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Redescription of *Odontozona edwardsi* (Bouvier, 1908) (Decapoda: Stenopodidea: Stenopodidae) and description of a new species of *Odontozona* commensal on the deep-water coral, *Lophelia pertusa* (Linneaus, 1758)

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Abstract

Odontozona edwardsi, a rare stenopodid shrimp from deep waters of the northwest African coast off Morocco and Western Sahara is redescribed and figured based on type material and an additional 26 specimens including some from the Gulf of Cadiz and off Roscoff, France. Specimens of another *Odontozona* from the Gulf of Mexico, off Sapelo Island, Georgia, and off Rio de Janeiro, Brazil have been confused with *O. edwardsi* and *O. spongicola*. This *Odontozona* is associated with the deep sea hard coral *Lophelia pertusa* and is herewith designated as a new species. Both these Atlantic species of *Odontozona* are distinguished from the deep-water Pacific *O. spongicola* as well as the recently described southwestern Atlantic *O. meloi* by several morphological characters. A key to the Atlantic species of *Odontozona* is presented.

Key words: *Odontozona*, Stenopodidae, Atlantic Ocean, Gulf of Mexico, *Lophelia pertusa*, new species

Introduction

Odontozona edwardsi was first mentioned as a new species of *Richardina* by Bouvier (1908a) from specimens collected by the R/V *Talisman* along the Morrocan and Sudanese (present Western Sahara) coasts. The only characters that Bouvier (1908a) gave for this new species were that the dactyli of the fourth and fifth pereiopods were biunguiculate with the carpi subdivided into four and the propodi into five segments. The gill formula was given as the same as that for *Stenopus spinosus* Risso, 1826. Holthuis (1946) divided the genus *Richardina* considering those species with biunguiculate dactyli on the fourth and fifth pereiopods as a new genus *Odontozona*, which includes *O. edwardsi* and stated that this species badly needed a more extensive description. García Raso (1996) reported on five specimens of *O. edwardsi* collected during the Balgim-84 Expedition off the Ibero-Moroccan coasts and provided illustrations of some morphological characters of two specimens.

Extensive sampling of cold seep and deep-water hard coral habitats on the northern upper continental slope of the Gulf of Mexico revealed some shrimp first designated as *Stenopus* sp. (Cordes *et al.* 2005; Cordes *et al.* 2006; Cordes *et al.* 2008). These studies of the seep-associated fauna of the Gulf of Mexico show a tight biogeographical connection with the mid-slope fauna of West Africa and the Gulf of Cadiz. Therefore, one of us (JWG) examined some of these *Stenopus* sp. specimens and tentatively assigned them to *O. edwardsi* (Becker *et al.* 2009; Lessard-Pilon *et al.* 2010; Goy 2010). Two additional specimens of this same species were collected off Sapelo Island, Georgia with one photographed live that were thought to belong to *O. spongicola* (Alcock & Anderson 1899) (D. Knott per. comm.). Finally, one of us (IAC) found another specimen of this *Odontozona* off Rio de Janeiro, Brazil. Through the courtesy of Dr. Alain Crosnier the type material and an additional 26 specimens of *O. edwardsi* in the holdings of the Muséum national d'Histoire Naturelle, Paris were allowed to be examined by us enabling a thorough redescription of *O. edwardsi* and a description of the Gulf of Mexico, Georgian and Brazilian specimens as a new species. The distributions of the species of *Odontozona* known from the Atlantic are reviewed and a key to the Atlantic species is presented.

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The specimens examined are deposited in the collections of the Museu Nacional/Universidade Federal do Rio de Janeiro, Brazil (MNRJ), Muséum national d'Histoire Naturelle, Paris (MNHN), Southeastern Regional Taxonomic Center, Marine Resources Research Institute, South Carolina Department of Natural Resources, Charleston (SERTC), and National Museum of Natural History, Washington, DC (USNM). Abbreviations used: cl, postorbital carapace length (in mm); ov, ovigerous; CP beam-trawl; DW, Waren's dredge; JSL, *Johnson-Sea-Link* Submersible.

Systematics

Stenopodidae Claus, 1872

Odontozona Holthuis, 1946

Odontozona edwardsi (Bouvier, 1908)

(Figs. 1–3)

Richardina edwardsi Bouvier, 1908a: 888.—Bouvier, 1908b: 150.—A. Milne-Edwards & Bouvier, 1909: 264.
Odontozona edwardsi.—Holthuis, 1946: 40.—Garcia Raso, 1996: 746, fig. 4.—Goy, 2010: 257.—De Grave & Fransen, 2011: 252.
Non *Odontozona edwardsi.*—Becker *et al.*, 2009: 792.—Lessard-Pilon *et al.*, 2010: 1885.—Goy, 2010: 251.

Material examined. (1) male lectotype, cl 5.2, ov., female syntype, cl 5.3, Les Pilones, Sudan, 25°39'N 18°22'W, *Talisman* No. 72, depth 882 m, 3 July 1883, sandy mud, coral & shells, MNHN Na 2946; (2) 2 male syntypes, cls 5.4, 5.4, south of Cape Bojador, 25°39'N 18°18'W, *Talisman* No.70, depth 698 m, 10 July 1883, sandy mud, coral & shells, MNHN Na 2944; (3) male syntype, cl 5.0, female syntype, cl 6.1, south of Cape Bojador, 25°39'N 18°18'W, *Talisman* No. 71, depth 640 m, 9 July 1883, sandy mud, coral & shells, MNHN Na 2945; (4) male syntype, cl 4.6, female syntype, cl 4.4, Maroc, 33°43'N 11°22'W, *Talisman* No. 20, depth 1105 m, 14 June 1883, sand, sponges, MNHN Na 2948; (5) male syntype, cl 4.3, 2 female syntypes, cls 4.6, 4.7, Maroc, 33°43'N 11°22'W, *Talisman* No.20, depth 1105 m, 14 June 1883, sand, sponges, MNHN Na 2949; (6) male, cl 3.5, 44°05'N 9°26.4'W – 45°05N 9°23.3'W, *Travailler* dragage No. 39, depth 1225–953 m, 15 Aug 1881, MNHN Na; (7) 2 males. cls 5.7, 3.4, female, cl 5.7, *Thalassa* 1971, Banc d'Arguin, Mauritanie, 18°22'N 16°36'W, MNHN Na; (8) female, cl 4.0, *Thalassa* 1971, Stn 352, MNHN Na; (9) male, cl 6.0, Roscoff, 44°07.5'N 04°43.8'W – 44°06.9'N 04°44'W, *Thalassa,* Stn 349, depth 900–600 m, 6 Oct 1971, MNHN Na; (10) male, cl 5.0, 47°33.8'N 07°12.6'W, *Thalassa* 1973, depth 511m, MNHN Na; (11) female, cl 5.3, 48°34'N 10°56.6'W – 48°32.9'N 10°45'W, *Thalassa* 1973–2453, depth 1975–2070 m, Stn 303, MNHN Na; (12) male, cl 3.6, 3 females cls 3.5, 5.0, 5.2, CENTOB BALGIM84, 35°31.3'N 07°26.2'W, N.O. *Cryos* stn CP62, depth 1209–1302 m, 6 Apr 1984, muddy bottom, foram, pteropod, MNHN Na 11902; (13) female, cl 6.2, CENTOB BALGIM84, Golfe Ibero-Marocain, 34°22.3'N 07°25.1'W, N.O. *Cryos* stn CP91, depth 948, shell, pteropod, hexactinellid, MNHN Na 11903: (14) ov., female, cl 5.6, Atlantic, 48°54.59'N 11°12.08'W, *Thalassa-Procelt* stn 67, depth 730–840 m, 23 June 1984, MNHN Na; (15) 4 males, cls 3.7, 4.2, 4.8, 5.2, 5 females, cls 4.0, 5.0, 5.1, 5.2, 5.4, CENTOB Seamount 1-, Atlantic, Portugal & Golfe Hispano-Marocain, Banc Galice, 42°52.4'N 11°50.6'W, N.O. *Noroit*, stn DW 116, depth 985–1000 m, 20 Oct 1988, MNHN Na; (16) male, cl 6.4, 2 females (1 ov.), cls 5.4, 6.9, CENTOB Seamount 1-Atlantic, Portugal & Golfe Hispano-Marocain, Banc Galice, 42°43.4'N 11°45.1'W, N. O. *Noroit*, stn DW 117, depth 770 m, 20 Oct 1988, MNHN Na.

Diagnosis. Moderately small stenopodid shrimp with slender, laterally compressed body, with few spinous processes; carapace with few spinules, distinct cincture of spinules along posterior margin of cervical groove, inferior orbital, antennal, branchiosteal, hepatic and pterygostomial spines present. Abdomen with transverse grooves on first three pleomeres, dorso-transverse carina on sixth pleomere, lateral pleura ending in few spinules. Second maxilliped with short tooth-like projection on ventral propodal margin. Third maxilliped with spinous ischial, meral margins. Third pereiopods with spinous margins on all segments. Carpus and propodus of fourth and fifth pereiopods with 5 and 4 segments respectively.

Redescription. Male lectotype (MNHN Na 2946) severely damaged, missing telson and most appendages; therefore redescription based mostly on the female syntype (MNHN Na 2946); mouthparts dissected from male

syntype; (MNHN Na 2945); variation among specimens summarized in redescription. A slender stenopodid shrimp with a compressed body.

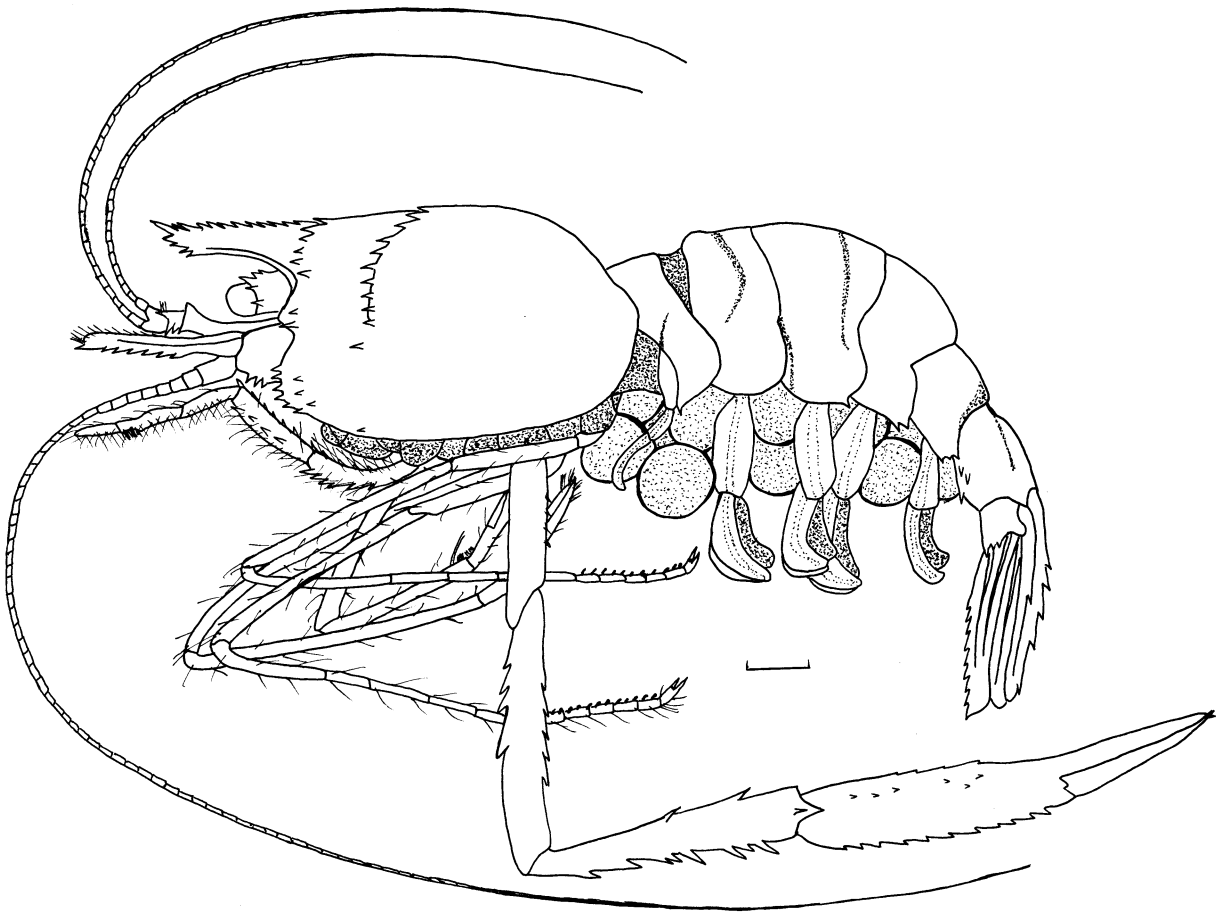

FIGURE 1. *Odontozona edwardsi* (Bouvier, 1908), female syntype, MNHN Na 2946. Scale bar = 1.0 mm.

Rostrum (Figs.1, 2A) long, reaching slightly past antennular peduncle, directed downwards and upturned at tip. Dorsal margin bearing 8–13 teeth, ventral margin with 1–4 teeth; no lateral teeth.

Carapace (Figs. 1, 2A) with strong inferior orbital, antennal, branchiostegal, and hepatic spines; 3–7 small pterygostomial spines. Cervical groove deep with 14–26 spines along posterior margin; area posterior to post-orbital margin with several large spines; few small spines occasionally posterior to pterygostomial angle. Ventrolateral carapace angle and branchiostegite slightly rounded.

Abdomen (Figs. 1, 2B, 3A) narrow, compressed, dorsally glabrous. Transverse grooves present on first three pleomeres; lateral margin of first pleuron with 1 or 2 anterior teeth; lateral margin of second pleuron rounded, glabrous in females, with small posterior tooth in males; lateral margin of third pleuron with small posterior tooth in females, 2 anterior and 3 posterior teeth in males; lateral margin of fourth pleuron with 2 or 3 posterior teeth in females, 2 anterior and 3 posterior teeth in males; lateral margin of fifth pleuron with 3 posterior teeth in females, one tooth in males; dorso-transverse carina on sixth pleomere, lateral margin usually with strong tooth (Fig. 3B). Males with first to fifth pleomeres with strong ventral median spine; fourth to eighth thoracic sternites with few small spines; sixth to eighth sternites of females unarmed, broader than males.

Telson (Fig. 3C) lance-shaped, nearly twice as long as sixth pleomere with median groove flanked by two longitudinal carinae bearing 5 posteriorly directed spines. Each lateral margin bearing distinct tooth at midlength, provided with numerous long plumose setae along posterior three-fifths.

Eyes (Figs. 1, 2A) well-developed with peduncle equal in length to unpigmented cornea. Dorsal surface of peduncle bears 2 or 3 spines, anterior margin with 2–4 spines.

Antennular peduncle (Fig, 2E) short, extending to middle of scaphocerite; proximal segment longest with

short, acute stylocerite proximally and small plumose lobe distally on outer margin, 2 distal spines on inner margin; middle segment 0.5 length of proximal segment with 2 spines on inner margin, large distal spine on outer margin; distal segment equal in length to middle segment, unarmed. Upper and lower flagella short reaching to middle of second pleomere.

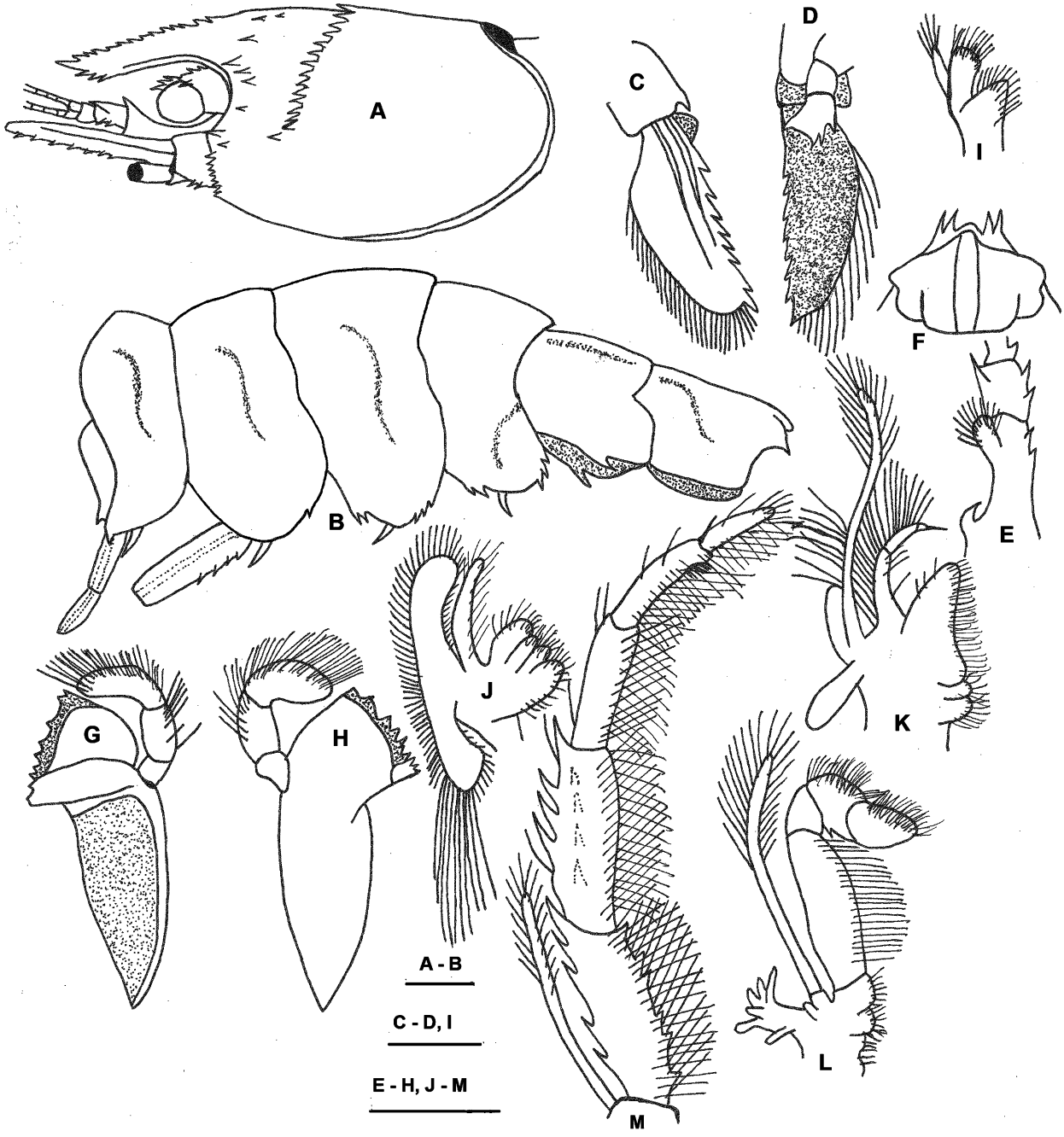

FIGURE 2. *Odontozona edwardsi* (Bouvier, 1908). A, B, F–M, male syntype MNHN Na 2945; C–E female syntype MNHN Na 2946. A, carapace, lateral view; B, abdomen, lateral view; C, scaphocerite, dorsal view; D, scaphocerite, ventral view; E, left antennular peduncle, dorsal view; F, epistome and labrum, ventral view; G, right mandible, ventral view; H, left mandible, dorsal view; I, maxillule; J, maxilla; K, first maxilliped; L, second maxilliped; M, third maxilliped. Scale bars = 1.0 mm.

Antenna (Figs. 1, 2C, D) with large basicerite, with 3 spines; scaphocerite twice as long as broad, lateral margin straight, with 5–9 teeth including terminal tooth. Dorsal surface of scaphocerite with 2 distinct longitudinal carinae, no spinules, ventral surface unarmed. Flagellum well developed extending beyond tip of telson.

Epistome (Fig. 2F) anteriorly triangular with 4 submedian spines; labrum normally developed; paragnath with median fissure.

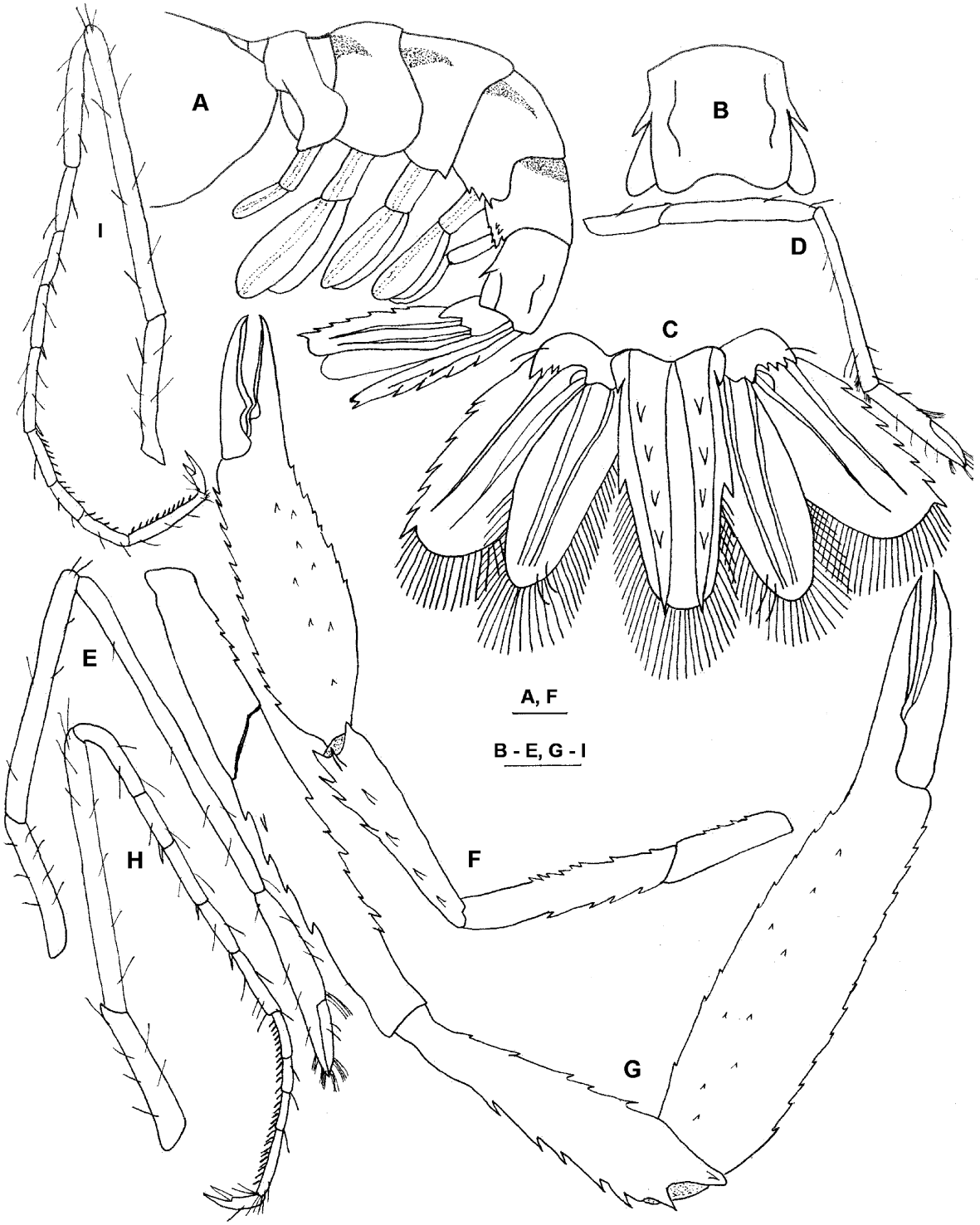

FIGURE 3. *Odontozona edwardsi* (Bouvier, 1908). A, B, F, female syntype MNHN Na 2945; C–E female syntype MNHN Na 2946; G–I, male syntype MNHN Na 2945. A, abdomen, lateral view; B, sixth abdominal somite, dorsal view; C, telson and uropods; D, first pereiopod; E, second pereiopod; F, left third pereiopod; G, right third pereiopod; H, fourth pereiopod; I, fifth pereiopod. Scale bars = 1.0 mm.

Mandible (Figs. 2G, H) robust, with short, fused molar and incisor processes. Molar surface nearly smooth, incisor with 9 small teeth. Palp well developed, 3-segmented, segments of subequal length; proximal segment glabrous, middle and distal segments setose.

Maxillule (Fig. 2I) with slender, undivided endopod bearing 5 plumose setae distally. Proximal endite moderately broad, truncate distally, with numerous distal compound spinose and plumose setae. Distal endite of subequal size, rounded distally, with numerous plumose setae.

Maxilla (Fig. 2J) with numerous plumose setae on both lobes of coxal and basal endites. Endopod long, slender, exceeding anterior margin of scaphognathite with distal and outer marginal plumose setae. Scaphognathite long, narrow, fringed with numerous plumose setae, rounded terminal margin with 10 long plumose setae.

First maxilliped (Fig. 2K) with 3-segmented endopod; proximal segment longer than wide, with 12 long plumose setae laterally along outer margin, inner margin with 4 short plumose setae; middle segment about 0.5 length of proximal with 10 long plumose setae along outer margin; distal segment short, slender with simple terminal seta. Basipodite large, rounded anterior, concave middle, rounded posterior, bearing dense fringe plumose setae; coxopodite bilobed, each lobe with numerous plumose setae. Exopod well developed, flagellum with 17 long plumose distolateral setae. Large epipod with slender proximal and distal lobes of equal length.

Second maxilliped (Fig. 2L) with 4-jointed endopod; dactylus suboval with dense fringe of short setae along distodorsal margin; propodus equal dactylar length, densely setose on dorsal margin, ventral margin bearing acute proximal tooth; carpus short, 0.75 propodal length, unarmed; merus 3 times dactylar length, ventral margin slightly convex with fringe of numerous long simple setae; ischium fused to basis, both lobate with dense fringe of short setae; coxa with 5 short setae. Exopod long, slender, undivided with distal third bearing 22 plumose setae; tiny epipod present; arthrobranch and podobranch also present.

Third maxilliped (Fig. 2M) with 7-segmented endopod, dactyus, propodus and carpus subequal in length, with numerous long plumose setae; propodus with setiferous organ at distomesial angle; merus and ischium equal length, merus with 3–6 large outer marginal spines, 4 lateral spines, ischium with 3–8 large outer marginal spines, 3–6 small inner marginal spines; basis and coxa fused, unarmed; exopod long with distal half bearing numerous plumose setae.

First pereiopod (Fig. 3D) smallest, shortest cheliped, all segments without spines; chela slender, long with fingers and palm subequal in length, cutting edge with indistinct ridge. Fingers bearing small tufts of long setae; distoventral part of carpus and distoproximal part of propodus bearing weak setiferous organ. Carpus longest segment, twice ischial length.

Second pereiopod (Fig. 3E) longer than first, cutting edge of chela similar to first, tips of fingers with small tufts of long setae. Pereiopod glabrous except for few scattered simple setae. Carpus longest segment, more than twice length of ischium.

Third pereiopod (Figs. 1, 3F, G) strongest, robust, longer than entire length of body; propodus, carpus, merus subequal in length. Palm with dorsal row of 11–14 spinules, ventral row of 4–8 spinules, few scattered spinules on dorsal and ventral surfaces. Fingers elongate with sharp crossing tips; dactylus glabrous, cutting edge with chitinous ridge with large proximal tooth fitting into shallow depression of chitinous ridge on the cutting edge of propodus. Carpus with 4–8 dorsal marginal spines, 0–5 ventral marginal spinules, 1–5 dorsomedial spines. Merus with 4 dorsal marginal spinules, 5–8 ventral marginal spinules. Ischium with 4 ventral marginal spinules.

Fourth and fifth pereiopods (Figs. 3H, I) long, slender, fifth slightly longer than fourth. Dactyli biunguiculate with unguis separated from dactylar corpus. Propodus subdivided into 2–5 segments bearing 11–28 ventral movable spines. Carpus subdivided into 4 or 5 segments bearing 2–5 ventral movable spines. Merus and ischium with few simple setae.

First pleopods uniramous, others biramous, all lacking appendices; ventral margin of basipodites on pleopod 2–5 armed with 3 spinules in males; all pleopodal basipodites of females glabrous.

Uropod (Fig. 3C) equal to length of telson; protopodite stout ending with 4 distal teeth, rounded proximal knob. Exopod wider than endopod with 7–11 acute teeth on outer margins; dorsal surface with 2 longitudinal carinae. Endopod without outer marginal teeth, 2 dorsal longitudinal carinae.

Measurements. (mm) Postorbital carapace length: females 2.7–5.1, males 2.7–4.4; carapace and rostrum length: females 4.0–6.9, males 3.4–6.4; total body length: females 7.5–17.2, males 7.5–15.5.

Color pattern. Unknown

Development. Ovigerous females range in size from 4.1–5.1 mm postorbital carapace length, 11.7–15.4 mm total length and carried 4–11 eggs. Eggs at blastula stage with undifferentiated yolk cells were 1.25 × 1.50 mm in size, while eggs with embryos having pigmented eyes and well developed appendages were 1.40 × 0.93 mm in size.

Distribution. Northwestern African coast, off Morocco, Western Sahara and Mauritanie; Gulf of Cadiz and off Roscoff, France. Specimens were collected at depths of 511 to 2070 m, with an average depth of 941 m.

Habitat. This rare species has been collected by beam trawl or epibenthic sled in sandy mud bottoms among coral, shells, sponges, pteropods and forams.

***Odontozona lopheliae* sp. nov.**
(Figs. 4–8)

Odontozona edwardsi.—Becker *et al.*, 2009: 792.—Lessard-Pilon *et al.*, 2010: 1885.—Goy, 2010: 251.

Material examined. (1) male holotype, cl 5.5, Ecoprof 5, TOISA *Voyager*, 22°24'12"S 46°06'18"W, 621m, among deep sea corals *Lophelia pertusa*, MNRJ 22552. (2) 2 female paratypes, cl 3.8, 3.9, off Sapelo Island, Georgia, U.S.A., 31°23.160'N 78°36.198'W, 665 m, 24 Aug 2004, SERTC –S1008. (3) 2 female paratypes, cls 4.2, 5.0, R/V *Seward Johnson II*, Green Canyon 234a, Gulf of Mexico, JSL 4714, 27°35.89'N 91°49.60'W, 524 m, on *Lophelia pertusa*, June 2004, USNM 1175271. (4) 1 male paratype, 4 female paratypes (2 ov. females), cls 3.6, 5.9, 5.7, 5.4, 5.2, R/V *Seward Johnson II*, Green Canyon 234a, Gulf of Mexico, JSL 4740, 27°44.81'N 91°13.44'W, 509 m, on *Lophelia pertusa*, June 2004, USNM 1222546.

Diagnosis. Small, robust shrimp with laterally compressed body, with few spinous processes; carapace with cincture of spines marking cervical groove; smooth behind cervical groove; small hepatic spine; antennal spine strong; few spines at supraorbital region; antennal spine strong; few spines between antennal spine and pterygostomian border. Abdomen glabrous. Eyes without pigment. Second maxilliped without ventral tooth on propodus. Third maxilliped with spinous ischial and meral borders. Merus, carpus and propodus of third pereiopod with marginal spinules. Carpus and propodus of fourth and fifth pereiopod with 5 and 6 segments respectively.

Description. (holotype male, MNRJ 22552). Rostrum (Fig. 4A) long, almost reaching distal end of antennular peduncle, straight, upturned at tip; dorsal margin bearing 10 teeth, posterior 3 situated posterior to hind margin of orbit, ventral margin with two teeth on distal fourth; no lateral teeth.

Carapace (Fig. 4A) robust, with small hepatic and strong antennal spines, without inferior orbital and branchiostegal spines; 7 pterygostomial spines. Cervical groove deep, with 34 spines along posterior margin; smooth behind cervical groove; with 4 spines at supraorbital region. Ventrolateral carapace angle and branchiostegite slightly rounded.

Abdomen (Fig. 4A) smooth, dorsally unarmed, without median carina and without transverse grooves; margins of pleura 1–4 and 6 rounded, spineless; that of pleomere 5 triangular, spineless.

Telson (Fig. 4C) lance-shaped; deeply sulcate mesially at middle length; with 4 rows of dorsolateral spines, inner pair of rows with 3 spines, outer pair with 7 spines; each lateral margin bearing distinct tooth at midlength, provided with numerous long plumose setae along posterior three-fifths; distal margin blunt, fringed with setae, with a pair of lateral spines.

Eyes (Fig. 4B) well-developed with unpigmented cornea twice length of peduncle. Dorsal surface of peduncle with 3 spines, anterior margin with spines .

Antennular peduncle (Fig. 4E) short, reaching third of scaphocerite; proximal segment longest with short, subquadrate stylocerite proximally, bearing 3 slender spines on distal margin, one strong distal tooth on outer margin, one strong mesial spine on inner margin; middle segment 0.6 length of proximal segment with bifid strong distal spine at outer margin, 2 strong spines on inner margin; distal segment half of middle segment length, unarmed. Upper and lower flagella short reaching to middle of second pleomere.

Antenna (Figs. 4A, D) with large basicerite, with 4 ventral teeth, one dorsomesial tooth; scaphocerite twice as long as broad, lateral margin slightly convex, with 5 teeth including terminal tooth. Dorsal surface of scaphocerite with distinct longitudinal carina, no spinules, ventral surface unarmed. Flagellum well developed extending beyond tip of telson.

Mandible (Fig. 5A) robust, with short, fused molar and incisor processes. Molar surface nearly smooth, incisor with 2 large distal teeth, 4 smaller proximal teeth. Palp well developed, 3-segmented, segments of subequal lengths; proximal segment glabrous, middle and distal segments setose.

Maxillule (Fig. 5B) with slender, undivided endopod bearing 7 simple setae distally. Proximal endite moderately broad, truncate distally, with numerous distal compound spinose and simple setae. Distal endite of subequal size, rounded distally, with numerous plumose setae.

Maxilla (Fig. 5C) with numerous plumose setae on both lobes of coxal and basal endites. Endopod long, slender, exceeding anterior margin of scaphognathite with distal and outer marginal simple setae. Scaphognathite long, narrow, fringed with numerous plumose setae, rounded terminal margin with 5 long plumose setae.

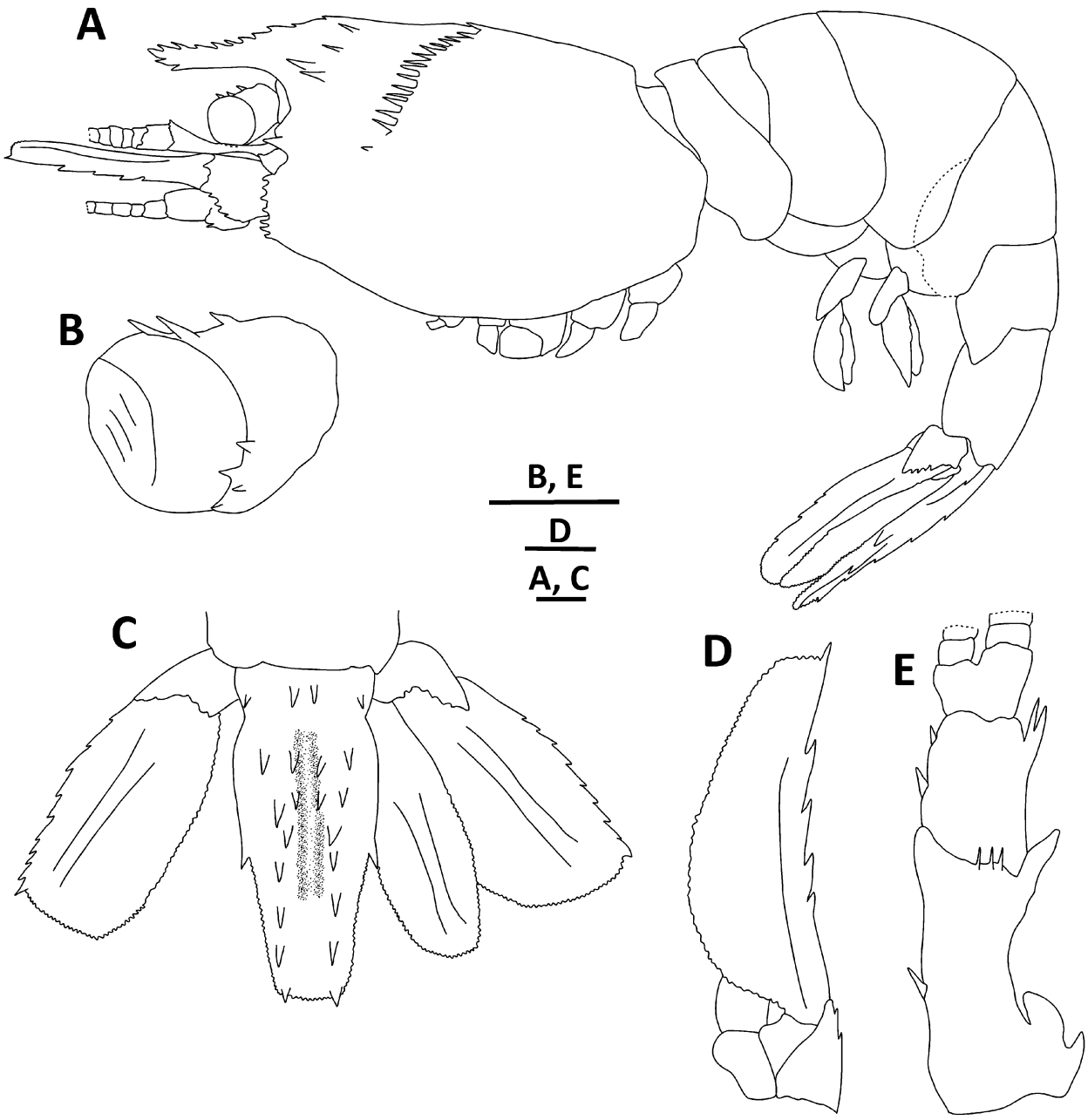

FIGURE 4. *Odontozona lopheliae* **sp. nov.**, male holotype , MNRJ 22552: A, lateral view; B, ocular peduncle and cornea; C, telson and uropods, dorsal view; D, antenna, dorsal view; E, antennule, dorsal view. Scale bars = 0.5 mm.

First maxilliped (Fig. 5D) with 3-segmented endopod; proximal segment longer than wide, with 11 simple setae laterally along outer margin, middle segment about 0.25 length of proximal with 1 simple seta on outer margin; distal segment short, slender. Basipodite large, rounded anterior, nearly straight middle, rounded posterior, bearing dense fringe of plumose setae; coxopodite with numerous plumose setae. Exopod well developed, two-segmented, basis with plumose setae on outer margin; flagellum twice as long as endopod with 32 long plumose distolateral setae. Large epipod with slender proximal and distal lobes of equal length.

Second maxilliped (Fig. 5E) with 4-segmented endopod; dactylus suboval with dense fringe of long setae along distodorsal margin; propodus equal dactylar length, densely setose on dorsal margin; carpus short, 0.5 propodal length, with 3 long distal plumose setae; merus 3 times dactylar length, ventral margin with fringe of numerous long simple setae, dorsal margin with distal simple seta; ischium fused to basis, both lobate with dense fringe of short setae; coxa with 8 short plumose setae. Exopod long, slender, undivided with distal third bearing numerous plumose setae; tiny epipod present; arthrobranch and podobranch also present.

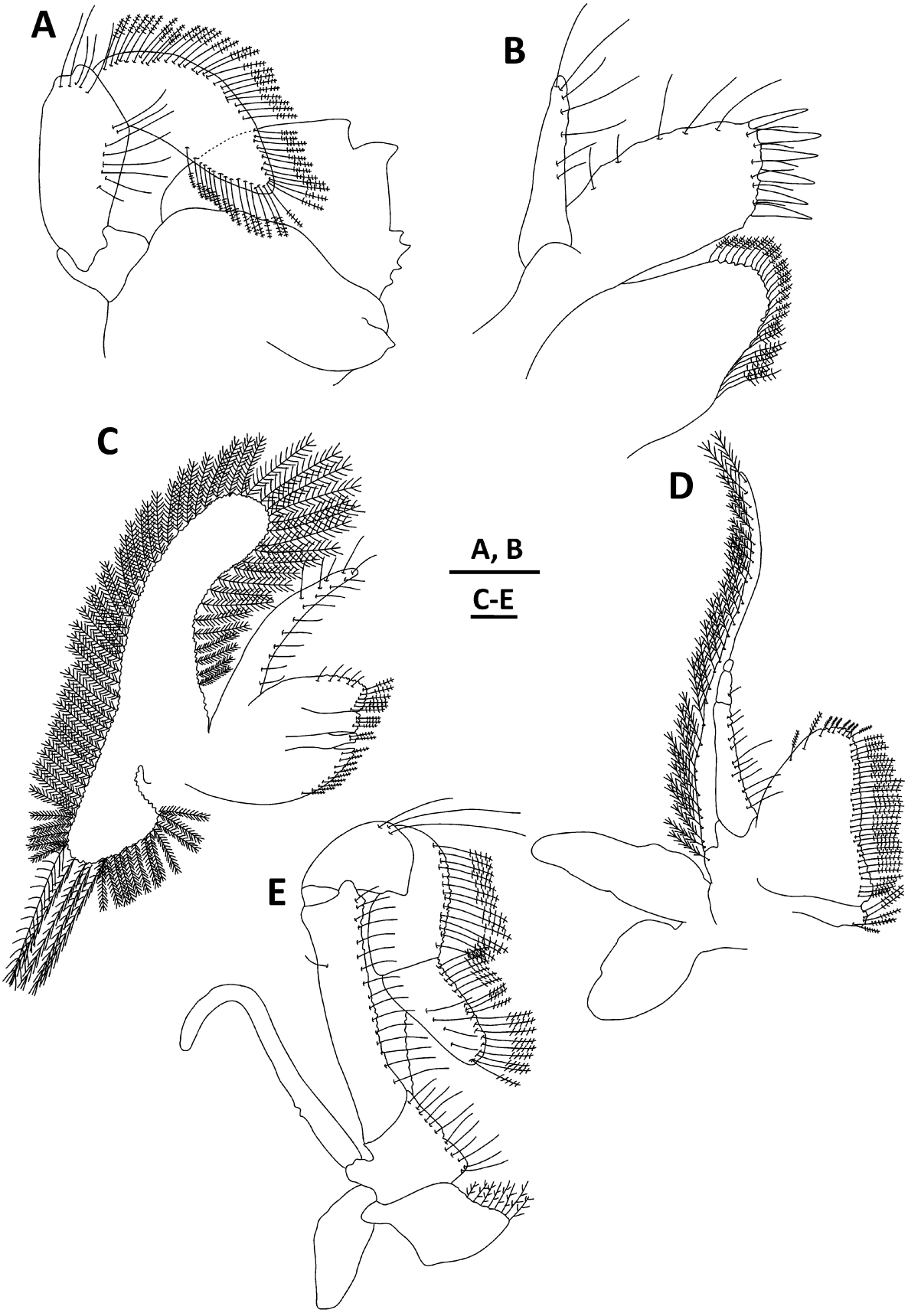

FIGURE 5. *Odontozona lopheliae* **sp. nov.**, male holotype, MNRJ 22552: A, right mandible, ventral view; B, maxillule; C, maxilla; D, first maxilliped; E. second maxilliped. Scale bars = 0.25 mm.

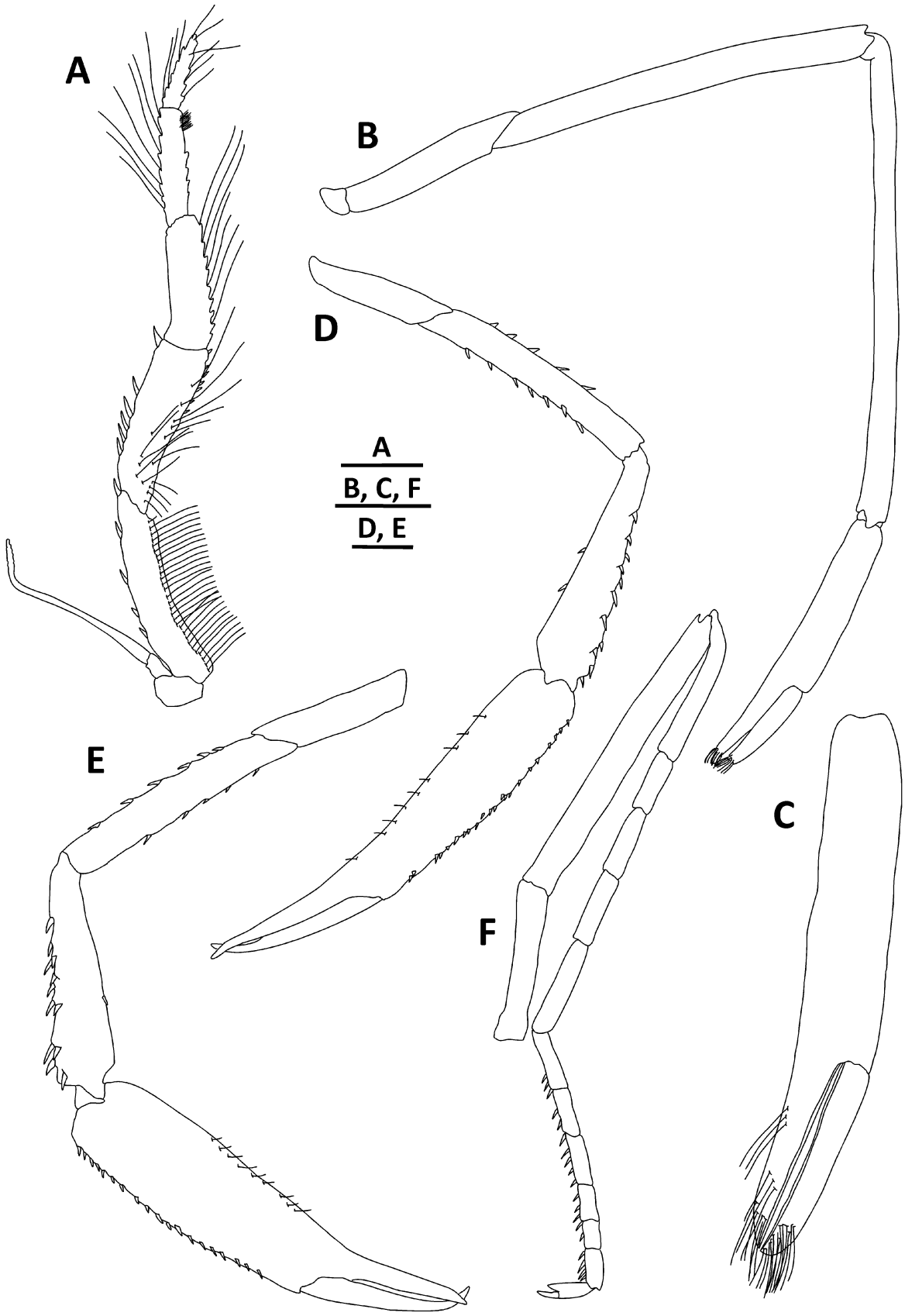

FIGURE 6. *Odontozona lopheliae* **sp. nov.**, male holotype, MNRJ 22552: A, third maxilliped; B, second pereiopod; C, propodus and dactylus, second pereiopod; D, left third pereopod; E, right third pereiopod; F, fourth pereiopod. Scale bars = 1.0 mm.

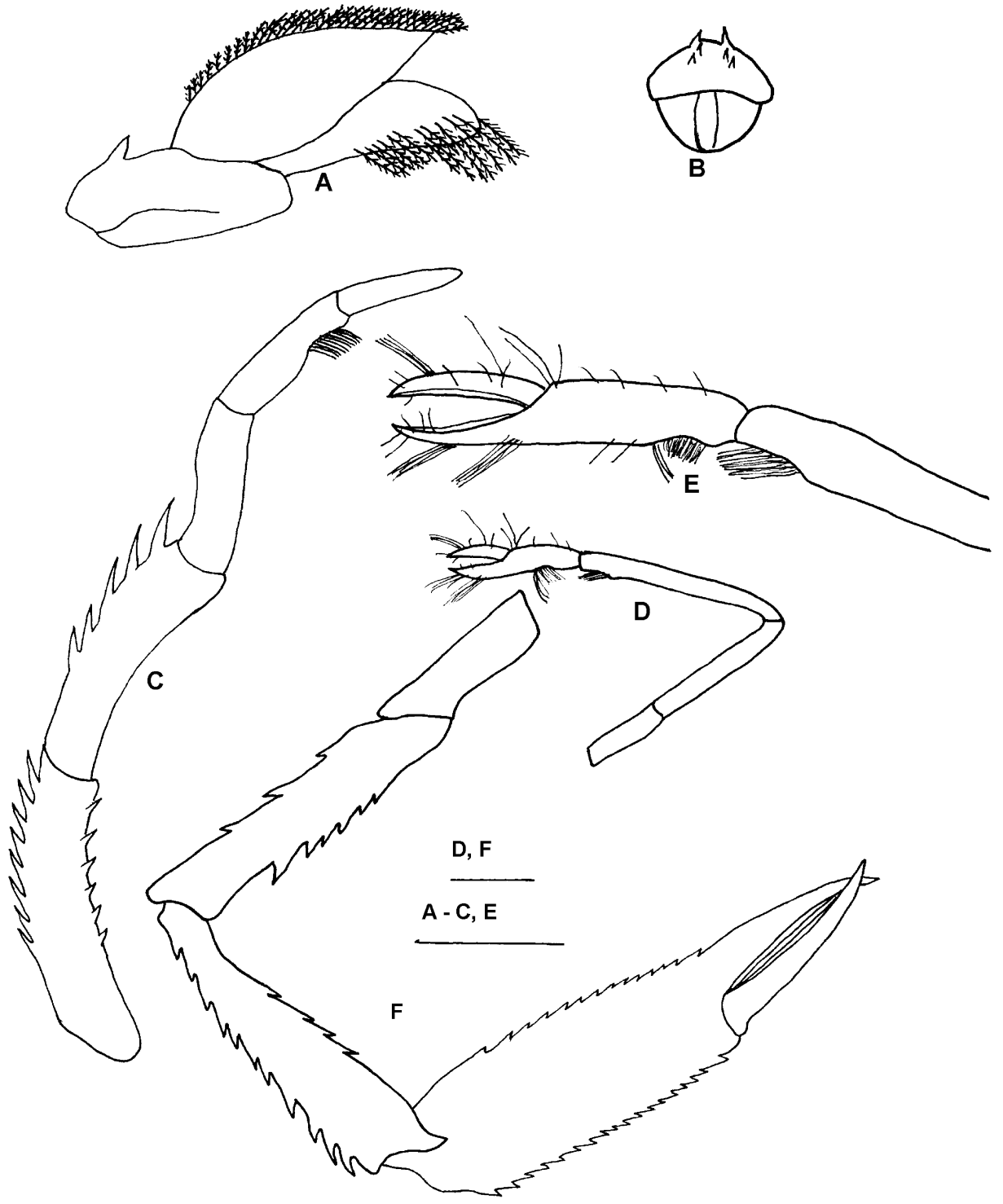

FIGURE 7. *Odnotozona lopheliae* **sp. nov.** Male holotype, MNRJ 22552: A, third pleopod. Female paratype USNM1222546: B, epistome and labrum, ventral view; C, third maxilliped (setae not shown); D, first periopod; E, propodus and dactylus, first periopod; F, third pereiopod. Scale bars = 1.0 mm.

Third maxilliped (Fig. 6A) with 7-segmented endopod, dactyus, propodus and carpus subequal in length, with numerous long plumose setae; propodus with setiferous organ at distomesial angle; merus and ischium equal length, merus with 6 outer marginal spines, inner margin fringed with simple setae and with 8 small distal spines, ischium with 5 large outermarginal spines, inner margin fringed with simple setae; basis and coxa fused, unarmed; 2-segmented exopod long, with distal half bearing numerous plumose setae.

First pereiopod missing. Second pereiopod (Fig. 6B) slender and elongate, glabrous; carpus longest segment, twice ischial length; cutting edge with indistinct ridge; tips of fingers with small tufts of long setae (Fig. 6C).

Third pereiopod (Fig. 6D, E) largest and strongest, longer than entire length of body; propodus, carpus, merus subequal in length. Palm with dorsal row of 19–22 spinules, ventral margin with short simple setae. Fingers elongate with hooked, crossing tips; dactylus glabrous, cutting edge with straight, indistinct ridge. Carpus with 11 or 12 dorsal marginal spines, 1 or 2 ventral marginal spinules. Merus with 5 or 6 dorsal and ventral marginal spines. Ischium unarmed

Fourth pereiopod (Fig, 6F) long and slender. Dactylus biunguiculate with long, slender unguis separated from dactylar corpus. Propodus subdivided into 4 segments, bearing 19 movable spines. Carpus subdivided in 5 segments, no ventral movable spines; merus and ischium not subdivided. Fifth pereiopod is missing.

Pleopods 1–5 missing at right side, 1, 2, 5 missing at left side. Pleopods 3, 4 at left side leaf like, biramous, lacking appendices (Fig. 7A), ventral margin of basipodite with spinule; endopods, exopods with plumose seta on inner surface and posterior margin.

Uropods (Fig. 4C) shorter than telson; protopodite stout ending with 4 or 5 distal teeth. Exopod wider than endopod, with 8–10 teeth on outer margins; dorsal surface with one longitudinal carina. Endopod without outer marginal teeth, longer than exopod.

Branchial formula same as *O. edwardsi* (Tab. 1.).

TABLE 1. Branchial formula of *Odontozona lopheliae* **sp. nov.**

	Maxillipeds			Pereiopods				
	I	II	III	I	II	III	IV	V
Pleurobranchs	–	–	1	1	1	1	1	1
Arthrobranchs	1	1	2	2	2	2	2	–
Podobranchs	–	1	–	–	–	–	–	–
Epipods	1	1	1	1	1	1	1	–
Exopods	1	1	1	–	–	–	–	–

Variations. The species shows some variation in spination of appendages. Female specimens have the abdominal pleura more rounded than males; there is a ventral medial spinule on each male pleomere; male thoracic sternites 4–6 bear a few blunt spinules, female sternites are broader, glabrous; first pleopods are uniramous and glabrous in both sexes, basipodite of male pleopods 2–5 bear a ventral spinule. Rostrum bears 6–12 dorsal, 1–4 ventral spines; cervical groove cincture with 26–36 spines. Epistome (Fig. 7B) triangular anteriorly with 2 submedian spines followed by 4 spines. Labrum normally developed. Paragnath rounded with median fissure. Third maxilliped (Fig 7C) with ischium bearing 1–8 outer marginal spines, 0–6 inner marginal spinules; merus with 1–6 strong outer marginal spines, 0–8 inner marginal spinules. First pereiopod (Fig. 7D, E) slender, elongate, well-developed carpo-propodal setiferous organ, cutting edge with indistinct ridge, fingers of chela bearing long setae at tips. Fourth and fifth pereiopods equal in length, carpus subdivided into 4 or 5 segments, propodus subdivided into 3–6 segments.

Measurements. (mm) holotype: carapace length, 5.5; carapace and rostrum length, 6.9; total length, from telson tip to scaphocerite tip, approximately 19.8; third pereiopod length, approximately 20.4. Additional examined specimens: carapace length, 3.6–5.9; carapace and rostrum length, 4.3–6.8; total length, 12.3–20.7; third pereiopod length, 10.2–20.5.

Color pattern. (Fig. 8) An ovigerous female was photographed off Sapelo Island, Georgia (SERTC 1008) taken from a depth of 665 m. Carapace, abdominal pleomeres, telson and uropods have numerous red spots along edges; spines on uropodal exopodite margin and dorsal longitudinal carinae of telson white. Dorsal region of carapace in front of cervical groove bright red, coloration extends along rostrum, over ocular peduncle, antennular peduncle and antennal scaphocerite; cornea of eyes white. Edges of third maxillipeds, first and second pereiopods red. Third pereiopods merus, carpus red; ischium, proximal propodus edged in red; distal propodus, dactylus white. Fourth, fifth pereiopods mostly whitish to transparent with few red spots along edges. Ovary and eggs blue.

Development. Ovigerous females ranged in size from 5.2–5.4 mm postorbital carapace length, 18.1–18.4 mm total length and carried 10–11 eggs. Eggs at blastula stage with undifferentiated yolk cells were 1.20 × 1.62 mm in size.

FIGURE 8. *Odontozona lopheliae* **sp. nov.** female. SERTC 1008, off Sapelo Island Georgia photo by Susan T. DeVictor.

Type locality. 22°24'12"S 46°06'18"W at Campos Basin, Rio de Janeiro, Brazil. Distribution: 31°386'N 78°6033'W off Sapelo Island, Georgia, USA; 27°35.89'N 91°49.60'W and 27°44.81'N 91°13.44'W Green Canyon, Gulf of Mexico.

Habitat. The holotype was sampled at a deep sea coral reef at a depth of 621 m by means of a ROV (remotely operated vehicle). The species' deepest record is from off Sapelo Island at 665 m. Six cruises from 2002 to 2005 recorded 84 specimens of the species by means of the deep-sea submersible *Johnson-Sea-Link* at primarily two locations, Green Canyon and Viosca Knoll in the Gulf of Mexico at depths from 459 to 525 m with an average depth of 489m. The use of deep-sea human operated orb remotely operated vehicles allowed the observation of the species' association with live or dead coral branches of *Lophelia pertusa*, a foundation species that is found throughout the world's oceans on topographic features (Rogers 1999).

Etymology. The species is named for its association with the deep-sea coral *Lophelia pertusa.*

Remarks. Both *Odontozona edwardsi* and *O. lopheliae* **sp. nov.** closely follow the definition of the genus *Odontozona* given by Holthuis (1946) and are most closely similar to each other as well as *O. spongicola* (Alcock & Anderson 1899) from deep water in the Pacific. The genus *Odontozona* includes 14 species (De Grave & Fransen 2011), *O. lopheliae* **sp. nov.** differs from 12 species of the genus in having the posterior half of carapace behind cervical groove cincture smooth. *Odontozona edwardsi* and *Odontozona spongicola* are close related with *O. lopheliae* **sp. nov.** sharing the feature mentioned above.

Odontozona edwardsi is easily separated from *O. lopheliae* and *O. spongicola* by the transverse grooves on the first three abdominal pleomeres, dorso-tranverse carina on the sixth pleomere, and the posterior pleural teeth versus the smooth pleon of these two species. *Odontozona spongicola* lacks the spinous propodal margins of the third perieopods (Goy 1992) seen in *O. edwardsi* and *O. lopheliae.* The other deep water Pacific species, *O. foresti* Hendrickx, 2002, lacks the spination of the third pereiopods and telson seen on *O. edwardsi* and *O. lopheliae.*

As mentioned above, the remaining Atlantic species of *Odontozona* are much more spinous on the carapace, abdomen, and appendages of both *O. edwardsi* and *O. lopheliae.* Atlantic *Odontozona* are distributed as follows: *Odontozona striata* Goy, 1981 and *O. meloi* Anker & Tavares, 2013 are known only from their respective

holotypes, the first sampled in deep waters off Cape San Antonio, Cuba and the latter sampled on Brazilian continental shelf (off Espírito Santo state) at a depth of 81.6 m. *Odontozona minoica* Dounas & Koukouras, 1989 is a deep-water species known from 125 m and 300 m in Aegean Sea off Crete (Koukouras & Dounas 2000). Besides that, two of the Atlantic species are restricted to shallow waters*: Odontozona libertae* Gore, 1981 presently known from 56 m off Key Largo, Florida and from 23 m in Granate Bay, Columbia (Criales 1997) and *Odontozona anaphorae* Manning & Chace, 1990, known only from the holotype from 10 m off Ascension Island in the South Atlantic Ocean. *Odonotozona addaia* Pretus, 1990 is presently known from a marine cave in the western Mediterreanean on the coast of Menorca at a depth of 5 m.

The Atlantic species of *Odontozona* can be separated base on the key below.

Key to the Atlantic species of *Odontozona*

1. Posterior half of carapace behind spinous cervical groove smooth 2
– Posterior half of carapace behind spinous cervical groove with scattered spinules or with post-cervical groove bearing cincture of spines or spinules organized in transverse rows 3
2. Cervical groove cincture of spines with fewer than 26 spines. Transverse grooves on first three abdominal somites. Dorso-transverse carina on sixth abdominal somite, posterior pleural teeth . . . . . *O. edwardsii* (Bouvier, 1908)
– Cervical groove cincture of spines with more than 26 spines. Abdomen smooth . . . . . *O. lopheliae* **sp. nov.**
3. Posterior half of carapace behind spinous cervical groove with scattered and inconspicuous spines elsewhere not arranged in transverse rows . . . . . *O. anaphorae* Manning & Chace, 1990
– Posterior half of carapace behind spinous cervical groove with post-cervical groove bearing cincture of spines or spinules organized in transverse rows 4
4. Propodus of third pereiopod with dorsal margin without spines, with 2 rows of long setae on dorsal and ventral margins . . . . . *O. meloi* Anker & Tavares, 2013
– Propodus of third pereiopod with no rows of long setae on dorsal and ventral margins 5
5. Pleuron of abdominal somite 3 with 3 medial teeth . . . . . *O. striata* Goy, 1981
– Pleuron of abdominal somite 3 with 0–2 medial teeth 6
6. Pleura of abdominal somites 3 and 4 without medial teeth. . . . . *O. libertae* Gore, 1981
– Pleura of abdominal somites 3 and 4 with 1 or 2 medial teeth 7
7. Pleura of abdominal somite 3 and 4 with one medial tooth . . . . . *O. minoica* Dounas & Kokouras, 1989
– Pleura of abdominal somites 3 and 4 with two medial teeth. . . . . *O. addaia* Pretus, 1990

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