of the *Argulus* spp. in the National Museum of Natural History and included a description of one new species, *Argulus floridensis*. Only a single male, previously identified as *A. pugettensis* Dana, 1853, was available at the time. Meehan (1940, p. 489) noted that the specimen was in poor condition; it has continued to deteriorate and now is in very poor condition. Both carapace alae have disintegrated, and the posterior respiratory areas cannot be found now. The left first maxilla is missing. Basal segments of the legs remain intact, and the abdomen is in good condition. Illustrations were made of the right second maxilla, left antennae, two rods from the right first maxilla, the abdomen and fleshy lobe at posterior of thorax, and the second, third, and fourth legs on the left side, showing the secondary sexual modifications (right and left from dorsal view of specimen). Meehan (1940) illustrated the right second and fourth legs and the left third leg. My illustrations and observations of the legs generally agree with those of Meehan, except for the inclusion of more details and additional features, which will be mentioned below, that were not in the original description.

In his last work on Branchiura and Copepoda, Wilson (1944) included characters of *A. floridensis* in a key to *Argulus* spp., but did not add any new details to Meehan's original description. Cressey (1972) included *A. floridensis* in a key to species, but no additional morphological information was provided. In the list of figures, *A. floridensis* was included under basal plates of second maxilla (Cressey 1972, p. viii); however, no illustration for *A. floridensis* was in that figure. Cressey (1972) listed one host, *Mugil* sp. (mullet), for *A. floridensis*, but that information is erroneous (W. Poly pers. obs.). A thorough redescription of the species must wait until collections are available that include a good series of males and females. The purpose of this redescription of the holotype is to make available new details of the male such that others, who might already possess specimens or who might collect some in the future, will be able to identify them as *A. floridensis*.

MATERIALS AND METHODS

The holotype was examined as a temporary slide mount (with 70% ethanol and Hoyer's medium), and drawings were made with the aid of a camera lucida (Poly 2016).

RESULTS

Family Argulidae Rafinesque, 1815

*Argulus Müller, 1785**Argulus floridensis* Meehan, 1940

Florida fishlouse Figures 1–6.

MATERIAL EXAMINED.— Holotype (unique), adult male, 5.46 mm total length [Meehan 1940: 5.85 mm], USNM 77810 [see note], Key West, Florida, 1884, collector: A.E. Verrill [= Addison Emery Verrill]. Note: Meehan (1940, p. 467) listed the catalog number as “77810 (old number 60589);” mentioned here in case of relevant information in historical records under the old number.

DIAGNOSIS.— Two respiratory areas with smaller oblong “area” anterior to slightly larger oblong posterior “area;” single postantennal spines very broad; male with 77 support rods in suction cup; 14–19 sclerites per rod in male; mouth tube with at least 19 scales on basal half; basal plate of second maxilla with 3 stout spines, scales covering nearly entire raised pad, one stout, naked seta on posterior margin of pad; accessory spines on thorax large, very broad base on raised pad with many scales, tapering to rounded tips; first 2 pairs of legs lacking flagella; posteroventral surface of coxae of second legs of male expanded into a broadly-rounded lobe that is covered with many small and closely-arranged scales; third legs of male with two pegs issuing from cleft on dorsal side of legs and two fingerlike papillae; small fleshy lobe at posterior of thorax; male abdomen bilobate with testes extending to the level of the anal sinus base; caudal rami long, slender, basal in anal sinus.

DESCRIPTION.— Total length 5.46 mm [Meehan 1940: 5.85 mm]. Carapace shape is “ovate, sinuses shallow, cephalic areas broad...; alae reaching abdomen [Meehan 1940].” Carapace length [Meehan 1940: 4.88 mm]. Maximum carapace width [Meehan 1940: 4.28 mm]. Pair of compound eyes anteriorly with diameters 250 (left) and 220 (right) μm . Transverse distance between eyes 0.83 mm (830 μm). Nauplius eye with one anterior and two posterior ocelli. Sclerotized dorsal ridges not forked anterior of eyes. Ventrally, carapace with small, posteriorly-projecting spines along outer margin [due to the deteriorated condition of the carapace alae, additional details cannot be included here]. Respiratory areas consist of two oblong-shaped areas, anterior one slightly smaller than posterior [from Meehan 1940] (Fig. 1). No pigmentation present (but probably lost in preservative and/or due to clearing).

Thorax compressed dorsoventrally, 4-segmented, with 2 pairs of posteriorly-projecting spines ventrally. Spines digitate with broad base, anterior pair (accessory spines) larger than posterior pair (postmaxillary spines), both pairs angled mesially. Accessory spines between basal segments of second maxillae; very broad base on a raised pad covered with many scales; spines tapering to rounded tips (Fig. 2). Male with ovoid fleshy lobe at posterior of fourth thoracic segment between natatory lobes (Figs. 3A, 4). Thorax with scales scattered on ventral surface; thoracic segment at base of third leg produced laterally into expanded anterolateral lobe with scales

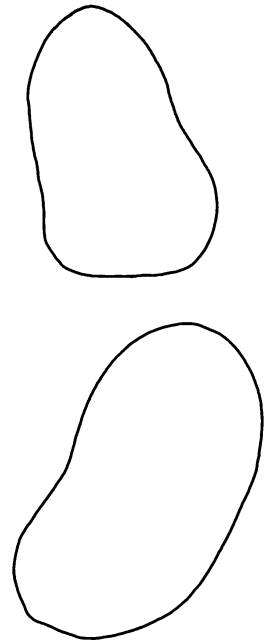


FIGURE 1. *Argulus floridensis*: shape of anterior and posterior respiratory areas (redrawn from Meehan 1940).

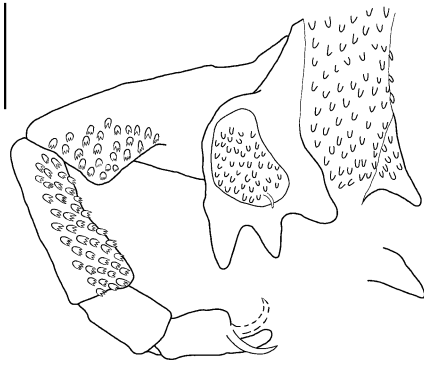


FIGURE 2. *Argulus floridensis*: Second maxilla, raised pad with scales (adjacent to thorax), accessory spine, and postmaxillary spine. Scale bar = 200 μ m.

protruding laterally and anteriorly in apposition to posterior lobe of coxae of second legs (Fig. 3A). Four pairs of biramous swimming legs composed of a precoxa, coxa, basis, exopod, and endopod. Exopods and endopods with plumose setae. First two pairs of legs lacking flagella. Endopods of first pair of legs 3-segmented with 3 setae distally. Endopods of second pair of legs unsegmented. Endopods of third and fourth pairs of legs 2-segmented. Second, third, and fourth legs of male with secondary sexual structures (Figs. 3A, B).

First legs lack secondary modifications. Second legs, the posterior ventral margin of coxae expanded into broadly-rounded lobe with many small, closely-arranged scales. Third legs, dorsal anterior coxae with broadly-rounded hump armed with many scales directed proximally; distal to this hump are two smaller, unarmed protuberances; at anterior distal margin of coxae an anteriorly-directed, fleshy projection (“upright fingerlike papilla” of Meehan 1940) (Fig. 3A).

Third legs with two sclerotized pegs in cleft on dorsal side at distal margins of coxae (or fused coxae+bases); pegs with a single, large horn and orifice distally; sclerotized ridge at anterior dorsal of coxa/basis junction; one fleshy papilla extends proximally (mesially) from sclerotized ridge anterior of two pegs and overhanging cleft (“saddle-shaped depression” of Meehan 1940). Posterior to pegs and cleft a triangular-shaped lobe covered with scales (Fig. 3B). Posterior margins of both precoxae+coxae and bases of fourth legs with natatory lobes bearing plumose setae. Anterior of bases a sclerotized ridge lies on basal half, opposed by recurved, finger-like appendage covered with fine scales distally; tiny spines or scales on its tip (Fig. 3A).

Abdomen bilobate. Abdomen length 1.72 mm [Meehan 1940: 1.58 mm]; maximum width

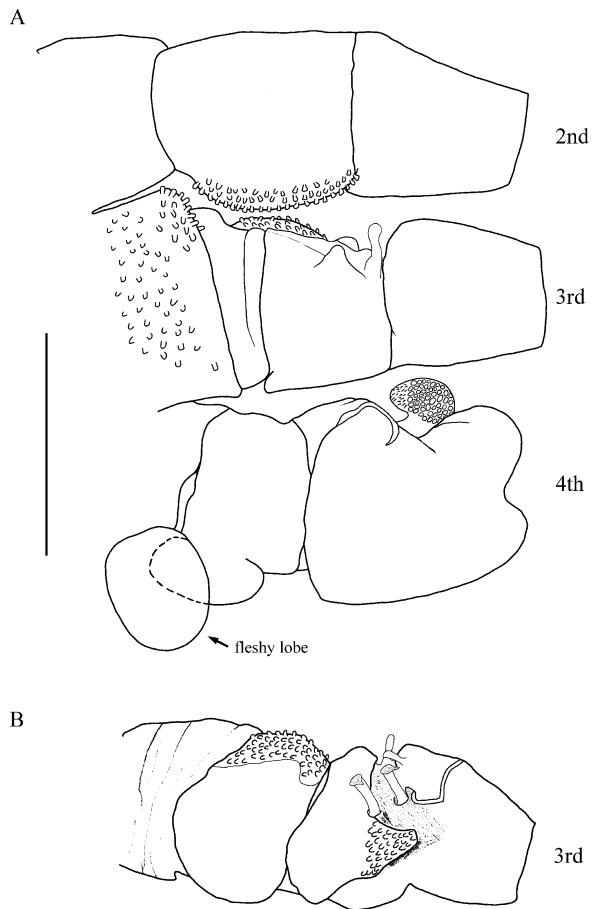


FIGURE 3. *Argulus floridensis*: A) ventral view of legs 2, 3, and 4 (precoxa, coxa, and basis only); exopods, endopods, setae, and sensillae omitted. B) dorsal view of leg 3 (precoxa, coxa, and basis only). Scale bar = 500 μ m.

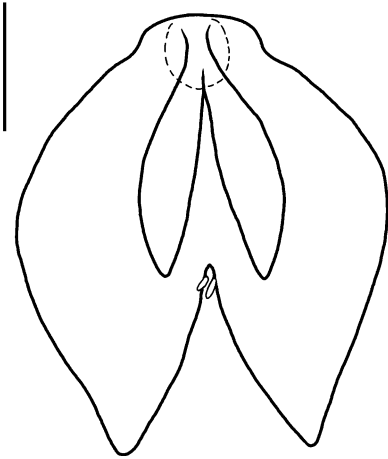


FIGURE 4. *Argulus floridensis*: abdomen; fleshy lobe at posterior of thorax is shown as a dashed outline at anterior of abdomen. Setae not shown on caudal rami. Scale bar = 500 μm .

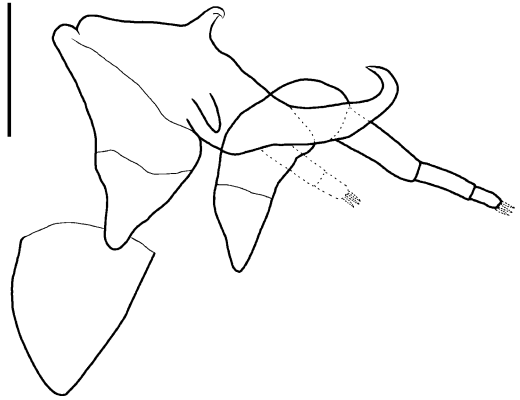


FIGURE 5. *Argulus floridensis*: first and second antennae. The fleshy segments of the first antennae were obscured or missing on this structure but are included as dashed outlines. Scale bar = 200 μm .

1.44 mm [Meehean 1940: 1.35 mm]. Anal sinus length 0.72 mm (720 μm) [Meehean 1940: 0.98 mm]. Caudal rami paired, long, slender, near base of anal sinus (could not see the setae clearly, usually there are 5 simple setae at the tip of each). Tips of abdominal lobes narrowly rounded, not pointy. Testes extending to level of anal sinus base (Fig. 4). Scales absent on ventral surface of abdomen; spines or scales absent along margins of abdominal lobes.

Mouth tube long, slender, with at least 19 scales on basal half.

First antennae 4-segmented. First segment (basal segment) sclerotized, large with stout posteriorly-projecting posterior spine, narrowly rounded at tip; second segment sclerotized with small recurved spine anteriorly with narrow, blunt tip, posteriorly-projecting medial spine with rounded tip, and large recurved terminal spine; third and fourth fleshy segments missing or obscured on the holotype (Fig. 5). Width of first antennae (mean of both antennae, μm) 530–540 (535) in male. Second antennae 5-segmented, fleshy. First two segments larger; remaining three thin, cylindrical; basal segment bears posteriorly-projecting posterior spine with narrowly-rounded tip. Postantennal spines single (as opposed to double in some taxa), very wide at base, tapering to narrowly-rounded tip (Fig. 5).

First maxillae modified into suction cups in adult. In male, first maxillae inner diameter 680 μm and outer diameter 1,050 μm ($n = 1$). Number of sclerites per support rod in male 14–19 ($n = 25$ support rods) [excludes abnormal rods with missing sclerites]. Basal (proximal) sclerite usually subquadrangular, shape variable; distal sclerites imbricate bowls, plates (Fig. 6). Suction cup with 29 sensilla on inside circumference.

Second maxillae 5-segmented with broad basal plate bearing three stout spines with the mesial spine broader than the other two (Fig. 2). Basal plate with elevated pad bearing 43 scales and one stout seta posteriorly. Bi-dentate to multidentate scales on ventral surfaces of segments 2 and 3; segment 4 lacking armature. Distal segment with

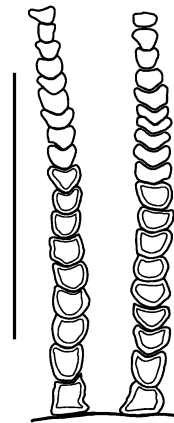


FIGURE 6. *Argulus floridensis*: Two support rods from suction cup (right first maxilla), Scale bar = 100 μm .

2 sharp claws (1 broken/missing) and one blunt, elongate lobe positioned above claws (did not see a small sensillum at tip of lobe).

HOST.— Unknown.

ETYMOLOGY.— The specific name, *floridensis*, is derived from the state, Florida, in which the type locality is located and has an adjectival suffix, *ensis*, meaning “of or from Florida.”

DISCUSSION

Not mentioned in the earlier description is that the third thoracic segment is produced laterally into an expanded anterolateral lobe that has scales protruding laterally and anteriorly in apposition to the posterior lobe of the coxae of the second legs. The fleshy lobe at posterior of thorax, the fleshy papilla and sclerotized pegs on the dorsal side of the third legs, number of support rods, and other measurements and morphological details also were not included in the original description. Meehean’s description of a “broadly bilobed lamella” applies to the right second leg on which the lobe does have a slight indentation or wrinkle near its midpoint. This demonstrates how slight differences can exist in structures within a species and even on the same specimen. Additional specimens are needed to determine if both conditions occur normally or if one might be abnormal or an artifact of preservation (the present author believes the morphology shown in Fig. 3A is likely the normal condition).

Of the 10 *Argulus* spp. reported from the Gulf of Mexico region in Poly (2009), the number of sclerites in the suction cup support rods of *A. floridensis* exceeds that of eight of the other species, with *A. funduli* being the only exception; the holotype (male) of *A. floridensis* has 14–19 sclerites per support rod compared with *A. funduli* (11–21, male; 12–26 female), *A. fuscus* Bere, 1936 (6–7, male; 12–14, female), *A. alosae* Gould, 1841 (10–12), *A. rotundus* Wilson, 1944 (11), *A. yucatanus* Poly, 2005 (2–5), *A. laticauda* Smith, 1873 (3–4), *A. megalops* Smith, 1873 (5–10), *A. varians* Bere, 1936 (3–6), *A. bicolor* Bere, 1936 (6–10) (Bere 1936; Meehean 1940; Wilson 1944; Cressey 1972; Bouchet 1985; Poly 2005). However, male *A. funduli* lack secondary sexual modifications on the second legs, lack accessory spines and postmaxillary spines, have short, blunt teeth on the basal plate of the second maxilla, and have a long thin abdomen that has many scales on its ventral surface (Poly, 2005, unpubl. data). The holotype of *A. floridensis* has 77 support rods in the first maxilla (suction cup) compared with *A. yucatanus* (37–51), *A. funduli* (53–64), *A. cubensis* (39–49), and *A. chromidis* (42). Unfortunately, numbers of support rods for nearly all *Argulus* spp. were never reported in original descriptions or subsequent studies but should be included as it is a valuable meristic character. Structures on the bases of the fourth legs of *A. floridensis*, *A. kosus* Avenant-Oldewage, 1994, and *A. yucatanus* are very similar, and males of these three species also have a fleshy lobe on the posterior margin of the thorax between the coxae of the fourth legs. However, features of the first and second maxillae and secondary sexual structures on legs of males distinguish among these three species (Van As et al. 1999; Poly 2005). The pair of pegs on the third legs of male *A. floridensis* resemble structures on males of other species, including *A. arcassonensis* Cuénot, 1912, *A. kusafugu* Yamaguti and Yamasu, 1959, *A. kosus*, and *A. yucatanus* (Yamaguti and Yamasu 1959; Masson and Delamare Deboutteville 1963; Van As et al. 1999; Poly 2005).

Argulus floridensis requires a more thorough redescription based on a good sample of male and females specimens and including more meristic and morphometric information such as numbers of suction cup support rods, types and numbers of scales on various structures, setae, sensillae, and other details. Illustrations of additional structures and inclusion of more details of the holotype herein should allow for identification of other specimens of *Argulus floridensis*.

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REFERENCES

- BERE, R. 1936. Parasitic copepods from Gulf of Mexico fish. *American Midland Naturalist* 17(3):577–625.
- BOUCHET, G.C. 1985. Redescription of *Argulus varians* Bere, 1936 (Branchiura, Argulidae) including a description of its early development and first larval stage. *Crustaceana* 49(1):30–35.
- CRESSEY, R.F. 1972. The genus *Argulus* (Crustacea: Branchiura) of the United States. Biota of Freshwater Ecosystems, U.S. Environmental Protection Agency Identification Manual 2. U.S. Government Printing Office, Washington, D.C., USA, i–viii + 1–14 pp.
- MASSON, M. AND C. DELAMARE DEBOUTTEVILLE. 1962[1963]. Études sur les crustacés branchiourés d'Europe. II. Les caractères sexuels du mâle chez *Argulus giordanii* Brian et chez *A. arcassonensis* Cuénot. *Bulletin du Muséum National d'Histoire Naturelle* (2e Série) 34:387–396.
- MEEHEAN, O.L. 1940. A review of the parasitic Crustacea of the genus *Argulus* in the collections of the United States National Museum. *Proceedings of the United States National Museum* 88(3087):459–522.
- POLY, W.J. 2005. *Argulus yucatanus* n. sp. (Crustacea: Branchiura) parasitic on *Cichlasoma urophthalmus* from Yucatan, Mexico. *Gulf and Caribbean Research* 17: 1–13.
- POLY, W.J. 2009. Branchiura (Crustacea) of the Gulf of Mexico. Pages 837–840 + pl. 20, fig. a (Chapter 46) in Darryl L. Felder and David K. Camp, eds., *Gulf of Mexico—Origin, Waters, and Biota: Volume 1, Biodiversity*. Texas A&M University Press, College Station, Texas, USA. xix + 1393 pp., 32 color pls.
- POLY, W.J. 2016. Collecting and processing branchiurans. *Journal of Crustacean Biology* 36(6): 855–859.
- VAN AS, J.G., J.P. VAN NIEKERK, AND P.A.S. OLIVER. 1999. Description of the previously unknown male of *Argulus kosus* Avenant-Oldewage, 1994 (Crustacea: Branchiura). *Systematic Parasitology* 43:75–80.
- WILSON, C.B. 1944. Parasitic copepods in the United States National Museum. *Proceedings of the United States National Museum* 94(no. 3177):529–582 + pls. 20–34.
- YAMAGUTI, S. AND T. YAMASU. 1959. On two species of *Argulus* (Branchiura, Crustacea) from Japanese fishes. *Biological Journal of Okayama University* 5:167–175.