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New species and records of *Caulleriella*, *Chaetocirratulus* and *Chaetozone* (Annelida, Cirratulidae) from continental shelf and slope depths of the Western North Atlantic Ocean

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Abstract

Seventeen species of cirratulid polychaetes, 13 new to science, are reported from continental shelf and slope depths of the western North Atlantic Ocean. The samples were collected as part of deep-water offshore reconnaissance surveys from New England to the Carolinas and long-term monitoring programs in Boston Harbor, Massachusetts Bay, and Georges Bank off Massachusetts. The new species are included in the genera *Caulleriella* (*C. cryptica* **n. sp**.), *Chaetocirratulus* (C. *hessleri* **n. sp**., *C. sandersi* **n. sp**., and *C. tomaculus* **n. sp**.), and *Chaetozone* (*C. adunca* **n. sp**., *C. artaspinosa* **n. sp**., *C. brychiata* **n. sp**., *C. castouria* **n. sp**., *C. donerae* **n. sp**., *C. lophia* **n. sp**., C. *novagracilis*, **n. sp**., *C. paucispinosa* **n. sp**. and *C. profunda* **n. sp**. In addition, *Chaetozone gayheadia* Hartman, 1965 is redescribed based on type-material and additional collections and transferred to the genus *Chaetocirratulus*. *Chaetozone benthaliana* McIntosh, 1985 is designated a *species inquirendum* because it was described from a posterior fragment that cannot be confirmed as belonging to any known cirratulid genus or species. Updated descriptions and new records are provided for *Chaetozone anasima*, *C. diodonta*, and *C. hystricosa* all originally described by Doner & Blake (2006).

Key words. polychaetes, benthos, deep-sea, new species, *Caulleriella*, *Chaetocirratulus*, *Chaetozone*, New England, Delaware, New Jersey, North Carolina, South Carolina

Introduction

Cirratulid polychaetes are commonly found in nearshore benthic communities along most continental margins and also in deep-sea locations; they are often the dominant taxa in some benthic communities. Cirratulids are classified into bitentaculate and multitentaculate genera (Blake & Magalhães 2019). While the multitentaculates are common in intertidal and nearshore shelf habitats, they are rare in deep water. In contrast, the bitentaculates are widespread in all habitats including the deep sea (Blake & Magalhães 2019). Recent studies have reported numerous new species

of Cirratulidae, mostly bitentaculates, from widespread global locations and over a full range of depths (Blake 1996, 2006, 2015, 2016, 2018, 2019, 2021b; Blake & Dean 2019; Chambers 2000; Chambers & Woodham 2003; Doner & Blake 2006; Dean & Blake 2007, 2009, 2016; Elías & Rivero 2008, 2009, 2011; Elías *et al.* 2017; Magalhães & Brock 2013; Grosse *et al*. 2021).

The emphasis in the present study is on bitentaculate species from the continental shelf and slope off the U.S. Atlantic coast. While the continental shelf collections are largely from off the northeastern coast, the deep-water continental slope samples were collected from off New England to the Carolinas. Extensive surveys by the U.S. Department of the Interior in the 1980s were focused on unexplored offshore habitats intended for potential oil and gas exploration. These surveys resulted in the collection of more than 2500 benthic samples containing numerous undescribed taxa. Previous monographs of polychaetes from these collections include Hilbig & Blake (1991) on the Dorvilleidae and Blake (2021a) on the Orbiniidae. Previous papers dealing with cirratulids from these collections were by Blake (1991, 2016, 2021b) and Doner & Blake (2006).

The present study is focused on the genera *Chaetocirratulus* Blake, 2018 and *Chaetozone* Malmgren, 1867 and includes new species and new records of previously described taxa. Additionally, a new species of the genus *Caulleriella* Chamberlin, 1919, not previously reported by Blake (2021b) is included. Where relevant, comments on type material of previously described species are included. The remaining genera including *Aphelochaeta*, *Tharyx*, and *Dodecaceria* will be treated in a subsequent paper. The following species are included in this report:

Caulleriella cryptica **n. sp**.
Chaetocirratulus gayheadius (Hartman, 1965) **n. comb**.
Chaetocirratulus hessleri **n. sp**.
Chaetocirratulus sandersi **n. sp**.
Chaetocirratulus tomaculus **n. sp**.
Chaetozone adunca **n. sp**.
Chaetozone anasima Doner & Blake, 2006
Chaetozone artaspinosa **n. sp**.
Chaetozone brychiata **n. sp**.
Chaetozone castouria **n. sp**.
Chaetozone diodonta Doner & Blake, 2006
Chaetozone donerae **n. sp**.
Chaetozone hystricosa Doner & Blake, 2006
Chaetozone lophia **n. sp**.
Chaetozone novagracilis **n. sp**.
Chaetozone paucispinosa **n. sp**.
Chaetozone profunda **n. sp**.

Materials and methods

Materials examined as part of this study. The offshore samples were collected by the author and colleagues as part of surveys funded by the U.S. Department of the Interior′s former Minerals Management Service (MMS), now the Bureau of Ocean Energy Management (BOEM) during the 1980s. These studies were extensive and intended to evaluate the potential impact of oil and gas exploration and development on Georges Bank off New England (1981–1985) and along the entire U.S. Atlantic Continental Slope and Rise (ACSAR) from New England to the Carolinas (1983–1987). Separate deep-water surveys off Cape Hatteras, North Carolina, for MMS in August 1992 and at two sites in the vicinity of the former Deep-water Disposal Site (DWD-106) for US EPA off New Jersey in November 1985 were also conducted. Supplemental nearshore samples from Boston Harbor and Massachusetts Bay collected over several years (1992–1997; 2002–2009) as part of the Massachusetts Water Resources Authority's (MWRA) long-term Harbor and Outfall Monitoring Program (HOM) associated with an ocean outfall are also included. All MMS collections are deposited in the National Museum of Natural History, Smithsonian Institution (USNM). Other collections are deposited in the Museum of Comparative Zoology (MCZ), Harvard University. Loans of critical type material were from the polychaete collections of the Los Angeles County Museum of Natural History (LACM-

AHF Poly) and Natural History Museum, London (NHM ZK). In the Materials Examined sections type specimens (holotype and paratypes) are noted in bold, all other specimens are non-type materials.

The MMS ACSAR samples were collected with a 0.25 m^2 box core, whereas the MMS Georges Bank, MWRA, and other nearshore samples were collected with a 0.04 m^2 Ted Young grab. The MMS and MWRA samples were processed with 300-µm-mesh sieves. A 500-µm-mesh sieve was routinely used with other surveys. The use of fine-mesh sieves ensured that sufficient numbers of smaller specimens, including juveniles, were retained, resulting in more than 3100 specimens of adults and juveniles available for this study.

Morphological observations. Specimens were examined using a Wild M-5 stereomicroscope and a Zeiss RA research microscope equipped with phase contrast optics. Photomicrographs were taken with a Nikon D7100 camera mounted on both the stereo- and compound microscopes. For observation, specimens were first stained with an aqueous solution of Shirlastain A to highlight difficult-to-see surficial morphology. Some specimens were stained with a saturated solution of methyl green (MG) in 70% ethyl alcohol (ETOH) in order to identify staining patterns of subdermal glands evident on some species. Line drawings were first sketched in pencil using a drawing tube or *camera lucida* on the Zeiss RA and later transferred to Dura-Lar® matte film and inked.

Using facilities of the Marine Biological Laboratory (MBL) in Woods Hole, Massachusetts, some specimens were prepared for observation with the scanning electron microscope (SEM) by dehydrating them from 100% ETOH followed by critical point drying and then sputter-coating with gold-palladium after mounting on stubs. Specimens were observed and photographed using the digital Zeiss Gemini at the MBL. Other specimens were prepared and scanned at Hofstra University by students of Dr. Jason Williams as part of a collaborative NSF PEET grant where specimens were similarly prepared for SEM by dehydrating in an ascending series of 70–95% ETOH followed by three changes of 100% ETOH for 15 min each. Specimens were critical-point dried with a Samdri 795 Critical Point Dryer, mounted on aluminum stubs, coated with gold using an EMS-550 Sputter coater, and viewed with a Hitachi S-2460N SEM.

Abbreviations used on figures: acSp, acicular spine(s); anC, anal cirrus; anL, anal lobe; br, branchiae; dCr, dorsal crest; dGr, dorsal groove; dT, dorsal tentacle; mo, mouth; neS, neurosetae; noS, notosetae; nuO, nuchal organ; per, peristomium; pig, pigment; pr, prostomium; prob, proboscis; pyg, pygidium; Pyg disk, pygidial disk; regen, regenerating; rDg, ridge; vGr, ventral groove, vRdg, ventral ridge.

Systematic Account

Family Cirratulidae Ryckholt, 1851

Diagnosis. Body elongate with numerous short segments; not divided into distinct regions, but anterior and/or posterior segments sometimes expanded and crowded. Prostomium narrow and conical or broad and wedge-shaped, without appendages; eyespots present or absent; paired nuchal organs present dorso-laterally. Peristomium achaetous, smooth or with two or more distinct annuli. Grooved dorsal tentacles arise as a single pair or as multiple groups of filaments on posterior margin of peristomium or on one or more anterior setigerous segments. Branchiae long, filamentous, usually occurring over numerous segments. Parapodia biramous with rudimentary podial lobes. Setae simple, including capillaries, acicular spines or bidentate hooks. Pygidium a simple lobe sometimes with sub-anal disk, or with one or two terminal cirri. Pharynx ventral, unarmed. Sexual and asexual reproduction may occur.

Remarks. The generic definitions of cirratulid collections from the MMS surveys from the 1980s were based on Hartman's (1961, 1969) system where most bitentaculate species with unidentate acicular spines were referred to *Chaetozone* and those with only capillary setae were mostly referred to *Tharyx*. As a result the numerous provisional taxa that were established as part of those projects have required considerable review in order to align and re-evaluate them with the genera now in use (Blake 1991, 2016, 2018; Blake & Magalhães 2019). Furthermore, the offshore collections reported in this study are derived from over 2500 samples, mostly retained on fine mesh sieves with 300- and 500 µm openings. Because of this, thousands of specimens are available and sorting through and evaluating these materials has therefore taken considerable time and effort.

Genus *Caulleriella* Chamberlin, 1919

Type species: *Cirratulus viridis* Langerhans, 1881. Original designation by Chamberlin 1919.

Diagnosis. (after Blake & Magalhães 2019). Prostomium elongate, conical to pointed. Peristomium elongated to short, with dorsal tentacles usually beginning anterior to setiger 1. Middle body segments not beaded; parapodia often with noto- and neuropodia widely separated laterally. Modified setae including capillaries and bidentate crotchet-like hooks, not arranged into modified cinctures. In some species, unidentate hooks may occur in some regions of the body in addition to bidentate hooks. Pygidium either a simple conical lobe or with one or two anal cirri.

Remarks. After Blake (2021b) reported on species of *Caulleriella* from the U.S. Atlantic coast, another species was discovered among lower continental slope specimens that had been erroneously referred to *Chaetozone* during the ACSAR program. The new species is most similar to *C. bathytata* Blake, 2019 from abyssal depths of the Pacific Ocean. The new species is here described as *Caulleriella cryptica* **n. sp**.

Caulleriella cryptica new species

Figures 1–2

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Chaetozone sp. B: Maciolek *et al*. 1987b: D-2 (in part).

Material examined. (*10 specimens*) **Off New England, North Atlantic ACSAR program**, coll. G. Hampson, Chief Scientist. **Sta. 5**: Cruise NA-5, Rep. 3, 30 Apr 1986, 40°05.01′N, 67°29.90′W, 2085 m, **holotype** (USNM 1661368); Cruise NA-1, Rep. 2, 05 Nov 1984, 40°05.16′N, 67°30.01′W, 2070 m, 3 **paratypes** (USNM 1661369); Cruise NA-2, Rep. 2, 29 Apr 1985, 40°05.07′N, 67°29.78′W, 2065 m, 2 **paratypes** (USNM 1661370); Rep. 3, 29 Apr 1985, 40°05.07′N, 67°29.88′W, 2065 m, 1 **paratype** (USNM 1661371). Cruise NA-3, Rep. 2, 04 Jul 1985, 40°05.08′N, 67°29.85′W, 2060 m 3 **paratypes** USNM 1661372).

Description. A small threadlike species, holotype (USNM 1661368) complete, with 70 setigers, 13.6 mm long, 0.4 mm across anterior and middle segments, only narrowing in far posterior setigers (Fig. 2A); paratype (USNM 1661370) with 75 setigers, 7.1 mm long, 0.26 mm wide. Body generally cylindrical in cross section throughout, with segments of anterior third short, ca. 1.5 to 2 times as wide as long; middle and posterior setigers rounded, moniliform (Fig. 2A, E–F), slightly wider than long. Dorsal and ventral grooves absent. Color in alcohol light tan.

Pre-setiger region long, narrow, about as long as first five setigers (Figs. 1A, 2A–B, D); prostomium and peristomium merged with one another (Figs. 1A, 2D). Prostomium long, narrow, triangular, tapering to pointed tip (Figs. 1A, 2A–B, D); eyespots absent; nuchal organs narrow slits on posterior lateral margin, weakly pigmented. Peristomium smooth, merging seamlessly with setiger 1 (Fig. 1A); with partial division into two rings dorsally, not evident ventrally; dorsal tentacles arising from near anterior border of second ring, with first branchiae located lateral and posterior to tentacles (Fig. 1A); second pair of branchiae arising dorsal to notosetae on setiger 1; subsequent branchiae similarly located. Dorsal tentacles broken off; branchiae mostly missing, short, or as stubs.

Parapodia reduced to low ridges from which setae arise. Setae include capillaries and bidentate hooks. Notosetae all capillaries over most of body; capillaries long, usually numbering 8–10 per fascicle; notopodial bidentate hooks not present until setiger 50–60 (57 in holotype) with 1–2 long-shafted hooks and 4–5 capillaries. Neuropodia with 7–8 long capillaries at first with bidentate hooks from setiger 15–25 (15 in holotype); hooks short, curved, 1–2 at first then increasing to 3–4 per fascicle posteriorly. All hooks with conspicuous blunted main fang surmounted by short, pointed apical tooth; distinct hood present extending from main fang to shaft on concave side (Figs. 1B–D, 2C); hood requires 1000x magnification to discern clearly. Hooks of anterior neuropodia with main fang shorter, less conspicuous on some paratypes (e.g., USNM 1661371).

Pygidium with semi-circular disk extending below anal opening (Fig. 2F).

Methyl green staining. No pattern.

Remarks. The hooks of *Caulleriella cryptica* **n. sp**. are bidentate with a distinct transparent hood that extends from the main fang to the shaft on the concave side. The only other species of *Caulleriella* having such hooks is *Caulleriella bathytata* Blake, 2019 from the Clarion-Clipperton Zone in the abyssal Pacific Ocean. The two species are similar in size and number of setigers but differ in that the neuropodial hooks of *C. cryptica* **n. sp**. begin

on setiger 15 instead of more posteriorly on setiger 31 and the prostomium of *C. cryptica* **n. sp**. is much longer and drawn out into a narrow triangular shape instead of being shorter, broadly triangular, and distinctly divided into two parts in *C. bathytata*. In addition, the peristomium of *C. cryptica* **n. sp**. is partially divided dorsally into two rings, whereas the peristomium of *C. bathytata* is entire.

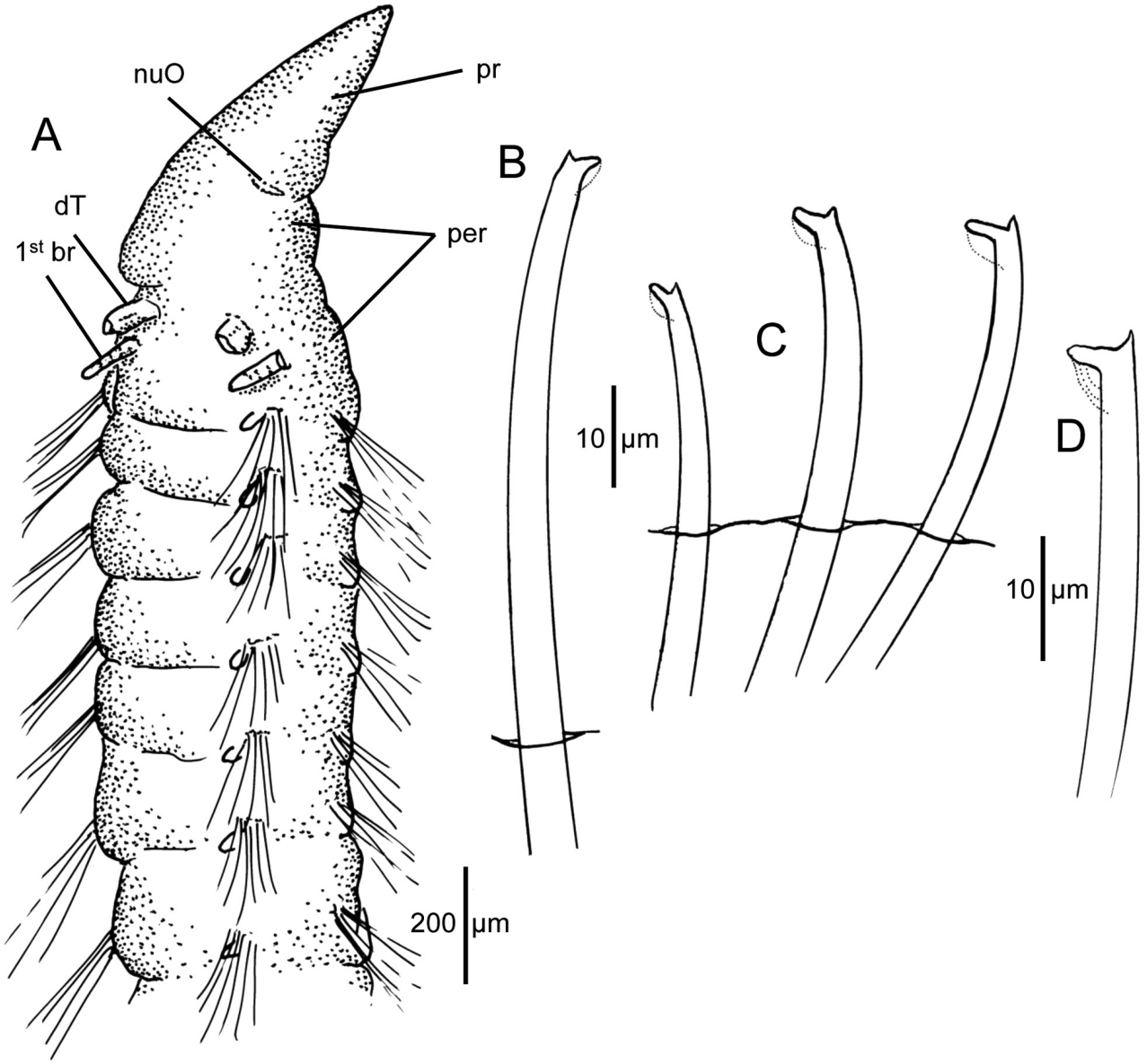

FIGURE 1. *Caulleriella cryptica* **n. sp**. Holotype (USNM 1661368): A, anterior end, right lateral view; B, notoacicular spine; C, neuroacicular spines; D, notoacicular spine.

Biology. All specimens are from North Atlantic ACSAR Station 5 on the lower continental slope off Georges Bank, adjacent to Lydonia Canyon at a depth of about 2070 m. Sediments consisted of about 66.5% sand and 33.5% silt + clay (Maciolek *et al*. 1987b). *Caulleriella cryptica* **n. sp**. was rare at this site, where 17 of the top 20 species were annelids. Of these, *Aurospio dibranchiata* Maciolek, 1981 was the most abundant species with 10.4% of the total fauna (Maciolek *et al*. 1987b). No specimens of *C. cryptica* **n. sp**. were observed with gametes.

Etymology. The epithet *cryptica*, is from the Greek, *krypto*, for hide or conceal, in reference to these specimens being hidden and misidentified as a species of *Chaetozone.*

Distribution. Off New England, 2060–2085 m.

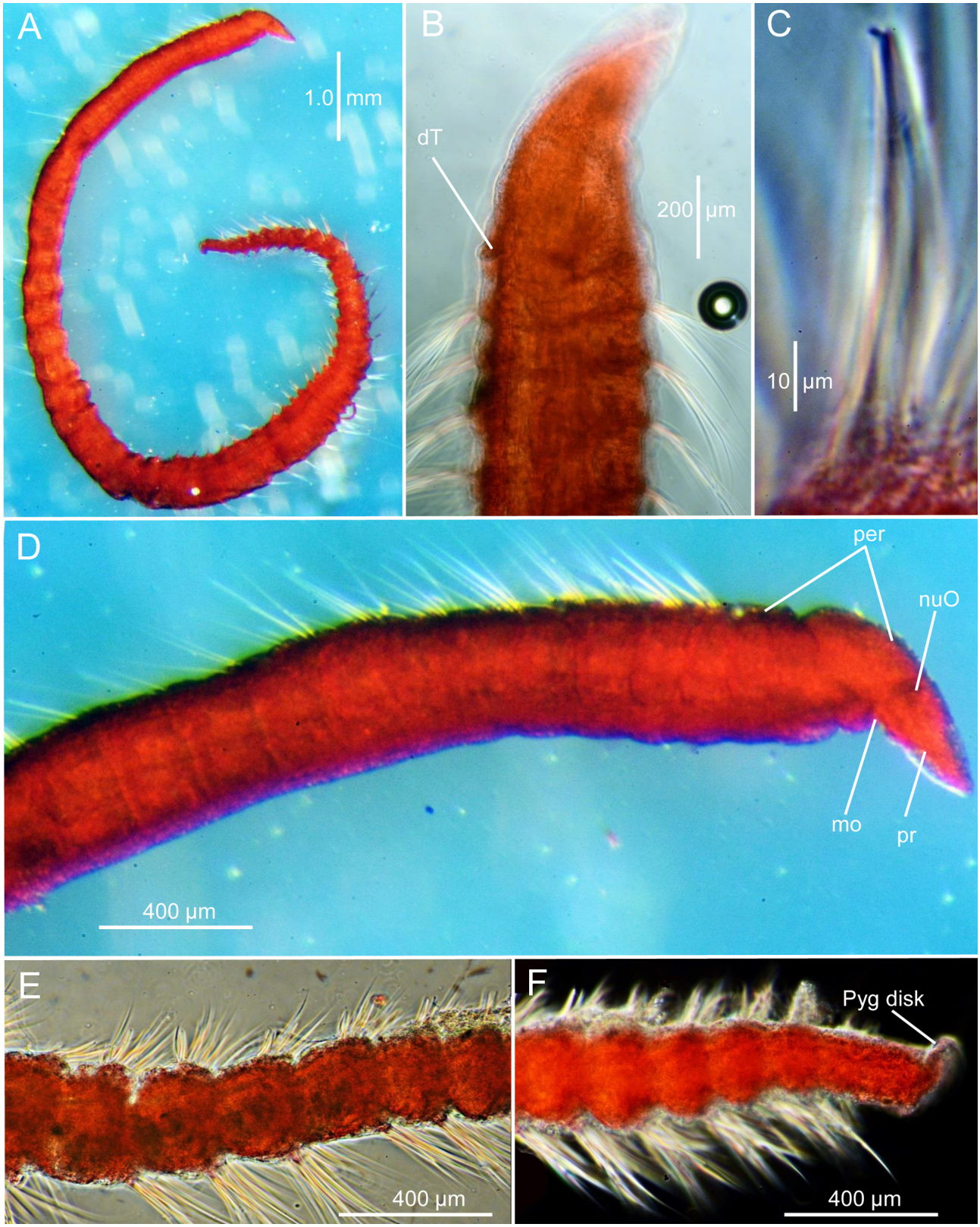

FIGURE 2. *Caulleriella cryptica* **n. sp**. Holotype (USNM 1661368): A, entire worm in right lateral view; B, anterior end, right lateral view; C, notopodial hook; D, anterior one-fourth of body, right lateral view; E, posterior setigers, dorsal view; F, posterior end with pygidial disk, left lateral view. All stained with Shirlastain A.

Genus *Chaetocirratulus* Blake, 2018

Type species: *Heterocirrus andersenensis* Augener, 1932. Original designation by Blake 2018.

Diagnosis. (after Blake 2018) Prostomium broadly rounded anteriorly or wedge-shaped; eyespots absent; with a pair of small nuchal organs as slits or depressions at posterior edge. Peristomium with a single pair of grooved dorsal tentacles arising from posterior margin or interface with setiger 1. First pair of branchiae arising from posterior margin of peristomium, an achaetous segment, or setiger 1. Body typically thick and fusiform over many segments, rarely with middle or posterior body segments beaded or moniliform; individual segments short, numerous. Setae include capillaries on most setigers and thick, pointed acicular spines in neuropodia and a few in notopodia or spines in neuropodia only; spines few, often small and inconspicuous, not forming cinctures. Individual spines straight to weakly sigmoid. Pygidium a simple ventral lobe.

Remarks. Species of *Chaetocirratulus* include a heterogeneous group of cirratulids that share characteristics of both the multitentaculate genus *Cirratulus* Lamarck, 1818 and the bitentaculate genus *Chaetozone*. The genus was established by Blake (2018) to accommodate a group of *Chaetozone* species that had large, often fusiform bodies with only a few acicular spines that were not arranged in spreading fascicles or in the more typical cinctures. Petersen (1991) had earlier recognized that these species did not agree with *Chaetozone* and referred them to the multitentaculate genus *Cirratulus* and redefined the genus to include species having two tentacular cirri in addition to multiple pairs of tentacles.

Two species previously described from the western North Atlantic Ocean considered to possibly belong to *Chaetocirratulus* are *Chaetozone benthaliana* McIntosh, 1885 from off Nova Scotia in 2275 m and *Chaetozone gayheadia* Hartman, 1961 from off New England in 300 m.

Comments on *Chaetozone benthaliana*. *Chaetozone benthaliana* is an enigma because the holotype (NHM ZK 1885.12.1.278) is represented only by a large posterior end collected as part of the *Challenger* Expedition from deep-water off Nova Scotia. This posterior fragment has been cut into two pieces, the largest of which has 80 setigers and is about 40 mm long and up to 7 mm wide. Most setae are broken off, but a few straight acicular spines are present in posterior setigers. Blake (2018: 121), without documentation, referred this taxon to *Chaetocirratulus*. However, given the lack of any anterior morphology, it is not possible to characterize this species to any genus of Cirratulidae based on the type specimen. I suggest, therefore, that *C. benthaliana* McIntosh be considered a *species inquirendum* and removed from the list of valid species of *Chaetozone*.

Kirkegaard (1983) referred a specimen from deep-water (1900 m) from the northeastern Atlantic southwest of Ireland to *C. benthaliana* and provided an illustrated description, but few details were provided and no explanation as to why he thought his specimen was the same species as the posterior end of *C. benthaliana* reported by McIntosh (1885) from off Canada. As part of a series of unpublished notes and sketches prepared by the late Dr. Mary E. Petersen and now in my possession are details of her observations on the specimen reported by Kirkegaard (1983). These notes were present in documents recovered from Dr. Petersen's laboratory following her death in 2014. Dr. Petersen noted that the specimen was widest in the middle of the body, narrowing at both anterior and posterior ends and having ca. 100 setigers, 36 mm long and 5 mm wide. She noted that the prostomium was broadly triangular and wedge-shaped, but had a mid-dorsal notch or depression. The nature of the peristomium was not noted, but her sketches indicate that two peristomial rings were present, the anteriormost being large with a pair of lateral creases, not crossing the dorsal or ventral surfaces. The dorsal tentacles were missing but their scars were present in a notch on the anterior border of setiger 1; most branchiae were missing, but the scars of the first pair of branchiae were visible on setiger 1 dorsal to the notosetae. Parapodia were well developed with ridges apparent along most of the body. Most of the setae were broken off, but smooth capillaries and a few acicular spines, when present, were straight, not curved; their first occurrence could not be determined, however one or two spines were present in both noto- and neuropodia from setiger 91. The notes and detailed sketches prepared by Dr. Petersen of the NE Atlantic specimen suggest a species that differs from any specimens of *Chaetocirratulus* observed along the U.S. Atlantic coast in the present study and likely represents an undescribed species.

Unlike *C. benthaliana*, where only a posterior fragment is available, numerous specimens of *C. gayheadia* were available for study including postlarvae, juveniles, and mature adults. Detailed observations on these specimens are presented below. In addition, representatives of three additional species, new to science, were encountered. In the present study, the following species have been identified off the U.S. Atlantic coast and are treated in this study.

1. *Chaetocirratulus gayheadius* (Hartman, 1965) **n. comb**.
2. *Chaetocirratulus hessleri* **n. sp**.
3. *Chaetocirratulus sandersi* **n. sp**.
4. *Chaetocirratulus tomaculus* **n. sp**.

Chaetocirratulus gayheadius (Hartman, 1965) new combination

Figures 3–7
Table 1

Chaetozone gayheadia Hartman, 1965: 166; Hartman & Fauchald 1971: 109–110 (in part); Maciolek *et al*. 1987b: D-2 (in part).
Cirratulus gayheadius: Petersen 1991: 592, 1999: 112, 117, Fig. 3A–D.
Chaetocirratulus gayheadius: Blake 2018: 121.

Material examined. (*96 specimens*) **Off New England, south of Gay Head, Martha's Vineyard, near head of Alvin Canyon**, R/V *Atlantis* Cruise 283, **Sta. Sl-3**, coll. H.L. Sanders, Chief Scientist, 28 Aug 1962, 39°58.4′N, 70°40.3′W, 300 m, **holotype** (LACM-AHF Poly 0564), 21 **paratypes** (LACM-AHF Poly 0565).—**Near Block Canyon**, R/V *Chain*, Cruise, 58, coll. H.L. Sanders, Chief Scientist, Epibenthic sled, **Sta. Ch 105-B**, 05 May 1966, 39°56.6′N, 71°03.6′W, 530 m, (62, LACM-AHF Poly 12721).—**Off New England, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 12**: Cruise NA-1, Rep. 1, 15 Nov. 1984, 39°54.32′N, 70°55.09′W, 558 m (2, USNM 1660929); Cruise NA-2, Rep. 1, 04 May 1985, 39°54.31′N, 70°55.04′W, 551 m (3, USNM 1660930); Rep. 2, 04 May 1985, 39°54.26′N, 70°55.07′W, 555 m (1, USNM 1660931); Cruise NA4, Rep. 3, 30 Nov 1985, 39°54.32′N, 70°55.12′W, 544 m (2, juv., USNM 1660932); Cruise NA-5, Rep. 2, 06 May 1986, 39°54.27′N, 70°55.17′W, 548 m (2. USNM 1660935); Cruise NA-6, Rep. 2, 30 Jul 1986, 39°54.26′N, 70°55.07′W, 559 m (1, USNM 1660933); Rep. 3, 30 Jul 1986, 39°54.24′N, 70°55.09′W, 563 m (1, juv., USNM 1660934).

Comments on the material examined. Evaluation of the materials here referred to *Chaetocirratulus gayheadius* has proven to be difficult and complex. The type collection from R/V *Atlantis* Sta. Sl-3 at a depth of 300 m off the northeastern US reported by Hartman (1965) consists of the holotype and 21 paratypes. Of these, the holotype is regenerating the pre-setiger region and likely several anterior setigers and therefore cannot be used to characterize the species. The paratypes include juveniles of various sizes as well as small anterior and posterior fragments. None of the paratypes contain more than 30 setigers and none are sexually mature. As such, apart from characterizing post larvae and juveniles of the species, the type collection cannot by itself be used to characterize *C. gayheadius*. In contrast, the nearby sample from R/V *Chain* Sta. Ch 105-B from a depth of 530 m reported as *Chaetozone gayheadia* by Hartman & Fauchald (1971) includes a full range of sizes, the smallest of which overlap the juvenile paratypes from the type collection in size and shape. In addition, larger specimens with up to 51 setigers are available to characterize the adult morphology of the species and allow it to be compared with its congeners. Both collections are from adjacent upper continental slope depths and are in proximity to submarine canyons. A few specimens from the New England upper continental slope collected as part of the ACSAR program are also available and agree with the morphology of the larger specimens from Sta. Ch 105-B. In order to characterize the species, an illustrated size range of the types and additional specimens is provided. Descriptions are provided for both the type specimens and the materials from Sta. Ch 105-B. An additional sample reported by Hartman & Fauchald (1971) as *Chaetozone gayheadia* from nearby Veatch Canyon, from R/V *Chain* Sta. Ch-87 at a depth of 1102 m represents a different species (see below). *Chaetocirratulus gayheadius* thus appears to be limited to upper slope depths of about 300–600 m.

Description of the holotype (LACM-AHF Poly 0564). Holotype regenerating pre-setiger region (Fig. 3A–B), complete, with 30 setigers, 5.6 mm long and 0.37 mm wide across anterior segments. Body slender throughout; anterior segments not expanded, individual segments distinctly separated from one another along most of body (Fig. 3A–C) but not moniliform, becoming crowded and narrower in last few segments (Fig. 3C). No dorsal or ventral grooves or depressions. Cross section of most segments rounded and slightly flattened dorsoventrally. Parapodia lateral throughout, with rami clearly separated. Color in alcohol: opaque white, without any pigmentation.

Prostomium and peristomium regenerating (Fig. 3A–B), merged together, narrow, not differentiated; mouth a narrow slit. Dorsal tentacles not regenerated. Branchiae arise just posterior to and dorsal to notosetae on right setigers 1–3 and on left setigers 1 and 3 (Fig. 3A–B). No branchiae more posteriorly, except on setiger 5.

Setae include smooth capillaries and sharp-tipped acicular spines. Notosetae of setigers 1–5 all capillaries, 3–4 per fascicle, each about as long as diameter of body, rather stiff. From setiger 6 notopodia provided with 1–2 pale, slender, curved acicular spines and 1–3 stiff capillaries. Notosetae of last 4–5 setigers long, dorsally oriented stiff capillaries. Neurosetae of setigers 1 to last (30) 2–3 pale, weakly curved acicular spines and 1–2 stiff capillaries. Neurosetae shorter than notosetae throughout.

Posterior segments tapering to pygidium (Fig. 3C). Pygidium a small, rounded ventral lobe enclosing terminal anus.

Methyl green staining. Body stains turquoise blue in irregular pre-setiger and postsetal areas; speckled bands present, mostly concentrated on anterior segments (Fig. 3B). Posterior setigers and pygidium with denser concentration of speckles (Fig. 3C). Branchiae irregularly speckled. Regenerating anterior end pale, not staining.

Remarks on the holotype. The holotype is regenerating the pre-setiger region and an undetermined number of anterior setigers. Since none of the paratypes from R/V *Atlantis* Sta. Sl-3 have neuropodial acicular spines before setiger 5, it is unlikely that setiger 1 of the regenerating holotype is the actual first setiger. Therefore, it is likely that in addition to the pre-setiger region, the holotype is also regenerating at least four anterior setigers. For this reason alone, the holotype cannot be used to characterize the species.

Description of the paratypes (LACM-AHF Poly 0565). All paratypes generally well preserved and in good condition. Most setae reasonably intact, many specimens with branchiae and a few with dorsal tentacles. Of 21 paratypes, six complete, nine anterior or posterior fragments, and six short complete, with enlarged anterior ends and narrow posterior ends (Figs. 3D–E, 4A–C).

Complete specimens range from 1.6 to 5.0 mm long and with 7 to 26 setigers. Greatest width of any paratype ca. 0.5 mm, not 1 mm as stated by Hartman (1965). Widest part of body first 1–7 anterior segments, then tapering posteriorly (Figs. 3D–E; 4A–D). Color in alcohol: pale to whitish; brown branchiae mentioned by Hartman (1965) not apparent, but may have faded or been lost.

Body shape generally linear, with 2–7 anterior segments largest, sometimes inflated depending on specimen; middle and posterior segments narrower, generally tapering posteriorly (Figs. 3D–E; 4A–D); anterior and some middle segments generally rounded or weakly moniliform, wider than long; most middle and posterior segments of larger specimens narrow, crowded, and tapering evenly towards simple narrow pygidium, rounded posteriorly (Fig. 4D).

Prostomium conical, tapering to narrow bluntly rounded apex (Figs. 3D–E; 4A–F); eyespots absent; nuchal organs curved slits on posterior lateral margin. Peristomium dorsally elevated, producing low dorsal crest; broader than prostomium; with two rings denoted only by lateral grooves in paratypes. Dorsal tentacles and first pair of branchiae arising from posterior margin of second peristomial ring; first branchiae located lateral to dorsal tentacles (Figs. 3D–E; 4E). Subsequent branchiae arising dorsal to and posterior to notosetae on following setigers.

Parapodia lateral throughout, rami well separated with setae emerging directly from body wall but anterior setigers with a bulged or swollen area providing a shoulder effect in some specimens. Anterior setae all long, simple capillaries, ca. 5–10 per noto- and neuropodia. Acicular spines typically present in neuropodia from setigers 5–10 and notopodia from setigers 7–11. Small post-larval specimens with either no acicular spines or from setiger 7–8 in neuropodia and none in notopodia. Spines one per podia initially, increasing to 2 or 3 in posterior segments; accompanied by 2 or 3 capillaries. Individual spines relatively straight, tapering to pointed tip (Fig. 4G).

Six short anterior ends with 6–7 large, rounded segments followed by narrow trunk with 2–7 narrow, crowded segments (Figs. 3D–E; 4A–C). These paratypes identified as regenerates and as evidence of asexual reproduction by Petersen (1999). However, these paratypes more likely represent post-larval growth patterns based on similar and more advanced specimens from Sta. Ch 105-B (see below).

Methyl green staining. All specimens stain, some more brightly than others. Dorsal tentacles usually stain along outer edges of ciliated groove, visible as two fine lines, turquoise to dark blue. Branchiae stain dark turquoise to dark blue, some but not all with small discrete speckles along one side, rather than evenly distributed (Fig. 3D–E). Pre-setiger region with a general mixture of dark blue and turquoise blue; coarser dark blue dots on a background of finer turquoise dots, with front of domed part of prostomium around the nuchal organs and extreme tip of the prostomium unstained or at most only lightly stained (Fig. 3D). Individual segments stain anterior to the parapodia and in an irregular transverse postsetal ring laterally and ventrally (Fig. 3D–E). Presetal rings present on some, but less dense. Areas where setae emerge unstained.

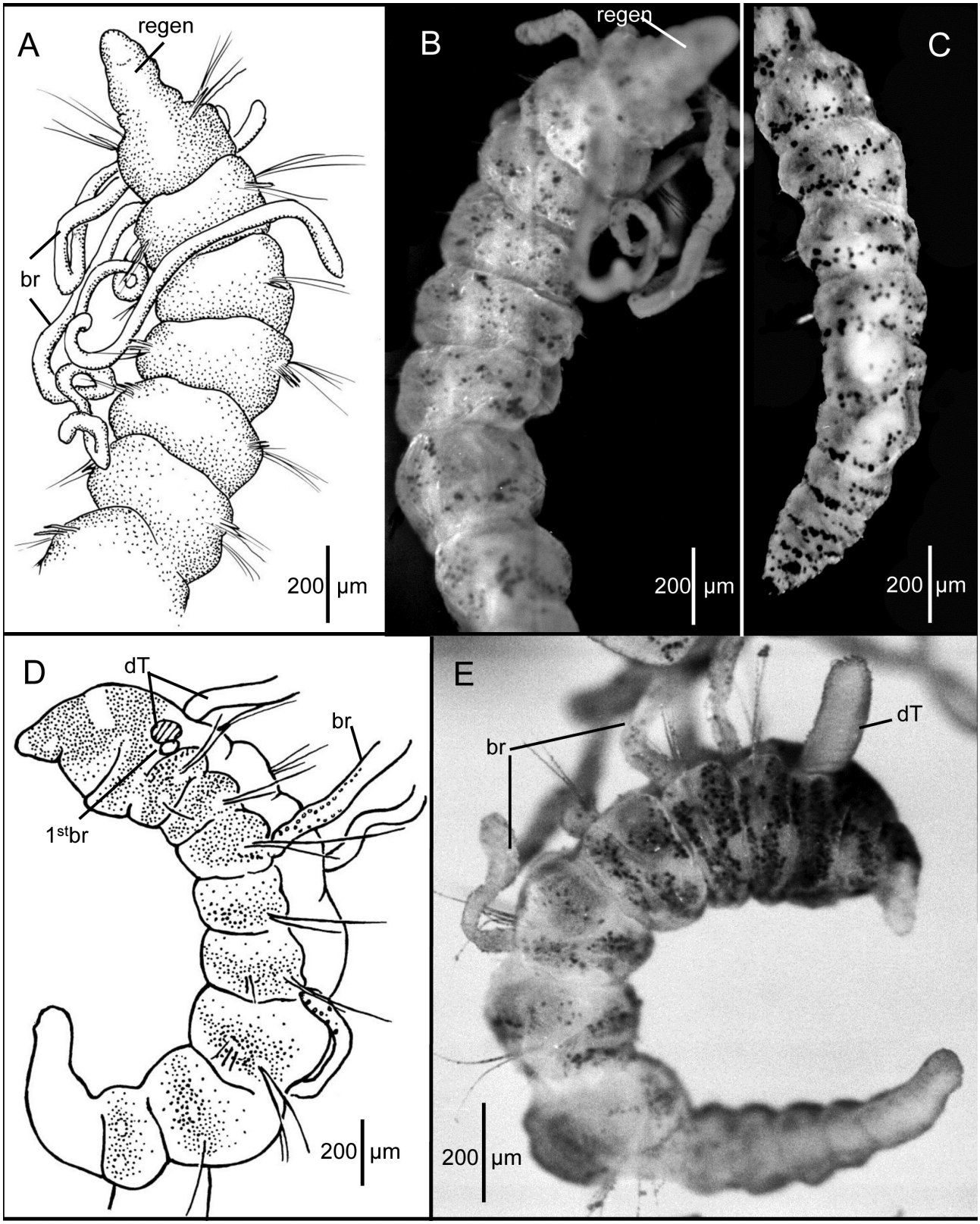

FIGURE 3. *Chaetocirratulus gayheadius*. Holotype (LACM AHF-Poly 0564): A, anterior end, ventral view; B, anterior end, dorsal view; C, posterior end, dorsolateral view. Paratypes (LACM AHF-Poly 0565): D, 8-setiger post-larva, left lateral view; E, 7-setiger post-larva, right lateral view. B–C, E, dark spots denote MG stain; D, stippled areas denote MG stain.

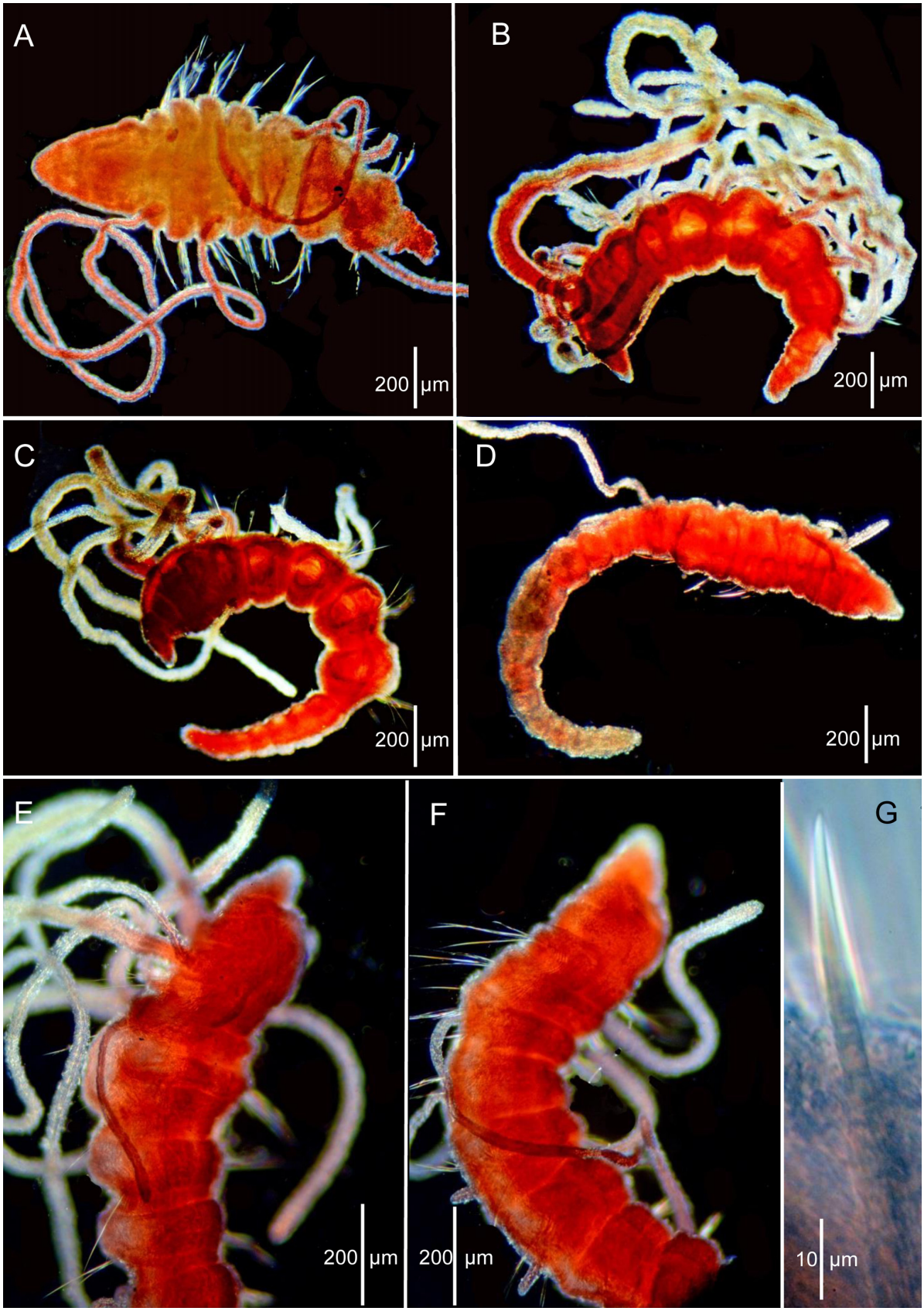

FIGURE 4. *Chaetocirratulus gayheadius*. Paratypes (LACM AHF-Poly 0565): A, 7-setiger post-larva, dorsal view; B, 7-setiger post-larva, left lateral view; C, 7-setiger post-larva, left lateral view; D, 20-setiger juvenile, right lateral view; E, 22-setiger juvenile, anterior, right ventrolateral view; F, 28-setiger juvenile, anterior end, ventral view; G, neuropodial acicular spine. All stained with Shirlastain A.

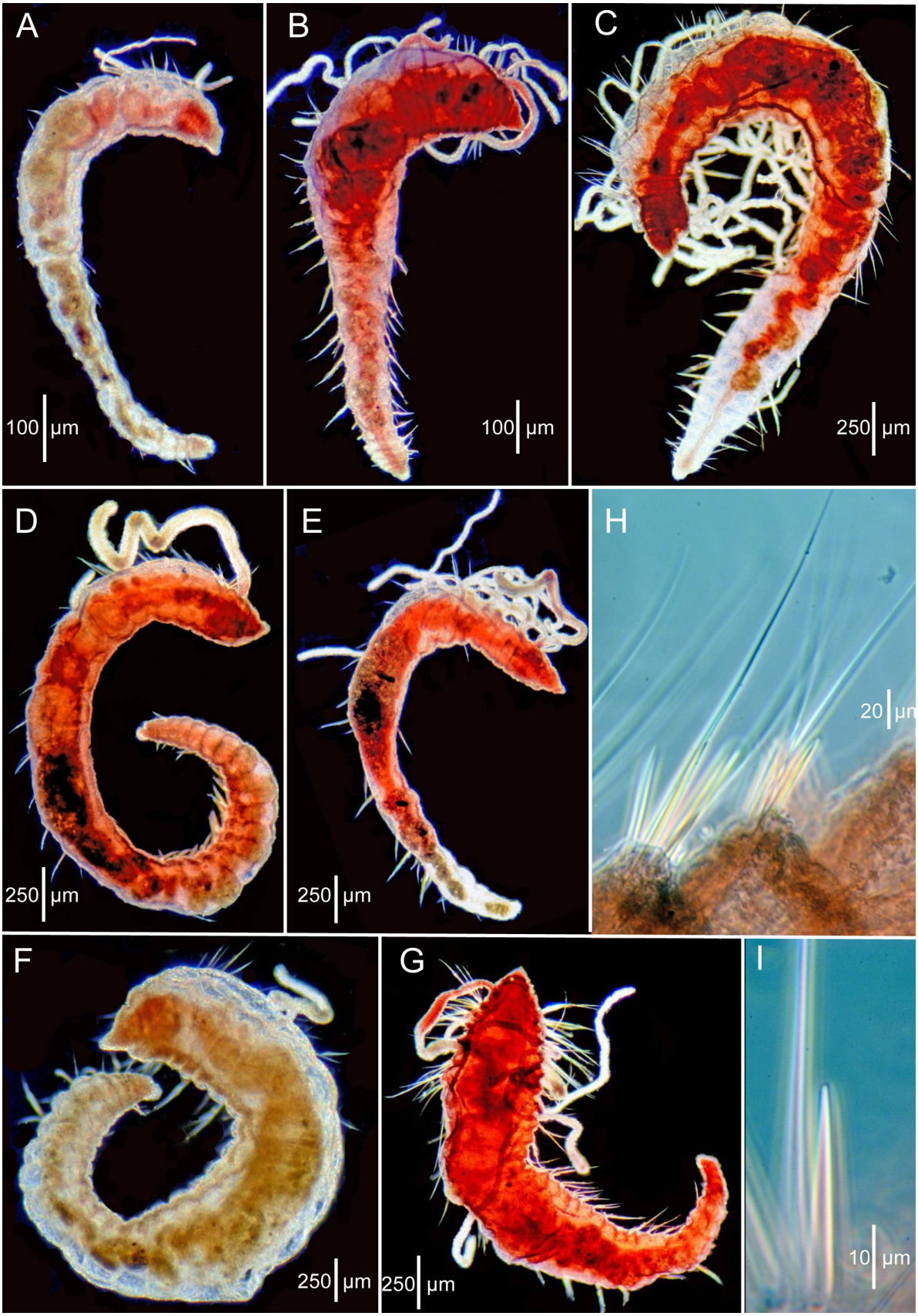

FIGURE 5. *Chaetocirratulus gayheadius*. Juveniles from Sta. Ch 105-B, (LACM AHF-Poly 12721): A, 19-setiger juvenile, right lateral view; B, 28-setiger juvenile, right lateral view; C, 31-setiger juvenile, left lateral view; D, 34-setiger juvenile, right lateral view; E, 17-setiger juvenile, right lateral view; F, 27-setiger juvenile, left lateral view; G, 29-setiger juvenile, ventral view; H, neuropodial acicular spines and capillaries; I, detail of acicular spine. All stained with Shirlastain A.

FIGURE 6. *Chaetocirratulus gayheadius*. Adults from Sta. Ch 105-B (LACM-AHF Poly 12721): A, 30-setiger specimen, dorsal view; B, 35-setiger specimen, right lateral view; C, 34-setiger specimen, dorsal view; D, 32-setiger specimen, right lateral view; E, 31-setiger specimen, left lateral view; F, 42-setiger specimen, ventrolateral view. A–E, stained with Shirlastain A; F, stained with MG.

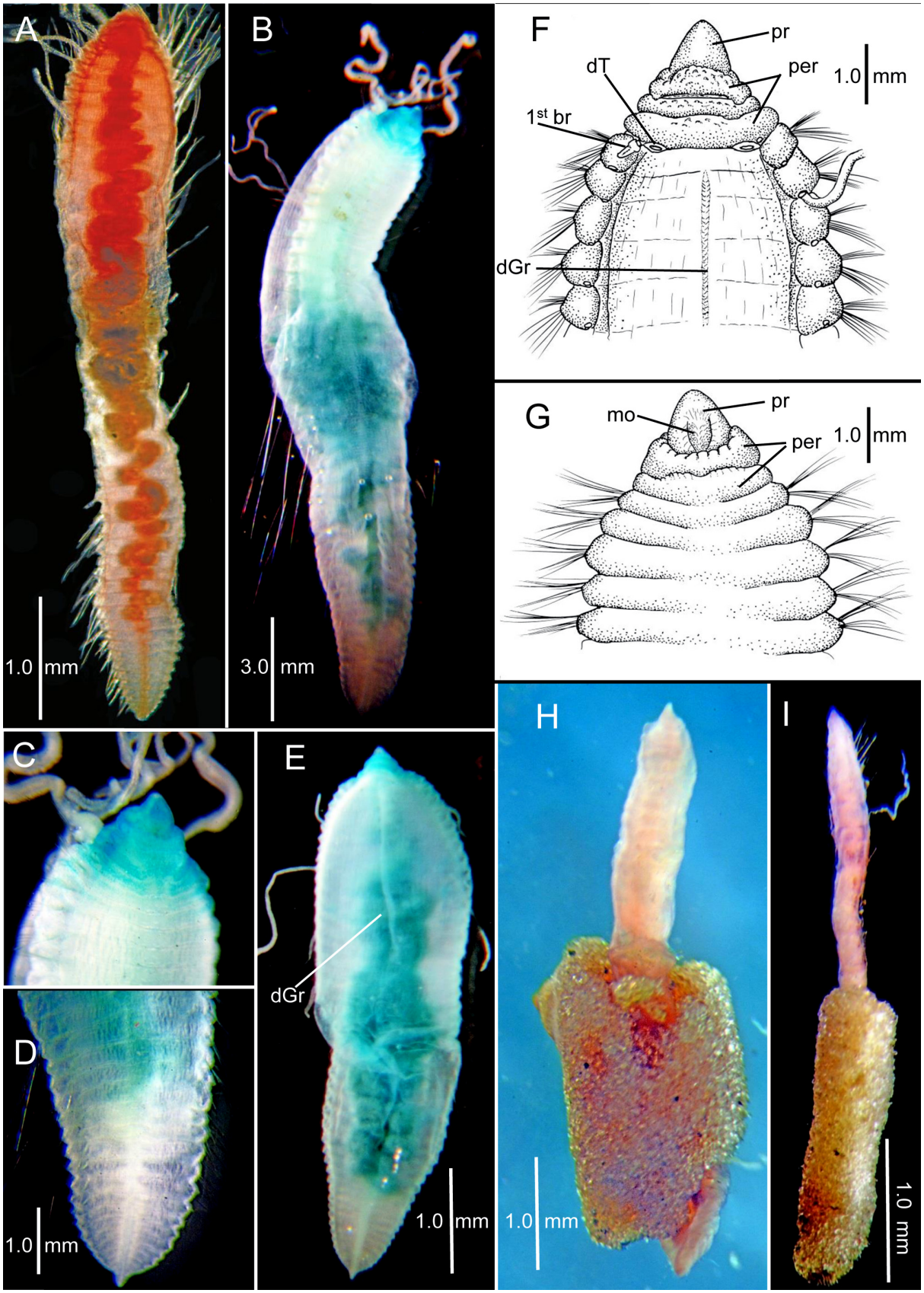

FIGURE 7. *Chaetocirratulus gayheadius*. Adult morphology; specimens from Sta. Ch 105-B (LACM-AHF Poly 12721): A, 40-setiger specimen, dorsal view; B–D, 51-setiger specimen, ventral view: B, entire worm; C, anterior end; D, posterior end; E, 46-setiger specimen; F, 40-setiger specimen, anterior end, dorsal view; G, 40-setiger specimen, anterior end, ventral view; H–I, two entire specimens partially surrounded by sand tubes. A, H–I stained with Shirlastain A; B–E, stained with MG.

Description of non-type specimens from R/V *Chain* Sta. Ch 105-B (LACM-AHF Poly 12722). A wide range of sizes and shapes available (Figs. 5–7). Smaller specimens closely resemble small post-larval paratypes in having a thickened pre-setiger region and a few enlarged anterior setigers followed by a narrowing set of middle and posterior setigers (Fig. 5A–B); with growth, the middle and posterior segments become thicker, resulting in a more consistent width along body (Fig. 5C–F). Specimens illustrated in Figure 5 measure 2.5–4.9 mm long with 19–34 setigers (Table 1). A second slightly larger set of specimens illustrated in Figure 6A–F with thickened part of body extending through anterior and middle segments and a narrow, dorsoventrally flattened posterior region. These specimens 3.1–5.2 mm long with 30–42 setigers (Table 1); largest specimens illustrated in Fig. 7A–F. Specimen in Fig. 7A, 6.0 mm long with 40 setigers; largest specimen in sample 10.25 mm long with 51 setigers (Fig. 7B–D); specimen in Fig. 5E, 7.3 mm long with 46 setigers; specimen in Fig. 7F–G 7.0 mm long with 40 setigers. Three complete specimens partially contained within tubes consisting entirely of small sand particles (Fig. 7H–I). Color in alcohol white.

With growth, rounded anterior setigers characteristic of post-larvae and juveniles become shorter and wider; middle segments become larger, then narrow again posteriorly with posterior segments becoming wide and dorsoventrally flattened. Largest specimens assume a thickened sausage shape with most segments short and crowded along entire body (Fig. 7A–E). Largest specimens with anterior dorsal segmental surface relatively smooth with indistinct segmental grooves; in addition a narrow mid-dorsal groove develops along anterior and middle segments (Fig. 7E–F) and a mid-ventral ridge line develops along middle and posterior segments.

Pre-setiger region of adults relatively short, wider than long; about as long as first four setigers (Fig. 7C, E–G). Prostomium broadly triangular, narrowing to rounded tip (Fig. 7F–G); eyespots absent; nuchal organs posterior lateral slits, not pigmented. Peristomium with three rings observed dorsally (Fig. 7F) and two rings ventrally (Fig. 7G). Dorsally, posterior ring and setiger 1 clearly separated by an intersegmental groove (Fig. 7F); ventrally, separation of anterior ring apparent laterally and dorsally, but merged with second ring ventrally forming posterior lip of mouth (Fig. 7G); several specimens with dorsal separation between first and second rings weak or indistinct; dorsal tentacles arising from posterior margin of third peristomial ring (Fig. 7F); first pair of branchiae lateral to dorsal tentacles. Second pair of branchiae arising dorsal to and posterior to notosetae on setiger 1 (Fig. 7F); subsequent branchiae arising in similar location on following setigers.

Parapodia swollen lateral lobes with noto- and neuropodia distinctly separated; pre- and postsetal lobes absent. Setae include capillaries and acicular spines; some specimens with a few long, natatory-like capillaries (Fig. 7B). Acicular spines all straight, tapering to narrow tip (Figs. 4G, 5H–I); neuropodial spines always occur more anteriorly than notopodial spines (Table 1). Except for largest specimens, neuropodial spines first present from setiger in first third of body, whereas notopodial spines arise more posteriorly in middle body segments. In largest specimens, origin of spines shifted more posteriorly to posterior third or fourth of body (Table 1). Smallest specimens with up to three neuropodial spines in a fascicle, whereas largest specimens, with only a single spine present, sometimes missing or skipping segments. For example, specimen illustrated in Fig. 5F–G with 40 setigerous segments with a single neuropodial spine first present from setiger 21 with spines missing from two subsequent segments, then resuming. These observations suggest inconsistent spine development with segmental growth in larger specimens. Setae of larger specimens include 7–8 long capillaries in anterior notopodia and 3–4 in posterior notopodia in addition to a single acicular spine; anterior neuropodia include 6–8 capillaries and posterior neuropodia with four capillaries plus an acicular spine in. Larger specimens have 1–2 additional long, natatory-like capillaries in anterior and middle notopodia (Fig. 7B).

Posterior end tapers to a narrow, triangular shaped pygidium terminating in a simple rounded lobe ventral to the anal opening (Fig. 7D).

Methyl green staining. Methyl green is concentrated on the pre-setiger region and first 3–4 setigers (Fig. 7B–C, E) with the strongest stain on the ventral side of the prostomium and lateral margins of the peristomium (Fig. 7C); additional stain occasionally retained laterally in grooves between anterior parapodia.

Comparative Remarks. The collection from Sta. Ch 105-B includes specimens ranging in size from about 2.5 to over 10 mm long and having 19 to 51 setigerous segments. These specimens overlap with smaller specimens from the type collection from Sta. Sl-3 and demonstrate a growth sequence from short post-larval forms to fully developed adults.

A general pattern of morphological change from postlarvae and juveniles to the adult body form is apparent when the full complement of specimens from Stations Sl-1 (types) and Ch 105-B are compared. Initially the post-

larvae and juveniles have 6–7 enlarged anterior moniliform setigers and a developing trunk region with narrow crowded segments (Figs. 3D–E, 4A–C). With growth, the larger rounded anterior setigers become less distinct and more crowded, with the moniliform shape of separate segments disappearing; the body tapers posteriorly along a narrowing trunk region (Figs 4D, 5A–E). Exceptions to this pattern include the regenerating holotype that has apparently lost the enlarged anterior setigers (Fig. 3A–C) and one paratype (Fig. 4E) where most of the segments, while not moniliform, are narrow and crowded only near the posterior end.

TABLE 1. Size, Setiger Count, and Acicular Spine Origin Data for *Chaetocirratulus gayheadius* (Hartman, 1965) from the Continental Slope off New England.

Station	Length (mm)	No. setigers	Neuro- spines begin	Noto -spines begin	Figure
Sl-3	1.6	7	7	0	4A
Sl-3	1.7	7	7	0	–
Sl-3	2.0	7	7	0	4B
Sl-3	2.3	8	8	0	3D
Sl-3	2.4	8	0	0	3E, 4C
Ch 105-B	2.5	19	5	10	5A
Ch 105-B	2.5	27	7	11	5F
Sl-3	2.7	20	6	9	4D
Ch 105-B	2.8	29	7	12	–
Ch 105-B	2.9	28	10	14	5B
Ch 105-B	3.1	17	7	12	5E
Ch 105-B	3.1	30	5	12	6A
Ch 105-B	3.4	31	10	17	6G
Sl-3	3.9	30	5	7	–
Sl-3	4.0	22	9	11	4E
Ch 105-B	4.1	34	8	10	5D
Ch 105-B	4.1	35	11	18	6B
Sl-3	4.3	28	6	9	4F
Ch 105-B	4.4	32	6	16	6D
Ch 105-B	4.5	31	8	14	6E
Sl-3	4.6	28	6	10	–
Ch 105-B	5.0	31	8	16	5C
Sl-3	5.0	26	6	8	–
Ch 105-B	5.2	34	11	15	6C
Ch 105-B	5.2	42	15	19	6F
Ch 105-B	6.0	40	13	24	7A
Ch 105-B	7.0	40	21	33	7F–G
Ch 105-B	7.2	44	28	34	–
Ch 105-B	7.3	46	28	33	7E
Ch 105-B	10.3	51	44	48	7B–D

With continued growth, the body of these worms becomes thicker (Fig. 6A–F) with little or no difference in size anywhere along the body; in addition, the posterior segments become dorsoventrally flattened. The largest specimens are sausage-shaped with no apparent difference in width anywhere along the body (Fig. 7A–E) except for a short pre-setiger region that is noticeably narrower than the following inflated and enlarged anterior setigers. This short and narrow anterior end on an inflated sausage-shaped body provides the adults of this species with a characteristic appearance not encountered in other cirratulids. The dorsal surface is relatively smooth on anterior segments with indistinct segmental grooves and a narrow dorsal groove. Juveniles have two peristomial rings, whereas in the

large adults, the anterior ring of juveniles is dorsally separated into two rings resulting in three rings, but the anterior two rings are merged ventrally forming the posterior lip of the mouth.

Four species of *Chaetocirratulus* have been identified from samples along the U.S. Atlantic continental slope. Of these, *C. gayheadius*, *C. hessleri* **n. sp**., and *C. tomaculus* **n. sp**. all have three peristomial rings, but differ in the nature and fate of these rings on the dorsal and ventral surfaces. Only *C. hessleri* **n. sp**. has a distinct dorsal crest that interrupts the three rings, whereas in *C. gayheadius* and *C. tomaculus* **n. sp**. the three peristomial rings are complete and not interrupted by a crest. *Chaetocirratulus gayheadius* differs from *C. tomaculus* **n. sp**. in having the anterior dorsal segmental surface relatively smooth with indistinct segmental grooves and a narrow dorsal groove. In contrast, the dorsal surface of *C. tomaculus* **n. sp**. exhibits a distinct segmental pattern on the dorsal surface with deep intersegmental grooves and no dorsal groove. The morphology of the four local species of *Chaetocirratulus* is compared in Table 2.

Biology. The sandy tubes found on three specimens from Sta. Ch 105-B is unusual. For most benthic cirratulids, tubes, when reported, are lined with thickened mucous or fine silt particles. Some species of *Kirkegaardia* have been reported to project their branchiae into the overlying water through openings in mucoid tubes (Blake & Magalhães 2019). Other species of *Kirkegaardia* form burrows within mud balls that serve as refuge or habitat (Blake 2016; Blake & Magalhães 2019). The presence of tubes consisting of tightly adhering clean sand particles in *C. gayheadius* (Fig. 7H–I) suggests a form of particle selection and cementing of these into tubes by the worms, the purpose of which is unknown.

Although long, natatory-like setae are present on the largest specimens, none were found with gametes.

Distribution. Off New England, 300–558 m.

Chaetocirratulus hessleri new species

Figures 8–9

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Chaetozone sp. B: Maciolek *et al.* 1987a: D-2 (in part).

Material examined. **Off New Jersey and Delaware, U.S. Mid-Atlantic ACSAR Program,** coll. R. Petrecca, Chief Scientist. **Sta. 3**: Cruise Mid-2, Rep. 3, 03 Aug 1984, 38°36′.84′N, 72°51.46′W, 2056 m, **holotype** (USNM 1660936).—**Off New England, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 3**: Cruise NA-3, Rep. 1, 03 Jul 1985, 41°01.37′N, 66°21.21′W,1337 m, **paratype** (USNM 1660937).

Description. A large species, holotype complete, with 90 setigers, 40 mm long and 3 mm wide across anterior setigers. Body elongate, not inflated along body but gradually narrowing in far posterior segments. Parapodia located laterally along body with intersegmental grooves not apparent in anterior setigers and only weakly so in posterior segments; dorsal surface elevated above parapodia, rounded and relatively smooth (Fig. 8A); venter similarly flattened, also lacking distinct intersegmental grooves in first half of body; distinct intersegmental grooves only apparent laterally between anterior parapodia. Dorsal and ventral grooves absent but with a narrow white line along venter, probably representing ventral nerve cord extending from posterior margin of peristomium posteriorly along most of body. Color in alcohol tan in first half of body, grey in posterior half. Distinct areas of dark, dusky pigment apparent on ventral surface of peristomium posterior to mouth and first two setigers, extending higher on sides; same pigment present on posterior border of first 4–5 parapodia (Fig. 9A, C–D).

Pre-setiger region about as wide as long. Prostomium broadly triangular, tapering to rounded apex (Fig. 8A); eyespots absent; nuchal organs at posterior lateral margins, mostly hidden by peristomium. Peristomium with three rings (Figs. 8A, 9A, C); first ring surrounding prostomium dorsally and forming posterior lip of mouth ventrally (Fig. 9A, D); second and third rings incomplete dorsally with a weakly developed dorsal crest (Fig. 8A). A short transverse notch present dorsally between first and second peristomial rings (Fig. 8A). Dorsal tentacles arise from posterior margin of third peristomial ring, with first pair of branchiae lateral to tentacles (Figs. 8A, 9C). Subsequent segmental branchiae dorsal to notosetae on posterior margin of individual parapodia. Branchiae present to about setiger 40.

Parapodia of anterior segments swollen, bearing distinct noto- and neuropodia from which setae arise (Fig. 9C). Parapodia less conspicuous in middle and posterior segments. Setae include long, smooth capillaries and acicular

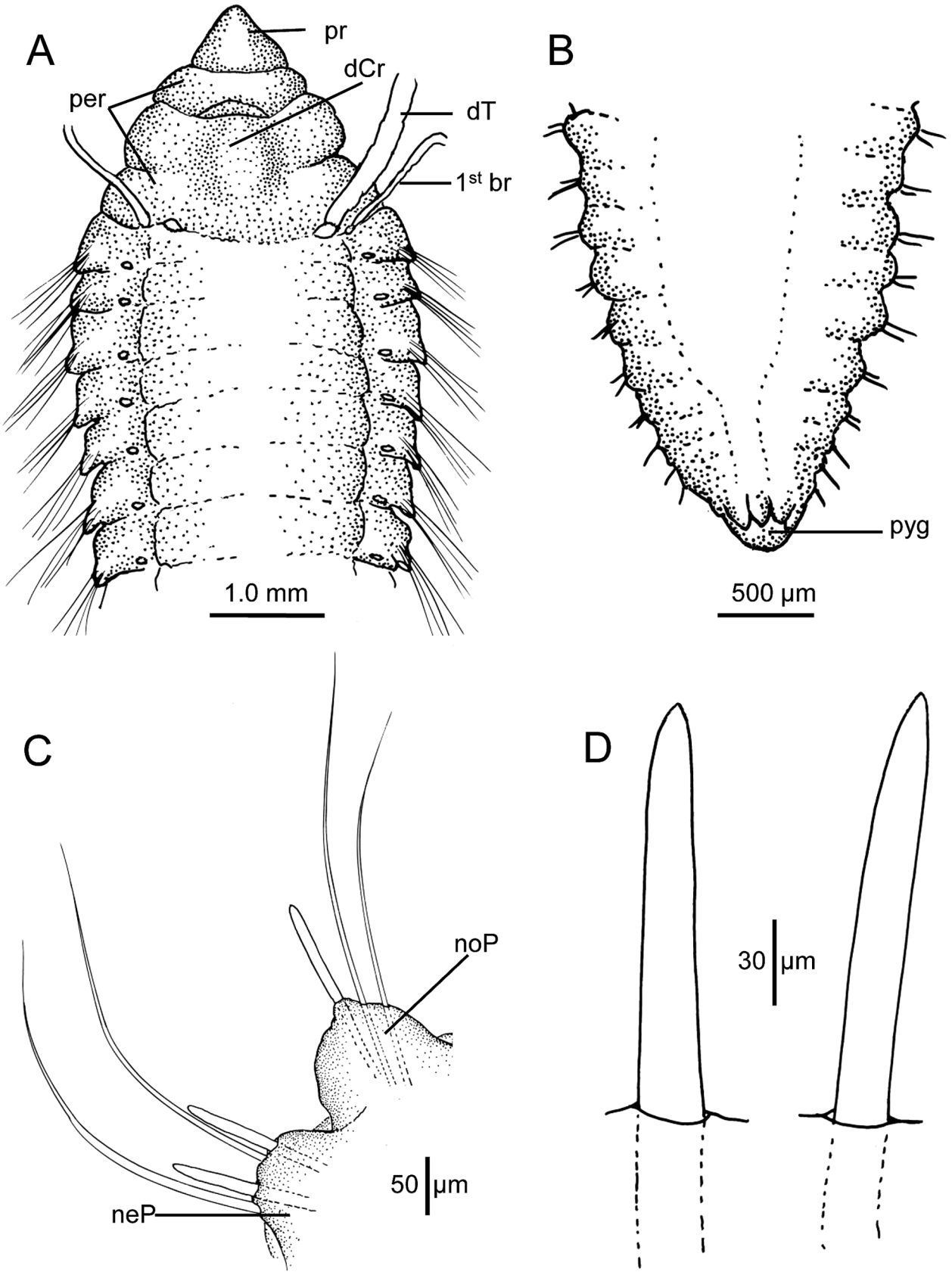

FIGURE 8. *Chaetocirratulus hessleri* **n. sp**. Holotype (USNM 1660936): A, anterior end, dorsal view; B, posterior end, dorsal view; C, setiger 60, anterior view; D, two neuropodial acicular spines.

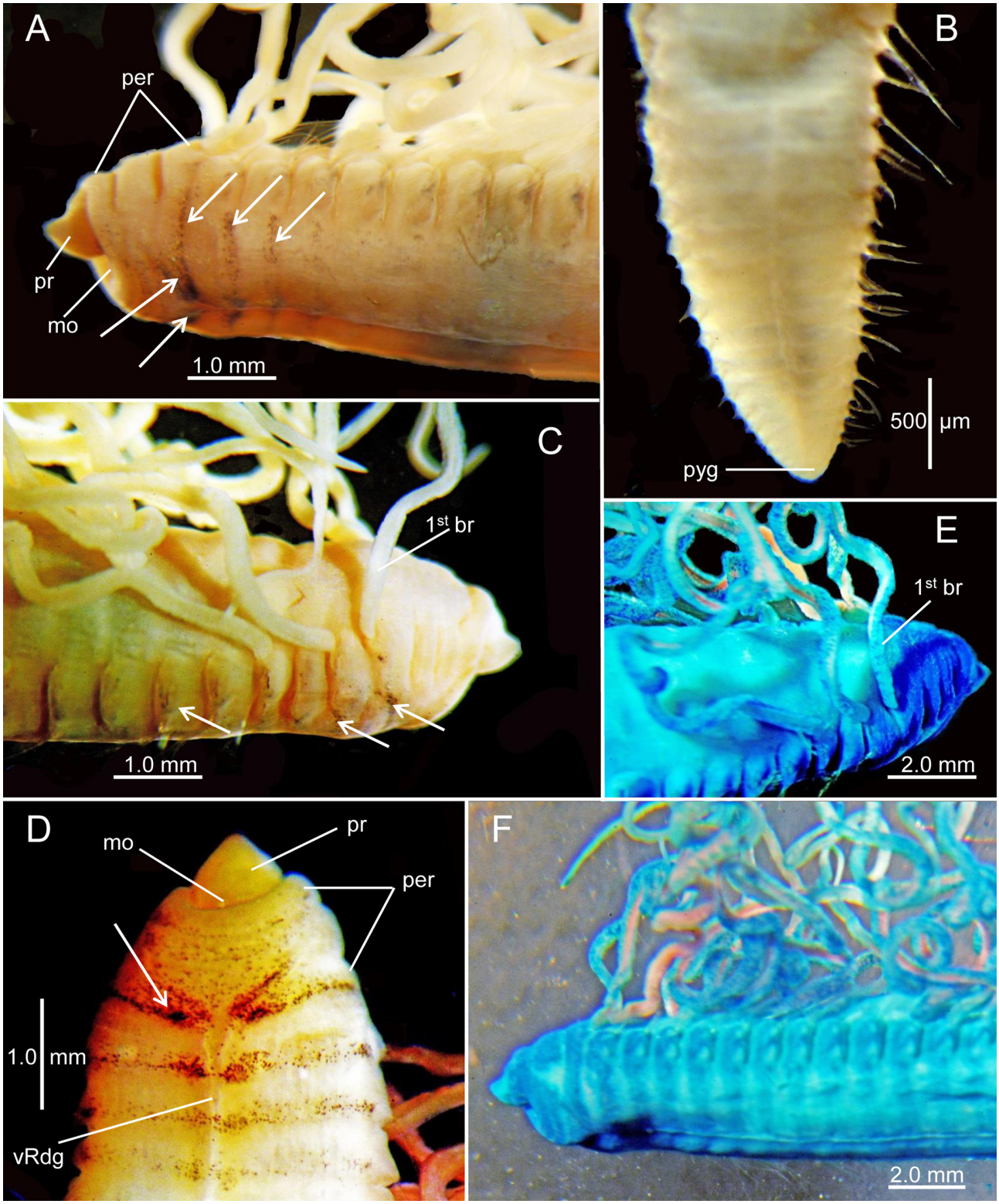

FIGURE 9. *Chaetocirratulus hessleri* **n. sp**. Holotype (USNM 1660936): A, anterior end, left lateral view; B, posterior end, dorsal view; C, anterior end, right dorsolateral view; D, anterior, ventral view; E, anterior end, dorsolateral view; F, anterior end, left lateral view. A–D stained with Shirlastain A; E–F stained with MG. Arrows in A, C, and D denote pigment.

spines. Capillaries numbering 19–21 per noto- and neuropodia in anterior setigers, reduced to 6–7 in middle segments and 2–3 in posterior setigers. Some capillaries with thicker shafts transitioning to acicular spines at about setiger 55–57 in both noto- and neuropodia (Fig. 8C). Individual spines with straight, not sigmoid, shafts and with bluntly rounded tips (Fig. 8C–D). Spines 1–2 per notopodium and 2–3 per neuropodium, accompanied by 2–3 capillaries.

Pygidium with smoothly rounded ventral lobe and 3–4 short dorsal lobes surrounding anal opening (Figs. 8B, 9B).

Variability. The paratype (USNM 1660937) is damaged, mostly complete, measuring 9.0 mm long and 1.2 mm wide with about 45 setigers, but at least five posterior segments missing. Last peristomial ring and first three setigers with black pigment spots on venter as in holotype. Most anterior and middle setae broken, but thick acicular spine observed in neuropodia of setiger 10. Three peristomial rings observed; dorsal crest present, but not as well developed as on holotype.

Methyl green staining. Methyl green imparts a distinctive pattern to the pre-setiger region and anterior parapodia (Fig. 9E–F). The entire prostomium and peristomium retain stain except for mid-dorsal and posterior-lateral clear areas. The anterior parapodia concentrate stain, which extends ventrally as a band onto the venter. The branchiae typically have numerous stained spots along their length; dorsal tentacles do not stain.

Remarks. Of the four species of *Chaetocirratulus* encountered in this study, three, including *C. hessleri* **n. sp**., have three peristomial rings. However, *C. hessleri* **n. sp**. is the only one to have a dorsal crest on the peristomium. In addition, *C. hessleri* **n. sp**. is the only one with conspicuous dark pigment on the ventral surface of the peristomium and first two setigers where it continues up and onto the lateral sides; the same pigment is also found on the posterior border of setigers 1–5. A comparison of all four species of *Chaetocirratulus* treated in this study is found in Table 2.

Etymology. This species is named for the late Dr. Robert E. Hessler, prominent deep-sea ecologist whose pioneering studies with Dr. Howard Sanders on the North Atlantic deep-sea benthos introduced the world to the undiscovered richness and diversity of deep-sea benthos.

Distribution. U.S. Atlantic continental slope, off New Jersey and Delaware, 2056 m; off New England, 1337 m.

Chaetocirratulus sandersi new species

Figures 10–11

urn:lsid:zoobank.org:act:B641B107-211D-4486-8C92-8A6710D46B48

Chaetozone sp. B: Maciolek *et al.* 1987a: D-2 (in part).

Material examined. **Off New Jersey and Delaware, U.S. Mid-Atlantic ACSAR Program,** coll. R. Petrecca, Chief Scientist. **Sta. 2A**: Cruise Mid-1, Leg 1, R/V *Cape Hatteras*, 01 Apr 1984, 38°35.78′N, 72°53.656′W, 2013 m, **holotype** (USNM 1660938).

Description. A moderately large species, holotype complete but damaged, 18 mm long, 3.5 mm wide across anterior setigers, with ca. 80 setigers; middle body segments about 4.5 mm wide, then narrowing to posterior end. Specimen partially damaged between setigers 19–20, distorting overall shape, but both sections remain joined (Fig. 11A). Body fusiform, widest in middle segments, with narrow crowded segments (Figs. 10A–B, 11A). Parapodia lateral with dorsal and ventral surfaces broad, with distinct intersegmental grooves across both surfaces (Fig. 10A–B). Dorsum elevated with distinct mid-dorsal groove (Fig. 10A), deepest along anterior segments, less prominent in middle and posterior segments; venter also elevated, but not as high, also with mid-ventral groove along anterior segments, with narrow ridge in groove (Fig. 10B). Middle and posterior segments lacking ventral groove. Color in alcohol light tan; venter of peristomium with a few minute scattered pigment spots.

Pre-setiger region broadly triangular, wider than long, about as long as first five setigers (Figs. 10A–B, 11A). Prostomium short, wedge-shaped, narrowing to rounded anterior margin (Fig. 10A–D); eyespots absent; nuchal organs narrow slits at posterior lateral margins. Peristomium with two rings, first largest with several transverse grooves or slits; dorsally surrounding posterior prostomium (Fig. 10A, C); ventrally forming large lip around mouth (Fig. 10 B, D); second ring narrower, dorsally bearing a pair of dorsal tentacles and first branchiae lateral to tentacles (Fig. 10A, C). Subsequent branchiae on setigers dorsal to notosetae. Most branchiae missing; a few short narrow filamentous branchiae retained in middle segments.

Parapodia well-developed along entire body, with those of first 20 anterior setigers largest and most prominent (Fig. 10A–C); noto- and neuropodia distinct ridges from which setae arise; separate postsetal lamellae not present. Setae include long, smooth capillaries and acicular spines. Capillaries numbering 9–10 per noto- and neuropodia in anterior setigers, reduced to 5–6 in middle segments and 1–3 in posterior setigers. Some capillaries with thicker shafts transitioning to acicular spines in mid-body at about setigers 27 (neuropodia) and 31 (notopodia). Individual spines with straight, not sigmoid, shafts and narrow rounded tips (Fig. 11C–D). Spines 1–2 per notopodium and 2–3 per neuropodium, accompanied by 1–3 capillaries.

Pygidium with a simple rounded, terminal lobe ventral to anal opening (Fig. 11B).

Methyl green staining. Methyl green stains the pre-setiger region heavily on both sides (Fig. 10C–D), continuing on the parapodia and producing transverse bands across the venter of anterior setigers (Fig. 10D); dorsal tentacles and branchiae not staining.

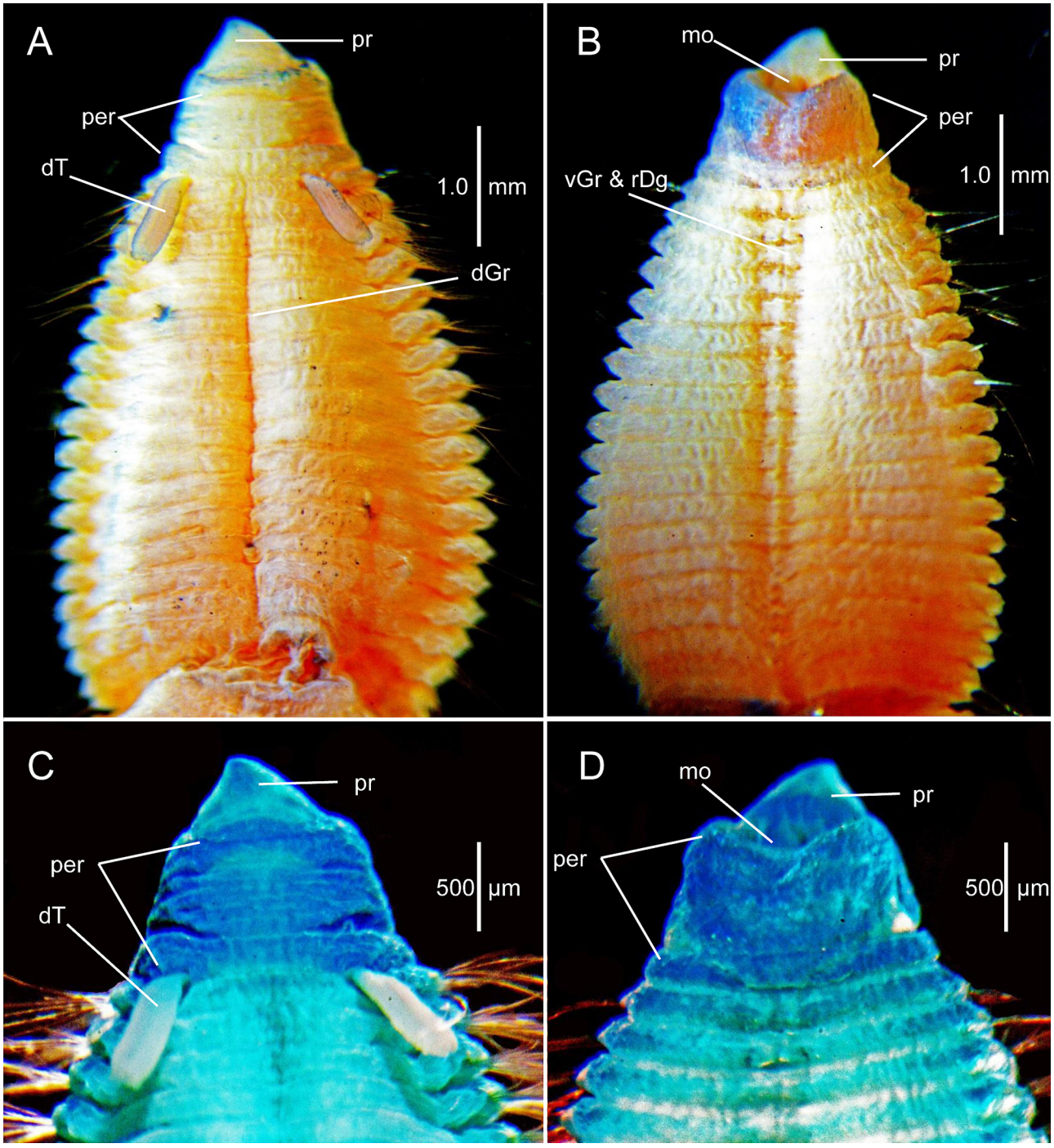

FIGURE 10. *Chaetocirratulus sandersi* **n. sp**. Holotype (USNM 1660938): A, anterior end, dorsal view; B, anterior end, ventral view; C, anterior end, dorsal view; D, same, ventral view. A–B, stained with Shirlastain A; C–D stained with MG.

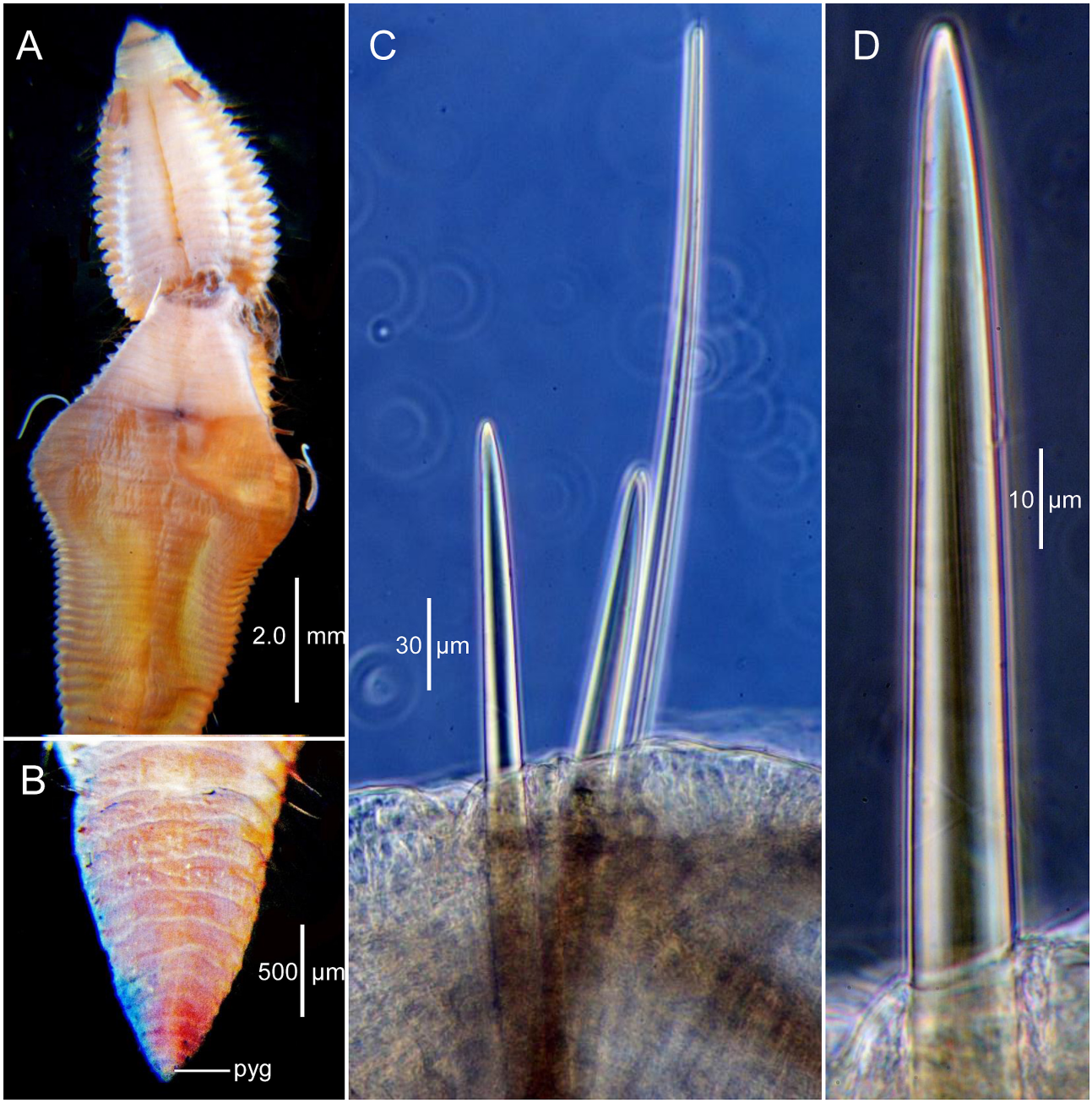

FIGURE 11. *Chaetocirratulus sandersi* **n. sp**. Holotype (USNM 1660938): A, anterior and middle sections of body in dorsal view showing damaged section; B, posterior end, dorsal view; C, two acicular spines and one capillary from posterior neuropodium; D, detail of neuropodial acicular spine. A–B stained with Shirlastain A.

Remarks. Among four species of *Chaetocirratulus* reported in this study from the U.S. Atlantic continental slope, *C. sandersi* **n. sp**. is the only one to have two peristomial rings instead of three. These are complete both dorsally and ventrally. No body pigment is present and there are distinct mid-dorsal and ventral grooves, the latter of which has a medial ridge. The morphology of the four species is compared in Table 2.

Etymology. This species is named for the late Dr. Howard Sanders, prominent ecologist whose classic studies with the late Dr. Robert Hessler on the North Atlantic deep-sea benthos introduced us to the undiscovered richness of deep-sea benthic infauna.

Distribution. Off New Jersey and Delaware, continental slope, 2013 m.

***Chaetocirratulus tomaculus* new species**
Figures 12–14
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Chaetozone gayheadia: Hartman & Fauchald 1971 (in part). **Not** Hartman 1965.

Material examined. (*147 specimens*) **Off New England Near Veatch Canyon**, R/V *Chain* Sta. Cruise 50, coll. R. R. Hessler, Chief Scientist, **Sta. Ch 87**: coll. 06 Jul 1965, 39°48.7′N, 70°40.8′W, 1102 m, **holotype** (LACM-AHF 12722), 11 **paratypes** (LACM-AHF Poly 12728); 130+ specimens including juveniles (LACM-AHF Poly 12729).—**Off New England, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 3**: Cruise NA-3, Rep. 3, 03 Jul 1985, 41°01.43′N, 66°20.21′W, 1328 m (1, USNM 1660943); Cruise NA-5, Rep. 3, 28 Apr 1986, 41°01.35′N, 66°20.24′W, 1355 m (1, USNM 1660940). **Sta. 9**: Cruise NA-1, Rep. 2, 12 Nov 1984, 39°50.44′N, 70°01.76′W, 1228 m (1, USNM 166041). **Sta. 10**: Cruise NA4, Rep. 2, 27 Nov 1985, 39°48.07′N, 70°05.32′W, 1234 m (1 juv., USNM 1660939); Rep. 3, 27 Nov 1985, 39°48.10′N, 70°05.33′W, 1219 m (1, USNM 1660942).

Description. A moderately sized species, with a thick grub-like or sausage-shaped body, widest in middle segments, tapering at anterior and posterior ends (Fig. 13A). Holotype (Fig. 12A–B) with 48 setigers, 9.9 mm long and 1.0 mm wide across middle segments. Largest paratype with 52 setigers, 14.1 mm long and 2.1 mm wide (Fig. 13A). Parapodia located laterally along body with intersegmental grooves well developed throughout. Dorsal surface elevated above parapodia, rounded with surface partitioned into rows of longitudinal ridges or blocks along most of body (Figs. 12C, 14B); venter similarly configured with prominent intersegmental grooves, ridges and blocks. Dorsal and ventral grooves absent, but with a narrow ridge along venter extending from peristomium to posterior end. Color in alcohol tan; with minute inconspicuous pigment spots present or absent on ventral surface of peristomium posterior to mouth and first two setigers.

Pre-setiger region short, about as wide as long; as long as first 4–5 setigers (Fig. 12A). Prostomium short, wide, broadly rounded anteriorly (Figs. 12A–B, 13A–C, 14B); smaller specimens with prostomium weakly triangular with narrower tip (Fig. 14E–G); eyespots absent; nuchal organs at posterior lateral margins, mostly hidden by peristomium. Peristomium with three rings, complete dorsally separated by distinct grooves lacking dorsal crest (Fig. 12A); incomplete ventrally (Fig. 12B); first peristomial ring surrounding prostomium dorsally and ventrally forming posterior lip of mouth and merged with second ring forming a large relatively smooth peristomial area only separated indistinctly by a shallow transverse groove (Figs. 12B, 13C); merged first and second ring narrowing, then continuing posteriorly overlapping third ring and middle of first 2–3 anterior setigers, continuing posteriorly as narrow mid-ventral ridge along entire body (Fig. 12B). Dorsal tentacles arise from posterior margin of third peristomial ring and with first pair of branchiae lateral to tentacles (Fig. 12A). Subsequent segmental branchiae occur dorsal to notosetae on posterior margin of individual parapodia. Branchiae missing on many specimens with stubs or scars present to about mid-body.

Parapodia of anterior segments bearing short, narrow noto- and neuropodia from which setae arise. Podia less conspicuous in middle and posterior segments. Setae include long, smooth capillaries and acicular spines. Capillaries numbering 19–22 per noto- and neuropodia in anterior setigers, reduced to 6–7 in middle segments and 2–3 in posterior setigers. Acicular spines in far posterior neuropodia first occurring in setigers 39–41 in largest specimens with 45–52 setigers; notopodial spines (Fig. 12D) in a few posteriormost setigers of same specimens, but irregular and may be absent on some setigers. Neuropodial spines 2–3 per neuropodium, each with straight shafts tapering to bluntly rounded tips (Figs. 12E–F; 13E, 14D); notopodial spines when present, each with slightly curved shafts tapering to sharply pointed tips (Fig. 12D); spines accompanied by 1–3 capillaries.

Pygidium with narrow rounded ventral lobe (Figs. 12C, 13D); with 4–5 short dorsal lobes surrounding anal opening (Figs. 12C).

Variability. Smaller specimens are narrower and thick, but with less of a sausage shape; some thick anteriorly, tapering posteriorly. Four smaller specimens are illustrated: Fig.14 E (2.2 mm long, 0.44 mm wide with 21 setigers); Fig. 14 F (2.8 mm long, 0.38 mm wide with 31 setigers) Fig. 14G (2.8 mm long, 0.43 mm wide with 26 setigers; Fig. 14H (3.6 mm long, 0.39 mm wide with 30 setigers). Acicular spines first present from setiger 6–10 in neuropodia and 8–10 in notopodia in these specimens. Specimen from NA-4, Sta. 10, comma-shaped, 3.5 mm long, 0.5 mm wide, with 33 setigers and first hooks in neuropodia from setiger 10.

Methyl green staining. Pre-setiger region with distinctive pattern; posterior half of prostomium with broad dorsal band; anterior margin not stained. Peristomium stained laterally, leaving dorsal surface unstained; two bands of lateral stain continuing across venter; similar lateral and ventral bands present on 4–6 anterior setigers (Fig. 14A–C).

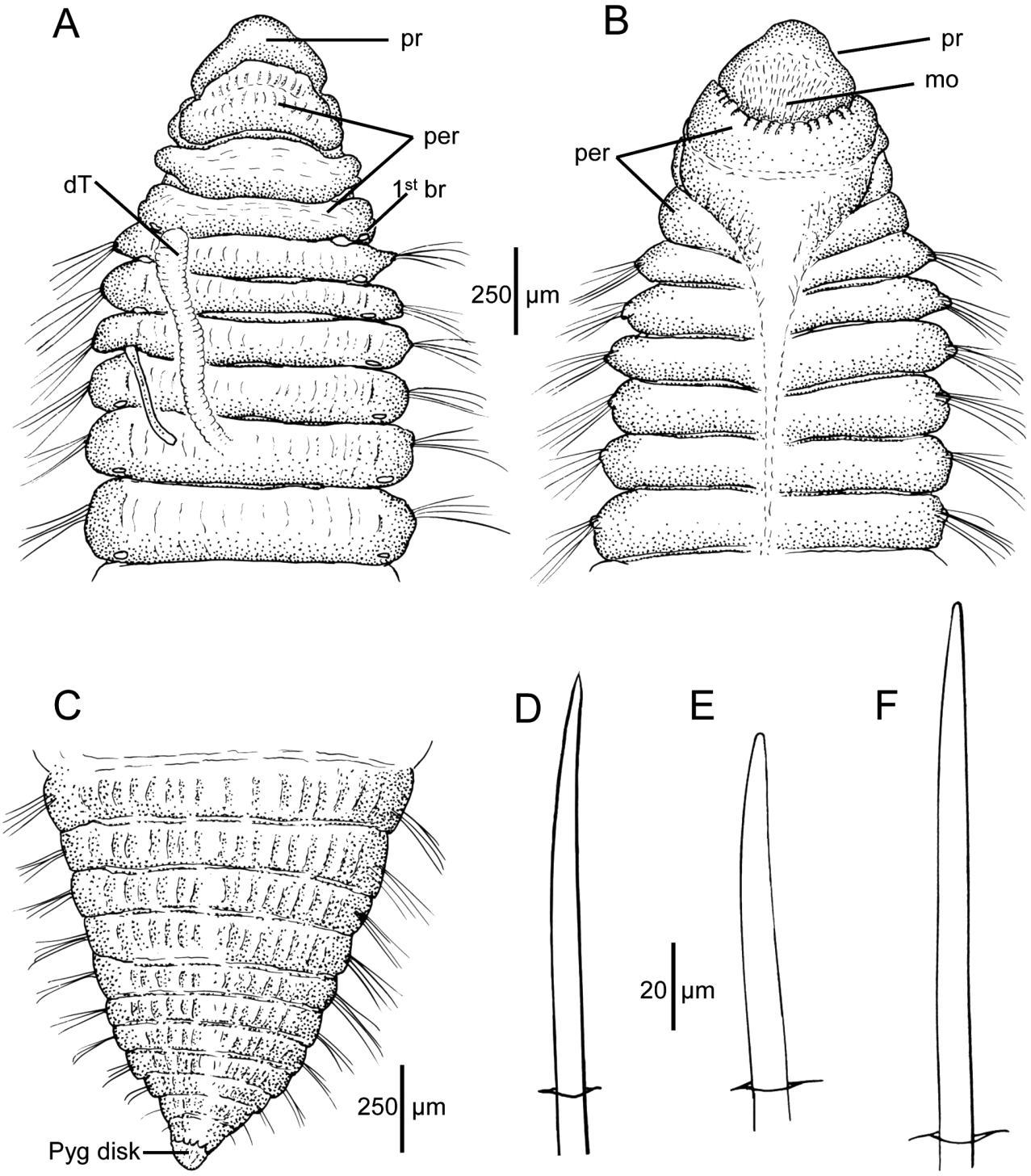

FIGURE 12. *Chaetocirratulus tomaculus* **n. sp**. Holotype (LACM-AHF Poly 12722): A, anterior end, dorsal view; B, anterior end, ventral view; C, posterior end, dorsal view; D, posterior notopodial acicular spine; E–F, posterior neuropodial acicular spines.

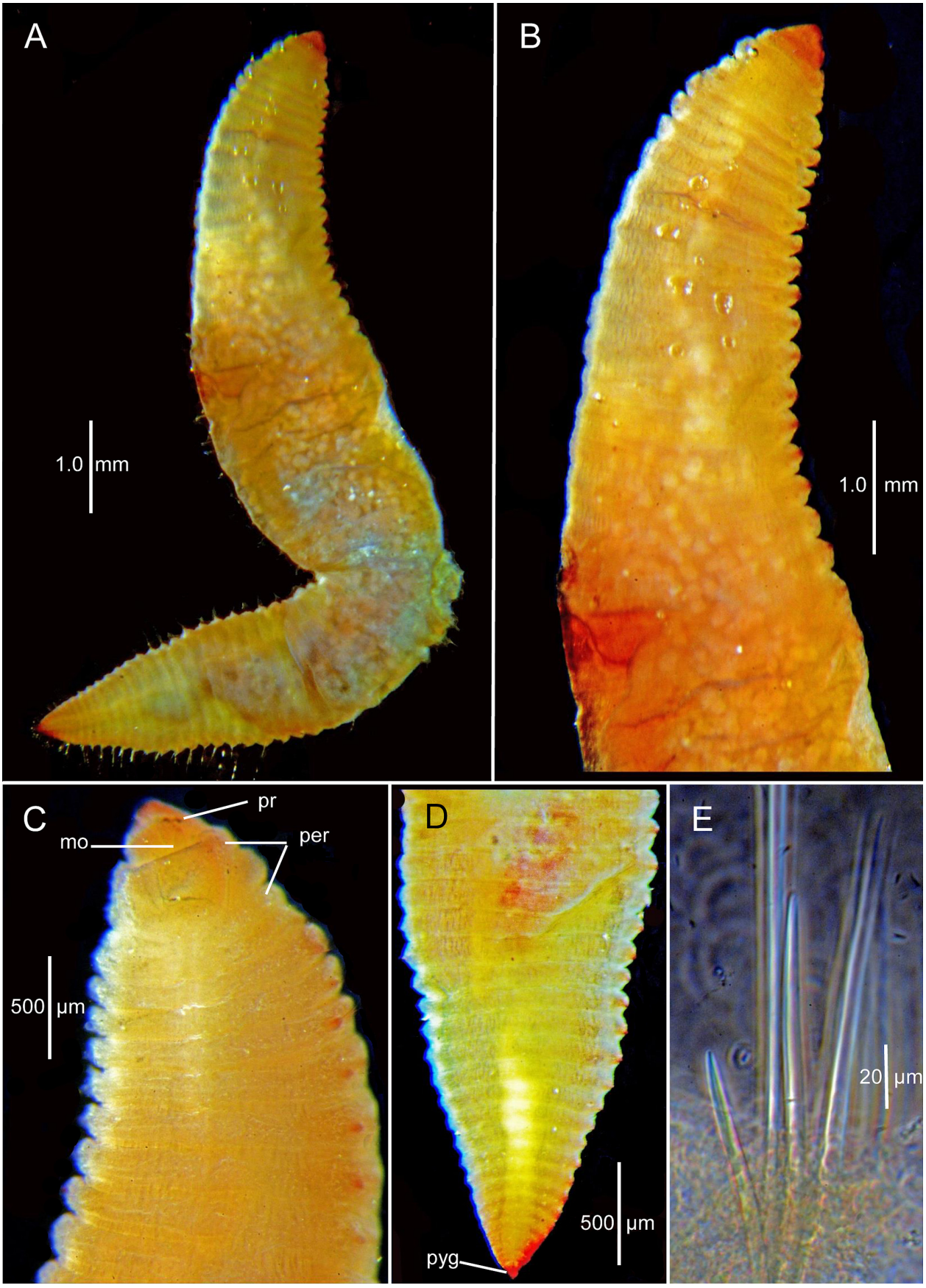

FIGURE 13. *Chaetocirratulus tomaculus* **n. sp**. Paratype (LACM-AHF Poly 12728): A, entire worm, dorsal view; B, anterior end, dorsal view; C, anterior ventral view; D, posterior end, dorsal view; E, neuroacicular spines and capillaries from a posterior neuropodium. Stained with Shirlastain A.

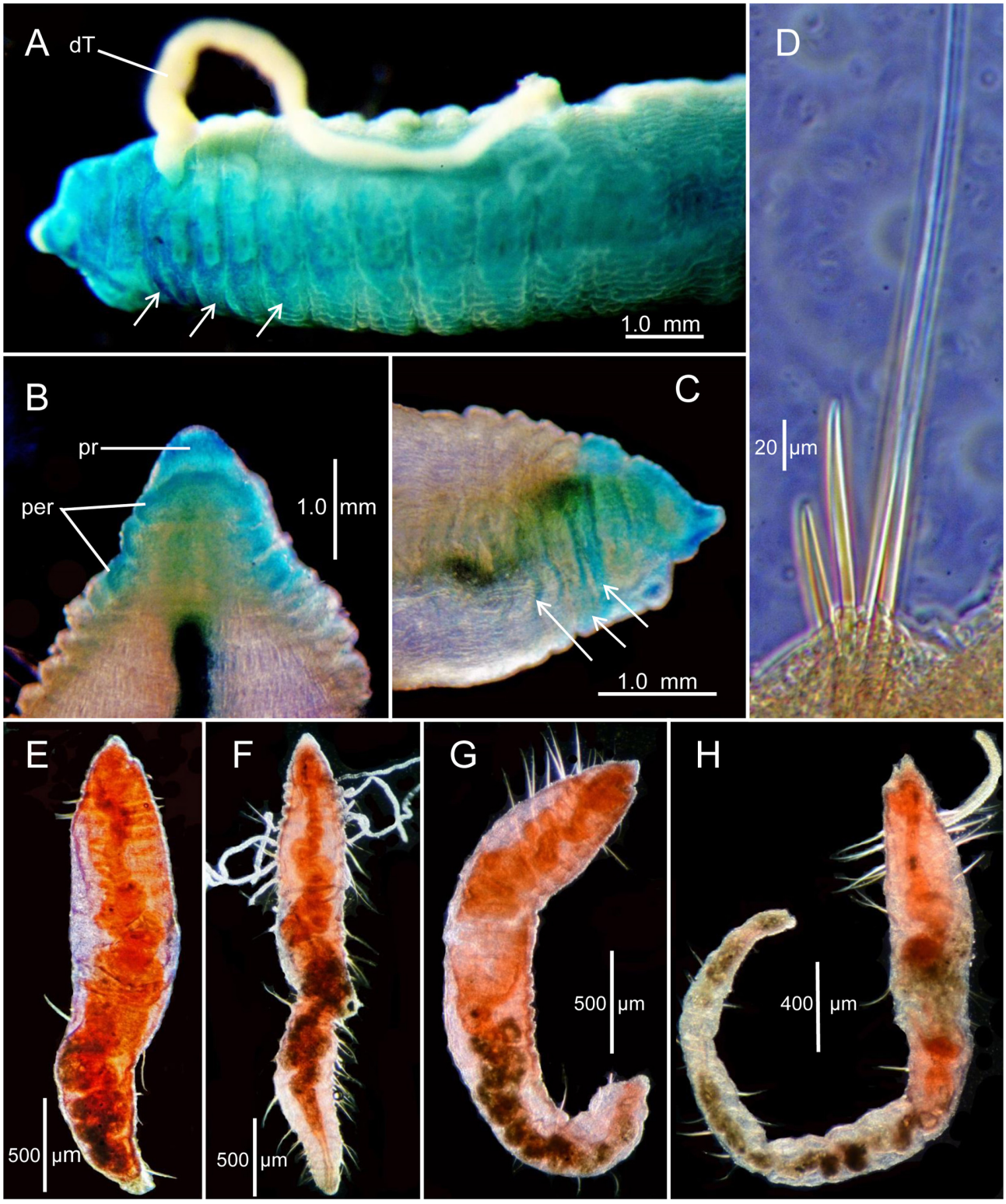

FIGURE 14. *Chaetocirratulus tomaculus* **n. sp**. Paratype (LACM-AHF Poly 12728): A, anterior end, left lateral view; B, anterior end, dorsal view; C, anterior right lateral view; D, neuroacicular spines and a capillary from a posterior neuropodium; E, 21-setiger specimen; F, 31-setiger specimen; G, 26-setiger specimen; H, 30-setiger specimen. A–C stained with MG; E–H stained with Shirlastain A. Arrows on A and C denote segmental MG pattern.

TABLE 2. Morphological Characteristics of Four Species of *Chaetocirratulus* from the U.S. Atlantic Continental Slope.

Character/Species	***C. gayheadius* (Hartman, 1965)**	***C. hessleri* n. sp.**	***C. sandersi* n. sp.**	***C. tomaculus* n. sp.**
Nature of prostomium	Broadly triangular	Broadly triangular	Short, wedge-shaped	Broadly rounded
Nature of peristomium	3 rings complete dorsally; 2 rings complete ventrally	3 rings dorsally with 1st complete; 2nd & 3rd incomplete with dorsal crest	2 rings complete; 1st large, 2nd narrow	3 rings complete dorsally; ventrally, 1st two merged, overlapping 3rd
Position of paired tentacles	Posterior margin of peristomium	Posterior margin of peristomium	Posterior margin of peristomium	Posterior margin of peristomium
Position of first branchiae	Lateral to dT	Lateral to dT	Lateral to dT	Lateral to dT
Nature of acicular spines	Straight shaft, tapering to narrow tip	Heavy straight shafts, with bluntly rounded tips	Straight shafts, not sigmoid, with narrow rounded tips	Ne: with straight shafts tapering to bluntly rounded tips; No: with pointed tips
Segmental origin of acicular spines	40–50 set adults No: 33–48 Ne: 21–44	90 set adult No & Ne: 55–57	80 set adult No: 31 Ne: 27	45–52 set adults No: 49–50 Ne: 39–41
Dorsal & ventral grooves	Narrow mid-dorsal groove along anterior & middle segments; mid-ventral ridge along middle and posterior segments	Absent	Mid-dorsal groove along anterior & middle segments; mid-ventral groove along anterior segments	Absent; venter with narrow ridge from peristomium to posterior end
Pygidium	Simple rounded lobe ventral to anal opening	With 3–4 short lobes surrounding anal opening; with rounded ventral lobe	Simple rounded lobe ventral to anal opening	With 4–5 short dorsal lobes surrounding anal opening; with narrow rounded ventral lobe
Distribution & depth	U.S. North Atlantic continental slope, off New England, 300–558 m	U.S. Mid-Atlantic continental slope, 2056 m	U.S. Mid-Atlantic continental slope, 2013 m	U.S. North Atlantic continental slope, off New England, 1102–1234 m

Abbreviations: dT, dorsal tentacle; Ne, neuropodial; No, notopodial; set, setiger.

Remarks. Globally, *Chaetocirratulus tomaculus* **n. sp**. is most similar to the type species *Chaetocirratulus andersenensis* (Augener, 1932) from Antarctica in having a broadly rounded prostomium, three peristomial rings and acicular spines limited to far posterior segments (Blake 2018). However, *C. andersenensis* has a distinctly short fusiform-shaped body and blunt-tipped acicular spines in both noto- and neuropodia, whereas *C. tomaculus* **n. sp**. has an elongate sausage-shaped body and blunt-tipped spines limited to neuropodia; notopodial spines are few and taper to a sharply pointed tip. In addition, the three peristomial rings of *C. andersenensis* are complete both dorsally and ventrally, whereas the rings are incomplete ventrally in *C. tomaculus* **n. sp**. with the first two rings merged, narrowing posteriorly and overlapping the third ring and several anterior setigers.

Locally, *Chaetocirratulus tomaculus* **n. sp**. is similar to *C. hessleri* **n. sp**. in having three peristomial rings, acicular spines limited to posterior setigers, and a similar methyl green staining pattern. However, *C. tomaculus* **n. sp**. has a broadly rounded prostomium instead of one that is triangular and narrows to an apical point, all three peristomial rings are complete dorsally instead of incomplete with a dorsal crest in *C. hessleri* **n. sp**. All four U.S. Atlantic species are compared in Table 2.

Biology. One large paratype with coelom packed with oocytes measuring 100–120 μm in diameter. No sediment data is available from Station Ch 87.

Etymology. The epithet, *tomaculus*, is from the Latin, *tomacina*, for a kind of sausage, in reference to the sausage-shaped body of this species.

Distribution. Off New England, continental slope depths of 1102–1328 m.

Genus *Chaetozone* Malmgren, 1867

Type species: *Chaetozone setosa* Malmgren, 1867, by monotypy.

Diagnosis. (Emended from Blake 2018). Prostomium conical to pointed, usually lacking eyespots, with a pair of small nuchal slits or depressions at posterior edge, sometimes pigmented. Peristomium with a single pair of grooved dorsal tentacles arising from posterior margin or sometimes more posterior on an achaetous anterior segment, or rarely on an anterior setiger. First pair of branchiae arising near dorsal tentacles, an achaetous segment or first setiger; sometimes with first two pairs of branchiae on a single anterior segment. Body usually expanded anteriorly and narrowed posteriorly, middle or posterior body segments sometimes moniliform; posterior end often expanded. Setae include capillaries on most setigers and acicular spines in neuropodia and notopodia, with spines typically concentrated in posterior segments, usually forming distinct armature with spines carried on cinctured segments with elevated membranes; cinctures with few to many spines sometimes encircling entire posterior end, accompanied with none to many alternating capillaries; bidentate spines sometimes present in juveniles or occasionally in ventral-most position of far posterior setigers of adults, accompanying unidentate spines in cinctures; some species with long, natatory-like capillary notosetae, sometimes limited to gravid individuals. Pygidium a simple lobe, disk-like, with long terminal cirrus, or few short lobes.

Remarks. Species of *Chaetozone* are recognized by having acicular spines in both noto- and neuropodia and with those of posterior segments frequently numerous and arranged in conspicuous spreading fascicles that often entirely encircle the body providing a characteristic armature. However, the species identified from the Atlantic slope and Georges Bank MMS surveys in the 1980s were classified according to the genera as defined by Hartman (1961, 1969). Effectively, any bitentaculate species having unidentate spines were referred to the genus *Chaetozone*. Because of this, several of the provisional taxa that were referred to *Chaetozone* from those surveys are now included in the genera *Chaetocirratulus* or *Tharyx*. Nevertheless, several species encountered in this study do have a reduced number of acicular spines that are not superficially conspicuous and as such are peripheral to the above definition. As part of this study, 12 species of *Chaetozone*, nine new to science are reported. In order to simplify the presentation of the 12 species of *Chaetozone* being reported here, they are grouped and arranged according to three categories with shared morphological characteristics. Each of these three categories or groups are introduced and discussed in order. The following 12 species of *Chaetozone* are treated in the present study:

The *Chaetozone curvata* group:

Chaetozone adunca **n. sp**.
Chaetozone anasima Doner & Blake, 2006
Chaetozone brychiata **n. sp**.

The *Chaetozone gracilis* group:

Chaetozone artaspinosa **n. sp**.
Chaetozone castouria **n. sp**.
Chaetozone novagracilis **n. sp**.
Chaetozone paucispinosa **n. sp**.

The *Chaetozone setosa* group:

Chaetozone diodonta Doner & Blake, 2006
Chaetozone donerae **n. sp.**
Chaetozone hystricosa Doner & Blake, 2006
Chaetozone lophia **n. sp**.
haetozone profunda **n. sp**.

The *Chaetozone curvata* group

Remarks. *Chaetozone curvata* Hartmann-Schröder, 1965 from nearshore habitats in Chile was the first species of *Chaetozone* to be described having acicular spines with a narrow filamentous tip that curves back and merges with the shaft. Subsequently, six additional species were described with this type of spine (Blake 1996, 2006, 2015, 2018; Doner & Blake 2006; Dean & Blake 2007); two new species representing the eighth and ninth species in this group are reported in the present study; additional specimens of *C. anasima* are also reported and described. The two new species are the first from deep-water belonging to this group. The morphology of all nine species in the *C. curvata* group is compared in Table 3.

Chaetozone adunca new species

Figures 15–16
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Chaetozone sp. 11: Blake *et al*. 1987: 61, 68, C-2; Maciolek *et al*. 1987b: D-2; Blake & Grassle 1994: 850, 855; Blake & Hilbig 1994: 883–884, 896; Hilbig 1994: 940.
Chaetozone sp. B: Maciolek *et al*. 1987b: D-2 (in part).
Chaetozone sp. 1: Maciolek *et al*. 1987b: D-2 (in part).

Material examined. (*407 specimens*) **Off Cape Hatteras, North Carolina, US South Atlantic ACSAR Program**, coll. J.A. Blake, Chief Scientist. **Sta. 9**: Cruise SA-3, Rep. 1, 22 Jul 1984, 35°28.30′N, 74°47.70′W, 579 m, **holotype** (USNM 1660944), 7 **paratypes** (USNM 1660945); Rep. 2, 22 Jul 1984, 3°28.40′N, 74°47.50′W, 614 m, 18 **paratypes** (USNM 1660946); Rep. 3, 22 Jul 1984, 35°28.30′N, 74°47.60′W, 598 m, 32 **paratypes** (USNM 1660947); Cruise SA-4, Rep. 1, 24 May 1985, 35°28.41′N, 74°47.44′W, 640 m, 23 **paratypes** (USNM 1660948); Rep. 2, 24 May 1985, 35°28.41′N, 74°47.56′W, 603 m, 9 **paratypes** (USNM 1660949); Rep. 3, 24 May 1985, 35°28.28′N, 74°47.52′W, 623 m, 25 **paratypes** (USNM 1660950); Cruise SA-5, Rep. 1, 25 Sep 1985, 35°28.41′N, 74°47.46′W, 629 m, 18 **paratypes** (USNM 1660951); Rep. 2, 25 Sep 1985, 35°28.41′N, 74°47.47′W, 629 m, 23 **paratypes** (USNM 1660952).—**MMS Cape Hatteras Survey, August 1992**, coll. J.A. Blake, Chief Scientist. **Sta. SA-9**: 35°28.36′N, 74°47.42′W, 620 m (57, USNM 1660953); **Sta. CH-1**: 35°42.47′N, 74°46.58′W, 804 m (15, USNM 1660954); **Sta. CH-3**, 35°37.08′N, 74°46.12′W, 812 m (7, USNM 1660955); **Sta. CH-18**: 35°30.01′N, 74°47.61′W, 530 m (1, USNM 1660956); **Sta. CH-19**: 35°29.79′N, 74°46.59′W, 812 m (13, USNM 1660957); **Sta. CH-34**: 35°25.10′N, 74°48.35′W, 775 m (8, USNM 1660958); **Sta. CH-41**: 35°22.19′N, 74°52.31′W, 590 m (6, USNM 1660959); **Sta. CH-42**: 35°21.28′N, 74°50.64′W, 785 m (1, USNM 1660960).—**Off Cape Lookout, North Carolina**, ACSAR, **Sta. 2**: Cruise SA-3, Rep. 1, 15 Jul 1984, 34°14.50′N, 75°43.90′W, 984 m (1, USNM 1660961); Rep 3, 15 Jul 1984, 34°15.00′N, 75°43.70′W, 1002 m (2, USNM 1660962).—**Off Charleston, South Carolina**, ACSAR **Sta. 14**: Cruise SA-4, Rep. 3, 20 May 1985, 32°23.67′N, 77°01.12′W, 803 m (1, USNM 1660963).—**Off New England, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 4**: Cruise NA-2, Rep. 1, 28 Apr 1985, 40°21.23′N, 67°32.32′W, 563 m (3, USNM 1660964); Rep. 2, 28 Apr 1985, 40°21.23′N, 67°32.33′W, 572 m (6, USNM 1660965). **Sta. 7**: Cruise NA-1, Rep. 1, 10 Nov 1984, 40°27.54′N, 67°40.34′W, 560

m (19, USNM 1660966); Rep. 2, 10 Nov 1984, 40°27.49′N, 67°40.29′W, 560 m (21, USNM 1660967); Rep. 3, 10 Nov 1984, 40°27.52′N, 67°40.36′W, 560 m (1, USNM 1660968); Cruise NA-2, Rep. 1, 28 Apr 1985, 40°27.50′N, 67°40.27′W, 560 m (10, USNM 1660969); Rep. 2, 28 Apr 1985, 40°27.46′N, 67°40.22′W, 560 m (22, USNM 1660970); Rep. 3, 28 Apr 1985, 40°27.44′N, 67°40.19′W, 558 m (4, USNM 1660971); Cruise NA-3, Rep. 1, 06 Jul 1985, 40°27.47′N, 67°40.26′W, 556 m (22, USNM 1660972); Rep. 2, 06 Jul 1985, 40°27.50′N, 67°40.22′W, 555 m (12, USNM 1660973); Rep. 3, 06 Jul 1985, 40°27.48′N, 67°40.21′W, 560 m (18, USNM 1660974); **Sta. 12**: Cruise NA-2, Rep. 2, 04 May 1985, 39°54.26′N, 70°55.07′W, 555 m (1, USNM 1660975); Cruise NA-5, Rep. 2, 06 May 1986, 39°54.27′N, 70°55.17′W, 548 m (1, USNM 1660976); Cruise NA-6, Rep. 2, 30 Jul 1986, 39°54.26′N, 70°55.07′W, 559 m (1, USNM 1660977); Cruise NA-6, Rep. 3, 30 Jul 1986, , 39°54.24′N, 70°55.09′W, 563 m (1, USNM 1660978).

Description. A moderately sized species, holotype with 75 setigers, 10.25 mm long, 0.5 mm wide across setiger 1, increasing over swollen anterior segments to 1.1 mm wide, and then decreasing posteriorly to 0.5 mm wide. Body variable in shape, larger specimens with a swollen thoracic region (Fig. 15A); most specimens with thorax only slightly enlarged (Fig. 16A–B). Individual segments short, narrow, about five times wider than long at first, with some middle thoracic segments 6–8 times wider than long in some specimens; posterior cinctured segments about twice as wide as long (Figs. 15B, 16F). Venter with shallow groove along most of body, absent in posterior cinctured segments. Dorsum with narrow groove in mid-body segments (Fig. 15A), reduced posteriorly. Posterior cinctured segments with deep intersegmental grooves (Figs. 15B, 16F) and a low elevated membrane from which capillaries and acicular spines emerge (Fig. 16B). Color in alcohol light tan; no apparent pigmentation.

Pre-setiger region long, narrow, smooth, about as long as first ten setigers (Fig. 15A). Prostomium long, narrow, triangular, pointed anteriorly, merging seamlessly with peristomium (Fig. 15A); eyespots absent; nuchal organs narrow slits. Peristomium triangular, not divided into rings, with weakly developed shallow lateral grooves visible on some specimens; dorsum narrow, producing weakly developed dorsal crest (Fig. 15A). Peristomium merging seamlessly with setiger 1; dorsal tentacles arising from posterior margin with first pair of branchiae lateral to tentacles (Fig. 15A); second pair of branchiae dorsal to notosetae on setiger 1 and posterior to position of first branchiae; subsequent branchiae from setiger 2 in same location dorsal to notosetae; present along most of body, but most missing and reduced to stubs or scars.

Parapodia of anterior and middle segments reduced to low ridges or mounds from which setae arise; posterior parapodia swollen, with low raised membrane from which setae arise forming prominent segmental cinctures on last 20–25 setigers. Setiger 1 and thoracic segments with 9–12 capillaries in notopodia and neuropodia; capillaries mostly of moderate size; a few long, natatory-like capillaries present or absent, but not associated with sexual maturity. Acicular spines first present in holotype from setiger 58 in notopodia and setiger 55 in neuropodia; spines 1–2 at first, increasing posteriorly, transitioning into full cinctures with 14 spines in notopodia and 13 neuropodia, up to 27 spines on a side (Fig. 16C); spines alternating with capillaries as long as or slightly longer than spines; cinctures with only narrow dorsal, lateral, and ventral gaps between noto- and neuropodial fascicles providing a prominent armature (Fig. 16C–D). Notopodial spines clearly longer than neuropodial spines (Fig. 16C). Individual spines with basal manubrium at emergence from podial lobes; spines curving and tapering gradually to narrow blunted tip at first (Figs. 15C, E–G, 16D–E); more posterior spines with narrow hooked tip (Fig. 15H–J); last 3–5 cinctures bearing spines where tip of hook curves back and merges with shaft (Figs. 15D, K).

Body narrowing sharply in last few cinctured segments, terminating in simple pygidium with a small, semicircular disk ventral to anal opening (Figs. 15B, 16F).

Methyl green staining. A distinct MG pattern present (Fig. 16G), with the entire pre-setiger region staining intensely, with only the tip of prostomium and a diagonal transverse band between the prostomium and peristomium not staining; about 9–10 anterior segments also retaining stain laterally and ventrally; rest of body only staining weakly, with no pattern; de-stains rapidly; pre-setiger and anterior segmental stain retained well after return to alcohol.

Remarks. *Chaetozone adunca* **n. sp**. belongs to the *C. curvata* group and represents the eighth species to be reported with acicular spines having a narrow tip that curves back and merges with the shaft. *Chaetozone adunca* **n. sp**. differs from others in this group by having a smooth pre-setiger region that is not divided into separate rings and with most segments having the acicular spines narrowing to a blunt or curved tip, with the spines having recurved tips limited to the posteriormost cinctured segments. This transition from blunt-tipped spines to the recurved type has not been previously reported in the genus. Two other species in group are also reported in the present paper: *C. anasima* and *C. brychiata* **n. sp**. (see below). All known species in the *C. curvata* group are compared in Table 3.

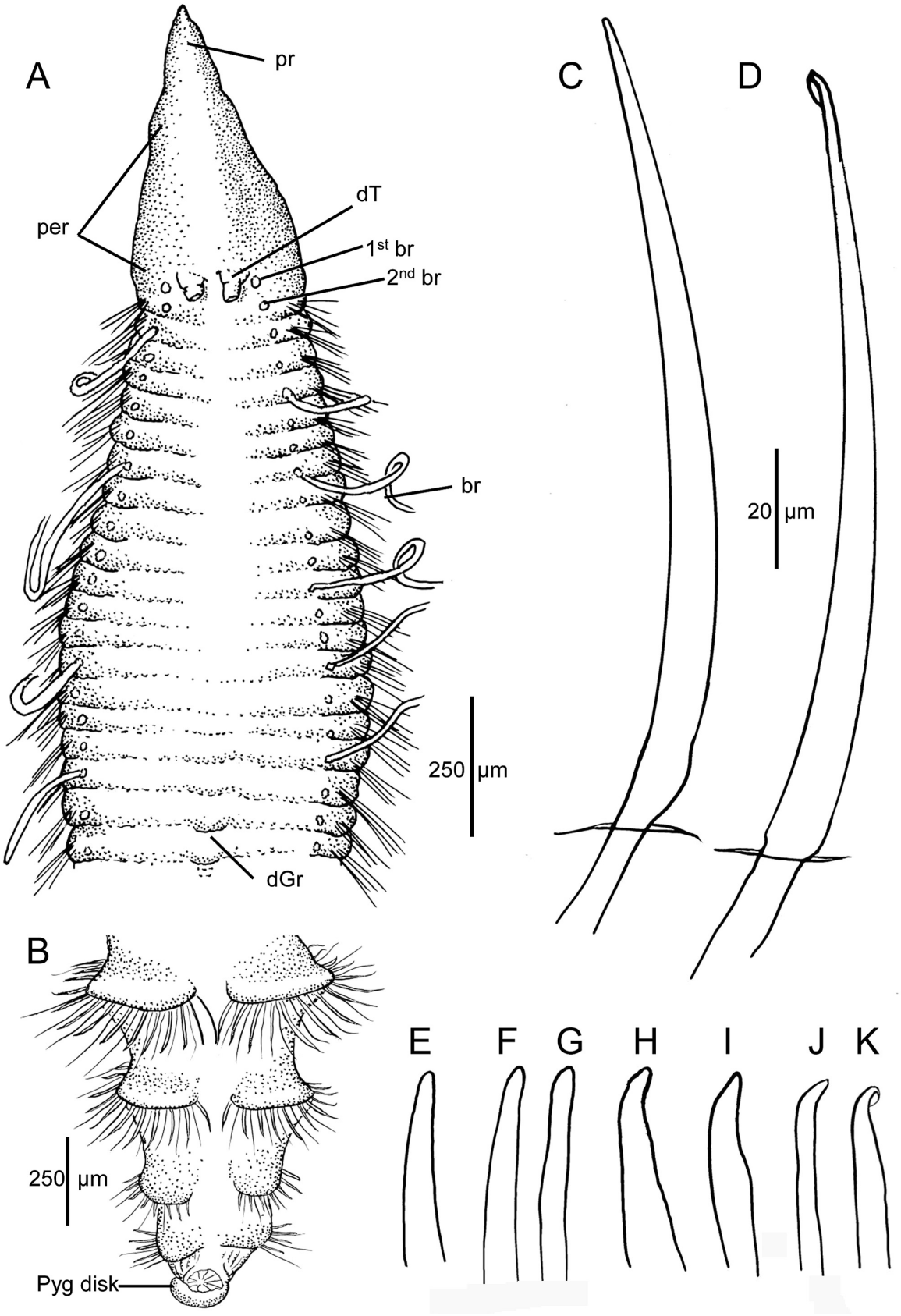

FIGURE 15. *Chaetozone adunca* **n. sp**. Holotype (USNM 1660944): A, anterior end, dorsal view; B, posterior end, dorsal view. Paratypes (USNM 1660947): C, neuropodial acicular spine with narrow blunted tip; D, neuropodial acicular spine from far posterior setiger with recurved tip; E–I, acicular spines with blunted tips; J–K, acicular spines with curved (J) and recurved (K) tips.

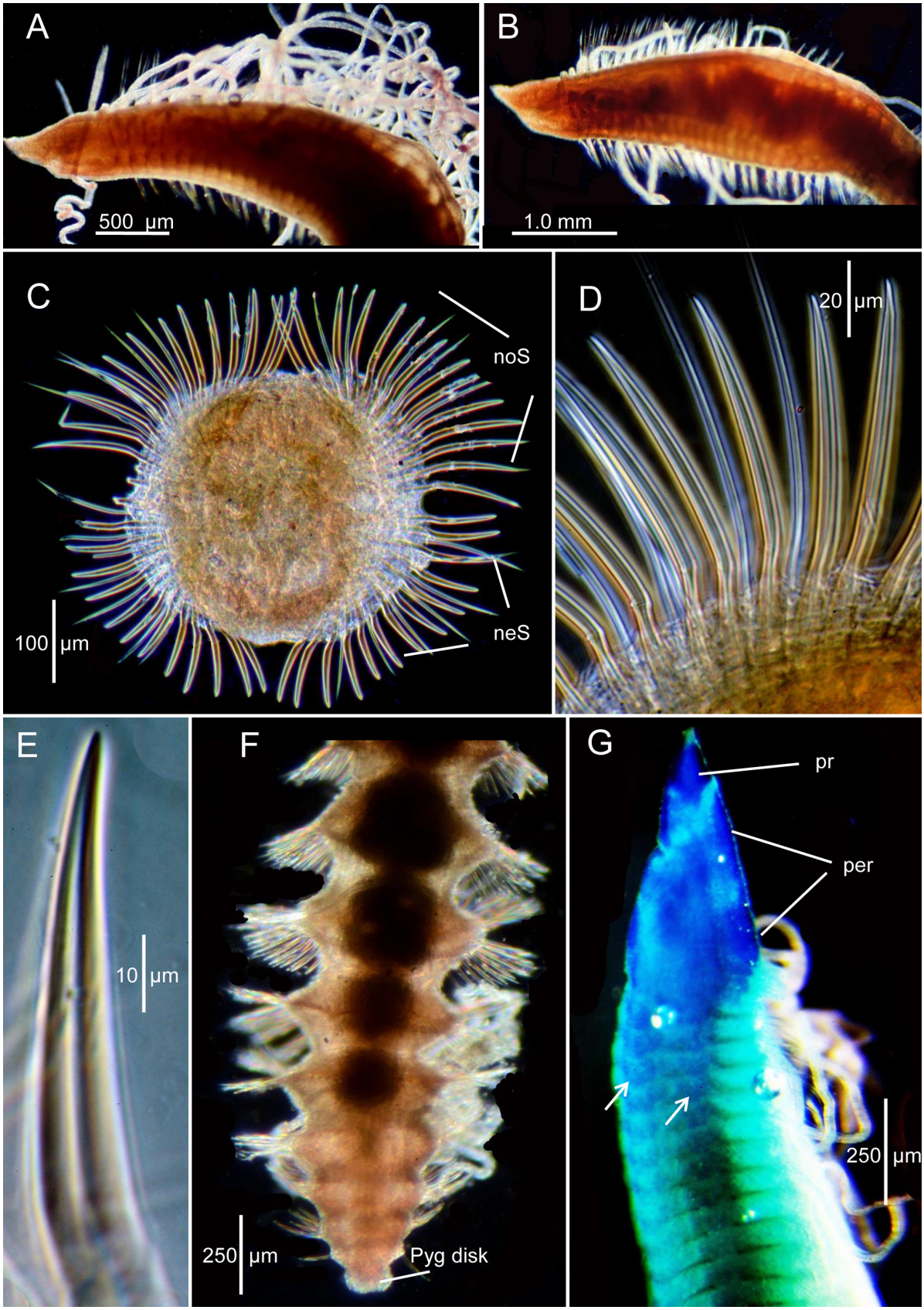

FIGURE 16. *Chaetozone adunca* **n. sp**. Paratypes (USNM 1660947): A, anterior end, left lateral view; B, same specimen, dorsolateral view; C, posterior segment, anterior view with full cinctures of 27 spines on a side and narrow dorsal and ventral gaps; D, detail of notopodial acicular spines and capillaries; E, neuropodial acicular spine; F, posterior end, dorsal view; G, anterior end, left lateral view, arrows denote MG. A–D, F stained with Shirlastain A; G, stained with MG.

TABLE 3. Taxonomic Characteristics of Nine Species of *Chaetozone* having Acicular Spines with Recurved Tips.

Species/ Character	Nature of segment 1	Nature of peristomium	Position of first pair of branchiae	Position of paired tentacles	Nature of posterior cinctures	Nature of posterior spines	Companion setae with spines
C. adunca **n. sp**.	Merged with peristomium	Smooth, with single long ring; weakly developed narrow dorsal crest	Per, lateral to dT	Posterior margin of per	Complete, up to 13 spines in noto & 14 in neuro; 23 on a side (holotype)	Curved shaft with basal manubrium; narrowing to blunt tip, then pointed, tip becoming inwardly curved and merged with shaft in posterior-most segments	Alternating thin capillaries
C. allanotai Blake, 2006	Entirely fused with Set 1	Single large ring with two weakly developed lateral grooves	Anterior margin Set 1, second br also on Set 1	Junction of per & Set 1	Complete, 11–13 spines in noto & 15–16 neuro; 16–29 on a side	Shaft straight, narrowing to fine inwardly curved tip, then merged with shaft	Alternating thin capillaries
C. anasima Doner & Blake, 2006	Segment 1 is 1st Set	Three rings separated laterally and broad dorsal crest	Per, lateral to dT	Posterior margin per	Partial, with dorsal and lateral gaps	Shaft straight, curved apically with tip sharply curved toward shaft	Alternating thin capillaries
C. brychiata **n. sp.**	Merged with peristomium	Two rings, first largest, not crossing dorsum, with large dorsal crest	On Set 1	Posterior margin of per	Partial, with 11–12 spines on a side and broad dorsal gap	Long, narrow curved shaft tapering to narrow hooked tip	Alternating with thin capillaries
C. camasetosa Blake 2015	Entirely fused with Set 1	Three distinct rings observed laterally, not crossing dorsum	Anterior margin Set 1, second br also on Set 1	Posterior margin per	Complete, with; 9–11 spines in noto & 11–12 in neuro; 20–23 on a side	Shaft with basal manubrium, long tapering; tip sharply curved inward & adhering to shaft	Alternating, thin, short capillaries
C. commonalis Blake, 1996	Segment 1 is 1st Set	Three distinct annular rings	Set 1	Posterior margin per ring 3	Complete with mid-dorsal gap; 10–11 spines in noto & 11–12 in neuro; 21–23 on a side	Long straight shaft, tapering to curved tip that bends inward & attaches to shaft	Alternating with thin capillaries
C. curvata Hartmann-Schröder, 1965	Segment 1 is 1st Set	Three distinct rings, distinct dorsally and laterally	Set 1	Posterior margin per	Complete, 12 spines in noto & 10 in neuro; 22 on a side	Shaft straight, curved apically with tip sharply curved toward shaft	Alternating thin capillaries
C. gesae Blake, 2018	Segment 1 is 1st Set	Three distinct rings, with smooth dorsal crest	Anterior margin set 1, second br also on set 1	Posterior margin per	Partial, with 7–8 spines in noto & 6–7 neuro; 13–15 on a side	Shaft straight, curved apically with tip curved & adhering to shaft	Alternating thin capillaries
C. nicoyana Dean & Blake, 2007	Fused with setiger 1	Three distinct annular rings	Anterior margin set 1, second br also on set 1	Posterior margin per	Partial, with 6–9 spines in noto & 6–10 in neuro; 12–19 on a side in double rows	Shaft long, narrow, with tip curved inward & adhering to shaft	Spines with alternating capillaries replaced by longer spines in posterior setigers

TABLE 3. (Continued)

Species/ Character	Posterior podial lobes or membranes	Long natatory-like notosetae	Approximate segmental origin of spines	Dorsal/Ventral longitudinal grooves or ridges	Pygidium	Methyl Green staining	Distribution/depth
C. adunca **n. sp**.	Low membranes bearing spines and capillaries	Few present, irregular along body	Posterior third: Noto: Set 58 Neuro: Set 55	Dorsum with narrow groove in mid-body segments, reduced posteriorly; venter with shallow groove along most of body, absent in posterior cinctured segments	Simple ventral disk	Pre-set region staining intensely with only tip of pr and per band not staining; anterior setigers with lateral and ventral bands	U.S. Atlantic continental slope, 530–812 m (this study)
C. allanotai Blake, 2006	High membranous lobes	Present on some specimens	Posterior third: Set 65–70 in noto & neuro	Shallow mid-ventral groove present	Simple ventral disk	Pre-set region deeply staining with clear band on posterior margin of pr	Off California, slope depths, 1800–3100 m (Blake 2006)
C. anasima Doner & Blake, 2006	Low membranes bearing spines and capillaries	Sometimes present in middle and posterior setigers	Posterior third: Noto: 55–60; Neuro: 50–55	Shallow mid-dorsal and ventral grooves present	Simple ventral disk	Posterior pr staining intensely, tip not staining; body stains uniformly	Northeastern USA, continental shelf, 50–180 m (Doner & Blake 2006; this study)
C. brychiata **n. sp.**	Reduced cinctures with low, elevated membranes	Absent	Posterior third: Noto: Set 45–58; Neuro: Set 36–45	Absent	Semi-circular disk with two short anal cirri	No pattern	U.S. Atlantic continental slope, 2011–2095 m
C. camasetosa Blake 2015	High membranes bearing spines and capillaries	Absent	Noto: Set 40; Neuro: Set 30	Shallow dorsal and ventral grooves in mid-body	Flattened ventral lobe	Tip of pr and last 2 per rings	SE Alaska to British Columbia, 12–95 m. (Blake 2015)
C. commonalis Blake, 1996	Medium membranes bearing spines and capillaries	Absent	Noto: Set 43–47; Neuro: Set 38–40	Shallow ventral groove along entire body	Flattened ventral disk	No pattern; pr unstained; per and body segments lightly stained	Central and southern California continental shelf (Blake 1996)
C. curvata Hartmann-Schröder, 1965	High, elevated membranes	Not observed	Posterior third, Set 60 in noto- & neuropodia	Absent	Rounded ventral lobe	Not tested	Central and southern Chile, 82–260m. (Blake 1996; 2018, Montiel 2005)
C. gesae Blake, 2018	Low, elevated membranes	Absent	Posterior third, ~Set 50 in noto- & neuropodia	Ventral groove present mid-body	Bi-lobed ventral disk	No pattern	Off northern Chile, 436 m. (Blake 2018)
C. nicoyana Dean & Blake, 2007	Low, not elevated	Absent	Anterior third; Set 16–20 in noto- & Set 12–15 in neuropodia	Absent	Flattened ventral lobe	No distinct pattern; ant segments with dark blue mid-ventral line	Costa Rica, 9–44 m (Dean & Blake 2007)

Abbreviations: ant, anterior; br, branchiae; neuro, neuropodium; noto, notopodium; per, peristomium; pr, prostomium; Set, setiger.

Biology. *Chaetozone adunca* **n. sp**., as *Chaetozone* sp. 11, was reported as among the dominant species off Cape Hatteras, North Carolina, during the ACSAR surveys (Blake *et al*. 1987, Blake & Grassle 1994) and the separate Cape Hatteras Survey (Blake & Hilbig 1994). Station 9 is an ACSAR upper continental slope station located at a depth of about 600 m in an area that exhibits high sedimentation rates and is influenced by the Western Boundary undercurrent (WBUC) and Gulf Stream (Blake & Grassle 1994). Perhaps because of the high sedimentation rates, infaunal densities at Station 9 at an average of 46,255 individuals per m^2 were the highest found at any location along the entire U.S. Atlantic continental slope (Blake *et al*. 1987; Blake & Grassle 1994). Similarly high densities were reported by Blake & Hilbig (1994) at stations (SA-9 and CH-1, CH-3, CH-18, CH-19, CH-34, CH-41 and CH-42) in the 500–800 m range as part of the separate Cape Hatteras survey.

At total of 145 species of benthic invertebrates were identified as Station SA-9 from nine samples collected on three surveys as part of the ACSAR program (Blake & Grassle 1994). *Chaetozone adunca* **n. sp**. (as *C*. sp. 11) ranked 11th out of 20 dominant species at Station 9. The five most abundant annelids identified at this site in order of abundance were *Cossura longocirrata* Webster & Benedict, 1887, *Scalibregma inflatum*, Rathke, 1843, *Limnodriloides medioporus* Cook, 1969, *Tubificoides intermedius* (Cook, 1969) and *Aricidea quadrilobata* Webster & Benedict, 1887.

Chaetozone adunca **n. sp**. also occurred at several upper slope stations in the North Atlantic ACSAR program, but was never among the dominant species (Maciolek *et al*. 1987b).

Etymology. The epithet is from the Latin, *aduncus*, for bent inward, in reference to the inwardly curved tip of some of the acicular spines of this species.

Distribution. U.S. Atlantic continental slope, 530–1003 m.

Chaetozone anasima Doner & Blake, 2006

Figure 17

Chaetozone setosa Blake *et al.* 1998b: C-1 (in part). **Not** Malmgren, 1867.
Chaetozone anasimus Doner & Blake, 2006: 67–68., figs. 2, 5C, G).
Chaetozone anasima: Blake & Levesque 2017: 572–575.

Material examined. (*208 specimens*) **Northeastern USA, Gulf of Maine**, **Georges Bank**, **MMS Benthic Infauna Monitoring Program**, coll. G.W. Hampson, Chief Scientist: **Sta. 14A**: Cruise M-6, Rep. 2, 20 Nov 1982, 41°57.5′W, 68°31.2′W, 168 m, (1, USNM 1660979); Cruise M-7, Rep.1, 06 Feb 1983, 41°57.5′W, 68°31.0′W, 168 m (1, USNM 1660980); Rep. 4 (2, USMM 1660981); Cruise M-8, Rep. 5, 14 May 1983, 41°57.5′W, 68°31.1′W, 170 m (1, USMM 1660982); Cruise M-9, Rep. 1, 13 Jul 1983, 41°57.5′W, 68°31.0′W, 179 m (1, USMM 1660983).—**Massachusetts Bay, MWRA Harbor and Outfall Monitoring Program: 1995 August Survey, Sta. FF-05**: Rep. 2, Aug 1995, 42°08.00′N, 70°25.35′W, 61 m (11, MCZ 161922). **Sta. FF-11**: Rep. 2, Aug 1995, 42°39.50′N, 70°30.00′W, 87 m (22, MCZ 161923); Rep. 3 (21 MCZ 161924). **1997 August Survey**, **Sta. FF-04**: Aug 1997, Rep.1, 42°17.30′N, 70°25.50′W, 87 m (31, MCZ 161925); Rep. 2 (21, MCZ 161926); Rep.3 (61, MCZ 161927). **Sta. FF-05**: Rep. 2, Aug 1997, 42°08.00′N, 70°25.35′W, 61 m (20, MCZ 161928); Rep. 3 (10, MCZ 161929). **Sta. FF-09**: Rep. 1, Aug 1997, 42°18.75′N, 70°39.40′W, 49 m (3, MCZ 161930); Rep. 2 (5, MCZ 161931). **August 2002 Survey**, **Sta. FF-11**: Rep. 2, Aug 2002, 42°39.50′N, 70°30.00′W, 88 m, 3 on SEM Stubs (MCZ 161932). **2006 August Survey**, **Sta. FF-04**: Rep. 3, 03 Aug 2006, 42°17.296′N, 70°25.30′W, 88 m (16, MCZ 161933).

Description. A moderately sized species, 9–12 mm long, 0.5–1 mm wide for 65–90 setigers. Body thick, robust in anterior two-thirds, then tapering posteriorly. Dorsum rounded with narrow groove (Fig. 17A); venter flattened with broad channel or groove along most of body (Fig. 17B–D). Anterior segments short, crowded about ten times wider than long; posterior segments longer, about 2.5 times as wide as long. Color in alcohol light tan, with no body pigments evident.

Pre-setiger region short, compact, about as wide as long and as long as first six setigers (Fig. 17A–B). Prostomium short, conical, pointed (Fig. 17A), sometimes with tip directed dorsally (Fig. 17B); eyespots absent; nuchal organs present on lateral surface of peristomium just anterior to oral opening, as a ciliated oval groove (Fig. 17B, inset). Peristomium with two lateral grooves producing three rings surmounted by broad dorsal crest (Fig. 17A–B). Dorsal tentacles arising from near posterior margin of peristomium with first pair of branchiae lateral and slightly posterior to tentacles (Fig. 17A). First branchiae appearing to arise from groove between peristomium and setiger 1 in some views (Fig. 17B); subsequent setigers with branchiae arising dorsal to notosetae (Fig. 17A).

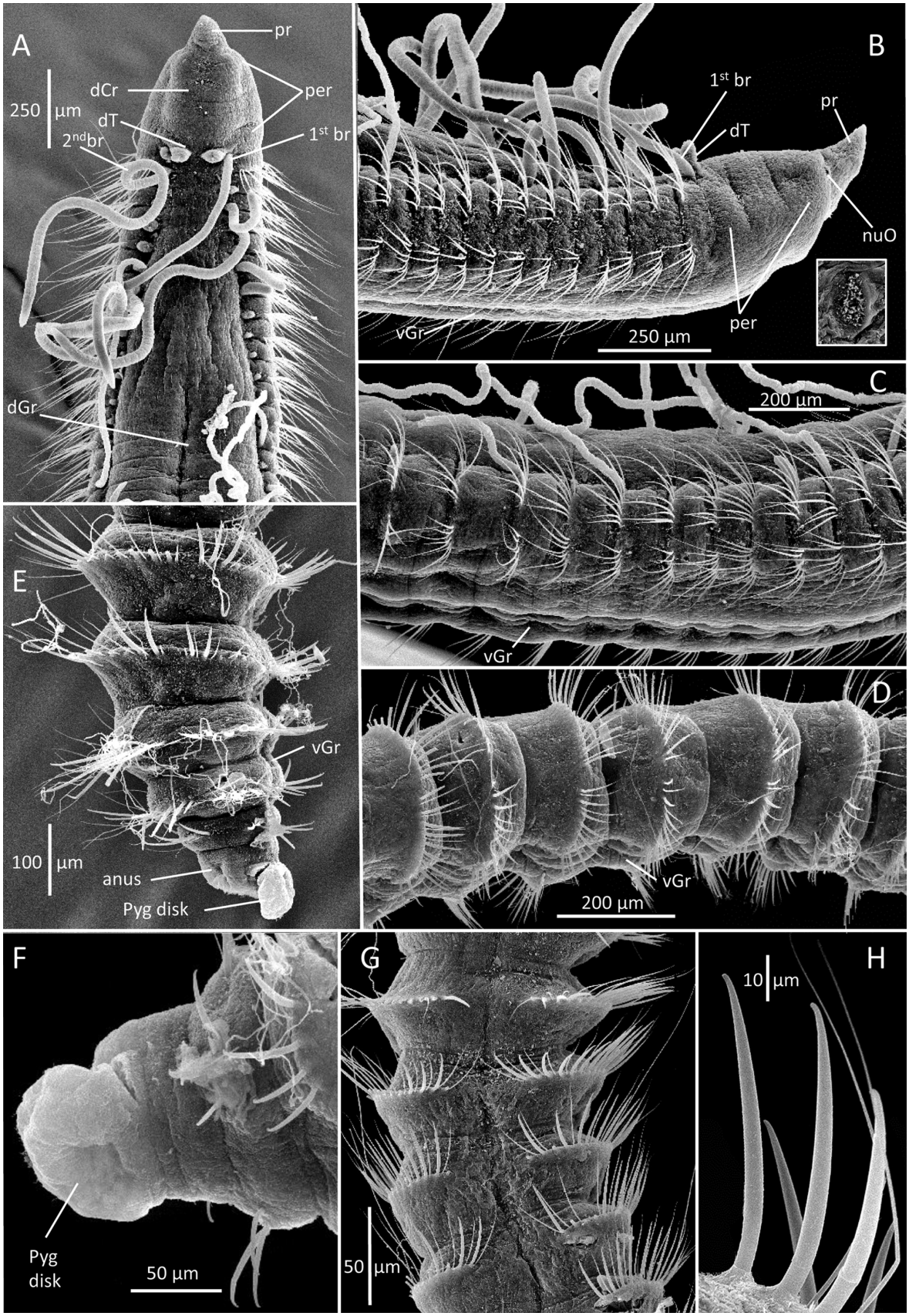

FIGURE 17. *Chaetozone anasima*. SEMs (MCZ 161932): A, anterior end, dorsal view; B, anterior end, right lateral view (inset with nuchal organ, not to scale); C, middle body segments, right lateral view; D, posterior segments, right lateral view; E, posterior end, right lateral view; F, pygidium, ventrolateral view; G, posterior segments, dorsal view; H, neuroacicular spines and capillaries.

Parapodia of anterior and middle setigers lateral enlargements, forming distinct shoulders along body between notopodium and rounded dorsal surface (Fig. 17A); setae arising from posterior margin of each noto- or neuropodium. Parapodia of posterior 20–25 setigers becoming narrow, and elevated forming distinct cinctures bearing acicular spines and capillaries (Fig. 17D, G). Noto- and neurosetae of anterior and middle body segments all capillaries, numbering about 8–12 per fascicle; long natatory-like capillaries variably present on some specimens, not associated with reproduction. Acicular spines first present from about setiger 50–60 in neuropodia and 55–65 in notopodia. In most specimens posterior setigers with 10–14 notopodial spines and 6–10 neuropodial spines or with 16–24 spines on a side producing full cinctures; spines accompanied by alternating thin, smooth capillaries, most longer than spines (Fig. 17D–E, G). Spines with narrow pointed tips that bend back and merge with shaft of spine on concave edge; recurved bent tips only apparent in light microscopy, not visible in SEM where spines appearing with curved tip (Fig. 17H). Cinctured segments with low elevated membranes from with setal fascicles emerge (Fig. 17G).

Pygidium with rounded lobe or inflated cushion ventral to anal opening (Fig. 17E–F).

Methyl green staining. Base of prostomium stains; rest of body stains lightly with no pattern after differentiation.

Remarks. *Chaetozone anasima* belongs to the *C. curvata* and occurs in inner and outer shelf habitats, whereas two additional new species described in this study, *C. adunca* **n. sp**. and *C. brychiata* **n. sp**., both occur in deep-water sediments. Morphological similarities and differences among the nine species in the *C. curvata* group are presented in Table 3.

Among species in the *Chaetozone curvata* group, *C. anasima* and five other species have three peristomial rings (Table 3). Of these, only *C. anasima* and *Chaetozone gesae* Blake, 2018 from off Chile, have a dorsal crest. However, *C. anasima* has full posterior cinctures with up 16–24 spines on a side instead of partial cinctures with 13–15 spines as in *C. gesae*. In addition, *C. gesae* is recorded as having the first and second pair of branchiae both occurring on setiger 1, whereas in *C. anasima*, the first branchiae occur on the posterior margin of the peristomium.

Among local species of nearshore and continental shelf species of *Chaetozone*, *C. anasima*, apart from the recurved tips on the acicular spines, may be easily recognized by the relatively short pre-setiger region with three peristomial rings and a prostomium that is typically turned upward. In contrast, *Chaetozone hystricosa* (Doner & Blake, 2006), with which *C. anasima* may occur, has an elongate, smooth pre-setiger region, not interrupted by annular rings, that tapers to a narrow anteriorly directed prostomium.

Distribution. Northeastern USA, Massachusetts Bay, 49–90 m; Gulf of Maine, 168–179 m.

Chaetozone brychiata new species

Figures 18–19

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Cirratulidae sp. 1: Maciolek *et al*. 1987a: D-2.
Chaetozone sp. 10: Maciolek *et al*. 1987a: D-2 (in part).

Material examined. (7 *specimens*) **Off Delaware, U.S. Mid-Atlantic ACSAR Program,** coll. R. Petrecca, Chief Scientist. **Sta. 10**: Cruise Mid-4, Rep. 1, 19 May 1985, 37°51.76′N, 72°20.01′W, 2095 m, **holotype** (USNM 1660984), 1 **paratype** (USNM 01660985); Cruise Mid-1, Rep. 1, 07 May 1984, 37°51.52′N, 73°17.57′W, 2095 m, 1 **paratype** (USNM 1660986). **Sta. 2**: Cruise Mid-4, Rep. 2, 17 May 1985, 38°35.66′N, 72°53.80′W, 2011 m (1 juvenile, USNM 1660987). **Sta. 3**: Cruise Mid-6, Rep. 1, 12 Nov 1985, 38°36.73′N, 72°51.62′W, 2064 m, 2 **paratypes** (USNM 1660988).—**Off New England, Lydonia Canyon, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 8**: Cruise NA-4, Rep. 1, 25 Nov. 1983, 40°10.21, 67°37.24′W, 2084 m (1, USNM 1660989).

Description. A small species, holotype (USNM 1660984) complete, with 65 setigers, 5.1 mm long and 0.35 mm wide; paratype (USNM 1660985) incomplete, with 62 setigers, 6.5 mm long and 0.44 mm wide; another paratype (USNM 1660988) with 70 setigers, 6.54 mm long and 0.37 mm wide. Body generally of similar width across anterior and middle setigers, tapering posteriorly; thoracic segments crowded, only slightly enlarged. Individual segments of anterior and middle segments short, about 6–7 times wider than long at first, posterior setigers longer, only about three times wider than long. No dorsal or ventral grooves along body; mid-ventral ridge consisting of

a row of paired swellings at junction of each segment mid-ventrally, present along entire body. Posterior segments with reduced cinctures, bearing acicular spines without with deep intersegmental grooves or elevated membranes. Color in alcohol light tan; no apparent pigmentation.

Pre-setiger region relatively short, only slightly longer than wide; long, narrow, smooth, about as long as first ten setigers (Figs. 18A, 19A). Prostomium conical, triangular, with pointed tip; eyespots absent; nuchal organs narrow slits on posterior lateral margins. Peristomium rectangular, medially extending dorsally over setiger 1; laterally with one deep groove producing two peristomial rings, but these not crossing dorsal surface; dorsum with broad dorsal crest extending from prostomium to posterior margin (Fig. 18A). Dorsal tentacles arising medially from posterior margin of peristomium, with first pair of branchiae on setiger 1, posterior and lateral to tentacles (Fig. 18A); second pair dorsal to notosetae on setiger 2 (Fig. 18A); subsequent branchiae from setiger 3 in same location dorsal to notosetae.

Parapodia of anterior and middle segments reduced to low ridges or mounds from which setae arise; posterior parapodia similar, lacking deep intersegmental grooves and elevated membranes (Figs. 18B, 19D). Setiger 1 and thoracic segments with 12–15 capillaries in notopodia and neuropodia; capillaries mostly of moderate size; long, natatory-like capillaries absent. Acicular spines first present in holotype from setiger 45 in notopodia and setiger 36 in neuropodia; paratype (USNM 1660988) with notopodial spines from setiger 58 and neuropodial spines from setiger 45; spines 2–3 at first, increasing posteriorly into partial cinctures over last 12–15 setigers with 4–5 spines in notopodia and 7 in neuropodia or up to 11–12 spines on a side; spines alternating with capillaries as long as or slightly longer than spines; cinctures not complete, leaving broad dorsal gap between notopodia (Figs. 18B, 19D). Spines unusually long, narrow, curving and tapering gradually to narrow hooked tip with tip of hook curving inwardly and merging with shaft (Figs. 18C, 19B–C).

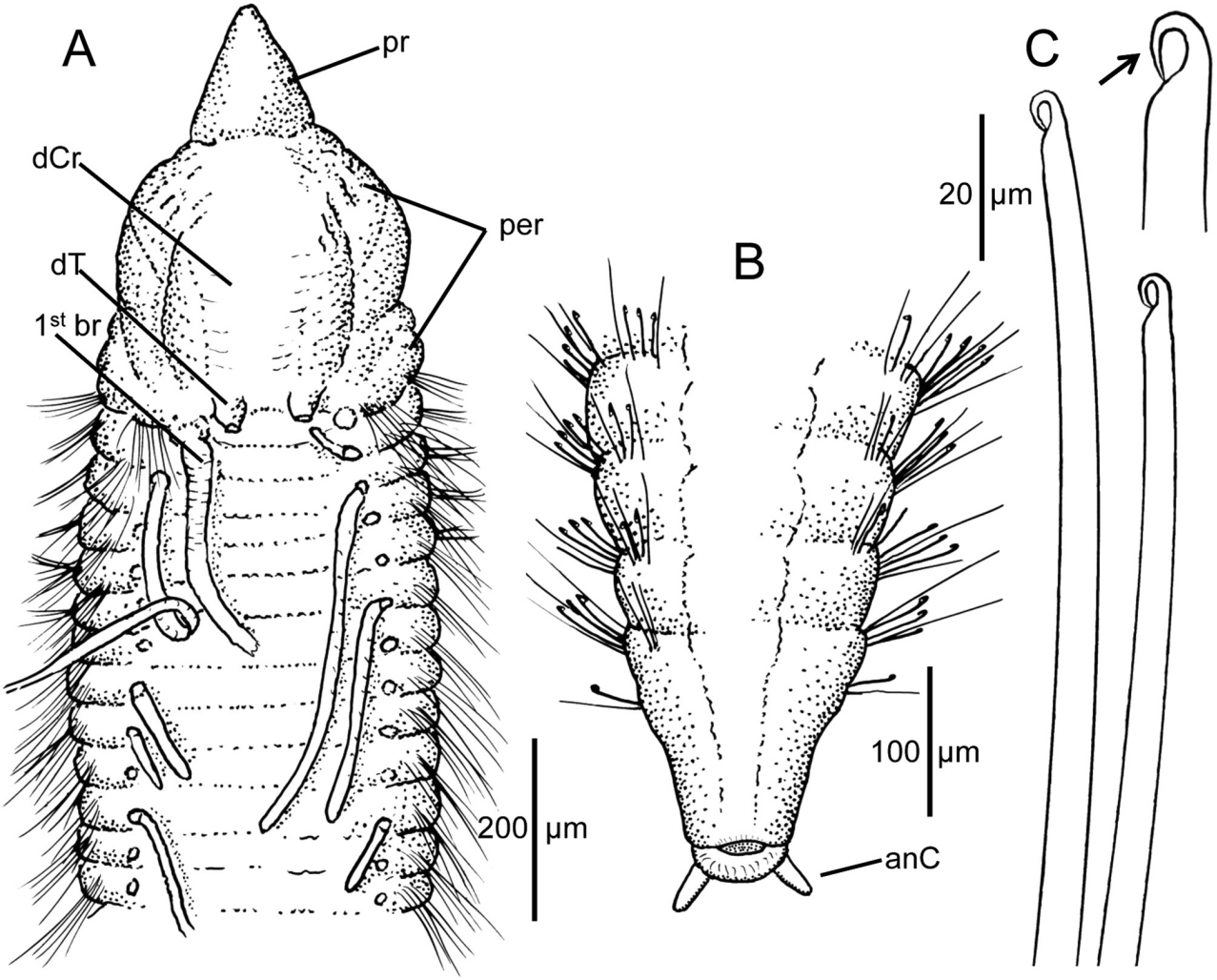

FIGURE 18. *Chaetozone brychiata* **n. sp**. Holotype (USNM 1660984): A, anterior end, dorsal view; B, posterior end, dorsal view; C, neuropodial acicular spines (detail of recurved tip not to scale).

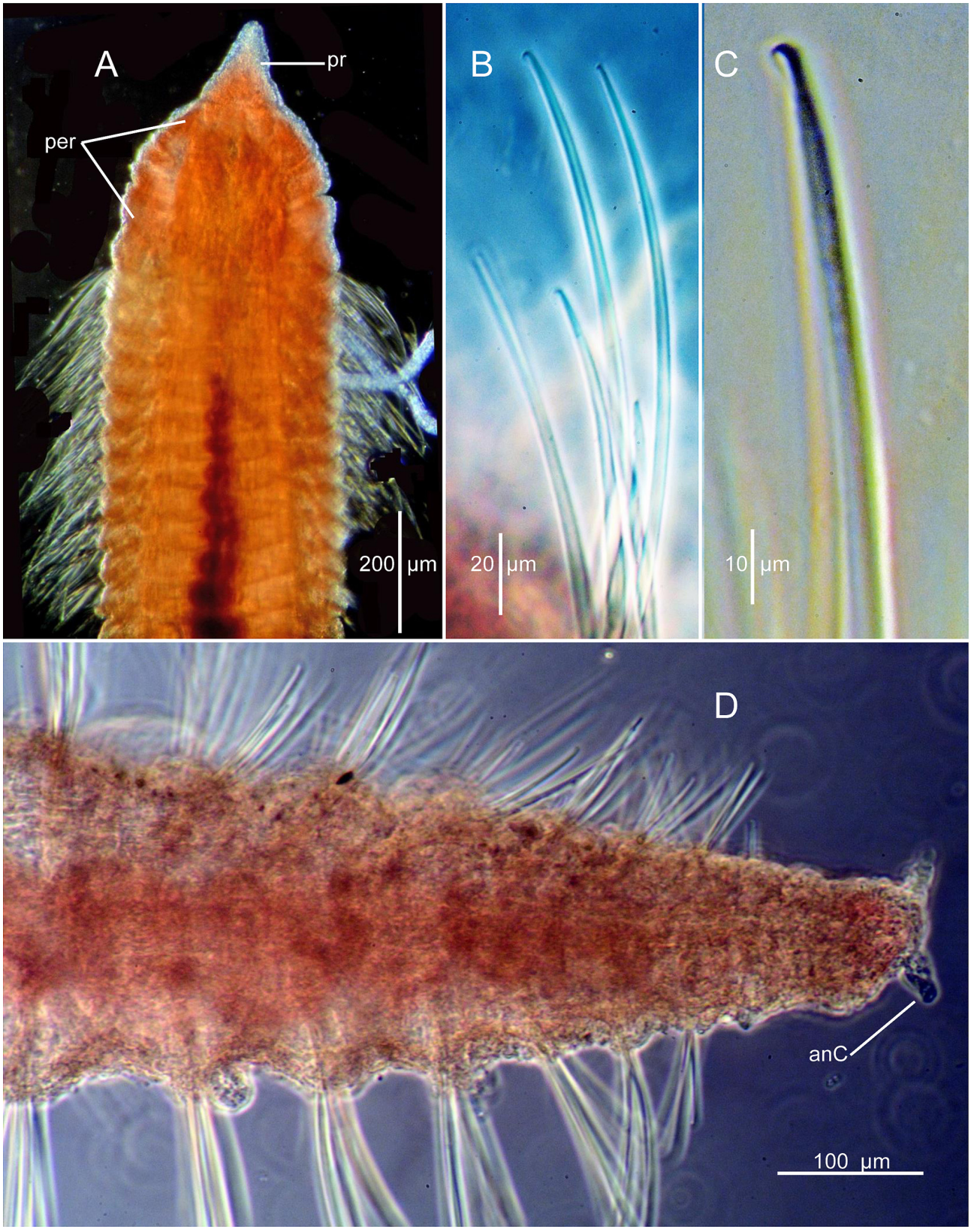

FIGURE 19. *Chaetozone brychiata* **n. sp**. Paratype (USNM 1660988): A, anterior end, dorsal view; B, fascicle of posterior neuropodial acicular spines; C, detail of neuropodial acicular spine; D, posterior end, dorsal view.

Body narrowing in last few segments, terminating in simple pygidium with a small, semicircular disk bearing two short anal cirri (Figs. 18B, 19D); specimen from North Atlantic Sta. 8 (USNM 1660989) damaged, with only a single lateral protuberance evident on pygidial disk.

Description of Juvenile. A juvenile (USNM 1660987) believed to be this species has 13 setigers and is only 0.8 mm long. The last setiger bears a single recurved acicular spine. The pygidium has a flattened disk bearing two anal cirri.

Methyl green staining. No pattern, stain not retained.

Remarks. *Chaetozone brychiata* **n. sp**. is the ninth species to be described in the *C. curvata* group, with acicular spines with a shaft that tapers to a pointed tip that curves downward and merges with the shaft. *Chaetozone brychiata* **n. sp**. differs from all other species *Chaetozone* by having two short anal cirri arising from a semi-circular pygidial disk. The only other cirratulids having two short anal cirri are in the genus *Caulleriella*. In addition, the acicular spines of *C. brychiata* **n. sp**. are unusually long and narrow, typically of the same width as accompanying capillaries.

Etymology. The epithet *brychiata* is from the Greek, *brychios*, "from the deep", in reference to the deep-sea habitat of this rare species.

Distribution. U.S. Atlantic continental slope, off Delaware, 2011–2095 m; U.S. North Atlantic slope, Lydonia Canyon, 2084 m.

The *Chaetozone gracilis* group

Remarks. *Chaetozone gracilis* (Moore, 1923) from deep-water off southern California was redescribed by Blake (1996) and represents an atypical species of *Chaetozone* in that the acicular spines in the noto- and neuropodia are reduced in number and not formed into the distinctive cinctures or the posterior armature typical of most species in the genus. Other atypical species of *Chaetozone* having reduced numbers of acicular spines not forming prominent posterior cinctures are *Chaetozone homosetosa* (Hartmann-Schroder & Rosenfeldt, 1989) from Antarctica and *Chaetozone castanea* Blake, 1918 from off Peru. These species are not included among species of *Chaetocirratulus* because their bodies are elongate and only expanded in the anterior segments rather than having thickened fusiform or sausage-shaped bodies. In addition, the prostomium is long, narrow and pointed rather than broad, rounded, or wedge-shaped as in species of *Chaetocirratulus*. Blake (2018: 121) prematurely referred *Chaetozone gracilis* to *Chaetocirratulus*. However, it is evident this species does not have the prostomium and body shape typical of *Chaetocirratulus* and is here retained in *Chaetozone*.

In the present study, four new species having a reduced number of acicular spines not forming cinctures in posterior parapodia were discovered off the U.S. Atlantic coast and are referred to *Chaetozone*. One is from shallow subtidal sediments in Boston Harbor whereas three others were discovered in deep water on the U.S. Atlantic continental slope. All four are described here.

Chaetozone artaspinosa new species

Figures 20–23

Table 4

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Chaetozone vivipara: Hilbig *et al*. 1996: 24; 29–30, 60, 63, D-1; Blake *et al*. 1998a: 77, E-1; Maciolek *et al*. 2006: C-24; 2008: 4-23–4-25, 4-28. **Not** Christie 1984.

Material examined. (*384 specimens*) **Northeastern USA, Boston Harbor Massachusetts, MWRA Harbor Monitoring Program**, **Sta. T-05A**: Rep 2, 25 Apr 2002, 70.960617°N, 42.339718°W, 9.0 m, **holotype** (MCZ 161934), 62 **paratypes** (MCZ 161935); 01 Aug 2007, Rep. 1, 70.9607315°N, 42.3396835°W, 16.2 m, 1 specimen on SEM stub (MCZ 161936), 3 specimens on SEM stub (MCZ 161937). **Sta. T-01**: Rep. 2, Apr 1995, 42°20.95′N, 70°57.81′W, 4 m (66 juveniles, MCZ 161938); Rep. 4, 22 May 2002, 70.963600°N, 42.349217°W, 4.0 m, 15 **paratypes** (MCZ 161939). **Sta. T-02**: Rep. 2, Apr 1995, 42°20.57′N, 71°00.12′W, 9 m (75 juveniles, MCZ 161940); Rep. 2, 05 Aug 2009, 71.0019302°N, 42.3429679°W, 7.5 m, 10 **paratypes** (MCZ 161941). **Sta. T-03**: Rep. 2, Apr 1995, 42.330°N 70.962°W, 8.7 m (140, MCZ 161943); **Sta. T-07**: Rep. 2, 25 Apr 2002, 70.978615°N, 42.289318°W, 7.5 m, 11 **paratypes** (MCZ 161942).

Description. A small to moderately sized species, holotype complete, with about 80 setigers, 11.2 mm long and

0.54 mm wide anteriorly (Fig. 21A); large paratype with 102 setigers, 14.4 mm long, and 0.44 mm wide (Fig. 20A); a small paratype (MCZ 161935) with 44 setigers, 3.3 mm long, and 0.73 mm wide across anterior segments. Body elongate, narrow, only weakly expanded anteriorly, tapering to posterior end (Fig 20A), sometimes weakly enlarged. Anterior setigers about ten times wider than long; middle segments up to five times wider than long. Dorsal surface rounded, slightly elevated above parapodia, without dorsal groove or ridge; ventral surface flattened with distinct ventral groove or channel extending from about setiger 1 along anterior and middle setigers, indistinct in posterior setigers. Posterior segments with parapodia elevated dorsally. Posterior end dorsoventrally flattened tapering to pygidium (Figs. 20A, E–F, 21B). Color in alcohol opaque white to light tan, with no pigmentation.

Pre-setiger region triangular in shape, slightly longer than wide (Figs. 20B, 21A, 22B); about as long as first five setigers in smaller specimens and about first ten setigers in larger specimens; Prostomium short, triangular, tapering to narrow pointed tip (Figs. 20A–B, 21A, 22A); eyespots absent; nuchal organs narrow oval-shaped ciliated openings on posterior lateral margins (Fig. 22C inset). Peristomium with two prominent lateral grooves producing three rings (Figs. 20B, 21A, 22A–C), but these not crossing dorsal surface, weakly developed dorsal crest present (Figs. 20B, 21A); some specimens with longitudinal groove in crest producing two parallel crests (Fig. 22B–C). Dorsal tentacles arise from medial location on posterior margin of peristomium (Figs. 20B, 21A, 22B–C); first pair of branchiae lateral to tentacles; second pair of branchiae on setiger 1 dorsal to notosetae; subsequent branchiae in similar location (Figs. 21A, 22C). Branchiae present along most of body.

Parapodia of anterior segments short thickened vertical lobes from which setae arise; these lobes weakly swollen, with noto- and neurosetae arising directly from them. Parapodia of posterior segments thinner, narrower, bearing acicular spines and capillaries in spreading fascicles (Figs. 20D, 21C, 22D, F).

All setae long, narrow. Anterior and middle setigers with setae all long, thin capillaries (Fig. 21D, 22F), with 8–10 in notopodia and 7–8 in neuropodia (Fig. 22A–C); posterior setigers with 5–8 capillaries in notopodia (Fig. 22F) and 4–5 capillaries and 1–3 acicular spines in neuropodia (Fig. 21E). Spines first present in neuropodia from middle body segments: about setiger 55 in 80-setiger holotype, setiger 70 in large 102-setiger paratype, and setiger 35 in smaller 44-setiger paratype; spines not observed in notopodia. Individual spines long, narrow, straight or only weakly curved, not sigmoidally curved; terminating in bluntly rounded tip (Figs. 21E, 22G).

Pygidium a rounded disk ventral to anal opening (Figs. 20E–F, 21B, 22E).

Methyl green staining. Peristomium retaining stain in irregular pattern (Fig. 20C); tip of prostomium sometimes retaining stain, otherwise no pattern.

Remarks. *Chaetozone artaspinosa* **n. sp**. was first observed in Boston Harbor benthos in August 1995 when large numbers of a small unknown cirratulid appeared in benthic samples collected as part of the harbor-wide benthic monitoring survey. Some of these specimens were shown to the late Dr. Mary E. Petersen who was visiting our laboratory in Woods Hole at the time. Dr. Petersen indicated that she had collected similar-appearing specimens in Denmark and had identified them as *Tharyx vivipara* Christie, 1984, an estuarine species from northeastern England in the U.K. that exhibited an unusual form of larval viviparity where early development occurred entirely within the bodies of females (Christie 1984). Dr. Petersen was convinced that our Boston Harbor specimens were the same as the species from the U.K. and Denmark. She was also convinced that they belonged to the genus *Chaetozone* instead of *Tharyx*, despite the original description and illustrations of *T. vivipara* clearly indicating that all setae were pointed capillaries and that none of the Boston Harbor specimens exhibited any evidence of viviparity. Petersen (1999) subsequently referred *T. vivipara* to the genus *Chaetozone* as part of her review of cirratulid reproduction and development, but did not provide a redescription of the European species. Hartmann-Schröder (1996) had earlier referred *T. vivipara* to *Aphelochaeta* with a brief description indicating that all setae were capillaries. Various technical reports of cirratulids from the U.K. summarized by Worsford (2009) have referred *T. vivipara* to *Chaetozone* based largely on Petersen (1999) but with only minimal descriptive notes.

A review of Dr. Petersen's unpublished notes, sketches, and prepared slides of *Tharyx vivipara* included information on the specimens she had collected from Limfjord, Denmark, in 1983. The notes and sketches appear to refer to the same species described by Christie (1984), but there is no evidence that she actually observed acicular spines on her specimens that would confirm referral of the species to *Chaetozone*. A detailed sketch of the anterior end in dorsal view was prepared, but none depicting setae. There are five well-prepared slides of posterior ends and a few separate parapodia of the Limfjord specimens. These are in good condition and clearly show spreading fascicles of noto- and neurosetae from pre-pygidial segments. Although some of the setae are broken, all intact setae are capillaries; no acicular spines are present among the intact capillaries. The longer capillaries have a dark core and

it is possible that such setae might have been mistaken for spines. However, these slides do not support the transfer of *Tharyx vivipara* to *Chaetozone*. It would appear that at least for the Danish specimens, Dr. Petersen based her assumption of a *Chaetozone* identity on the overall shape of the body and posterior setigers as being similar in appearance to other *Chaetozone* species she had observed. Based on these observations and my interpretation of Dr. Petersen's observations and records, *T. vivipara* should be included in the genus *Aphelochaeta* following Hartmann-Schröder (1996). However, it is possible that the specimens from Denmark and the U.K. are not the same species.

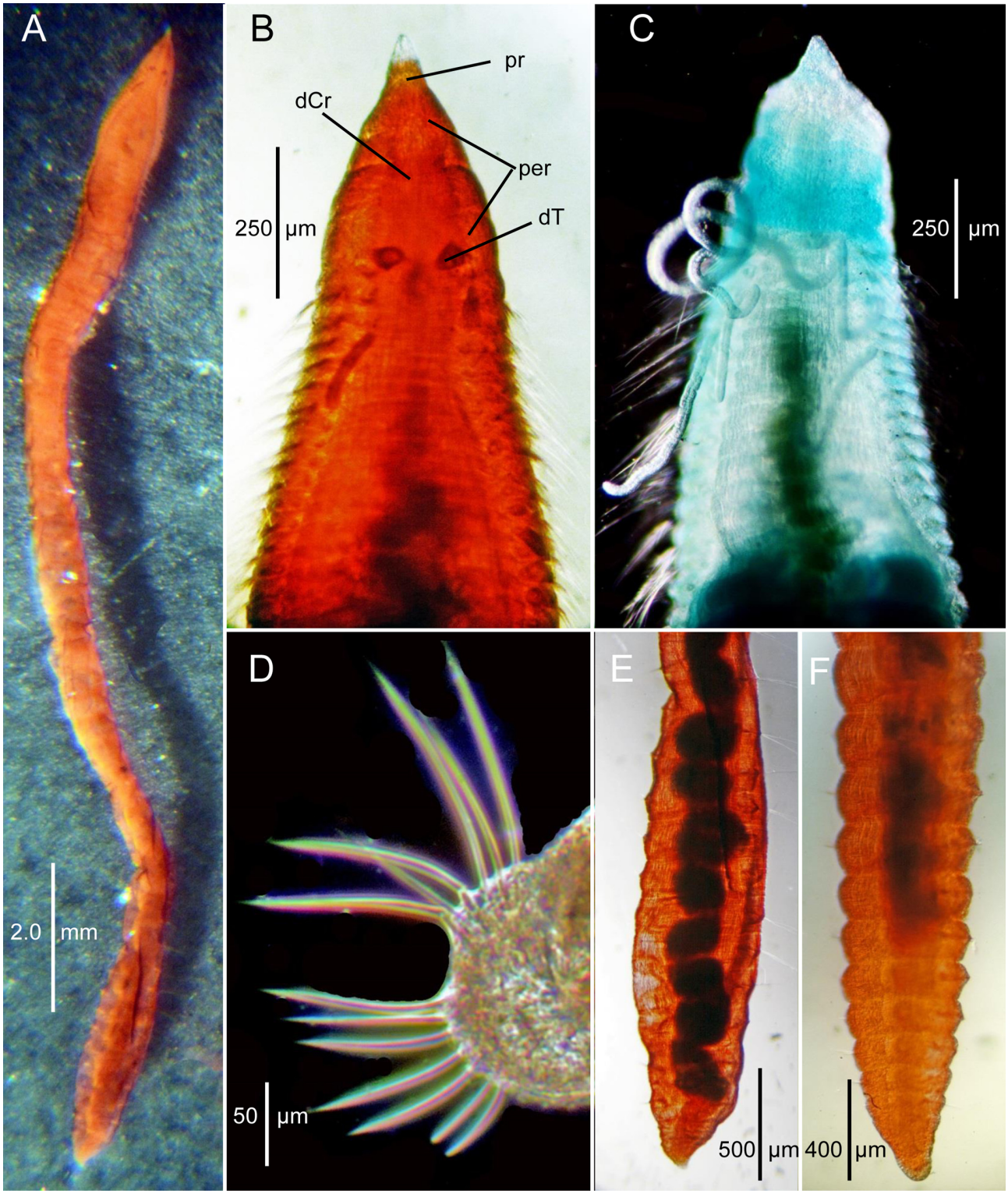

FIGURE 20. *Chaetozone artaspinosa* **n. sp**. Paratypes (MCZ 161935): A, entire worm, dorsal view; B, anterior end dorsal view; C, anterior end, dorsal view; D, posterior setiger, anterior view; E, posterior end, left lateral view; F, posterior end, dorsal view. A–B, D–F, stained with Shirlastain A; C, stained with MG.

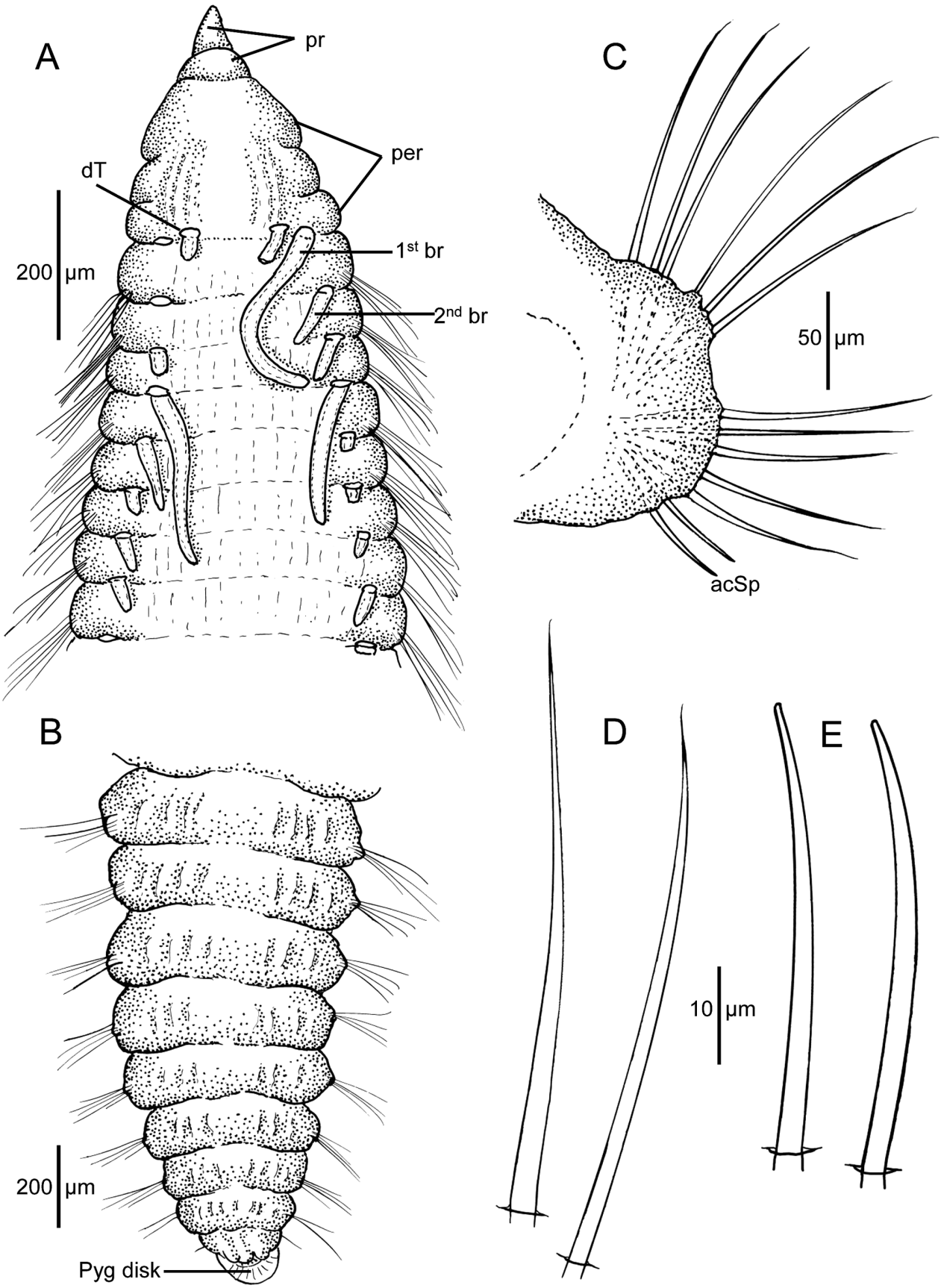

FIGURE 21. *Chaetozone artaspinosa* **n. sp**. Holotype (MCZ 161934): A, anterior end, dorsal view; B, posterior end, dorsal view. Paratype (MCZ 161935): C, posterior setiger, anterior view; D, capillary neurosetae from (C); E, neuroacicular spines from (C).

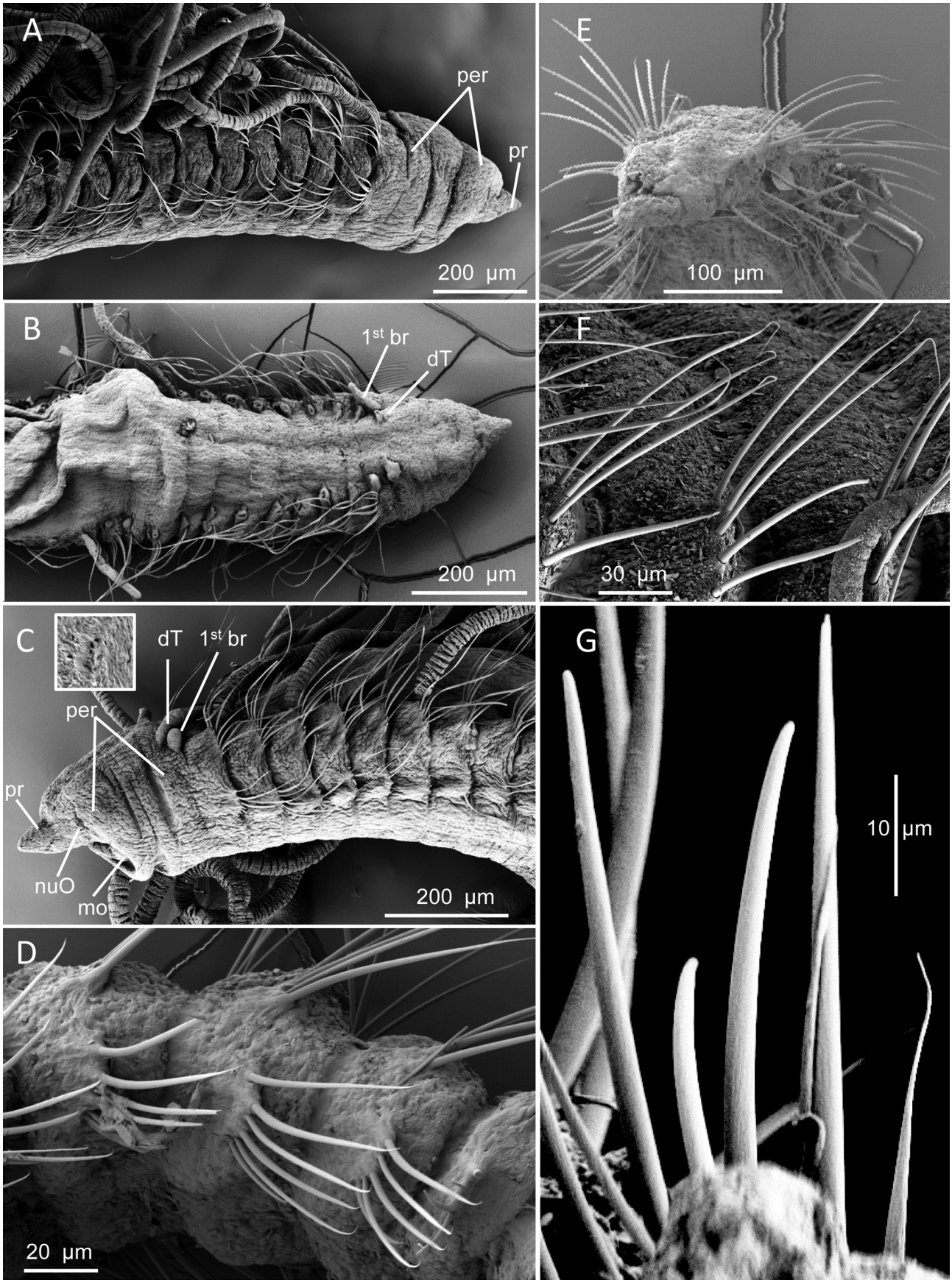

FIGURE 22. *Chaetozone artaspinosa* **n. sp**. SEMs (MCZ 161937): A, anterior end, right lateral view; B, anterior end, dorsal view; C, anterior end, left lateral view (inset of nuchal organ not to scale); D, posterior setigers, left lateral view; E, posterior end, posterior view; F, notosetae, middle body; G, neuroacicular spines, posterior setiger.

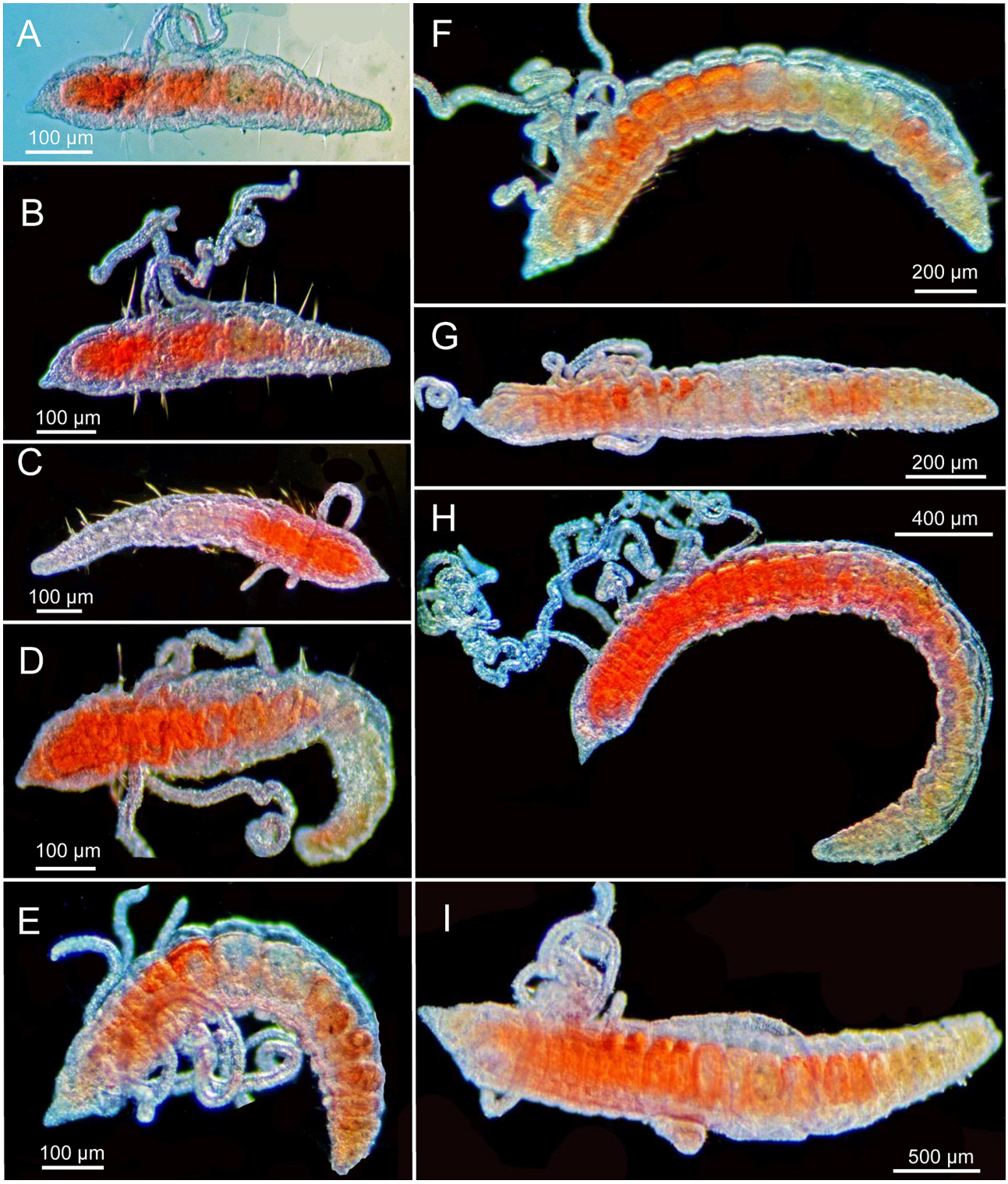

FIGURE 23. *Chaetozone artaspinosa* **n. sp**. Juveniles (MCZ 161940): A, 10-setiger post-larva; B, 11-setiger post-larva; C, 12-setiger juvenile; D, 13-setiger juvenile; E, 13-setiger juvenile; F, 19-setiger juvenile; G, 22-setiger juvenile; H, 25-setiger juvenile; I, 28-setiger juvenile. All stained with Shirlastain A.

Despite the identity of the Boston Harbor specimens being based on anecdotal observations and comments by Dr. Petersen, they were subsequently referred to as *Chaetozone vivipara* in the database by the project team and have continued to be identified as such in subsequent monitoring surveys; there being no alternative identification available. Systematic studies on Cirratulidae by the author and supported by the NSF PEET program (2001–2008) included extensive studies on global Cirratulidae and included traditional methods as well as SEM to assist in defin-

ing the morphology of local species. A recent review of specimens and SEM images of "*C. vivipara*" from Boston Harbor clearly demonstrates that they are not the same species described by Christie (1984), but another species having an entirely different morphology here described as *Chaetozone artaspinosa* **n. sp**.

Chaetozone artaspinosa **n. sp**. is most similar to *C. castanea* from off Peru and Chile in having acicular spines that are long, narrow, and straight or only weakly curved (Blake 2018) rather than thick and sigmoidally curved. *Chaetozone artaspinosa* **n. sp**. differs from *C. castanea* in having three peristomial rings instead of four (with the first merged with the prostomium), no acicular notopodial spines instead of 2–3, 1–3 neuropodial acicular spines instead of 5–6 and a sub-anal pygidial lobe that is thick and cushion-like instead of disk-like. In addition, the body of *C. castanea* is heavily pigmented brown whereas, *C. artaspinosa* **n. sp**. has no pigmentation on the body.

Locally, *Chaetozone artaspinosa* **n. sp**. may be superficially mistaken for *Tharyx acutus* Webster & Benedict, 1887, with which it may occur. Both species have acicular spines limited to the neuropodia. However, *C. artaspinosa* **n. sp**. has three distinct peristomial rings whereas *T. acutus* has an elongate smooth peristomium with only lateral grooves denoting the posterior lip of the mouth, but not producing separate rings. In addition, posterior segments of *T. acutus* are expanded, with a broad ventral groove into which the neurosetae project, including the acicular spines that have a sub-bidentate knobby tip. In contrast, the posterior segments of *C. artaspinosa* **n. sp**. are narrow, rounded, and while variously flattened ventrally, lack a distinct ventral groove; the neuroacicular spines are elongate and have a simple, narrowly blunted tip without any apical knobs or teeth.

Biology. *Chaetozone artaspinosa* **n. sp**., as *C. vivipara*, was first reported in the August 1995 MWRA Boston Harbor collections (Hilbig *et al*. 1996) but was not reported in the spring (April) 1995 samples. In the August samples, the species was reported in densities of 8,000 to 29,000 individuals per m^2 at stations T-01 and T-02 (Deer Island Flats and off Logan Airport, northern Harbor). Hilbig *et al*. (1996) suggested that large numbers of unidentified juvenile cirratulids enumerated in the April 1995 samples from these same two stations might have belonged to this species; juvenile cirratulids were the third most abundant taxon at both stations in the April 1995 samples.

In order to determine if the juvenile cirratulids set aside in April of 1995 were *C. artaspinosa* **n. sp**., some of the specimens available from replicates from Stations T-01, T-02, and T-03 were examined and determined to indeed include juveniles of *C. artaspinosa* **n. sp**. In addition, adults packed with eggs were also present at Sta. T-03. Some of the meristic data is presented in Table 4 and images of juveniles from 10 to 28 setigers in length are illustrated in Figure 23. The smallest juveniles with 10 and 11 setigers were grub-like post-larval forms (Fig. 23A–B) but had well-developed dorsal tentacles; one or two stiff capillary setae were present in noto- and neuropodia, but acicular spines were not present. Juveniles with 12 and 13 setigers (Fig. 23C–E) exhibit some elongation of the trunk region and branchiae were present on a few anterior setigers; one acicular spine was observed on the tenth setiger of a 14-setiger specimen (Table 4). Larger juveniles with 19 setigers (Fig. 23F), 22 setigers (Fig. 23G), 25 setigers (Fig. 23H), and 28 setigers (Fig. 23I) exhibit an elongation of the body from the thick and grub-like post-larval shape to an elongated body with a consistent width and length but no enlargement of anterior and posterior setigers as present in adults (Fig. 20A). Acicular spines with a narrow rounded tip are consistently first present from about the 14-setiger stage. Initially, the spines are first present from setiger 10 in specimens with 14–20 setigers; specimens with 25–28 setigers have the spines first present at setigers 14–15. Thus, the juveniles have neuropodial acicular spines first present in middle body segments as with the much larger adults (holotype: first acicular spine in setiger 55 of 80). These observations of juveniles therefore suggest that with growth and setal replacement, acicular spines retain their position in the middle body segments.

Stations T-01, T-02, and T-05A are locations in Boston Harbor where *Chaetozone artaspinosa* **n. sp**. occurred consistently (Maciolek *et al* 2006, 2008). The species was typically among the top 10 or 15 most abundant benthic invertebrates at these sites. These three sites are located in the northern part of Boston Harbor near the main shipping channel into Boston. Sediments at these sites have lower percentages of fines (silt + clay ca. 20%) and higher sand inventories. In addition, total organic carbon is relatively low at about 0.8% (Maciolek *et al* 2008).

Several specimens of *C. artaspinosa* **n. sp**. collected in April 1995 (Sta. T-03) and 2002 (Sta. T-05A) were observed with the middle segments packed with eggs measuring up to 95–125 μm in diameter. Gametes were not observed in specimens from the August surveys, suggesting that this species reproduces in the spring. The appearance of juveniles in April samples previously discussed supports this suggestion.

Etymology. The epithet is from *artus*, Latin for narrow and *spina*, Latin for thorn, referring to the narrow acicular spines that characterize this species.

Distribution. Known only from Boston Harbor, Massachusetts, in shallow subtidal sediments from 4–16 m, but likely widespread in estuaries along the U.S. northeastern coast.

TABLE 4. Growth Characteristics of Juvenile *Chaetozone artaspinosa* **n. sp.** from Boston Harbor, Sta. T-02, April 1995.

Number of Setigers	Length (mm)	Acicular spines begin setiger	Number of acicular spines	Figure
10	0.67	–	0	23A
11	0.64	–	0	23B
11	0.64	–	0	–
12	0.85	–	0	–
12	0.92	–	0	–
12	0.98	–	0	23C
13	0.95	–	0	23D
13	0.90	–	0	23E
14	1.10	10	1	–
19	0.95	10	1-2	23F
20	0.92	10	2-3+1 cap	–
22	0.98	12	2-3	23G
25	2.3	14	1-2	23H
25	2.1	15	2-3	–
26	2.6	14	2-3 +1 cap	–
28	2.8	15	2-3	23I

Chaetozone castouria new species

Figures 24–26

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Chaetozone sp. 2. Blake *et al*. 1987: C-2; Maciolek *et al.* 1987a: D-2; Hilbig 1994: 940.
Chaetozone sp. 6. Blake *et al.* 1987: C-2; Maciolek *et al.* 1987a: D-2; 1987b: D-2; Hilbig 1994: 940.

Material examined. (*141 specimens*) **Off New Jersey and Delaware, U.S. Mid-Atlantic ACSAR Program,** coll. R. Petrecca, Chief Scientist. **Sta. 1**: Cruise Mid-4, Rep. 3, 17 May 1985, 38°35.88′N, 72°53.13′W, 2194 m, **holotype** (USNM 1660990), 1 **paratype** (USNM 1660991); Rep. 1, 17 May 1985, 38°35.88′N, 72°53.18′W, 2200 m, 2 **paratypes** (USNM 1660992); Cruise Mid-1, Rep. 1, 31 Mar 1984, 38°35.98′N, 72°52.86′W, 2195 m, 2 **paratypes** (USNM 1660993); Cruise Mid-2, Rep.3, 03 Aug 1984, 38°35.99′N, 72°52.87′W, 2194 m, 2 **paratypes** (USNM 1660994); Cruise Mid-3, Rep. 1, 02 Dec 1984, 38°35.92′N, 72°53.03′W, 2165 m, 1 **paratype** (USNM 1660995); Cruise Mid-5, Rep. 2, 05 Aug 1985, 38°35.90′N, 72°53.11′W, 2185 m, 1 **paratype** (USNM 1660996); Rep. 3, 05 Aug 1985, 38°35.91′N, 72°53.10′W, 2185 m, 1 **paratype** (USNM 1660997); Cruise Mid-6, Rep. 2, 13 Nov 1985, 38°35.89′N, 72°53.12′W, 2199 m, 1 **paratype** (USNM 1660998). **Sta. 2**: Cruise Mid-1, Rep. 2, 01 Apr 1984, 38°35.71N, 72°53.69′W, 2018 (2, USNM 1660999); Cruise Mid-2, Rep. 2, 03 Aug 1984, 38°35.74′N, 72°53.687′W, 2014 m, 1 **paratype** (USNM 1661000); Cruise Mid-3, Rep. 1, 02 Dec 1984, 38°35.69N, 72°53.63′W, 2015 m (1, USNM 1661001); Cruise Mid-4, Rep. 2, 17 May 1985, 38°35.66′N, 72°53.80′W, 2011 m, 1 **paratype** (USNM 1661002); Cruise Mid-5, Rep. 1, 05 Aug 1985, 38°35.68′N, 72°53.79′W, 2010 m (1, USNM 1661003); Cruise Mid-6, Rep. 3, 13 Nov 1985, 38°35.83′N, 72°53.91′W, 1994 m, 1 **paratype** (USNM 1661004). **Sta. 3**: Cruise Mid-3, Rep. 2, 03 Dec 1984, 38°36.91′N, 72°51.55′W, 2050 m (1, USNM 1661005); Cruise Mid-5, Rep. 2, 05 Aug 1985, 38°36.75′N, 72°51.52′W, 2058 m (1, USNM 1661006). **Sta. 4**: Cruise Mid-4, Rep. 1, 16 May 1985, 38°44.41′N, 72°41.24′W, 2100 m, 3 **paratypes** (USNM 1661007); Rep. 2, 16 May 1985, 38°44.45′N, 72°41.26′W, 2091 m, 2 **paratypes** (USNM 1661008); Cruise Mid-5, Rep. 1, 16 May 1985, 38°44.45′N, 72°41.26′W, 2091 m, 3 **paratypes** (USNM 1661009). **Sta. 5**: Cruise Mid-1, Rep. 1, 08 May 1984, 38°50.54′N, 72°33.18′W, 2055 m (2, USNM 1661011); Rep. 2, 04 May 1984, 38°50.53′N, 72°33.10′W, 2065 m, 1 **paratype** (USNM 1661010); Rep. 3, 08 May 1984, 38°50.46′N, 72°33.14′W, 2080 m, (1, USNM 1661012); Cruise Mid-2, Rep. 2, 01 Aug 1984, 38°50.42′N, 72°33.05′W, 2089 m (1, USNM 1661013); Cruise Mid-3, Rep. 1, 05 Dec 1984, 38°50.42′N, 72°33.04′W, 2085 m

(1, USNM 1661014); Rep. 2, 05 Dec 1984, 38°50.40′N, 72°33.12′W, 2090 m (2, USNM 1661015); Rep. 3, 05 Dec 1984, 38°50.47′N, 72°33.07′W, 2070 m (1, USNM 1661016); Cruise Mid-4, Rep.1, 16 May 1985, 38°50.46′N, 72°33.23′W, 2080 m (1, USNM 1661017); Rep. 2, 16 May 1985, 38°50.48′N, 72°33.19′W, 2080 m (1, USNM 1661018); Cruise Mid-6, Rep.2, 11 Nov 1985, 38°50.49′N, 72°33.17W, 2079 m, 3 **paratypes** (USNM 1661019); Rep. 3, 11 Nov 1985, 38°50.44′N, 72°33.20W, 2089 m (3, USNM 1661020). **Sta. 6**: Cruise Mid-1, Rep. 1, 03 May 1984, 39°05.61′N, 72°02.98′W, 2090 m, 3 **paratypes** (USNM 1661021); Cruise Mid-2, Rep. 1, 01 Aug 1984, 39°05.65′N, 72°02.97′W, 2084 m (1, USNM 1661022); Cruise Mid-3, Rep. 1, 28 Nov 1984, 39°05.58′N, 72°02.81′W, 2090 m (1, USNM 1661023); Rep. 2, 28 Nov 1984, 39°05.57′N, 72°02.83′W, 2090 m (2, USNM 1661024); Rep. 3, 28 Nov 1984, 39°05.65′N, 72°02.08′W, 2085, (3, USNM 1661025); Cruise Mid-4, Rep. 3, 15 May 1985, 39°05.66′N, 72°03.22′W, 2085 m (1, USNM 1661026); Cruise Mid-5, Rep. 2, 02 Aug 1985, 39°05.64′N, 72°03.24′W, 2080 m (1, USNM 1661027); Cruise Mid-6, Rep. 1, 10 Nov 1985, 39°05.67′N, 72°03.36′W, 2089 m (2, USNM 1661028); Rep, 3, 10 Nov 1985, 39°05.51′N, 72°03.16′W, 2092 m, 2 **paratypes** (USNM 1661029). **Sta. 7**: Cruise Mid-1, Rep. 1, 06 May 1984, 38°27.32′N, 73°03.43′W, 2110 m, 4 **paratypes** (USNM 1661030); Rep. 2 (4, USNM); 06 May 1984, 38°27.30′N, 73°03.43′W, 2100 m, 4 **paratypes** (USNM 1661031); Rep. 3, 06 May 1984, 38°27.34′N, 73°03.48′W, 2100 m, 3 **paratypes** (USNM 1661032); Cruise Mid-3, Rep. 2, 05 Aug 1984, 38°27.34′N, 73°03.41′W, 2104 m (2, USNM 1661033); Rep. 3, 05 Aug 1984, 38°27.39′N, 73°03.39′W, 2099 m (1, USNM 1661034); Cruise Mid-5, Rep. 1, 07 Aug 1985, 38°27.34′N, 73°03.53′W, 2085 m (1, USNM 1661035); Rep. 2, 07 Aug 1985, 38°27.32′N, 73°03.54′W, 2095 m (1, USNM 1661036); Cruise Mid-6, Rep. 3, 14 Nov1985, 38°27.28′N, 73°03.54′W, 2104 m, 2 **paratypes** (USNM 1661037). **Sta. 8**: Cruise Mid-1, Rep. 1, 06 May 1984, 38°27.36′N, 73°05.09′W, 2148 m (1, USNM 1661038); Rep. 2, 06 May 1984, 38°27.36′N, 73°05.88′W, 2150 m (4, USNM 1661039); Rep. 3, 06 May 1984, 38°27.36′N, 73°04.81′W, 2150 m (2, USNM 1661040); **Sta. 9**: Cruise Mid-1, Rep. 1, 06 May 1984, 38°17.24′N, 73°14.51′W, 2105 m (2, USNM 1661041); Rep. 2, 06 May 1984, 38°17.22′N, 73°14.56′W, 2108 m, 3 **paratypes** (USNM 1661042); Rep. 3, 06 May 1984, 38°17.23′N, 73°14.60′W, 2108 m (3, USNM 1661043); Cruise Mid-3, Rep. 2, 30 Nov 1984, 38°17.28′N, 73°14.47′W, 2105 m (3, USNM 1661044); Cruise Mid-4, Rep. 1, 18 May 1985, 38°17.19′N, 73°14.66′W, 2100 m (1, USNM 1661045); Cruise Mid-5, Rep. 3, 09 Aug 1985, 38°17.19′N, 73°14.63′W, 2100 m (1, USNM 1661046). **Sta. 11**: Cruise Mid-1, Rep. 2, 07 May 1984, 38°40.31′N, 72°56.31′W, 1520 m, 1 **paratype** (USNM 1661047); Rep. 3, 07 May 1984, 38°40.22′N, 72°56.27′W, 1520 m, 1 **paratype** (USNM 1661048); Cruise Mid-2, Rep. 2, 05 Aug 1984, 38°40.14′N, 72°56.41′W, 1509 m (1, USNM 1661049); Cruise Mid-3, Rep. 2, 04 Dec 1984, 38°40.14′N, 72°56.31′W, 1520 m, 1 **paratype** (USNM 1661050); Cruise Mid-4, Rep. 1, 17 May 1985, 38°40.10′N, 72°56.43′W, 1510 m (1, USNM 1661051); Rep. 2, 17 May 1985, 38°40.12′N, 72°56.44′W, 1510 m (1, USNM 1661052). **Sta. 13**: Cruise Mid-1, Rep. 3, 03 Apr 1984, 37°53.36′N, 73°45.10′W, 1613 m (1, USNM 1661053); Cruise Mid-2, Rep. 2, 07 Aug 1984, 37°53.28′N, 73°45.26′W, 1619 m (1, USNM 1661054); Cruise Mid-4, Rep. 3, 19 May 1985, 37°53.27′N, 73°45.27′W, 1605 m (1, USNM 1661055); Cruise Mid-5, Rep. 1, 09 Aug 1985, 37°53.26′N, 73°45.21′W, 1607 m (2, USNM 16610556); Cruise Mid-6, Rep. 3, 15 Nov 1985, 37°53.31′N, 73°45.27′W, 1609 m, 2 **paratypes** (USNM 1661057). **Sta. 14**: Cruise Mid-4, Rep. 2, 19 May 1985, 37°53.83′N, 73°44.76′W, 1492 m (1, USNM 1661058); Cruise Mid-6, Rep. 1, 19 May 1985, 37°53.69′N, 73°44.69′W, 1515 m (1, USNM 1661059).—**Off New England, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 2**: Cruise NA-1, Rep. 1, 08 Nov 1984, 40°57.20′N, 66°13.72′W, 2112 m (1, USNM 1661060); Rep. 2, 08 Nov 1984, 40°57.18′N, 66°13.87′W, 2095 m (1, USNM 1661061); Rep. 3, 09 Nov 1984, 40°57.15′N, 66°13.80′W, 2103 m (1, USNM 1661062); Cruise NA-2, Rep.3, 26 Apr 1985, 40°57.15′N, 66°13.72′W, 2100 m (1, USNM 1661063); Cruise NA-3, Rep. 3, 03 Jul 1985, 40°57.19′N, 66°13.67′W, 2100 m (2, USNM 1661064). **Sta. 6**: Cruise NA-5, Rep. 1, 30 Apr 1986, 40°04.94′N, 67°29.17′W, 2120 m (1, USNM 1661065). **Sta. 8**: Cruise NA-1, Rep. 3, 11 Nov 1984, 40°10.320′N, 67°37.38′W, 2180 m (1, USNM 1661066); Cruise NA-2, Rep.3, 20 Apr 1985, 40°10.27′N, 67°37.22′W, 2180 m (1, USNM 1661067). **Sta. 9:** Cruise NA-6, Rep. 2, 28 Jul 1986, 39°50.41, 70°01.62′W, 1230 m, 1 **paratype** (USNM 1661068). **Sta. 13**: Cruise NA-5, Rep. 1, 06 May 1986, 39°47.99′N, 70°55.08′W, 1270 m, 1 **paratype** (USNM 1661069). **Sta. 15**: Cruise NA-5, Rep. 3, 06 May 1986, 39°40.00′N, 70°54.41′W, 2160 m (1, USNM 1661070).—**US South Atlantic ACSAR Program**, **Off Cape Lookout, North Carolina**, coll. J.A. Blake, Chief Scientist. **Sta. 2**: Cruise SA-2, Rep. 2, 27 Mar 1984, 34°14.46′N, 75°43.85′W, 1003 m (2, USNM 1661071). **Sta. 3**: Cruise SA-2, Rep. 2, 27 Mar 1984, 34°14.63′N, 75°40.17′W, 1513 m (4, USNM 1661072); Cruise SA-3, Rep. 3, 14 Jul 1984, 34°15.10′N, 75°40.30′W, 1489 m (1, USNM 1661074); **Sta. 4**: Cruise SA-2, Rep. 2, 20 May 1984, 34°11.90′N, 75°38.70′W, 2029 m (1, USNM 1661073).—**Off Cape Hatteras, Hatteras Canyon**. **Sta. 6**: Cruise SA-1, Rep. 2, 19 Nov 1983, 34°48.97′N, 75°15.96′W, 1910 m (3

USNM 16611075); Cruise SA-2, Rep. 1, 25 May 1984, 34°49.90′N, 75°13.50′W, 1974 m (4, USNM 1661076); Rep. 2, 25 May 1984, 34°50.200′N, 75°13.40′W, 1979 m (1, USNM 1661077); Rep. 3, 25 May 1984, 34°49.90′N, 75°13.70′W, 1984 m (2, USNM 1661078).—**Off Cape Fear, North Carolina**. **Sta. 12**: Rep. 2, 22 May 1985, 34°00.23′N, 76°07.26′W, 2010 m (2, USNM 1661079).

Description. A moderately sized species, with a long, narrow, threadlike body. Largest specimens available include a paratype (USNM 1661000) from Mid-Atlantic slope with 72 setigers, 16 mm long, and 0.20 mm wide and a paratype (USNM 1661068) from North Atlantic slope (USNM 1661068), broken in two parts, sexually mature, with 88 setigers, 17.6 mm long and 0.25 mm wide across anterior segments (Figs. 24A–B, 25D–F). Holotype (USNM 1660990) from the Mid-Atlantic slope, with 50 setigers, 7.3 mm long and 0.15 mm wide across anterior setigers (Fig. 25A–C); most paratypes of a similar size.

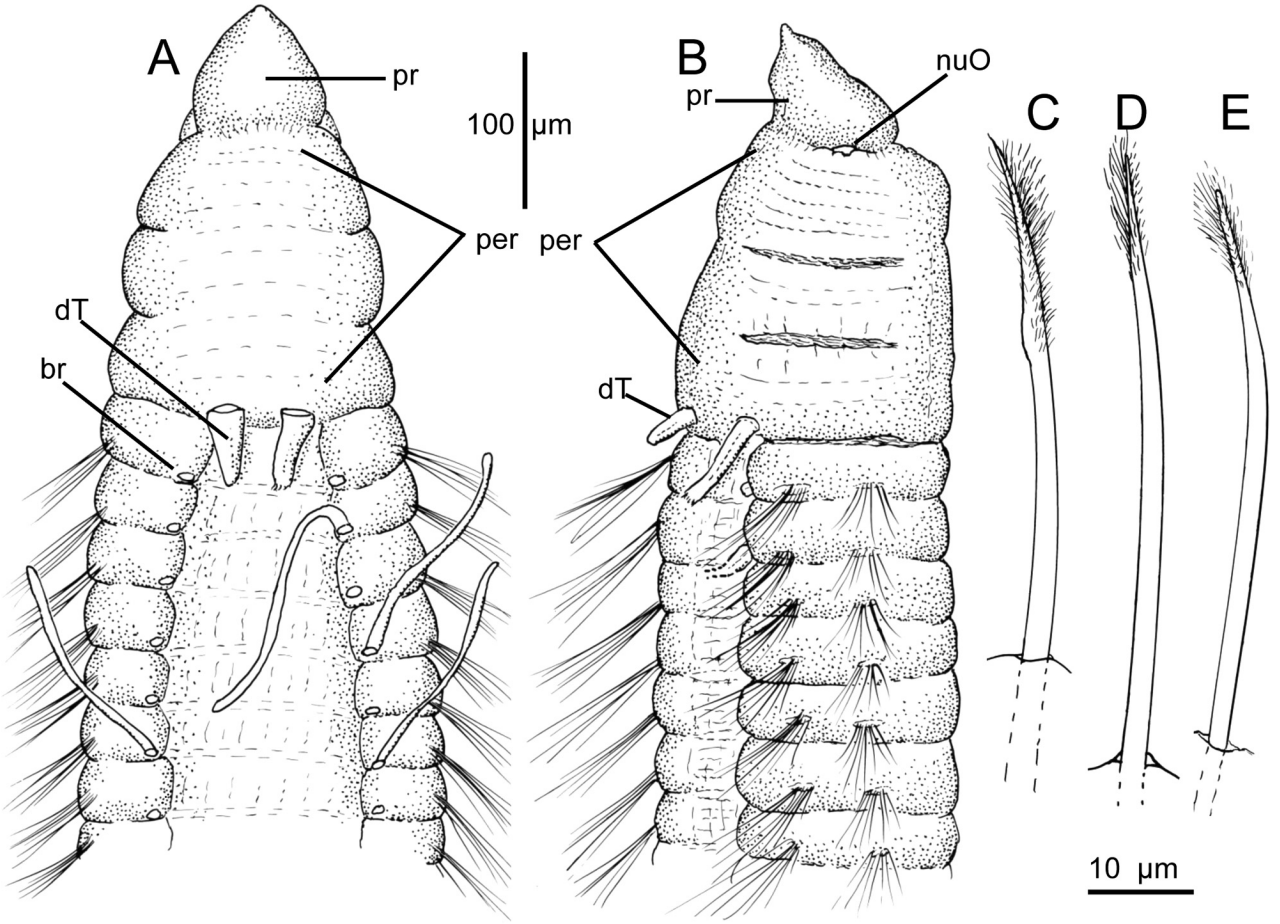

FIGURE 24. *Chaetozone castouria* **n. sp**. Paratype (USNM 1660996): A, anterior end, dorsal view; B, anterior end, ventral view; C–E, neuropodial acicular spines.

Body of a more-or-less consistent width, slightly wider in pre-setiger region and first few setigers (Figs. 25A–B, 26A); posterior end distinctly inflated, rounded dorsally, and flattened ventrally (Figs. 25A, C, F, 26A). First 10–15 setigers narrow, crowded; subsequent setigers becoming moniliform, about as wide as long with those in posterior half of body more elongate, about 1½ to 2 times as long as wide (Fig. 26A); posterior inflated segments again crowded (Figs. 25A,C, F, 26A). Some specimens with an expanded "stomach" area consisting of 4–5 swollen segments filled with fine-grained sediment (Fig. 25A). Dorsal and ventral grooves absent. Color in alcohol opaque white to light tan, with no pigmentation.

Pre-setiger region elongate, about as long as first seven setigers (Fig. 24A–B). Prostomium short, pear-shaped, as long as wide, tapering to pointed tip when viewed dorsally (Fig. 24A), more pointed when viewed laterally and often directed dorsally (Figs. 24B, 25D, G); eyespots absent; nuchal organs narrow slits on posterior lateral margin. Peristomium divided by lateral grooves into three weakly developed rings, each about equal in size (Fig. 24A–B); dorsal and ventral surfaces smooth, not interrupted by groove, with parapodia forming dorsolateral shoulders (Fig.

24A–B). Dorsal tentacles arise from medial location on posterior margin of peristomium (Fig. 24A–B); first pair of branchiae on setiger 1 dorsal to notosetae; subsequent branchiae in a similar location (Fig. 24A), mostly in anterior setigers with only a few on middle and posterior segments.

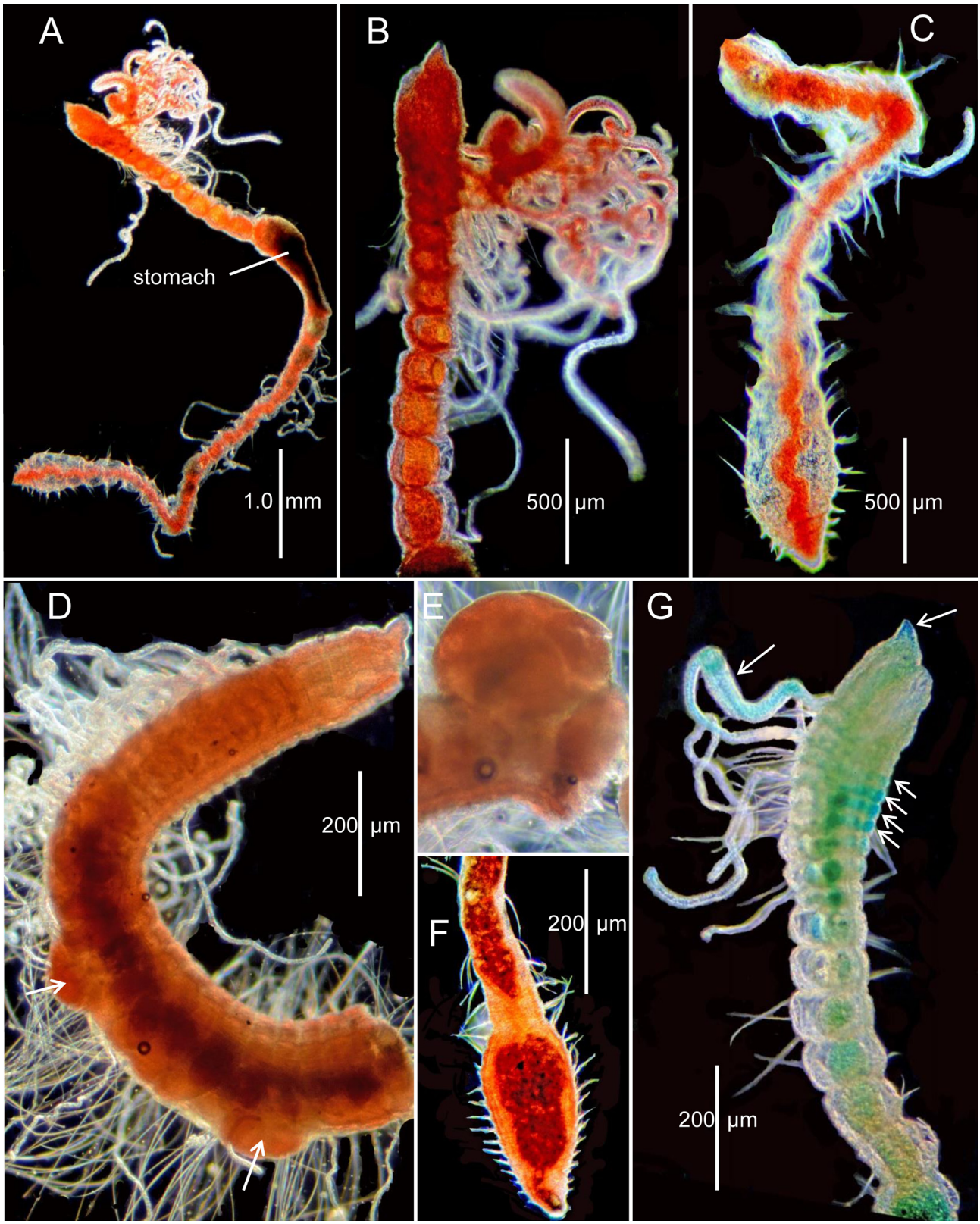

FIGURE 25. *Chaetozone castouria* **n. sp**. A, entire worm; B, anterior end, left lateral view; C, posterior end, dorsal view; D, anterior end of ovigerous specimen (arrows denote egg masses); E, detail of egg mass (not to scale); F, posterior end, dorsal view; G, anterior end of specimen (arrows denote MG concentrations). A–F stained with Shirlastain A; G, stained with MG. A–C, Holotype (USNM 1660990); D–F, Paratype (USNM 1661068); G, Paratype (USNM 1661069).

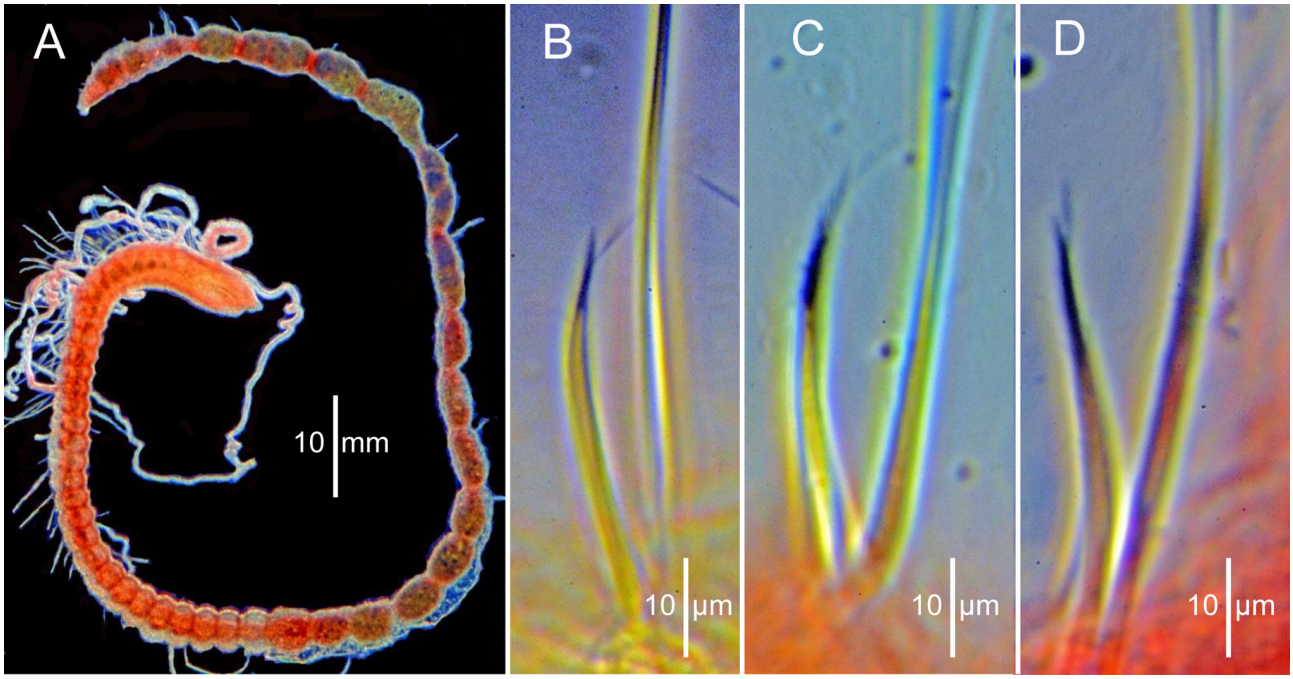

FIGURE 26. *Chaetozone castouria* **n. sp**. Paratype (USNM 1660991); A, entire worm, right lateral view. B–D, paratype (USNM 1660997): acicular spines and capillaries. A, Stained with Shirlastain A.

Parapodia of anterior segments weakly swollen, with noto- and neurosetae arising directly from body wall. Parapodia of moniliform segments inconspicuous, no distinct podia evident where setae emerge. Setae include long, smooth capillaries and acicular spines in both noto- and neuropodia. Capillaries numbering 10–12 per noto- and neuropodium in anterior setigers, reduced to 6–7 in middle segments, and 0–2 in posterior setigers. Some capillaries with thicker shafts transitioning to short acicular spines in posterior quarter of body, at about setiger 40 in 50-setiger holotype and setiger 70 in 88-setiger paratype (USNM 1661068). Spines in posterior setigers numbering 1–3; with no more than two per neuropodium and one per notopodium, accompanied by 0–3 capillaries. Spines short, narrow, tapering to pointed tip covered with dense cloak of fibrils (Fig. 24C–E) producing dark bristled tip in light microscope (Fig. 26B–D). Sexually mature specimen (USNM 1661068) with long natatory capillaries in anterior and middle setigers.

Posterior expanded section with nine segments in holotype and up to 14 segments in larger specimens Fig. 25 A, C, F). These expanded sections rounded dorsally, flattened ventrally, tapering to pygidium consisting of a short, rounded lobe ventral to anal opening.

Methyl green staining. The tip of the prostomium stains intensely with MG as well as several segments on venter of 5–7 anterior setigers (Fig. 25G). The dorsal tentacles when present may retain stain lightly; the rest of the body does not retain any stain externally.

Remarks. *Chaetozone castouria* **n. sp**. is a small deep-water threadlike species with a long, moniliform abdominal section terminating in an expanded posterior region with crowded segments that is rounded dorsally and flattened ventrally. The acicular spines of *C. castouria* **n. sp**. are limited to the posterior quarter of the body or in the largest specimens, a few far posterior setigers. The spines occur in both noto- and neuropodia and are short and taper to a pointed tip that is covered with fine bristles (Fig. 24C–E); in phase contrast, these bristles produce a darkened apex to the spines (Fig. 26B–D). The spines number no more than two per neuropodium and one per notopodium and are usually accompanied by 2–3 capillaries.

The moniliform segments, the expanded posterior section of the body, and MG bands on the venter of some anterior setigers of *Chaetozone castouria* **n. sp**. are reminiscent of similar morphology among species of the genus *Aphelochaeta*, including the type-species, *Aphelochaeta monilaris* Hartman, 1961 from offshore California. However, by definition, species of *Aphelochaeta* do not have acicular spines anywhere along the body. As such, *C. castouria* **n. sp**. is unique among species of *Chaetozone* by having an expanded posterior end to the body and acicular spines with a bristled apex.

Biology. One paratype (USNM 1661068) was observed with three large blister-like egg-bearing pouches on the dorsal surface of anterior setigers. Each pouch contains at least 5–6 eggs having diameters of ca. 160–200 µm. Each egg has a smooth cytoplasm and distinct nucleolus. The specimen also has long natatory capillaries along much of the body. With relatively few large eggs relative to the size of the worms, it is likely that development is direct, perhaps with a type of brooding. Gametes were not observed in other specimens.

Most of the long, moniliform segments of the middle and posterior sections of the body have the gut filled with sediment giving these segments the appearance of strings of fecal pellets (Fig. 26A). The sediments in the gut consist of numerous tightly packed fine sand and silt-sized particles. Sediment particle size in sediments where *C. castouria* **n. sp**. occurred consisted of 70% or more silt + clay (Blake & Grassle 1994; Maciolek *et al*. 1987a–b). The species occurs in middle and lower slope depths from about 1200–2200 m. Another widespread cirratulid in similar depths along the U.S. Atlantic slope with an elongate threadlike body and fecal pellets in elongate moniliform segments is the recently described *Caulleriella rodmani* Blake, 2021b.

Etymology. The epithet, *castouria*, is from the Greek *castor*, for beaver and *oura*, Greek for tail in reference to the expanded and flattened posterior segments of this species that when best developed, resembles the tail of a beaver.

Distribution. Widespread along the entire U.S. Atlantic slope from off New England to the Carolinas: New England slope, 1230–2180 m; Mid-Atlantic slope, 1492–2200 m; South Atlantic slope, 1003–2029 m.

Chaetozone novagracilis new species

Figures 27–28

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Chaetozone setosa: Blake *et al.* 1987: C-2 (in part). **Not** Malmgren 1867.

Material examined. (*2 specimens*) **Off Charleston, South Carolina, US South Atlantic ACSAR Program**, coll. J.A. Blake, Chief Scientist. **Sta. 14A**: Cruise SA-5, Rep. 2, 20 Sep 1985, 32°23.26′N, 77°165.29′W, 605 m, **holotype** (USNM 1661373); Rep. 3, 20 Sep 1985, 32°22.22′N, 77°15.31′W, 605 m, 1 **paratype** (USNM 1661374).

Description. An elongate, relatively narrow-bodied species with width consistent through middle segments, then tapering slightly posteriorly. Holotype complete, but partially broken in two places posteriorly; with 77 setigers, 9.25 mm long, and 0.54 mm wide across anterior setigers (Figs. 27A–B, 28A–B). Paratype similar but with posterior setigers damaged, stretched, and terminal end missing. Body cylindrical in cross section, with dorsal and ventral surfaces weakly rounded; elevated.. Holotype with shallow dorsal groove along anterior end middle segments (Fig. 28B). All segments short, with anterior and middle segments crowded, about 8–9 times wider than long; posterior segments longer, about as long as wide, but not moniliform; cinctures not developed. Color in alcohol light tan without any pigment on body.

Pre-setiger region elongate, thick, about as long as first ten setigers, tapering anteriorly (Figs. 27A–B, 28A–B). Prostomium triangular, tapering to narrow pointed tip (Fig. 27A–B); eyespots absent; nuchal organs rounded raised openings on posterior lateral margin (Fig. 27B). Peristomium an elongate, single ring lacking any evidence of annular rings or grooves; paratype with two longitudinal grooves separated mid-dorsally by ridge producing dorsal crest (Fig. 27A). Dorsal tentacles arise near posterior margin of peristomium with first pair of branchiae on setiger 1; subsequent branchiae in similar location. All branchiae missing or reduced to stubs, except for a single thin branchia on one posterior segment of holotype.

Parapodia of anterior and middle segments located laterally, on raised ridges with noto- and neuropodia positioned close together (Figs. 27A–B, 28B); parapodia of posterior segments more widely separated, with podia reduced to low ridges or mounds from which setae arise. Anterior setae all long capillaries numbering about 10–12 per fascicle in notopodia and 6–8 in neuropodia, continuing through middle setigers; long natatory-like setae absent. Neuropodial acicular spines from setiger 44 in holotype; these spines number two per fascicle with capillaries at first; increasing to 5–6 spines in far posterior setigers accompanied by only 1–2 capillaries. Notopodia without separate acicular spines except last two setigers where two short, thickened, spinous capillaries occur among long thin capillaries. Thus, only up to seven or eight spines or spinous capillaries present in far posterior setigers; distinct posterior cinctures of spines not developed. Individual neuropodial spines unusual, with thickened shaft weakly curving to rounded tip; in lateral view, concave side of shaft with a groove and with apex of shaft expanded bearing same groove (Fig. 28C). In other views, groove and expanded shaft not clearly evident.

Body terminating in multilobed pygidium consisting of two rounded ventral lobes and two small dorsal lobes (Fig. 27C).

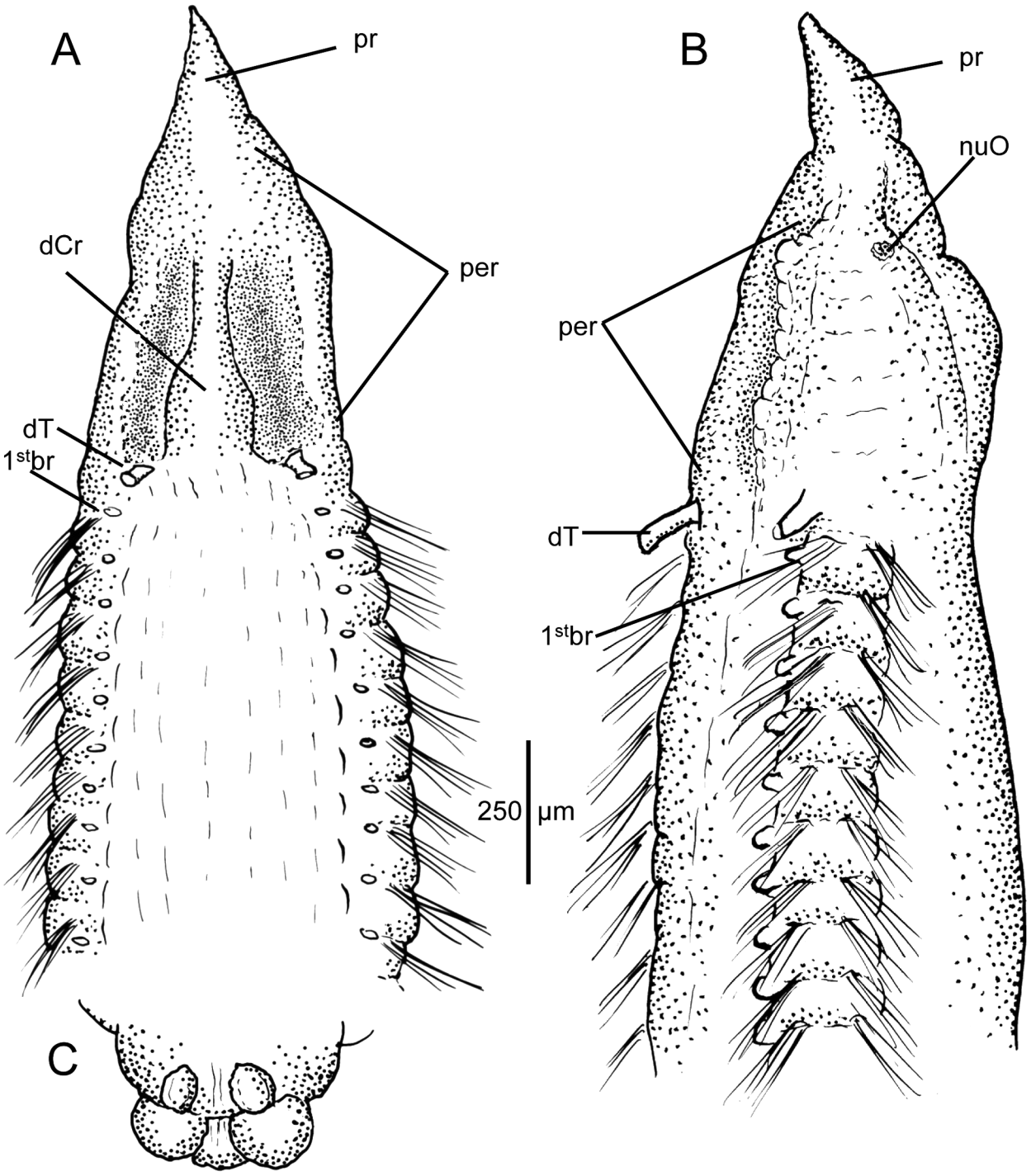

FIGURE 27. *Chaetozone novagracilis* **n. sp**. Holotype (USNM 1661373): A, anterior end, dorsal view; B, anterior end, right lateral view; C, pygidium, dorsal view.

Methyl green staining. Prostomium retaining stain, otherwise no pattern.

Remarks. *Chaetozone novagracilis* **n. sp**. is unusual among bitentaculate cirratulids in having a multilobed pygidium and a unique grooved apical enlargement on the acicular spines. Although prominent and well-developed neuropodial acicular spines are present, notopodial spines are reduced to a pair of spinous capillaries. The absence of an equivalent number of notopodial spines and of distinct posterior cinctures of spines departs from the latest generic diagnosis of the genus. In this regard, *Chaetozone novagracilis* **n. sp**. is most similar to *C. gracilis*, a deep-

water species from off California (depth 4016 m) that also has a reduced number of acicular spines that do not form distinct posterior cinctures and a multilobed pygidium (Moore 1923; Blake 1996). *Chaetozone novagracilis* **n. sp**. differs from *C. gracilis* in having an undivided peristomium instead of one that has a smooth elongate ring followed by a separate achaetous segment that bears the dorsal tentacles and first pair of branchiae. In contrast, the peristomium of *C. novagracilis* **n. sp**. is undivided with the dorsal tentacles on the posterior margin and the first pair of branchiae arising from setiger 1. In addition, the neuropodial acicular spines of *C. novagracilis* **n. sp**. first occur on setiger 44 instead of 33, and the spines have an unusual apical enlargement that bears a longitudinal grove or channel that continues along convex side of the shaft. Such a spine has not been previously observed in cirratulids.

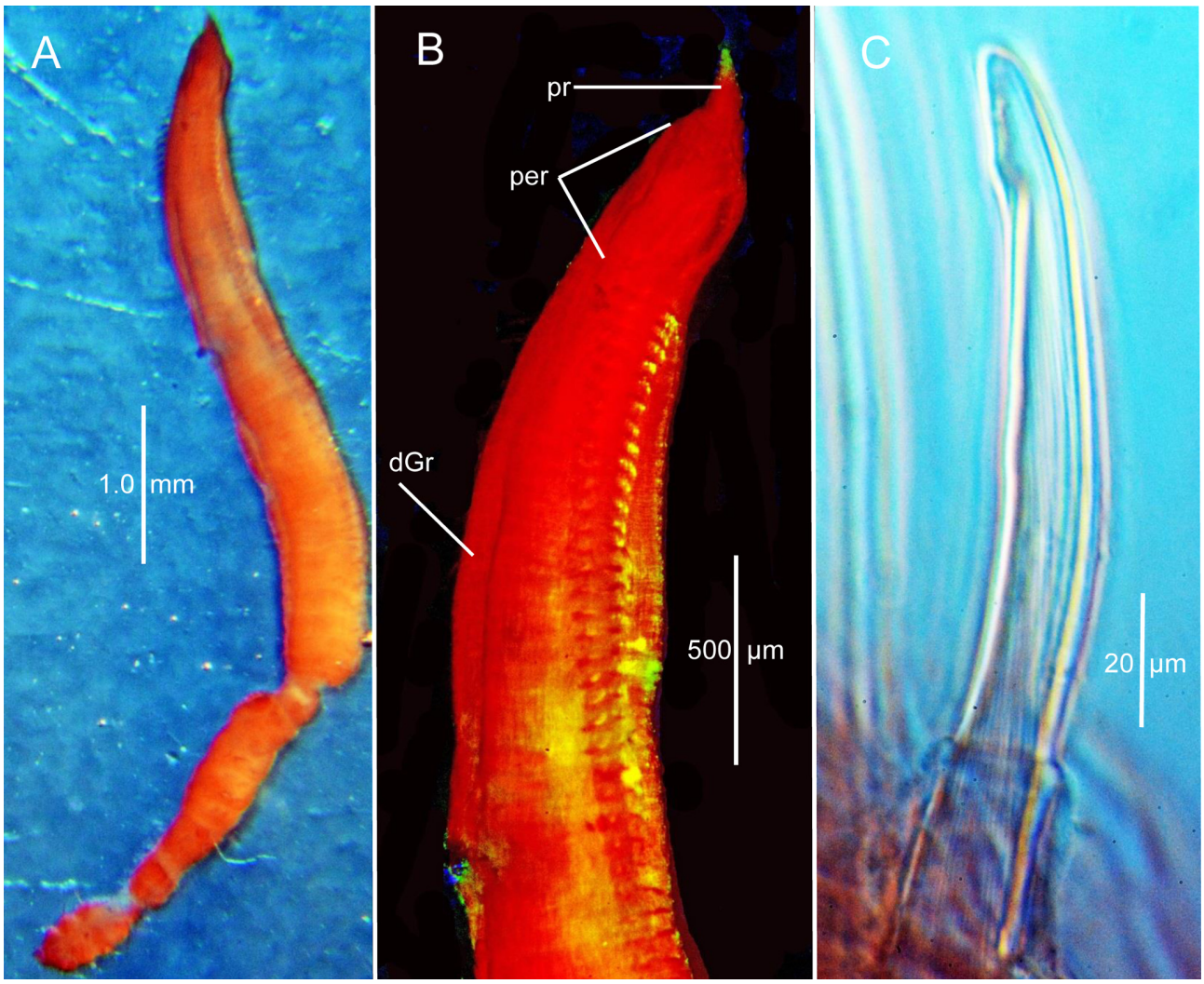

FIGURE 28. *Chaetozone novagracilis* **n. sp**. Holotype (USNM 1661373): A, entire worm, right lateral view; B, anterior end, right lateral view; C, neuropodial acicular spine. Stained with Shirlastain A.

Biology. Cruise SA-5 was the only ACSAR survey on which samples were collected at Sta. 14A off South Carolina. The ecological results were presented by Blake *et al*. (1987) and Blake & Grassle (1994). The site was unusual in that the sediment consisted of 94–95% sand with low water content. The coarse grain size of the sediments appears to be important for *Chaetozone novagracilis* **n. sp**. because it was not encountered at other adjacent 600 m stations off Cape Lookout and Cape Hatteras where the sediments have a high silt + clay content. Other newly described polychaetes known only from Sta. 14A are the orbiniid *Leodamas mucronatus* Blake, 2021a and another cirratulid, *Caulleriella pintada* Blake, 2021b. The latter species, with 14% of the total number of individuals among three replicate 0.09 m^2 samples, was the most abundant benthic invertebrate species at the site (Blake & Grassle 1994; Blake 2021b).

Etymology. The epithet is from *novus,* Latin for new or recent; and *gracilis*, Latin for slender or thin and is in reference to the close morphological similarity of the new species to *C. gracilis* (Moore, 1923).

Distribution. Off Charleston, South Carolina, 605 m.

Chaetozone paucispinosa **new species**
Figures 29–31
Table 5
urn:lsid:zoobank.org:act:2613441D-0481-4F32-A05A-7C22A1B2EAF7

Chaetozone sp. 1: Blake *et al*. 1987; Maciolek *et al*. 1987a: D-2 (in part); 1987b: D-2 (in part).

Material examined. (*444 specimens*) **Off Delaware and New Jersey, U.S. Mid-Atlantic ACSAR Program,** coll. R. Petrecca, Chief Scientist. **Sta. 1**: Cruise Mid-1, Rep. 1, 31 Mar 1984, 38°35.98′N, 72°52.89′W, 2195 m, **holotype** (USNM 1661244), 1 **paratype** (USNM 1661245); Cruise Mid-2, Rep 1, 03 Aug 1984, 38°36.12′N, 72°53.06′W, 2209 m, 12 **paratypes** (USNM 1661246); Rep. 3, 03 Aug 1984, 38°35.99′N, 72°52.87′W, 2194 m, 4 **paratypes** (USNM 16612447); Cruise Mid-3, Rep. 1, 02 Dec 1984, 38°35.92′N, 72°53.03′W, 2163 m, 4 **paratypes** (USNM 1661248); Rep. 2, 02 Dec 1984, 38°35.94′N, 72°53.04′W, 2175 m, 2 **paratypes** (USNM 1661249); Rep. 3, 03 Dec 1984, 38°35.97′N, 72°52.01′W, 2185 m, 2 **paratypes** (USNM 1661250); Cruise Mid-4, Rep. 3, 17 May 1985, 38°35.88′N, 72°53.13′W, 2195 m, 4, **paratypes** (USNM 1661251); Cruise Mid-5, Rep. 2, 05 Aug 1985, 38°35.90′N, 72°53.11′W, 2185 m, 8 **paratypes** (USNM 1661252); Cruise Mid-6, Rep. 2, 13 Nov 1985, 38°35.89′N, 72°53.12′W, 2199 m, (2, USNM 1661253); Rep. 3, 13 Nov 1985, 38°35.93′N, 72°53.19′W, 2194 m, 9 **paratypes** (USNM 1661254). **Sta. 2**: Cruise Mid-1, Rep. 2, 01 Apr 1984, 38°35.71′N, 72°53.69′W, 2018 m (2, USNM 1661255); Rep. 3, 01 Apr 1984, 38°35.71′N, 72°53.61′W, 2033 m (1, USNM 1661256); Cruise Mid-2, Rep. 1, 03 Aug 1984, 38°35.77′N, 72°53.58′W, 2019 m (3, USNM 1661257); Rep. 2, 03 Aug 1984, 38°35.74′N, 72°53.68′W, 2014 m (2, USNM 1661258); Rep. 3, 03 Aug 1984, 38°35.76′N, 72°53.81′W, 2004 m (1, USNM 1661259); Cruise Mid-3, Rep. 1, 02 Dec 1984, 38°35.69′N, 72°53.63′W, 2015 m (1, USNM 1661260); Rep. 3, 02 Dec 1984, 38°35.75′N, 72°53.67′W, 2010 m (1, USNM 1661261); Cruise Mid-5, Rep. 1, 05 Aug 1985, 38°35.68′N, 72°53.79′W, 2010 m (5, USNM 1661262); Rep. 3, 05 Aug 1985, 38°35.69′N, 72°53.78′W, 2005 m (4, USNM 1661263); Cruise Mid-6, Rep. 3, 13 Nov 1985, 38°35.83′N, 72°53.91′W, 1994 m (8, USNM 1661264). **Sta. 3**: Cruise Mid-1, Rep. 1, 03 May 1984, 38°36.88′N, 72°51.41′W, 2055 m (1, USNM 1661265); Rep. 2, 03 May 1984, 38°36.88′N, 72°51.34′W, 2055 m, 1 **paratype** (USNM 1661266); Rep. 3, 03 May 1984, 38°36.86′N, 72°51.29′W, 2060 m, 3 **paratypes** (USNM 1661267); Cruise Mid-2, Rep. 2, 03 Aug 1984, 38°36.87′N, 72°51.45′W, 2049 m (2, USNM 1661268); Rep. 3, 03 Aug 1984, 38°36.84′N, 72°51.46′W, 2056 m (4, USNM 1661269); Cruise Mid-3, Rep. 1, 03 Dec 1984, 38°36.84′N, 72°51.50′W, 2050 m (3, USNM 1661270); Rep. 2, 03 Dec 1984, 38°36.91′N, 72°51.55′W, 2050 m (8, USNM 1661271); Rep. 3, 03 Dec 1984, 38°36.81′N, 72°51.55′W, 2050 m (1, USNM 1661272); Cruise Mid-4, Rep. 3, 16 May 1985, 38°36.75′N, 72°51.60′W, 2052 m (3, USNM 1661273); Cruise Mid-5, Rep. 2, 05 Aug 1985, 38°36.75′N, 72°51.52′W, 2058 m, 4 **paratypes** (USNM 1661274); Rep. 3, 05 Aug 1985, 38°36.82′N, 72°51.54′W, 2050 m (2, USNM 1661275); Cruise Mid-6, Rep. 2, 12 Nov 1985, 38°36.75′N, 72°51.61′W, 2064 m (12, USNM 1661276); Rep. 3, 12 Nov 1985, 38°36.77′N, 72°51.64′W, 2056 m (7, USNM 1661277). **Sta. 4**: Cruise Mid-1, Rep. 2, 08 May 1984, 38°44.45′N, 72°41.04′W, 2108 m (1, USNM 1661278); Cruise Mid-2, Rep. 1, 01 Aug 1984, 38°44.48′N, 72°41.05′W, 2124 m (7, USNM 1661279); Rep. 2, 01 Aug 1984, 38°44.53′N, 72°41.23′W, 2114 m (1, USNM 1661280); Rep. 3, 01 Aug 1984, 38°44.54′N, 72°40.95′W, 2099 m (1, USNM 1661281); Cruise Mid-3, Rep. 1, 05 Dec 1984, 38°44.36′N, 72°41.21′W, 2105 m (5, USNM 1661282); Rep. 2, 05 Dec 1984, 38°44.38′N, 72°41.00′W, 2110 m (2, USNM 1661283); Cruise Mid-4, Rep. 2, 16 May 1985, 38°44.45′N, 72°41.26′W, 2091 m, 3 **paratypes** (USNM 1661284); Cruise Mid-5, Rep. 1, 03 Aug 1985, 38°44.43′N, 72°41.24′W, 2095 m (7, USNM 1661285); Rep. 2, 03 Aug 1985, 38°44.44′N, 72°41.22′W, 2095 m (2, USNM 1661286); Rep. 3, 3 Aug 1985, 38°44.41′N, 72°41.21′W, 2095 m (4, USNM 1661287); Cruise Mid-6, Rep. 1, 11 Nov 1985, 38°44.34′N, 72°41.27′W, 2112 m (2, USNM 1661288); Rep. 2, 11 Nov 1985, 38°44.40′N, 72°41.25′W, 2106 m (10, USNM 1661289). **Sta. 5**: Cruise Mid-1, Rep. 1, 08 May 1984, 38°50.54′N, 72°33.18′W, 2055 m (2, USNM 1661290); Rep. 2, 08 May 1984, 38°50.53′N, 72°33.10′W, 2065 m (1, USNM 1661291); Rep. 3, 08 May 1984, 38°50.46′N, 72°33.14′W, 2080 m (8, USNM 1661292); Cruise Mid-2, Rep. 1, 01 Aug 1984, 38°50.42′N, 72°33.03′W, 2089 m (5, USNM 1661293); Rep. 2, 01 Aug 1984, 38°50.42′N, 72°33.05′W, 2089 m, 2 **paratypes** (USNM 1661294); Rep. 3, 01 Aug 1984, 38°50.52′N, 72°32.96′W, 2074 m (2, USNM 1661295); Cruise Mid-3, Rep. 3, 05 Dec 1984, 38°50.47′N, 72°33.07′W, 2070 m (2, USNM 1661296); Cruise Mid-6, Rep. 1, 11 Nov 1985, 38°50.49′N, 72°33.17′W, 2079 m (6, USNM 1661297);

Rep. 2, 11 Nov 1985, 38°50.49′N, 72°33.17′W, 2084 m (10, USNM 1661298); Rep. 3, 11 Nov 1985, 38°50.44′N, 72°33.20′W, 2089 m (2, USNM 1661299). **Sta. 6**: Cruise Mid-1, Rep. 1, 03 May 1984, 39°05.61′N, 72°02.98′W, 2090 m (5, USNM 1661300); Rep. 2, 03 May 1984, 39°05.63′N, 72°03.00′W, 2088 m (5, USNM 1661301); Rep. 3, 03 May 1984, 39°05.59′N, 72°03.00′W, 2090 m (3, USNM 1661302); Cruise Mid-2, Rep. 1, 01 Aug 1984, 39°05.65′N, 72°02.97′W, 2084 m (2, USNM 1661303); Rep. 2, 01 Aug 1984, 39°05.68′N, 72°02.99′W, 2084 m (4, USNM 1661304); Rep. 3, 01 Aug 1984, 39°05.69′N, 72°02.99′W, 2084 m (1, USNM 1661305); Cruise Mid-3, Rep. 1, 28 Nov 1984, 39°05.58′N, 72°02.81′W, 2090 m (1, USNM 1661306); Rep. 2, 28 Nov 1984, 39°05.57′N, 72°02.83′W, 2090 m (5, USNM 1661307); Rep. 3, 28 Nov 1984, 39°05.65′N, 72°02.08′W, 2085 m (3, USNM 1661308); Cruise Mid-5, Rep. 1, 02 Aug 1985, 39°05.65′N, 72°03.22′W, 2080 m (1, USNM 1661309); Rep. 2, 02 Aug 1985, 39°05.64′N, 72°03.24′W, 2080 m (6, USNM 1661310); Rep. 3, 02 Aug 1985, 39°05.65′N, 72°03.22′W, 2080 m (1, USNM 1661311). **Sta. 7**: Cruise Mid-1, Rep. 1, 06 May 1984, 38°27.32′N, 73°03.45′W, 2110 m (2, USNM 1661312); Rep. 2, 06 May 1984, 38°27.32′N, 73°03.45′W, 2110 m (12, USNM 1661313); Cruise Mid-2, Rep. 1, 05 Aug 1984, 38°27.34′N, 73°03.41′W, 2104 m (4, USNM 1661314); Rep. 2, 05 Aug 1984, 38°27.32′N, 73°03.38′W, 2104 m (6, USNM 1661315); Rep. 3, 05 Aug 1984, 38°27.34′N, 73°03.41′W, 2104 m (11, USNM 1661316); Cruise Mid-3, Rep. 1, 02 Dec 1984, 38°27.28′N, 73°03.38′W, 2110 m (3, USNM 1661317); Cruise Mid-4, Rep. 1, 13 May 1985, 38°27.27′N, 73°03.52′W, 2106 m (8, USNM 1661318); Rep. 2, 13 May 1985, 38°27.27′N, 73°03.52′W, 2106 m (3, USNM 1661319); Cruise Mid-5, Rep. 3, 07 Aug 1985, 38°27.31′N, 73°03.54′W, 2088 m, 3 **paratypes** (USNM 1661320); Cruise Mid-6, Rep. 1, 16 Nov 1985, 38°27.29′N, 73°03.58′W, 2096 m (3, USNM 1661321). **Sta. 8**: Cruise Mid-1, Rep. 1, 06 May 1984, 38°27.36′N, 73°05.09′W, 2148 m (5, USNM 1661322); Rep. 2, 06 May 1984, 38°27.36′N, 73°04.88′W, 2150 m, 11 **paratypes** (USNM 1661323); Cruise Mid-2, Rep. 2, 05 Aug 1984, 38°27.21′N, 73°04.79′W, 2159 m (3, USNM 1661324); Cruise Mid-3, Rep. 2, 01 Dec 1984, 38°27.13′N, 73°04.87′W, 2150 m (1, USNM 1661325); Rep. 3, 01 Dec 1984, 38°27.30′N, 73°04.79′W, 2155 m (7, USNM 1661326).—**Off New Jersey, U.S. EPA DWD-106 Site Survey**, coll. R. Petrecca, Chief Scientist. **Sta. F**: Rep. 1, 18 Nov 1985, 38°51.10′N, 72°16.39′W, 2500 m (2, MCZ 161951); Rep. 3, 18 Nov 1985, 38°51.11′N, 72°16.39′W, 2500 m (2, MCZ 161952). **Sta. G**: Rep. 1, 18 Nov 1985, 38°55.66′N, 72°02.53′W, 2505 m (3, MCZ 161953); Rep. 2, 18 Nov 1985, 38°55.63′N, 72°02.54′W, 2509 m (8, MCZ 161954); Rep. 3, 18 Nov 1985, 38°55.60′N, 72°02.54′W, 2505 m (3, MCZ 161955).—**Off New England, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 2**: Cruise NA-1, Rep. 1, 08 Nov 1984, 40°57.20′N, 66°13.72′W, 2112 m (1, USNM 1661327); Rep. 2, 08 Nov 1984, 40°57.18′N, 66°13.87′W, 2095 m (2, USNM 1661328). **Sta. 3**: Cruise NA-5, Rep. 2, 27 Apr 1986, 41°01.35′N, 66°20.24′W, 1335 m (2, USNM 1661329); Cruise NA-6, Rep. 1, 25 Jul 1986, 41°01.55′N, 66°20.12W, 1345 m (2, USNM 1661330); Rep. 3, 25 Jul 1986, 41°01.51′N, 66°20.27′W, 1333 m (2, USNM 1661331). **Sta. 5**: Cruise NA-1, Rep. 2, 05 Nov 1984, 40°05.06′N, 67°29.94′W, 2052 m (1, USNM 1661332); Cruise NA-4, Rep. 1, 25 Nov 1985, 40°05.06′N, 67°29.86′W, 2074 m (1, USNM 1661333); Rep. 2, 25 Nov 1985, 40°05.09′N, 67°29.84′W, 2071 m (1, USNM 1661334). **Sta. 6**: Cruise NA-2, Rep. 1, 29 Apr 1985, 40°05.04′N, 67°29.99′W, 2108 m (3, USNM 1661335); Rep. 2, 29 Apr 1985, 40°05.03′N, 67°29.13′W, 2108 m (3, USNM 1661336); Rep. 3, 29 Apr 1985, 40°05.06′N, 67°29.13′W, 2107 m (4, USNM 1661337); Cruise NA-5, Rep. 2, 30 Apr 1986, 40°05.11′N, 67°29.21′W, 2110 m (4, USNM 1661338). **Sta. 8**: Cruise NA-1, Rep. 1, 10 Nov 1984, 40°10.37′N, 67°37.43′W, 2175 m (2, USNM 1661339); Cruise NA-2, Rep. 4, 29 Apr 1985, 40°10.24′N, 67°37.25′W, 2185 m (4, USNM 1661340); Cruse NA-3, Rep. 1, 05 Jul 1985, 40°10.26′N, 67°37.22′W, 2180 m (1, USNM 1661341); Rep. 3, 05 Jul 1985, 40°10.26′N, 67°37.21′W, 2180 m (6, USNM 1661342); Cruise NA-4, Rep. 2, 22 Nov 1985, 40°10.25′N, 67°37.33′W, 2179 m (1, USNM 1661343); Cruse NA-5, Rep. 2, 29 Apr 1986, 40°10.19′N, 67°37.29′W, 2165 m (4, USNM 1661344); Rep. 3, 29 Apr 1986, 40°10.14′N, 67°37.45′W, 2130 m (2, USNM 1661345); Cruise NA-6, Rep. 2, 27 Jul 1986, 40°10.23′N, 67°37.25′W, 2193 m (3, USNM 1661346); Rep. 3, 27 Jul 1986, 40°10.21′N, 67°37.28′W, 2188 m (3, USNM 1661347). **Sta. 9**: Cruise NA-1, Rep. 1, 12 Nov 1984, 39°50.45′N, 70°01.76′W, 1200 m (1, USNM 1661348); Rep. 3, 12 Nov 1984, 39°50.53′N, 70°01.68′W, 1225 m (1, USNM 1661349); Cruise NA-2, Rep. 1, 03 May 1985, 39°50.43′N, 70°01.58′W, 1235 m (3, USNM 1661350); Cruise NA-5, Rep. 1, 03 May 1986, 39°50.54′N, 70°01.79′W, 1214 m (1, USNM 1661351); Rep. 2, 03 May 1986, 39°50.49′N, 70°01.76′W, 1208 m (2, USNM 1661352); Cruise NA-6, Rep. 1, 28 Jul 1986, 39°50.37′N, 70°01.72′W, 1233 m (1, USNM 1661353). **Sta. 10**: Cruise NA-1, Rep. 1, 12 Nov 1984, 39°48.22′N, 70°05.33′W, 1200 m (1, USNM 1661354); Cruise NA-6, Rep. 2, 28 Jul 1986, 39°48.07′N, 70°05.37′W, 1253 m (1, USNM 1661355); **Sta. 13**: Cruise NA-5, Rep. 1, 06 May 1986, 39°47.99′N, 70°55.08′W, 1270 m (4, USNM 1661356); **Sta. 14**: Cruise NA-1, Rep. 3, 09 Dec 1984, 39°40.89′N, 70°54.29′W, 2107 m (2, USNM 1661357); Cruise NA-2, Rep. 1, 05 May 1985, 39°40.91′N,

70°54.17′W, 2095 m (3, USNM 1661358). **Sta. 15**: Cruise NA-1, Rep. 2, 09 Dec 1984, 39°40.10′N, 70°54.27′W, 2155 m (7, USNM 1661359); Rep. 3, 09 Dec 1984, 39°40.06′N, 70°54.30′W, 2155 m (7, USNM 1661360); Cruise NA-2, Rep. 1, 05 May 1985, 39°40.07′N, 70°54.27′W, 2145 m (7, USNM 1661361); Rep. 3, 06 May 1984, 39°40.10′N, 70°54.31′W, 2140 m (5, USNM 1661362); Cruise NA-4, Rep. 1, 28 Nov 1985, 39°40.05N, 70°54.29′W, 2124 m (1, USNM 1661363); Cruise NA-5, Rep. 2, 05 May 1986, 39°39.95′N, 70°54.19′W, 2164 m (2, USNM 1661364); Rep. 3, 06 May 1986, 39°40.00′N, 70°54.41′W, 2160 m (3, USNM 1661365).—**Off Cape Lookout, North Carolina, US South Atlantic ACSAR Program**, coll. J.A. Blake, Chief Scientist. **Sta. 5**: Cruise SA-1, Rep. 3, 14 Nov 1983, 34°05.89′N, 75°18.19′W, 3040 m (1, USNM 1661366); Cruise SA-2, Rep. 2, 19 May 1984, 34°06.70′N, 75°18.60′W, 3034 m (1, USNM 1661367).

Description. Holotype (USNM 1661244) (Figs. 29A–C, 30A, E) with 100 setigers, 12.1 mm long, 0.4 mm wide; largest specimen (USNM 1661295) with 151 setigers, 21 mm long, 0.5 mm wide across anterior setigers; another large specimen (USNM 1661267) with 102 setigers, 16. 5 mm long and 0.45 mm wide; a 49-setiger specimen (USNM 1661274) 5.8 mm long, 0.18 mm wide (Fig. 30B); a 26-setiger juvenile 2.4 mm long and 0.09 mm wide (Fig. 30C) and an 18-setiger juvenile 1.46 mm long and 0.08 mm wide (USNM 1661322) (Fig. 30D).

Body elongate, cylindrical in cross section; anterior 15–20 setigers of adults short, crowded, about 7–8 times wider than long (Fig. 30A), then individual segments increasing in length in middle body, becoming moniliform posteriorly (Fig. 30B), but with farthest posterior segments again narrowing to pygidium (Fig. 30B–E). Juveniles and smaller adults with middle and posterior segments moniliform (Fig. 30C–D). Dorsal and ventral grooves not apparent. Color in alcohol light tan; larger specimens, including holotype, with clusters of black pigment spots on lateral margins of last peristomial ring (Figs. 29C, 30G).

Pre-setiger region elongate, narrow, as long as first ten setigers in larger specimens (Figs. 29A–C, 30A). Prostomium conical, tapering to narrow rounded tip; entire prostomium turned upward in some specimens (Figs. 29A, 30A–B); eyespots absent; nuchal organs curved notches on posterior lateral margin, appearing as pigmented spots in some juveniles. Peristomium long, divided into three distinct rings with grooves apparent laterally (Fig. 29A–B); rings not complete dorsally; first ring merged dorsally with posterior margin of prostomium and ventrally surrounding oral opening from which bulbous pharynx or proboscis emerges (Figs. 29B–C, 30F–G). Some specimens with first peristomial ring dorsally elevated producing rounded crest, but consistent dorsal crest not present in this species. Ventrally, first peristomial ring separated from merged second and third ring by deep groove (Fig. 29B); second and third rings only separated laterally, but distinctly separated from setiger 1 by a deep groove (Fig. 29C). Dorsal tentacles arising from posterior margin of peristomium with first pair of branchiae lateral to tentacles (Fig. 29A). Second pair of branchiae on setiger 1 dorsal to notosetae; branchiae in similar location on following segments. Branchiae mostly missing, but when present each long and thin, occurring along most of body (Figs. 29A–B, 30A, D).

Parapodia of anterior and middle segments reduced to low ridges or mounds from which setae arise; segments moniliform in posterior and more anteriorly in smaller specimens with parapodia dorsolateral with noto- and notopodia close to one another (Fig. 31A). Parapodial cinctures not present. Anterior setae all long capillaries numbering about 12–15 per fascicle in largest specimens and usually including long natatory-like setae in notopodia of anterior and middle segments; these not associated with sexual maturity. Neuropodial spines from middle body segments in juveniles and specimens with fewer than 75 setigers; holotype and larger specimens with neuropodial spines from posterior quarter of body, setiger 73 of 100 in holotype. Neuropodial spines numbering 1–3 in juveniles, increasing to 7–8 per fascicle in largest specimens. Neuropodial spines narrow, with rounded tip, distinctly curved sigmoidally in ventral-most spines, becoming straighter and more elongate in dorsal part of fascicle (Figs. 29D–F, 31C). Notosetae of posterior setigers mostly capillaries (Fig. 31B), with spines only present in a few pre-pygidial setigers in largest specimens, these numbering no more that 1–2 per fascicle; each straight, with sharply pointed tip. Maximal number of spines observed in largest specimens 8–10 on a side; most specimens with no more than 4–7 spines on a side.

Body terminating in short pygidium bearing a semicircular disk ventral to the anal opening (Fig. 30E).

Methyl green staining. A distinctive MG staining pattern is evident on the pre-setiger region (Figs. 30 F–G) where the prostomium and peristomium stain prominently with dorsolateral unstained patches; the second and third peristomial rings typically stain dark blue; the proboscis when extended and posterior lips of the mouth do not stain (Fig. 30F–G). In larger specimens, the parapodia of 3–4 anterior setigers also stain to varying degrees. The rest of the body de-stains rapidly with no pattern.

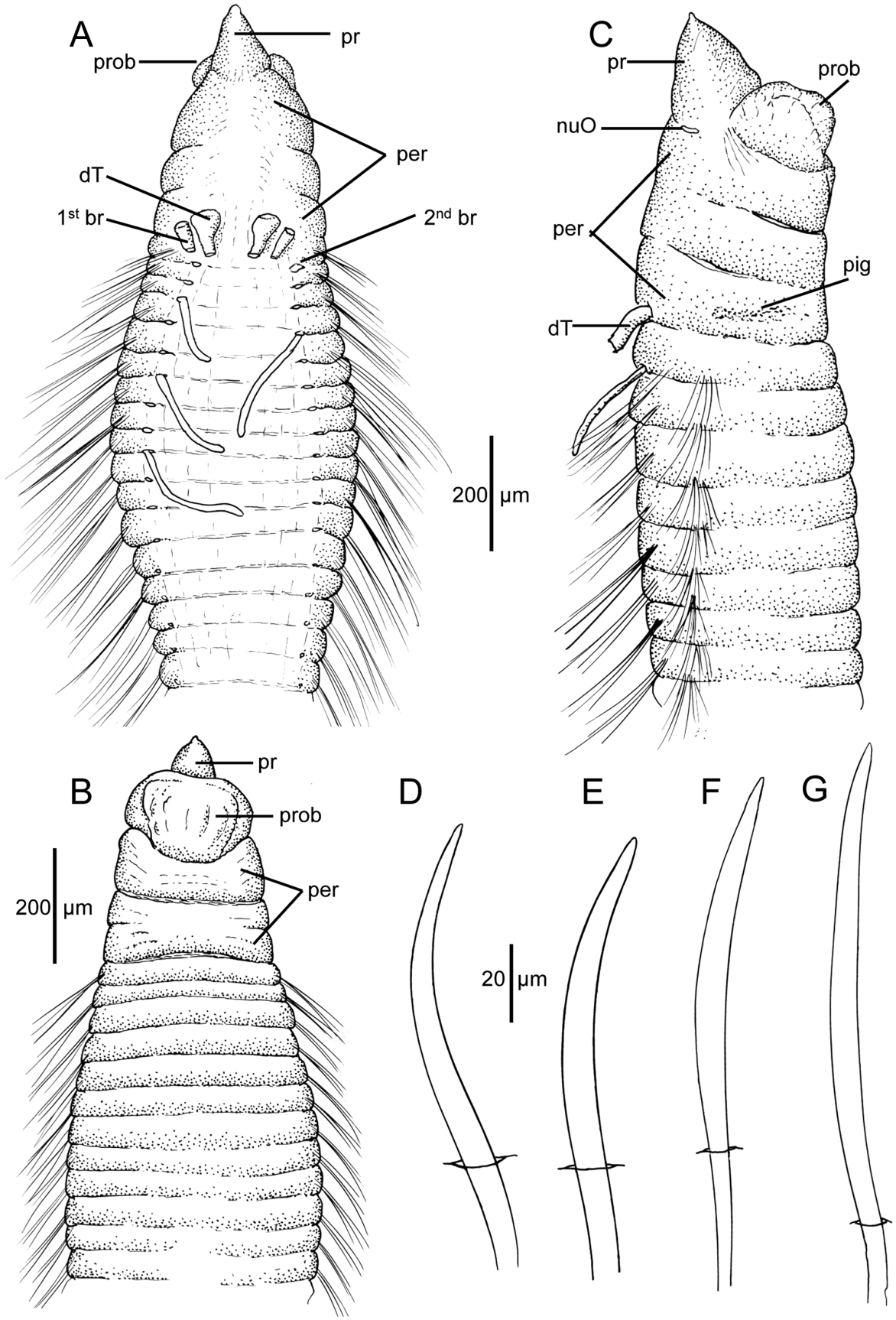

FIGURE 29. *Chaetozone paucispinosa* **n. sp**. Holotype (USNM 1661244): A, anterior end, dorsal view; B, anterior end, ventral view; C, anterior end, right lateral view. Paratype (USNM 1661266): D–G, neuropodial acicular spines.

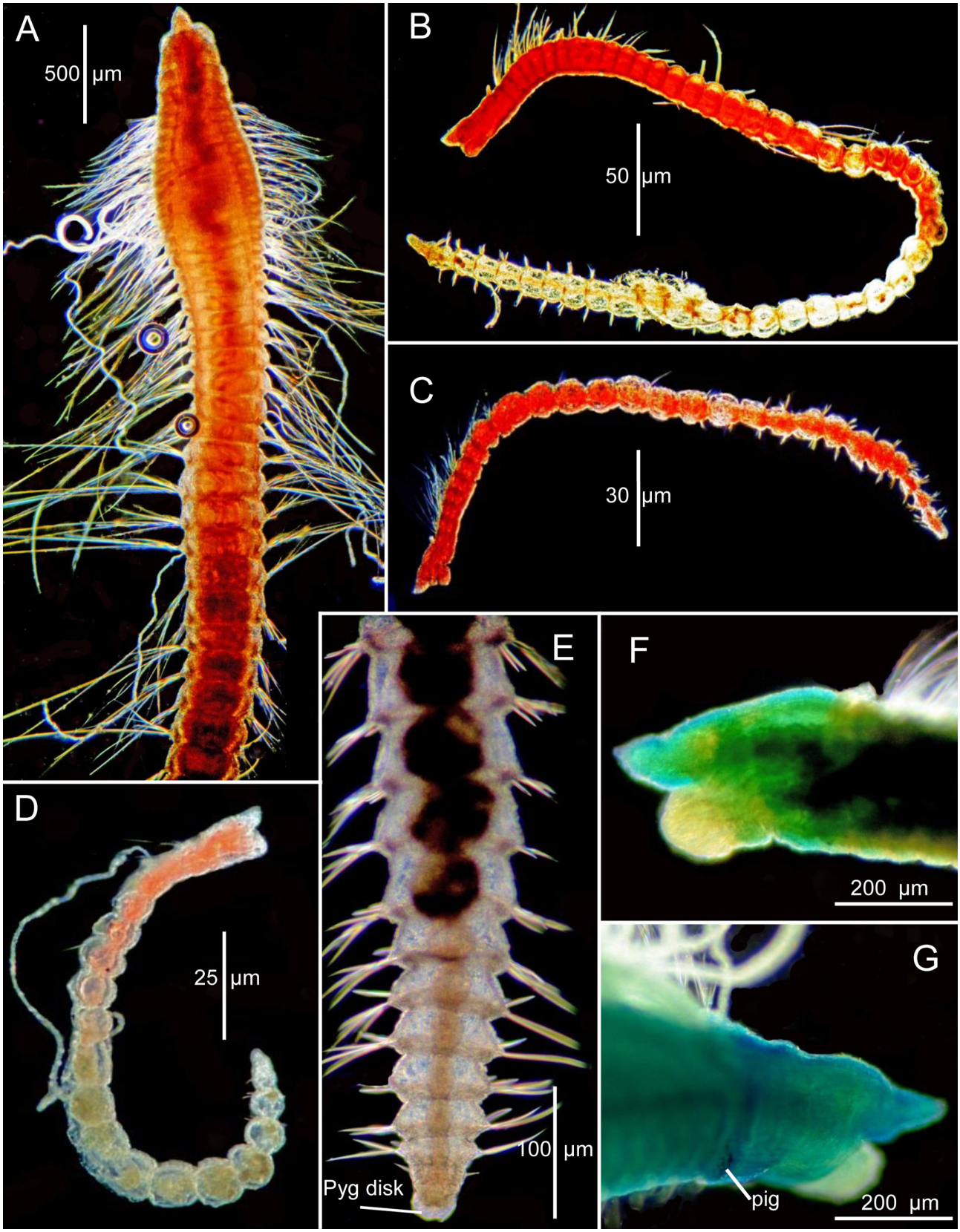

FIGURE 30. *Chaetozone paucispinosa* **n. sp**. A, anterior end, dorsal view; B, entire 49-setiger specimen, left lateral view; C. entire 26-setiger specimen, left lateral view; D, entire 18-setiger juvenile, right lateral view; E, posterior end, dorsal view; F, anterior end, left lateral view; G, anterior end, right lateral view. A, E, G holotype (USNM 1661244); B USNM 1661274; C, USNM 1661296; D, USNM 1661322; F, MCZ 161954. A–E stained with Shirlastain A; F–G, stained with MG.

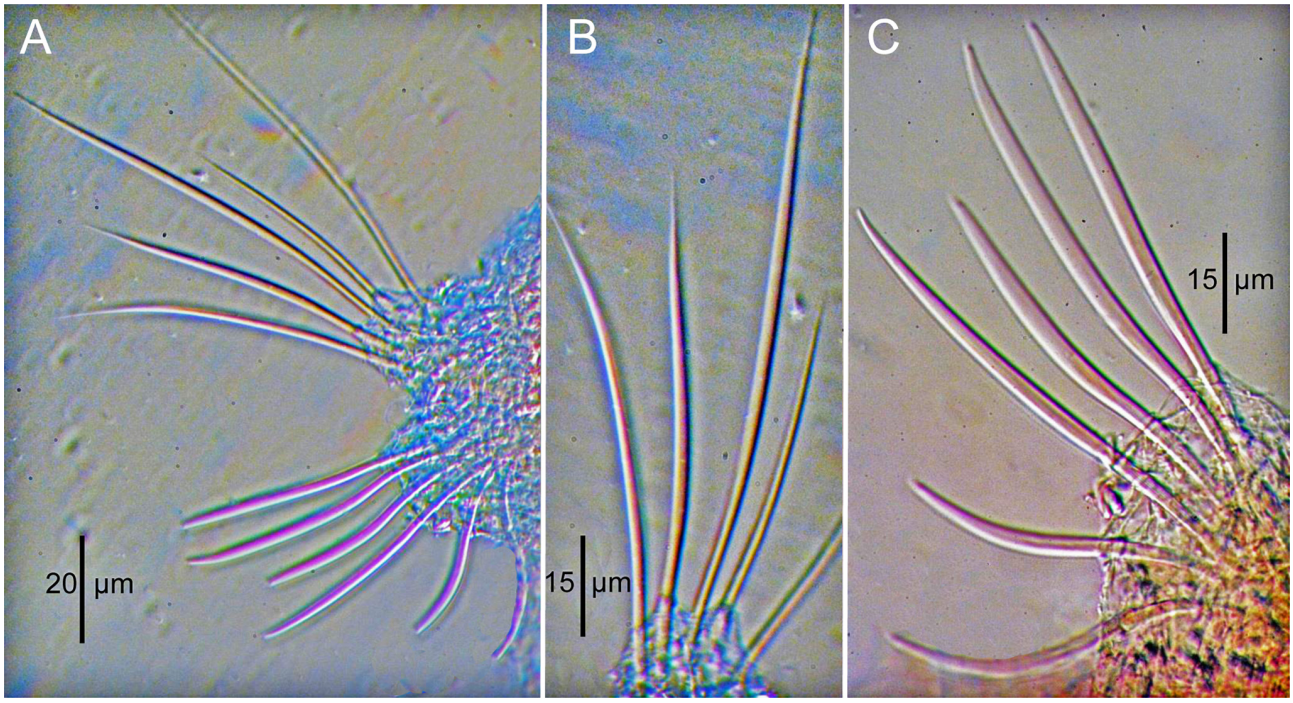

FIGURE 31. *Chaetozone paucispinosa* **n. sp**. (USNM 1661276); A, posterior setiger, right side, anterior view; B, notosetae from (A); C, neurosetae from (A).

Remarks. *Chaetozone paucispinosa* **n. sp.** is a widespread lower continental slope species along the US Atlantic coast, with numerous specimens available for study including juveniles and sexually mature adults. Due to the large number of specimens that were collected, it was possible to document the considerable variation in their overall appearance with growth. Juveniles initially have moniliform segments along most of their length; after about 50 setigers are developed, the first third of the body has crowded segments, with moniliform segments retained in the posterior two-thirds. The largest specimens only have moniliform segments in the last 15 or so segments. Most specimens, large or small, have an expanded oral opening from which a partially protruding pharynx is typically observed (Figs. 29A–C, 30B–D, F–G). In lateral view the everted pharynx is easily visible and provides a superficial clue relative to the identification of this species. In many of the larger specimens, the prostomium is turned up, or somewhat directed dorsally, best seen in lateral view (Figs. 29C, 30B). The acicular spines are generally narrow with the smaller spines being curved and the longer ones having straighter shafts. The largest specimens also have black pigment spots located ventrolateral on the last peristomial ring (Figs. 29C, 30G). A summary of size and acicular spine data for this species is presented in Table 5.

Relative to the nature and number of acicular spines, *C. paucispinosa* **n. sp**. is most similar to *Chaetozone homosetosa* from Antarctica (Blake 2018). Both species have the peristomium divided into three rings and the dorsal tentacles and first branchiae arising from the posterior margin of the peristomium. In addition, both species are recorded as having black pigment spots on the lateral margins of the last peristomial ring and similar methyl green staining patterns. However, *C. homosetosa* has a prominent dorsal peristomial crest that is entirely lacking in *C. paucispinosa* **n. sp**. In addition, the acicular spines of *C. homosetosa* while similarly narrow are more sigmoidally curved than in *C. paucispinosa* **n. sp**.

Biology. Although widespread along the entire U.S. Atlantic continental slope, *C. paucispinosa* **n. sp**. (as *C*. sp. 1) was never reported as a dominant taxon at any station in any of the three ACSAR program areas. Sperm packets were observed in several specimens (e.g., USNM 1661350).

Etymology. The epithet *paucispinosa* is from *paucis*, Latin for few and *spina*, Latin for thorn, in reference to the reduced number of spines in the posterior setigers of this species.

Distribution. Widespread along the U.S. Atlantic continental slope in depths of 1200–3040 m.

TABLE 5. Size and Distribution of Acicular Spines in ***Chaetozone paucispinosa* n. sp.**

No. set	Length (mm)	Width (mm)	First neuropodial spines (set)	Max No. neuropodial spines/set	First notopodial spines	Specimen
18	1.5	0.08	11	1	0	(USNM 1661322) Fig. 30D
26	2.4	0.09	14	1	0	(USNM 1661296) Fig. 30C
49	5.8	0.18	23	3–4	0	(USNM 1661274) Fig. 30B
73	8.6	0.4	45	4–5	0	(USNM 1661349)
81	12.6	0.4	43	5–6	0–1	(USNM 1661350)
100	12.1	0.4	73	7–8	0–1 few pre-pygidial set	Holotype (USNM 1661244), Figs. 29A–B, 30A, E
102	16.5	0.45	90	6–8	1–2 few pre-pygidial set	(USNM 1661267)
151	21.0	0.5	101	7–8	0–1 few pre-pygidial set	(USNM 1661295)

Abbreviation: set, setiger(s).

The *Chaetozone setosa* group

Remarks. *Chaetozone setosa*, the type-species of the genus, has noto- and neuropodia with spreading fascicles of numerous and enlarged sigmoid-shaped acicular spines with rounded or pointed tips that are not curved or recurved, and that usually alternate with capillaries. This type of armature is represented by six species in the present study, three of which are new to science.

Chaetozone diodonta Doner& Blake, 2006

Figure 32–33

Chaetozone sp. A: Maciolek-Blake *et al*. 1985: B-5 (in part).
Chaetozone sp. B: Maciolek-Blake *et al*. 1985: 33, B-5.
Chaetozone diodonta Doner & Blake, 2006: 71–72, Fig. 4, 5D; Blake & Levesque 2017: 572–573, 576–577.

Material examined. (*883 specimens*) **Off Massachusetts, Georges Bank**, **MMS Benthic Infauna Monitoring Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 8**: **Cruise M-1**, Rep. 2, Jul 1981, 40°27.0′N, 67°37.0′W, 145 m (3, USNM 1661080); Rep. 3, (1, USNM 1661081); Rep. 5, (5, USNM 1661082); Rep. 6 (7, USNM 1661083); **Cruise M-2**, Rep. 1, 11 Nov 1981, 40°27.2′N, 67°37.1′W, 140 m (1, USNM 1661084); Rep. 2 (2, USNM 1661085); Rep. 3 (1, USNM 1661086); Rep. 4 (1, USNM 1661087); Rep. 5 (1, USNM 1661088); Rep. 6 (3, USNM 1661089); **Cruise M-3**, Rep. 1, 17 Feb 1982, 40°27.2′N, 67°37.1′W, 147 m (1, USNM 1661090); Rep. 4, (1, USNM 1661091); Rep. 5 (3, USNM 1661092); Rep. 6 (3, USNM 1661093); **Cruise M-4**, Rep. 2, 13 May 1982, 40°27.2′N, 67°37.2′W, 140 m (2, USNM 01661094); Rep. 4 (1, USNM 1661095); Rep. 5 (10, USNM 1661096); Rep. 6 (5, USNM 1661097); **Cruise M-5**, Rep. 1, 23 Jul 1982, 40°27.1′N, 67°37.1′W, 140 m (1, USNM 1661098); Rep. 3 (6, USNM 11661099); Rep. 6 (6, USNM 1661100); **Cruise M-6**, Rep. 1, 22 Nov 1982, 40°27.1′N, 67°37.2′W, 145 m (2, USNM 1661101); Rep. 2 (2, USNM 1661102); Rep. 3 (20, USNM 1661103); Rep. 4 (4, USNM 1661104); Rep. 5 (7, USNM 1661105); Rep. 6 (7, USNM 1661106); **Cruise M-7**, Rep. 1, 09 Nov 1982, 40°27.1′N, 67°37.2′W, 142 m (2, USNM1661107); Rep. 2 (3, USNM 1661108); Rep. 4 (3, USNM 1661109); Rep. 5, (6, USNM 1661110); Rep. 6 (10, USNM 1661111); **Cruise M-8**, Rep. 2, 16 May 1983, 40°27.1′N, 67°37.43′W, 146 m (6, USNM 1661112); **Cruise M-9**, Rep. 1, 15 Jul 1983, 40°27.1′N, 67°37.43′W, 152 m (11, USNM 1661113); Rep. 2 (10, USNM 1661114); Rep. 4 (14, USNM 1661115); Rep. 5 (5, USNM 1661116); **Cruise M-10**, Rep 1, 16 Nov 1983, 40°27.1′N, 67°37.4′W, 152 m (3, USNM 1661117); Rep. 2 (2, USNM 1661118); Rep. 3 (3, USNM 1661119); Rep. 5 (4, USNM 1661120); **Cruise M-11**, 03 Feb 1984, Rep. 2, 40°27.2′N, 67°37.1′W, 152 m (3, USNM 1661121); Rep. 3 (12, USNM 1661122); Rep. 4 (10,

USNM 1661123); **Cruise M-12**, 05 Jun 1984, Rep. 1, 40°27.2′N, 67°37.1′W, 152 m (7, USNM 1661124); Rep. 3 (10, USNM 1661125); Rep. 5 (5, USNM 1661126). **Sta. 16**: **Cruise M-1**, Jul 1981, Rep. 1, 40°34.2′N, 67°12.3′W, 140 m (1, USNM 1661127); Rep. 4 (2, USNM 01661128); **Cruise M-2**, 18 Nov 1981, Rep. 3, 40°34.2′N, 67°12.3′W, 140 m (1, USNM 1661129); **Cruise M-3**, 17 Feb 1982, Rep. 3, 40°34.3′N, 67°12.5′W, 141 m (5, USNM 1661130); Rep. 5 (1, USNM 1661131); **Cruise M-4**, 12 May 1982, Rep. 1, 40°34.3′N, 67°12.4′W, 140 m (3, USNM 1661132); Rep. 3 (4, USNM 1661133); Rep. 5 (1, USNM 1661134); **Cruise M-6**, 21 Nov 1982, Rep.1, 40°34.3′N, 67°12.4′W, 138 m (5, USNM 1661135); Rep. 2 (1, USNM 1661136); Rep. 3 (13, USNM 1661137); Rep. 4 (6, USNM 1661138); Rep. 5 (4, USNM1661139); Rep. 6 (4, USNM 1661140); **Cruise M-7**, 09 Feb 1983, Rep. 1, 40°34.3′N, 67°12.4′W, 143 m (3, USNM 1661141); Rep. 2 (9, USNM 1661142); Rep. 3 (5, USNM 1661143); Rep. 4 (6, USNM 1661144); Rep. 5 (18, USNM 1661145); Rep. 6 (7, USNM 1661146); **Cruise M-8**, 16 May 1983, Rep. 1, 40°34.3′N, 67°12.4′W, 139 m (9, USNM 1661147); Rep. 6 (4, USNM 1661148); **Cruise M-9**, 15 Jul 1983, Rep. 3, 40°34.2′N, 67°12.3′W, 142 m (2, USNM 1661149); Rep. 4 (18, USNM 1661150); Rep. 5 (10, USNM 1661151); **Cruise M-10**, 15 Nov 1983, Rep. 1, 40°34.2′N, 67°12.3′W, 142 m (14, USNM 01661152); Rep. 2 (2, USNM 1661153); Rep. 3 (23, USNM 1661154); Rep. 4 (13, USNM 1661155); Rep. 5 (11, USNM 1661156); Rep. 6 (14, USNM 1661157); **Cruise M-11**, 03 Feb 1984, Rep. 1, 40°34.2′N, 67°12.3′W, 142 m (7, USNM 1661158); Rep. 2 (7, USNM 1661159); Rep. 3 (9, USNM 1661160); Rep. 4 (17, USNM 1661161); Rep. 5 (8, USNM 1661162); Rep. 6 (11, USNM 1661163); **Cruise M-12**, 05 Jun 1984, Rep. 2, 40°34.2′N, 67°12.3′W, 142 m (18, USNM 1661164); Rep. 3 (5, USNM 1661165); Rep. 4 (8, USNM 1661166); Rep. 5 (2, USNM 1661167); Rep. 6 (4, USNM 1661168). **Sta. 17**: **Cruise M-1**, Rep. 4, Jul 1981, 40°35.0′N, 67°11.7′W, 145 m (1, USNM 1661169); **Cruise M-2**, Rep. 1, 18 Nov. 1981, 40°35.0′N, 67°11.7′W, 145 m (5, USNM 1661170); **Cruise M-3**, Rep. 1, 18 Feb 1982, 40°34.90′N, 67°11.1′W, 145 m (1, USNM 1661171); Rep. 4 (3, USNM 1661172); Rep. 6 (3, USNM 1661173); **Cruise M-4**, Rep.4, 12 May 1982, 40°35.0′N, 67°11.3′W, 130 m (3, USNM 1661174); **Cruise M-5**, Rep. 1, 23 Jul 1983, 40°35.0′N, 67°11.2′W, 135 m (3, USNM 1661175); Rep. 5 (3, USNM 01661176); **Cruise M-6**, Rep. 2, Nov 1982, 40°35.0′N, 67°11.2′W, 140 m (5, USNM 1661177); Rep. 3 (3, USNM 1661178); Rep. 4 (5, USNM 1661179); Rep. 5 (5, USNM 1661180); **Cruise M-7**, Rep. 1, 08 Feb 1983, 40°35.0′N, 67°11.3′W, 144 m (3, USNM 1661181); Rep. 2 (3, USNM 1661182); Rep. 3 (2, USNM 1661183); Rep. 5 (1, USNM 1661184); Rep. 6 (5, USNM 1661185); **Cruise M-8**, Rep. 6, 16 May 1983, 40°35.0′N, 67°11.3′W, 141 m, (5, USNM 1661186), SEM stubs (4, USNM 1661187); **Sta. 18**: **Cruise M-1**, Rep. 4, Jul 1981, 40°33.5′N, 67°11.3′W, 145 m (3, USNM 1661188); Rep. 5 (5, USNM 1661189); Rep. 6 (4, USNM 1661190); **Cruise M-2**, Rep. 2, 18 Nov 1981, 40°33.5′N, 67°13.7.6′W, 145 m (3, USNM 1661191); Rep. 3 (5, USNM 1661192); Rep. 4 (3, USNM 1661193); **Cruise M-3**, Rep. 2, 17 Feb 1982, 40°33.5′N, 67°13.4′W, 147 m (3, USNM 1661194); Rep. 3 (2, USNM 1661195); Rep. 4 (3, USNM 1661196); Rep. 5 (9, USNM 1661197); Rep. 6 (7, USNM 1661198); **Cruise M-4**, Rep. 1, 13 May 1982, 40°33.5′N, 67°13.6′W, 150 m (9, USNM 1661199); Rep. 2 (7, USNM 1661200); Rep. 3 (9, USNM 1661201); Rep. 5 (4, USNM 1661202); Rep. 6 (1, USNM 1661203); **Cruise M-5**, Rep. 4, 23 Jul 1982, 40°33.5′N, 67°13.5′W, 140 m (4, USNM 1661204); Rep. 6 (11, USNM 1661205); **Cruise M-6**, Rep. 1, 21 Nov 1982, 40°33.5′N, 67°13.6′W, 144 m (2, USNM 1661206); Rep. 2 (8, USNM 1661207); Rep. 3 (22, USNM 1661208); Rep. 5 (9, USNM 1661209); Rep. 6 (9, USNM 1661210); **Cruise M-7**, Rep. 1, 09 Feb 1983, 40°33.5′N, 67°13.5′W, 147 m (30, USNM 1661211); Rep. 2 (18 USNM 1661212); Rep. 3 (15, USNM 1661213); Rep. 4 (5, USNM 1661214); **Cruise M-8**, Rep. 1, 16 May 1983, 40°33.5′N, 67°13.5′W, 141 m (8, USNM 1661215); Rep. 2 (12, USNM 1661216); Rep. 3 (13, USNM 1661217); Rep. 4 (25, USNM 1661218).

Description. A moderately sized species, 6.0–9.5 mm long, 0.6–0.8 mm wide for up to 100–120 setigers. Specimen from USNM 1661105 complete, 9.5 mm long with 115 setigers. Body thickest in anterior half, then gradually tapering posteriorly to narrow pre-pygidial segments (Fig. 32A). Body rounded dorsally with narrow groove anteriorly (Fig. 32D); flattened ventrally with prominent mid-ventral groove along entire length (Fig. 32A–B). Anterior setigers short, crowded, about ten times as wide as long (Fig. 32D); segments of posterior segments not as short, but still 5–6 times wider than long. Posterior segments with partial cinctures with wide dorsal and ventral gaps (Fig 32F). Color in alcohol light tan, lacking distinctive body pigment.

Pre-setiger region relatively thick, short, as long as first 8–10 crowded anterior setigers. Prostomium thick, elongate, conical, tapering to pointed tip (Fig. 32A–B, D), sometimes curved ventrally with tip not clearly visible when viewed dorsally (Fig. 32C); eyespots absent; nuchal organs oval, elongate curved grooves (Fig. 32D inset). Peristomium as wide as long or wider; with two lateral grooves producing three distinct rings (Fig. 32B–D), but these only partially visible dorsally; with distinct dorsal crest (Fig. 32B–D), best developed in anterior half. Dorsal tentacles arising from posterior margin of peristomium; first branchiae lateral to tentacles and anterior to setiger 1(Fig. 32B–D). Subsequent pairs of branchiae positioned dorsal to and slightly posterior to notosetae (Fig. 32D).

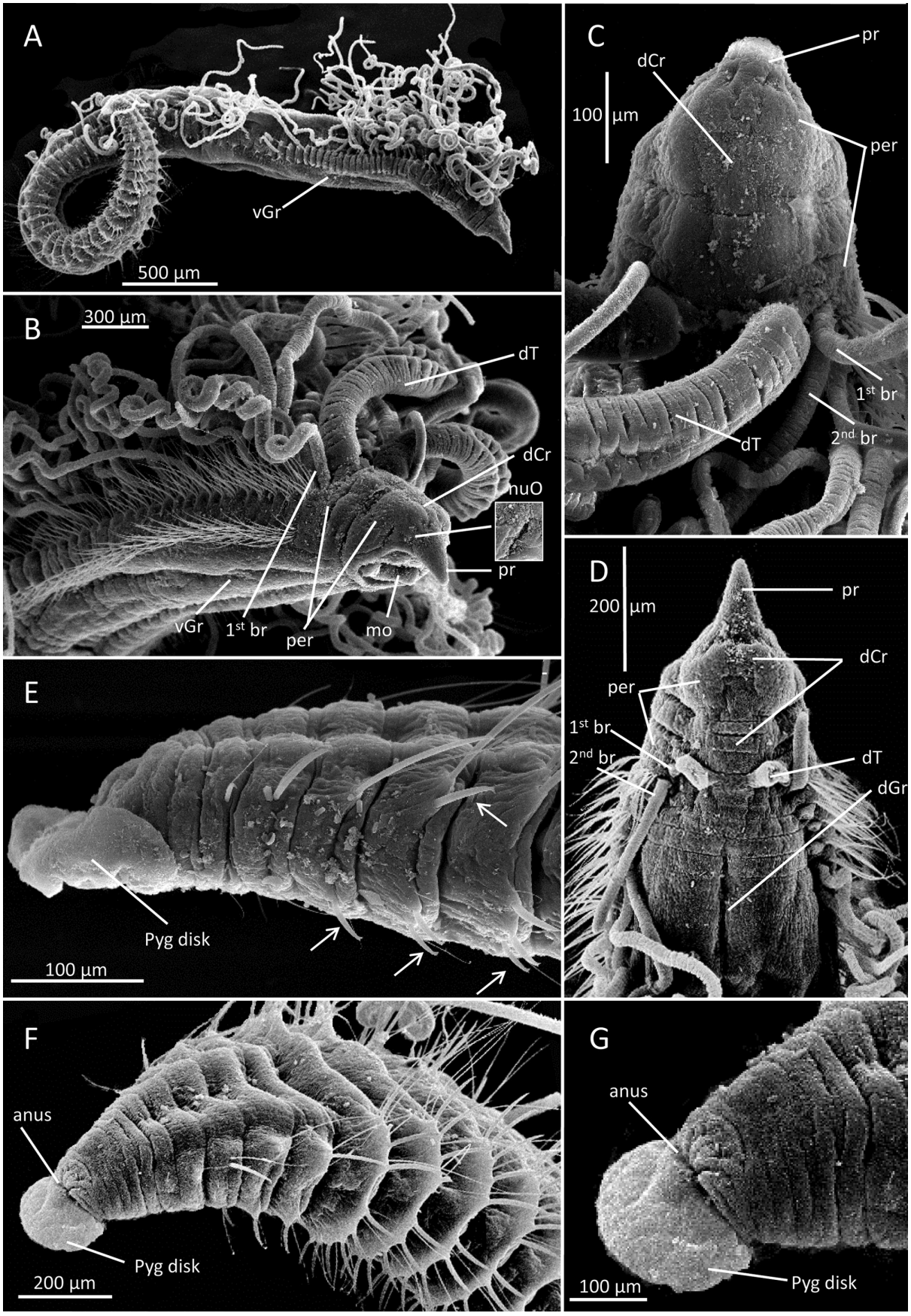

FIGURE 32. *Chaetozone diodonta*. SEMs (USNM 1661187): A, entire worm, right lateral view; B, anterior end, ventrolateral view; C, anterior end, dorsal view; D, anterior end, dorsal view; E, posterior setigers and pygidium, right lateral view; F, posterior setigers and pygidium, dorsolateral view; G, pygidial disk, dorsal view.

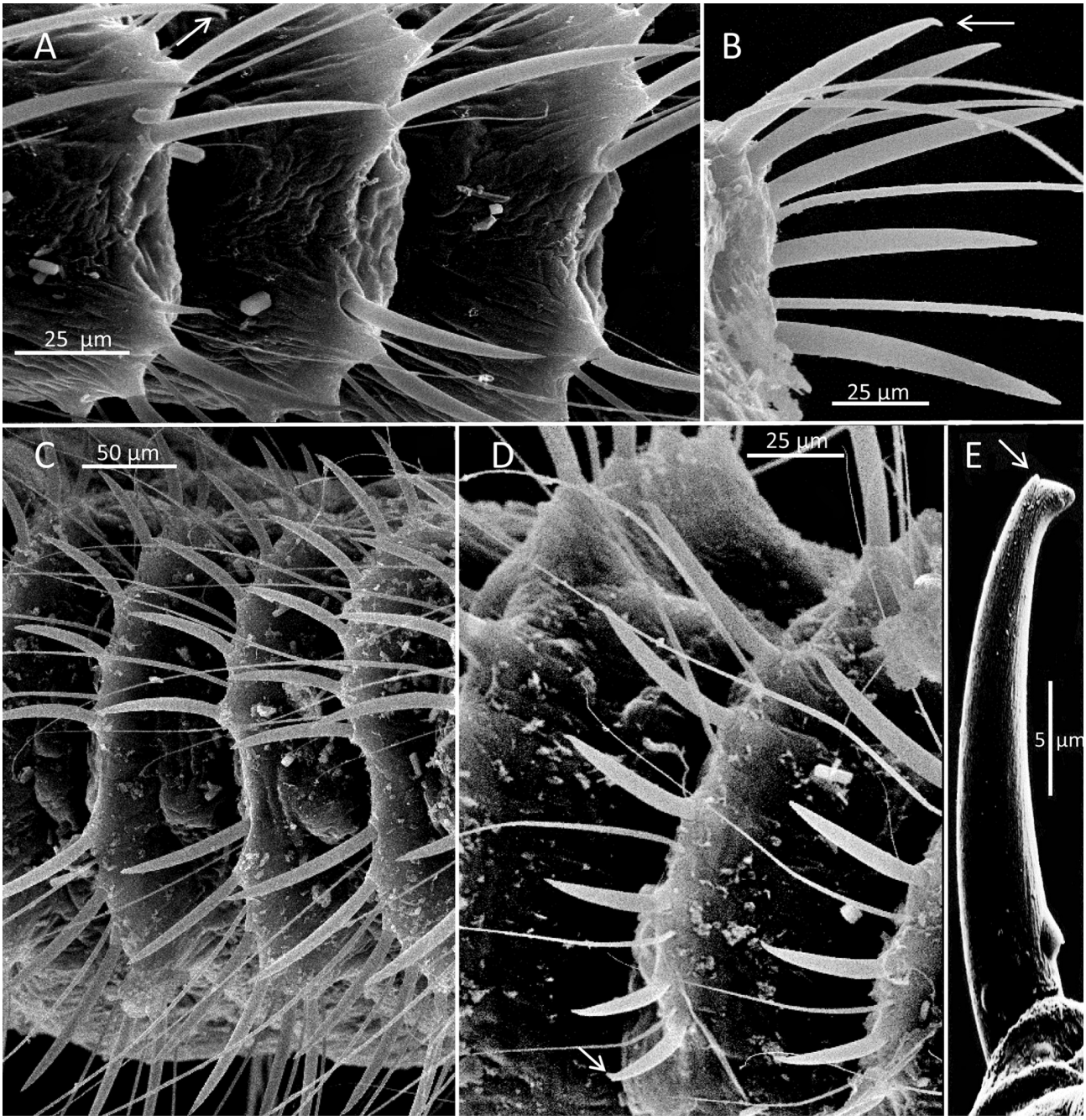

FIGURE 33. *Chaetozone diodonta*. SEMs (USNM 1661187): A, posterior setiger, lateral view (arrow denotes bidentate spine); B, notoacicular spines (arrow denotes bidentate spine); C, posterior setiger, lateral view; D, neuroacicular spines (arrow denotes bidentate spine); E, neuroacicular spine with apical tooth (arrow).

Noto- and neuropodia reduced to low tori bearing setal fascicles. Parapodia of anterior setigers forming distinct protruding lateral shoulders (Fig. 32A–B), these becoming reduced and entirely absent in middle and posterior segments. Notosetae of anterior setigers simple, smooth capillaries, 7–8 per fascicle with one or two transitioning to long, acicular spines from about setiger 65–70 with addition of one, rarely two, bidentate hooks at setiger 80–90 in inferior-most position; up to 5–6 spines per notopodium alternating with capillaries (Fig. 33A–D). Neurosetae of first setigers simple capillaries, 5–6 per fascicle with transition to short acicular spines by about setiger 15–20; posterior setigers with 5–7 spines per fascicle alternating with capillaries; one or two bidentate spines typically present in inferior-most position in fascicle (Fig. 32D). Posterior setigers with partial cinctures with elevated membranes bearing up 10–13 spines on a side. Setae of last 5–10 setigers reduced to a single capillary and spine in both podia. Individual acicular spines thick, weakly curving to pointed tip; bidentate hooks with long, pointed main tooth curv-

ing laterally to shaft, surmounted by short pointed, apical tooth (Fig. 33E).

Pygidium with 5–6 elongate lobes lateral and dorsal to anal opening, large semi-circular flattened disk ventral to anal opening (Fig. 32E–G).

Variability. There is considerable variability in the kinds and numbers of acicular spines along the body. In some specimens the notopodial bidentate hooks do not appear until the last 5–10 setigers. In other specimens, unidentate neuropodial spines are present initially with a few transitioning to bidentate hooks more posteriorly. However, the tips of the spines are curved and details including the small apical tooth may be difficult to observe at certain angles in light microscopy.

Methyl green staining. No apparent pattern.

Remarks. Locally, *Chaetozone diodonta* is most similar to *C. donerae* **n. sp**., in having partial cinctures of posterior spines with wide dorsal and ventral gaps between the noto- and neuropodia. The presence of bidentate hooks among acicular spines in *C. diodonta* is a distinct difference from *C. donerae* **n. sp**., which has only unidentate spines. In addition, *C. diodonta* has three distinct peristomial rings instead of two.

The only other North American species of *Chaetozone* having both uni- and bidentate spines in posterior cinctures is *Chaetozone lunula* Blake, 1996 from the continental shelf off northern California in depths of 77–190 m. The two species are also similar in having reduced cinctures with up to 13 spines on a side and a prominent ventral gap between the neuropodia. However, unlike *C. diodonta,* which has bidentate hooks along much of the body and in both noto- and neuropodia, *C. lunula* has only one or two bidentate hooks limited to the ventral-most position in the neuropodia. In addition, *C. diodonta* differs from *C. lunula* in having three peristomial rings instead of two and a large rounded pygidial disk instead of a short lobe bearing a terminal anal cirrus.

Biology. On Georges Bank, *Chaetozone diodonta* populations are mainly concentrated at four stations (Sta. 8, 16, 17, and 18) along the 140–150 m isobath. Station 8 is at the head of Lydonia Canyon. These four stations have sediments that consist of more than 95% gravel and sand-size particles with minimal silt and clay (Maciolek *et al*. 1985). Owing to the high percentage of coarse particles, the corresponding percent carbon is low (0.12% at Station 8 and <0.05% at Stations 16, 17, and 18). *Chaetozone diodonta*, as *Chaetozone* sp. B, was the tenth most abundant benthic invertebrate species at Station 8, ninth at Station 16, and third at Station 18 (Maciolek *et al*. 1985). In the present study, the 883 specimens reported were distributed at Sta. 8 (225), Sta. 16 (315), Sta. 17 (75), and Sta. 18 (268). The holotype (USNM 1076549) is from Sta. 17 collected on 19 Nov 1982, at 40°35.0′N, 67°11.2′W, and 140 m (Doner & Blake 2006). Paratypes reported in the 2006 paper were from Sta. 8 (3), 16 (8), and 17 (6). The four paratypes reported from Sta. 2 should be re-examined because the majority of specimens of the similar appearing *Chaetozone donerae* **n. sp**. were from that location at 60–70 m (see below).

Distribution. Off New England, 140–152 m.

Chaetozone donerae new species

Figures 34–35

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Chaetozone sp. A: Maciolek-Blake *et al*. 1985: B-5 (in part).

Material examined. (*87 specimens*) **Off Massachusetts, Georges Bank**, **MMS Benthic Infauna Monitoring Program**, coll. G.W. Hampson, Chief Scientist: **Sta. 2**: **Cruise M-2**, Rep. 1, 14 Nov 1981, 40°59.2′N, 66°55.9′W, 70 m, **holotype** (USNM 1661219); Rep. 3, 14, 7 **paratypes** (USNM 1661220); **Cruise M-3**, Rep. 5, 18 Feb 1982, 40°59.2′N, 66°56.0′W, 73 m, 1 **paratype** (USNM 1661221); Rep. 6 (2, USNM 1661222); **Cruise M-4**, Rep. 1, 12 May 1982, 40°59.1′N, 66°55.9′W, 66 m (2, USNM 1661223); Rep. 6 (2, USNM 1661224); **Cruise M-5**, Rep. 1, 22 Jul 1982, 40°59.0′N, 66°55.8′W, 66 m, SEM stub 1 (1, USNM 1661225), SEM stub 2 (1, USNM 1661226) (7, USNM 1661227); **Cruise M-7**, Rep. 1, 07 Feb 1983, 40°59.2′N, 66°55.9′W, 71 m (6, USNM 1661228); Rep. 3, 9 **paratypes** (USNM 1661229); Rep. 4, 1 **paratype** (USNM 1661230); Rep. 6 (2, USNM 1661231); **Cruise M-8**, Rep. 1, 15 May 1983, 40°59.3′N, 66°55.9′W, 73 m, 2 **paratypes** (USNM 1661232); Rep. 3 (3, USNM 1661233); Rep. 4 (11, USNM 1661234); Rep. 6 (6, USNM 1661235); **Cruise M-9**, Rep. 1, 14 Jul 1983, 41°13.0′N, 66°55.8′W, 79 m, 2 **paratypes** (USNM 16612236); Rep. 3, 3 **paratypes** (USNM 1661237); **Cruise M-10**, Rep. 1, 15 Nov 1983, 41°13.0′N, 66°55.8′W, 79 m, 4 **paratypes** (USNM 1661238); Rep. 3 (1, USNM 1661239). **Cruise M-11**, Rep. 4,

03 Feb 1984, 40°59.0′N, 66°55.8′W, 79 m (3, USNM 1661240); **Cruise M-12**, Rep. 1 04 Jun 1984, 40°59.0′N, 66°55.8′W, 79 m (4, USNM 1661241). **Sta. 5-29**: **Cruise M1**, Rep. 2, Jul 1981, 40°39.4′N, 67°46.9′W, 82 m, 1 **paratype** (USNM 1661242); Rep. 3, 1 **paratype** (USNM 1661243).—**Massachusetts Bay, MWRA Harbor and Outfall Monitoring Program: 1995 August Survey**, **Sta. NF-17**: Rep. 1, Aug 1995, 42°22.88′N, 70°48.89′W, 29 m (4, MCZ 161944); Rep. 2 (31, MCZ 161945). **1997 August Survey**, **Sta. NF-17**: Rep. 2, Aug 1997, 42°22.88′N, 70°48.89′W, 29 m (5, MCZ 161946.—**Massachusetts, off Gloucester Harbor**, coll. B.J. Dinkins, Sep 2009, 42°34.25′N, 70°70.65′W, 30.5 m, (3, MCZ 161947).

Description. A moderate sized species; holotype complete, 7.5 mm long, 0.5 mm wide across anterior segments with ca. 98 setigers (USNM 16612220); some complete paratypes larger, up to 13 mm long and 0.8 mm wide across anterior setigers, with ca. 95–100 setigers (USNM 16612236). Body relatively thick, widest in anterior half then gradually tapering to posterior end. Segments narrow, crowded along entire body; anterior and middle setigers short, ca. nine times wider than long. A narrow groove present along dorsal midline through middle segments (Fig. 34A); shallow ventral groove present along most of body. Posterior setigers with reduced cinctures leaving dorsal gap between notopodia and wide ventral gap between neuropodia (Fig. 35E). Color in alcohol light tan.

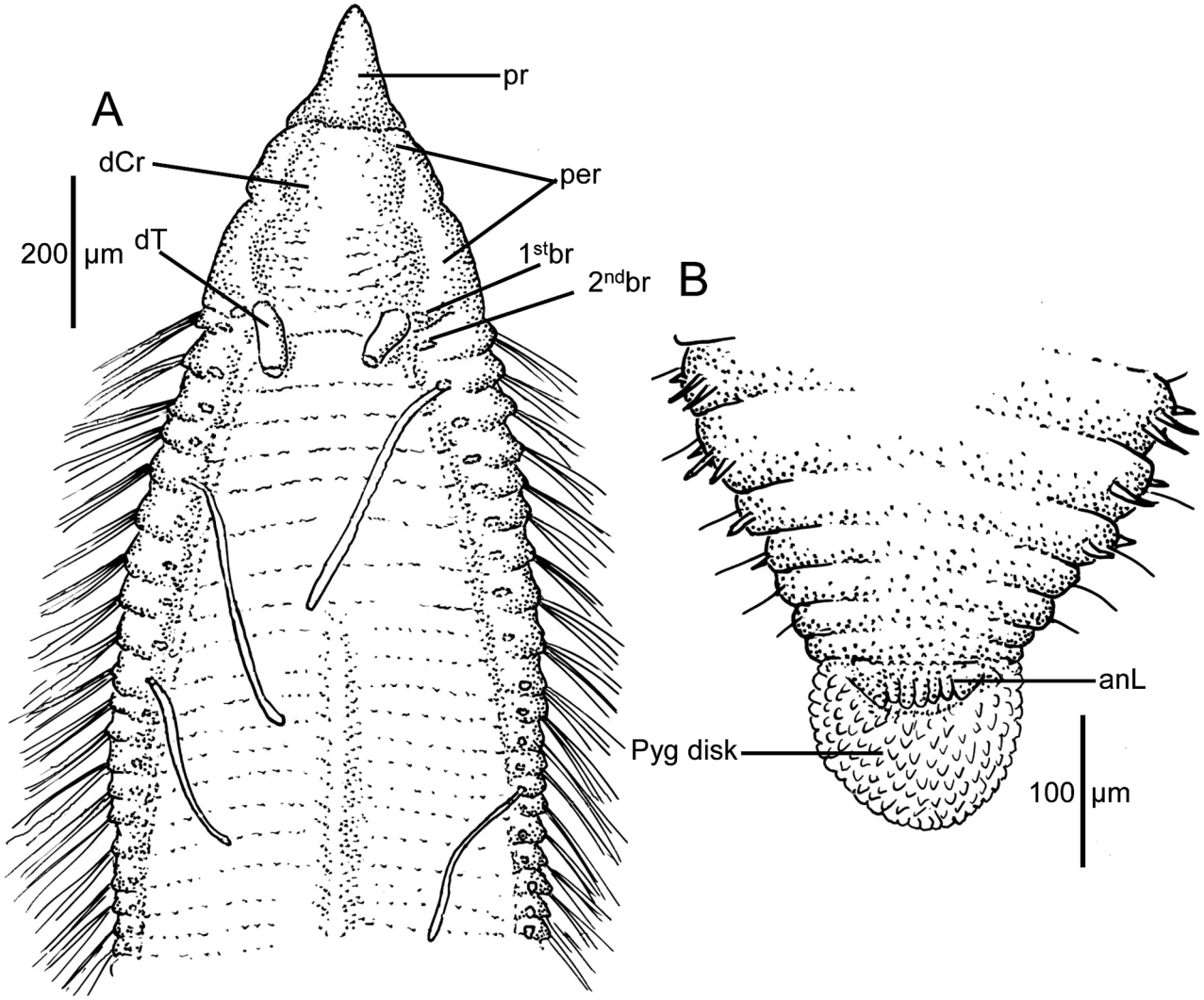

FIGURE 34. *Chaetozone donerae* **n. sp**. Paratype (USNM 1661243): A, anterior end, dorsal view; B, posterior end, dorsal view.

Pre-setiger region relatively long, about as long as first eight setigers (Fig. 34A). Prostomium triangular, tapering to narrow apex (Figs. 34A, 35A–B); eyespots absent; nuchal organs narrow slits on posterior lateral margins. Peristomium with two rings, with lateral groove not crossing dorsum (Fig. 34A); first ring narrowest, sometimes more swollen than second, both with low dorsal crest extending partially over setiger 1 mid-dorsally (Fig. 34A); dorsal tentacles arising from posterior margin (Figs. 34A, 35B). First branchiae on peristomium lateral to dorsal

tentacles; second branchiae on setiger 1, dorsal to notosetae (Fig. 34A); subsequent branchiae in similar position. Branchiae long, numerous in anterior setigers, not as dense posteriorly (Fig. 35A–B), mostly absent in posterior setigers (Fig. 35A).

Parapodia of anterior and middle segments with parapodia formed into distinct lateral ridges from which setae arise; noto- and neuropodia close to one another. Setiger 1 and thoracic segments with 10–12 capillaries in notopodia and neuropodia; capillaries mostly of moderate size; long, natatory-like capillaries absent. Acicular spines first present in holotype from setiger 60–64 in notopodia and setiger 50–54 in neuropodia; spines 1–2 at first, increasing posteriorly into partial cinctures with 4–5 spines in notopodia and 5–6 in neuropodia or up to 9–11 spines on a side producing partial cinctures with wide dorsal and ventral gaps between notopodia dorsally and neuropodia ventrally (Fig. 35E). Spines distinctly curved, with basal manubrium, tapering to narrow tip (Fig. 35E–F); some spines with groove along one edge (Fig. 35G); spines alternating with capillaries up to three times longer than spines (Fig. 35E).

Body narrowing in last few segments; anus surrounded by 6–8 narrow lobes (Figs. 34B, 35D; pygidium terminating in semicircular disk bearing numerous glandular cells (Figs. 34B, 35D).

Methyl green staining. Body stains lightly with MG concentrated on laterally positioned parapodia, most strongly in posterior setigers where brightly stained parapodia contrast with lighter body.

Remarks. Locally, *Chaetozone donerae* **n. sp**. from Georges Bank is most similar to *C. diodonta* with which it may occur. The two species both exhibit reduced cinctures of acicular spines with distinct dorsal and ventral gaps, but differ in several respects. *Chaetozone diodonta* has three distinct peristomial rings instead of two, and has both bidentate and unidentate acicular spines in posterior neuropodia instead of only unidentate hooks. In addition, *C. donerae* **n. sp**. has fewer spines in posterior cinctures with 9–11 spines on a side producing a wider dorsal gap between the notopodia; *C. diodonta* has up to 13 spines on a side.

Globally, *Chaetozone donerae* **n. sp**. is most similar to *Chaetozone christiei* Chambers, 2000 from British waters off Northumberland on the North Sea and along the English Channel where the species occurs in intertidal and shallow subtidal depths. Both *C. donerae* **n. sp**. and *C. christiei* have reduced cinctures of acicular spines in posterior parapodia leaving wide dorsal and ventral gaps between spines on both sides of the body. *Chaetozone christiei* (ca. 12 mm long with 110 setigers) and *C. donerae* **n. sp**. (ca. 13 mm long with 98 setigers) are of a similar size and shape and both are reported to have a ventral groove along most of the body. *Chaetozone donerae* **n. sp**. has two peristomial rings with a dorsal crest, whereas *C. christiei* has three peristomial rings and no dorsal crest. The dorsal tentacles of both species arise from the posterior margin of the peristomium. The first branchiae arise lateral and slightly posterior to the dorsal tentacles on *C. donerae* **n. sp**., whereas the first pair of branchiae of *C. christiei* occur on setiger 1. *Chaetozone donerae* **n. sp**. has up to 4–5 spines in notopodia and 5–6 in neuropodia or 9–11 on side, whereas *C. christiei* is reported to have up to 4–5 spines in both noto- and neuropodia or 8–10 spines on a side. The MG staining pattern was not reported for *C. christiei*.

Biology. On Georges Bank, *Chaetozone donerae* **n. sp**. occurred at Stations 2 and 5 at depths of 65–80 m. Both stations mainly consist of coarse to fine sands (96–99%) with only trace amounts of silt (1–4%) (Maciolek *et al*. 1985). In contrast, *C. diodonta* occurred along the deeper 140–150 m isobaths, also with a high sand content (~95%), but with the coarse sand (~45%) fractions being higher than at the shallower sites (~20%) where *C. donerae* **n. sp**. occurred.

Chaetozone donerae **n. sp**. (as *C*. sp. A), although consistently present, was not among abundant species at the sites on Georges Bank where it occurred. Station 2 was typically dominated by several syllid polychaetes and the sand dollar *Echinarachnius parma* (Lamarck, 1816) (Maciolek *et al*. 1985). The species was also collected at 30 m sites in Massachusetts Bay and off Gloucester Harbor.

Etymology. This species is named for Ms. Stacy A. Doner Tewari, my former graduate student and colleague, in recognition of her work on benthic ecology and expertise with the systematics of Cirratulidae and other polychaetes.

Distribution. Off New England, Georges Bank, 65–82 m; off Gloucester, Harbor, 30 m; Massachusetts Bay, 29 m.

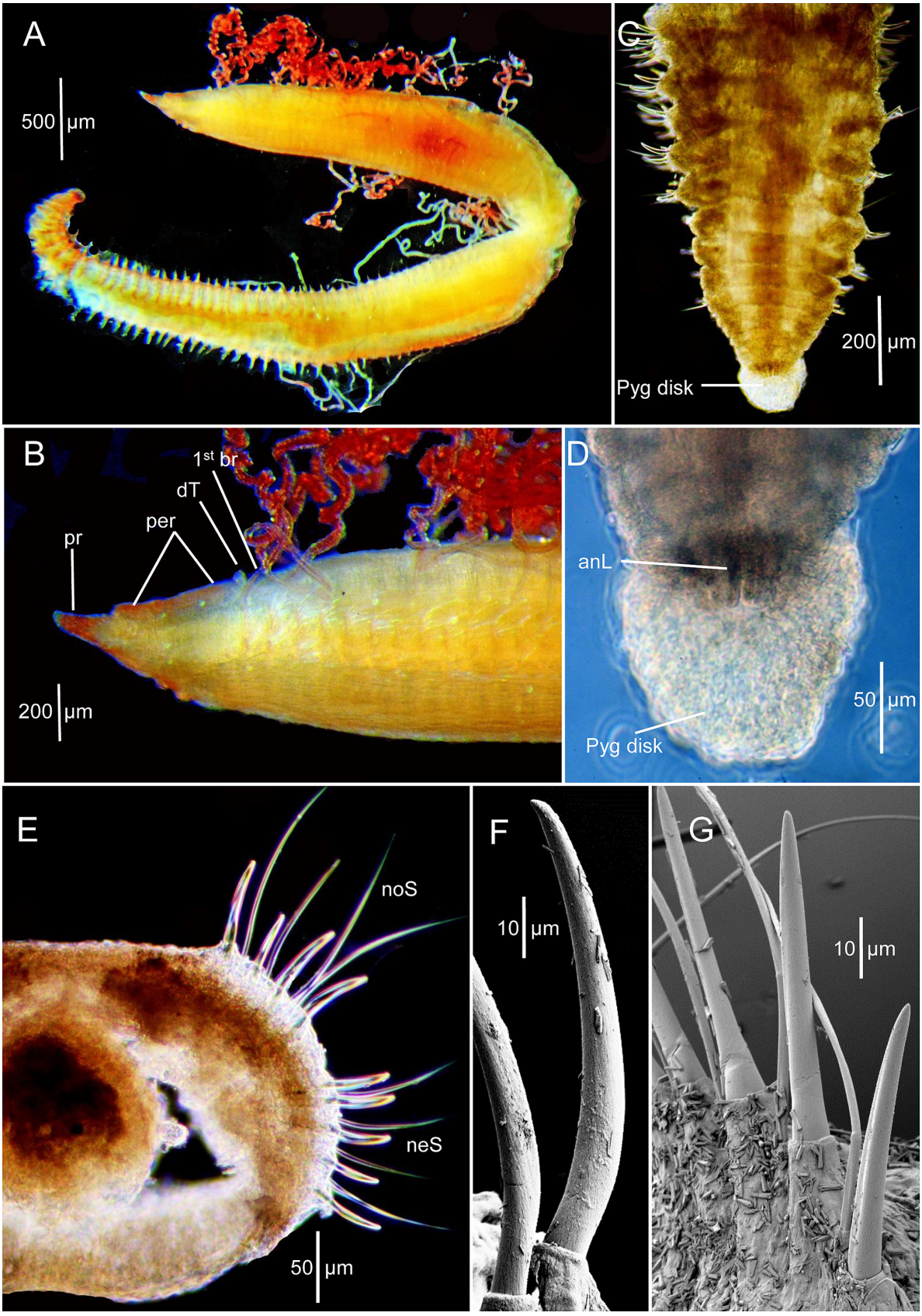

FIGURE 35. *Chaetozone donerae* **n. sp**. Holotype (USNM 1661219): A, entire worm; B, anterior end, dorsal view. Paratype (USNM 1661243): C, posterior end, dorsal view; D, pygidial disk, dorsal view; E, posterior parapodium, anterior view, with acicular spines and capillaries. SEMs (USNM 1661226): F–G, acicular spines and capillaries from posterior neuropodium. A–E, stained with Shirlastain A.

Chaetozone hystricosa Doner & Blake, 2006

Figure 36

Chaetozone setosa Blake *et al*. 1998b: C-1 (in part). **Not** Malmgren, 1867.
Chaetozone hystricosus Doner & Blake, 2006: 69–71, Fig. 3, 5A, F.
Chaetozone hystricosa: Blake & Levesque 2017: 573.

Material examined. (*8 specimens*) **Northeastern United States, MWRA Harbor & Outfall Monitoring Program: Boston Harbor**, **Sta. T-05A**: Rep. 2, 05 Aug. 2009, 42°20.38'N, 70°57.64'W, 17.5 m (2, MCZ 161948).—**Massachusetts Bay**, **1997 August Survey**, **Sta. FF-04**, Rep. 1, Aug 1997, 42°17.30′N, 70°25.50′W, 87 m (3, MCZ 1619490); **Sta. FF-04**: Rep. 2, 14 Aug. 2002, 42°17.30′N, 70°25.50′W, 90 m, 3 specimens on SEM stub (MCZ 161950).

Description. A moderately sized species, adults with 70–80 setigers, 9–15 mm long and up to 0.45 mm wide. Body long, dorsum rounded, venter flattened with mid-ventral groove (Fig. 36A); body segments generally short and crowded anteriorly and less so in posterior cinctured setigers bearing numerous acicular spines. Color in alcohol light tan, lacking any distinctive body pigment.

Pre-setiger region long, narrow, smooth, about as long as first seven setigers (Fig. 36A). Prostomium elongate, pointed anteriorly (Fig. 36A–B); eyespots absent; ciliated oval nuchal organs present on posterior lateral border with peristomium just anterior to oral opening (Fig. 36B, inset). Peristomium smooth, lacking any grooves or annular rings, merging seamlessly with prostomium anteriorly and setiger 1 posteriorly (Fig. 36A–B); dorsal surface with elongate dorsal crest (Fig. 36B); dorsal tentacles arise anterior to setiger 1 with first pair of branchiae lateral and posterior to tentacles (Fig. 36A–B). Second pair of branchiae dorsal to notosetae on setiger 1; subsequent branchiae arise in similar position (Fig. 36A–B).

Anterior parapodia low rounded lobes from which setae emerge; noto- and neurosetae from setiger 1 all capillaries, 7–10 per fascicle in notopodia and 5–7 in neuropodia; capillaries of anterior setigers with fringe of fibrils along one edge (Fig. 36G). Long, thin natatory-like capillaries present along body, not associated with sexual maturity (Fig. 36C–E). Acicular spines from about setiger 40–45 in neuropodia and setiger 45–50 in notopodia. Posterior cinctured segments with deep intersegmental furrows separating highly elevated membranous podial lobes from which spines and capillaries emerge (Fig. 36D–F). In most posterior cinctured setigers, acicular spines 6–7 per fascicle in noto- and neuropodia with 12–14 spines on a side, with narrow dorsal and ventral gaps between fascicles (Fig. 36D–E); spines accompanied by alternating, long, thin capillaries (Fig. 36H); acicular spines curved, thickened, with blunt tips (Fig. 36H).

Pygidium a simple flattened lobe ventral to anal opening (Fig. 36D–E).

Methyl green staining. No pattern.

Remarks. Locally, *Chaetozone hystricosa* is readily recognized by the long, smooth pre-setiger region where there are no annular rings on the peristomium, which is merged almost seamlessly with both the prostomium and setiger 1. The long, narrow dorsal peristomial crest was not noted in the original description.

Globally, the only species of *Chaetozone* with a smooth, non-annulated pre-setiger region similar to that found in *C. hystricosa*, a continental shelf species, are two species from abyssal depths: *Chaetozone reticulata* Blake, 2018 from the Weddell Sea, Antarctica in 3111 m and *Chaetozone truebloodi* Blake, 2019 from the equatorial Pacific Ocean in 4880 m. Neither of the two deep-sea species, however, have a dorsal peristomial crest and the prostomium of both species is relatively short and rounded apically instead of being long, narrow, and acutely pointed. In addition, these two species have fewer posterior spines, up to 9 or 11 on a side, instead of 12–14 as in *C. hystricosa*.

Distribution. Northeastern United States, Boston Harbor to Massachusetts Bay, 15–90 m.

Chaetozone lophia new species

Figures 37–38

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Chaetozone sp. 10: Blake *et al*. 1987: 61, 68, C-2; Maciolek *et al.* 1987b: D-2 (in part); Blake & Grassle 1994: 850, 855; Hilbig 1994: 940 (in part).
Chaetozone cf. *setosa*: Blake *et al*. 1987: 61, 68, C-2; Blake & Grassle 1994: 850, 855; Hilbig 1994: 940 (in part). **Not** Malmgren, 1867.

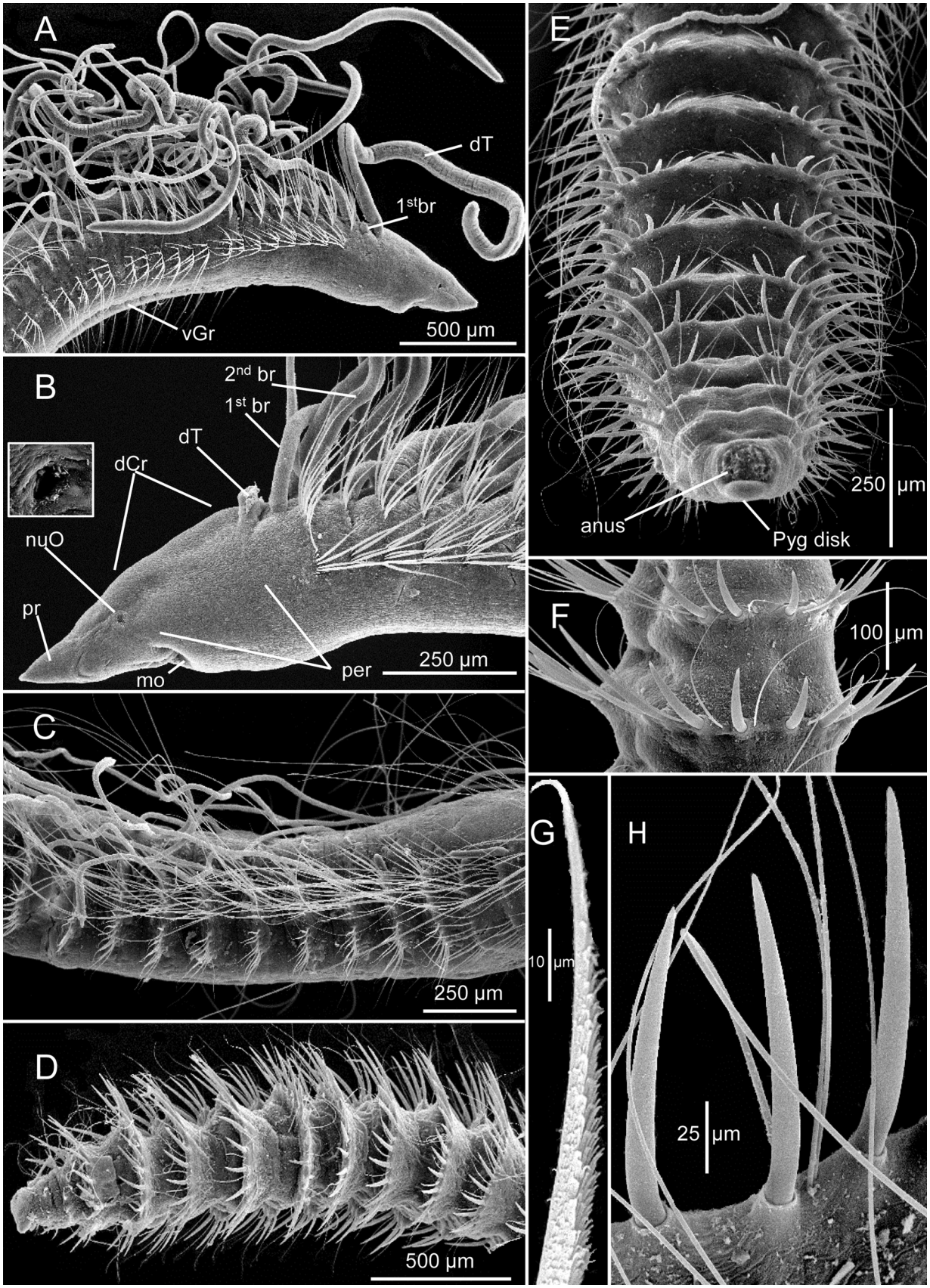

FIGURE 36. *Chaetozone hystricosa*. SEMS, (MCZ 161950): A, anterior end, right lateral view; B, anterior end, left lateral view, inset of nuchal organ (not to scale); C, mid-body segments, lateral view; D, posterior segments and pygidium, lateral view; E, posterior segments and pygidium, dorsal view; F, two far posterior setigers with acicular spines and capillaries, lateral view; G, capillary notoseta from an anterior setiger; H, neuroacicular spines and capillaries from a far posterior setiger.

Material examined. (*184 specimens*) **US South Atlantic ACSAR Program**, **Off Cape Lookout, North Carolina**, coll. J.A. Blake, Chief Scientist: **Sta. 1**: Cruise SA1, Rep. 3, 11 Nov 1983, 34°16.00′N, 75°45.97′W, 580 m, **holotype** (USNM 1661375), 1 **paratype** (USNM 1661376); Cruise SA2, Rep. 1, 26 Mar 1984, 34°15.93′N, 75°46.16′W, 583 m, 2 **paratypes** (USNM 1661377); Rep. 2, 26 Mar 1984, 34°15.81′N, 75°46.01′W, 583 m, 10 **paratypes** (USNM 1661378); Rep. 3, 27 Mar 1984, 34°15.81′N, 75°45.78′W, 593 m, 11 **paratypes** (USNM 1661379); Cruise SA3, Rep. 1, 15 Jul 1984, 34°16.40′N, 75°45.80′W, 584 m, 4 **paratypes** (USNM 1661380); Rep. 2, 15 Jul 1984, 34°16.30′N, 75°45.60′W, 599 m, 3 **paratypes** (USNM 1661381); Rep. 3, 16 Jul 1984, 34°16.60′N, 75°45.60′W, 591 m, 2 **paratypes** (USNM 1661382).—**Off Cape Fear, North Carolina**. **Sta. 11**: Cruise SA4, Rep. 2, 22 May 1985, 33°04.92′N, 76°24.97′W, 802 m, (1, USNM 1661383); Rep. 3, 22 May 1985, 33°04.87′N, 76°25.14′W, 799 m (2, USNM 1661384); Cruise SA5, Rep. 1, 23 Sep 1985, 33°04.83′N, 76°25.19′W, 796 m (4, USNM 1661385); Rep. 2, 23 Sep 1985, 33°04.83′N, 76°25.17′W, 796 m (3, USNM 1661386); Cruise SA6, Rep. 1, 22 Nov 1985, 33°04.95′N, 76°25.15′W, 804 m, (4, USNM 1661387); Rep. 2, 22 Nov 1985, 33°04.94′N, 76°25.17′W, 804 m (2 USNM 1661388); Rep. 3, 22 Nov 1985, 33°04.84′N, 76°25.06′W, 807 m (2, USNM 1661389).—**Off Charleston, South Carolina**. **Sta. 14**: Cruise SA4, Rep. 1, 20 May 1985, 32°23.64, 76°01.13′W, 805 m (6, USNM 1661390); Rep. 2, 20 May 1985, 32°23.64, 76°01.19′W, 802 m (5, USNM 1661391); Cruise SA5, Rep. 2, 20 Sep. 1985, 32°23.72, 76°01.24′W, 799 (6, USNM 1661392); Rep. 3, 20 Sep. 1985, 32°23.63, 76°01.11′W, 799 m (4, USNM 1661393); Cruise SA6, Rep. 1, 18 Nov 1985, 32°23.73, 76°01.10′W, 799 m (6, USNM 1661394).—**Off New England, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 3**: Cruise NA5, Rep. 1, 27 Apr 1986, 41°01.46′N, 66°20.34′W, 1335 m (1, USNM 1661395). **Sta. 4**: Cruise NA1, Rep. 3, 09 Nov 1984, 41°01.39′N, 66°20.16′W, 1330 m (3, USNM 1661396); Cruise NA-2, Rep. 2, 22 Nov 1985, 41°01.42′N, 66°20.32′W, 1334 m (23, USNM 1661397). **Sta. 7**: Cruise NA-1, Rep. 1, 10 Nov 1984, 40°27.54′N, 67°40.34′W, 560 m (2, USNM 1661409). **Sta. 9**: Cruise NA5, Rep. 1, 03 May 1986, 39°50.54′N, 70°01.79′W, 1214 m (1, USNM 1661408). **Sta. 12**: Cruise NA-1, Rep. 2, 15 Nov. 1984, 39°54.35′N, 70°55.18′W, 558 m (4, USNM 1661398); Cruise NA-2, Rep. 1, 04 May 1985, 39°54.31′N, 70°55.04′W, 551 m (7, USNM 1661399); Rep. 2, 04 May 1985, 39°54.26′N, 70°55.07′W, 555 m (7, USNM 1661400); Cruise NA-4, Rep. 1, 30 Nov 1985, 39°54.28′N, 70°55.12′W, 560 m (8, USNM 1661401); Rep. 2, 30 Nov 1985, 39°54.28′N, 70°55.12′W, 559 (5, USNM 1661402); Rep. 3, 30 Nov 1985, 39°54.32′N, 70°55.12′W, 544 (9, USNM 1661403); Cruise NA-5, Rep. 1, 06 May 1986, 39°54.17′N, 70°55.22′W, 560 m (3, USNM 1661404); Rep. 3, 06 May 1986, 39°54.25′N, 70°55.09′W, 552 m (3, USNM 1661405); Cruise, NA-6, Rep. 2, 30 Jul 1986, 39°54.26′N, 70°55.07′W, 559 m (7, USNM 1661406); Rep. 3, 30 Jul 1986, 39°54.24′N, 70°55.09′W, 563 m (6, USNM 1661407).

Description. Largest specimens generally range from 6–7 mm long with about 45–50 setigers. Holotype with 48 setigers, 7.0 mm long (Figs. 37A–B, 38E–F); large paratype (USNM 1661376) with 47 setigers, 6.7 mm long (Fig. 38A–B). Body elongate, generally cylindrical in cross section; anterior 12–15 setigers narrow, ca. 0.4 mm wide, then increasing in size with middle body segments often swollen and distended due to enlarged stomach area containing fine sediment particles (Fig. 38A), about 0.8 mm wide or wider; body then narrowing and tapering in posterior segments (Fig. 38D). Anterior and middle body segments short, about four times wider than long (Fig. 37A–B); posterior segments with deep cinctures and elevated membranes bearing armature of capillaries and acicular spines (Figs. 37D, 38D). Body terminates in narrow pygidium bearing rounded disk. Body with ventral ridge along most of length formed by medial bulge where segments meet mid-ventrally. Dorsal surface without ridges or grooves except in far posterior cinctured segments where notch sometimes present between the left and right notopodia (Fig. 37D). Color in alcohol light tan; larger specimens with black pigment spots on anterior and posterior lateral margins of first peristomial ring (Fig. 37C); these sometimes concentrated in discrete areas.

Pre-setiger region elongate, narrow, as long as first five setigers. Prostomium long, triangular, tapering to pointed tip (Figs. 37A–C, 38A, C, E–F); eyespots absent; nuchal organs rounded notches on posterior lateral margin (Fig. 37C). Peristomium long, divided into two distinct rings (Figs. 37A–C, 38C); first ring bulbous, with prominent dorsal crest extending onto second ring (Fig. 37A); second ring slightly narrower than first, not rounded, merging with setiger 1 (Fig. 37A–C); mouth a transverse opening on anterior border of first peristomial ring (Fig. 37B); dorsal tentacles arising from near posterior end of second ring (Fig. 37A, C); first pair of branchiae arising lateral and slightly posterior to dorsal tentacles (Fig. 37A, C). Second pair of branchiae arising dorsal and posterior to notosetae on setiger 1; subsequent branchiae in similar position (Fig. 37A); branchiae continuing to far posterior segments.

Parapodia of anterior and middle segments reduced to low ridges or mounds from which setae arise; posterior parapodia modified with deep intersegmental notches with parapodia becoming elevated and bearing thin mem-

branes with acicular spines and capillaries (Fig. 37D, 38D, G). Anterior setae all long capillaries numbering about 12–15 per fascicle, including long natatory-like setae in notopodia of anterior and middle segments; these not associated with sexual maturity. Notopodial acicular spines from setigers 29–32 (holotype 30); neuropodial spines from setigers 25–27 (holotype 26). Spines numbering 1–3 initially, then increasing to 9–10 in notopodia and 7–8 in neuropodia; with 16–18 spines on a side (Fig. 38G). Spines alternating with capillaries only slightly longer and narrower than spines (Fig. 38G–I). Cinctures providing a prominent armature with narrow dorsal, lateral, and ventral gaps between noto- and neuropodial fascicles (Figs. 38D, 38G). Individual spines with basal manubrium at emergence from podial lobes; spines curving and tapering to narrow pointed tip (Fig. 38G–I).

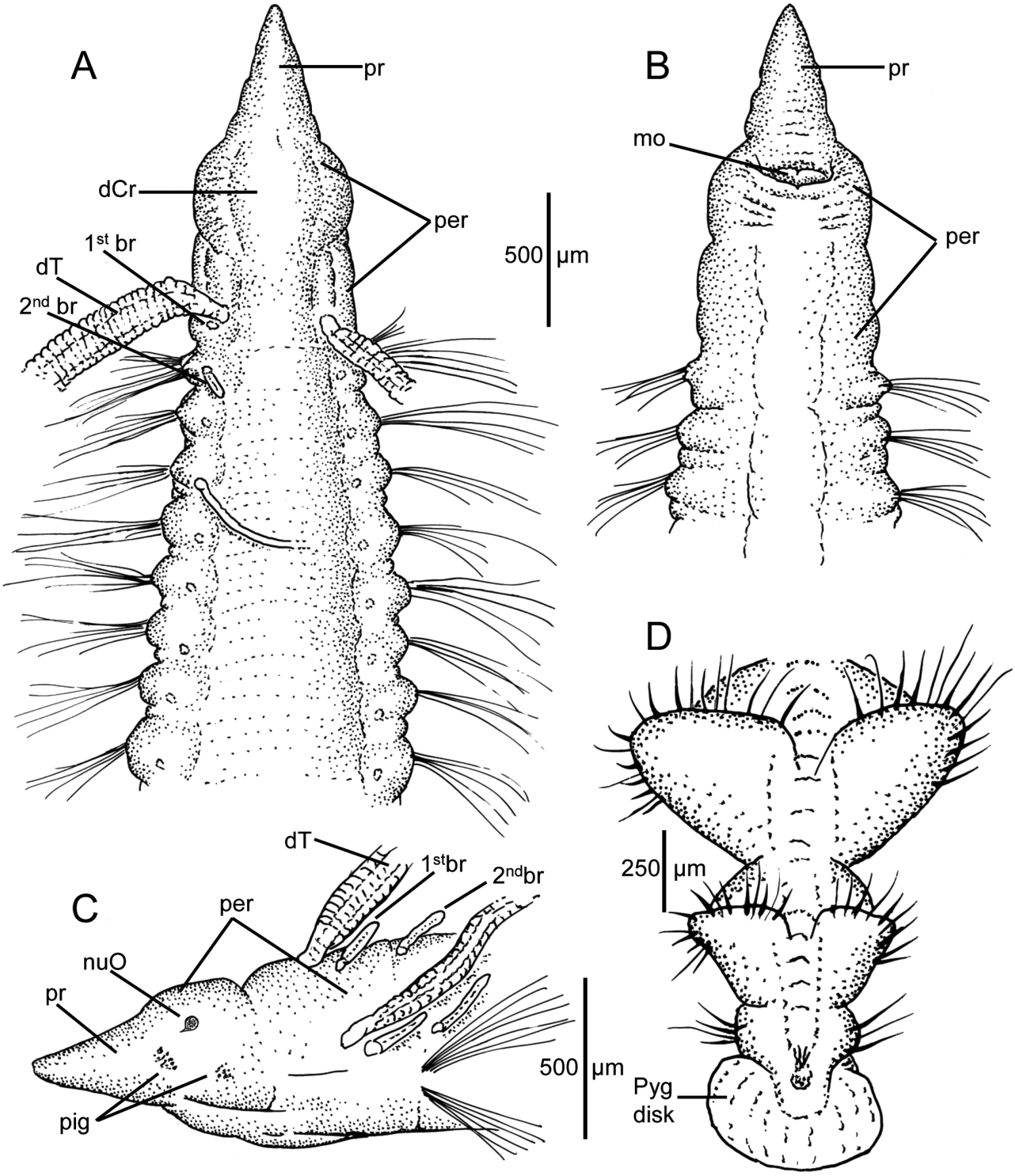

FIGURE 37. *Chaetozone lophia* **n. sp**. Holotype (USNM 1661375): A, anterior end, dorsal view; B, anterior end, ventral view. Paratype (USNM 1661380): C, anterior end, left lateral view; D, posterior end, dorsal view.

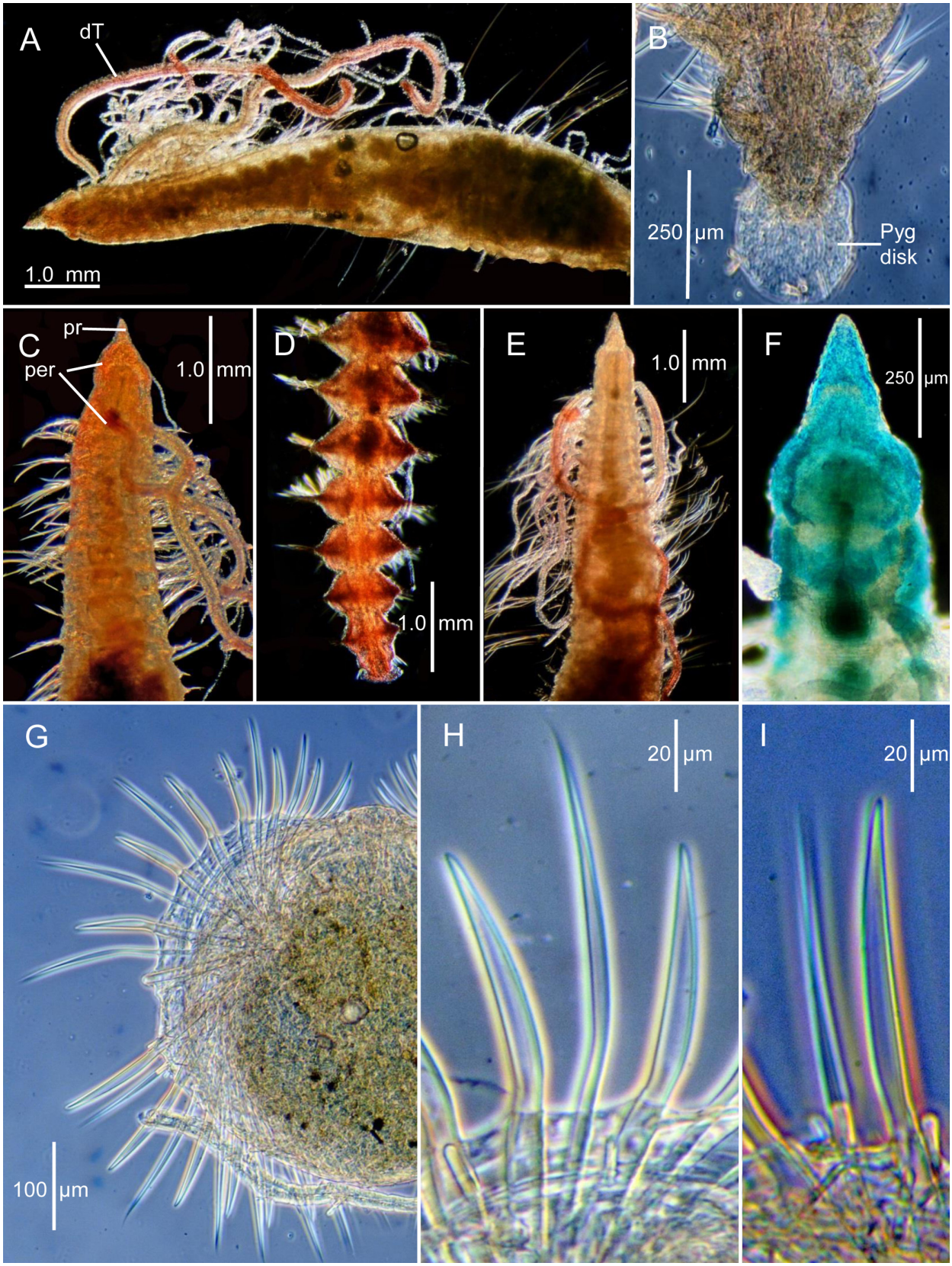

FIGURE 38. *Chaetozone lophia* **n. sp**. A, anterior end, left lateral view; B, posterior end with pygidial disk, dorsal view; C, anterior end, dorsal view; D, posterior end, dorsal view; E, anterior end, dorsal view; F, anterior end, dorsal view; G, posterior parapodium, anterior view; H, two notopodial acicular spines and a capillary from (G); I, neuropodial acicular spine and capillary from (G). A–E stained with Shirlastain A; F stained with MG. A–B, paratypes (USNM 1661377); C–D, holotype (USNM 1661375); E–F, paratypes (USNM 1661376); G–I, paratypes (USNM 1661380).

Body terminating in short pygidium bearing a semicircular disk ventral to anal opening (Figs. 37D, 38B, D).

Methyl green staining. A distinct MG pattern produced on pre-setiger region and a few anterior setigers (Fig. 38F); most of body not retaining stain after differentiation. Prostomium stains from the tip to a curved clear area near the posterior margin; first peristomial ring stains entirely, separated from second ring by a curved clear area; second ring also staining. Anterior 2–3 setigers with notopodia retaining stain.

Remarks. *Chaetozone lophia* **n. sp**. is distinguished by having two peristomial rings, the first of which is enlarged and bulbous with a dorsal crest, the enlarged middle segments due to a stomach packed with sediment, and the distinctive MG staining pattern. In addition, most of the specimens have clusters of black pigment on the lateral sides of the first peristomial ring and sometimes on the venter posterior to the mouth.

Among species of *Chaetozone* with an enlarged and bulbous anterior ring on the peristomium, *C. lophia* **n. sp**. is similar morphologically in several respects to *Chaetozone bathyala* Blake, 2015 from the Canadian Arctic and *Chaetozone grasslei* Blake, 2019 from the abyssal Pacific Ocean. In *C. bathyala*, however, the second peristomial ring instead of being entire as in *C. lophia* **n. sp**., is distinctly divided into two parts, the second being a distinct achaetous segment anterior to setiger 1 that bears the first pair of branchiae. *Chaetozone grasslei* is a long slender threadlike species that lacks a dorsal crest and the enlarged middle segments and lacks the distinct MG staining pattern of *C. lophia* **n. sp**.

Biology. The collection included both juveniles and mature adults. One complete specimen (USNM 1661389) with 45 setigers has eggs protruding from six middle body segments (setigers 25–30). These eggs ranged from small, rounded oocytes of about 60 µm in diameter to larger, rounded eggs measuring up to 155 µm in longest diameter.

Etymology. The epithet is from the Greek, *lophia* for crest; in reference to the prominent dorsal crest on the peristomium of this species.

Distribution. Upper to middle continental slope: southeastern US, off the Carolinas, 580–807 m; northeastern US, off New England, 551–1335 m.

Chaetozone profunda new species

Figures 39–40

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Chaetozone sp. 9: Blake *et al*. 1987: C-2; Hilbig 1994: 940.
Chaetozone sp. 10: Maciolek *et al*. 1987a: D-2; 1987b: D-2 (in part).
Chaetozone setosa: Maciolek *et al*. 1987a: D-2; 1987b: D-2 (in part). **Not** Malmgren, 1867.

Material examined. (*198 specimens*) **Off New England, U.S. North Atlantic ACSAR Program**, coll. G.W. Hampson, Chief Scientist. **Sta. 8**: Cruise NA-1, Rep. 1, 10 Nov 1984, 40°10.37′N, 67°37.43′W, 2175 m, **holotype** (USNM 1661492) and 3 **paratypes** (USNM 1661493); Rep. 3, 10 Nov 1984, 40°10.32′N, 67°37.38′W, 2180 m, 2 **paratypes** (USNM 1661494); Cruise NA-4, Rep. 1, 25 Nov 1985, 40°10.21′N, 67°37.24′W, 2184 m, 1 **paratype** (USNM 1661495); Cruise NA-5, Rep. 3, 25 Nov 1985, 40°10.25′N, 67°37.41′W, 2182 m (2, USNM 1661496). **Sta. 2**: Cruise NA-6, Rep. 1, 24 Jul 1986, 40°57.27′N, 66°13.78′W, 2095 m, 2 **paratypes** (USNM 1661497. **Sta. 3**: NA-1, Rep. 1, 09 Nov 1984, 41°01.39′N, 66°20.16′W, 1350 m (1, USNM 1661498); Rep. 3, 09 Nov 1984, 41°01.41′N, 66°20.22′W, 1338 m (1, USNM 1661499). **Sta. 5**: Cruise NA-1, Rep. 3, 05 Nov 1984, 40°05.29′N, 67°29.96′W, 2045 m, 3 **paratypes** (USNM 1661500); Cruise NA-3, Rep. 2, 04 Jul 1985, 40°05.08′N, 67°29.85′W, 2060 m, 2 **paratypes** (USNM 1661501). **Sta. 9**: Cruise NA-5, Rep. 1, 03 May 1986, 39°50.54′N, 70°01.79′W, 1214 m (1, USNM 1661502); **Sta. 15**: Cruise NA-1, Rep. 2, 09 Dec 1984, 39°54.26′N, 70°54.26′W, 2154 m, 1 **paratype** (USNM 1661503).—**Off Delaware and New Jersey, U.S. Mid-Atlantic ACSAR Program,** coll. R. Petrecca, Chief Scientist. **Sta. 1**: Cruise Mid-2, Rep. 1, 03 Aug 1984, 38°36.12′N, 72°53.06′W, 2209 m (1, USNM 1661504); Rep. 3, 03 Aug 1984, 38°36.21′N, 72°52.96′W, 2179 m (1, USNM 1661505); Cruise Mid-4, Rep. 3, 17 May 1985, 38°35.88′N, 72°53.13′W, 2195 m (2, USNM 1661506); Cruise Mid-5, Rep. 1, 05 Aug 1985, 38°35.91′N, 72°53.10′W, 2185 m (3, USNM 1661507); Rep. 3, 05 Aug 1985, 38°35.90′N, 72°53.11′W, 2185 m (5, USNM 1661508). **Sta. 2**: Cruise Mid-1, Rep. 2, 01 Apr 1984, 38°35.71′N, 72°53.69′W, 2018 m (2, USNM 1661509); Rep. 3, 01 Apr 1984, 38°35.71′N, 72°53.61′W, 2033 m (2, USNM 1661510); Cruise Mid-2, Rep. 3, 03 Aug 1984, 38°35.76′N, 72°53.81′W, 2004 m (3, USNM 1661511); Cruise Mid-3, Rep. 2, 02 Dec 1984, 38°35.75′N, 72°53.67′W, 2010 m (1, USNM 1661512); Rep. 3, 02 Dec 1984, 38°35.68′N, 72°53.69′W, 2015 m (1, USNM 16615013); Cruise Mid 6, Rep. 1, 13 Nov 1985,

38°35.66′N, 72°53.71′W, 2064 m (2, USNM 1661514). **Sta. 3**: Cruise Mid-1, Rep. 2, 05 May 1984, 38°36.88′N, 72°51.34′W, 2055 m (1, USNM 1661515); Cruise Mid-2, Rep. 2, 03 Aug 1984, 38°36.87′N, 72°51.45′W, 2049 m (2, USNM 1661516); Cruise Mid-3, Rep. 2, 03 Dec 1984, 38°36.91′N, 72°51.55′W, 2050 m (2, USNM 1661517); Cruise Mid-6, Rep. 2, 12 Nov 1985, 38°36.75′N, 72°51.61′W, 2064 m (1, USNM 1661518). **Sta. 4**: Rep. 2, 01 Aug 1984, 38°44.53′N, 72°41.23′W, 2106 m (1, USNM 1661519); Cruise Mid-3, Rep. 3, 05 Dec 1984, 38°44.40′N, 72°41.08′W, 2105 m (1, USNM 1661520); Cruise Mid-5: Cruise Rep. 2, 03 Aug 1985, 38°44.44′N, 72°41.22′W, 2095 m (2, USNM 1661521). **Sta. 5**: Cruise Mid-1, Rep. 2, 04 May 1984, 38°50.53′N, 72°33.10′W, 2065 m (1, USNM 1661522); Rep. 3, 08 May 1984, 38°50.46′N, 72°33.14′W, 2080 m (1, USNM 16615023); Cruise Mid-2, Rep. 1, 01 Aug 1984, 38°50.42′N, 72°33.03′W, 2089 m (1, USNM 1661524); Rep. 3, 01 Aug 1984, 38°50.52′N, 72°32.96′W, 2074 m (2, USNM 16615025); Cruise Mid-3, Rep. 2; 05 Dec 1984, 38°50.40′N, 72°33.12′W, 2090 m (1, USNM 1661526); Rep. 3; 05 Dec 1984, 38°50.40′N, 72°33.12′W, 2090 m (1, USNM 01661527); Cruise Mid-4, Rep. 1, 16 May 1985, 38°50.46′N, 72°33.23′W, 2080 m (3, USNM 1661528); Rep. 2, 16 May 1985, 39°05.66′N, 72°03.25′W, 2045 m (1, USNM 16615029); Rep. 3, 16 May 1985, 38°50.46′N, 72°33.21′W, 2075 m (5, USNM 01661530); Cruise Mid-5, Rep. 1, 03 Aug 1985, 38°50.44′N, 72°33.18′W, 2077 m (1, USNM 1661531); Rep. 2, 03 Aug 1985, 38°50.44′N, 72°33.18′W, 2077 m (1, USNM 1661532). **Sta. 6**: Cruise Mid-1, Rep. 1, 03 May 1984, 39°05.61′N, 72°02.98′W, 2090 m (2, USNM 1661533); Rep. 2, 03 May 1984, 39°05.63′N, 72°03.00′W, 2088 m (3, USNM 1661534); Rep. 3, 03 May, 1984, 39°05.59′N, 72°03.00′W, 2090 m (1, USNM 1661535); Cruise Mid-2, Rep. 1, 01 Aug 1988, 39°05.65′N, 72°02.97′W, 2084 m (1, USNM 1661536); Rep. 2, 01 Aug 1984, 39°05.68′N, 72°02.99′W, 2084 m (2, USNM 1661537); Cruise Mid-3, Rep. 1, 28 Nov 1984, 39°05.58′N, 72°02.81′W, 2090 m (2, USNM 1661538); Cruise Mid 4, Rep. 3, 15 May 1985, 39°05.65′N, 72°03.22′W, 2085 m (2, USNM 1661539); Cruise Mid-6, Rep. 1, 10 Nov 1985, 39°05.67′N, 72°03.36′W, 2089 m (2, USNM 1661540). **Sta. 7**: Cruise Mid-1, Rep. 1, 03 May 1984, 38°27.32′N, 73°03.45′W, 2110 m (2, USNM 1661541); Rep. 2, 06 May 1984, 38°27.30′N, 73°03.43′W, 2100 m (1, USNM 1661542); Cruise Mid-3, Rep. 2, 02 Dec 1984, 38°27.31′N, 73°03.44′W, 2110 m (1, USNM 1661543); Rep. 3, 02 Aug 1984, 38°27.25′N, 73°03.44′W, 2100 m (3, USNM 1661544); Cruise Mid-4, Rep. 1, 18 May 1985, 38°27.26′N, 73°03.55′W, 2100 m (7, USNM 1661545); Rep. 2, 18 May 1986, 38°27.27′N, 73°03.52′W, 2105 m (3, USNM 1661546), Cruise Mid-6, Rep. 1, 14 Nov 1984, 38°27.29′N, 73°03.58′W, 2096 m (3, USNM 1661547). **Sta. 8**: Cruise Mid-1, Rep. 1, 06 May 1984, 38°27.36′N, 73°05.09′W, 2148 m (2, USNM 1661548); Rep. 2, 06 May 1984, 38°27.36′N, 73°04.88′W, 2150 m (4, USNM 1661549); Rep. 3, 06 May 1984, 38°27.36′N, 73°04.81′W, 2150 m (1, USNM 1661550); Cruise Mid-3, Rep. 2, 01 Dec 1984, 38°27.13′N, 73°04.87′W, 2150 m (1, USNM 1661551); Rep. 3, 01 Dec 1984, 38°27.30′N, 73°04.79′W, 2155 m (2, USNM 1661552). **Sta. 9**: Cruise Mid-1, Rep. 3, 06 May 1984, 38°17.23′N, 73°14.60W, 2108 m (1, USNM 1661553); Cruise Mid-2, Rep. 2, 06 Aug 1984, 38°17.26′N, 73°14.49′W, 2114 m (1, USNM 1661554); Cruise Mid-3, Rep. 1, 30 Nov 1984, 38°17.20′N, 73°14.38′W, 2110 m (1, USNM 1661555); Rep. 3, 30 Nov 1984, 38°17.20′N, 73°14.47′W, 2105 m (8, USNM 1661556); Cruise Mid-4, Rep. 3, 18 May 1985, 38°17.24′N, 73°14.62′W, 2100 m (3, USNM 166157). Cruise Mid-6, Rep. 2, 17 Nov 1985, 38°17.28′N, 73°14.65′W, 2104 m (6, USNM 1661558). **Sta. 10**: Cruise Mid-1, Rep. 3, 07 May 1984, 37°51.83′N, 73°19.94′W, 2095 m (1, USNM 1661559); Cruise Mid-3, Rep. 3, 30 Nov 1984, 37°51.80′N, 73°19.85′W, 2100 m (5, USNM 1661560); Cruise Mid-4, Rep. 1, 19 May 1985, 37°51.76′N, 72°20.01′W, 2095 m (5, USNM 1661561); Rep. 3, 19 May 1985, 37°51.73′N, 73°20.01′W, 2095 m (2, USNM 1661562). **Sta. 11**: Cruise Mid-2, Rep. 3, 05 Aug 1984, 38°40.25′N, 72°56.24′W, 1504 m (1, USNM 1661563); Cruise Mid-6, Rep. 3, 13 Nov 1985, 38°40.06′N, 72°56.41′W, 1519 m (3, USNM 1661564). **Sta. 12**: Cruise Mid-1, Rep. 1, 07 May 1984, 38°29.34′N, 72°42.23′W, 2501 m (3, USNM 1661565); Rep. 2, 07 May 1984, 38°29.33′N, 72°42.19′W, 2500 m (3, USNM 1661566); Rep. 3, 08 May 1984, 38°29.33′N, 72°42.24′W, 2500 m (1, USNM 16615676); Cruise Mid-2, Rep. 2, 05 Aug 1984, 38°29.39′N, 72°42.01′W, 2504 m (1, USNM 1661568); Cruise Mid-3, Rep. 2, 03 Dec 1984, 38°29.22′N, 72°42.13′W, 2505 m (1, USNM 1661569); Cruise Mid-4, Rep. 2, 18 May 1985, 38°29.22′N, 72°42.17′W, 2505 m (5, USNM 1661570); Cruise Mid-6, Rep. 2, 14 Nov 1985, 38°29.20′N, 72°42.29′W, 2504 m (1, USNM 1661571).—**Off New Jersey, U.S. EPA DWD-106 Site Survey**, R. Petrecca, Chief Scientist. **Sta. F**: Rep. 1, 18 Nov 1985, 38°51.10′N, 72°16.39′W, 2500 m (2, MCZ 161956); Rep. 2, 18 Nov 1985, 38°51.12′N, 72°16.32′W, 2500 m (7, MCZ 161957); Rep. 3, 18 Nov 1985, 38°51.11′N, 72°16.39′W, 2500 m (1, MCZ 161958). **Sta. G**: Rep. 1, 18 Nov 1985, 38°55.66′N, 72°02.53′W, 2505 m (5, MCZ 161959); Rep. 2, 18 Nov 1985, 38°55.63′N, 72°02.54′W, 2509 m (2, MCZ 161960); Rep. 3, 18 Nov 1985, 38°55.60′N, 72°02.54′W, 2505 m (7, MCZ 161961).—**Off the Cape Lookout, North Carolina, US South Atlantic ACSAR Program**, coll. J.A. Blake, Chief Scientist. **Sta. 7**: Cruise SA-2, Rep. 1, 21 May 1984, 33°58.30′N, 74°56.20′W, 3494 m (1, USNM 1661572).

Description. An elongate narrow species with middle segments often expanded due to enlarged stomach area. Holotype complete with 55 setigers, 7.7 mm long and ca. 0.4 mm wide across anterior setigers (Fig. 40A); some paratypes larger, with ca. 60 setigers, up to 8.2 mm long. Body generally cylindrical in cross section but dorsal and ventral surfaces generally only weakly elevated; dorsal and ventral grooves absent. Body gradually narrowing posteriorly towards pygidium (Fig. 40A, D). Anterior and middle segments short, crowded, about five times wider than long (Fig. 39A–B); these transitioning to spine-bearing segments about as wide as long, becoming moniliform with deep cinctures, each about 1.5 times as wide as long (Fig. 40D). Some specimens with several expanded segments together forming a bulge in mid-body segments (Fig. 40A). This "stomach" usually filled with ingested sediment and prominent in a few specimens, not apparent in others. Color in alcohol light tan with no distinctive pigmentation.

Pre-setiger region about as long as first seven setigers, tapering anteriorly (Figs. 39A–B, 40B, E). Prostomium triangular, elongate, tapering to narrow tip (Fig. 39A); eyespots absent; nuchal organs narrow curved grooves on posterior lateral margin (Figs. 39B). Peristomium with two separate rings separated by groove, best developed dorsally (Figs. 39A–B, 40C); anterior ring smooth; second ring with dorsal tentacles near anterior border followed by first pair of branchiae posterior to tentacles (Figs. 39A–B, 40C). First setiger merged entirely with peristomium along anterior margin, bearing second pair of branchiae dorsal to notosetae (Fig. 39A–B); subsequent branchiae in similar location dorsal to notosetae. Branchiae thin, elongate, continuing along body to posterior setigers.

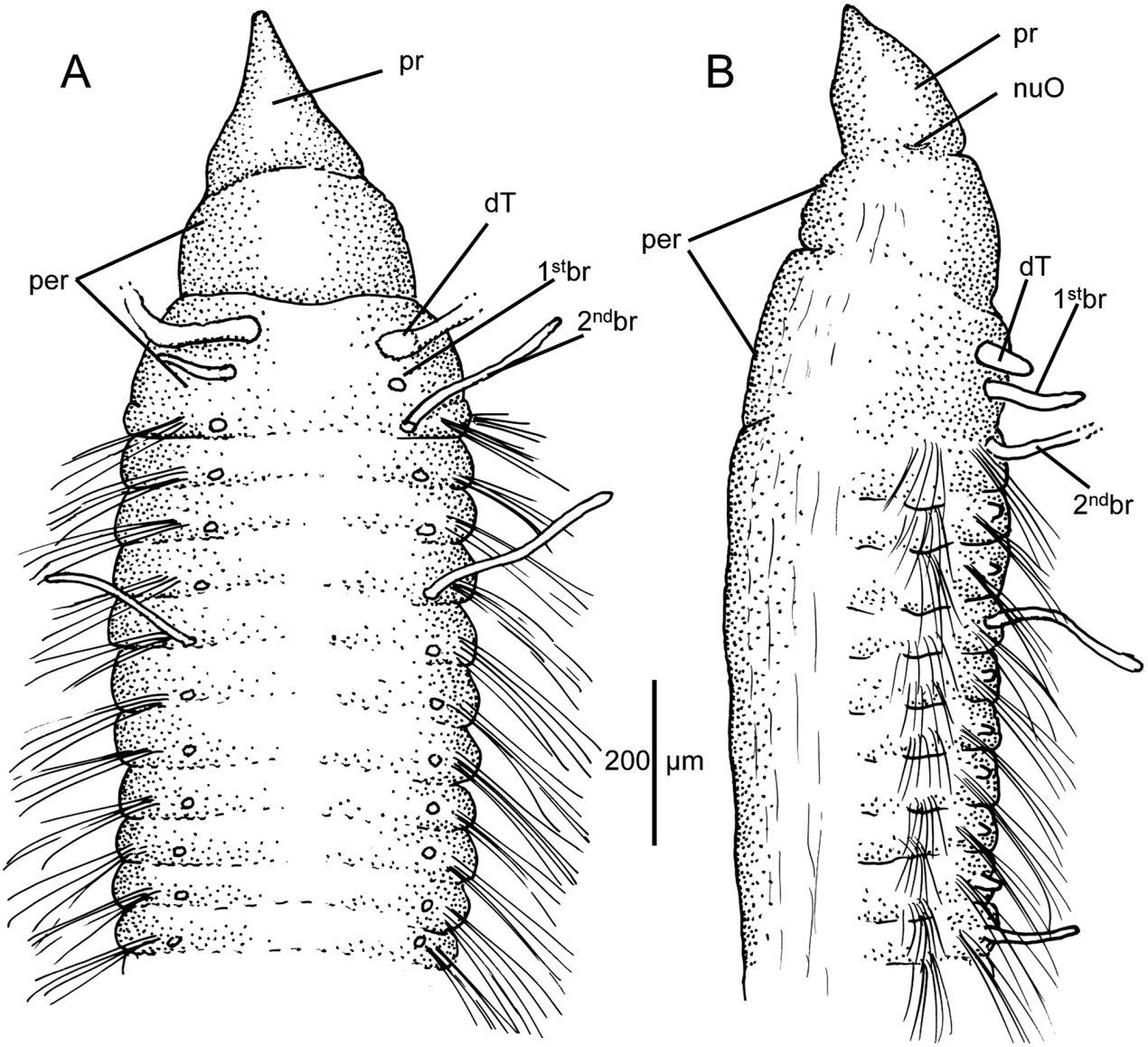

FIGURE 39. *Chaetozone profunda* **n. sp**. A, anterior end, dorsal view; B, anterior end, left lateral view. A: paratype (USNM 1661502); B: USNM (USNM 1661539).

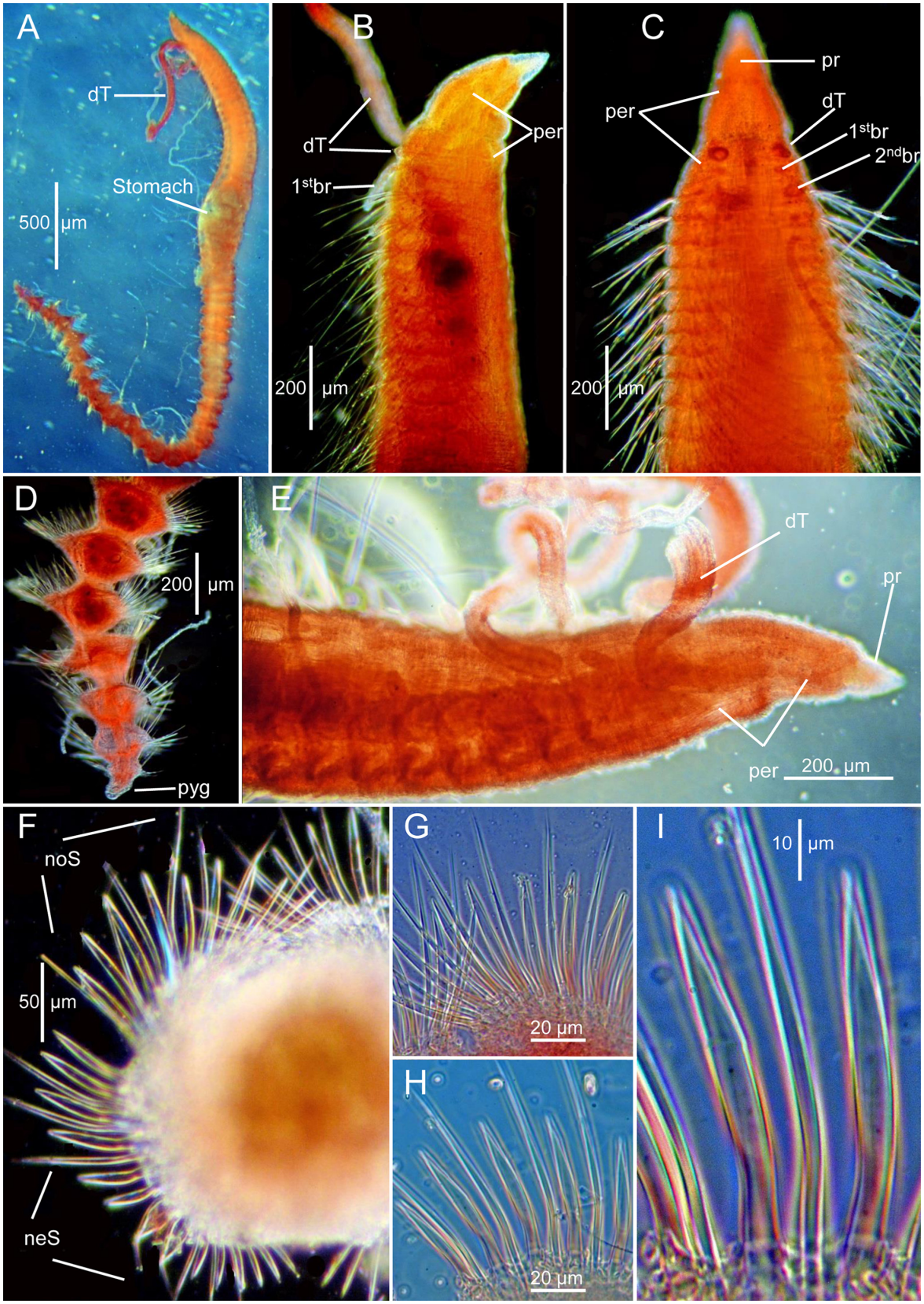

FIGURE 40. *Chaetozone profunda* **n. sp**. A, entire worm, left lateral view; B, anterior end, right lateral view; C, anterior end, dorsal view; D, posterior end, dorsal view; E, anterior end, right lateral view; F, posterior parapodium with acicular spines and capillaries, anterior view; G, notoacicular spines and capillaries from (F); H, neuroacicular spines and capillaries from (F); I, detail of neuroacicular spines and capillary from (H).A, D–E holotype (USNM 1661492); B, paratype (USNM 1661497); C, paratype USNM 1661494); F–I, paratype (USNM 1661495).

Parapodia of anterior and middle segments reduced to low ridges or mounds from which setae arise; posterior parapodia becoming moniliform, modified with deep intersegmental notches producing cinctured segments with parapodia becoming elevated and bearing thin membranes from which setae arise (Fig. 40D, F). Anterior setae all long capillaries numbering about 10–12 per fascicle, including long natatory-like setae in some notopodia of anterior and middle segments (Fig. 40A); these not associated with sexual maturity. Notopodial acicular spines from setigers 29–32 (holotype 29); neuropodial spines from setigers 25–27 (holotype 26). Spines numbering 1–3 initially, then increasing to 9–11 in notopodia and 14–15 in neuropodia; with full cinctures having up to 23–26 spines on a side (Fig. 40F). Spines alternating with thin, sharply pointed spinous capillaries slightly longer than spines (Fig. 40F–G). Cinctures with narrow dorsal, lateral, and ventral gaps between noto- and neuropodial fascicles providing a prominent armature encircling posterior segments (Fig. 40F). Individual spines with basal manubrium at emergence from podial lobes; spines only weakly curved, tapering to narrow pointed tip; blade appearing fusiform in some views (Fig. 40G–I).

Body terminating in short narrow pygidium bearing an elongate semicircular disk (Fig. 40D).

Methyl green staining. Posterior part of prostomium retaining MG stain, otherwise no pattern.

Remarks. *Chaetozone profunda* **n. sp**. is the third species of the genus reported to have the peristomium divided into two rings, with the large posterior ring including an achaetous segment that merges seamlessly with setiger 1; the dorsal tentacles arise from the anterior half of the second ring instead of near the posterior margin as in most *Chaetozone* species; first branchiae are located immediately posterior to the dorsal tentacles and the second pair arise on the merged setiger 1 in a line from the dorsal tentacles and first branchiae. The two previously described species having these characteristics, both from the Antarctic seas, are *C. australosetosa* Blake 2018 and *C. biannulata* Blake, 2018. *Chaetozone profunda* **n. sp**. most closely resembles *C. biannulata* in having a long narrow pre-setiger region with a pointed prostomium. In addition, both species are of a similar size and have 55–60 setigers. *Chaetozone profunda* **n. sp**. differs from *C. biannulata* in having the first peristomial ring distinctly separated from the prostomium instead of merged or only weakly separated and lacking instead of having a peristomial dorsal crest. In *C. profunda* **n. sp**. the neuropodial acicular spines are first present from setigers 25–27, whereas in *C. biannulata*, the neuropodial spines are first present from setigers 37–38. The number of spines in posterior cinctures are similar, with *C. profunda* **n. sp**. having 20–24 spines on side and *C. biannulata* having 23–26.

Locally, *Chaetozone profunda* **n. sp**. can be easily distinguished from its congeners by the long, narrow pre-setiger region terminating in a narrow pointed prostomium, dorsal tentacles arising from the second peristomial ring well anterior to setiger 1, and with full cinctures of acicular spines and moniliform cinctured segments appearing in the second half of the body. A few specimens were observed with an expanded "stomach" filled with fine sediment particles in a few segments in middle body segments, but most specimens lacked this feature.

Biology. A deep-water species, *Chaetozone profunda* **n. sp**. occurs in sediments having relatively high silt + clay inventories. However, North Atlantic Station 8, where the holotype and several paratypes were collected, is at the base of Lydonia Canyon where the sediments consisted of approximately 50% fine sands in addition to silt and clay (Maciolek *et. al*. 1987b). In contrast, the Mid-Atlantic stations had lower sand inventories (ca. 15%) and higher percentages of silt + clay.

Etymology. The epithet is from the Latin, *profundus* for deep or vast, referring to the deep-sea habitat of this species.

Distribution. U.S. Atlantic continental slope: Northeastern slope, 1338–2184 m; Mid-Atlantic slope, 1519–2509 m; U.S. South Atlantic slope, 3494 m.

Discussion

The present study is part of a series of papers describing the cirratulid fauna of the U.S. Atlantic coast (Blake 1991, 2016, 2021b; Doner & Blake 2006). Collections containing cirratulids were derived from benthic reconnaissance and monitoring programs along the U.S. Atlantic coast conducted over the past 40 years at intertidal and nearshore sites to offshore sites on the continental shelf and slope. These projects were intended to evaluate short- and long-term impacts of oil and gas exploration and potential development as well as sewage disposal and abatement. The author was involved in most of these studies as a manager, senior ecologist, and systematist.

To date, bitentaculate cirratulids of the genera *Caulleriella* (5 spp.), *Chaetocirratulu*s (4 spp.), *Chaetozone* (12

spp.), and *Kirkegaardi*a (5 spp.) have been treated in detail (Blake 2016, 2021b, this study; Doner & Blake 2006). The genus *Tharyx* (2 spp.) was treated in part by Blake (1991) as was *Dodecaceria* (2 spp.) by Martin (1933) and Gibson (1979), but other species are known; the genus *Aphelochaeta* has yet to be worked up; several undescribed provisional species are known to be present. The next paper in this series will, therefore, deal with *Aphelochaeta*, *Tharyx*, *Dodecaceria*, and any additional specimens of other genera.

U.S. Atlantic species of *Caulleriella*

Blake (2021b) reported on six species of *Caulleriella*, four new, from shelf and slope depths of the U.S. Atlantic coast; three of the four new species were from deep-water. As part of that study, 49 species of *Caulleriella* were listed as valid globally, of which eight were from water depths of 500 m or greater. As part of the present study another deep-water species of *Caulleriella*, *C. cryptica* **n. sp**. from off New England in water depths of 2060–2085 m, was discovered among specimens originally identified as *Chaetozone.* This new species brings the total number of valid species of *Caulleriella* to 50 and deep-water species to nine. *Caulleriella cryptica* **n. sp**. is the second known species of the genus to have bidentate hooks with a hood extending from the main fang to the concave side of the shaft. The only other species having such a hook is *C. bathytata*, from abyssal depths of the equatorial Pacific Ocean (Blake 2019).

U.S. Atlantic species of *Chaetocirratulus*

The genus *Chaetocirratulus* was established by Blake (2018) to accommodate a group of mostly large-bodied bitentaculate cirratulids with a broad wedge-shaped prostomium and a reduced number of acicular spines that do not form a prominent posterior armature. Most of these worms have thick fusiform or sausage-shaped bodies and were previously referred to the genus *Chaetozone*. The overall appearance of these worms was noticed by the late Dr. Mary E. Petersen to be similar to some species of the multitentaculate genus *Cirratulus*; as such, she redefined the genus to include these bitentaculate species (Petersen 1991).

Blake (2018) while working with Antarctic and South American cirratulids encountered several different taxa that belonged to this group of cirratulids. After careful study of type materials of previously reported species and new materials, the genus *Chaetocirratulus* was established to accommodate this group of cirratulids having shared characteristics. Six species, including three new ones, were referred to the new genus; all but one were from depths greater than 500 m. In the present study, four species of *Chaetocirratulus*, three new, were identified in continental slope sediments off the U.S. Atlantic coast. All four species are from deep water.

The ten known species of *Chaetocirratulus* listed below are from Antarctica (four species), western South America (two species), and off the U.S. Atlantic coast (four species). Two additional deep-water species have been identified from abyssal depths off the eastern coast of Australia (Blake unpublished). The absence of *Chaetocirratulus* reported from other oceans more likely reflects the lack of deep-water sampling rather than any biogeographic pattern. It would appear that species of *Chaetocirratulus* are deep-water bi-tentaculate analogues of shallow-water multitentaculate *Cirratulus* species. The following is a list of the ten currently known species of *Chaetocirratulus*:

1. *Chaetocirratulus abyssalis* Blake, 2018. Antarctica, Ross Sea, 1565–1674 m.
2. *Chaetocirratulus andersenensis* (Augener, 1932). Antarctica120–840 m, Drake Passage, 2905 m.
3. *Chaetocirratulus epitocus* (Monro, 1930). Antarctic Peninsula, 93–335 m.
4. *Chaetocirratulus furvus* Blake, 2018. Off Peru, 1000 m.
5. *Chaetocirratulus gayheadius* (Hartman, 1965), **n. comb**. U.S. Atlantic slope, off New England, 300–558 m.
6. *Chaetocirratulus hessleri* Blake, **n. sp**. U.S. Atlantic continental slope, off New Jersey and Delaware, 1100–2056 m.
7. *Chaetocirratulus neogracilis* Blake, 2018. Peru-Chile Trench, 4100 m.
8. *Chaetocirratulus pinguis* (Hartman, 1978). East Antarctic Peninsula, Weddell Sea, 317–865 m; Ross Sea, 647 m.
9. *Chaetocirratulus sandersi* Blake, **n. sp**. U.S. Atlantic continental slope, off New Jersey and Delaware, 2013 m.
10. *Chaetocirratulus tomaculus* Blake, **n. sp**. U.S. Atlantic slope off New England, 1102 m.

Remarks on the known species of *Chaetozone*

Chaetozone is the largest genus in the Cirratulidae with 73 species listed as valid in WoRMS (Read & Fauchald 2021). However, at least eight species currently considered to be valid should be removed owing to previously

published synonyms, referrals to other genera, or as *species inquirendum* identified in the present paper. Details of those eight species are indicated below. With these eight removed and nine new species added in this paper, the total number of valid species of *Chaetozone* is now 74. Of these, 25 species are from water depths greater than 500 m.

Eight species of *Chaetozone* suggested for removal from the list of valid species

Chaetozone atlantica McIntosh, 1885. *Species inquirendum.* Type specimen (NHM ZK 1885.12.1.277) an anterior fragment (pre-setiger region + 8 setigers) lacking most setae, those present all capillaries; acicular spines not observed; branchiae and dorsal tentacles all absent, scars or stubs difficult to observe. Cannot be confirmed as *Chaetozone* and has no distinguishing characteristics. This study.

Chaetozone benthaliana McIntosh, 1885. *Species inquirendum.* Described from posterior fragment, cut into two pieces; confirmed by examination of Type (NHM ZK 1885.12.1.278). Cannot be referred to any known genus or species of Cirratulidae. This study.

Chaetozone berkeleyorum Banse & Hobson (1968). Hobson & Banse (1981: 52) referred this species to synonymy with *Cirratulus cirratus*. Blake (1996: 356) subsequently referred *C. berkeleyorum* to synonymy with *Cirratulus spectabilis* (Kinberg, 1866).

Chaetozone dunmanni McIntosh, 1911. McIntosh (1915: 253; Pl. 100, fig. 13; Pl. 109, fig. 14; Pl. 111, fig. 3) referred this species to synonymy with *Cirratulus caudatus* Levinsen, 1893.

Chaetozone gayheadia Hartman, 1965. Transferred to *Chaetocirratulus* and redescribed and illustrated for the first time in this study.

Chaetozone multioculata Hartman, 1961. Referred to genus *Cirratulus* by Blake (1996: 353).

Chaetozone vivipara (Christie, 1984 as *Tharyx vivipara*). Removed to *Aphelochaeta*. *Fide* Hartmann-Schröder, 1996; this study.

Chaetozone whiteavesi McIntosh, 1911. Referred to *Aphelochaeta* by Blake (2015: 539).

List of 74 valid species of *Chaetozone* based on results presented in this paper (25 species indicated with * are from greater than 500 m):

1. *Chaetozone abranchiata* (G.A. Hansen, 1878). North Sea.
2. *Chaetozone acuminata* Dean & Blake, 2007. NE Pacific, Costa Rica, 35 m.
3. *Chaetozone acuta* Banse & Hobson, 1968. NE Pacific, Puget Sound, 15–35 m.
4. **Chaetozone adunca* Blake **n. sp**. U.S. Atlantic continental slope, 530–1003 m.
5. **Chaetozone akaina* Blake, 2019. North equatorial Pacific Ocean, abyssal plain, 4480–4880 m.
6. **Chaetozone allanotai* Blake, 2006. Off California, slope depths, 1800–3200 m.
7. *Chaetozone anasima* Doner & Blake, 2006. W North Atlantic, New England, 20–85 m.
8. *Chaetozone artaspinosa* Blake **n. sp**. U.S. Atlantic coast, Boston Harbor, Massachusetts, 4–9 m.
9. **Chaetozone australosetosa* Blake, 2018. Widespread around Antarctica, 317–978 m.
10. *Chaetozone bansei* Blake, 1996. NE Pacific, California10–35 m.
11. *Chaetozone barentsensis* Grosse, Capa & Bakken, 2021. Barents Sea, 337–380 m; North Sea, 6 m.
12. *Chaetozone bathyala* Blake, 2015. Alaskan and Canadian Arctic and subarctic, intertidal to 55 m.
13. **Chaetozone biannulata* Blake, 2018. Widespread around Antarctica in deep water, 421–6337 m.
14. **Chaetozone bransfieldiensis* (Hartmann-Schröder & Rosenfeldt, 1989). Antarctic seas, 73–1674 m.
15. **Chaetozone brychiata* Blake **n. sp**. U.S. Atlantic continental slope, off Delaware, 2011–2095 m.
16. **Chaetozone brunnea* Blake, 2006. NE Pacific, off northern California, 2000–3200 m.
17. *Chaetozone camasetosa* Blake, 2015. NE Pacific, SE Alaska to British Columbia, 12–95 m.
18. *Chaetozone caputesocis* (Saint-Joseph, 1894). France.
19. *Chaetozone careyi* Blake, 2015. Alaskan Arctic, Beaufort Sea, 10–55 m; Canadian Arctic, Hudson Strait, intertidal.
20. *Chaetozone carpenteri* McIntosh, 1911. Mediterranean Sea and environs, 30–98 m. *Fide* Chambers *et al*. (2011).
21. *Chaetozone castanea* Blake, 2018. Off Peru and Chile, 65–160 m.
22. **Chaetozone castouria* Blake **n. sp**. U.S. Atlantic continental slope from off New England to the Carolinas, 1003–2200 m.

23. *Chaetozone chambersae* Grosse, Capa & Bakken, 2021. North Sea, 22–56 m.
24. *Chaetozone christiei* Chambers, 2000. England, Northumberland coast and English Channel, intertidal; W Scotland, Ayrshire coast, 10 m.
25. *Chaetozone cimar* Dean & Blake, 2007. NE Pacific, off Costa Rica, 50 m.
26. *Chaetozone columbiana* Blake, 1996. NE Pacific, Oregon to Washington, subtidal.
27. *Chaetozone commonalis* Blake, 1996. NE Pacific, off central California, 90–410 m.
28. *Chaetozone corona* Berkeley & Berkeley, 1941. NE Pacific, California to Costa Rica, 24–120 m; introduced to E North Atlantic, Brittany Coast, Adriatic Sea, Mediterranean Sea.
29. **Chaetozone cristata* Blake, 2018. West Antarctic Peninsula, 92–670 m.
30. *Chaetozone curvata* Hartmann-Schröder, 1965. SE Pacific, off Chile, 82–260 m. *Fide* Blake (2018).
31. *Chaetozone dimorphosetosa* (Hutchings & Murray, 1984). Australia, New South Wales, subtidal.
32. *Chaetozone diodonta* Doner & Blake, 2006. North Atlantic, New England, Georges Bank, 100–160 m.
33. *Chaetozone donerae* Blake **n. sp**. U.S. Atlantic continental shelf, off New England, 65–82 m.
34. *Chaetozone dossena* Blake & Dean, 2019. Caribbean Sea, Venezuela, 6–10 m.
35. *Chaetozone elakata* Blake & Lavesque, 2017. E. North Atlantic, offshore Bay of Biscay, 60 m.
36. *Chaetozone flagellifera* Gallardo, 1968. Bay of Nha Trang, Vietnam, 19–43 m.
37. *Chaetozone gesae* Blake, 2018. Off Chile, 436 m.
38. *Chaetozone gibber* Woodham & Chambers, 1994. North Atlantic, off SE and SE England, Mediterranean Sea; shallow subtidal.
39. **Chaetozone gracilis* (Moore, 1923). NE Pacific, off California, abyssal depths, 4016 m. See Blake (1996).
40. **Chaetozone grasslei* Blake, 2019. North equatorial Pacific Ocean, abyssal plain, 4844–4880 m.
41. **Chaetozone hartmanae* Blake, 1996. Off southern California, basins and canyons, 542–914 m.
42. *Chaetozone hedgpethi* Blake, 1996. PE Pacific, northern California, shallow subtidal; Costa Rica, 18–24 m.
43. *Chaetozone hobsonae* Blake, 2015. NE Pacific, SE Alaska to British Columbia, low water to 95 m.
44. **Chaetozone homosetosa* (Hartmann-Schröder & Rosenfeldt, 1989). Antarctic Peninsula59–868 m; Weddell Sea, 994–1988 m. *Fide* Blake (2018).
45. *Chaetozone hystricosa* Doner & Blake, 2006. W North Atlantic, New England, Massachusetts, 25–100 m.
46. **Chaetozone jubata* Chambers & Woodham, 2003. E North Atlantic, North Sea, 700–1000 m.
47. *Chaetozone larae* Elias, Rivero & Orensanz, 2017. SW Atlantic, off Argentina, 70 m.
48. **Chaetozone lophia* Blake **n. sp**. U.S. Atlantic continental slope, off the Carolinas, 580–807 m; off New England, 551–1335 m.
49. *Chaetozone lunula* Blake, 1996, NE Pacific, central California, shelf depths, 77–190 m.
50. *Chaetozone macrophthalma* Langerhans, 1880. E North Atlantic, Madeira.
51. *Chaetozone malmgreni* Blake, 2015. NE Pacific, off Oregon, 109 m.
52. *Chaetozone maotienae* Gallardo, 1968. Bay of Nha Trang, Vietnam, 11–30 m.
53. **Chaetozone michellae* Magalhaes & Bailey-Brock, 2013, Hawaii, off Oahu, 417–597 m.
54. *Chaetozone monteverdii* Grosse, Capa & Bakken, 2021. Off Norway, 280 m; North Sea, 248–328 m.
55. *Chaetozone nicoyana* Dean & Blake, 2007. NE Pacific, Costa Rica, 9–44 m.
56. **Chaetozone novagracilis* Blake **n. sp**. U.S. Atlantic continental slope, of South Carolina, 605 m.
57. **Chaetozone pacifica* McIntosh, 1885. New Zealand, North Island, off East Cape, 1280 m.
58. **Chaetozone palaea* Blake, 2006. NE Pacific, off California, slope depths, 1675–3130 m.
59. **Chaetozone paucispinosa* Blake **n. sp**. U.S. Atlantic continental slope, 1200–3000 m.
60. *Chaetozone pigmentata* Blake, 2015. Arctic, Alaska to Baffin Island and Labrador Sea, 38–245 m.
61. *Chaetozone platycera* Hutchings & Murray, 1984. Australia, New South Wales, intertidal.
62. **Chaetozone profunda* Blake **n. sp**. U.S. Atlantic continental slope, 1338–3494 m.
63. *Chaetozone pseudosetosa* Grosse, Capa & Bakken, 2021. Norway, sub-arctic; North Sea; 4–160 m.
64. *Chaetozone pugettensis* Blake, 2015. NE Pacific, Puget Sound, shallow water.
65. *Chaetozone quinta* Grosse, Capa & Bakken, 2021. Off Norway, 60–160 m.
66. **Chaetozone reticulata* Blake, 2018. Weddell Sea, Antarctica, 3111 m.
67. *Chaetozone ronaldi* Magalhães & Bailey-Brock, 2013. Hawaii, off Oahu, 408–481 m.
68. *Chaetozone ruffi* Blake, 2015. Alaskan Arctic, shallow water.
69. *Chaetozone senticosa* Blake, 1996. NE Pacific, California, 5–10 m.

70. *Chaetozone setosa* Malmgren, 1867. Norwegian Arctic, Spitsbergen; Barents Sea; White Sea, 30–407 m. See Blake (2015); Grosse *et al*. (2021).
71. **Chaetozone shackletoni* Blake, 2018. Antarctica: Drake Passage, Scotia Sea, Weddell Sea, 1622–2288 m.
72. **Chaetozone spinosa* Moore, 1903. NW Pacific, off Japan, 280 m; NE Pacific, off California, slope depths, 2623–2955 m; Peru-Chile Trench, 4100 m. See Blake (1996, 2006, 2018).
73. **Chaetozone truebloodi* Blake, 2019. North equatorial Pacific Ocean, abyssal plain, 4880 m.
74. *Chaetozone zetlandica* McIntosh, 1911. E North Atlantic, Ireland and Scotland, subtidal to 70 m. *Fide* Woodham & Chambers (1994).

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