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Comments on two questionably new axiidean taxa from the Gulf of Mexico (Crustacea: Decapoda)

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Abstract

A recent descriptive account based on material in the Senckenberg Forschungsinstitut und Naturmuseum included descriptions of two new fossorial axiidean shrimp from the northeastern Gulf of Mexico. Both were based on fragmentary immature specimens, and the accompanying illustrations appeared to potentially represent known species. The types were obtained on loan for study in each of our labs. In one case we conclude that erroneous interpretations of a mangled immature specimen of *Axianassa arenaria* Kensley & Heard, 1990, led to its assignment to the wrong infraorder, and thus its erroneous description as a new genus and species. In the second case, misinterpretations of morphology of four fragmentary juvenile specimens led to assignment of a name for a population already known in literature to be separated genetically and developmentally from Atlantic populations of *Callichirus major* (Say, 1818) and Gulf of Mexico populations of *C. islagrande* (Schmitt, 1935). While no diagnostic characters of value were furnished with the description, we nonetheless conclude that the new name must be used.

Key words: Axianassidae, *Axianassa*, Callianassidae, *Callichirus*, Gulf of Mexico, taxonomy

Introduction

In a recent account of material housed in the Senckenberg Forschungsinstitut und Naturmuseum in Frankfurt am Main, Sakai & Türkay (2012) included descriptions of two new species from Gulf of Mexico waters, one ostensibly a new axiid burrowing shrimp (Axiidea: Axiidae) assigned to a new genus, the other a callianassid ghost shrimp (Axiidea: Callianassidae) assigned to *Callichirus* Stimpson, 1866. In the course of efforts to compile and verify records from the northern Gulf of Mexico region following the major regional BP Macondo oil spill, it was noticed by one of us (DLF) that this work did not compare the taxa to regionally relevant literature nor to extensive museum holdings of possibly similar species from the region. Both descriptions were based on fragmentary immature individuals, with accounts limited to specimens immediately at hand.

Here we reanalyze the two descriptions, based upon study of the authors' illustrations, re-examination of the type material, comparisons to existing specimens from near the type locality, and review relevant literature. We defer for now further evaluation of other taxa reported by Sakai & Türkay (2012).

Material and methods

Holotypes and other fragments of the species in question were obtained on loan from Senckenberg Forschungsinstitut und Naturmuseum in Frankfurt am Main (SMF), and examined by both authors by incident and transmitted light under dissection and transmission light microscopes, for the latter as temporary glycerine mounts. Digital photographs were taken with a motorized Nikon SMZ25 stereomicroscope, using NIS-Elements Microscope Imaging Software with an Extended Depth of Focus (EDF) patch. Comparative material was examined at the Smithsonian Institution National Museum of Natural History in Washington (USNM), University of

Louisiana at Lafayette Zoological Collections (ULLZ) and the Naturhistorisches Museum Wien (NHMW). Abbreviations used in the manuscript include P1–5 for first to fifth pereopods. For type specimens we cited the original text of the labels in quotation marks; the sign \ was used to indicate the line break.

Systematic account

Infraorder Gebiidea

Family Axianassidae

Axianassa Schmitt, 1924

Axianassa Schmitt, 1924: 76.

Anomalaxius Sakai & Türkay, 2012: 725 [new synonym].

Axianassa arenaria Kensley & Heard, 1990

Fig. 1

Axianassa arenaria Kensley & Heard, 1990: 563, fig. 5; Felder *et al.* 2009: 1062.

Anomalaxius floridanus Sakai & Türkay, 2012: 725, fig. 1 [new synonym].

Material investigated. SMF 37121, printed label: "*Anomalaxius florida* Sakai 2010 \ Golf von Mexico, USA, Florida, Pensacola, Santa \ Rosa island, PW-Stat. 12 (30° 25.278'N 87° 25.264'W \ - 30° 25.278'N 87° 25.264'W) Staubsauger 20 m \ TiefeSchelf, siltiger Feinsand mit geringem \ Schillgehalt \13.09.1972 \ 1 juvenil Expl. \ Pensacola, Santa Rosa Island, Jürgen Dörjes \ Holotypus". Small label: "Axiidae PW12 ex Sammlung DOERJES".

Comparative material. *Axianassa arenaria*: USNM 211490, holotype, Gulf of Mexico, 28°33'59"N, 84°20'09"W, 38 m; USNM 211491, paratype male, Gulf of Mexico, 27°52'30"N, 83°33'59"W, 34 m.

Comments. Initially, assuming a somewhat reasonable reproduction of the specimen in the illustration by Sakai & Türkay (2012), we immediately noticed the extremely long antennal peduncle and narrowly elongate antennal acicle, along with a cheliped and walking pereopods that were very near those described for the axianassid, *Axianassa arenaria*. Especially compelling, the type locality for this axianassid (Kensley & Heard, 1990) was just southeast of the area off Santa Rosa Island, Florida, near the supposed type locality reported for *Anomalaxius*. Even so, the type locality reported for this new species by Sakai & Türkay (2012), stated as "shelf, 20 m", is when plotted several kilometers inland and well to the west of Santa Rosa Island (in estuarine Perdido Bay, Alabama). This is an obvious error as the two transects figured by Frey & Dörjes (1988: fig. 1), to which the authors referred, are shown to be south of Santa Rosa Island. Curiously, this same obviously incorrect geographical position was given by Sakai & Türkay (2012) for *Callichirus santarosaensis* (see below). It is not clear from which of the two transects of Frey & Dörjes (1988) the two specimens came; the "W" in the labels' station information suggests the western one, but in both transects the station numbers and water depths do not correspond.

Our suspicion that *Anomalaxius* actually represented a mutilated juvenile of *Axianassa arenaria* was at the outset incompatible with the median carina and proximal lateral tooth said to be on the rostrum, a gastric region reported to have broad median and submedian carinae, and the supposed absence of a linea thalassinica, none of which could apply to well-described adults of *Axianassa arenaria*. We could not discern these described features on the small, obviously juvenile, holotype specimen (Fig. 1A–C) which had largely collapsed and become shriveled by preservation or perhaps dried at some time. Instead, we found no evidence of a lateral tooth on the rostrum, nor median and submedian carinae, all these appearing to be at best artifacts of shriveling and integumental folding (Fig. 1D–F). The rostrum (artificially bent down and overlying relatively large juvenile corneas) is not acute, but has a rounded tip. It did show a very slight median linear feature, but under oblique lighting this appeared to be refraction from a weak longitudinal median depression, not a carina. We confirmed on the holotype a rostral depression along with a small terminal papilla as described in *Axianassa arenaria* by Kensley & Heard (1990). We observed a clearly identifiable though weakly developed linea thalassinica on the right side,

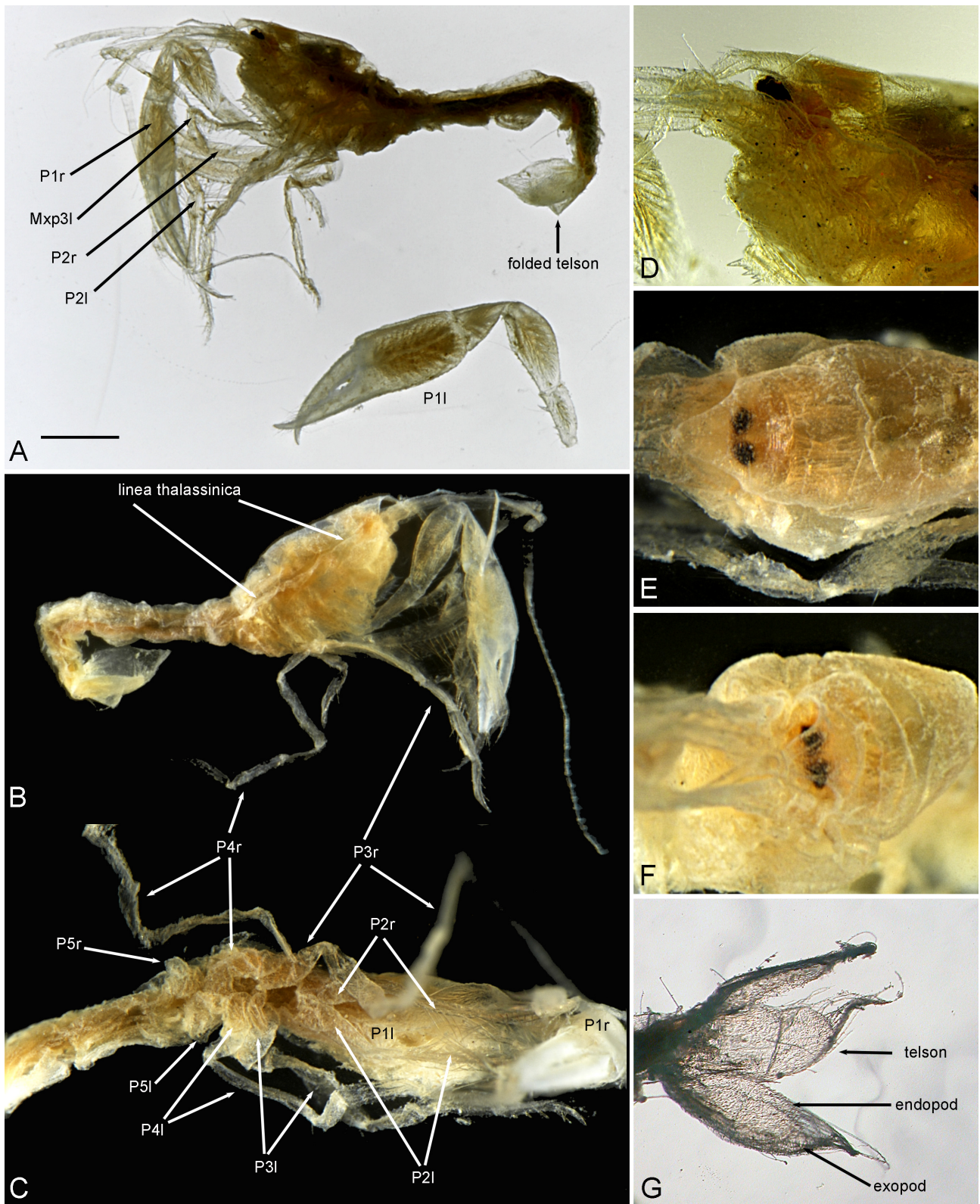


FIGURE 1. *Axianassa arenaria* Kensley & Heard, 1990. Holotype of *Anomalaxius floridanus* Sakai & Türkay, 2012, SMF 37121. A, lateral view from left; B, same from right; B, ventral view; D, rostrum lateral view; E, same, dorsal view; F, same, frontal view; G, telson and uropods, ventral view. P1–P5, pereopod 1–5, r, right, l, left. Scale applies to A only.

obscured on the left by folds of the carapace (Fig. 1B). Yet, most importantly and in contradiction to the authors' report of their being missing, both second pereopods are largely intact in the holotype and this appendage is achelate terminally (though the tip of the simple dactylus is missing on the right side). This definitively excludes

the specimen from Axiidea. Only the P5s of both sides are largely missing from the holotype, their absence also stated in the description, with only their coxae being present. Sakai & Türkay (2012: fig. 1E) thus showed not P3 and P4, but left P2 and right P4 as we here represent with other pereopods (Fig. 1C). In addition, the chelipeds are not equal as stated, but unequal, with the minor remaining attached (not figured by the authors), having 0.8 times the palm length and 0.7 times the palm height of the detached major P1. The major P1 is on the left side, not on the right as indicated in the legend to fig. 1D of the description. The telson was described as being shorter than the uropods, but Sakai & Türkay (2012: fig. 1G) show the tailfan from the left side, not from the right side as indicated by the legend. We found the telson to be folded (see Fig. 1A), and when unfolded it revealed a rounded posterior border overreaching the uropods (Fig. 1G).

We conclude Sakai & Türkay (2012) have placed this specimen in the incorrect decapod infraorder and family, thus providing a new generic and species name for material assignable to a known genus and species. Given our observations and comparisons, we place this genus into synonymy with *Axianassa* and place the species into synonymy with *Axianassa arenaria* Kensley & Heard, 1990.

Infraorder Axiidea

Family Callianassidae

Callichirus santarosaensis Sakai & Türkay, 2012

Fig. 2A–E

Callichirus santarosaensis Sakai & Türkay, 2012: 746, fig. 10

Callianassa major.—Willis, 1942: 2 [part, Gulf of Mexico populations only, not "*Callianassa major* Say, 1818"]; Williams, 1965: 101 [part, Gulf of Mexico populations only]; Felder, 1973: 22–24, pl. 2, figs 10, 11 [not "*Callianassa major* Say, 1818"]; Felder, 1978: 409–429 [part, Gulf of Mexico populations only, not "*C. major* Say, 1818"]; Rabalais *et al.* 1981: 105 [not "*Callianassa major* Say"]; Williams, 1984: 184 [part, Gulf of Mexico populations only].

Callichirus major.—Manning & Felder 1986: 439 [part, Gulf of Mexico population only, not "*Callichirus major* (Say, 1818)"]; Abele & Kim 1986: 27 [part, Gulf of Mexico populations only, not "*Callichirus major* (Say, 1818)"]; Rakocinski *et al.* 1993: 102; Felder & Griffis 1994: 1, 2, 45–47, figs. 1, 23; Staton & Felder 1995: 523–536, fig. 1A, 2, 3 [part, Gulf of Mexico populations only, not "*Callichirus major* (Say)"]; Adkinson & Heard 1995: 109 (not "*Callichirus major* (Say, 1818)"); Strasser & Felder 1998: 599–610 [part, Gulf of Mexico population only, not "*Callichirus major* (Say)"]; Strasser & Felder 1999a: 844–878 [part, Gulf of Mexico population only, not "*Callichirus major* (Say, 1818)"]; Strasser & Felder 1999b: 211–222 [part, Gulf of Mexico population, not "*Callichirus major* (Say)"]; Felder 2001: 444 [part, Gulf of Mexico population only, not "*C. major* (Say) *sensu stricto*"]; Felder *et al.* 2009: 1092, footnote 109, [part, Gulf of Mexico populations only, not "*Callichirus major* (Say, 1818)"]; Robles *et al.* 2009: fig. 1 [part, Gulf of Mexico material only, not "*Callichirus major* (Say, 1818)"].

Material investigated. SMF 37122, printed label: "*Callichirus santarosaensis* Sakai 2010 \ Gulf von Mexico, USA, Florida, Pensacola, Santa / Rosa Island, Staubsauger, PW-Stat. 2.5m (30° 25.278'N \ 87° 25.264' W - 30° 25.278' N 87° 25.264' W) \ Staubsauger 2.5 m Tiefe Strand, weißer Sand \ 15.09.1972 \ 1 ♂ \ Pensacola, Santa Rosa Island, Jürgen Dörjes \ Holotypus".

Comparative material. *Callichirus major* (Say, 1818): USA, Gulf of Mexico, Louisiana, Isles Dernieres, Bayside (ULLZ 13031); Atlantic Florida, Lake Worth, Peanut Island, (ULLZ 13944); Brazil, Rio Grande do Norte, Pirangi Beach (NHMW 25547). *Callichirus islagrande* (Schmitt, 1935): USA, Gulf of Mexico, Louisiana, Isles Dernieres, Bay side washover (ULLZ 12968).

Comments. Sakai & Türkay (2012) described *Callichirus santarosaensis* based on "holotype, male (TL/CL, 23.0/4.2 mm, damaged and lacking larger cheliped, P4 and 5); 5 fragments (2 carapaces, 3 abdomens)". SMF 37122, labelled "Holotypus" (see Fig. 2A) received on loan by us, consisted of a vial that contained among the holotype also the other fragments including 3 left and 1 right detached chelipeds (see Fig. 2B). Fortunately, it was possible to recognize the holotype among all the fragments as it was the only "specimen" with pleon and tailfan still connected to the carapace by empty pleomeres 1 and 2 and represented corresponding characters as figured by the authors. In order to facilitate its future recognition, we have separated the holotype and put it in its own vial. On the basis of this damaged and immature material, Sakai & Türkay (2012) concluded that relative lengths of the antennular versus antennal peduncles, as well as shape of the telson, distinguished this new species from *C. major*

(Say, 1818). However, their illustration misrepresents (fig. 10A), the terminus of the antennal peduncle, creating an artifact extension to the terminal article by failing to show proximal segmentation of the flagellum. This would be obvious to students of the group familiar with the degree to which peduncle segmentation of the antennae is conserved within the genus, and would have been readily apparent had direct comparisons been made to either specimens of *C. major* (from which the species was separated) or to quality illustrations in literature (for example, Williams 1984: fig. 127).

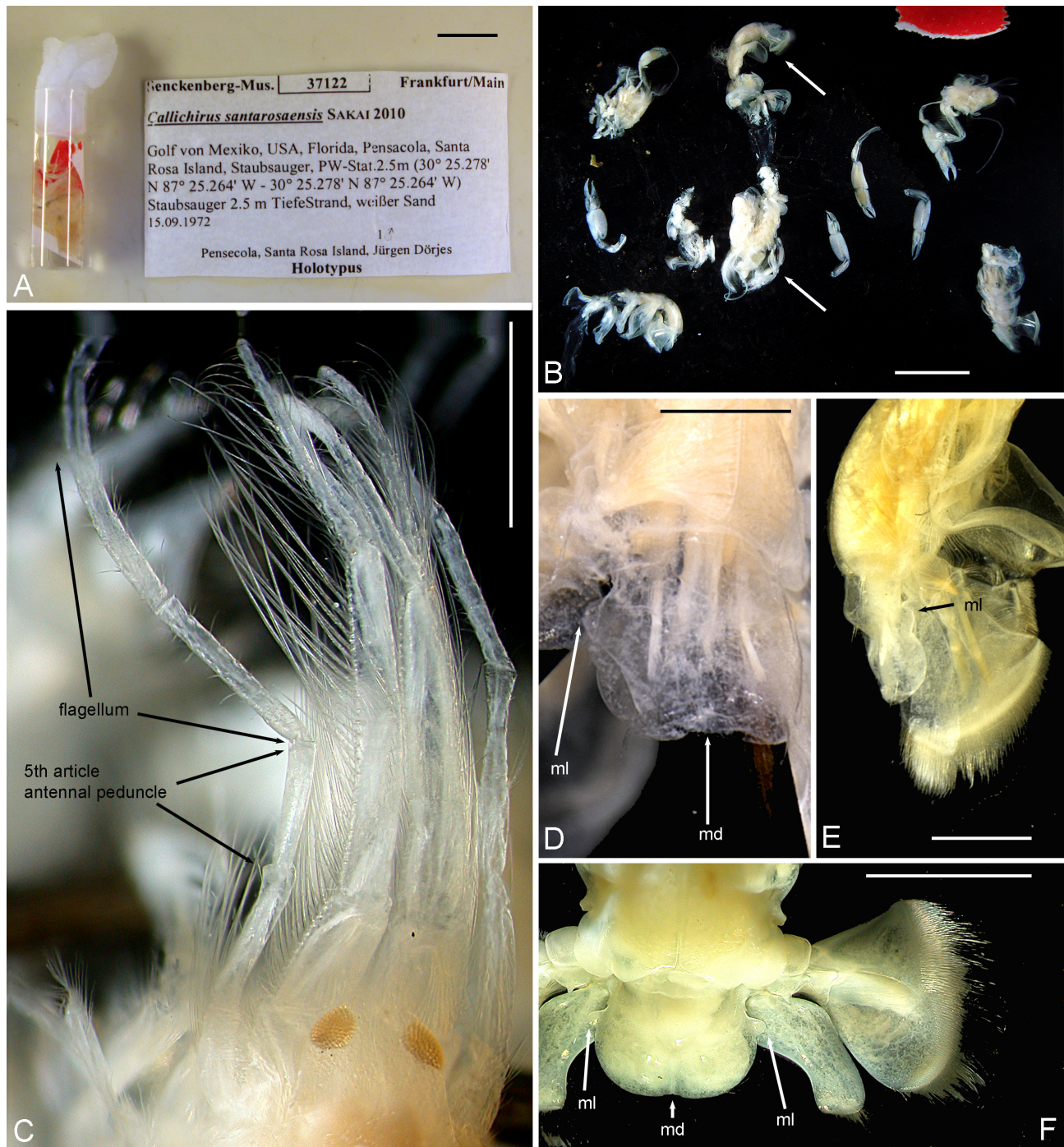


FIGURE 2. A–E, *Callichirus santarosaensis* Sakai & Türkay, 2012, SMF 37122. A, vial with fragmented type material labelled as "Holotypus"; B, fragments of "Holotypus", arrows point to actual holotype; C, holotype, eyes and antennae in dorsal view; D, holotype, telson in dorsal view; E, holotype, tailfan in lateral view. F, *Callichirus major* (Say, 1818), NHMW 25547, telson and right uropods. ml, mid-lateral lobes; md, median depression. Scale is 10 mm (A), 5 mm (B), 3 mm (F) and 1 mm (C–E).

The telson was originally illustrated in a posterior abdominal portrayal but the illustration lacked detail of dorsal sculpture of both the telson and abdominal somites that is typical of adult congeners. Our investigation of the holotype showed that the authors missed the mid-lateral lobes of the telson (best visible in the decayed holotype in a more lateral view, see Fig. 2D, E) that are characteristic of *C. major* (Fig. 2F). Also the median depression is visible in the holotype (compare Fig. 2D with 2F) and in one of the other pleon fragments. As previously noted for early postlarvae of *Callichirus* spp. (Strasser & Felder 1999a, 2000) dorsal sculpture and telson shape are not so strongly evident in early stages as in adults. Many juveniles assigned to Gulf of Mexico and Florida Atlantic populations of *Callichirus major* (ULLZ 13031, 13944, respectively) and Gulf populations of *Callichirus islagrande* (ULLZ 12968), nearly equal in size to the holotype of this species, are similarly developed in these characters. Finally, the authors stated that their material lacked the major cheliped, but their illustrations labelled as minor chelipeds (Sakai & Türkay 2012: Fig. C–E) could well represent typical variation and male asymmetry in that appendage. Our examination of these specimens and similar male and female juveniles of *C. major* from both populations in the Gulf of Mexico and those along the Florida Atlantic coast suggest these are major chelipeds.

This stated, there are no presently known morphological adult characters to separate this species from *Callichirus major*, so why not sink this new name? While curiously not mentioned by the authors, though in part cited previously in works by one of them (Sakai 2005, 2011), several comparative studies have previously recognised the uniqueness of the northern Gulf of Mexico population on the basis of genetics, larval history, and larval behavior (Staton & Felder 1995; Strasser & Felder 1998, 1999a,b,c), though none went so far as to assign a separate species name. Deferring to further analyses, several papers specifically noted the likely need for eventual taxonomic recognition (Staton & Felder 1995; Felder 2001; Felder et al. 2009), but none reported morphological differences that could support this. Sakai & Türkay (2012) erected a new name but the morphological diagnosis they furnished is of no value in distinction of it from *C. major* s.s., nor for that matter, from early juvenile stages of the sympatric northern Gulf of Mexico species, *Callichirus islagrande*. We have observed that juveniles of *C. islagrande*, much as adults (see Felder 1973), can be distinguished from both Florida Atlantic and Gulf of Mexico populations previously assigned to *C. major* by their more narrowed and protracted terminal process of the eyestalk and by the distal setation of the uropodal endopod that extends further onto the mesial margin. We have confirmed that they differ as well in these characters from the type of *Callichirus santarosaensis*.

Further complicating a decision on how to regard this proposed new name, the type locality given as a geographical position is the same as the authors give for *Anomalaxius*, discussed above, with a notable difference in that the habitat of *Anomalaxius* was described as shelf waters in 20 m while that of *Callichirus santarosaensis* was stated to be 2.5 m water depth, ostensibly off sandy beaches of Santa Rosa Island. In both cases, the published geographical position for the type locality turns out to be near inland shores of Perdido Bay, well west and somewhat inland of Santa Rosa Island.

Regardless of all these shortcomings, we find ample previously published evidence to justify that *Callichirus* populations in the northern Gulf of Mexico are indeed separate from *Callichirus major* s.s. and *C. islagrande*. We recommend the name *Callichirus santarosaensis* be applied to northern Gulf of Mexico populations formerly treated as *C. major*, but in the absence of morphological characters, this must be solely on the basis of geographical origins of materials, underpinned by genetic analyses (sensu Staton and Felder 1995) when possible. We do so, even though previously known geographic distributions for Gulf of Mexico populations assigned to *Callichirus major* fall just short of reaching east to the reported type locality of this new species (reaching to Perdido Key, but reported from neither Perdido Bay nor Santa Rosa Island), and even though *C. islagrande*, rather than its congener, is in our collections conspicuously abundant on beachfronts of Santa Rosa Island. Comparisons to comparably sized juveniles of *Callichirus islagrande* in museum holdings reveal differences in eyestalk development and setation of the uropodal endopod that rule out *C. santarosaensis* being confused with that species.

Discussion

Describing new taxa on the basis of fragmentary, poorly preserved, and/or conspicuously immature stages comes with risks of errors that in turn require subsequent publications to correct mistakes, while adding unnecessarily to confusing synonymies and thus to the tasks of subsequent workers. While names assigned to such taxa must be used, the holotype bears little resemblance to typical members of the species. This may be expected for names

assigned in the distant past to the deteriorating collections of early explorers, but can usually be avoided today if taxonomists forego unjustified rush to apply a name before specimen material are thoroughly, comparatively, and analytically studied by critical methods. Most essential, literature pertaining to possible close relatives of suspected new species, along with available collections of potentially related or conspecific juvenile and adult specimens from the general locality of origin, must be studied thoroughly. We contend that it is the responsibility of not only authors, but also reviewers and editors to assure that these professional practices are followed prior to the publication of new names. In an age that presents great challenges to understanding of biodiversity and expects refinement in analytical systematic methods, enforcement of such standards cannot be neglected without further undermining of an already limited confidence that many scientific colleagues place in taxonomists.

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