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Designation of a neotype for *Glypturus rabalaisae* Sakai, 2011, a ghost shrimp from continental shelf waters of the northern Gulf of Mexico (Crustacea: Decapoda: Callianassidae)

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Abstract

Glypturus rabalaisae Sakai, 2011 was named for type materials identified solely on the basis of illustrations that had been originally reported as "*Glypturus acanthochirus*" by previous authors (Rabalais *et al.* 1981). As the voucher specimens for those illustrations (thus the types) are lost, a neotype is designated. "*Glypturus rabalaisae*" as originally applied by Sakai (2005) constituted a *nomen nudum*, and the name has debatably remained so regarded, since the description in Sakai (2011) failed to clearly account for disposition of a type. In the interest of stability, his 2011 description is herewith regarded to meet minimum ICZN requirements for validity, and the name is conserved. Synonymies, brief diagnoses, and updated ranges are provided for *Glypturus rabalaisae* and its only known regional congener, *G. acanthochirus* Stimpson, 1866. Available illustrations of *G. rabalaisae* are augmented by color photographs.

Key words: Crustacea, Decapoda, Callianassidae

Introduction

Originally, Sakai (2005) simply applied the name "*Glypturus rabalaisae*" to members of a population from continental shelf of the northwestern Gulf of Mexico that had been previously illustrated by Rabalais *et al.* (1981) as "*Callianassa acanthochirus*", but he undertook no comparative study of available regional materials to confirm diagnostic characters or update distributions, and he did not designate type materials for his intended new species. As pointed out by Dworschak (2007) the name was thus to be regarded as a *nomen nudum*, invalid under ICZN Article 72.3. Sakai (2011) thereafter addressed his nomenclatural error by simply designating, as the holotype and paratypes, a male and two females that he identified only by the collection date that pertained to subject specimens for figures reported in the Rabalais *et al.* paper, again without first hand examination of the materials and also without indication of a depository or catalog number. Hyžný & Müller (2012) thus argued that the name remained a *nomen nudum* for lack of a specified type repository, though this lapse appears to violate only an ICZN recommendation (ICZN Article 16.4.2).

There is no evidence upon which to base identification of type specimens among selected "representatives of all species" that Rabalais *et al.* (1981) indicated as being "placed in the United States National Museum (USNM)", while also noting that "others were retained at the University of Texas Marine Science Institute, Port Aransas, Texas (UTMSI)". The only catalog number they indicated for a specimen of their "*Callianassa acanthochirus*" was USNM 172310 for a female collected 13 June 1976, which was itself reported in error and should have been USNM 172309. This specimen was not listed among intended type materials by Sakai (2011).

An exhaustive search of uncatalogued USNM holdings has also produced no specimens to match those of "*Callianassa acanthochirus*" illustrated by Rabalais *et al.* (1981), and thus potentially representing the types of *Glypturus rabalaisae*. While a few axiidean decapods were moved to the Louisiana Universities Marine Consortium (LUMCON) collections following the UTMSI project (Nancy Rabalais, personal communication), those have also been carefully checked and determined to include no further materials assignable to *Glypturus rabalaisae*. Finally, a search of specimen shelves at UTMSI has produced no such specimens and revealed that all related research collections had been transferred to the USNM prior to 2017 (Richard Kalke, personal communication).

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In the absence of any materials that might represent types, a neotype is designated. To augment the illustrations and descriptive comments of Rabalais *et al.* (1981), a brief diagnosis is provided, along with color photographs based upon collections of additional specimens. For comparison, a brief diagnosis and synonymy are provided for the sympatric congener *Glypturus acanthochirus* Stimpson, 1866, along with an updated account of its distribution. For each species, its diagnosis includes GenBank accession numbers for sequences applicable to the species, as originally reported by Felder & Robles (2009).

The abbreviation "pocl" indicates postorbital carapace length, and is measured to ± 0.1 mm; where shown, "m" indicates depth at collection site in meters. As the lengthy process of transferring the University of Louisiana's Lafayette zoological (ULLZ) collections to the Smithsonian Institution's National Museum of Natural History, Washington (USNM) is currently underway, equivalent cross-referenced catalog numbers are shown for some specimens.

Taxonomy

Infraorder Axiidea de Saint Laurent, 1979

Superfamily Callianassoidea Dana, 1852

Family Callianassidae Dana, 1852

Glypturus Stimpson, 1866

Type species: *Glypturus acanthochirus* Stimpson, 1866 (for generic diagnosis see Komai *et al.* 2015)

Glypturus rabalaisae Sakai, 2011

(Fig. 1A–D)

Callianassa (*Callichirus*) *acanthochirus*.–Heard & Reames 1979: 52–53, fig. 1A–D.
Callianassa acanthochirus.—Rabalais *et al.* 1981: 103–105, 110–112, table 1 (part), fig. 3a–f, fig. 5A, B (part), fig. 6A–E (part).
Glypturus acanthochirus.—Sakai 1999: 73–74 (part, not *Glypturus acanthochirus* Stimpson, 1966).
Glypturus rabalaisae (*nomen nudum*).—Sakai 2005: 132, 133, 135, 282 (name invalid, as per Dworschak 2007: 159).
Glypturus sp. GMX-1, GMX-2.—Felder & Robles 2009: 334, 338, fig. 1, table 1.
Glypturus sp.—Felder *et al.* 2009: 1062, 1093; Hyžný & Müller 2012: 969, table 1, 1975.
Glypturus rabalaisae Sakai, 2011: 430–431, 438, 546.

Neotype.—Northwestern Gulf of Mexico (Texas): female, pocl 5.9 mm (USNM 172309) BLM South Texas Outer Continental Shelf study, Station 4 (replicate 3), Transect I, 28° 14'N, 96° 29'W, 10 m depth, benthic grab, 13 June 1976.

Other material. Northwestern Gulf of Mexico (Texas): 2 juvenile females (USNM 1564605 = ULLZ 18073) BLM South Texas Outer Continental Shelf study, 28° 14'N, 96° 29'W, 10 m depth, bottom grab, 11 October 1976. Northwestern Gulf of Mexico (Louisiana): 1 ovigerous female (photograph voucher), pocl 11.6 mm (USNM 1563582 = part of ULLZ 4659) 28°19.088'N, 91°19.688'W, 70 m, otter trawl, 30 June 2001; 3 males, pocl 7.4 (photograph voucher), 6.0, 5.0 mm (USNM 1542663 = part of ULLZ 4659), 28°19.088'N, 91°19.688'W, 70 m, otter trawl, 30 June 2001; 1 ovigerous female, pocl 14.8 mm (USNM 1542541 = ULLZ 5466) off Timbalier Bay, 29° 29.303'N, 90° 24.992'W, 11.5 m, 29 July 2005; 1 juvenile male (USNM 1547261 = ULLZ 13950) off Timbalier Bay, 12.2 m depth, 12 July 1984; 1 male, pocl 19.2 mm (USNM 266213) bycatch of commercial shrimp trawler, off Grand Isle, November 1939; 1 female, pocl 7.5 mm (USNM 1547263 = ULLZ 13952) BLM summer cruise, stn. S20, N500, no. 6, 1979? Northeastern Gulf of Mexico (Mississippi): 1 male (USNM 1564428 = ULLZ 18241) Mississippi Sound, 3 November 1980.

Diagnosis. Carapace with well-defined dorsal oval, front with three spines, median spine forming rostrum reaching to or beyond middle of cornea. Eyestalk cornea darkly pigmented, inflated, disk-shaped, subterminal, not

covering full width of eyestalk, not encompassing distal stalk margin. Antennal (second antenna) peduncle reaching beyond antennular (first antenna) peduncle, distal end of antennular peduncle reaching slightly beyond distal end of penultimate article of extended antennal peduncle. Major cheliped palm with 1–4 spines along dorsal margin, carpus with typically 5–8 spines along ventral margin. Minor cheliped carpus length (measured mid-height of outer surface) distinctly greater than median length of palm (measured mid-height of outer surface, extending to gape). Telson posterior margin with small median spine or triangular tooth. Pigmentation in life extensively rose-pink (Fig. 1). Applicable GenBank sequence accession numbers for USNM 1542663 = ULLZ 4659: (16s) EU882932, EU882933; (12s) EU875042, EU875043.

Size. Carapace length ranges to that of an exceptionally large male, pocl 19.2 mm, collected by a shrimp trawler off Grand Isle Louisiana. Currently limited collections otherwise include two ovigerous females, pocl 11.6 and 14.8 mm, but more commonly small individuals, pocl 5.0 to 7.5 mm, and a few even smaller juveniles.

Habitat. Infaunal burrower in fine sand, muddy sand, and sandy mud bottoms, sometimes those mixed with shell hash; offshore waters 6.5–91 m depth.

Distribution. Western Atlantic: Northeastern to northwestern Gulf of Mexico, Alabama to Texas.

Remarks. The chosen neotype for this species is a small female that was included in the "Material Examined" originally reported by Rabalais *et al.* (1981: 103) as *Callianassa acanthochirus*. Other specimens originally assigned to *C. acanthochirus* by those authors were illustrated in that paper (fig. 3 a–f) and were later designated as a holotype and paratypes of *Glypturus rabalaisae* by Sakai (2011). As these are lost, a reasonably intact topotypic specimen was chosen from among the few that remain among those listed in the 1981 report.

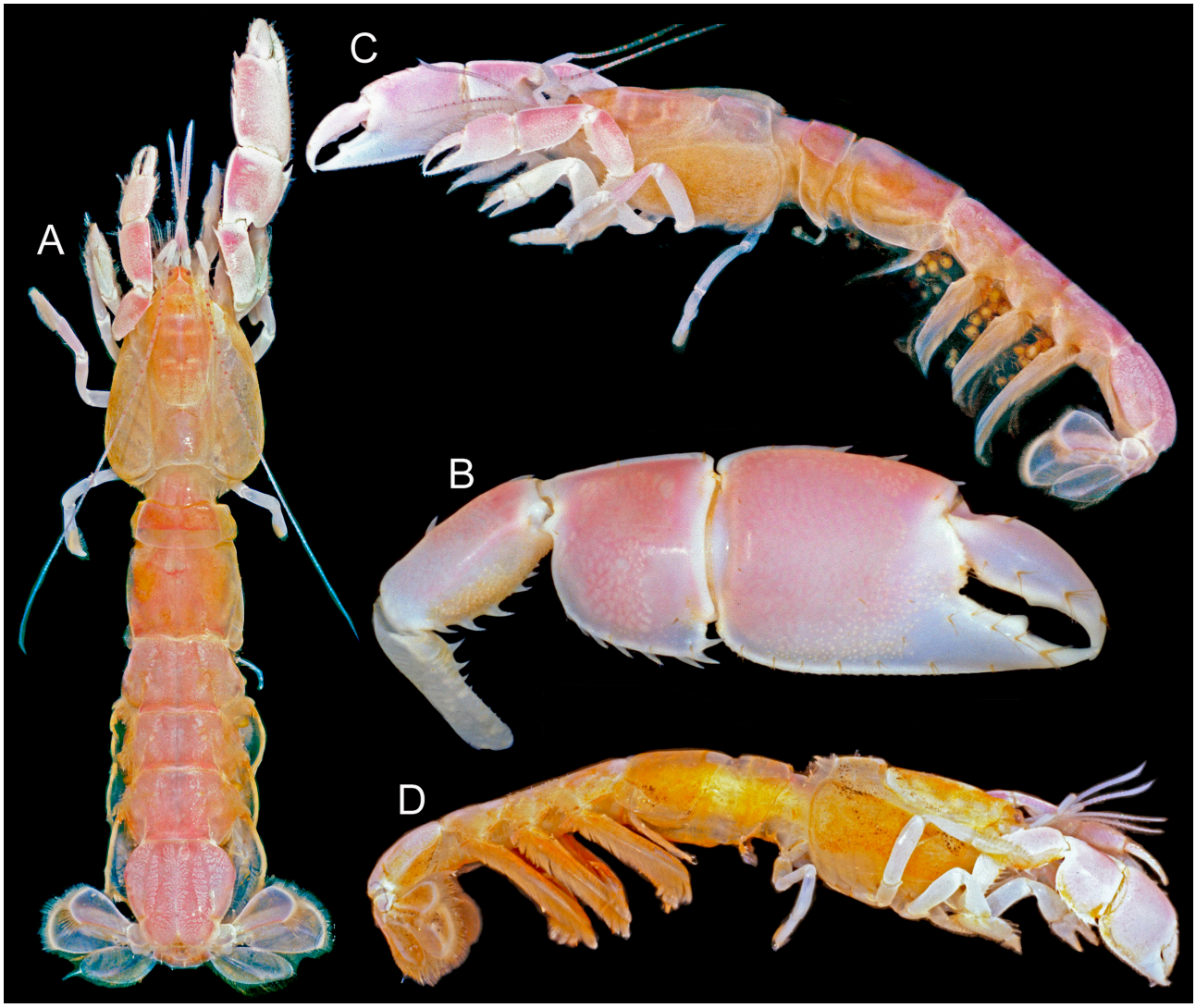

FIGURE 1. *Glypturus rabalaisae*, northwestern Gulf of Mexico type materials prior to preservation. A–C, USNM 1563582 (= part of ULLZ 4659) ovigerous female, pocl 11.6 mm; D, USNM 1542663 (= part of ULLZ 4659) male, pocl 7.4 mm.

The reported distributional range of *G. rabalaisae* in both of Sakai's accounts was limited to the type locality, but it is herewith concluded, as in Felder *et al.* (2009), that the report of a somewhat larger (pocl 13 mm) specimen by Heard & Reames (1979) also applies to this species, even though the line illustration in that paper does not clearly indicate presence of a posteromedian spine on the telson. Most collected specimens of *G. rabalaisae* are small, often immature, and apparently those readily obtainable at sediment depths reached by trawls or shallow penetrating corers and grabs. Among recent collections of this species, many were coated to varied extent by a thin layer of rust-red precipitate (Fig. 1), suggesting they occupied burrows extending into redox transition zones of hypoxic sedimentary pore waters. Larger adults of the species are likely to be most common in deeper substrates, though there is no evidence that they reach the very large sizes reported for *Glypturus acanthochirus* and some other congeners. However, in a review of collections from the region, the largest presently known specimen of the species (USNM 266213, pocl 19.2 mm) was found to have been taken as bycatch of a Louisiana commercial shrimp trawler, 90 years ago.

G. rabalaisae is not only distinct from *G. acanthochirus* genetically, but also in morphology, color, and habitat. These differences are treated comparatively in "Remarks" for *G. acanthochirus* below.

Glypturus acanthochirus Stimpson, 1866

Glypturus acanthochirus Stimpson, 1866: 46.

Glypturus acanthochirus Stimpson.—Stimpson 1871: 121; Kingsley 1899: 821; Rathbun 1900: 150; 1901: 93; Borradaile 1903: 548; De Man 1928: 19, 25, 180; Manning 1987: 390, fig. 3 a–h (not fig. 4 a–d); Poore & Suchanek 1988 p. 201, fig. 4 d; Manning & Felder 1991: 778, fig. 2 "*Glypturus*"; Dworschak 1992: 209; Dworschak & Ott 1993: 282; Collins *et al.* 1996: 54, pl. 12, fig. 1; pl. 15, figs. 1, 3, 4; Sakai 1999: 73 (part), fig. 14 i; Tudge *et al.* 2000:144; Curran & Martin 2003: 230, 234, fig. 4 B; Dworschak 2004: 20, fig. 4 F; Sakai 2005: 133; Ngoc-Ho 2005: 73; Abed-Navandi & Dworschak 2005: 160; Collins *et al.* 2009: 70; Felder & Robles 2009: 338, fig. 1, table 1; Felder *et al.* 2009: 1062, 1093; Sakai 2011: fig. 65 A, B; Dworschak *et al.* 2012: 169, 171, 177, 192, fig. 69.31Q; Hyžný & Müller 2012: 970–975, 981, 984, 985, 987, fig. 1 A, B; fig. 2 A–C; fig. 3 A–C, I; fig. 4 C; Komai *et al*. 2015: 14–18, 28, 29, 51–54, table 1.

Callianassa (*Callichirus*) *acanthochirus* (Stimpson).—Schmitt 1935: 4, 20, pl. 1 fig. 6, pl. 2 fig. 5, pl. 3, fig. 4, pl. 4 fig. 6; (not Heard & Reames 1979: 52 = *G. rabalaisae*).

Callianassa acanthochirus (Stimpson).—Gurney 1944: 84; Biffar 1971: 637, 639-642, 655-661, figs. 3 a–i, 4 a–f; (not Heard & Reames 1979: 52, fig. 1, = *G. rabalaisae*).

Callichirus acanthochirus (Stimpson).—de Saint Laurent & Le Loeuff 1979: 96.

Material examined.Southeastern Gulf of Mexico (Florida Keys): 1 male (photograph voucher) pocl 15.9 mm (ULLZ 14962), Sugarloaf Key, 24° 37' 28.474"N, 81° 32' 35.469"W, 0.5 m, shallow grassbed, 16 May 2013; 1 male, pocl 14.2 mm (USNM 122438), Dry Tortugas, 5 August 1930. Cuba (Isla de la Juventud): 1 female (photograph voucher), pocl 30.3 mm (ULLZ 14885), Punta del Este, grassbed, 12 June 1995; 1 female, pocl 23.6 mm (ULLZ 14884), Playa Punta Francés, 10 June 1995. Belize: 1 ovigerous female, pocl 9.7 mm (ULLZ 11112), Twin Cays, grassbed near mangrove shoreline, 20 February 2009. Puerto Rico: 1 male, pocl 13.0 mm (USNM 266220) Parguera Bay, Lajas, 6 January 1955. Turks and Caicos Islands: 1 female, pocl 13.5 mm (USNM 205996), Pine Cay, 9 April 1988. Jamaica: 1 male (genetic voucher), pocl 12.9 mm (USNM 1541512 = ULLZ 6528), Montego Bay, shallow rubble-strewn sandy grassbed, 16 May 2003. Venezuela: 1 female, pocl 28.2 mm (USNM 286415), Gulf of Cariaco, 10° 33' 05.3''N, 63° 49' 20.3''W, 0.7 m, 18 February 1977. Dutch Antilles (Aruba): 1 female, pocl 8.5 mm (USNM 221787), Klein Lagoon, 6 January 1987.

Diagnosis.Carapace with well-defined dorsal oval, front with three spines, median spine forming rostrum reaching to or beyond middle of cornea. Eyestalk cornea darkly pigmented, inflated, disk-shaped, subterminal, not covering full width of eyestalk, not encompassing distal stalk margin. Antennal (second antenna) peduncle reaching beyond antennular (first antenna) peduncle in mature specimens, distal end of antennular peduncle reaching to, not beyond, distal end of penultimate article of extended antennal peduncle. Major cheliped palm with 1–4 spines along dorsal margin, carpus with typically 5–8 spines along ventral margin. Minor cheliped carpus length (measured mid-height of outer surface) slightly less than to slightly greater than median length of palm (measured mid-height of outer surface, extending to gape). Telson posterior margin lacking median spine or tooth. Pigmentation in life shades of orange and golden brown over lighter yellowish background, usually with rusty diffuse patches on chelae, other appendages, and body. Applicable GenBank sequence accession numbers for USNM 1541512 = ULLZ 6528 from Jamaica: (16s) EU882929, (12s) EU875039.

Size.Carapace length of mature in both sexes typically of pocl 10–20 mm, less commonly ranging to a known maximum of 35 mm; however, successful extraction of large specimens is difficult and the abundance of large diameter burrows suggests such large individuals may occur frequently in subtidal seagrass beds.

Habitat.Infaunal burrower in intertidal and nearshore subtidal sediments of calcareous protected beaches and mud flats, including emergent to subtidal seagrass beds and deeper bottoms of small embayments with vegetated margins; 0–13 m.

Distribution.Western Atlantic: Bahamas; Florida southeastern Atlantic coast and Keys; Gulf of Mexico (sw, se); Cuba; Belize; Puerto Rico; Jamaica; Curaçao; Lesser Antilles; Caribbean mainland margins and coastal islands of Central and northern South America to Colombia and Venezuela.

Remarks.As already established, the specimens reported as *Callianassa acanthochirus* and illustrated by Heard & Reames (1979) and Rabalais *et al*. (1981) do not depict *Glypturus acanthochirus* but instead *Glypturus rabalaisae*. However, morphological features of *G. acanthochirus* are illustrated in a number of widely available references (Schmitt 1935: pl. 1 fig. 6, pl. 2, fig. 5, pl. 3, fig. 4, pl. 4 fig. 6; Biffar 1971: figs. 3 a–i, 4 a–f;; Manning 1987: fig. 3 a–h; Manning & Felder 1991: fig. 2 "*Glypturus*"; Collins *et al.* 1996: pl. 12, fig. 1; pl. 15, figs. 1, 3, 4; Sakai 1999: fig. 14 i; Curran & Martin 2003: fig. 4 B; Dworschak 2004: fig. 4 F; Sakai 2011: fig. 65 A, B; Dworschak *et al.* 2012: fig. 69.31Q; Hyžný & Müller 2012: fig. 1 A, B; fig. 2 A–C; fig. 3; A–C, I; fig. 4 C).

In both *G. rabalaisae* and its regional congener, *G. acanthochirus*, the major cheliped palm bears 1–3 spines along its dorsal margin, while the carpus usually has 5–8 spines along its ventral margin. In both species, the eye corneas are disk-shaped and narrower than the eyestalk, positioned distinctly short of the eyestalk distal margin. However, the two species otherwise differ markedly, both morphologically and ecologically, as well as genetically (Felder & Robles 2009). While *G. rabalaisae* is apparently restricted to muddy fine siliceous sandy to sandy mud offshore bottoms of the inshore to mid-continental shelf (6.5–91 m depths, per Rabalais *et al.* 1981), *G. acanthochirus* is typically found in intertidal to subtidal inshore grassbeds and sand flats (0–13 m depths), usually in areas of predominently calcareous sediments (Dworschak *et al.* 2012). *G. acanthochirus* also reaches much larger sizes than does *G. rabalaisae*, and coloration in life differs markedly between the two species. The shades of rose pink coloration on the chelae, other appendages, and the body in typical adults of *G. rabalaisae* are usually in striking contrast to patterning in shades of orange, golden brown, and diffuse rust on chelae, other appendages, and the body seen in most specimens of *G. acanthochirus*, these colors sometimes being intensely developed on upper surfaces, as well as near appendage articulations and tips.

As noted by Sakai (2005; 2011), morphological distinction of the two species can usually be based on the telson alone, which bears a small median spine or triangular tooth on the posterior margin in *G. rabalaisae*, this being absent in *G. acanthochirus*. It should be noted, however, that this small spine or tooth can be easily overlooked when translucent in small specimens, and it may also be easily compressed or broken in the process of collection. Additionally, in *G. rabalaisae*, the median length of the minor cheliped carpus is distinctly greater than the median length of the palm. In *G. acanthochirus*, the median length of the minor cheliped carpus is instead usually only slightly greater than, subequal to, or slightly less than the median length of the palm, the variation dependent upon sex and maturity of the specimen. Also, the major chela in mature specimens of *G. rabalaisae*, in those cases where it is intact, appears to be more ovoid than in *G. acanthochirus*. It appears to be relatively broad proximally with the upper and lower margins arched to converge distally, apparently moreso than in available specimens of *G. acanthochirus*. However, confirming the diagnostic value of this feature will require additional mature specimens of *G. rabalaisae* with intact mature chelipeds.

While Sakai (2005) appears to have confused relative lengths of antennular and antennal peduncles, Sakai (2011) gave a corrected comparative account that can also be applied to separation of *G. rabalaisae* from *G. acanthochirus*, with some modification and caution. In specimens of *G. rabalaisae*, the distal end of the antennular peduncle reaches slightly but distinctly beyond the distal end of the fully extended antennal penultimate article, while in mature specimens of *G. acanthochirus* it reaches almost exactly to the distal end of that article. Study of specimens across a wide range of sizes has shown this character to dependably separate specimens of *G. rabalaisae* from all except juvenile specimens of *G. acanthochirus*, so long as the antennal peduncle is manipulated to full extension.

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