JOURNAL OF CRUSTACEAN BIOLOGY, 27(1): 121–139, 2007

A REVISION OF THE GENUS *CHIRIDOTEA* (ISOPODA: CHAETILIIDAE) WITH SPECIES REDESCRIPTIONS AND A KEY

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ABSTRACT

A review of the isopod genus *Chiridotea* Harger, 1878 is presented. Five species are recognized from the eastern United States and the northern Gulf of Mexico (*Chiridotea almyra*, *C. arenicola*, *C. coeca*, *C. excavata* and *C. tuftsii*). *C. nigrescens* is regarded as a junior synonym of *C. coeca*. Diagnoses and descriptions are given for each species, neotypes are selected for *C. coeca* and *C. tuftsii*, and a key for species identification is presented.

INTRODUCTION

Species of *Chiridotea* Harger, 1878 are small, dorsoventrally flattened, marine isopods of the family Chaetiliidae (Poore, 2001). They live within sandy substrates where they burrow shallowly into the sediment. Most are inter- and subtidal, and marine dwelling, with only one species (*C. almyra* Bowman, 1955) found in low salinity or brackish water environments. Most of the species are distributed along the Atlantic coasts of the eastern United States and Canada (from Nova Scotia to Florida), except for one (*C. excavata* Harper, 1974), which was described from the Gulf of Mexico but has now been recorded from North Carolina and South Carolina.

Harger (1878) established *Chiridotea* for four species (*Idotea coeca* Say, 1818; *Idotea tuftsii* Stimpson, 1853; *Oniscus entomon* Linnaeus, 1758 and *Idotea sabini* Krøyer, 1849) from a review of isopods from New England, and he named *C. coeca* (Say, 1818) as the type species. *Oniscus entomon* and *Idotea sabini*, included from European and Arctic material respectively, were later moved to the genus *Saduria*. Since Harger (1878), five species have been described with little taxonomic revision. Bowman (1955) recorded a new species from South Carolina (*C. almyra*), taking the opportunity to revise the diagnoses of *C. tuftsii* and *C. coeca*. Wigley (1960, 1961) described two new species from New England (*C. arenicola* Wigley, 1960 and *C. nigrescens* Wigley, 1961). Menzies and Frankenberg (1966) gave a diagnosis of *C. caeca* (sic) and described a new species (*C. stenops* Menzies and Frankenberg, 1966) from Georgia. Schultz (1969) provided a key to *Chiridotea* that included the six known species. Harper (1974) described a new species (*C. excavata*) from Texas, expanding the range of the genus from the eastern United States to the northwestern Gulf of Mexico.

Watling and Maurer (1975) were the first to report apparent inconsistencies in existing species descriptions. They determined that *C. stenops* was an invalid species and was, in fact, based on misidentified juvenile specimens of *C. arenicola*. They argued that the diagnostic characters used by Wigley (1960, 1961), Menzies and Frankenberg (1966) and Schultz (1969), were variable with size/age (head lateral lobe shape and setation, antennal morphology). Furthermore, Watling and Maurer (1975) suggested that the different life stages of *C. nigrescens* and *C. coeca* be examined in case of similar confusion between these species. Clearly, adequate species descriptions for *Chiridotea* were lacking, and much confusion existed regarding species identification, yet no comprehensive revision of the genus was subsequently undertaken.

Our preliminary examination of the collections of the National Museum of Natural History (NMNH), Washington D.C., uncovered three specimen lots labeled with names that have never appeared in the literature: '*Chiridotea stenocula* Menzies and Frankenberg', '*C. minuta* George and Menzies' and '*C. triloba* (Say)'. The first species appears to be an incorrectly catalogued *C. stenops*, as Menzies and Frankenberg (1966) list *Aegathoa oculata* as a synonym of this species. *C. minuta* does not appear in any publications by George and Menzies, and we found no published record for *C. triloba*. Examination has shown they are all misidentified immature or manca specimens of existing species.

For this study, type and non-type material of all *Chiridotea* species in the NMNH, as well as material recently collected from the southeastern United States Atlantic coast, was examined in an effort to determine clear diagnostic characters for species definitions. Different size classes within each species were also examined, wherever possible, to record morphological changes related to development. The five existing species are re-diagnosed, redescribed, and a key to their identification is presented. In addition, neotypes are selected for *Idotea coeca* and *Idotea tuftsii* (both formerly without type material).

The abbreviations used are: MRRI-Marine Resources Research Institute, South Carolina Department of Natural Resources (SCDNR), Charleston, SC; NMNH-National Museum of Natural History (Smithsonian), [formerly USNM], Washington, D.C.; ODA-Ocean disposal area

(Charleston); ODMDS- Ocean dredge material disposal site (Charleston); SERTC - Southeastern Regional Taxonomic Center, SCDNR, Charleston, SC.

Systematics

Family Chaetiliidae Dana, 1849

Chaetilinae Dana, 1849: 427.
Chaetilidae Dana, 1852: 300. [note spellings]

Genus *Chiridotea* Harger, 1878

Chiridotea Harger, 1878: 374.—Bowman, 1955: 225.—Menzies and Frankenberg, 1966: 24.

Type Species.—*Idotea coeca* Say, 1818 by original designation.

Composition.—*C. almyra*, *C. arenicola*, *C. coeca*, *C. excavata*, *C. tuftsii*.

Diagnosis.—Head and pereon ovate in dorsal view and widest at pereionites 3 and 4. Lateral lobes of head with ocular notch (developing more fully with size/age); short rostrum present. Pereionites 2-7 with dorsal coxal plates visible and expanded over bases of pereiopods, extending posteriorly to an acute point. Pleotelson with three articulating pleonites present with a fourth partially fused and marked by a lateral suture line; pleonite 1 in both sexes with ventral mid-line ridge tipped with setae; distolateral margins of pleotelson fringed with setae.

Maxillipedal palp composed of three articles (with article fusion thought to be 1/2 + 3/4 + 5), article two largest, articles two and three with mesial setae; endite with a single coupling hook, exopod as long as broad, not extending past article two of palp. Maxilla 1 outer lobe with eight to ten terminal robust setae; inner lobe with one long plumose seta, with a minute seta subapically. Maxilla 2 inner, medial and outer lobes each with four to six terminal robust setae. Mandible with toothed incisor, lacinia mobilis trapezoid in shape with distal edge longer than proximal, not distinctly toothed, with spine row of 10-12 spines associated; with tuft of fine setae medially; without distinct molar.

Pereiopods 1-3 subchelate; propodus of pereiopod 1 generally larger than propodus of pereiopods 2 and 3; pereiopod 1 basis anterior margin usually devoid of plumose setae; pereiopods 2 and 3 similar in size and with similar setation, with distinct row(s) of plumose setae along anterior margins of basis, ischium and merus. Pereiopods 4-7 fossorial, progressively larger in size, generally with serrulate setae on anterior margins and plumose setae on posterior margins, without secondary unguis.

Uropodal endopod and exopod present; exopod about half-length of endopod, with setose margins. In females, oöstegites on pereiopods 1-5 form the marsupium, oöstegites on pereiopods 2-4 forming the majority of the marsupium. In males, penes separate, almost entirely covered ventrally by the ventral coxal plates of pereiopod 7 expanded over the sternum to meet in the midline, opening adjacent to the ventral mid-line ridge on pleonite 1. Pleopod 2 of male with appendix masculina 2-3 times the length of rami, usually distally curved, distally triangular in cross section.

Key to the Species of *Chiridotea (Adults)**

1. Pereiopod 1 dactylus with row of spines on posterior margin . . . . . 2 (Figs. 9B, 11B)
– Pereiopod 1 dactylus without row of spines on posterior margin . . . 3 (Figs. 2A, 4A, 7A, 7C)
2. Antenna 2 of females significantly longer than antenna 1 (twice the length); body at least 5.5 mm in length; distinct notch between lateral lobes of head . . . . . *C. tuftsii* (Figs. 11, 12)
– Antenna 2 of females only slightly longer than antenna 1; body less than 5 mm in length; indistinct or very shallow notch between lateral lobes of head . . . . . *C. excavata* (Figs. 9, 10)
3. Pereiopod 1 with a distinct single robust seta on the posterior margin of the propodus, near tip of dactlyus . . . . . 4 (Figs. 4A, 7A, 7C)
– Pereiopod 1 with many small robust setae along the entire posterior margin of the propodus . . . . . *C. almyra* (Figs. 1, 2)
4. Head with two clearly defined lateral lobes, each fringed with setae. Pereiopod 1 carpus with two to four large robust setae on posterodistal margin . . . . . *C. coeca* (Figs. 5-8)
– Head with only one clearly defined lateral lobe, fringed with setae. Pereiopod 1 carpus with one large robust seta and a smaller robust seta on posterodistal margin . . . . . *C. arenicola* (Figs. 3, 4)

* Several morphological characters that can be diagnostic for adults (size of ocular notch, antennal morphology, setation) are variable in mancas (where pereiopod seven has not fully developed) and juveniles (those specimens without oöstegites apparent or without a developed appendix masculina on pleopod 2, as in mature females and males).

Chiridotea almyra Bowman, 1955 (Figs. 1-2)

Chiridotea almyra Bowman, 1955: 228, figs. 1, a-i, 2d, f, g, h, k.

Material Examined.—HOLOTYPE: NMNH 96960, at Willtown Bluff, Edisto River, South Carolina, 33°15′45″N, 80°53′12″W, 1 April 1940. PARATYPE: NMNH 96962, at Willtown Bluff, Edisto River, South Carolina, 33°15′45″N, 80°53′12″W, 1 April 1940.

Other material: Massachusetts: NMNH 102105, near Pocasset River, Cape Cod, coll. W. D. Burbanck, 15 October 1957. NMNH 101844, Mashpee River, coll. W. D. Burbanck, 15 August 1955. NMNH 101782, Pocasset River, Cape Cod, coll. W. D. Burbanck, 22 April 1958. NMNH 102104, Pocasset River, Cape Cod, coll. W. D. Burbanck, 3 January 1958. New York: NMNH 213089, Hudson River, New York, coll. Z. Zo, 5 September 1973. NMNH 86519 (labeled as *C. coeca*), Haverstraw Bay, Hudson River, 24 August 1936. Delaware: NMNH 238656 (labeled as *C. tuftsii*), 14 July 1953. Maryland: NMNH 120148, near Betterton, Chesapeake Bay, coll. J. M. Odell, July 1966. NMNH 122206, near Betterton, Chesapeake Bay, April 1967. North Carolina: NMNH 107144, Currituck Sound, coll. J. A. Kerwin, 19 October 1960. South Carolina: NMNH 97613, near Willtown Bluff, Edisto River, May 1940. NMNH 97614, near Willtown Bluff, Edisto River, May 1940. NMNH 97615, near Willtown Bluff, Edisto River, 19 March 1940. Georgia: NMNH 97612, near King's Ferry, Ogeechee River, 9 June 1939.

Diagnosis.—Head with two distinct lateral lobes, antero-lateral margins fringed with setae, either scattered or in

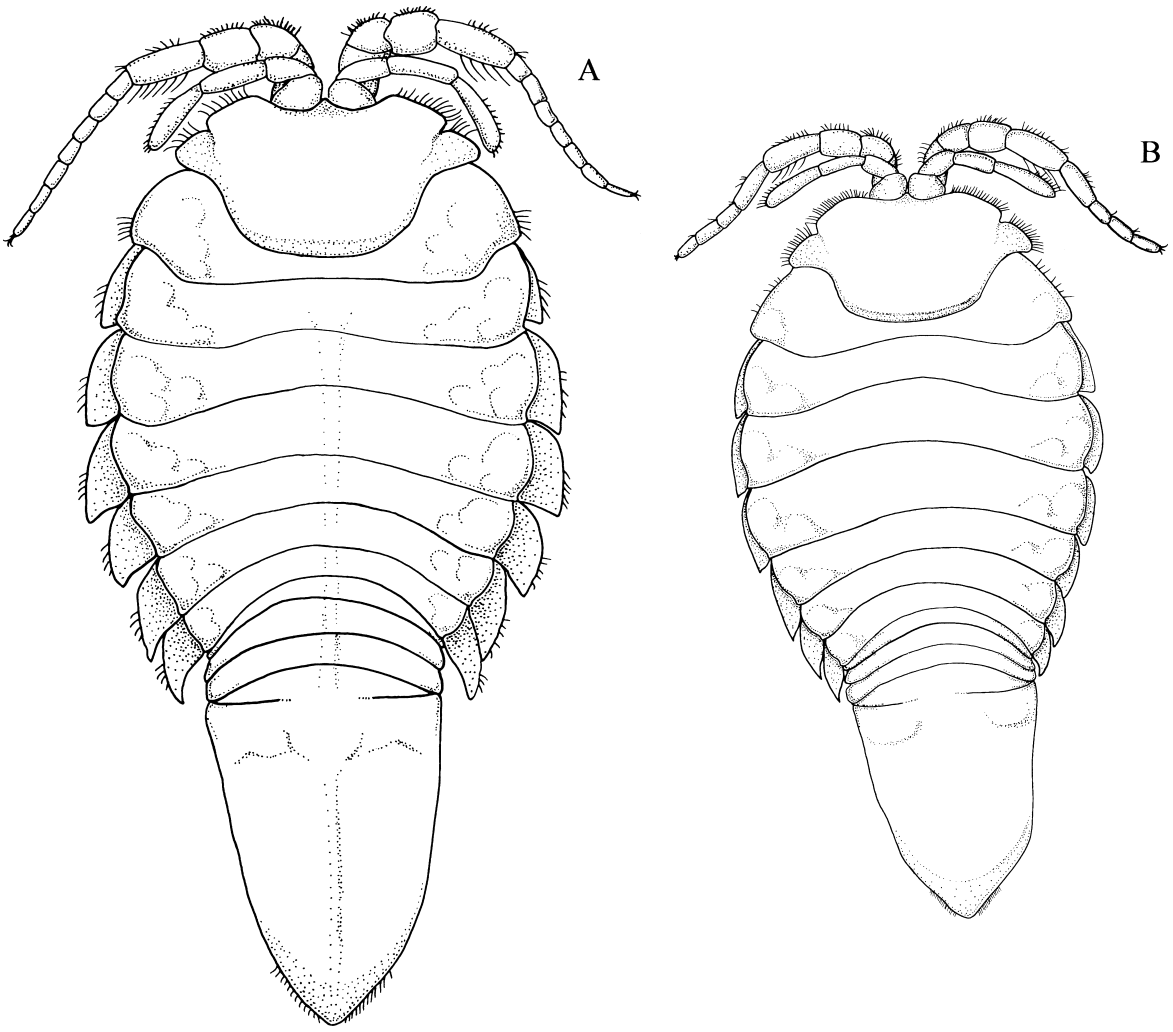

Fig. 1. *Chiridotea almyra* Bowman, 1955. A, male (NMNH 97614), 6.3 mm; B, paratype female (NMNH 96962) 5 mm.

tightly packed tufts. Dorsal carina (of males) extended from pereionites 2-7 to tip of pleotelson (carina not distinct in most females). Pleotelson broad, tapered in the last 1/3 length to a blunt point.

Antenna 2 around twice the length of antenna 1 (reaching past distal edge of pereonite 1).

Pereiopod 1 ischium and merus with only a few scattered setae on the anterior margin; carpus with two distinct robust setae on posterodistal margin; propodus with many small robust setae of varying lengths along entire posterior margin; dactylus posterior margin smooth. Pereiopods 2 and 3 carpus with a distinct large robust seta on the posterior margin, with a fringe of fine setae along distal edge of posterior margin; propodus with two distinct robust setae on posterior margin, near tip of dactylus (when dactylus is closed against propodus), with short fine setae along entire posterior margin.

Description.—*Female*. 5-8 mm. Lateral margins of head with distinct ocular notch forming two lateral lobes, with setae present on both lobes. Pereionites 1-7 with low ornamentation on dorsolateral margins. Pleotelson about twice as long as wide, broad to 2/3 length and then tapered to a blunt point, apex with fringes of simple setae on distolateral margins.

Antenna 1 flagellum elongate, longer than article 2 of peduncle. Antenna 2 distinctly longer than antenna 1 (almost twice the length), flagellum with 4-9 articles (varies with age/size).

Mouthparts as for genus.

Pereiopod 1 basis anterior margin without row of plumose setae; ischium and merus each with one or two setae on anterior margin, merus posterodistal margin with scattered setae; carpus posterodistal margin with two distinct robust setae and several scattered short, fine setae; propodus anterior margin with four to six serrulate setae and scattered short, fine setae, posterior margin with around 20 small robust setae of varying lengths, dactylus posterior margin without spines, unguis and secondary unguis present. Pereiopod 2 basis anterior margin with six or more long, plumose setae in two rows; ischium anterior margin with five or more plumose setae; merus anterodistal margin with up to nine plumose setae, posterodistal margin with scattered simple setae; carpus posterodistal margin with one

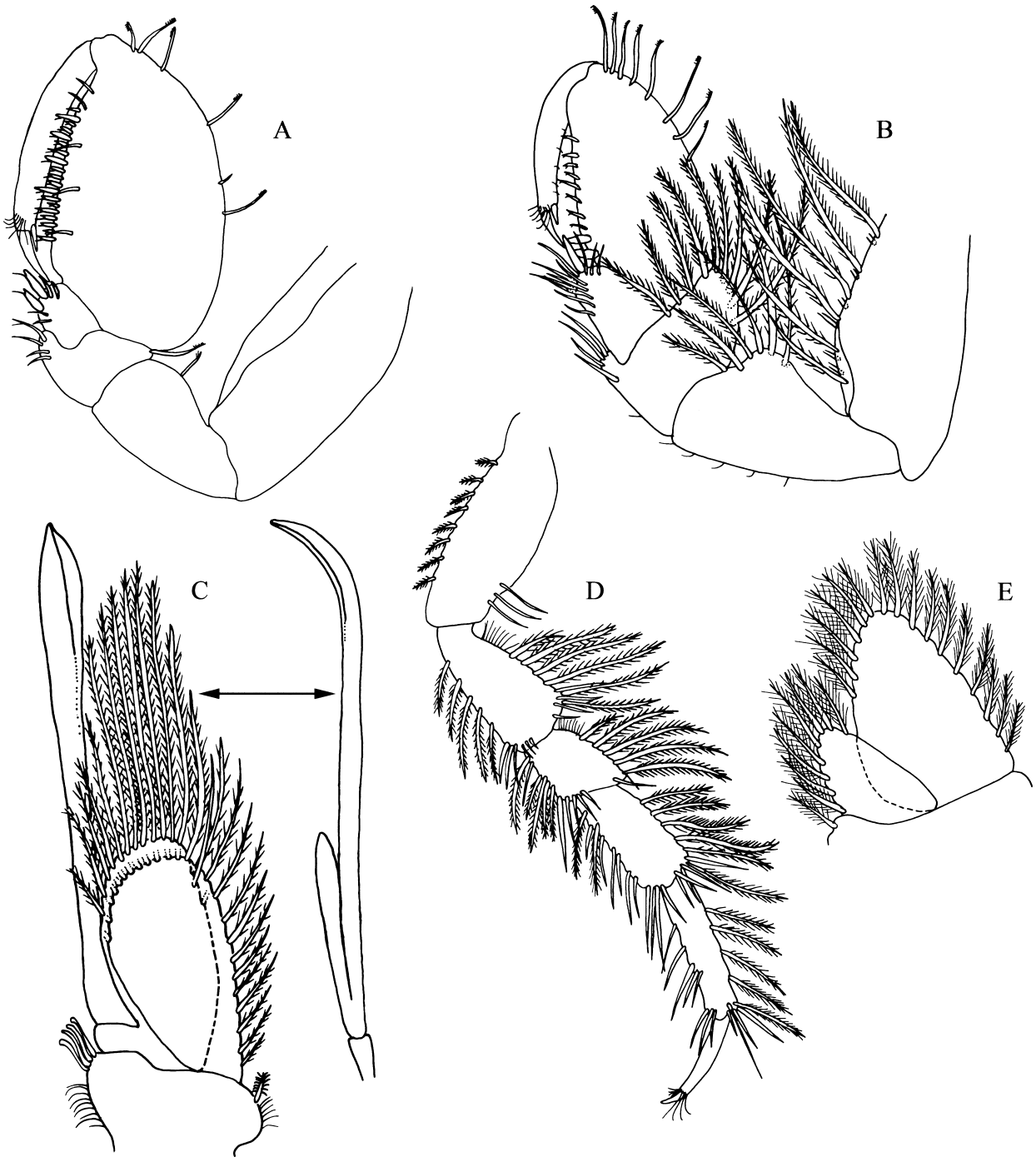

Fig. 2. *Chiridotea almyra* Bowman, 1955. Paratype female (NMNH 96962), 5 mm, A, pereiopod 1; B, pereiopod 2; D, pereiopod 5; E, distal end of uropod. Male (NMNH 97614), 6.3 mm, C, pleopod 2 with appendix masculina.

large robust seta with several scattered simple setae; propodus anterior margin with three or more serrulate setae present, posterior margin with two robust setae adjacent to tip of dactylus, with small robust setae present along entire margin; unguis and secondary unguis present. Pereiopod 3 as for pereiopod 2. Pereiopods 4-7 basis, ischium, merus, carpus and propodus anterior margins with plumose setae, posterior margins with serrulate and plumose setae; dactylus without serrulate or plumose setae.

Pleopods 1-2 peduncle with up to four mesial coupling hooks; rami lamellar, about twice as long as broad, margins setose, setae as long as rami. Uropodal exopod with eight marginal plumose setae, setae not extending to the inner margin.

Male.— 6-10 mm. Body larger than female; pereionites 1-7 with low ornamentation on dorsolateral margins, with a low dorsal carina extending down the mid-line from pereonite 2 to the pleotelson.

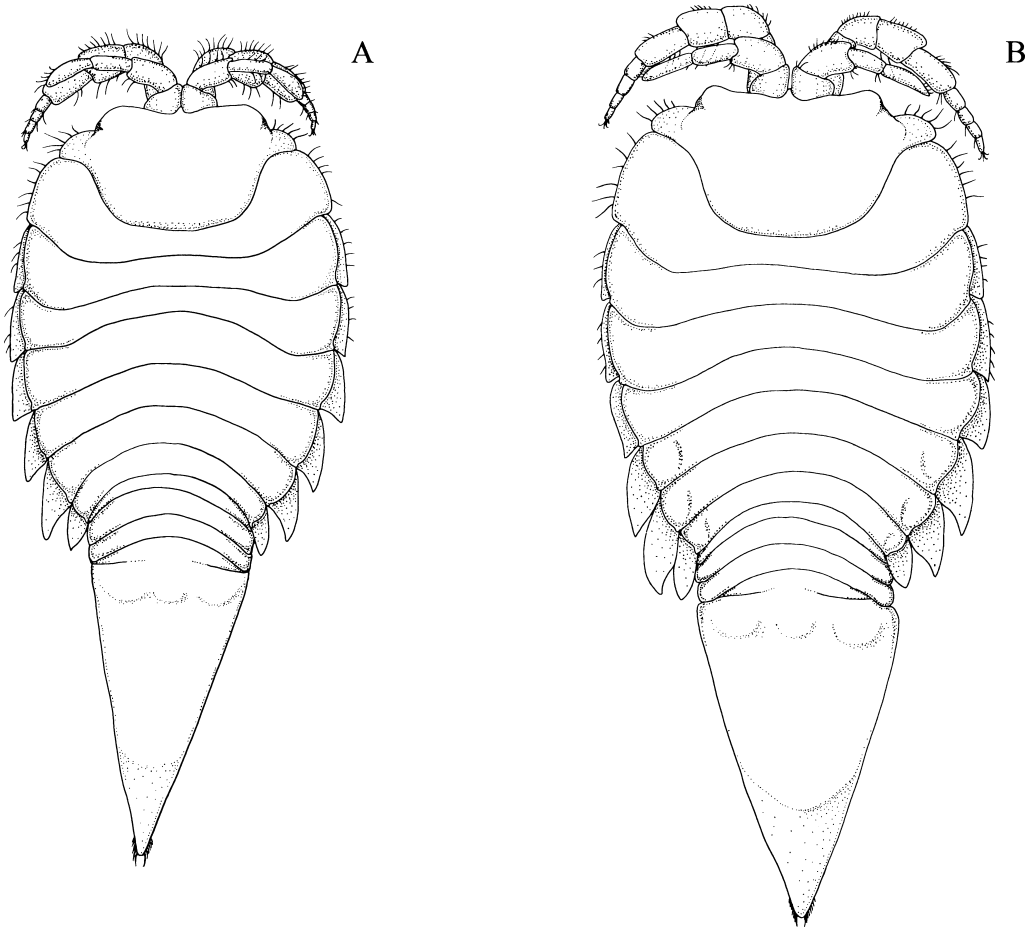

Fig. 3. *Chiridotea arenicola* Wigley, 1960. A, male (NMNH 190287), 5.5 mm; B, female (NMNH 104281), 6 mm.

Antennae, pereiopods and uropods as for female.

Pleopod 2 inner ramus with appendix masculina a little more than two times the length of the rami; appendix masculina distinctly curved apically.

Distribution.—Eastern United States: Massachusetts to Georgia. Thought to be a low salinity, brackish water species.

Remarks.—A full description of this species is included here to expand on Bowman's (1955) diagnosis.

This species most closely resembles *C. coeca* and *C. tuftsii*. It differs from *C. coeca* in that there is a row of small robust setae of varying lengths, along the entire posterior margin of the propodus, instead of the distinct, large robust setae on the posterodistal margin of the propodus (as in *C. coeca*). *C. almyra* can be distinguished from *C. tuftsii* most easily by examining the posterior margin of the dactylus of pereiopod 1, which in *C. tuftsii* possesses numerous spines but is smooth in *C. almyra*.

It should be noted that during this investigation, two different morphological types were found within the *Chiridotea almyra* material studied. All the material examined from South Carolina, Georgia, Maryland and New York conformed closely to the South Carolina types. However, populations from Massachusetts were larger (8 mm females and 10 mm males compared to 5 mm females and 6 mm males from type material); they were also less setose (without tightly packed tufts of plumose setae on head and pereiopods 4-7, as in South Carolina populations). In all the diagnostic characters, the Massachusetts specimens were the same as the type material; therefore we believe at this time that these specimens are not otherwise significantly different enough to justify designation as a separate species.

Pigmentation was seen to vary between specimens (this could be an artifact of preservation), some specimens were completely dark with dorsal chromatophores, while others had barely any pigment.

Juvenile specimens of *C. almyra* that were examined possessed a flagellum on antenna 2 that had a reduced number of articles (1-4) but antenna 2 was, nevertheless, longer than antenna 1. The robust setae along the entire posterior margin the propodus of pereiopod 1 were present in juveniles but were less in number.

Chiridotea arenicola Wigley, 1960
(Figs. 3-4)

Chiridotea arenicola Wigley, 1960: 153-160, figs. 1-9.—Watling and Maurer, 1975: 121-124, fig. 1.

Chiridotea stenops Menzies and Frankenberg, 1966: 26, fig. 6a-h.

Material Examined.—HOLOTYPE: NMNH 104282, near Woods Hole Marine Laboratory, Massachusetts, 41°48′N, 67°53′W, 6 August 1959. PARATYPES: NMNH 104281,

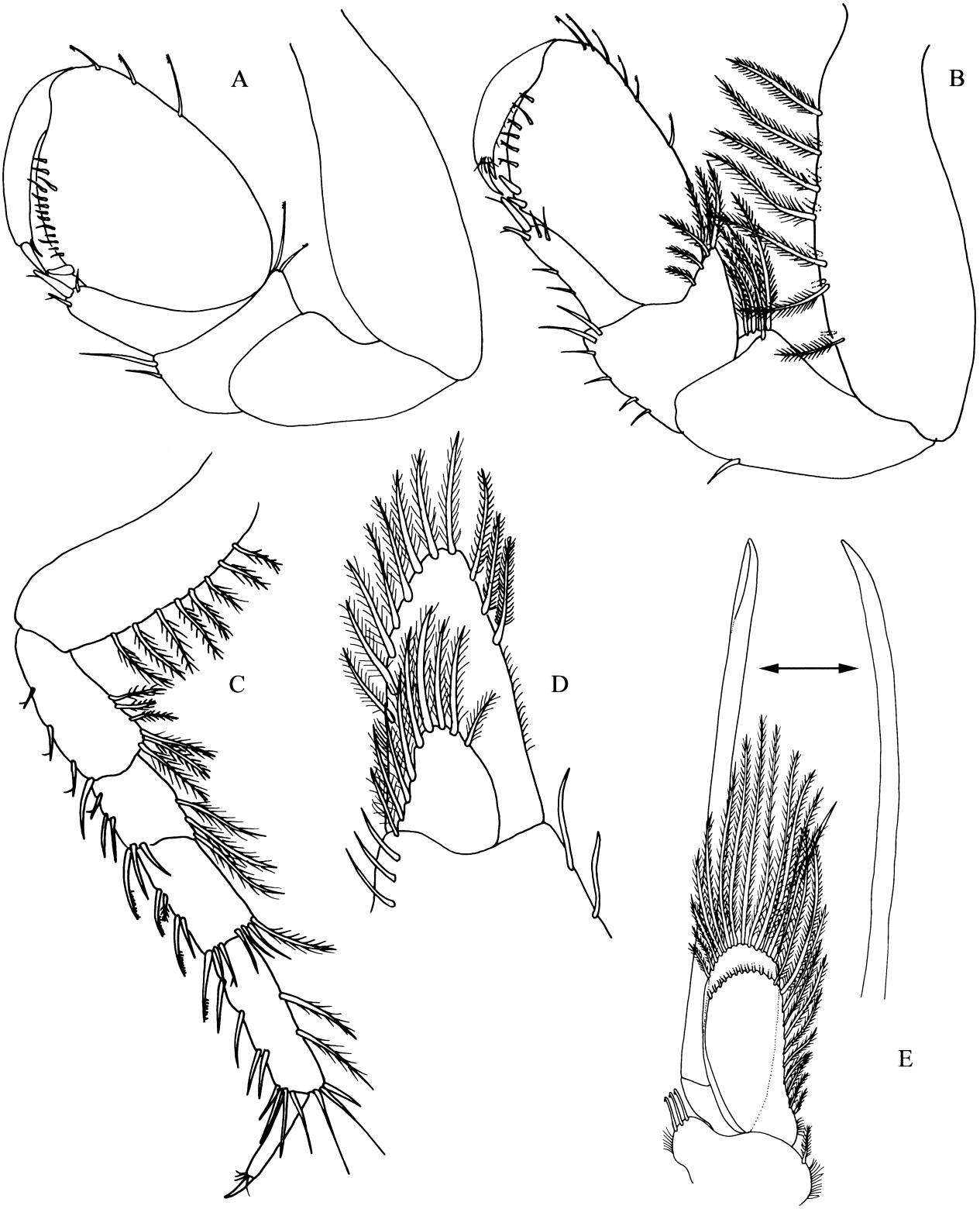

Fig. 4. *Chiridotea arenicola* Wigley, 1960. Male (NMNH 190287), 5.5 mm, A, pereiopod 1; B, pereiopod 2; C, pereiopod 5; D, distal end of uropod; E, pleopod 2 with appendix masculina.

near Woods Hole Marine Laboratory, Massachusetts, 41°48′N, 67°53′W, 6 August 1959.

Other material: Massachusetts: NMNH 25102 (labeled as *C. coeca*), Woods Hole. New Jersey: NMNH 190248 (labeled as '*C. triloba*'), 39°31′18″N, 73°07′54″W, 15 November 1976. NMNH 190278, 39°28′00″N, 73°13′54″W, 15 November 1976. NMNH 190281, 39°15′24″N, 74°09′24″W, 15 August 1976. NMNH

190282, 39°06′36″N, 73°45′24″W, 17 August 1976. NMNH 190287, 39°15′12″N, 74°09′06″W, 16 June 1976. South Carolina: SERTC #S2334 Georgetown ODMDS, 33°07′55″N, 079°06′48″W, 6.5-11.5 m, coll. SCDNR, 1983. Georgia: NMNH 174693 (labeled as '*C. stenops*' holotype), 31°45′26″N, 80°29′03″W, 24 February 1977.

Diagnosis.—Head with one distinctly defined lateral lobe, its margins fringed with setae. Pereionites 1-7 dorsally smooth (no carina). Pleotelson uniformly tapered to a narrowly rounded point.

Antenna 2 a little less than twice the length of antenna 1 (reaching to distolateral edge of pereionite 1).

Pereiopod 1 ischium and merus with none or few scattered setae on the anterior margin; carpus with one large distinct robust seta and a smaller robust seta on the posterodistal margin; propodus with a distinct large robust seta on posterior margin, adjacent to tip of dactlyus (when the dactylus is closed against the propodus), with short fine setae along entire posterior margin; dactylus smooth (without spines). Pereiopods 2 and 3 carpus with a distinct large robust seta and a smaller robust seta on the posterior margin, with a fringe of small fine setae along distal edge of posterior margin; propodus with two distinct robust setae on posterior margin, near tip of dactylus (when the dactylus is closed against the propodus), with short fine setae along entire posterior margin.

Description.—*Male*. 5.5-8.5 mm. Lateral margins of head without distinct ocular notch, with only one distinct lateral lobe, with setae present. Pereionites 1-7 dorsolateral margins smooth. Pleotelson about 2½ times as long as wide, uniformly tapered to a narrowly rounded point, apex with fringes of simple setae on distolateral margins.

Antenna 1 flagellum not elongate (no longer than article 2 of peduncle). Antenna 2 distinctly longer than antenna 1 (reaching to distolateral edge of pereonite 1), flagellum with four to five articles (varies with age/size).

Mouthparts as for genus.

Pereiopod 1 basis anterior margin without setae; ischium anterodistal margin without setae, posterior margin without setae; merus anterodistal margin with two to three to serrulate setae, posterior margin with up to two simple setae; carpus posterodistal margin with one large distinct robust seta, a smaller robust seta and scattered simple setae; propodus broad, anterior margin with three to four serrulate setae, posterodistal margin with one distinct robust seta adjacent to unguis of dactylus (when dactylus closed against propodus) and with small setae along entire margin; dactylus posterior margin without spines, unguis and secondary unguis present. Pereiopod 2 basis anterior margin with two rows of seven to nine plumose setae; ischium anterior margin with four to five plumose setae fringed around anterodistal edge, posterior margin with scattered setae; merus anterior margin with six to eight plumose setae fringed around anterodistal edge, posterior margin with up to ten scattered setae; carpus posterodistal margin with one distinct large robust seta and a smaller robust seta, with simple setae fringing the posterior margin of the propodus; propodus anterior margin with six or more serrulate setae, posterodistal margin with two distinct robust setae adjacent to unguis of dactylus (when dactylus closed against propodus) and small setae along the entire posterior margin; dactylus posterior margin without spines, unguis and secondary unguis present. Pereiopod 3 as for pereiopod 2. Pereiopods 4-7 basis anterior margin without row of plumose setae, posterior margin with a row of plumose setae; ischium, merus, carpus and propodus anterior margins with serrulate setae, posterior margins with plumose setae; dactylus without distinct setation.

Pleopod 1 peduncle with up to four mesial coupling hooks; rami lamellar, about twice as long as broad, margins setose, setae as long as rami. Pleopod 2 peduncle with up to four mesial coupling hooks; rami lamellar, about twice as long as broad, inner ramus with appendix masculina about three times the length of the rami; appendix masculina slightly curved apically. Uropodal exopod with nine marginal plumose setae, setae not extending to the inner margin.

Female.—6-9 mm. Usually larger than male, body shape and ornamentation similar to male. Antennae, pereiopods and uropods as for male.

Distribution.—Eastern United States: Massachusetts to Georgia.

Remarks.—*Chiridotea arenicola* can be separated from all other *Chiridotea* species by the morphology of the head. More specifically, in all other species there are two well-defined lateral lobes present (usually fringed with setae), whereas in *C. arenicola* only one is distinct (the more posterior of the two), with the more anterior lobe expanded dorsally rather than laterally and incorporated into the dorsal ornamentation of the head.

C. arenicola most resembles *C. coeca* and *C. almyra*. Apart from the distinct head morphology, *C. arenicola* further differs from these two species by its possession of a long tapered pleotelson (which is relatively broad in the other two species); an antenna 2 that is distinctly longer than antenna 1 (versus not distinctly longer in *C. coeca*) but much less than twice as long as antenna 1 (as in *C. almyra*); pereiopod 1 with a single distinct robust seta on the posterior margin of the carpus (vs. 2-4 in *C. coeca* and 2 in *C. almyra*) and a single robust seta on the posterior margin of the propodus (vs. no distinct large robust seta in *C. almyra*).

Examination of Wigley's types showed several errors in the original description. The adult male recorded by Wigley (NMNH 104280) was actually a juvenile specimen. As well, Wigley did not fully describe the robust setae on the posterodistal margins of the carpus of pereiopods 1-3. We confirm Watling & Maurer's (1975) synonymy.

Pigmentation varied between specimens (this could be an artifact of preservation), but in those where pigment was retained the chromatophores were largely concentrated on the pleotelston, pereiopods, and uropods.

Juvenile specimens of *C. arenicola* that were examined possessed a flagellum on antenna 2 that had a reduced number of articles (1-4) with antenna 2 shorter than or similar in length to antenna 1. The setation of pereiopod 1 was similar to the adult setation, with fewer setae along the posterior margin of the propodus.

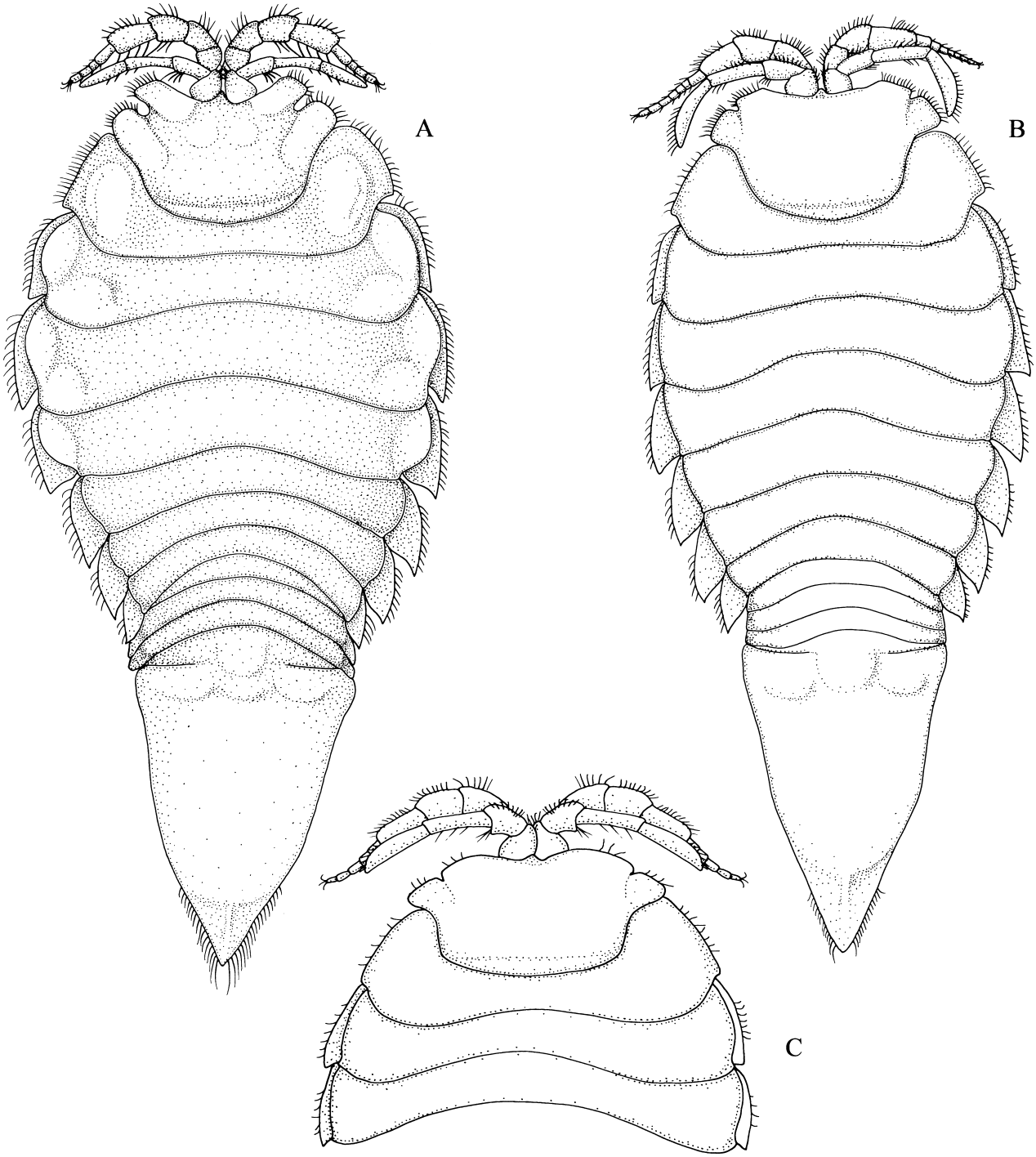

Fig. 5. *Chiridotea coeca* (Say, 1818). A, mature female (NMNH 111085), 11 mm; B, neotype male (NMNH 35289), 11 mm; C, immature female (NMNH 111085), 6 mm.

Chiridotea coeca (Say, 1818)
(Figs. 5-8)

Idotea cœca Say, 1818: 424-425.—Gould, 1841: 337.
Idotaea caeca.—Gould, 1835: 29.
Idotea caeca.—Milne-Edwards, 1840: 131.—Guérin-Méneville, 1843: 35.—DeKay, 1844: 42.—White, 1847: 94.—Verrill and Smith, 1874: 340, 569, 340 (46), 569 (275), pl. 5, fig. 22.
Chiridotea coeca.—Harger, 1878: 374; 1879: 159; 1880: 338-340, pl. 4, figs. 16-19.—Richardson, 1901: 539.—Bowman, 1955: 225, fig. 2b, e, i.—Menzies and Frankenberg, 1966: 25, fig. 5a-e.—Griffith and Telford, 1985: 296-297, figs. 2, 3, 4a-d, 5.
Glyptonotus caecus.—Miers, 1881: 17-18.
Chiridotea.—Richardson, 1900: 226.
Chiridotea caeca.—Richardson, 1905: 353-354, figs. 380-381.—Racovitza and Sevastos, 1910: 195.—Collinge, 1918: 73-74, pl. 7, fig. 1.

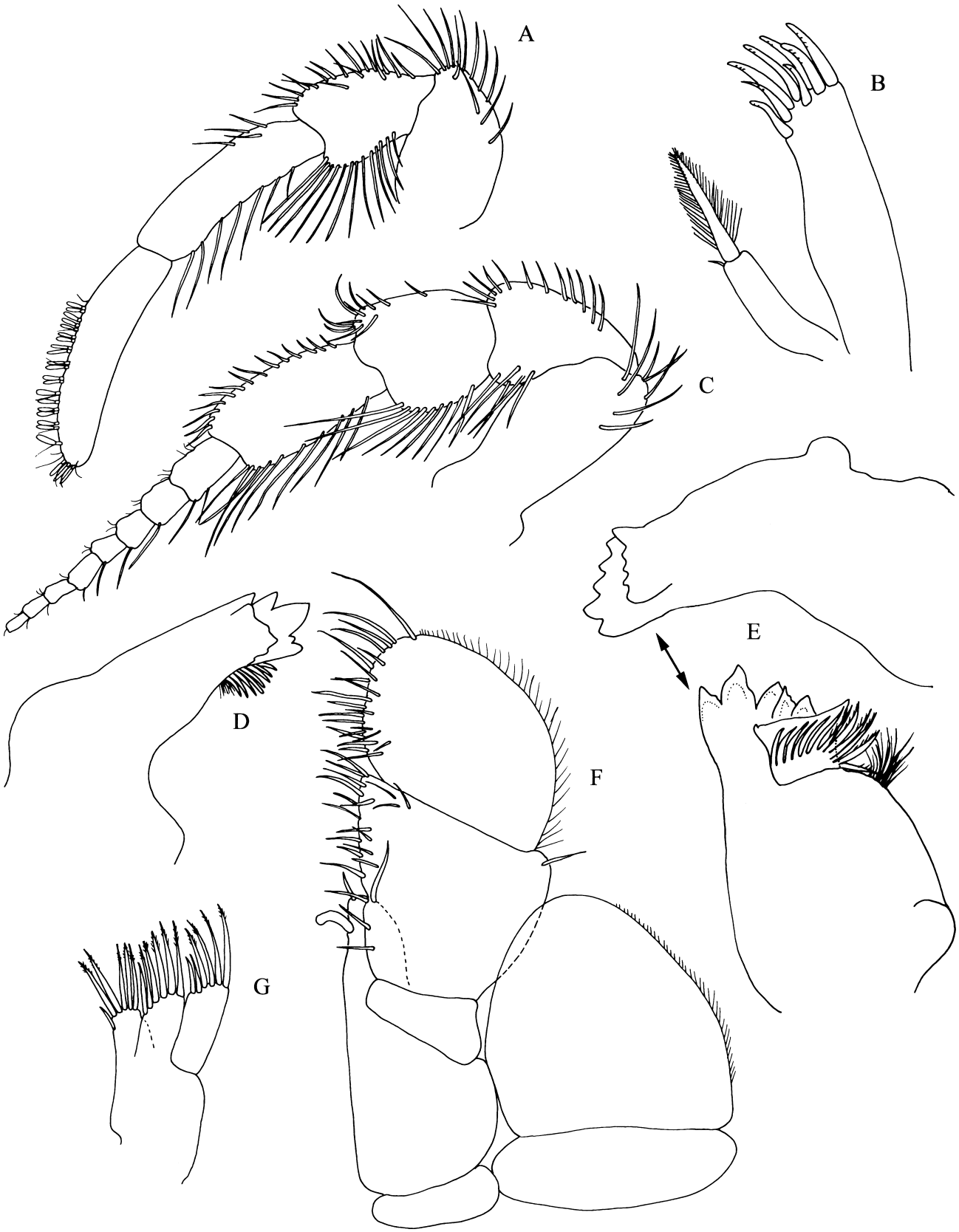

Fig. 6. *Chiridotea coeca* (Say, 1818). Neotype male (NMNH 35289), 11 mm, A, antenna 1; B, maxilla 1; C, antenna 2; D, right mandible; E, left mandible with medial tip shown; F, maxilliped; G, maxilla 2.

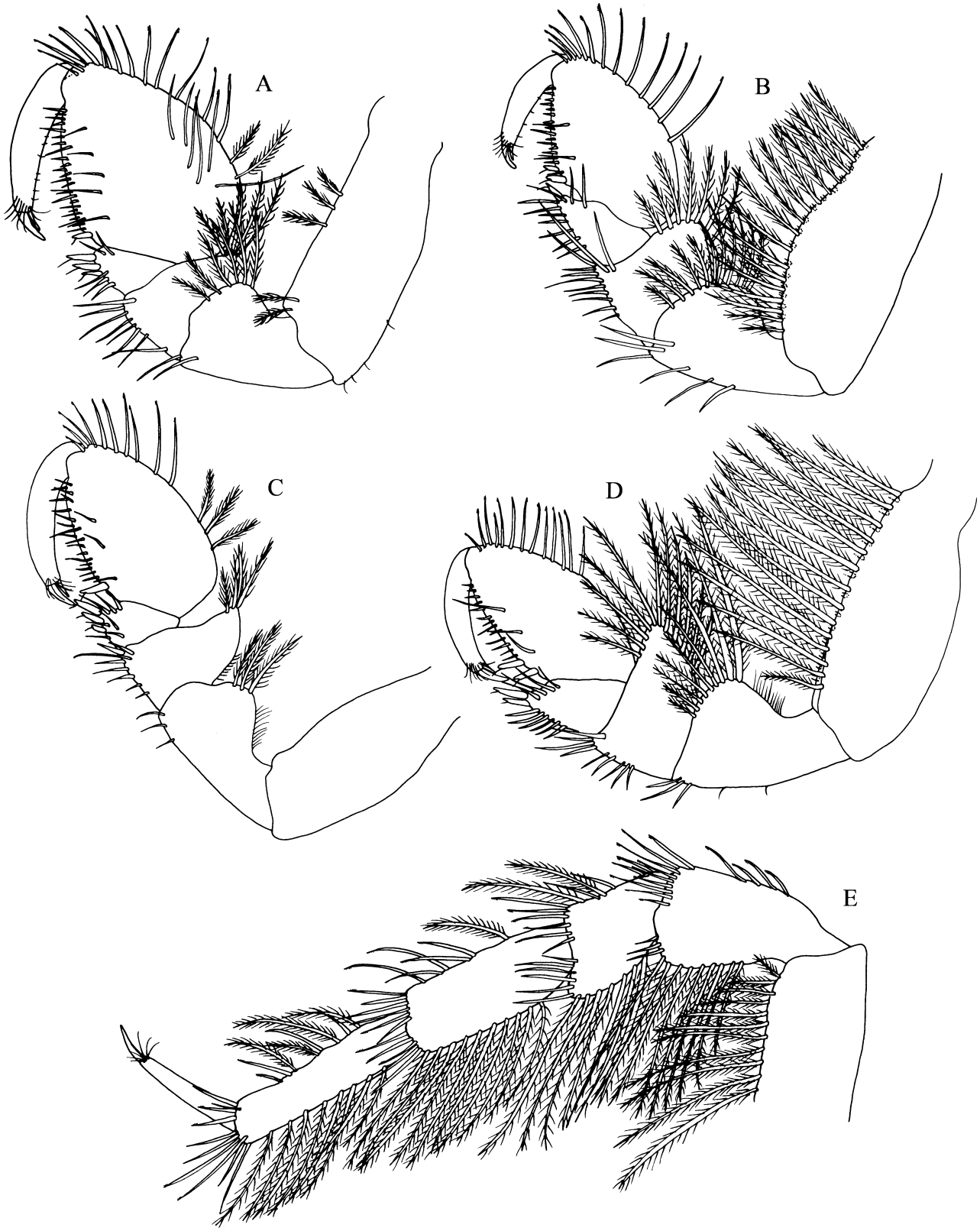

Fig. 7. *Chiridotea coeca* (Say, 1818). Female (NMNH 111085), 11 mm, A, pereiopod 1; B, pereiopod 2. Neotype male (NMNH 35289), 11 mm, C, pereiopod 1; D, pereiopod 2; E, pereiopod 5.

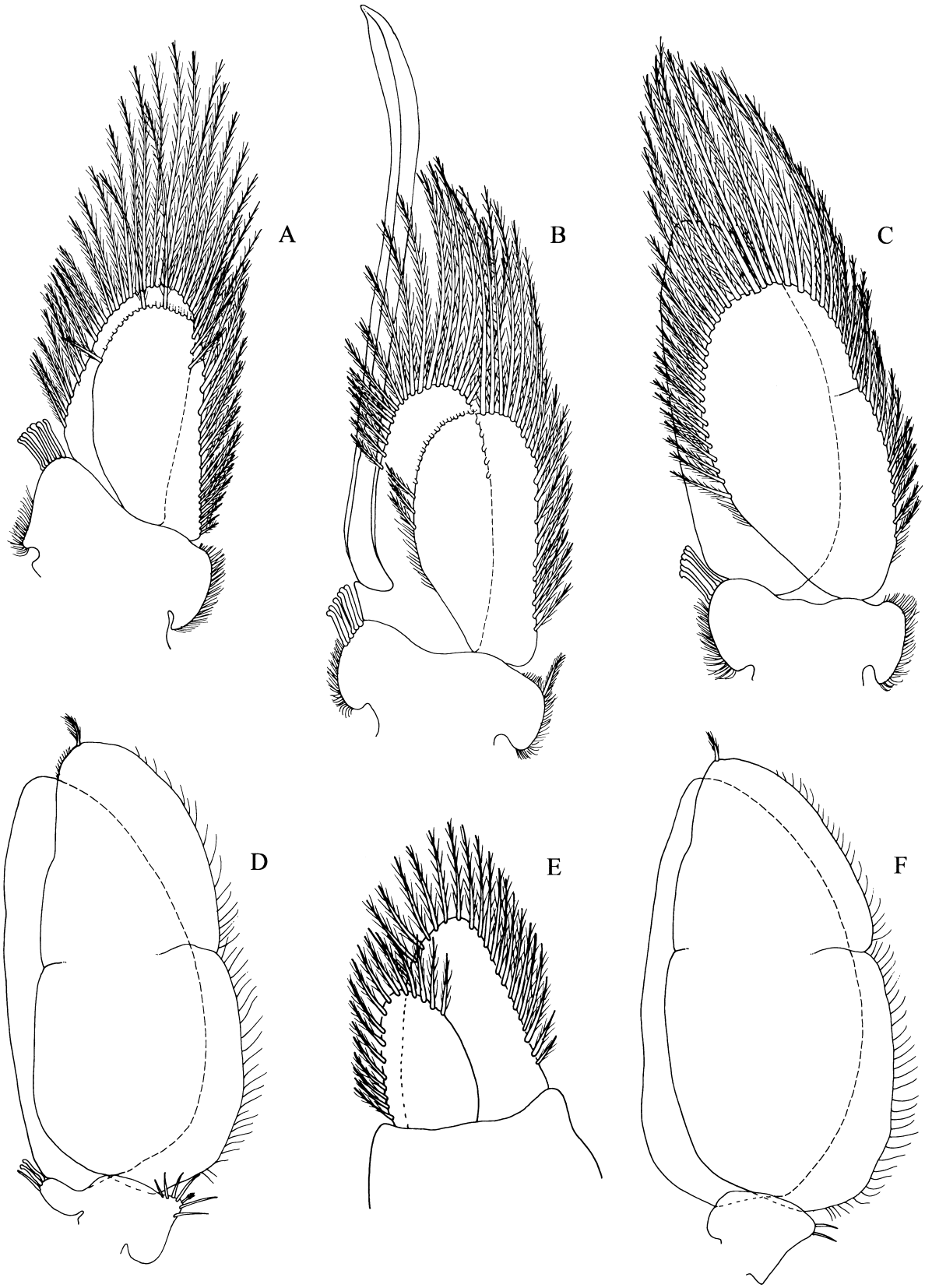

Fig. 8. *Chiridotea coeca* (Say, 1818). Neotype male (NMNH 35289), 11 mm, A, pleopod 1; B, pleopod 2 with appendix masculina; C, pleopod 3; D, pleopod 4; E, distal end of uropod; F, pleopod 5.

Chiridotea nigrescens Wigley, 1961: 286-292, figs. 1, 2a-d, 3a-e (new synonym).

Material Examined.—NEOTYPE, NMNH 35289, Halifax, Nova Scotia, Canada, 1885. Canada: NMNH 10423, Halifax, Nova Scotia. Massachusetts: NMNH 106382 (*C. nigrescens* holotype), Old Silver Beach, 42°38′N, 70°38′W, 31 January 1960. NMNH 106383 (*C. nigrescens* paratypes), Old Silver Beach, 42°38′N, 70°38′W, 31 January 1960. NMNH 150050 (labeled as *C. nigrescens*), 34°46′N, 86°00′W. New York: NMNH 86518 (labeled as *C. almyra*), Hudson River, 13 August 1936. Delaware: NMNH 144057 (labeled as *C. nigrescens*), Cape Henlopen, Tidal Flats, 29 February 1972. North Carolina: NMNH 86524, Money Island, 6 June 1940. NMNH 101772 Oregon Inlet, 9 January 1957. NMNH 285679, Atlantic Beach, 33°38′N, 75°50′W, September 1966. NMNH 150050 (labeled as *C. nigrescens*), 8 April 1972. South Carolina: SERTC #S2322, Grand Strand, Garden City Beach to Cherry Grove Beach, 33°20′29″N, 079°02′49″W, coll. SCDNR, benthic grab, 1984. SERTC #S2324, Charleston ODA, 32°25′30″N, 079°30′57″W, 8.0-17.0 m, coll. SCDNR, benthic grab, August 1978. SERTC #S2319, Cooper, Wando, Ashley Rivers, near Charleston Harbor, coll. SCDNR, 1984. Georgia: NMNH 111085, Jekyll Island, March 1964.

Diagnosis.—Head with two distinct lateral lobes, anterolateral margins fringed with setae (mature females with sculptured and raised lobes, males with flattened distinct lobes, immature individuals with lobes shallowly defined). Pleotelson broad to 2/3 length and then tapered to a subacute point.

Antenna 2 not distinctly longer than antenna 1.

Pereiopod 1 ischium and merus fringed with plumose setae on anterior margin; carpus with 3-4 distinct robust setae on posterodistal margin, with a fringe of simple setae along the posterodistal margin; propodus broad in female, with one distinct robust seta on posterior margin, near tip of dactylus (when the dactylus is closed against the propodus), with more slender robust setae along entire posterior margin; dactylus without spines. Pereiopods 2 and 3 carpus posterodistal margin with two distinct robust setae in males, one distinct robust seta in females, with a fringe of simple setae around the posterodistal margin; propodus with two distinct robust setae on posterior margin, near tip of dactylus (when the dactylus is closed against the propodus), with more slender robust setae along entire posterior margin.

Description.—*Male*. 6-14 mm. Lateral margins of head with distinct ocular notch forming two lateral lobes, with setae present on both lobes. Pereionites 1-7 without ornamentation on dorsolateral margins, without distinct dorsal carina at mid-line. Pleotelson about twice as long as wide, broad to 2/3 length then tapered to a sub-acute point, apex with fringes of simple setae on distolateral margins.

Antenna 1 flagellum elongate (longer than article 2 of peduncle). Antenna 2 similar length to antenna 1, flagellum with six to eight articles (varies with age/size).

Maxillipedal palp with three apparent articles (fusion of articles 2 + 3 and 4 + 5), article two largest, articles two and three with mesial setae; endite with one coupling hook, exopod as long as broad, not extending past article two of palp. Maxilla 1 outer lobe with 8 terminal robust setae, inner lobe with one long plumose seta, with a minute seta subapically. Maxilla 2 inner, medial and outer lobes each with six terminal robust setae. Mandible with well developed incisor and lacinia mobilis with setal row, molar indistinct.

Pereiopod 1 basis anterior margin generally without setae but sometimes with a few scattered plumose setae; ischium anterodistal margin with two to six plumose setae, posterior margin with scattered simple setae; merus anterodistal margin with three to five plumose setae, posterior margin with two to seven simple setae; carpus posterodistal margin with three to four robust setae and scattered simple setae, with six to eight simple setae fringing the proximal posterior margin of the propodus; propodus longer than broad, anterior margin with ten to twenty serrulate setae and one to three plumose setae, posterior margin with one distinct robust seta adjacent to unguis of dactylus (when dactylus closed against propodus) and with robust setae of alternating lengths along entire margin; dactylus posterior margin without spines, unguis and secondary unguis present. Pereiopod 2 basis anterior margin with two rows of fifteen or more long, plumose setae; ischium anterior margin with seven or more plumose setae, posterior margin with scattered setae; merus anterior margin with eight or more setae fringed around anterodistal edge, posterior margin with up to twelve setae; carpus posterodistal margin with two large distinct robust setae and seven or more scattered simple setae along length, with up to ten setae fringing the proximal posterior margin of the propodus; propodus anterior margin with ten or more setae present, posterodistal margin with two distinct robust setae adjacent to unguis of dactylus (when dactylus closed against propodus) and simple setae of alternating lengths along the entire posterior margin; dactylus posterior margin without spines, unguis and secondary unguis present. Pereiopod 3 as for pereiopod 2. Pereiopods 4-7 basis anterior margin usually with row of plumose setae, posterior margin with two rows of plumose setae; ischium, merus, carpus and propodus anterior and lateral margins with serrulate setae, posterior margins with plumose setae; dactylus without distinct setation.

Pleopod 1 peduncle with up to six mesial coupling hooks; rami lamellar, about twice as long as broad, margins setose, setae as long as rami. Pleopod 2 peduncle with up to six mesial coupling hooks; rami lamellar, about twice as long as broad, inner ramus with appendix masculina about 2½; times the length of the rami; appendix masculina curved apically. Pleopod 3 peduncle with up to six mesial coupling hooks; outer ramus lamellar and fringed with setae, with transverse notch on outer margin; inner ramus longer than outer ramus, without notch and not fringed with setae. Pleopods 4 and 5 similar; peduncle with up to four mesial coupling hooks; outer ramus and inner ramus similar elongate shape, outer ramus with setae along outer margin, with transverse notches at mid length on outer and inner margins, inner ramus without notches or setae. Uropodal exopod with 16 marginal plumose setae, setae not extending to the inner margin.

Female. 7-13 mm. Body usually larger than in male; lateral margins of head with shallow to deep notch forming

two lateral lobes (in mature females the lateral lobes are raised and sculptured, in immature specimens the lobes are flattened and the notch between them shallow). Pereionites 1-4 with distinct ornamentation on dorsolateral margins.

Antenna 2 flagellum with 4-5 articles. Pereiopod 1 propodus broader than in male. Pereiopod 2 carpus posterodistal margin with one distinct robust seta (vs. two setae in males).

Distribution.—Eastern Canada and United States: Nova Scotia (Halifax) to Florida.

Remarks.—*Chiridotea coeca* is most similar to *C. arenicola* but is distinguished by the presence of two distinct lateral lobes on the head (vs. one in *C. arenicola*), and the presence of 3-4 robust setae on the posterodistal margin of the carpus of pereiopod 1 (vs. one robust seta in *C. arenicola*). *C. coeca* is the only species of *Chiridotea* that exhibits sexual dimorphism in terms of distinctly different dorsal ornamentation and the structure and setation of pereiopods 1 and 2.

C. nigrescens Wigley, 1961 is regarded here to be a junior synonym of *C. coeca*. In the original description (Wigley, 1961), *C. nigrescens* was distinguished from *C. coeca* by its smaller size, dark color, smaller antereolateral notch on the head, and fewer setae on the head anterior to the notch. In this examination, all of these characters have proved to be variable with age and/or size, and it was found that all *C. nigrescens* specimens examined from the NMNH collections (NMNH 106382; 106383; 144057; 150050) are actually males and immature individuals of *C. coeca*. On careful examination it was discovered that only mature females of *C. coeca* (those with developed oostegites) exhibit distinctive dorsal ornamentation on the head and pereionites. The males and juveniles have no distinct dorsal ornamentation. This has not been properly described by previous authors (Bowman, 1955; Wigley, 1961) (a mature *C. coeca* female was illustrated by Bowman (1955) with this dorsal ornamentation but labeled as a male) and has lead to much confusion regarding the identification of *C. coeca*. The situation has been further confounded by the lack of type specimens for *C. coeca*, as none were ever designated by Say (1818). The *C. nigrescens* holotype female (NMNH 106382) exists now in pieces with only the pereiopods and antennae available for study, but they are indistinguishable from those of *C. coeca*. Of the five *C. nigrescens* paratype specimens (NMNH 106383), which were recorded by Wigley (1961) as consisting of 1 male and 4 females, all proved to be *C. coeca*, with the females immature and thus not exhibiting the extreme body ornamentation.

Of the material examined here, a neotype for *C. coeca* was selected (NMNH 35289). The authors are convinced that no type material exists after thorough searches of the collections of the National Museum of Natural History (Smithsonian) and The Academy of Natural Sciences Museum, Philadelphia (where some of Thomas Say's types are housed). The decision to create neotypes was based on a need for taxonomic clarity between the species, beginning with a clearly described neotype for the genus. The type locality given for *Idotea cæca* by Say (1818) was vague: 'coast of the United States, found as far south as Florida.' Therefore no exact type locality could be determined. The specimen chosen as the neotype was selected because of the excellent condition of the entire lot of 9 specimens. A male was chosen as the neotype, because it is more representative of the different age classes: it does not show the extreme morphological changes that the female goes through in maturity. The authors looked at specimens from Canada, Massachusetts, New York, Delaware, North Carolina, South Carolina and Georgia and were satisfied that the neotype specimens (from Halifax, Nova Scotia) were the same as Say's species, as well as representative of all the populations studied. No exact (latitude and longitude) locality information could be obtained for the neotype as the collection took place in 1885.

Careful reading of Say (1818) showed he spelled the name *cæca* (with the diphthong 'œ'), correctly translated to *coeca* according to ICZN rules and not '*caeca*', which has been incorrectly used by several authors. While he did not state it, Say more than likely named the species from the Latin for blind.

Juvenile specimens of *C. coeca* that were examined possessed a flagellum on antenna 2 that had a reduced number of articles (1-4) with antenna 2 either shorter than or similar length to antenna 1. The robust seta on the posterior margin of the propodus of pereiopod 1 is as clearly developed in juveniles as it is in the adults.

Chiridotea excavata Harper, 1974. (Figs. 9-10)

Chiridotea excavata Harper, 1974: 229-239, figs. 1, 2a, b, 3a-c, 4a-c, 5a, b, 6a, b, 7a, b, 8, 9a, b.

Material Examined.—HOLOTYPE: NMNH 150035, Texas, Galveston Island, 10.2 km west of the east end, 29°13′N, 94°54′W, 3.5 m, 4 December 1968. PARATYPES: NMNH 150036, Texas, Galveston Island, 10.2 Km W of E End, 29°13′N, 94°54′W, 3.5 m, 4 December 1968. NMNH 150037, Texas, Calhoun County, Matagorda Island, 28°13′N, 96°38′W, 8 m, 7 June 1973.

Other material: North Carolina: NMNH 138723 (*C. minuta* holotype), 35°30′N, 80°00′W, 11 July 1965. NMNH 138724 (*C. minuta* paratype), 35°30′N, 80°00′W, 11 July 1965. NMNH 138725 (labeled as *C. minuta*), 33°08′N, 76°03′W, 16 December 1964. South Carolina: SERTC #S2320, Charleston ODA, 32°25′30″N, 079°30′57″W, 8.0-17.0 m, coll. SCDNR, benthic grab, August 1978. SERTC #S2321, Skull Creek, Hilton Head, 32°09′42″N, 80°27′39″W, 1987.

Diagnosis.—Head with two indistinct lateral lobes. Dorsal carina (in females) extended from head to tip of pleotelson. Pleotelson uniformly tapered to a rounded point.

Antenna 2 of females only slightly longer than antenna 1 (not reaching past distal edge of pereonite 1).

Pereiopod 1 ischium and merus with only scattered setae on the anterior margins; carpus with two distinct robust setae on posterodistal margin; propodus posterior margin concave rather than convex, with around 7 robust setae along entire length; dactylus posterior margin with row of spines. Pereiopods 2 and 3 carpus with three to four distinct robust setae on the posterodistal margin; propodus with one distinct robust setae on posterior margin, near tip of dactylus

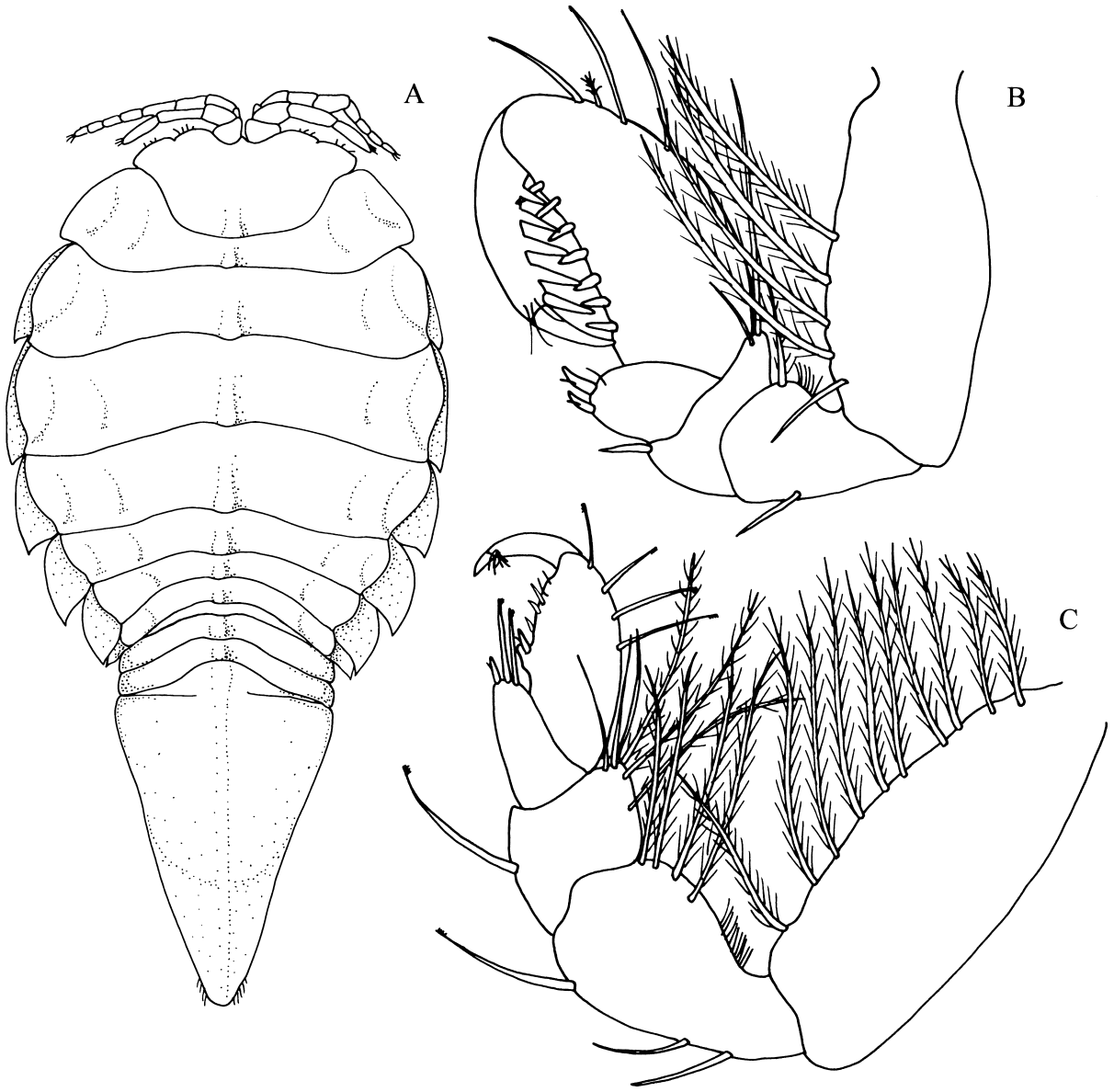

Fig. 9. *Chiridotea excavata* Harper, 1974. Female (SERTC S2320), 5 mm, A, dorsal view; B, pereiopod 1; C, pereiopod 2.

(when the dactylus is closed against the propodus), with robust setae of different lengths along length of margin.

Description.—*Female*. 2.7-5 mm. Lateral margins of head with shallow ocular notch forming two indistinct lateral lobes, with some setae present on both lobes. Pereionites 1-7 with low ornamentation on dorsolateral margins, with distinct dorsal carina at mid-line. Pleotelson almost 2 times as long as wide, uniformly tapered to a rounded point, apex with fringes of simple setae on distolateral margins.

Antenna 1 flagellum not elongate (not longer than article 2 of peduncle). Antenna 2 slightly longer than antenna 1, flagellum with 4-5 articles (varies with size/age).

Mouthparts as for genus.

Pereiopod 1 basis anterior margin with a row of four plumose setae; ischium anterodistal margin with up to two plumose setae, posterior margin with up to two scattered setae; merus anterodistal margin with two to three scattered setae, posterior margin with a single robust seta and sometimes one to three scattered setae; carpus posterodistal margin with two robust setae and one or two simple setae; propodus longer than broad, anterior margin with up to five serrulate setae, posterior margin with seven to eight robust setae along entire margin; dactylus posterior margin with four to five spines, unguis and secondary unguis present. Pereiopod 2 basis anterior margin with nine or more long, plumose setae; ischium anterior margin with three or more plumose setae, posterior margin with scattered serrulate and simple setae; merus anterior margin with scattered simple setae and up to four plumose setae, posterior margin with scattered simple and serrulate setae; carpus posterodistal margin with one short robust seta (sometimes two) and two long robust setae; propodus anterior margin with four or more simple and serrulate setae present, posterodistal margin with a distinct robust seta adjacent to the unguis of dactylus (when dactylus closed against propodus), with robust setae

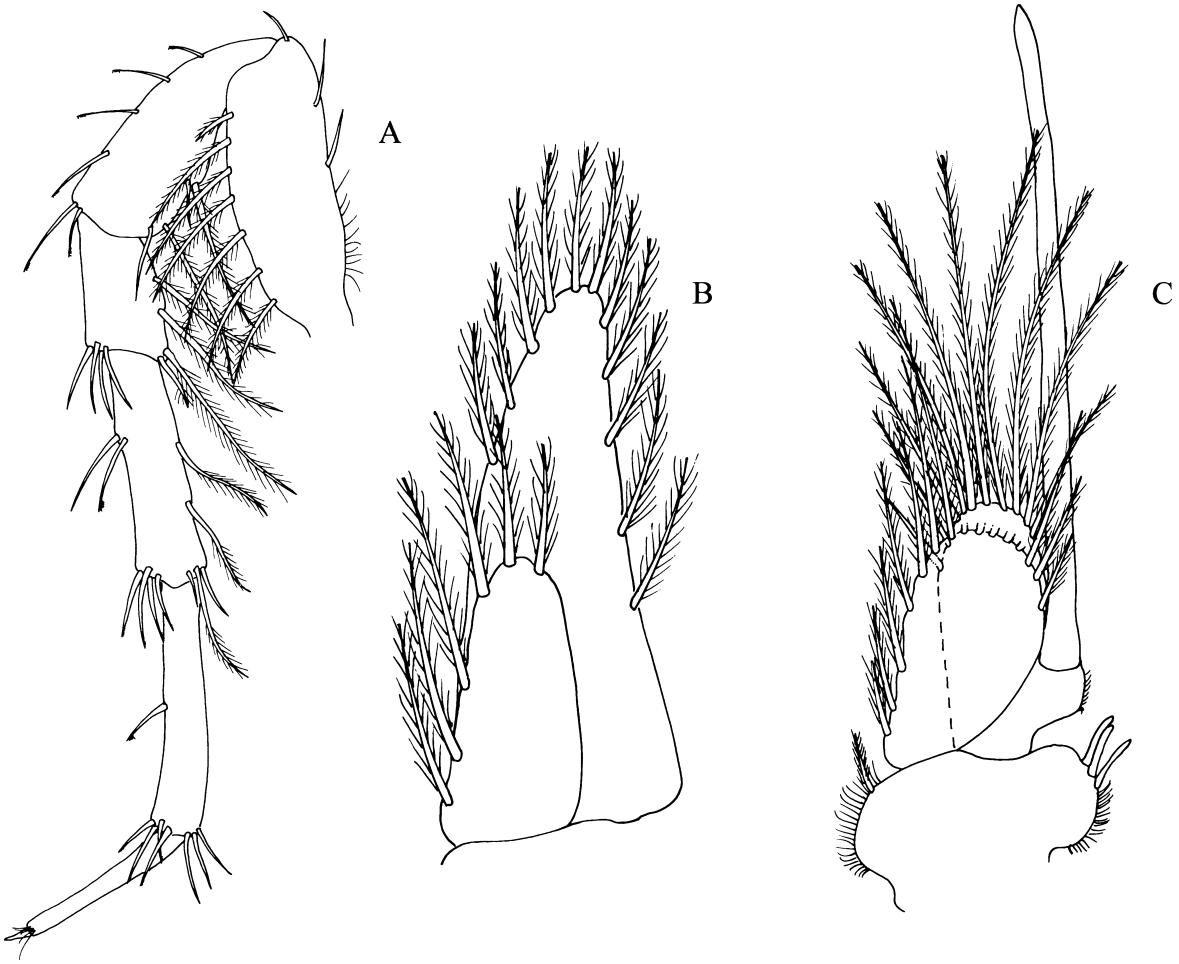

Fig. 10. *Chiridotea excavata* Harper, 1974. Female (SERTC S2320), 5 mm, A, pereopod 5; B, distal end of uropod. Male (SERTC non-cataloged material), 5 mm, C, pleopod 2 with appendix masculina.

of different lengths along entire margin. Pereiopod 3 as for pereiopod 2. Pereiopods 4-7 basis anterior margin with scattered simple setae, posterior margin with a row of six to seven plumose setae; ischium, merus and carpus anterior margins with serrulate setae, posterior margins with plumose setae; propodus with serrulate setae on anterior margin and distally; dactylus without distinct setation.

Pleopod 1 peduncle with up to three mesial coupling hooks; rami lamellar, about twice as long as broad, margins setose, setae slightly longer than rami. Pleopod 2 peduncle with up to four mesial coupling hooks; rami lamellar, about twice as long as broad, margins setose, setae slightly longer than rami. Uropodal exopod with six marginal plumose setae, setae not extending to the inner margin.

Male. 3-5 mm. Body shape and ornamentation as for female. Pleopod 2 inner ramus with appendix masculina about three times the length of the rami; appendix masculina not distinctly curved apically.

Distribution.—Southeastern United States and Gulf of Mexico: North Carolina, South Carolina and Texas (Galveston).

Remarks.—*Chiridotea excavata* most closely resembles *C. tuftsii*, but can be distinguished by its smaller size at maturity (up to 5 mm vs. up to 6.5 mm for *C. tuftsii*) and antennae, which are of a similar length (vs. antenna 2 being twice the length of antenna 1 in *C. tuftsii*).

With the discovery of new material from North Carolina and South Carolina (see Discussion), the range of this species has been extended to the Atlantic coast of the United States.

A single damaged male specimen was discovered in material collected by SCDNR from South Carolina, but the locality information has been lost for that specimen, therefore it is unusable for museum cataloging purposes: details of pleopod two, bearing the appendix masculina are, however, useful and so are illustrated.

Juvenile specimens of *C. excavata* that were examined possessed a flagellum on antenna 2 that had a reduced number of articles (1-3) with antenna 2 either shorter than or similar length to antenna 1. The spines on the dactylus of pereiopod 1 were as distinctly developed in juveniles as in adults, although slightly less in number.

Chiridotea tuftsii (Stimpson, 1853)
(Figs. 11-12)

Idotæa tuftsii Stimpson, 1853: 39
Idotea tuftsii.—Verrill and Smith, 1874: 340, 569.—Verrill, 1874: 362.

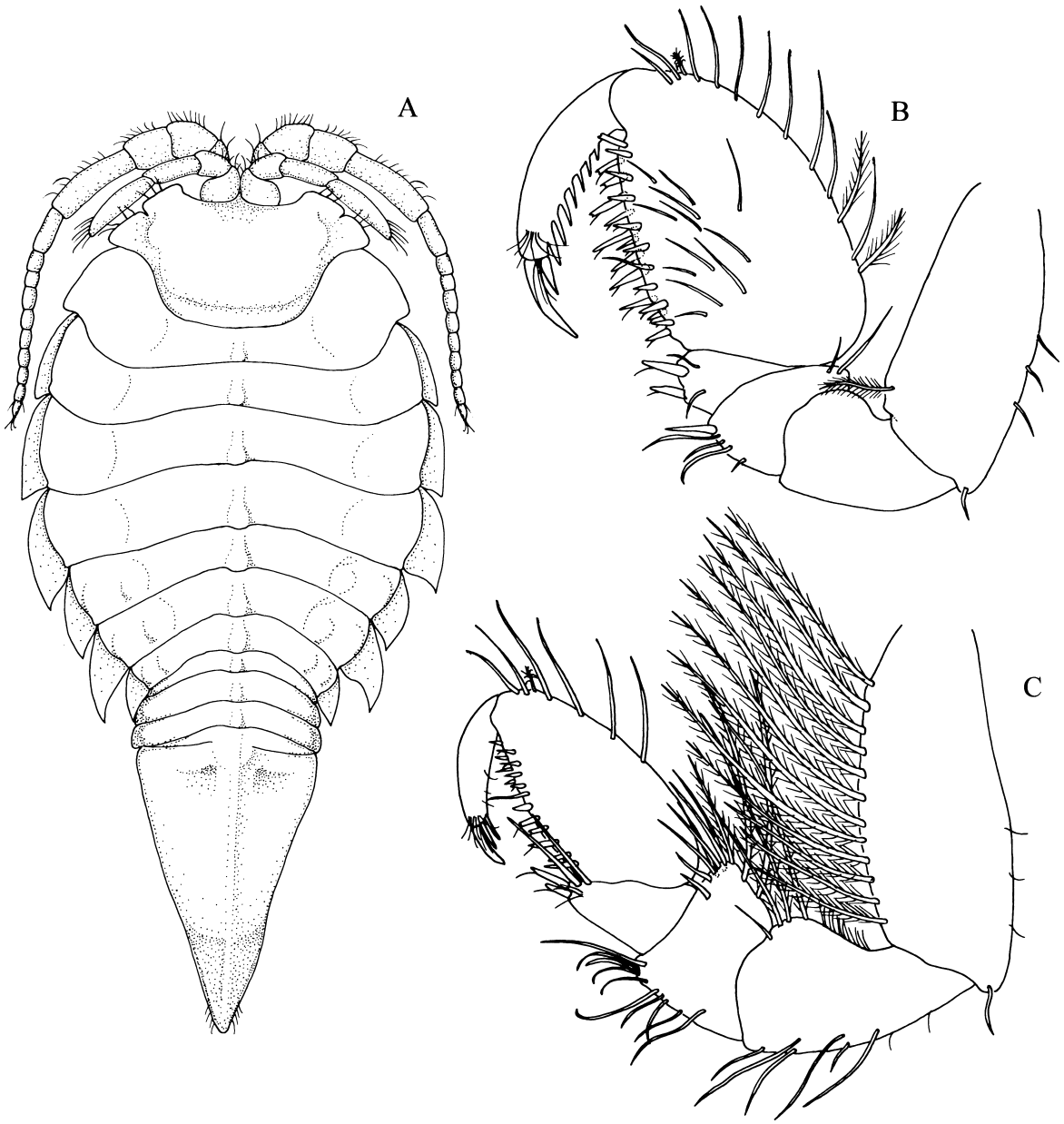

Fig. 11. *Chiridotea tuftsii* (Stimpson, 1853). Female (NMNH 214136), 5.5 mm, A, dorsal view; B, Pereiopod 1; C, pereiopod 2.

Chiridotea tuftsii.—Harger, 1878: 374; 1879: 159; 1880: 340-341, pl. 4, figs. 20-23.—Richardson, 1900: 226; 1901: 539; 1905: 354-355, figs. 382-383.—Racovitza and Sevastos, 1910: 195.—Collinge, 1918: 74, pl. 7, fig. 2.
Glyptonotus tuftsii.—Miers, 1881: 18-19.
Chiridotea tuftsi.—Schultz, 1969: 61, fig. 65 g.—Bowman, 1955: 225-228, fig. 2a, c, j.

Material Examined.—Massachusetts: NEOTYPE: NMNH 214136, 40°34′56″N, 66°33′01″W, 73 m, 10 May 1977. NMNH 307422 (labeled as *C. arenicola*), Georges Bank, 41°07′58″N, 67°09′06″W, 13 July 1983. NMNH 307464, Georges Bank, 41°07′58″N, 67°09′06″W, 2 June 1984. NMNH 307445, Georges Bank, 41°07′58″N, 67°09′06″W, 5 Feb 1983. NMNH 35258, Massachusetts Bay, 1868. NMNH 212993 (labeled as *C. coeca*), Georges Bank, 40°29′24″N, 68°06′19″W, 55 m, 20 August 1977. NMNH 307477 (labeled as *Chiridotea* sp.), Georges Bank, 40°35′24″N, 66°33′17″W, 13 May 1983 (manca). NMNH 307478 (labeled as *Chiridotea* sp.), Georges Bank, 40°18′17″N, 68°20′03″W, 13 May 1983. NMNH 307479 (labeled as *Chiridotea* sp.), Georges Bank, 40°35′24″N, 66°33′17″W, 13 July 1983. New Jersey: NMNH 190295 (labeled as *Chiridotea* sp.), 38° 41′24″N, 73°32′12″W, 65 m, 6 November 1976 (manca). Delaware: NMNH 190279 (labeled as *C. arenicola*), 38°17′30″N, 74°41′00″W, 23 August 1976.

Diagnosis.—Head with two distinct lateral lobes, anterolateral margins fringed with setae. Dorsal carina (of female) extended from pereonite 1 to tip of pleotelson, Pleotelson uniformly tapered to a narrowly rounded point.

Antenna 2 significantly longer than antenna 1 and reaching past the distolateral margin of pereionite 2.

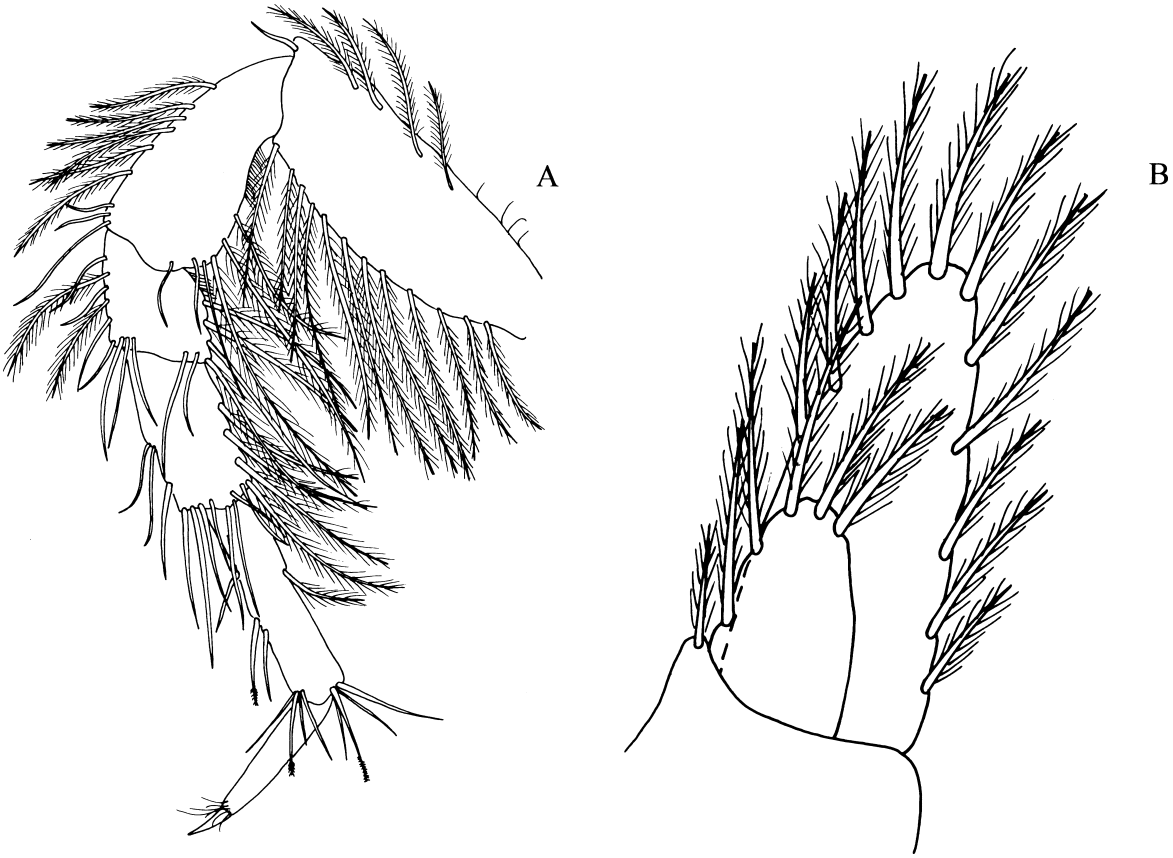

Fig. 12. *Chiridotea tuftsii* (Stimpson, 1853). Female (NMNH 214136), 5.5 mm, A, pereiopod 5; B, distal end of uropod.

Pereiopod 1 ischium and merus with only a few scattered setae on the anterior margin; carpus with two distinct robust setae on posterodistal margin; propodus posterior margin with robust setae of varying lengths (and orientated to sit either side of the closed dactylus) along entire margin; dactylus posterior margin with seven to eight spines. Pereiopods 2 and 3 carpus with four distinct robust setae on the posterior margin; propodus posterior margin with robust setae of varying lengths along entire margin.

Description.—*Female*. 5.5-6.5 mm. Lateral margins of head with ocular notch forming two distinct lateral lobes, with setae present on both lobes. Pereionites 1-7 with low ornamentation on dorsolateral margins (most distinct on pereionites 5-7), with distinct dorsal carina at mid-line. Pleotelson slightly more than 2 times as long as wide, not broad, uniformly tapered to a narrowly rounded point, apex with fringes of simple setae on distolateral margins.

Antenna 1 flagellum elongate (longer than article 2 of peduncle). Antenna 2 longer than antenna 1 (reaching past the second pereionite), flagellum with 7-10 articles (varies with size/age).

Mouthparts as for genus.

Pereiopod 1 basis anterior margin generally without setae but sometimes with a one or two scattered plumose setae; ischium anterodistal margin with none or up to two plumose setae, posterior margin with none or up to two scattered setae; merus anterodistal margin with two to three scattered setae, posterior margin with four to six scattered setae and a single robust seta; carpus posterodistal margin with two robust setae and scattered simple setae; propodus longer than broad, anterior margin with up to ten serrulate setae and two to three plumose setae, posterior margin with robust setae of alternating lengths along entire margin; dactylus posterior margin with seven to eight spines, unguis and secondary unguis present. Pereiopod 2 basis anterior margin with nine or more long, plumose setae; ischium anterior margin with scattered simple setae and two or more plumose setae, posterior margin with scattered setae; merus anterior margin with scattered simple setae and up to four plumose setae, posterior margin with scattered simple and serrulate setae; carpus posterodistal margin with two short robust setae and two long robust setae, with scattered setae fringing the proximal posterior margin of the propodus; propodus anterior margin with six or more simple and serrulate setae present, posterodistal margin with robust setae of alternating lengths along entire margin. Pereiopod 3 as for pereiopod 2. Pereiopods 4-7 basis anterior margin with row of plumose setae, posterior margin with a row of plumose setae; ischium and merus anterior and posterior margins with plumose setae and some serrulate setae; carpus and propodus anterior margins with serrulate setae, posterior margins with plumose setae; dactylus without distinct setation.

Uropodal exopod with five marginal plumose setae, setae not extending to the inner margin.

Male. Unknown.

Distribution.—Eastern Canada and Northeastern United States: Nova Scotia (Grand Manan) to Gulf of St. Lawrence (Amherst Island).

Remarks.—Male specimens are yet to be described, and unfortunately none were found in this study.

The authors are satisfied that Stimpson's type specimens are lost. Stimpson (1853) indicated that he lodged types in the Smithsonian and in 'the cabinet of Professor Agassiz, Cambridge. . .' yet none exist in the current collections of the NMNH or the Museum of Comparative Zoology, Harvard University. A neotype was selected from material examined from Georges Bank, near Stimpson's type locality (Grand Manan Island).

Chiridotea tuftsii is superficially most similar to *C. almyra* (both possess an antenna 2 that is significantly longer than antenna 1). *C. tuftsii* can be easily distinguished from *C. almyra* by pereiopod 1, which has distinct spines on the posterior margin of the dactylus (vs. no spines in *C. almyra*). *C. excavata* also has spines on the anterior margin of the dactylus of pereiopod 1, however it has antennae that not so dissimilar in length.

Juvenile specimens of *C. tuftsii* that were examined possessed a flagellum on antenna 2 that had a reduced number of articles (1-3) but antenna 2 was, nevertheless, longer than antenna 1. The spines on the dactylus of pereiopod 1 were also distinctly developed in juveniles.

Discussion

Examination of the three previously unknown *Chiridotea* species found in the collections of the NMNH lead to these conclusions: specimens labelled with the nomen nudum '*Chiridotea stenocula* Menzies and Frankenberg' (NMNH 111072) are manca specimens that were too small to positively identify to species level (they could be *C. almyra*); specimens labelled with the nomen nudum '*Chiridotea minuta* George and Menzies' (NMNH 138724) are immature and manca specimens of *C. excavata*; specimens labelled with the nomen nudum '*Chiridotea triloba*' (NMNH 190248) are immature specimens of *C. arenicola*, rather than a misidentification of *Edotia triloba* (Say, 1818) as it was first assumed. The common problem seems to be that manca (where pereiopod 7 has not yet fully developed) individuals of all species are morphologically very similar, as the ocular notch and antennae, often used as diagnostic characters, seem to develop last. The best solution is to identify adults wherever possible. We have attempted to include new characters in the presented key (pereiopod 1 and 2 morphology) that are also apparent in manca specimens.

Observation of functional compound eyes has proven difficult in this investigation. In the preserved specimens examined here, there was rarely evidence of eyes, except for noticeable swellings on the head near the ocular notch. Tait (1927) observed the presence of eyes in *C. coeca* and *C. tuftsii*. Wigley (1960, 1961) noted eyes in *C. arenicola* and *C. nigrescens* (= *C. tuftsii*), describing them as variable between specimens, dark or silvery white and adding that they can become indistinguishable after the specimens is preserved. It was noted in this investigation that several preserved manca specimens of *C. arenicola* and *C. tuftsii* possessed pigmented eyes near the lateral lobes, yet these eyes could not be conclusively detected in adults from the same sample. It is likely that all species have eyes that become difficult to detect once a specimen is preserved.

Acknowledgements

We are grateful to Dr. Rafael Lemaitre, Cheryl Bright and Chad Walter (NMNH) for loaning material for examination. Many thanks to Dr. Gary Poore (Museum Victoria) for helpful discussion on morphology and taxonomy; to Dr. Dale Calder (Royal Ontario Museum) for assistance with nomenclatural questions; and to David Knott (SCDNR) for reviewing and commenting on the manuscript. We also thank three anonymous reviewers for their helpful critiques. This study was conducted in part as an Honor's Year project (AMC) at the College of Charleston, South Carolina. This document is Contribution No. 588 of the Marine Resources Division, South Carolina Department of Natural Resources.

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RECEIVED: 21 January 2006.
ACCEPTED: 18 May 2006.