

New species and records of Cirratulidae (Annelida, Polychaeta) from methane seep and seamount habitats in the Pacific Ocean off Costa Rica

JAMES A. BLAKE^{1,2*}, CHARLOTTE A. SEID³ & GREG W. ROUSE³

¹Aquatic Research & Consulting, 24 Hitty Tom Road, Duxbury, MA 02332 USA

²Department of Invertebrate Zoology, Museum of Comparative Zoology, Harvard University, 26 Oxford Street, Cambridge, MA 02138 USA

³Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA 92093-0202 USA

✉ cseid@ucsd.edu;  <https://orcid.org/0000-0002-5307-691X>

✉ grouse@ucsd.edu;  <https://orcid.org/0000-0001-9036-9263>

*Corresponding author: ✉ jablake9@gmail.com;  <https://orcid.org/0000-0001-8217-9769>

Abstract

Eight species of polychaetes in six genera belonging to the family Cirratulidae are reported from seamounts and methane seeps off Costa Rica in the Pacific Ocean. Seven species are new to science. The genus *Aphelocheata* includes two new species: *A. pigmentata* **sp. nov.**, and *A. rotunda* **sp. nov.** The genera *Chaetocirratulus*, *Chaetozone*, *Kirkegaardia*, and *Raricirrus* each include a single new species: *Chaetocirratulus chromatus* **sp. nov.**, *Chaetozone carinata* **sp. nov.**, *K. davidgeorgei* **sp. nov.**, and *R. hartmanae* **sp. nov.** The genus *Cirratulus* includes two species: *C. megalus* Chamberlin, 1919 originally described from deep water off Peru, and *Cirratulus jacoensis* **sp. nov.** from Jacó Summit off Costa Rica. The samples in which these taxa were found are all from deep water (>200 m) with most from bathyal depths of 1000–2184 m. *Cirratulus tumbesiensis* Carrasco, 1978 from Chile is referred to the genus *Cirriformia*.

Key words: *Aphelocheata*, *Chaetocirratulus*, *Cirratulus*, *Kirkegaardia*, *Raricirrus*, deep-sea

Introduction

A rich invertebrate fauna has been discovered associated with deep-water methane seeps on the continental margin off Costa Rica (CRM) in the eastern Pacific Ocean (Seid *et al.* 2025). A series of five surveys with the R/V *Atlantis* (2009, 2010, 2017, and 2018) with the HOV *Alvin* and the R/V *Falkor* (2019) with the ROV *SuBastian*, resulted in 63 submersible dives in depths between 300–3600 m in a wide range of seep habitats at 11 different locations. According to Seid *et al.* (2025), these surveys yielded more than 450 species of invertebrates identified to date based on DNA sequences and morphology. Of these, 131 represent previously described species, 58 are new to science, and the rest are uncertain or provisional but many likely represent additional undescribed species. Of the latter, specimens of the polychaete family Cirratulidae were collected but not treated beyond preliminary genus-level identification. The Cirratulidae are one of the most common families of polychaetes found in marine sediments and occur from the intertidal to abyssal depths (Blake & Magalhães 2019).

Samples of Cirratulidae collected from methane seeps and adjacent non-seep habitats as part of these surveys were provided to the first author for study. The collections provided by SIO include eight species of Cirratulidae in six genera, with seven species new to science. As part of the original sampling effort, samples intended for DNA extraction were obtained from selected individuals of most species. In addition, photographs were obtained of several specimens in life.

Materials and Methods

Sampling methods used aboard the HOV *Alvin* and ROV *SuBastian* included hydraulic arms, suction samplers,

scoops, and push cores. Each sample was carefully processed after collection and each specimen examined alive in cold seawater. Some live specimens were photographed, either with a handheld camera or one attached to a stereomicroscope. Tissue samples from other live specimens intended for DNA sequencing were extracted and preserved in 95% ethanol (ETOH). Most specimens were preserved in 10% formalin and later transferred to 50 or 70% ETOH for long-term preservation. Specimens were archived in the Scripps Institution of Oceanography Benthic Invertebrate Collection (SIO-BIC). Details of the field work may be found in Seid *et al.* (2025). Relevant specimens of Cirratulidae were selected and shipped to the first author for study.

After receipt from SIO-BIC, specimens from each sample 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. Measurements were taken with a calibrated micrometer on the compound microscope, or a metric ruler for large specimens. Line drawings were first sketched in pencil using a drawing tube or camera lucida on the Zeiss RA microscope and later transferred to Dura-Lar® matte film and inked. The photographs and drawings were subsequently edited in Photoshop CS3®.

Specimen collection and field operations offshore Costa Rica were performed under the following permits issued by CONAGEBIO (Comisión Nacional para la Gestión de la Biodiversidad), INCOPECA (Instituto Costarricense de Pesca y Acuicultura), and SINAC (Sistema Nacional de Áreas de Conservación) under MINAE (Ministerio de Ambiente y Energía), Government of Costa Rica: INCOPECA-CPI-003-12-2018, R-070-2018-OT-CONAGEBIO, SINAC-CUSBSE-PI-R-032-2018, SINAC-SE-CUS-PI-R-035-2017.

In accordance with the Nagoya Protocol on Access and Benefit Sharing, DNA sequencing for this project was authorized by the Contract for the Grant of Prior Informed Consent between MINAE-SINAC-ACMC and Jorge Cortés-Núñez for the Basic Research Project: “FK190106-Cuantificación de los vínculos biológicos, químicos y físicos entre las comunidades quimiosintéticas con el mar profundo circundante”.

Genetic comparisons were based on a standard fragment of the mitochondrial gene cytochrome c oxidase I (COI), using previously published sequences (Seid *et al.*, 2025), other publicly available sequences on GenBank, and newly generated sequences. DNA extraction, amplification, sequencing, phylogenetic analysis (maximum likelihood), and genetic distance calculations (uncorrected) were performed using the same methods as Hiley *et al.* (2025).

Sample curation and assignment of museum numbers and GenBank numbers was by Harim Cha and Charlotte Seid of Scripps Institution of Oceanography (SIO-BIC) and Jeffrey Sibaja-Cordero of the University of Costa Rica (MZUCR).

Abbreviations used in text: CRM, Costa Rica Margin; ETOH, ethyl alcohol; HOV, human occupied vehicle; MCZ IZ, Museum of Comparative Zoology, Department of Invertebrate Zoology, Harvard University; MZUCR, Museum of Zoology, University of Costa Rica; ROV, remotely operated vehicle; SIO-BIC, Scripps Institution of Oceanography Benthic Invertebrate Collection; WoRMS, World Register of Marine Species.

Abbreviations used on figures. aLmo, anterior lip of mouth; br, branchiae; bv, blood vessel; dCr, dorsal crest; dGr, dorsal groove; dt, dorsal tentacle(s); GenSeg, genital segment; GenSp, genital spine(s); hB, heart body; mo, mouth; mVrdg, mid-ventral ridge; neS, neurosetae; noS, notosetae; nuO, nuchal organ; per, peristomium; pig, pigment; pLmo, posterior lip of mouth; pr, prostomium; pyg, pygidium.

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. According to Read & Fauchald (2025a), the Cirratulidae currently comprises 18 genera including six formerly assigned to the family Ctenodrilidae. Six genera are included in the present study: bitentaculate genera: *Aphelochaeta*, *Chaetozone*, *Chaetocirratulus*, *Kirkegaardia*; multitentaculate genus: *Cirratulus*, and atentaculate genus: *Raricirrus*. Within these genera, eight species, seven new to science, have been discovered and are here described from the seep and seamount habitats off Costa Rica.

Genus *Aphelochaeta* Blake, 1991

Type species: *Tharyx monilaris* Hartman, 1960. Original designation by Blake (1991).

Diagnosis. (after Dean & Blake 2016). Prostomium conical to rounded; peristomium elongate with pair of grooved dorsal tentacles arising either on or anterior to setiger 1. Anterior segments often expanded, crowded or uncrowded; abdominal segments sometimes beaded or moniliform in appearance; setae simple capillaries lacking distinct serrations using light microscopy but distinct fibrils may be visible using SEM; posterior end frequently expanded, tapering to simple pygidial lobe.

Remarks. According to Read & Fauchald (2025b) there are currently 49 valid species of *Aphelochaeta*. In the present study, specimens representing two new species have been encountered from the seep sites off Costa Rica and are described here. Specimens of *Aphelochaeta* are among the more difficult of the Cirratulidae to characterize owing to their lack of acicular spines or any kind of modified setae. Capillaries are sometimes larger or more conspicuous, but species hypotheses are based primarily on pre-setiger morphology including presence or absence of a peristomial crest, location of dorsal tentacles and branchiae, the nature of anterior and posterior segments including segmental expansion, crowding, development of distinct parapodial shoulders, and presence or absence of mid-ventral grooves or ridges. The pygidial morphology is helpful if specimens are complete. Methyl Green staining patterns are typically species-specific if present. Table 1 is provided to summarize the morphology of *Aphelochaeta* species from the northeastern and Central Pacific Ocean, including the two described here.

Aphelochaeta pigmentata new species

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Figures 1–2

Aphelochaeta sp. SIO_BIC_A1380: Seid *et al.* 2025: 54, fig. 21F.

Material examined. NE Pacific Ocean off Costa Rica, Jacó Summit methane seep, R/V *Atlantis* Cruise 15-44, HOV *Alvin* Dive 4510, coll. G. Rouse & D. Huang, 04 Mar 2009, 9.1726°N, 84.7986°W, 741 m, **holotype** (SIO-BIC A1429), 2 **paratypes** (MZUCR-1534-01).

Description. An elongate species, with thickened pre-setiger region and anterior setigers (Fig. 1A–C). Two specimens available, incomplete; holotype with 36 setigers, 4.2 mm long, 0.5 mm wide across peristomium; paratype similar, with 34 setigers, 4.2 mm long, 0.60 mm wide across peristomium. First 19–20 setigers narrow, crowded, following setigers about as long as wide. Body with parapodia elevated over flattened dorsal surface (Fig. 2A); venter rounded, ventral surface with both longitudinal and transverse grooves producing three longitudinal ridges along venter of anterior segments (Fig. 2B); posterior setigers with only a low medial ridge. Color in alcohol brown, with extensive and prominent pigment pattern on holotype and paratype (Figs 1B–C, 2A–B). Darkest pigment on prostomium and anterior aspects of peristomium. Anterior half of prostomium and anterior border of peristomium darkly pigmented dorsally (Figs 1B; 2A); ventrally most of prostomium and posterior lip of mouth darkly pigmented together with another pigmented transverse ridge posterior to posterior lip of mouth (Figs 1C; 2B). Rest of body with distinct pigmented spots or possibly chromatophores on peristomium and individual segments most prominent on venter (Fig. 2B); this segmental pigment continuing variably along length of fragments.

TABLE 1. Selected Morphological Characters of 26 known *Aphelochaeta* Species from the North Pacific and Central Pacific Ocean.

Species/Character	Prostomial shape	Number peristomial rings	Dorsal peristomial crest	Position of tentacles	Position of dorsal branchiae	Crowded thoracic segments	Mid-ventral groove or ridge	Thoracic shoulders	Setae	MG Stain	Distribution	Reference
<i>A. monilaris</i> (Hartman, 1960) Type Species	Conical, pointed	3	Absent	Per	Per	No	Absent	Present	Smith	Pro & vent bands on ant sets	NE Pacific, California, shelf depths	Hartman 1960; 1961; 1963; 1969; Blake 1991; 1996
<i>A. abyssalis</i> Blake, 2019	Short, triangular, tapering to pointed tip; merged w/ per	0	Absent	Per	Set 1	All segments crowded	Absent	Weak	Smith	No pattern	N Pacific, CCZ. 4514–4861 m	Blake 2019
<i>A. antelonga</i> Dean & Blake, 2016	Short, conical, w/ narrow rounded tip	2	Absent	Per	Per	Yes	Absent	Absent	Fib	Vent of set 8–12 dark; rest no pattern	NE Pacific, Costa Rica, Gulf of Nicoya, 11–18 m	Dean & Blake 2016
<i>A. arizonae</i> Magalhães & Bailey-Brock, 2013	Pointed	3	Absent	Set. 1	Per	Yes	Absent	Present	Fib	Ant bands on thoracic segs	N Pacific Ocean, Hawaii, Oahu, intertidal	Magalhães & Bailey-Brock, 2013
<i>A. bullata</i> Doner & Blake, 2008	Triangular tapering to rounded tip	4	Present, inflated, oval	Per	Per	Yes	Absent	Present	Smith	No pattern	NE Pacific, N California slope, 2160–3775 m	Doner & Blake 2009
<i>A. clarionensis</i> Blake, 2019	Short, w/ broadly rounded tip	2	Present, oval	Per	Set 1	Yes	Ridge	Absent	Smith	Pro & per w/ pattern	N Pacific, CCZ, 4516–4518 m	Blake 2019
<i>A. clippertonensis</i> Blake, 2019	Triangular, tapering to pointed tip	3	Absent	Per	Per	No	Absent	Absent	Smith	No pattern	N Pacific, CCZ, 4506–4870 m	Blake 2019
<i>A. elongata</i> Blake, 1996.	Elongate, triangular, merged with per, w/ pointed tip	3	Absent	Set. 1	Set. 1	No	Absent	Present	Smith	Bands, mid venter	NE Pacific, California, intertidal	Blake 1996
<i>A. glandaria</i> Blake 1996	Triangular, w/ pointed tip	3	Present	Set. 1	Set. 1	Yes	Groove	Present	Fib	Light color overall; speckles ant sets	NE Pacific, California, shelf, 77–200 m; Costa Rica, 11–18 m	Blake 1996; Dean & Blake 2016
<i>A. guimondi</i> Dean & Blake, 2016	Triangular, narrow w/ rounded tip	3	Absent	Per	Set. 1	No	Absent	Present	Fib	Venter of ant 1/3 stained, rest no pattern	NE Pacific, Costa Rica, Gulf of Nicoya, 11–26 m	Dean & Blake 2016
<i>A. guttata</i> Doner & Blake, 2008	Conical, w/ rounded tip	3	Present	Per	Per	No	Absent	Present	Smith	Intense; speckles on per & inter seg	NE Pacific, N California slope, 2420–3666 m	Doner & Blake 2009
<i>A. honouliuli</i> Magalhães & Bailey-Brock, 2013	Rounded	3	Present	Per	Set. 1	Yes	Absent	Present	Fib	Pro; ant & post per; vent of ant set stain darkly	N Pacific Ocean, Hawaii, Oahu, Mamala Bay, 50–195 m	Magalhães & Bailey-Brock, 2013

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TABLE 1. (Continued)

Species/Character	Prostomial shape	Number peristomial rings	Dorsal peristomial crest	Position of dorsal tentacles	Position pair of branchiae	Crowded thoracic segments	Mid-ventral groove or ridge	Thoracic shoulders	Setae	MG Stain	Distribution	Reference
<i>A. multifilis</i> (Moore, 1909)	Conical, broadly rounded anteriorly; merged with per	2	Absent	Per	Per	Yes	Absent	Present	Smth	No pattern	NE Pacific, S California, intertidal	Moore, 1909; Blake 1996
<i>A. petersenae</i> Blake, 1996	Triangular, w/ pointed tip	2–3	Absent	Per	Per	Yes	Absent	Present	Smth	Intense; pro & per mask; ant segs w/ vent & lat bands	NE Pacific, S California, intertidal	Blake 1996
<i>A. phillipsi</i> Blake, 1996	Triangular, w/ pointed tip; merged with per	None	Absent	Set. 1	Per	No	Absent	Absent	Smth	Per bands; vent bands ant segs	NE Pacific, California, 60–98 m	Blake 1996
<i>A. pigmentata</i> Blake, Seid & Rouse sp. nov.	Short, conical, rounded tip	None	Present	Per	Per	Yes	Absent	Present	Smth	Not tested	NE Pacific, off Costa Rica, 745 m	This study
<i>A. praeacuta</i> Dean & Blake, 2016	Triangular, w/ narrow pointed tip	2	Present	Per	Set. 1	Yes	Absent	Absent	Fib	Dorsum of ant segs; rest no pattern	NE Pacific, Costa Rica, Gulf of Nicoya, 13–28 m	Dean & Blake 2016
<i>Aphelochaeta rotunda</i> Blake, Seid & Rouse sp. nov.	Spherical	2	Present	Per	Set. 1	Yes	Absent	Absent	Smth	Lat of per; ant set w/ dorsal & lat seg bands	NE Pacific, off Costa Rica, 1886 m	This study
<i>A. saipanensis</i> Magalhães & Bailey-Brock, 2013	Rounded	3–4	Absent	Set. 1	Set. 1	Yes	Absent	Present	Fib	3rd per ring & vent bands post th segs	N Pacific, Mariana Islands, Saipan, reef flats, intertidal	Magalhães & Bailey-Brock, 2013
<i>A. spargosis</i> Blake, 2019	Short, bluntly rounded on ant margin	3	Present, narrow	Per	Per	Yes	Groove	Absent	Smth	Prominent bands on pro, per, and ant segs	N Pacific, CCZ, 4480–4516	Blake 2019
<i>A. striata</i> Dean & Blake, 2016	Triangular tapering to pointed tip	2	Absent	Per	Set. 1	No	Groove	Present	Fib	Ant segs w/ vent bands across set 4–8	NE Pacific, Costa Rica, Gulf of Nicoya, 11–38 m	Dean & Blake 2016
<i>A. tanyperistomia</i> , Blake, 2019	Short, w/ palpode on tip	0	Present	Per	Set. 1	Yes	Absent	Present	Smth	No pattern	N Pacific, CCZ 4506–4877 m	Blake 2019
<i>A. tigrina</i> Blake, 1996	Triangular, tapering to pointed tip	3	Present	Per	Per	Yes	Absent	Present	Fib	Prominent seg bands along most of body	NE Pacific, Central California, 90–160 m	Blake 1996
<i>A. williamsae</i> Blake, 1996	Short, triangular, tapering to narrow tip	2–3	Absent	Per	Per	Yes	Absent	Present	Smth	Vent of ant segs	NE Pacific, Central California, 90–150 m	Blake 1996
<i>A. wilsoni</i> Blake, 2019	Short, conical, rounded on ant margin	0	Absent	Per	Per	No	Absent	Present	Smth	Ant segs only	N Pacific, CCZ 4500–4860 m	Blake 2019
<i>A. zebra</i> Dean & Blake, 2016	Short, w/ rounded tip	3	Absent	Set. 1	Set. 1	Yes	Absent	Present	Smth	Vent interseg lines post segs stain darkly	NE Pacific, Costa Rica, Gulf of Nicoya, coral reef	Dean & Blake 2016

Abbreviations: ant, anterior; CCZ, Clarion Clipperton Zone; fib, fibrillated; interseg, intersegmental; MG, Methyl Green; lat, lateral; mid, middle; mser, microserrations; per, peristomium; pro, prostomium; seg(s), segments; set(s), setiger(s); smth, smooth; th, thoracic; vent, ventral; w/, with. Note: setal fibrils best observed with at least 400X.

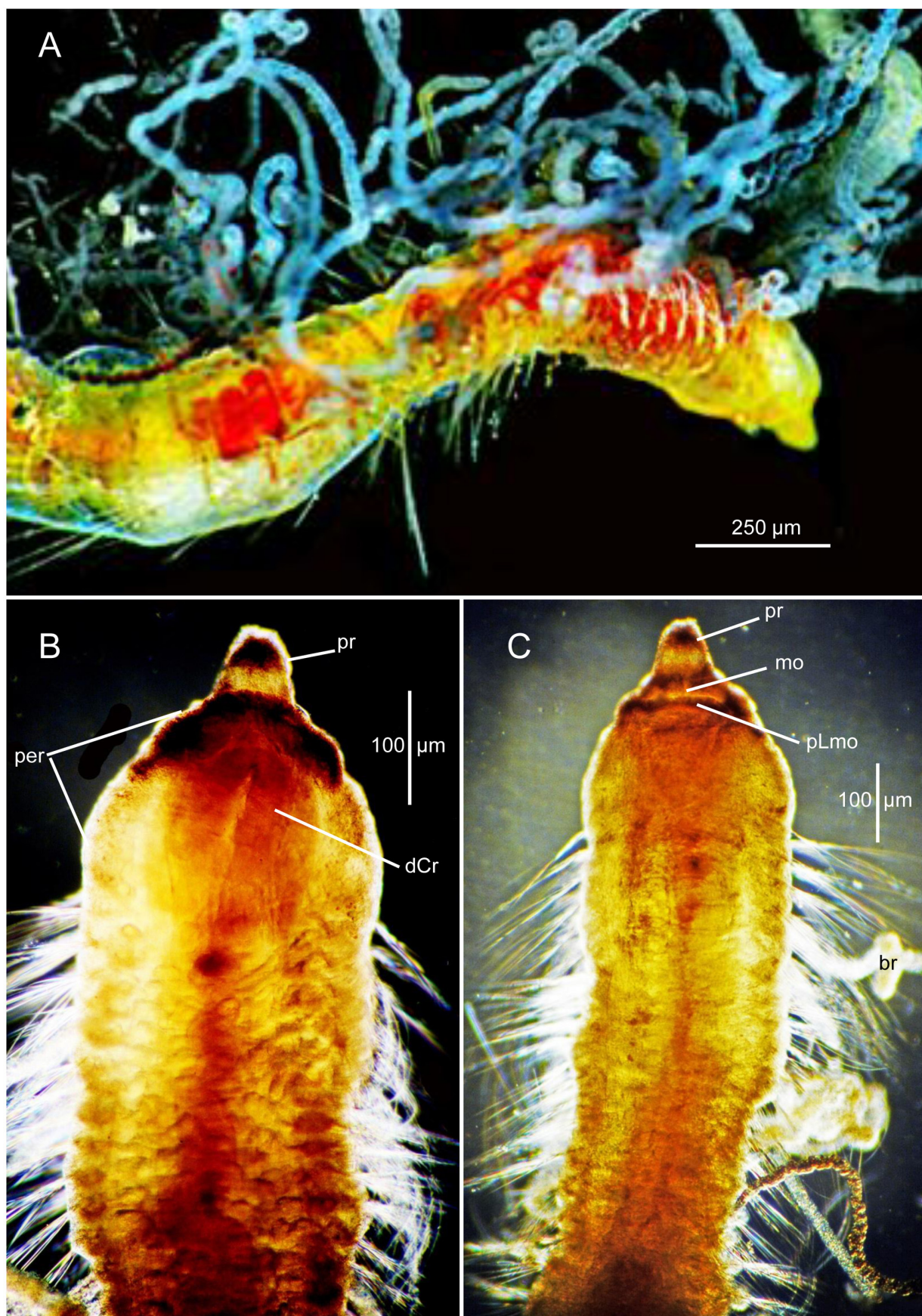


FIGURE 1. *Aphelochaeta pigmentata* sp. nov. Holotype (SIO-BIC A1429); A, anterior end, right lateral view; B, anterior end, ventral view. Paratype (MZUCR-1534-01): C, anterior end, ventral view. A, photograph in life by GWR, rest by JAB.

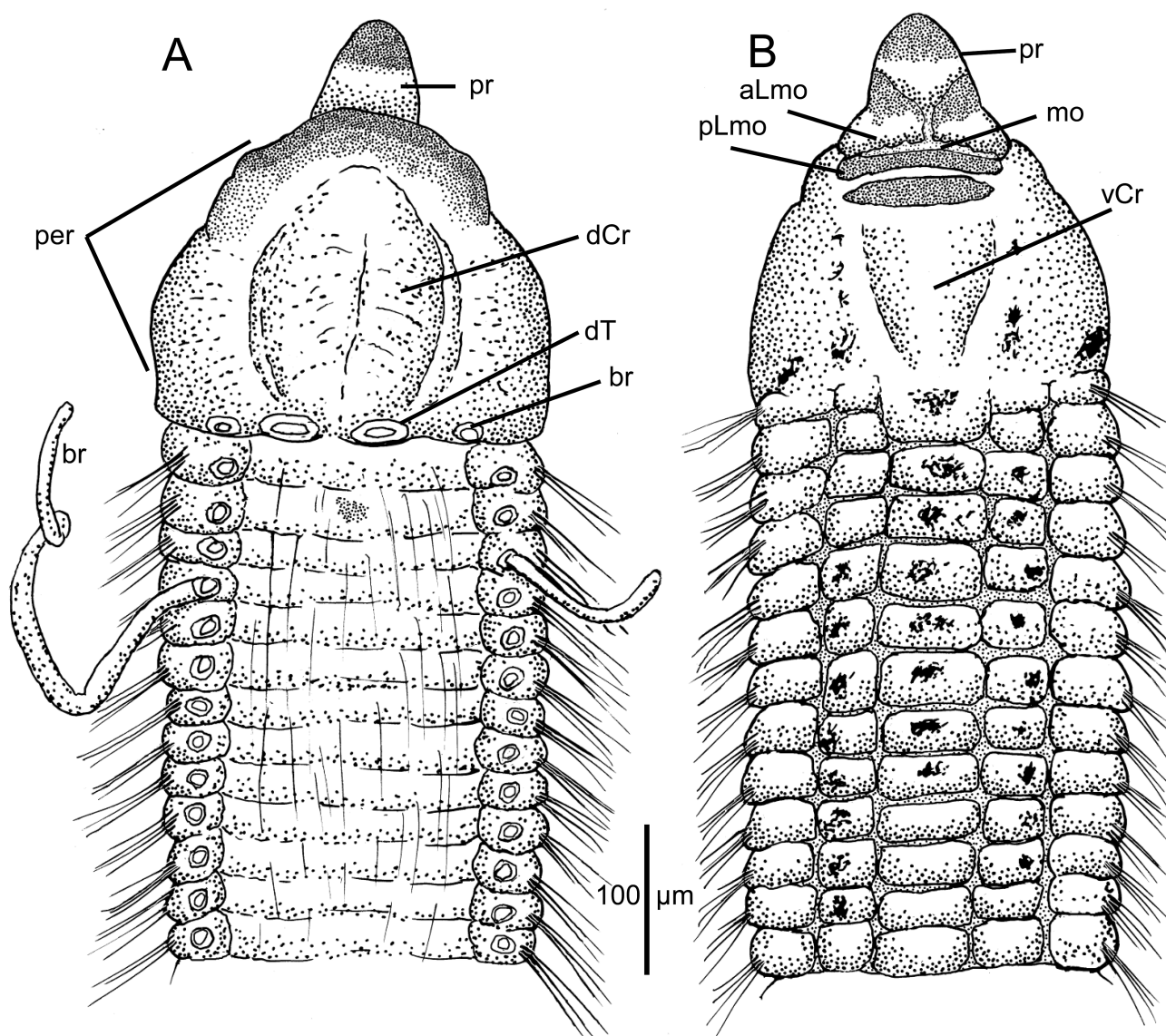


FIGURE 2. *Aphelochaeta pigmentata* sp. nov. Holotype (SIO-BIC A1429): A, anterior end, dorsal view. Paratype (MZUCR-1534-01): B, anterior end, ventral view.

Prostomium short, conical with rounded tip in dorsal and ventral view (Figs 1A–C; 2A–B); eyespots absent; nuchal organs not observed; ventrally with a broad base forming crenulated anterior lip of mouth (Fig. 2B). Peristomium large, with broad dorsal surface bearing an oval dorsal crest (Fig. 2A); anterior border a thick, darkly pigmented ridge; ventrally with a triangular-shaped ventral crest extending from oral ridges to anterior border of setiger 1 (Figs 1C; 2B). Mouth a narrow transverse slit between crenulated prostomial anterior lip and peristomial posterior lip with smooth border (Figs 1C; 2B). Pharynx not observed. Paired dorsal tentacles medial on posterior border of peristomium, posterior to dorsal crest (Fig. 2A). First pair of branchiae also on peristomium, lateral to dorsal tentacles (Fig. 2A); subsequent branchiae dorsal to notosetae on all segments. Most branchiae missing or reduced to stubs or scars.

Parapodia of anterior setigers enlarged dorsally forming elevated shoulders over relatively smooth dorsal surface (Fig. 2A). Noto- and neurosetae all capillaries; notosetae of anterior setigers with up to 15 long thin capillaries per fascicle; posteriorly long capillaries reduced to 6–7 per fascicle, but additionally with 5–6 short, very thin capillaries in a separate bundle. Neurosetae with 8–9 long capillaries in anterior setigers and 4–6 in posterior setigers; short thin capillaries not present. All capillaries smooth as observed with light microscope at 1000 x.

Pygidium not observed.

Remarks. *Aphelochaeta pigmentata* **sp. nov.** differs from all known cirratulids in the nature of the dark pigment patterns on the prostomium and peristomium and additional pigment along the body, mainly on the venter. In addition, the peristomium of *A. pigmentata* **sp. nov.** is entire and not divided into distinct rings. Note that these pigments are not evident in the photo taken from life (Fig. 1A). The pigments likely represent different colors in life, not evident in the image.

The only other species of *Aphelochaeta* in the North Pacific Ocean to have a peristomium not divided into separate rings and with a dorsal peristomial crest is *A. tanyperistomia* Blake, 2019 from abyssal depths of the Clarion Clipperton Zone. That species, however, has a long narrow peristomium instead of a broadly expanded one and an expanded thoracic region instead of having the body of a consistent width throughout.

GenBank Accession Numbers: Holotype (SIO-BIC A1429): PZ288275.

Etymology. The epithet is from the Latin *pigmentum* for color, in reference to the distinctive pigment pattern found on the pre-setiger region and other areas of the body of this species.

Distribution. Pacific Ocean off Costa Rica, Jacó Summit 745 m.

Aphelochaeta rotunda new species

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Figures 3–4

Material examined. NE Pacific Ocean off Costa Rica, Jacó Scar methane seep, R/V *Atlantis* Cruise 37-13, HOV *Alvin* Dive 4914, coll. C. Roman & A. Durkin, 29 May 2017, 9.1149°N, 84.8397°W, 1886 m, **holotype** (MZUCR-1535-01).

Description. An elongate, mostly slender species, of a moderate size; holotype only specimen, incomplete with 43 setigers, broken into two parts with handling, 10.6 mm long, 0.5 mm wide across anterior and posterior setigers. First 18 setigers narrow, crowded, remaining setigers about as long as wide. Body with flattened dorsum and rounded venter with weakly developed mid-ventral ridge. Color in alcohol, light tan; with distinct pigment spots on posterior half of peristomium (Fig. 3B).

Prostomium large, with distinctly spherical shape, smoothly rounded on anterior and lateral margins (Figs 3A–B; 4A–B); nuchal organs not observed; eyespots absent. Peristomium elongate, about as long as first five setigers; with two rings; first ring narrow, dorsally with five rounded lobes encompassing prostomium (Fig. 3A); second ring large with oval-shaped dorsal crest, merging with setiger 1 (Fig. 3A); ventrally first peristomial ring forming posterior lip of mouth, this lip with a finely lobed anterior margin followed by 3–4 transverse lobes that likely expand when proboscis everted (Fig. 3B). Mouth starts on anterior margin of peristomium, preceding posterior lip as a channel or vestibule. Second peristomial ring on venter swollen forming a ventral crest; proboscis not observed. Dorsal tentacles arise on posterior margin of peristomium (Figs 3A; 4B). First pair of branchiae on setiger 1, posterior to dorsal tentacles and dorsal to notosetae (Figs 3A; 4B). Most branchiae missing or reduced to stubs or scars; all located posterior and slightly dorsal to notosetae.

Parapodia reduced to low mounds from which setae arise; anterior parapodia not producing shoulders. Setae all capillaries, long and short; long, natatory-like notosetae absent. Anterior notosetae numbering 9–10 per fascicle, reduced to 6–7 in middle setigers, and 3–5 in posterior setigers, neurosetae similar in number and distribution as notosetae, but shorter in anterior setigers.

Pygidium not observed.

Remarks. *Aphelochaeta rotunda* **sp. nov.** differs from other species in the nature of the distinctive spherical shaped prostomium. Other species typically have elongated or triangular shaped prostomia that usually taper to a narrow anterior tip. In addition, the anterior dorsal border of the first peristomial ring has five lobes that encompass the posterior border of the prostomium. The oral morphology is also unusual in that the posterior lip of the mouth has a crenulated anterior edge followed by a sac-like area with transverse rows of lobes that likely expand when the proboscis is everted. No DNA sequencing was possible as the specimen was initially fixed in formalin.

Methyl Green staining. MG stain produces a distinctive pattern (Fig. 4A) on anterior and mid-body setigers with broad ventral bands leaving the intersegmental furrows unstained; the bands continue up and on to the dorsal lateral surface (Fig. 4B–C). Stain is also retained irregularly on the lateral surfaces of the peristomium (Fig. 4B–C). Posterior setigers do not retain stain.

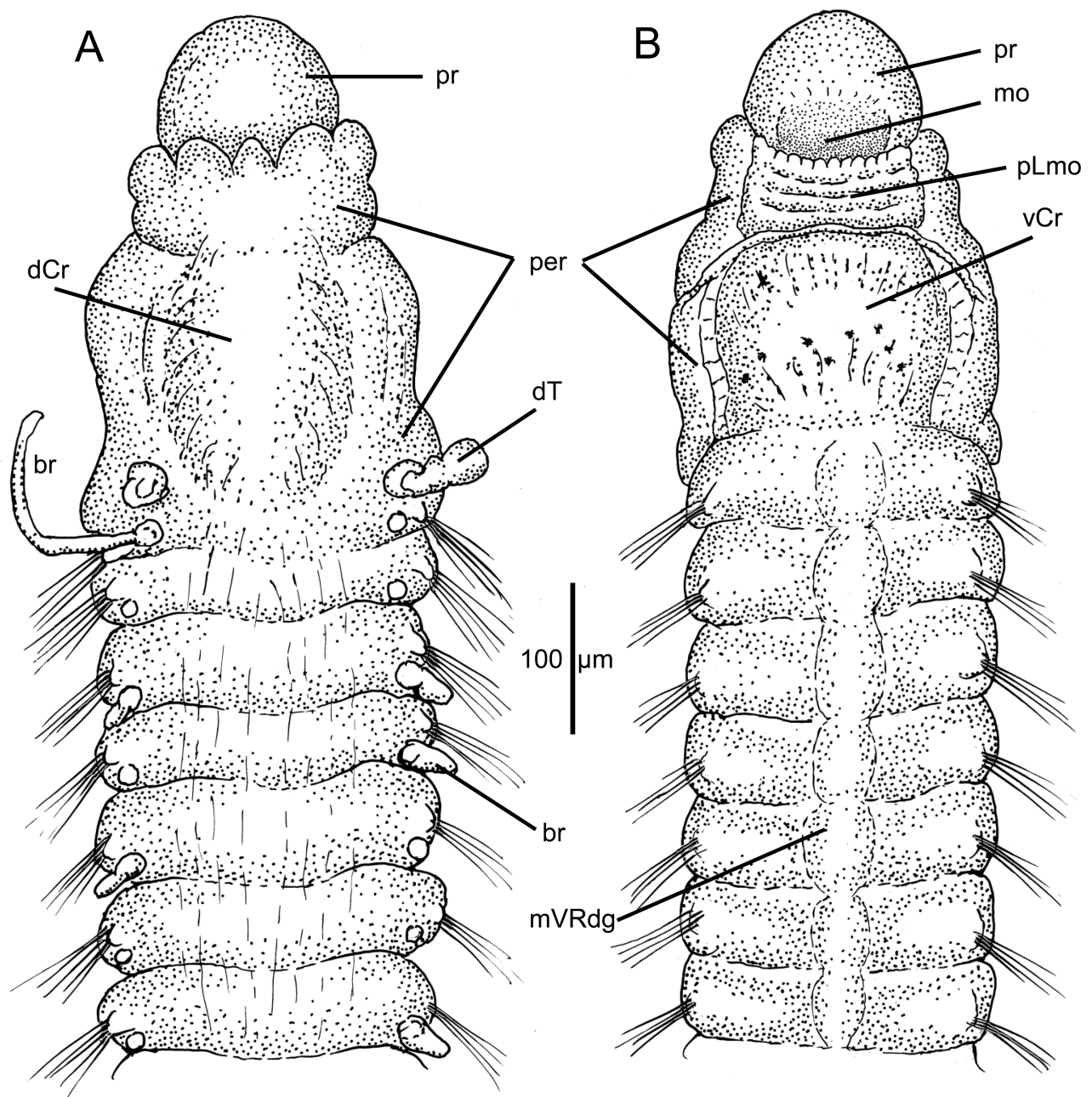


FIGURE 3. *Aphelochaeta rotunda* sp. nov. Holotype (MZUCR-1535-01): A, anterior end, dorsal view; B, same, ventral view.

Etymology. The epithet is from *rotundus*, Latin for circular or spherical, in reference to the distinctive spherical shape to the prostomium of this species.

Distribution. Pacific Ocean off Costa Rica, Jacó Scar, 1886 m.

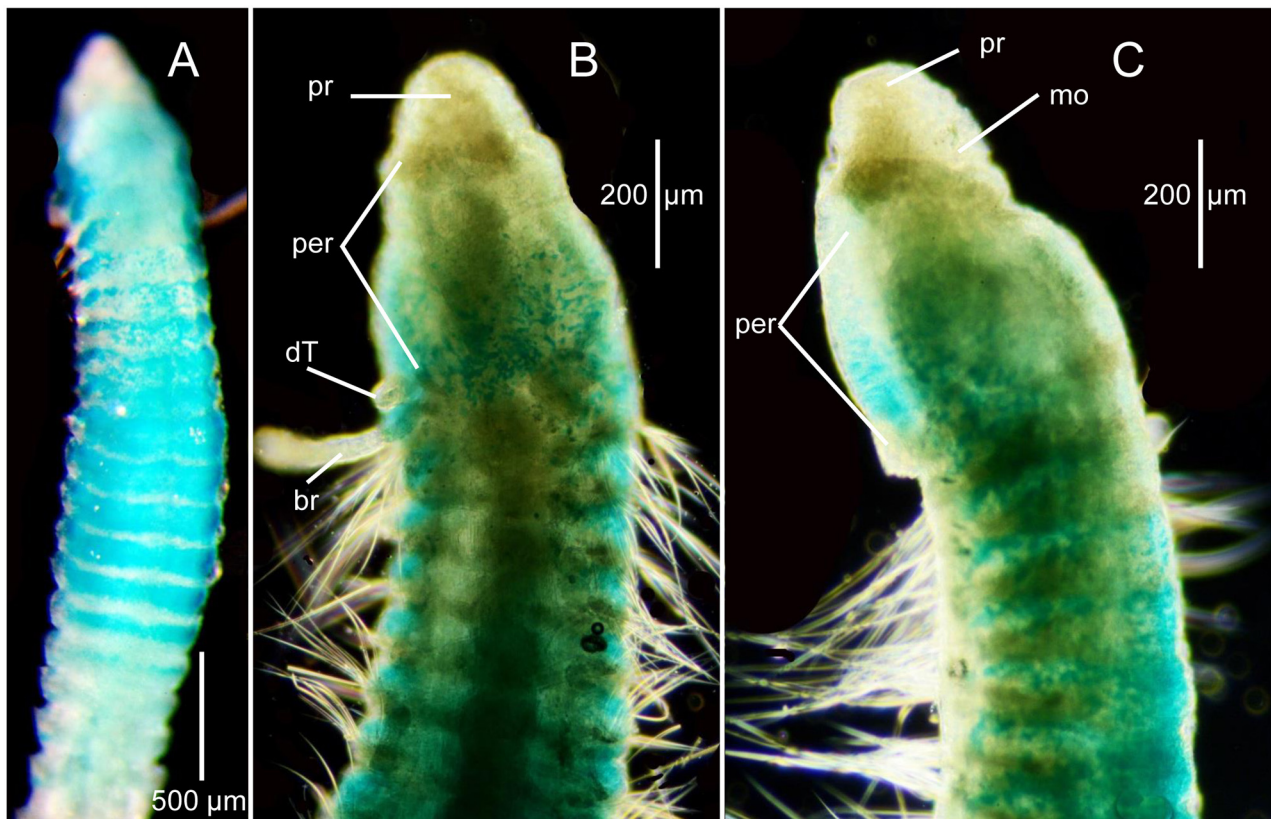


FIGURE 4. *Aphelochaeta rotunda* sp. nov. Holotype (MZUCR-1535-01): A, anterior 16 setigers, ventral view; B, same, dorsal view of pre-setiger region and seven anterior setigers; C, same, ventrolateral view. Stained with Methyl Green.

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. Expanded anterior or middle segments present or absent. 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 asetigerous 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. The genus *Chaetocirratulus* was established by Blake (2018) to accommodate several bitentaculate cirratulid species that had been previously referred to the genus *Chaetozone* Malmgren, 1867, but had fewer acicular spines that were not arranged into the characteristic cinctures of *Chaetozone*. These bitentaculate species were also noted to be similar to species of the multitentaculate genus *Cirratulus*. In fact, Petersen (1991) had earlier recognized a similarity of these specimens to species of *Cirratulus* and redefined the genus to have two or more dorsal tentacles. Another characteristic of several *Chaetocirratulus* species, including the one reported in this paper, is that the anterior middle segments are sometimes swollen, producing a scalibregmatid-like shape to the specimens.

Twelve species of *Chaetocirratulus* are currently known (Read & Fauchald 2025c). A new species has been discovered from the seamount and seep habitats off Costa Rica and represents the first species of the genus to be reported from the North Pacific Ocean.

***Chaetocirratulus chromatus* new species**

urn:lsid:zoobank.org:act:62767A34-66E0-460A-B563-76EE331EF780

Figures 5–6

Material examined. NE Pacific Ocean off Costa Rica, Jacó Scar methane seep, R/V *Atlantis* Cruise 42-03, HOV *Alvin* Dive 4976, coll. D. Bewley & S. Goffredi, 22 Oct 2018, 9.115°N, 84.840°W, 1885 m, **holotype** (MZUCR-1536-01).

Description. A moderately sized species, holotype mostly complete, with 49 setigers, 14.9 mm long, 1.24 mm wide across swollen anterior setigers, and 0.15 wide across narrow posterior setigers. Body narrow at first, then with expanded section from setigers 8–21, followed by long narrow abdominal region (Fig. 5A); far posterior damaged, pygidium missing. Parapodia located laterally along body, with well-developed intersegmental grooves through about setiger 25, then grooves not well defined. Dorsal surface of anterior setigers, especially on expanded segments, rounded and elevated above parapodia forming a kind of segmented ridge (Fig. 6A). Venter with weakly developed segmental grooves; mid-ventral groove present from setiger 15 to posterior end. Color in alcohol with base color distinctly brown, with black pigment granules scattered over dorsal and ventral surfaces (Figs 5A–B; 6A–B).

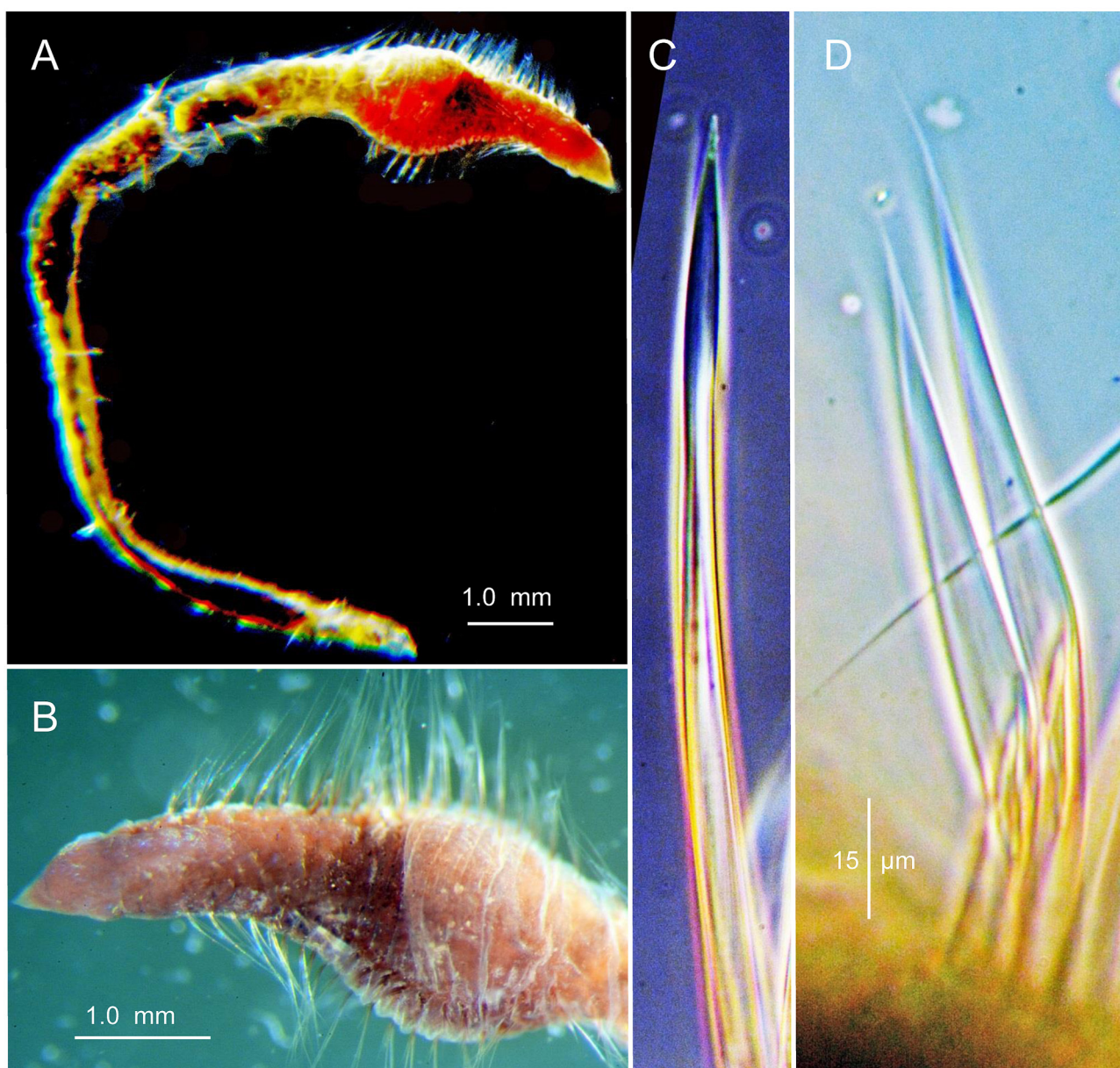


FIGURE 5. *Chaetocirratulus chromatus* **sp. nov.** Holotype (MZUCR-1536-01): A, entire worm, right lateral view; B, anterior end, left lateral view; C, acicular spine from posterior neuropodium; D, two neuropodial acicular spines with bent shafts. A, stained with Shirlastain A.

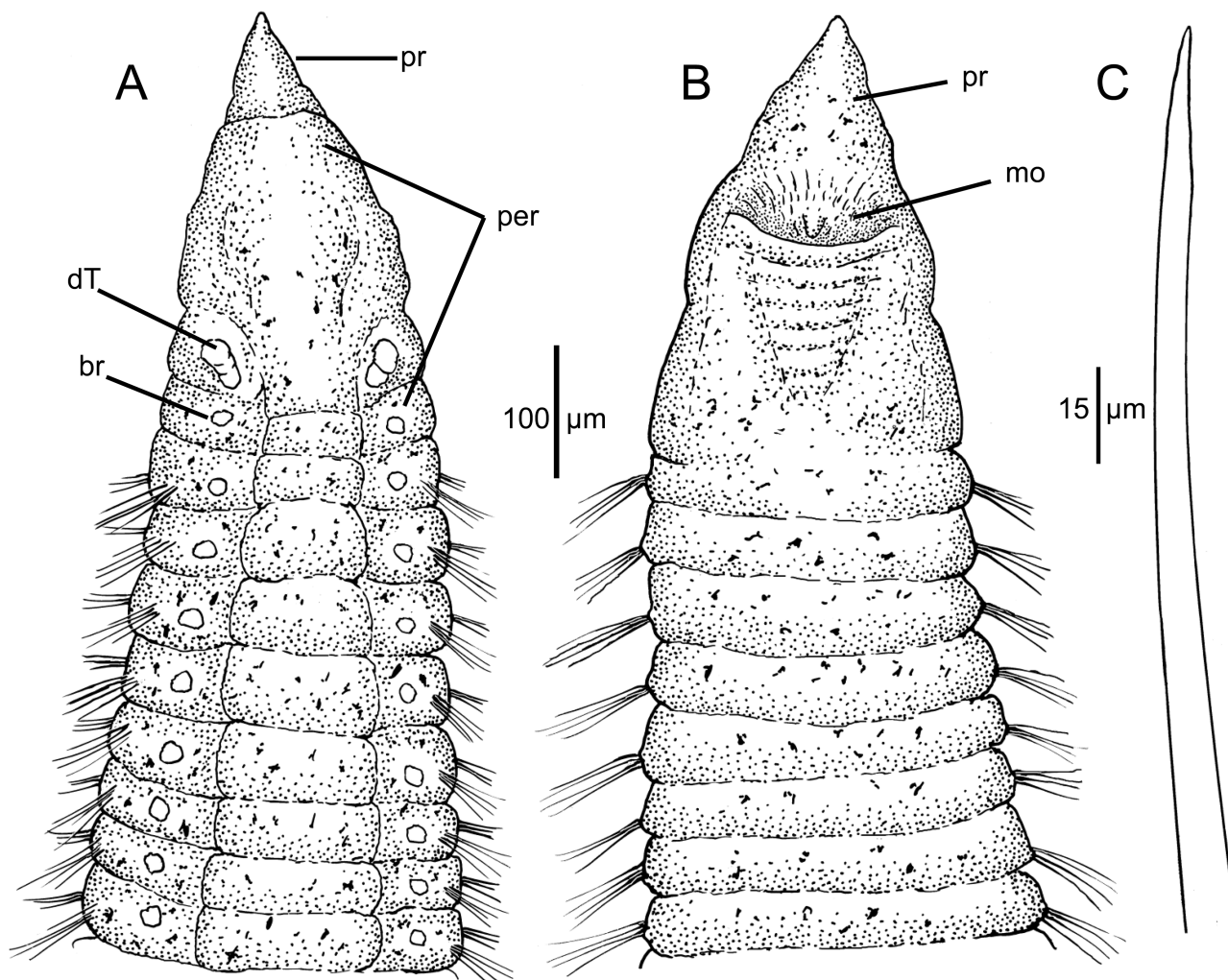


FIGURE 6. *Chaetocirratulus chromatus* sp. nov. Holotype (MZUCR-1536-01): A, anterior end, dorsal view; B, anterior end, ventral view; C, acicular spine from posterior neuropodium.

Pre-setiger region long, about as long as first six setigers (Figs 5A–B; 6A–B). Prostomium triangular, tapering to narrow tip (Figs 5A–B; 6A–B); eyespots absent; nuchal organs not observed. Peristomium with three rings, visible dorsally (Fig. 6A), but ventrally entire with no separate rings evident (Fig. 6B). Dorsally, first peristomial ring longest, extending from prostomium to second ring that bears a dorsal tentacle on either side; third ring, dorsally resembles following setigerous segments and bears first pair of branchiae (Fig. 6A). Both dorsal tentacles reduced to short stubs; all branchiae missing, reduced to scars and stubs. Ventrally peristomium merges with prostomium forming anterior border of mouth, as a smooth vestibule (Fig. 6B); posterior border of mouth a smooth rim (Fig. 6B); posterior to mouth a series of ridges continues near to border with setiger 1 (Fig. 6B). Proboscis not visible.

Parapodia of anterior segments bearing short, narrow noto- and neuropodia from which setae arise. Podia less inconspicuous in middle and posterior segments. Setae include long smooth capillaries and acicular spines. Capillaries numbering 9–11 per noto- and neuropodia in anterior setigers, reduced to 6–7 in middle segments, and 2–3 in posterior setigers. Acicular spines first occurring in neuropodia of setiger 18; numbering 1–3, usually two per neuropodium, accompanied by 3–4 capillaries, reduced to 2–3 capillaries in far posterior setigers; spines not present in notopodia. Acicular spines each with straight shafts tapering to narrow, blunt, or pointed tips (Figs 5C; 6C); in some angles spines appearing to have broad blades (Fig. 5D).

Pygidium not observed.

Methyl Green staining. Body stains uniformly with no pattern; de-stains rapidly.

Remarks. Out of 13 known species, *Chaetocirratulus chromatus* sp. nov. is the only member of the genus with acicular spines limited to the neuropodia. In addition, although most species have enlarged sausage-shaped

bodies, *C. chromatus* **sp. nov.** is the only one recorded to date having a distinctly swollen anterior section that is preceded by narrower segments and followed by a long narrow posterior section. The dorsal tentacles of previously described species of *Chaetocirratulus* arise either from setiger 1, a preceding peristomial ring, or from the interface between the peristomium and setiger 1. In *C. chromatus* **sp. nov.** the dorsal tentacles arise from the second of three peristomial rings, anterior to setiger 1. The first branchiae arise from the last peristomial ring, anterior to setiger 1, the only species in the genus with this character. As noted in the description, the third peristomial ring dorsally resembles setiger 1 and might be considered an achaetous segment rather than a peristomial ring.

Chaetocirratulus chromatus **sp. nov.** is the first member of this genus to be reported from the northeastern Pacific Ocean; other species are from the southeastern Pacific off Peru and Chile, southwestern Pacific Ocean off Eastern Australia, Southern Ocean, and North Atlantic Ocean. All known species are from deep-water habitats (Blake 2018, 2022, 2023). No DNA sequencing was possible as the specimen was initially fixed in formalin.

Etymology. The epithet is from the Greek *chroma*, for color of the skin, in reference to the brownish base color of the integument of this species.

Distribution. Pacific Ocean off Costa Rica, Jacó Scar, 1885 m.

Genus *Chaetozone* Malmgren, 1867

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

Diagnosis. (Emended from Blake, 2018). Prostomium blunt to conical, elongate to short, usually lacking eyespots, with a pair of small nuchal slits or depressions at posterior edge. Peristomium with a single pair of grooved dorsal tentacles arising from posterior edge of peristomium, or sometimes more posterior on an asetigerous anterior segment, or rarely on an anterior setiger. First pair of branchiae arising from peristomium, 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, rarely with middle or posterior body segments beaded or moniliform; posterior end often expanded. Setae include capillaries on most setigers and sigmoid acicular spines in neuropodia and notopodia, with spines typically concentrated in posterior segments forming distinct cinctures with spines carried on 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. *Chaetozone* is the largest of the cirratulid genera with 85 species, 24 (28%) of which occur in the northeastern Pacific Ocean. One new species has been encountered off Costa Rica at the Mound 12 seep site.

Chaetozone carinata new species

urn:lsid:zoobank.org:act:E3D95197-644C-4382-8936-0343532BC46D

Figures 7–9

Chaetozone sp. SIO_BIC_A9846: Seid *et al.* 2025: 54, fig. 21H.

Material examined. NE Pacific Ocean off Costa Rica, Mound 12 methane seep, R/V *Atlantis* Cruise 42-03, HOV *Alvin* Dive 4987, coll. E. Cordes & E. Cowell, 02 Feb 2018, 8.9309°N, 84.3133°W, 999 m, **holotype** (MZUCR-1537-01).

Description. A moderate sized species, holotype (SIO-BIC A9846) incomplete after removal of posterior segments for DNA; specimen with slightly expanded anterior body section best seen in dorsal or ventral view; with 42 setigers, 5.1 mm long, 0.38 mm wide across setiger 8, 0.61 mm wide across expanded segments (Fig. 8A–B); estimated size of complete specimen based on photograph from life (Fig. 7), 16.1 mm long with approximately 100 setigers, Holotype elongate, narrow along most of body, but with crowded and narrow anterior setigers of which setigers 15–25 slightly expanded; following middle and posterior setigers from about setiger 30 narrow, more elongate, not crowded. Body with parapodia of anterior setigers elevated over flattened dorsal surface (Fig.

9A); individual parapodia forming distinct shoulders along body (Fig 9A). Venter rounded with a low medial ridge developing by about setigers 5–6, continuing posteriorly. Posterior end slightly flattened, bearing cinctures of acicular spines; pygidium inconspicuous rounded lobe. Color in alcohol, light tan with no separate pigmentation; in life red heart body evident from about setiger 35 to about setiger 48.

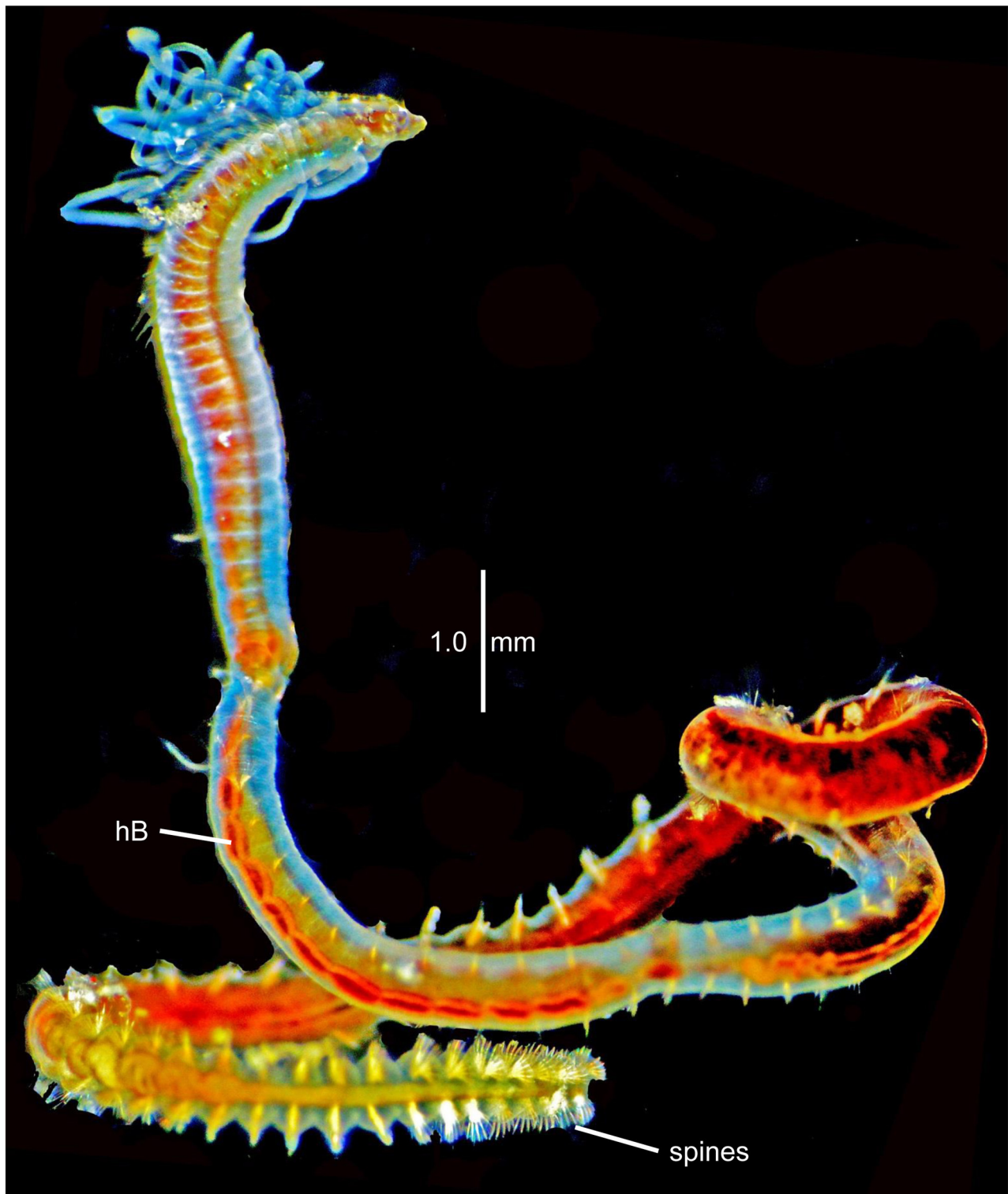


FIGURE 7. *Chaetozone carinata* **sp. nov.** Entire image of holotype (MZUCR-1537-01) in life before preservation and removal of posterior half for DNA. Photograph in life by Nerida Wilson.

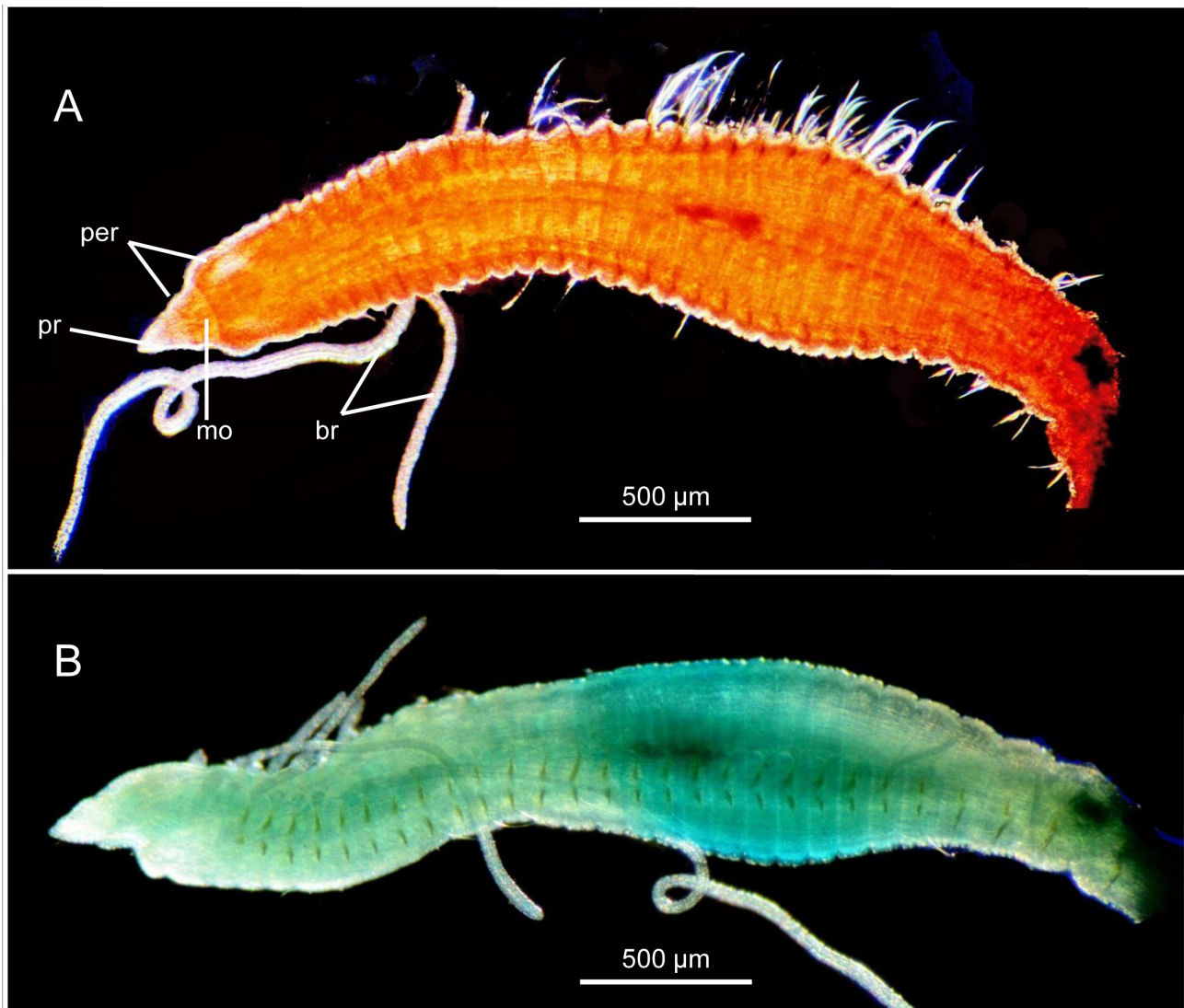


FIGURE 8. *Chaetozone carinata* **sp. nov.** Holotype (MZUCR-1537-01: A, anterior and middle body segments, ventral view; B, same, left lateral view. A, stained with Shirlastain A; B, stained with Methyl Green.

Pre-setiger region elongate, about as long first seven setigers (Figs 8A–B; 9A–B). Prostomium short, triangular, narrowing to pointed tip (Figs 8A–B; 9A–B); dorsally merging indistinctly with peristomium (Fig. 9A); ventrally distinctly separated from peristomium anterior to mouth (Fig. 9B); eyespots absent; nuchal organs not observed. Peristomium with two rings evident dorsally (Fig. 9A), not obvious ventrally; a large elongate fusiform dorsal crest overlays both peristomial rings, extending from prostomium to anterior border of setiger 1 (Fig. 9A); second ring bears paired dorsal tentacles and first pair of branchiae positioned posterior to tentacles (Fig. 9A); subsequent branchiae dorsal to notosetae on all segments (Fig. 9A). Ventrally, mouth extending from near prostomium as a vestibule, bordered posteriorly by a simple posterior lip (Fig. 9B); pharynx not observed.

Parapodia of anterior setigers enlarged dorsally forming elevated shoulders over relatively smooth dorsal surface (Fig. 9A). Ventral surface with a single longitudinal ridge from about setigers 8–9 along entire body. Noto- and neurosetae of anterior setigers all capillaries; anterior setigers with about 6–8 long thin capillary notosetae per fascicle; long capillaries reduced posteriorly to 5–6 per fascicle. Neurosetae with 6–8 long capillaries in anterior setigers and 3–4 in posterior setigers; short thin capillaries not present. All capillaries smooth as observed with light microscope at 1000 x. Acicular spines from at least last 13–14 setigers based on photograph from life; spines arranged in cinctures over last 8 setigers; cinctures with a mid-dorsal gap between notopodial spines; neuropodial spines not observed. Details of spines not observed but images suggest pointed tips.

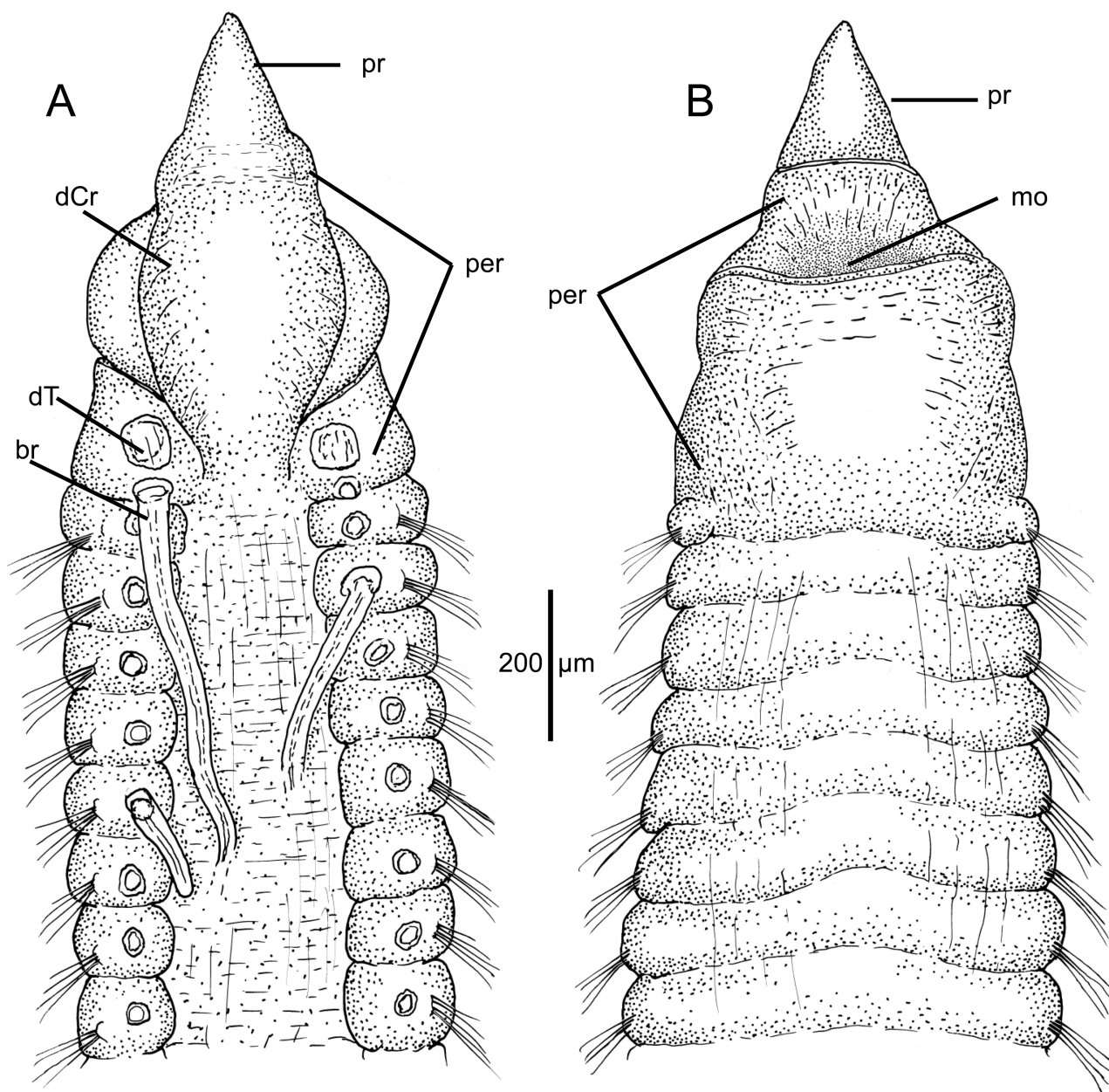


FIGURE 9. *Chaetozone carinata* sp. nov. Holotype (MZUCR-1537-01): A, anterior end, dorsal view; B, same, ventral view.

Methyl Green staining. Methyl Green concentrates on the venter of the expanded anterior segments and extends laterally up the sides of each segment ending just below the parapodial shoulders (Fig. 8B).

Remarks. *Chaetozone carinata* sp. nov. is a distinctive species in having an elongate peristomial dorsal crest that is fusiform in shape, merging with the prostomium and extending posteriorly to the anterior border of setiger 1 while overlying two peristomial rings. *Chaetozone lophia* Blake, 2022 from off the U.S. Atlantic coast in upper and middle slope depths is similar in appearance, but while the peristomium is divided into two rings, the dorsal crest is limited to the prostomium and first ring. In addition, the pygidium of *C. carinata* sp. nov. is a simple lobe, whereas the pygidium of *C. lophia* is a broad disk. Unfortunately, the posterior segments of the holotype of *C. carinata* sp. nov. were entirely removed for DNA and while the photograph shows the posterior end and spines, a detailed account of the posterior spines and cinctures will require the collection of additional specimens.

Etymology. The epithet is from the Latin, *carina*, for keel or crest, in reference to the distinctive elongate peristomial crest found on this species.

GenBank Accession Numbers: Holotype (MZUCR-1537-01): PQ449331.

Distribution. Pacific Ocean off Costa Rica, Mound 12, 999 m.

Genus *Kirkegaardia* Blake, 2016

Type species: *Monticellina heterochaeta* Laubier, 1961. Designated by Blake (2016).

Homonym: *Monticellina* Laubier, 1961. Preoccupied by *Monticellina* Westblad, 1953.

Diagnosis (after Blake 2016): Bitentaculate cirratulids with distinct body regions and all setae distally pointed. Pre-setiger region typically elongate, cylindrical, with short, blunt prostomium and long peristomium with none to many weakly developed annulations or peristomium short and thick; dorsal tentacles arising on posterior margin of peristomium, anterior to setiger 1. Thoracic notopodia often shifted dorsally, elevated, producing distinct dorsal groove along thoracic region; other species with thoracic parapodia more lateral, leaving broad elevated dorsum; parapodia of middle and posterior region lateral. Middle body segments longer than wide, frequently beadlike; posterior segments wider than long, somewhat crowded, with posteriormost segments usually expanded or enlarged. Setae include simple capillaries with fibrils observed under SEM and denticulated capillaries with distinct denticles or serrations present along one edge of seta; blades usually basally expanded. Pygidium with simple ventral lobe.

Remarks. The world register of Marine Species (WoRMS) currently lists 53 valid species of *Kirkegaardia* (Read & Fauchald 2025d). Of these, 15 have the characteristic serrated or denticulate setae limited to the neuropodia. A new species has been identified from Seamount 6 off Costa Rica.

Kirkegaardia davidgeorgei new species

urn:lsid:zoobank.org:act:916C108B-E0A4-458D-A922-C2795DCA20E4

Figures 10–11

Material examined. NE Pacific Ocean off Costa Rica, Seamount 6 (non-seep), R/V *Falkor* Cruise FK190106, ROV *SuBastian* Dive S0227, coll. G. Rouse, 22 Jan 2019, 7.681°N, 85.912°W, 500–700 m, **holotype** (SIO-BIC A10177); 1 **paratype** (MZUCR-1540-01).

Description. Holotype complete with ca 245 setigers, 22 mm long, 0.95 mm wide across anterior setigers and 0.57 mm across posterior setigers. An elongate, narrow-bodied species with wide anterior segments, then narrowing posteriorly (Fig. 10A, B); anterior setigers narrow, crowded (Fig. 11A, B), middle segments becoming longer, but still crowded; posterior setigers larger, not tightly crowded with a few weakly moniliform, then tapering; far posterior segments enlarged forming distinct posterior tail region with dorsal furrow, terminating with bulbous pygidial lobe (Fig. 10B, D). Color in alcohol: light tan; black pigment spots on ventral surface of peristomium (Figs 10C; 11B), a few extending on to ventrolateral surface; anterior dorsal margin of setiger 1 with a line of dark pigment. Heart body darkly pigmented, conspicuous, first apparent from anterior abdominal setigers, about setiger 35 (Fig. 10A–B); darkly pigmented paired blood vessels also apparent ventrally within setigers 1–5 (Fig. 10C).

Pre-setiger region relatively short, as wide as long (Figs 10C; 11A–B). Prostomium short, triangular, tapering to bluntly rounded tip (Fig. 11A–B); eyespots absent; nuchal organs not observed. Peristomium with two distinct rings apparent in dorsal view, these interrupted by large oval-shaped dorsal crest extending from prostomium to anterior border of setiger 1 (Fig. 11A). Ventrally, peristomial rings indistinct, none extending across venter; one multilobed ring forming lateral and posterior lip of large mouth opening between prostomium and mouth (Fig. 11B). Pigment spots on posterior peristomial border distinctive (Figs 10C; 11B).

Anterior setigers, narrow, crowded, with parapodia forming distinct lateral shoulders separated from raised rounded dorsal surface (Fig. 11A); dorsal tentacles arising from setiger 1 on elevated dorsum, these with large rounded base (Fig. 11A), actual tentacles missing on holotype. First pair of branchiae lateral to dorsal tentacles on setiger 1; second pair of branchiae and following on posterior medial border of each setiger, on lateral borders of raised medial sections of individual segments. Most branchiae missing or broken off with handling; however, where present, branchiae long, thin, concentrated on narrow anterior setigers, but present along most of body (Fig. 11A).

Parapodia low tori or mounds from which setae project; notosetae typically longer than neurosetae; long natatory notosetae present only in posterior setigers. Notosetae numbering 9–12 per fascicle in anterior setigers, reduced to 7–8 in abdominal segments. Neurosetae numbering 10–12 per fascicle in anterior setigers, reduced to 6–7 in middle and posterior abdominal segments. Capillary noto- and neurosetae of anterior setigers long, narrow, with no visible serrations or denticles along smooth margin; similar notosetae continuing to posterior end with some, however, becoming long, natatory-like. Neurosetae from setigers 85–90 transitioning to shorter and broader capillaries with

distinct denticles along cutting edge (Fig. 11C); these numbering 9–10 per fascicle at first, then reduced to 6–7 denticulated capillaries in posterior setigers. With care, denticles visible at 400x but details not apparent until 1000x magnification.

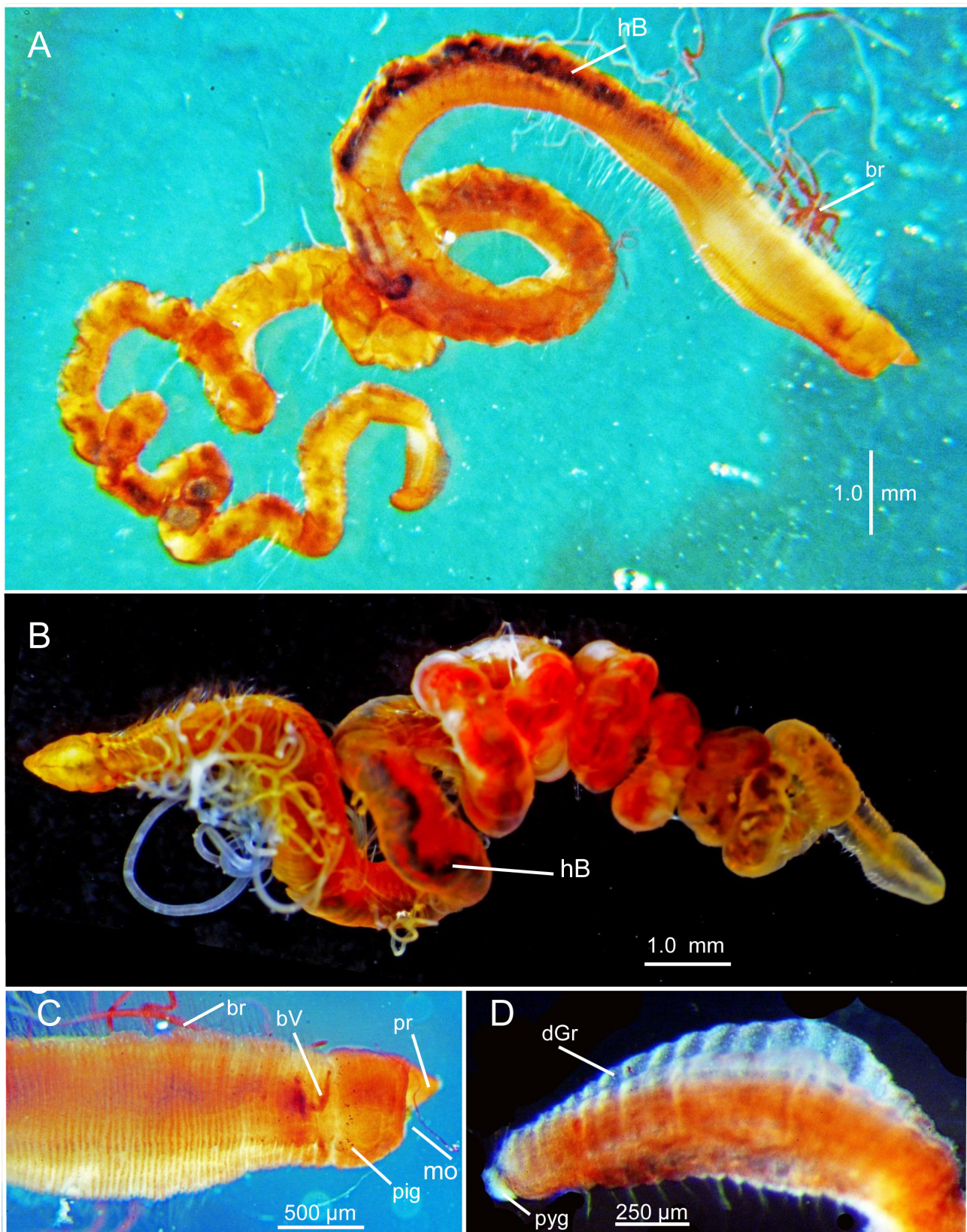


FIGURE 10. *Kirkegaardia davidgeorgei* sp. nov. Holotype (SIO-BIC A10177): A, entire worm, right lateral view; B, entire worm, in life, coiled, prostomium dorsal; C, anterior end, right ventrolateral view; D, posterior end, right lateral view. A, C–D stained with Shirlastain A. (B, in life, by GWR; rest original by JAB).

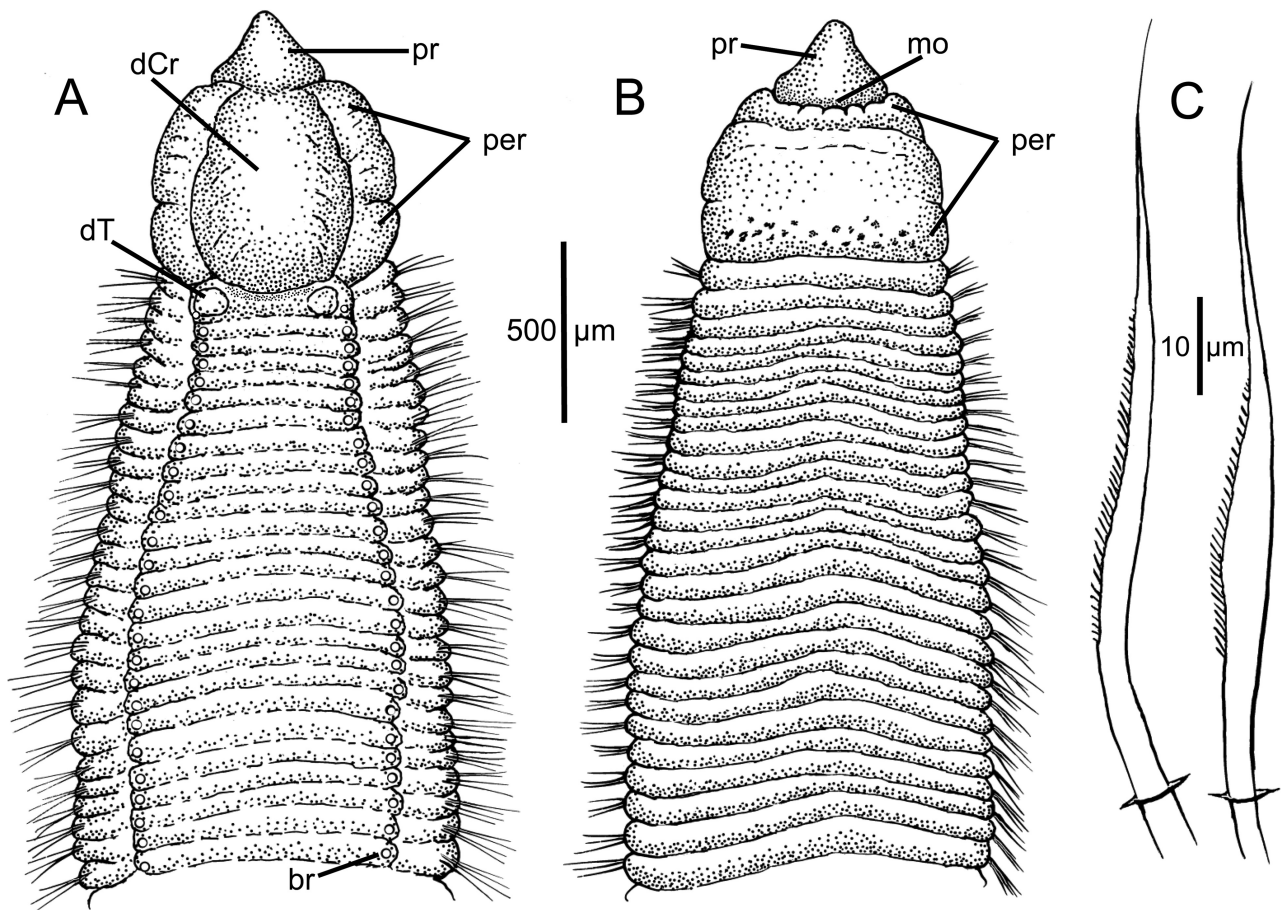


FIGURE 11. *Kirkegaardia davidgeorgei* **sp. nov.** Holotype (SIO-BIC A10177): A, anterior end, dorsal view; B, same, ventral view; C, serrated neurosetae from posterior setigers.

Methyl Green staining. Body staining uniformly with no distinct pattern. Venter of anterior region retains stain longest.

Remarks. The new species, *K. davidgeorgei* **sp. nov.** belongs to a group of species identified by Blake (2016) as belonging to the “*Kirkegaardia baptisteae-tesselata* group”. Species in this group do not have the parapodia elevated over the dorsum as in many species and thus do not produce a mid-dorsal channel along the body. The dorsum is generally smooth, although a dorsal ridge is developed on some species. In addition, the pre-setiger region is not long and narrow as in many species of the genus, but about as long as wide. In addition, most species have serrated or denticulate neurosetae, but not notosetae. At present approximately 22 species belong to this group as described or reported by Blake (2016) and Freitas *et al.* (2022).

Kirkegaardia davidgeorgei **sp. nov.** is most similar to, *K. carrikeri* (Dean & Blake, 2009) also from off Costa Rica. Both species have a short, triangular-shaped prostomium, a multi-ringed peristomium, a dorsal peristomial crest, serrated setae limited to the neuropodia, and posterior segments expanded with a terminal pygidial lobe. However, the holotype of *K. davidgeorgei* **sp. nov.** is considerably larger (245 setigers, 22 mm long) than any of the original 26 specimens of *K. carrikeri* (up to 119 setigers, ca. 10 mm long). There are two peristomial rings apparent dorsally in *K. davidgeorgei* **sp. nov.** and three in *K. carrikeri*; the venter of the peristomium was not reported for *K. carrikeri*. Both species have a large dorsal peristomial crest; this is oval shaped in *K. davidgeorgei* **sp. nov.** and rectangular in *K. carrikeri*. The dorsal tentacles of *K. carrikeri* originate on the posterior margin of the peristomium according to Dean & Blake (2009: Figs 3B, 4A–B), whereas the dorsal tentacles clearly begin on setiger 1 in *K. davidgeorgei* **sp. nov.** Serrated setae begin in neuropodia from setiger 31–33 in *K. carrikeri* and about setigers 85–90 in *K. davidgeorgei* **sp. nov.** The far posterior region is expanded with a mid-dorsal groove or fold in *K. davidgeorgei* **sp. nov.**; these setigers are also expanded in *K. carrikeri*, but there is no indication of a dorsal groove. In addition to these morphological differences, while both species occur offshore Costa Rica, *K. carrikeri* occurs in

shallow sediments (11–24 m) in the Gulf of Nicoya consisting of sand or muddy sand whereas *K. davidgeorgei* **sp. nov.** occurs in deep water (500–700 m) on a seamount for which no sediment or collection details were provided.

The COI sequence generated for the holotype is most similar to a series of GenBank sequences (83–87%) identified as Cirratulidae only. There are two COI sequences on GenBank identified as *Kirkegaardia* but these (KT307704 and KY775641) are more than 20% divergent.

GenBank Accession Number. (MZUCR-1540-01): GenBank PZ288277.

Etymology. This species is named for the late Dr. J. David George, Natural History Museum, London, a long-time friend of the first author, in recognition of his contributions to cirratulid biology and systematics.

Distribution. Pacific Ocean off Costa Rica, Seamount 6, 500–700 m.

Genus *Cirratulus* Lamarck, 1818

Type species: *Lumbricus cirratus* Müller, 1776.

Diagnosis. (after Blake & Magalhães 2019): Prostomium wedge-shaped, elongate or blunt, often with transverse rows of eyespots; peristomium with two or more annulations. Two or more grooved dorsal tentacles present, arising from a single anterior segment (setiger 1). Branchiae first present from same setiger as dorsal tentacles, occurring singly, and continuing over most of body to posterior end. Parapodial rami well separated. Setae including capillaries and acicular spines. Pygidium with one or more lobes surrounding anus.

Remarks. A total of 43 valid species of *Cirratulus* are currently recognized (Read & Fauchald (2025e). Of these, nine occur in the eastern Pacific Ocean (Table 2). Of these, only *C. megalus* Chamberlin, 1919 from off Peru and *C. sinicolens* Chamberlin, 1919 from the Gulf of California are reported from deep water. The present samples include two different species. The first is identified as *C. megalus* Chamberlin, 1919, and is represented by six specimens that were compared with a syntype archived with the MCZ IZ. The second, *Cirratulus jacoensis* **sp. nov.**, is an entirely different species, represented by two large specimens. All species of *Cirratulus* from the Eastern Pacific Ocean are summarized in Table 2.

Another species, *Cirratulus tumbesiensis* Carrasco, 1978 from shallow subtidal sediments in Chile, is here referred to the genus *Cirriformia* Hartman, 1936 because the dorsal cirri are clustered on setiger 3 instead of the peristomium or setiger 1 (see Table 2 footnote).

Cirratulus jacoensis new species

urn:lsid:zoobank.org:act:E7D48F41-ED67-450B-A22D-1C369DC43C06

Figures 12–13

Cirratulus stet.: Seid *et al.* 2025: 55–56, fig. 22A.

Material examined. NE Pacific Ocean off Costa Rica, Jacó Summit methane seep, R/V *Falkor* Cruise FK190106, ROV *SuBastian* Dive S0213, coll. G. Rouse, 06 Jan 2019, 9.17403°N, 84.7999°W, 742 m, **holotype** (SIO-BIC A10051). R/V *Atlantis* Cruise 15-44, HOV *Alvin* Dive 4510, coll. K. Verhein & V. Orphan, 04 Mar 2009, 9.172610°N, 84.7986°W, 741–745 m, 1 **paratype** (MZUCR-1538-01).

Description. A large species, holotype (SIO-BIC A10051) incomplete with posterior section cut for DNA, but with 20 segments and pygidium intact as separate piece, overall with 165 setigers 3.0 cm long and 2.5 mm wide across anterior setigers, likely with another 50 setigers before excision for DNA analysis. Paratype (MZUCR-1538-01) larger, in two parts with section between removed for DNA; anterior section 6.0 cm long and 8.0 mm wide with 105 setigers and posterior section 8.3 cm long with 110 setigers or 14.3 cm long with both parts combined with 215 setigers plus unknown size of number of setigers in removed section. Body elongate, similarly thickened and wide along entire fragment tapering in far posterior segments. Parapodia reduced to low oval mounds from which setae arise; individual segments narrow, crowded along entire body (Figs 12A; 13A–C); intersegmental grooves complete with each segment an entire ring encircling body. Dorsum elevated, rounded, smooth along entire body (Fig. 13A–B); venter flattened, with broad mid-ventral groove along entire body with mid-ventral ridge (Fig. 13C). Color in alcohol tan; both specimens with minute black speckles on venter of third peristomial ring (Fig. 13C) and scattered over first 15 setigers.

TABLE 2. Morphological Characters of Nine Species of *Cirratulus* from the Eastern Pacific Ocean¹.

Species/Character	Prostomial shape	Prostomial eyespots	Number peristomial rings	Position & number of dorsal tentacles	Mid-ventral groove or ridge	Notopodial acicular spines	Neuropodial acicular spines	Distribution	References
<i>C. cingulatus</i> Johnson, 1901	Curved ant, as long as wide	5–6 in 2 transverse rows	5–6	Set 1, 11–12/side	Absent	NoSp from set 25, 1–3, ea straight	NoSp from set 12, 1–3, curved	British Columbia & WA, intertidal	Johnson 1901; Blake 1996 (synonymy)
<i>C. dillonensis</i> Blake, 1996	Rounded ant, longer than wide	5–6 in 2 rows; reddish	2	Set 1 & 2 15–16/side	Absent	NoSp from set 12–13, ea straight	NoSp from set 7–8, curved	Central California, intertidal in rocks	Blake 1996
<i>C. jacoensis</i> sp. nov.	Truncate, wider than long	Absent	3	Set 1; 8/side	Groove	NoSp from set 53–54, straight, blunt tips; w/ caps	NoSp from set 21, all straight, blunt tips; w/ caps	Off Costa Rica; Jacó Summit, 742–745 m	This study
<i>C. megalus</i> Chamberlin, 1919	Rounded ant, as wide as long	Absent	4; venter with surficial papillated V shape	Set 1, ca 15/side	Ridge present	NoSp from ca 70, brass colored, straight w/ blunt tips	NoSp from ca set 35; all spines, brass-colored, straight with narrow blunt tips	SE Pacific, off Peru, 980 m; NE Pacific off Costa Rica, 1186–1796 m	Chamberlin 1919; This study
<i>C. multioculatus</i> (Hartman, 1961)	Triangular, wider than long	2 transverse rows of red eyespots	2	Set 1, 2–3 /side	Absent	NoSp from set 15–17, brass colored, straight	NoSp from 10–13; spines, brass-colored, sigmoidally curved	Central California, in rocks, 40–168 m	Hartman 1961, 1969; Blake 1996
<i>C. revillagigadoensis</i> Rioja, 1960	Triangular, wider than long, rounded on ant margin	35–50 along entire anterior margin	5 dorsally complete; ventrally forming post lip of mouth	Set 1, 25–30 in dense mass mid-dorsally	Present	NoSp (1–2) from set 45–50, longer and less curved than NeSp	NoSp (2–3) from set 30–35, sigmoid and long	Off Western Mexico, Revillagigedo Archipelago, intertidal	Rioja 1960
<i>C. robustus</i> Johnson, 1901	Short, curved ant 2x as long as wide	2 transverse rows of 5–6 red eyespots	3, 1 st 2 large, 3 rd narrow ant to set 1	Set 1, 4–5 in group, widely spaced	Venter concave w/ mid-ventral groove	NoSp from set 29–30, brass-colored, straight	NoSp from set 15–16; spines brass-colored, curved	Central California to Puget Sound, intertidal to ca 60 m	Johnson 1901; Blake 1996 (synonymy)
<i>C. sinicolens</i> Chamberlin, 1919	Rounded ant; ca as wide as long	Absent	4	Set 1, 3–4 in group	Venter flat; groove not reported	Absent, all caps	NoSp from set 17–18, brass-colored, straight	Gulf of California, 1570–1670 m	Chamberlin 1919; Fauchald 1972
<i>C. spectabilis</i> (Kinberg, 1866)	Triangular, wider than long w/ bluntly rounded ant margin	2–3 black eyespots	2, overlain with dorsal crest	Set 1, 2 lat groups ea w/ 5–6 tentacles	Venter flattened w/ narrow groove	NoSp from set 12–13, straight	NoSp from set 7–10, curved & thicker than noSp	Central California to British Columbia, intertidal w/ rocks	Kinberg, 1866; Blake 1996 (synonymy)

¹ *Cirratulus tumbesiensis* Carrasco, 1978 from shallow subtidal sediments in Chile, is here referred to the genus *Cirriformia* Hartman, 1936 because the dorsal cirri are clustered on setiger 3 instead of setiger 1.

Abbreviations: ant, anterior; ca, about; cap(s), capillaries; ea, each; lat, lateral; m, meters; neSp, neuropodial spines; noSp, notopodial spines; set, setiger; w/, with.

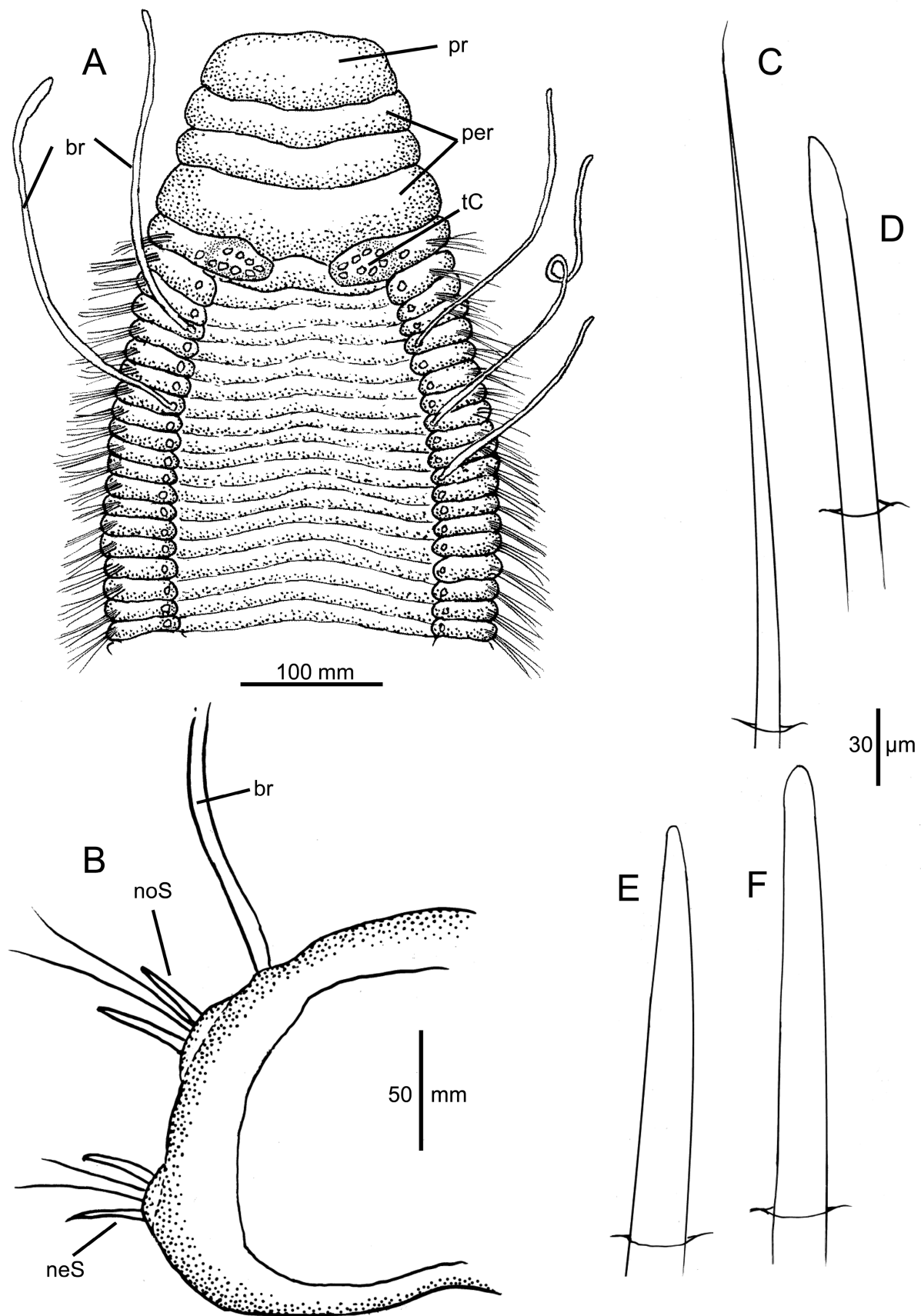


FIGURE 12. *Cirratulus jacoensis* sp. nov. Holotype (SIO-BIC A10051): A, anterior end, dorsal view; B, mid-body parapodium in posterior view; C–D, notopodial capillary and acicular spine from mid-body setiger; E–F, neuropodial acicular spines from mid-body setigers.

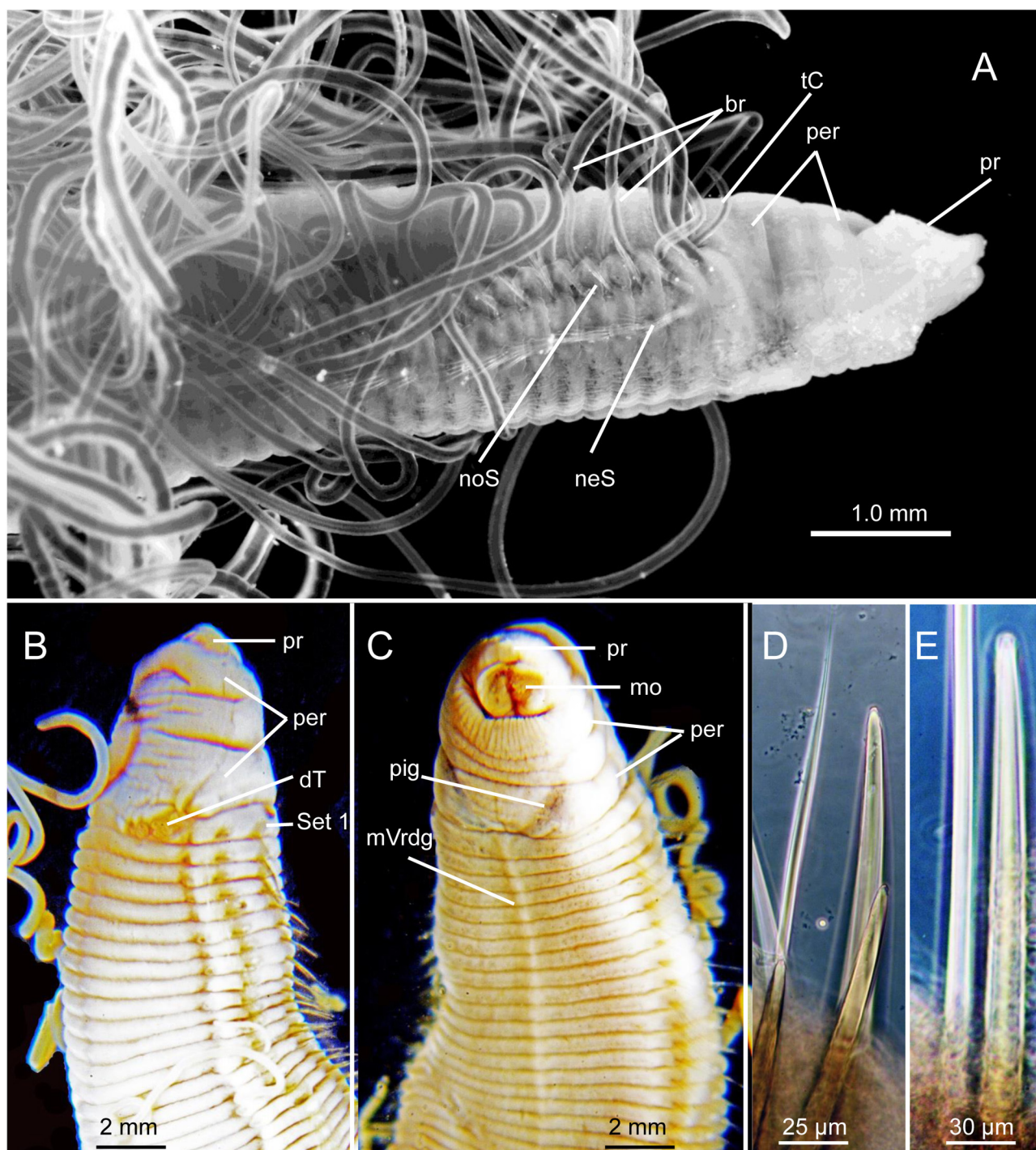


FIGURE 13. *Cirratulus jacoensis* sp. nov. Holotype (SIO-BIC A10051): A, anterior end, right lateral view. Paratype (MZUCR-1538-01): B, anterior end, dorsal lateral view; C, anterior end, ventral view; D, neuropodial acicular spines and capillaries from mid-body setiger; E, Notopodial capillary shaft and acicular spine from mid-body setiger.

Pre-setiger region as long as first 11–12 setigers (Figs 12A; 13A–C). Prostomium short, wider than long, weakly triangular along anterior margin (Figs 12A; 13A–C), but curved ventrally on holotype; dorsally separated from peristomium by distinct groove (Figs 12A; 13B); ventrally forming anterior lip of mouth (Fig. 13C); eyespots absent; nuchal organs not observed. Peristomium broad, formed by three distinct rings with third ring largest; complete dorsally (Figs 12A; 13A); ventrally with third ring distinctly larger than first two (Figs 13C); peristomial rings each with transverse grooves dorsally and ventrally on large paratype (Fig. 13B–C); dorsal crest absent on both specimens; peristomium ventrally surrounding oral morphology (Fig. 13C); details of oral morphology obscured

on holotype by short everted proboscis, but clearly visible on paratype with mouth opening between two lateral lips (Fig. 13C). Proboscis partially everted on holotype, with smooth rounded ring or lips.

Setiger 1 modified, bearing paired clusters of 8–10 dorsal tentacles (Figs 12A; 13B); first branchiae lateral to tentacles (Fig. 12A; 13A); dorsal tentacles mostly missing, limited to short stubs or scars. Branchiae numerous, long, narrow, from setiger 1 (Fig. 13A), arising dorsal to notopodium (Fig 12B), continuing posteriorly; each branchia smooth, filamentous along entire length, missing branchiae represented by scars or stubs.

Setae include capillaries and acicular spines. Notopodia with all capillaries to about setigers 52–53 (Fig. 12C), then a single acicular spine appears (Fig. 12D), following notopodia with two spines and 1–2 long capillaries (Fig. 12B); neuropodia with all capillaries on setigers 1–20 on holotype and setigers 1–30 on paratype; capillaries shorter than those of notopodia; following setigers with two spines and two medial capillaries (Fig. 12B). Acicular spines long, brass-colored with narrow rounded tips (Figs 12D–F; 13D–E); capillaries thin, with serrations not evident in light microscopy.

Pygidium a rounded lobe with terminal anus; anal cirri absent.

Remarks. Deep-water species of *Cirratulus* are rare; most species are from intertidal or shallow continental shelf depths. *Cirratulus jacoensis* **sp. nov.** from bathyal depths off Costa Rica is the third deep-water species to be reported from the Pacific Ocean. The first, *C. megalus*, was originally described from off Peru and herein reported from off Costa Rica (see below); the second, *C. sinincolens*, is known only from the Gulf of California in bathyal depths (Chamberlin 1919; Fauchald 1972). All species of *Cirratulus* from the eastern Pacific are compared in Table 2.

Cirratulus jacoensis **sp. nov.** is distinctive in having a truncated prostomium, three peristomial rings, numerous narrow and tightly spaced segments along the entire body, blunt-tipped acicular spines in both noto- and neuropodia typically occurring in pairs, and minute ventral pigment spots on the posterior ring of the peristomium and anterior setigers. The two COI sequences here are nearly identical. They were only 2.4–2.6% from the sequences generated here for *Cirratulus megalus* (below), which was found at deeper depths but geographically proximate and also from seeps.

GenBank Accession Numbers: Holotype (SIO-BIC A10051): GenBank PQ449254; paratype (MZUCR-1537-01): PQ449280.

Etymology. The epithet is based on the type locality of the specimens on the summit of the Jacó subducted seamount off Costa Rica.

Distribution. NE Pacific Ocean off Costa Rica, Jacó Summit, 741–745 m.

Cirratulus megalus Chamberlin, 1919

Figure 14

Cirratulus megalus Chamberlin, 1919: 375–377, pl. 70, figs. 1–4; Hartman 1959: 404; Díaz-Díaz & Salazar-Vallejo, 2009: 143; 2021: 198. ?Tasso *et al.* 2018: 39. **Not** Chevez-Lopez Y & Cruz-Gomez C. 2019: 59.
Aphelocheata sp. SIO_BIC_A1380: Seid *et al.* 2025: 54, fig. 21E.
Cirratulus stet.: Seid *et al.* 2025: 55–56.

Material examined. (9 specimens) **SE Pacific Ocean, off Peru**, R/V *Albatross*, coll. US Fish Commission, Alexander Agassiz, 8-ft beam trawl with mud bag, 12 Nov 1904, 5.7833°S, 81.40°W, 980 m, **Syntype** (MCZ IZ ANNc-2376).—**NE Pacific Ocean off Costa Rica, Parrita Seep, R/V Atlantis Cruise 15-44**, HOV *Alvin* Dive 4506, coll. B. Thomas & D. Huang, 27 Feb 2009, 8.9601°N, 84.6360°W, 1186 m (1, SIO-BIC A1380).—**Jacó Scar methane seep, R/V Atlantis Cruise 37-13**, HOV *Alvin* Dive 4912, coll. V. Orphan & K. Dawson, 27 May 2017, 9.11633°N, 84.8372°W, 1811 m (2, SIO-BIC A8303; 1, MZUCR-1539-01). **Jacó Scar methane seep, R/V Atlantis Cruise 42-03**, HOV *Alvin* Dive 4971, coll. E. Cordes & R. Rutstein, 17 Oct 2018, 9.11743°N, 84.83962°W, 1796 m (1, SIO-BIC A9649); HOV *Alvin* Dive 4973, coll. V. Orphan & N. Gallo, 19 Oct 2018, 9.11785°N, 84.83953°W, 1784 m (1, SIO-BIC A9677); HOV *Alvin* Dive 4989, coll. L. Levin & D. Casagrande, 04 Nov 2018, 9.118°N, 84.840°W, 1768–1785 m (1, SIO-BIC A9907); 9.11778°N, 84.83945°W, 1783 m (1, SIO-BIC A9962).

Description. A large species, all specimens from off Costa Rica with some parts removed for DNA analysis. Syntype (MCZ IZ ANNc-2376) from off Peru, exceptionally large, complete, 19 cm long, 7 mm wide across mid-body, with ca 290 setigers. Largest Costa Rican specimen (SIO-BIC A9962) 6.1 cm long, 3.6 mm wide across

mid-body, now with 129 setigers. Another large specimen (SIO-BIC A9677) now incomplete, 6.8 cm long, 3.8 mm wide with 121 setigers. Complete specimen (SIO-BIC 9649) 5.9 cm long, 2.0 mm wide across mid-body segments. Smaller specimen (SIO-BIC A9907), posterior end removed, 38 mm long, 2 mm wide across mid-body, with 52 setigers. Smallest specimen (SIO-BIC A1380) with posterior end removed, 28 mm long, 2.8 mm wide with 44 setigers.

Body elongate, thickened, slightly wider across anterior setigers (Fig. 14A–C), narrowing in far posterior setigers. Parapodia swollen mounds located laterally along body; individual segments separated by distinct intersegmental grooves. Dorsum elevated above parapodia, rounded, relatively smooth along entire body; venter flattened with distinct mid-ventral ridge along entire body (Fig. 14B, C, I); anterior setigers with ridge recessed into groove, posterior setigers with ridge elevated above dorsum, not recessed into groove. Color in alcohol tan with distinct areas of dark pigment; best developed on specimen SIO-BIC A9977 (Fig. 14C). Pigment forming prominent segmental bands on venter, with mid-ventral groove/ridge unpigmented; additional pigment on anterior lateral surfaces of individual segments, on anterior and posterior faces of parapodia, pigment variable, not prominent, limited to anterior 1/3 of body.

Pre-setiger region as long as first 8–10 setigers (Fig. 14A–C). Prostomium broadly rounded on anterior margin, dorsally extending posteriorly as crest merging with peristomium (Fig. 14A); ventrally forming anterior lip or border of mouth (Fig. 14B–C); eyes absent; nuchal organs not observed. Peristomium elongate, with four distinct rings; dorsally, first ring merged with posterior prostomial crest and with separate peristomial crest overlying posterior of first ring and onto second ring; second through fourth rings of a similar size. Ventrally, first peristomial ring lateral to mouth; second ring extending across venter producing ventral lip of mouth with 4–5 large lobes posterior to oral opening; rings 3–4 each becoming increasing larger. Overall, ventral surface of peristomium with transverse grooves of individual rings obvious, but entire ventral surface with surficial V-shape beginning posterior to mouth and ending on setiger 1 (Fig. 14B–C). The V is defined by an irregular papillate surface and some pigment. Setiger 1 modified, bearing cluster of dorsal tentacles and first branchiae (Fig. 14A). Most dorsal tentacles missing, limited to short stubs; when present, initially with narrow filament becoming thick and annulated with medial ciliated groove. Branchiae numerous, long, narrow, from setiger 1 arising from dorsal to notopodium, continuing posteriorly, absent from far posterior setigers; each branchia filamentous along entire length, with numerous tightly spaced minute rings encircling each branchia along entire length.

Setae include capillaries and acicular spines. Anterior setigers all with fascicles of long capillaries, golden colored, numbering up to 20–25 per fascicle in both noto- and neuropodia (Fig. 14D); largest capillaries with a finely serrated edge observed with high magnification (1000 x). Acicular spines begin from about setiger 35 in neuropodia and about setiger 72 in notopodia (SIO-BIC A9677). Posterior parapodia with 2–3 spines in neuropodia and 1–2 in notopodia (Fig. 14E); these spines accompanied by an equal number of capillaries. Individual spines golden colored, with straight shafts tapering to narrow blunted or pointed tip (Fig. 14E–H).

Pygidium a simple lobe ventral to anal opening (Fig. 14I).

Remarks. *Cirratulus megalus* was originally described from two specimens collected off Peru in 980 m (Chamberlin 1919) and has not been formally reported since. However, the species is listed in keys by Díaz-Díaz & Salazar-Vallejo (2009, 2021) as part a review of polychaetes of Mexico and tropical America. Tasso *et al.* (2018) encountered a specimen in shallow water (0–15 m) off Peru that was provisionally assigned to *C. megalus*, but no description was provided. Likewise, Chavez-Lopez & Cruz-Gomez (2019) recorded specimens as *Cirratulus cf. megalus* from a shallow-water coastal lagoon from the Oaxaca coast of Mexico, but provided no morphology. It is unlikely that these shallow-water records are actually *C. megalus*, a deep-water species. The present specimens from deep-water methane seep habitats from off Costa Rica agree well with a large syntype of the species archived in the MCZ invertebrate collections.

The syntype of *C. megalus* (MCZ IZ ANNc-2376) was examined in order to verify the identification of the new specimens. The type specimen is large, up to 19 cm long and about 9 mm wide in middle segments and with about 290 setigers. Although smaller, the Costa Rican deep-water specimens share all of the main characters of the syntype including the elongate pre-setiger region with four peristomial rings and dorsal tentacles and the branchiae beginning on setiger 1. The present report is the first after the original to provide morphological data on this species.

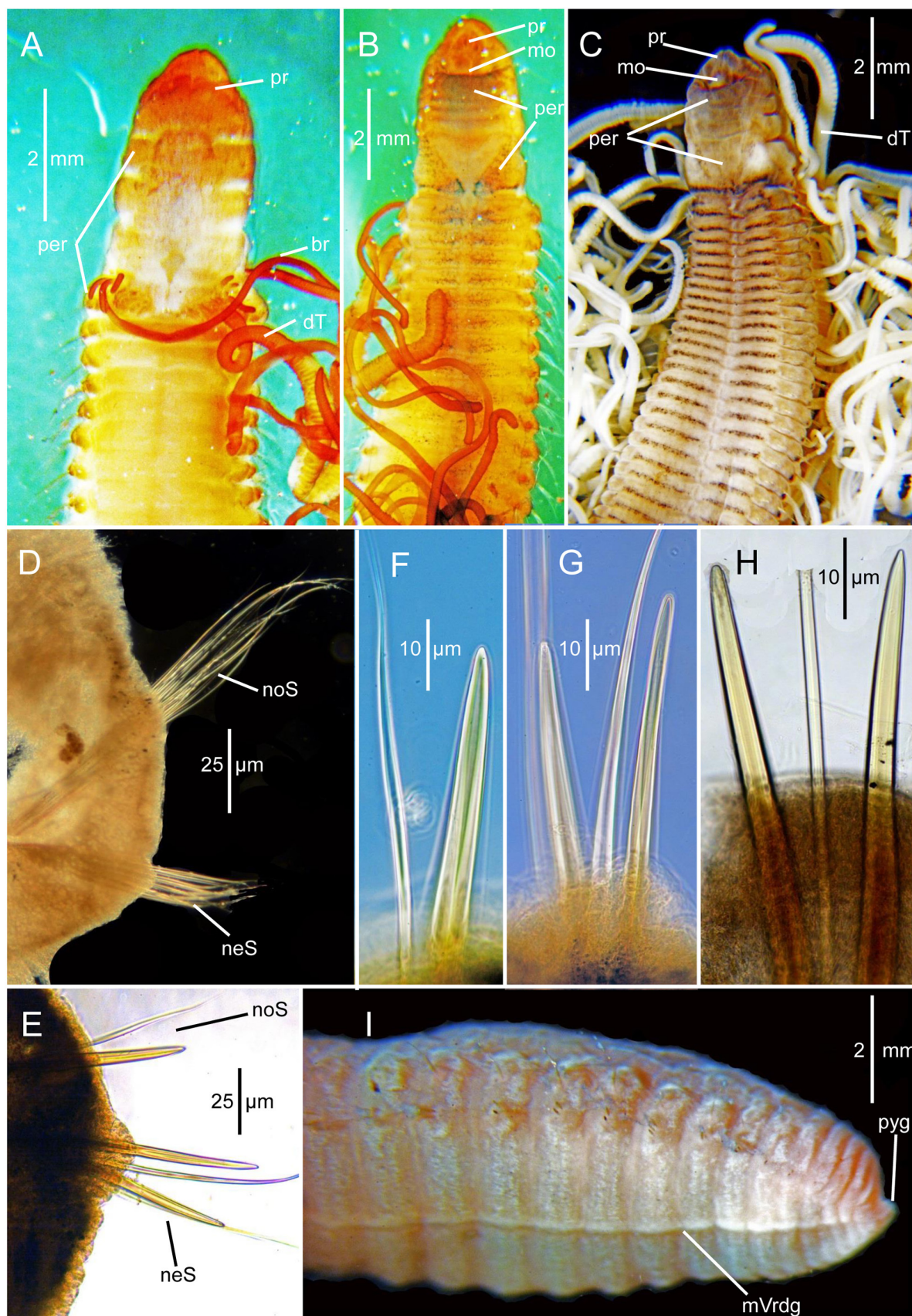


FIGURE 14. *Cirratulus megalus*. A, anterior end, dorsal view; B, same, ventral view; C, ventral view of another specimen; D, setiger 30, anterior view; E, setiger 100, anterior view; F, same, detail of notopodial acicular spine and capillary; G, same, detail of neuropodial spines and capillary; H, same, more detail of neuropodial spines; I, posterior end, ventrolateral view, with pygidium. A, B, D, I (SIO-BIC A9962), C, E, F, G, H (SIO-BIC A9677).

Cirratulus megalus has some similarity with *Cirratulus sinincolens* Chamberlin, 1919 originally collected in the Gulf of California in 1570 m; another species known largely from the original account. Fauchald (1972) however, did examine the holotype and reported four additional specimens from near the type locality. His account was brief but did confirm the absence of notopodial spines reported by Chamberlin (1919). The four specimens examined by Fauchald (1972) were obtained from the LACM and examined, thus verifying Fauchald's observations and identification of *C. sinincolens*; however, two of the specimens belonged to other cirratulid genera. In comparison with *C. megalus*, *C. sinincolens* has 5–6 lateral peristomial grooves but these are not continuous as distinct transverse rings; neuropodial acicular spines are present in posterior neuropodia but lacking in notopodia; the pygidium is crescent-shaped and bears six lobes, one large ventral, two lateral, and three dorsal. In contrast, *C. megalus* has four distinct peristomial rings dorsally, interrupted ventrally by the oral morphology and a large V-shaped area not crossed by rings; neuropodial acicular spines begin in anterior neuropodia at about setiger 35 and about setiger 72 in notopodia; and the pygidium is a small rounded lobe ventral to the anus without any lobes or papillae. The five COI sequences generated here for *C. megalus* are nearly identical. They were 2.4–2.6% different from the sequences generated here for *C. jacoensis* **sp. nov.**

GenBank Accession Numbers: (SIO-BIC A1380): GenBank PQ449000; (SIO-BIC A8303): GenBank PQ449297; (SIO-BIC A9677): GenBank PQ449320; (SIO-BIC A9907): GenBank PQ449334; (SIO-BIC A9962): PQ449339.

Distribution. SE Pacific, off Peru, 980 m; NE Pacific off Costa Rica, 1186–1811 m.

Genus *Raricirrus* Hartman, 1961

Type species: *Raricirrus maculatus* Hartman, 1961, by monotypy and original designation.

Diagnosis. (modified from Magalhães *et al.* 2017). Prostomium rounded, eyespots absent, nuchal organs shallow ciliary pits, posterior-lateral, rounded or elongate. Peristomium not obviously distinct from prostomium and setiger 1 dorsally; ventral cilia present or absent on peristomium and first few segments; first segment complete setiger. Dorsal tentacles absent. Branchiae present on anterior segments, filiform or club-like distally. Notosetae short and long serrate capillaries anteriorly and modified setae posteriorly as acicular spines, coarsely serrate forms and short pectinate falcigers. Neurosetae short serrate capillaries and/or modified as acicular spines, falcate and finely pectinate, and coarsely serrate. Simple enlarged spines may be present in one or two far posterior segments. Heart body an enlarged dorsal vessel present in variable number of anterior and middle segments. Pygidium a simple lobe with anal opening usually dorsal; posterior region distinct with a few segments expanded. Asexual reproduction via architomy. Sexual reproduction may occur; epitokous individuals, hermaphroditism, seminal vesicle and reproductive stylet may be present.

Remarks. The genus *Raricirrus* was originally described by Hartman (1961) based on specimens from southern California, off Pt. Fermin on the Palos Verdes shelf. The first species, *R. maculatus* Hartman, 1961, appears to be limited to shelf depths of about 45–150 m in the same general areas. The species was re-described in part by Montagne (1984) and in greater detail by Petersen & George (1991). The latter authors also described the second species, *R. beryli* Petersen & George, 1991 from the North Sea in depths of 48–160 m. The third species, *R. variabilis* Dean, 1995 was described from experimental wood panels collected from a deep-water site in the Caribbean Sea off St. Croix in 4000 m. Recently, three additional species were described: *Raricirrus arctius* Buzhinskaja & Smirnov, 2017 from Arctic Ocean in 1992–1993 m; *R. jennae* Magalhães, Linse & Wiklund 2017 from deep-water in Monterey Bay, California in 3100 m, and *R. anubis* Jimi, Fujimoto, Yoshihiro, Oguchi & Miura, 2021 from whale bones off Japan in 399 m bringing the total number of known species at the time of this writing to six (Read & Fauchald 2025f). Another species has been discovered off Costa Rica and is herein described and compared with its six congeners (Table 3).

TABLE 3. Characteristics of the Seven Known Species of *Raricirrus* Hartman, 1961 (Annelida, Cirratulidae).

Species/ Characters	Size/No. setigers	Prostomium/ nuchal organ	Peristomium/ ventral cilia	Heart body	Branchiae	Notopodial capillaries	Neuropodial capillaries	Notopodial spines	Neuropodial spines	Large “genital” spines”	Pygidium	Distribution	Reference
<i>R. maculatus</i> Hartman, 1961 Type Species	5.3 mm L; ~30 sets	Rounded anteriorly; nuO lat patches of cilia	Fused dorsally w/ pr & set 1; ventral cilia not evident	Sets 9–12	Sets 3–13	Short & long	Absent	Short, serrate from set 16	Ant sets w/ short & long pectinate acSp w/ falcate tips + coarse serrate setae from set 18	Present	Round ventral pad w/ terminal anus	NE Pacific Ocean, Southern California, 45–151 m	Hartman 1961; 1969; Montagne 1984; Petersen & George 1991
<i>R. anubis</i> Jimi Fujimoto, Fujiwara, Oguchi & Miura 2021	17 mm L; 29–30 sets	Triangular w/ narrow rounded tip; nuO post lat	Per smooth, w/o annulation; ventral cilia not reported	Sets 9–14	Sets 5–15	Short & long	Short & long	A single heavy acSp in posterior set	Pectinate spines in mid- body; heavy falcate spines w/ serrated tip in post sets	Present	Rounded; terminal anus	NW Pacific Ocean, Sagami Bay, Japan, whale bones, 399 m	Jimi, Fujimoto, Fujiwara, Oguchi & Miura 2021
<i>R. aretius</i> Buzhinskaja & Smirnov, 2017	>20 mm L; > 35 sets	Broadly rounded ant; nuO not observed	Fused to pr & set 1; cilia present ant & post to mo; narrow ventral band post to mo & on set 1–5	Sets 2–15	Sets 5–12	Short & long	Absent	2–3 straight, thick serrate setae in post region	Narrow pectinate falcigers ant; mid-body w/; coarsely serrate spines ; posterior acSp heavier, pectinate falcigers	Absent	Oval w/ dorso- terminal anus	Arctic Ocean, Laptev Sea, 1992–1993 m; mid-Atlantic Ridge, Loki’s Castle, 2300 m	Buzhinskaja & Smirnov 2017; Elertsen <i>et al.</i> 2024; Grosse <i>et al.</i> 2025
<i>R. beryli</i> Petersen & George, 1991	15 mm L; ~30 sets	Narrow, rounded ant; nuO small, oval	Fused dorsally w/ pr & set 1; cilia ant to mo, & post of mo extending over per and on to set 1	Sets 9–21	Sets 5–16	Short & long	Absent	Short, thick, coarsely serrate from set 25	Ant sets w/ short & long finely serrate setae w/ falcate tips & short serrate setae from set 25	Absent	Bluntly rounded w/ dorso- terminal anus	North Sea, Beryl Oil platform, 100–115 m	Petersen & George 1991

.....continued on the next page

TABLE 3. (Continued)

Species/ Characters	Size/No. setigers	Prostomium/ nuchal organ	Peristomium & ventral cilia	Heart body	Branchiae	Notopodial capillaries	Neuropodial capillaries	Notopodial spines	Neuropodial spines	Large “genital” spines”	Pygidium	Distribution	Reference
<i>R. hartmanae</i> Blake, Seid & Rouse sp. nov.	32 mm L; > 37 sets	Broadly rounded ant; nuO rounded lobes	Per elongate, weakly annulated, about as long as 1.5 of set 1. Mo, a wide lateral slit w/ 3 pr ant lobes & 2 per lobes.	Sets 2–7	Sets 6–22	Long, few short, up to 30 per fascicle in mid-body	Absent	Single large, brass-colored acSp from ca set 22 to post end; accompanied by 4–5 capillaries	Ant sets with narrow, straight to curved acSp with serrated edge; mid body sets w/ large curved spines w/ serrated edges; posterior sets with a single large brass- colored falcate spine	Present	W/ short ventral lobe below anal opening	NE Pacific Ocean, off Costa Rica, 990 m	This study
<i>R. jennae</i> Magalhães, Linse, & Wiklund, 2017	6 mm L; 19–32 sets	Conical w/ rounded tip; nuO elongate, posterolateral	Per w/ 2 rings; w/ dorsal crest over per & on to set 1	Sets 10–16	Sets 10–16	Short	Short	Straight acicular spines from sets 15–20	Straight acicular spines from set 1	Absent	Not observed	NE Pacific Ocean, Monterey Bay, California, wood, 3100 m; Southern Ocean, 2646 m	Magalhães, Linse & Wiklund 2017
<i>R. variabilis</i> Dean, 1995	6.75 mm L; 18–31 sets	Conical, w/ rounded ant; nuO slits or ciliated depressions	Per fused dorsally w/ pr & set 1; cilia not observed	Sets 10–16	Sets 10–16	Short & long	Absent	Short, pectinate setae of ant setigers w/ widely spaced teeth grading to pectinate falcigers in mid-body & coarse serrate setae post to genital spines	Ant sets w/ pectinate falcigers becoming longer posteriorly and w/ coarsely serrate setae post to genital spines	Present	Rounded w/ dorso- terminal anus	Caribbean Sea, off St. Croix, Virgin Islands, wood panels, 4000 m	Dean 1995

Abbreviations: acSp, acicular spine(s); ant, anterior; ca, about; L, length; mo, mouth; NE, northeast; NW, northwest; nuO, nuchal organ(s); per, peristomium; post, posterior; pr, prostomium; set/s, setiger/s; w/, with; w/o, without.

***Raricirrus hartmanae* new species**

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Figures 15–16

Raricirrus cf. *maculatus* Hartman, 1961: Seid *et al.* 2025: 56, fig. 22B.

Material examined. NE Pacific Ocean off Costa Rica, Mound 12 methane seep, R/V *Atlantis* Cruise 15-44, HOV *Alvin* Dive 4503, coll. E. Cordes & J. Gonzalez, 24 Feb 2009, 8.9300°N, 84.3124°W, 990 m, **holotype** (SIO-BIC A1342), 1 **paratype** (MZUCR-1541-01).

Description. A large species, holotype 32 mm long, 1.2 mm wide across middle setigers, with 37 setigers (Fig. 15A); paratype similar except posterior segments from setiger 29 removed for DNA. Body elongate, with narrow anterior region with six small, mostly rounded segments following prostomium and peristomium (Fig. 15A); these followed by long middle section consisting of rounded segments transitioning to a narrow posterior end composed of slightly widened segments; setiger 24 of holotype (setiger 26 of paratype) about twice size of preceding and following segments (Figs 15A; 16C) bearing a single large brass-colored genital spine directed anteriorly on either side (Figs 15E; 16C); this genital segment transitional between rounded middle body segments and posterior region (Fig. 15A). Both specimens with middle body segments from setiger 8 packed with ova measuring 75–80 µm in diameter. Color in life, based on photograph (Fig. 15A), yellow, mainly due to densely packed ova; in preservative entire body gray. Heart body observed on setigers 2–7 in photograph of living specimen (Fig. 15A, G); not observed in preserved specimens due to dark color of body.

Pre-setiger region elongate, about as long as first two setigers (Fig. 15A, G). Prostomium broadly rounded anteriorly with a pair of rounded postero-lateral nuchal organs (Figs 15G; 16A); eyespots absent. Prostomium separated from peristomium by shallow dorsal groove. Peristomium narrow, about twice as long as prostomium, with 4–5 narrow transverse grooves or folds across dorsum (Fig. 16A), venter smooth (Fig. 16B). Mouth a large orifice bordered anteriorly by large medial and two lateral prostomial lobes and posteriorly by two lobes recessed on peristomium (Fig. 16B). Dorsal tentacles absent. Branchiae long, thin, first present from about setiger 6 continuing to about setiger 22–23 (Fig. 15A); these arising posterior to notopodial lobe; branchiae smooth or crenulated, fragile, most broken off on both specimens during handling.

Parapodia lateral throughout with setae emerging from low parapodial mounds. Setae include finely serrated notopodial capillaries, serrated acicular spines, heavy acicular spines, and large genital spines on one posterior segment. Notopodia with only capillaries in setigers 1–22 (Fig. 15B) or before segment with large genital spine; setigers 1–6 with 10–12 capillaries increasing to 30–40 by about setiger 15, including short, thin, newly emergent setae and long, heavier capillaries with minute serrations along one side visible at high magnification (1000x) (Fig. 15B). Setigers just before and after genital segment with notopodia bearing 6–10 long and short capillaries and a single large acicular spine (Fig. 15C). Posterior notopodia from about setiger 22, with only 10–12 short capillaries accompanied by a single thick acicular spine. Neuropodial capillaries entirely absent. Neuropodia of setigers 1–4 with 8–10 narrow acicular spines with rounded tips and finely serrated edges (Fig. 16D, E); setigers 5–6 with narrow acicular spines in anterior row, joined by larger, curved acicular spines in second row (Fig. 16F), both with finely serrated margins. Neuropodia of mid-body with curved acicular spines of two types in two rows, one short and broad with coarsely serrated margin in anterior row (Figs 15D; 16G), and another longer and narrower with fine denticles along margin in second row (Figs 15D; 16H). A single large acicular spine lacking lateral serrations first appears in noto- and neuropodia one or two segments anterior to the genital segment and continues along far posterior setigers (Figs 15C, F); notopodia with accompanying capillaries; neuropodia with accompanying serrated spines. Posterior brass-colored spines large, those of notopodia tapering to narrow blunt tip (Fig. 15C); spines of neuropodia with a distinct subterminal boss, then also tapering to narrow blunt tip (Fig. 15F). Genital spine only seta on setiger 24 (holotype) or 26 (paratype); genital spine single, brass-colored, present on either side of genital segment (Fig. 15A, E), spines directed anteriorly (Fig. 16C).

Pygidium with a short ventral lobe below anal opening (Fig. 15A).

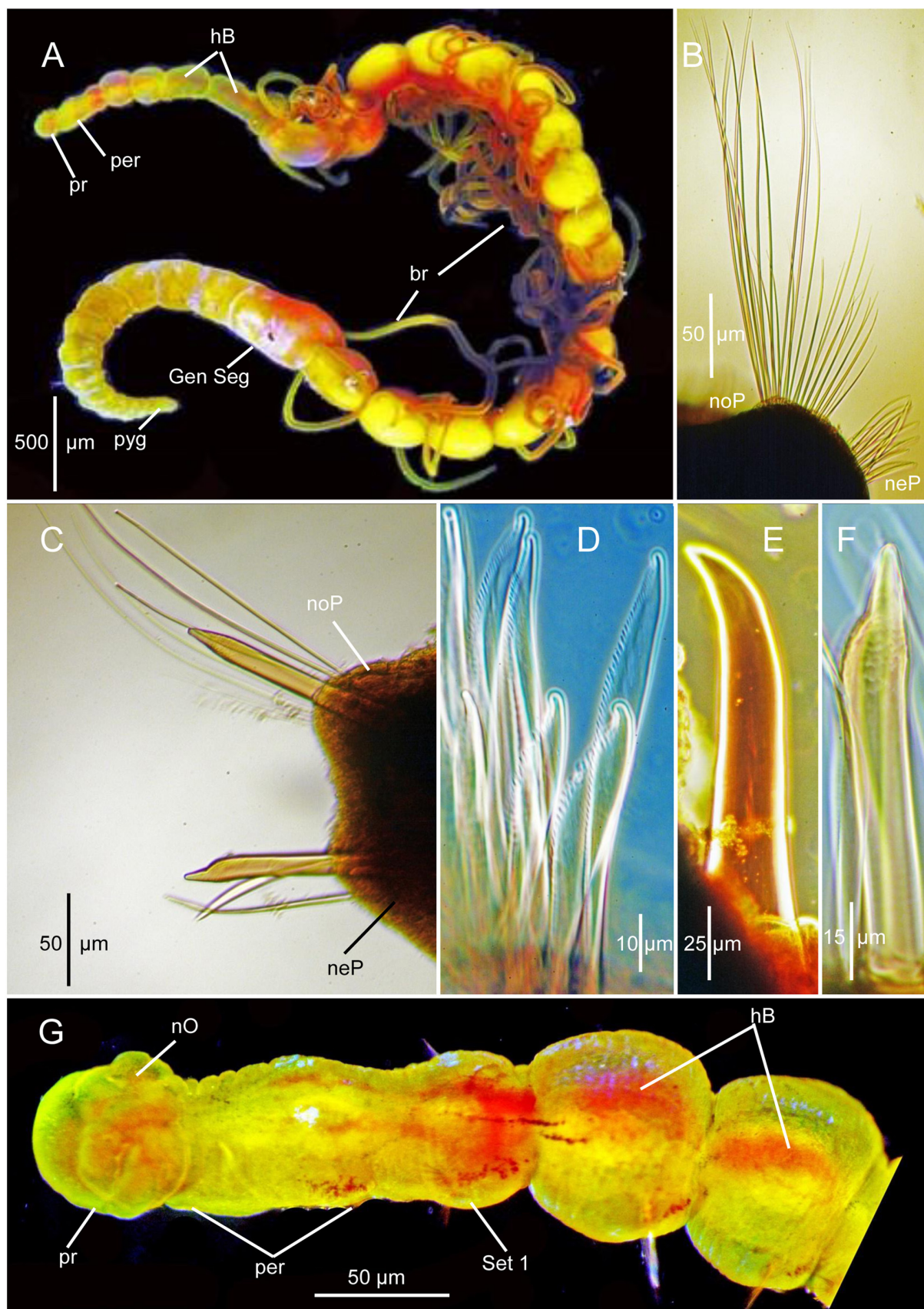


FIGURE 15. *Raricirrus hartmanae* sp. nov. A, entire worm in left lateral view; B, mid-body parapodium, anterior view; C, posterior region parapodium, anterior view; D, neurosetae from mid-body neuropodium; E, genital spine, from setiger 24; F, posterior neuropodial spine; G, anterior end, dorsolateral view. A, D–E, G, holotype (SIO-BIC A1342); B–C, paratype (MZUCR-1541-01); (A, G, original in life by GWR, rest original by JAB).

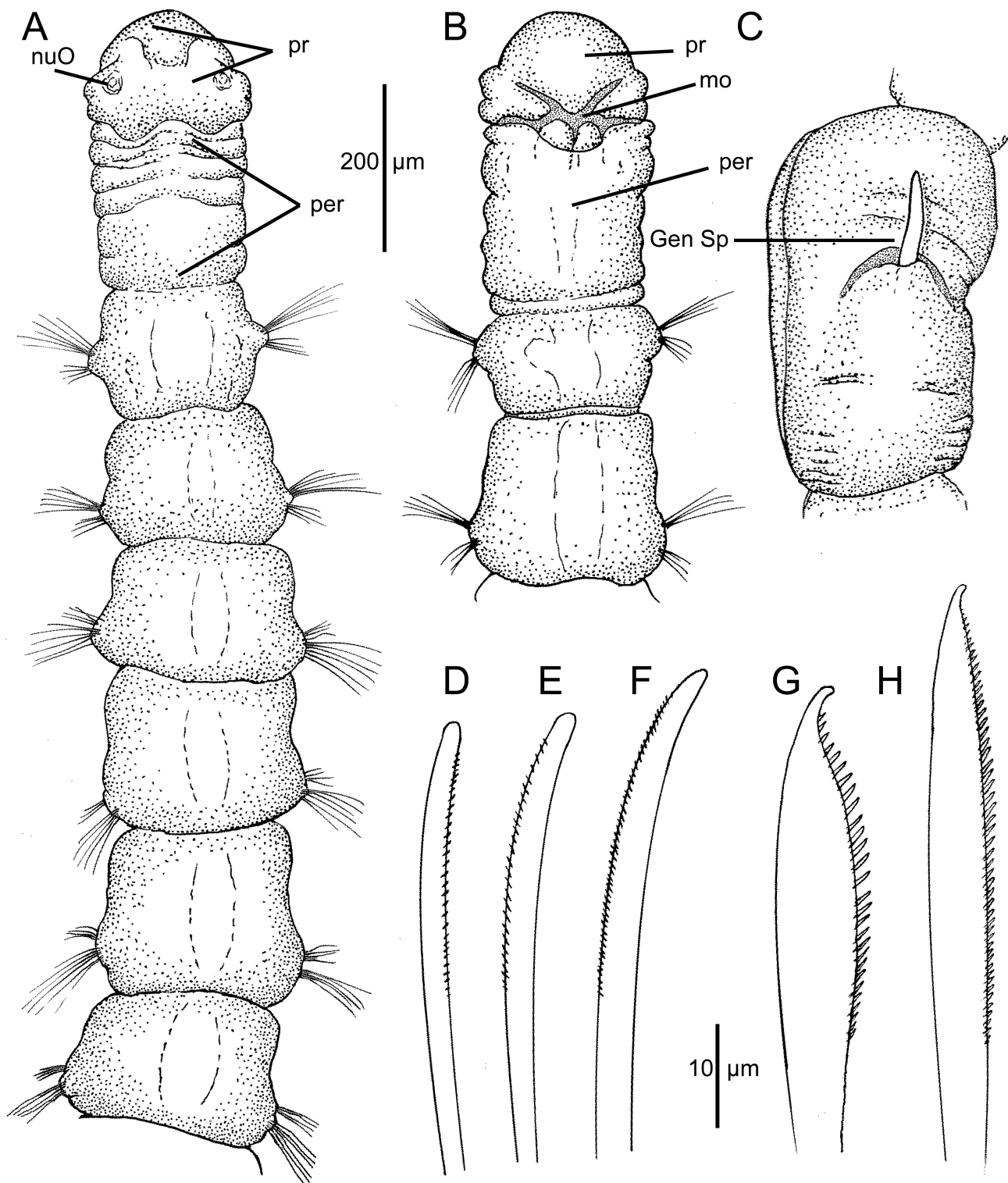


FIGURE 16. *Raricirrus hartmanae* **sp. nov.** A. Pre-setiger region, setigers 1–6, dorsal view; B, Pre-setiger region and setigers 1–2, ventral view; C, genital setiger 24, right lateral view; D, E, F, neuropodial acicular spines from anterior setigers; G, H, neuropodial acicular spines from middle setigers. A, C, Holotype (SIO-BIC A1342); B, D–H, paratype (MZUCR-1541-01).

Remarks. Of the seven known species of *Raricirrus*, *R. hartmanae* **sp. nov.** is the largest with a length of up to 32 mm. No other species exceeds 20 mm in length, and most are much smaller. *Raricirrus hartmanae* **sp. nov.** is one of four species reported with large genital-like spines on one or two posterior setigers (Table 3). Of these only *R. anubis* and *R. hartmanae* **sp. nov.** have heavy acicular spines in the noto- and neuropodia of far posterior

setigers following the segment bearing the large genital spines. In *R. anubis*, however, there are multiple noto- and neuropodial acicular spines in a row alternating with capillaries; each of the spines bears a prominent subterminal boss with a pectinate border. In contrast, the posterior spines of *R. hartmanae* **sp. nov.** are each solitary in the noto- and neuropodia and while the neuropodial spines do have a subterminal boss, this is weakly ribbed, not pectinate; notopodial spines have no subapical boss and taper evenly to a smooth blunt tip. These solitary spines are accompanied by 3–5 capillaries in the notopodia and 2–3 short, narrow acicular spines in the neuropodia. Details of all seven species of *Raricirrus* are listed in Table 3. The COI sequence for *R. hartmanae* **sp. nov.** was 17% divergent from sequences of *Raricirrus arcticus* (GenBank PV074767, PV074778, PV074782).

GenBank Accession Number: (SIO-BIC A1342): GenBank PQ449276.

Etymology. This species is named for the late Dr. Olga Hartman, who originally described the genus *Raricirrus* and the first species.

Distribution. Pacific Ocean off Costa Rica, methane seeps, 990 m.

Discussion

As of this writing, 391 species in 16 genera of Cirratulidae are recorded as valid in WoRMS (Read & Fauchald 1925a). In addition to the seven new species described herein, we are aware of seven additional new species that have recently been published or are in press but not yet listed in WoRMS, thus bringing the total number of known species of Cirratulidae to 405. The largest genus is *Chaetozone* Malmgren, 1867, with 85 species followed by *Aphelochaeta* (54), *Kirkegaardia* (54), *Caulleriella* Chamberlin, 1919. (52), *Cirratulus* (44), *Cirriformia* Hartman, 1936 (24), *Dodecaceria* Örsted, 1843 (23), *Tharyx* Webster & Benedict, 1887 (19), *Timarete* Kinberg, 1866 (16), *Chaetocirratulus* (13), *Protocirrinieris* Czerniavsky, 1881 (12), *Raricirrus* (7), *Ctenodrilus* Claparède, 1863 (5), *Raphidrilus* Monticelli, 1910 (5), *Fauvelicirratulus* Çinar & Petersen, 2011 (1), and *Aphropharynx* Wilfert, 1974 (1).

Cirratulidae from the Northeastern Pacific. The first compendium of Cirratulidae from the northeastern Pacific, chiefly from California, was by Blake (1996) who recorded 47 species in ten genera with 20 species new to science. Subsequently, new species of coastal cirratulids from Costa Rica were reported by Dean & Blake (2007, 2009, and 2016). Additional species were described from northern California, Oregon, and Washington (Puget Sound) by Blake (2006, 2015, and 2016) and Doner & Blake (2009). These post-1996 records and the addition of a few taxa formerly in the Ctenodrilidae plus seven new species and one new record from the current study offshore Costa Rica brings the total number of cirratulid species recorded from the NE Pacific to 91 (Table 4).

TABLE 4. List of 91 Species of Cirratulidae from the Eastern North Pacific Ocean by Genus in order of Description.

Bitentaculate Soft-bottom Genera and Species	
1.	<i>Aphelochaeta multifilis</i> (Moore, 1909). Southern California, intertidal. <i>Fide</i> Blake (1996).
2.	<i>Aphelochaeta monilaris</i> (Hartman, 1960). California, shallow subtidal to shelf depths.
3.	<i>Aphelochaeta elongata</i> Blake, 1996. Northern California, shallow embayments.
4.	<i>Aphelochaeta glandaria</i> Blake, 1996. Central and southern California, 75–200 m.
5.	<i>Aphelochaeta petersenae</i> Blake, 1996. Southern California, intertidal to shallow subtidal.
6.	<i>Aphelochaeta phillipsi</i> Blake, 1996. Southern California, 60–98 m.
7.	<i>Aphelochaeta tigrina</i> Blake, 1996. California, Santa Maria Basin to Point Conception. 90–160m.
8.	<i>Aphelochaeta williamsae</i> Blake, 1996. California, Santa Maria Basin, 90–150.
9.	<i>Aphelochaeta bullata</i> Doner & Blake, 2009. Off Northern California continental slope, 2160–3775 m.
10.	<i>Aphelochaeta guttata</i> Doner & Blake, 2009. Off Northern California, continental slope, 2420–3666 m.
11.	<i>Aphelochaeta antelonga</i> Dean & Blake, 2016. Costa Rica, Gulf of Nicoya, 11–18 m.
12.	<i>Aphelochaeta guimondi</i> Dean & Blake, 2016. Costa Rica, Gulf of Nicoya, 11–26 m.
13.	<i>Aphelochaeta praeacuta</i> Dean & Blake, 2016. Costa Rica, Bahia Culebra, 13–28 m.
14.	<i>Aphelochaeta striata</i> Dean & Blake, 2016. Costa Rica, Gulf of Nicoya, 11–28 m.

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TABLE 4. (Continued)

15. *Aphelochaeta zebra* Dean & Blake, 2016. Costa Rica, Punta Islotes, Golfo Dulce, intertidal.
16. *Aphelochaeta pigmentata* Blake, Seid & Rouse, **sp. nov.** Off Costa Rica, Jacó Summit 745 m; Quepos Plateau, 2184 m.
17. *Aphelochaeta rotunda* Blake, Seid & Rouse, **sp. nov.** Off Costa Rica, Jacó Scar, 1886 m.
18. *Caulleriella pacifica* E. Berkeley, 1929. California to Washington, intertidal to shallow subtidal.
19. *Caulleriella hamata* (Hartman, 1948). Washington to Alaska, intertidal in rocks; ?California.
20. *Caulleriella apicula* Blake, 1996. Southern California, 24 m.
21. *Caulleriella cristata* Blake, 1996. Central California, intertidal in rocks.
22. *Caulleriella lajolla* Blake, 1996. Southern California, subtidal with algal holdfasts.
23. *Caulleriella culula* Dean & Blake, 2007. Costa Rica, Gulf of Nicoya, 9–46 m.
24. *Caulleriella dulcensis* Dean & Blake, 2007. Costa Rica, Golfo Dulce, intertidal.
25. *Caulleriella minuta* Dean & Blake, 2007. Costa Rica, Golfo, intertidal.
26. *Caulleriella moralesensis* Dean & Blake, 2007. Costa Rica, Punta Moraleña, intertidal.
27. *Caulleriella murilloi* Dean & Blake, 2007. Costa Rica, Gulf of Dulce and Gulf of Nicoya, intertidal.
28. *Chaetocirratulus chromatus* Blake, Seid & Rouse, **sp. nov.** Off Costa Rica, Jacó Scar, 1885 m.
29. *Chaetozone spinosa* Moore, 1903. Off California, 2623–2955 m; Japan, 280 m. *Fide* Blake (1996).
30. *Chaetozone gracilis* (Moore, 1923). Off Catalina Island, abyssal 4392 m. *Fide* Blake (1996).
31. *Chaetozone armata* Hartman, 1963. Southern California, 27–180 m.
32. *Chaetozone corona* Berkeley & Berkeley, 1941. Southern California; Gulf of California, 24–119 m. *Fide* Blake (1996).
33. *Chaetozone acuta* Banse & Hobson, 1968. Puget Sound, 15–35 m. *Fide* Blake (1996).
34. *Chaetozone bansei* Blake, 1996. Off San Francisco, Gulf of the Farallones, 10–16 m.
35. *Chaetozone columbiana* Blake, 1996. Off Oregon and Washington, 58 m.
36. *Chaetozone commonalis* Blake, 1996. Central California, shelf depths, 90–410 m.
37. *Chaetozone hartmanae* Blake, 1996. Southern California, shelf and slope, 542–914 m.
38. *Chaetozone hedgpethi* Blake, 1996. Northern California, intertidal in sand.
39. *Chaetozone lunula* Blake, 1996. Northern California, 77–190 m.
40. *Chaetozone senticosa* Blake, 1996. Central and northern California, embayments, 5–10 m.
41. *Chaetozone palaea* Blake, 2006. California continental slope 1675–3130 m.
42. *Chaetozone allanotai* Blake, 2006. California continental slope 1800–3100m.
43. *Chaetozone brunnea* Blake, 2006. California continental slope 2000–3200 m.
44. *Chaetozone acuminata* Dean & Blake, 2007. Costa Rica, 35 m, Gulf of Nicoya.
45. *Chaetozone cimar* Dean & Blake, 2007. Costa Rica, 50 m.
46. *Chaetozone nicoyana* Dean & Blake, 2007. Costa Rica, Gulf of Nicoya, 9–44 m.
47. *Chaetozone malmgreni* Blake, 2015. Offshore Oregon, 109 m.
48. *Chaetozone pigmentata* Blake, 2015. North American Arctic, widely distributed, 38–245 m.
49. *Chaetozone pugettensis* Blake, 2015. Puget Sound, in silt and clay, shallow water, 9 m.
50. *Chaetozone hobsonae* Blake, 2015. British Columbia and SE Alaska, low water to 95 m.
51. *Chaetozone camasetosa* Blake, 2015. Southeastern Alaska to British Columbia, subtidal, 12–95 m.
52. *Chaetozone carinata* Blake, Seid & Rouse, **sp. nov.** Off Costa Rica, Mound 12, 999 m, and Coco Canyon, 546 m.
53. *Kirkegaardia tessellata* (Hartman, 1960). Central and Southern California, shelf and slope, 70–550 m. *Fide* Blake (2016).
54. *Kirkegaardia secunda* (Banse & Hobson, 1968). Washington, Puget Sound, subtidal. *Fide* Blake (1996, 2016).
55. *Kirkegaardia serratiseta* (Banse & Hobson, 1968). Washington, Puget Sound, 9–84 m. *Fide* Blake (1996, 2016).

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TABLE 4. (Continued)

56.	<i>Kirkegaardia luticastella</i> (Jumars, 1975). Southern California, deep basins, ca. 1200 m; off northern California, 2600 m. <i>Fide</i> Blake (2016).
57.	<i>Kirkegaardia cryptica</i> (Blake, 1996). California, shelf and bathyal depths, 92–585 m.
58.	<i>Kirkegaardia siblina</i> (Blake, 1996). Southern California, 7–10 m.
59.	<i>Kirkegaardia acunae</i> (Dean & Blake, 2009). Costa Rica, Gulf of Nicoya, 9–46 m.
60.	<i>Kirkegaardia antelaxa</i> (Dean & Blake, 2009). Costa Rica, Gulf of Nicoya, 18 m.
61.	<i>Kirkegaardia carrikeri</i> (Dean & Blake, 2009). Costa Rica, Gulf of Nicoya, 11–24 m.
62.	<i>Kirkegaardia elongata</i> (Dean & Blake, 2009). Costa Rica, Gulf of Nicoya, 18 m.
63.	<i>Kirkegaardia giribeti</i> (Dean & Blake, 2009). Costa Rica, Gulf of Nicoya, intertidal.
64.	<i>Kirkegaardia setosa</i> (Dean & Blake, 2009). Costa Rica, Gulf of Nicoya, 18 m.
65.	<i>Kirkegaardia dutchae</i> Blake, 2016. Washington, Puget Sound, 14–82.
66.	<i>Kirkegaardia cristata</i> Blake, 2016. Washington, Puget Sound, 20 m.
67.	<i>Kirkegaardia franciscana</i> Blake, 2016. Northern California continental slope, 2237–2983 m.
68.	<i>Kirkegaardia carinata</i> Blake, 2016. Northern California continental slope, 2821–3864 m.
69.	<i>Kirkegaardia davidgeorgei</i> Blake, Seid & Rouse, sp. nov. Off Costa Rica, Seamount 6, 500–700 m.
70.	<i>Tharyx parvus</i> E. Berkeley, 1929. California, San Francisco Bay, subtidal; British Columbia, Vancouver Island, low water. <i>Fide</i> Blake (1996).
71.	<i>Tharyx</i> cf. <i>kirkegaardi</i> Blake, 1991. Northern California slope, 1260–2400 m; U.S. Atlantic slope, 255–3000 m. <i>Fide</i> Blake, 1996.
72.	<i>Tharyx circacutus</i> Blake, 2015. Puget Sound, subtidal.
Bitentaculate Hard-bottom Genera	
73.	<i>Dodecaceria</i> cf. <i>concharum</i> Örsted, 1843. California, bores into calcareous substrates, intertidal. <i>Fide</i> Blake, 1996.
74.	<i>Dodecaceria fewkesi</i> Berkeley & Berkeley, 1954. Southern California to British Columbia secretes rock-like structure around tubes, intertidal. <i>Fide</i> Blake, 1996.
Multitentaculate Genera	
75.	<i>Cirratulus spectabilis</i> (Kinberg, 1866). Central California to British Columbia, intertidal in rocks. <i>Fide</i> Blake (1996).
76.	<i>Cirratulus cingulatus</i> Johnson, 1901. Washington & British Columbia, intertidal.
77.	<i>Cirratulus robustus</i> Johnson, 1901. Central California to Washington, Puget Sound, 50–60 m. <i>Fide</i> Blake (1996).
78.	<i>Cirratulus megalus</i> Chamberlin, 1919. SE Pacific, off Peru, 980 m; NE Pacific off Costa Rica, 1186–1811 m.
79.	<i>Cirratulus sinicolens</i> Chamberlin, 1919. Gulf of California, 1600–1650 m.
80.	<i>Cirratulus multioculatus</i> (Hartman, 1961). Central and Southern California, rocky subtidal, 40–170 m. <i>Fide</i> Blake (1996).
81.	<i>Cirratulus dillonensis</i> Blake, 1996. Northern California, intertidal in rocks.
82.	<i>Cirratulus jacoensis</i> Blake, Seid & Rouse, sp. nov. Off Costa Rica, Jacó Summit, 742–745 m.
83.	<i>Cirriformia spirabranca</i> (Moore, 1904). Northern to southern California, intertidal. <i>Fide</i> Blake (1996).
84.	<i>Cirriformia moorei</i> Blake, 1996. Central and southern California, intertidal to 25 m.
85.	<i>Protocirrinieris socialis</i> Blake, 1996. Central and southern California, intertidal.
86.	<i>Timarete luxuriosa</i> (Moore, 1904). Southern California, intertidal. <i>Fide</i> Blake (1996).
87.	<i>Timarete perbranchiata</i> (Chamberlin, 1918). Central and Southern California, intertidal. <i>Fide</i> Blake (1996).
Atentaculate Genera formerly included in the Family Ctenodrilidae	
88.	<i>Ctenodrilus serratus</i> (Schmidt, 1857). Central and Southern California, intertidal; cosmopolitan.
89.	<i>Raricirrus maculatus</i> Hartman, 1961. Southern California, 45–150 m.
90.	<i>Raricirrus jennae</i> Magalhães, Linse & Wiklund, 2017. California, Monterey Bay, 3100 m, with wood.
91.	<i>Raricirrus hartmanae</i> Blake, Seid & Rouse, sp. nov. off Costa Rica, methane seeps, Mound 12, 990 m.

Of these 91 species, 25 (27.5%) are recorded from deep water greater than 200 m. Most of these, including seven newly described in the present study, were reported after 1996. Additional deep-water cirratulids are known to us from monitoring the deep-water disposal site off Northern California and from various offshore deep-water vent and seep sites from northern California to British Columbia.

Sixty-eight of the 91 species, or 74.7%, belong to bitentaculate genera. Most of these taxa are small, live in fine sands or silt, and typically require fine-mesh sieves (300 µm or 500 µm) to separate them from the sediment. This is evident by the fact that most species of bitentaculate cirratulids have been collected since the 1960s when finer mesh sieves came into common usage. In contrast, most of the multitentaculate species, being much larger, have been recognized for a longer period of time.

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References

- Augener, H. (1932) Polychaeten von den Auckland und Campbell-Inseln. *Videnskabelige Meddelelser Naturhistorisk Forening i København*, 75, 1–115, 44 figs. [<https://biodiversitylibrary.org/page/27905256>]
- Banse, K. & Hobson, K. (1968) Benthic polychaetes from Puget Sound, Washington. *Proceedings of the United States National Museum*, 125 (3667), 1–53.
<https://doi.org/10.5479/si.00963801.125-3667.1>
- Berkeley, E. (1929) Polychaetous annelids from the Nanaimo District. 4. Chaetopteridae to Maldanidae. *Contributions to Canadian Biology*, Ottawa, new series, 4, 305–316, 1 plate.
<https://doi.org/10.1139/f29-022>
- Berkeley, E. & Berkeley, C. (1941) On a collection of Polychaeta from Southern California. *Bulletin of the Southern California Academy of Sciences*, 40, 16–60. [<https://www.biodiversitylibrary.org/page/34209137>]
- Berkeley, E. & Berkeley, C. (1954) Notes on the life-history of the polychaete *Dodecaceria fewkesi* (nom. n.). *Journal of the Fisheries Research Board of Canada*, 11, 326–334.
<https://doi.org/10.1139/f54-021>
- Blake, J.A. (1991) Revision of some genera and species of Cirratulidae from the Western North Atlantic. In: Petersen, M.E. & Kirkegaard, J.B. (Eds.), *Systematics, Biology and Morphology of World Polychaeta. Proceedings of the 2nd International Polychaete Conference, Copenhagen 1986. Ophelia*, 5 (Supplement), 17–30.
https://doi.org/10.1163/9789004629745_005
- Blake, J.A. (1996) Chapter 8. Family Cirratulidae Ryckholdt, 1851. Including a revision of the genera and species from the eastern North Pacific. In: Blake, J.A., Hilbig, B. & Scott, P.H. (Eds.), *Taxonomic Atlas of the Benthic Fauna of the Santa Maria Basin and the Western Santa Barbara Channel*. Volume 6. *The Annelida Part 3, Polychaeta: Orbiniidae to Cossuridae*. Santa Barbara Museum of Natural History, Santa Barbara, California, pp. 263–384.
- Blake, J.A. (2006) New species and records of deep-water Cirratulidae (Polychaeta) from off Northern California. *Scientia Marina*, 70S3, 45–57.
<https://doi.org/10.3989/scimar.2006.70s345>
- Blake, J.A. (2015) New species of *Chaetozone* and *Tharyx* (Polychaeta: Cirratulidae) from the Alaskan and Canadian Arctic and the Northeastern Pacific, including a description of the lectotype of *Chaetozone setosa* Malmgren from Spitsbergen in the Norwegian Arctic. *Zootaxa*, 3919 (3), 501–552.
<https://doi.org/10.11646/zootaxa.3919.3.5>
- Blake, J.A. (2016) *Kirkegaardia* (Polychaeta, Cirratulidae), new name for *Monticellina* Laubier, preoccupied in the Rhabdocoela, together with new records and descriptions of eight previously known and sixteen new species from the Atlantic, Pacific, and Southern Oceans. *Zootaxa*, 4166 (1), 1–93.

<https://doi.org/10.11646/zootaxa.4166.1.1>

- Blake, J.A. (2018) Bitentaculate Cirratulidae (Annelida, Polychaeta) collected chiefly during cruises of the R/V *Anton Bruun*, USNS *Eltanin*, USCG *Glacier*, R/V *Hero*, RVIB *Nathaniel B. Palmer*, and R/V *Polarstern* from the Southern Ocean, Antarctica, and off Western South America. *Zootaxa*, 4537 (1), 1–130.
<https://doi.org/10.11646/zootaxa.4537.1.1>
- Blake, J.A. (2019) New species of Cirratulidae (Annelida, Polychaeta) from abyssal depths of the Clarion-Clipperton Fracture Zone, North Equatorial Pacific Ocean. *Zootaxa*, 4629 (2), 151–187.
<https://doi.org/10.11646/zootaxa.4629.2.1>
- Blake, J.A. (2022) New species and records of *Caulleriella*, *Chaetocirratulus*, and *Chaetozone* (Annelida, Cirratulidae) from continental shelf and slope depths of the Western North Atlantic Ocean. *Zootaxa*, 5113 (1), 1–89.
<https://doi.org/10.11646/zootaxa.5113.1.1>
- Blake, J.A. (2023) New species of Cirratulidae (Annelida) from Continental slope and abyssal depths off Eastern Australia. *Records of the Australian Museum*, 75, 249–270.
<https://doi.org/10.3853/j.2201-4349.75.2023.1799>
- Blake, J.A. & Magalhães, W. (2019) Cirratulidae Ryckholt, 1851. In: Purschke, G., Böggemann, M. & Westheide, W. (Eds.), *Handbook of Zoology. Annelida 1: Annelida Basal groups and Pleistoannelida, Sedentaria 1*. pp. 339–397.
<https://doi.org/10.1515/9783110291582>
- Buzhinskaja, G.N. & Smirnov, R.V. (2017) A new species of *Raricirrus* (Polychaeta, Ctenodrilidae) from the continental slope of the Laptev Sea near the Gakkel Ridge. *Proceedings of the Zoological Institute RAS*, 321 (4), 425–432.
<https://doi.org/10.31610/trudyzin/2017.321.4.425>
- Carrasco, F.D. (1978) Polychaeta (Annelida) de Bahía de Concepción, Chile. Familias Orbiniidae, Cirratulidae, Cossuridae, Capitellidae y Ampharetidae, con la descripción de tres especies y una subespecie nuevas. *Boletín de la Sociedad de Biología de Concepción*, 51 (1), 67–92. [[https://bolsocebiolconcepc.cl/pdfs/v51\(1\)/10-Carrasco.pdf](https://bolsocebiolconcepc.cl/pdfs/v51(1)/10-Carrasco.pdf)]
- Chamberlin, R.V. (1918) Polychaetes from Monterey Bay. *Proceedings of the Biological Society of Washington*, 31, 173–180. [<https://www.biodiversitylibrary.org/page/3332088>]
- Chamberlin, R.V. (1919) The Annelida Polychaeta. *Memoirs of the Museum of Comparative Zoology, Harvard*, 48, 1–514, pls. 1–80. [<https://www.biodiversitylibrary.org/ia/memoirsofmuseumo4801harv>]
- Chevez-Lopez, Y. & Cruz-Gomez, C. (2019) New records of polychaetes (Annelida, Polychaeta) from three locations of Oaxaca, Mexico. *Revista de Biología Tropical*, 67 (S5), Supplement, 157–168.
<https://doi.org/10.15517/rbt.v67iS5.38941>
- Çinar, M.E. & Petersen, M.E. (2011) Re-description of *Cirratulus dollfusi* (Polychaeta: Cirratulidae), and *Fauvelicirratulus* as a new genus. *Journal of the Marine Biological Association of the United Kingdom*, 91 (2), 415–418.
<https://doi.org/10.1017/S0025315410000895>
- Claparède, A.R.É. (1863) *Beobachtungen über Anatomie und Entwicklungsgeschichte wirbelloser Thiere an der Küste von Normandie angestellt*. Verlag von Wilhelm Engelmann, Leipzig, 120 pp., 18 plates.
<https://doi.org/10.5962/bhl.title.10030>
- Czerniavsky, V. (1881) Materialia ad zoographiam Ponticam comparatam. Fasc. III Vermes [Second part]. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 56 (2), 338–420. [<https://biodiversitylibrary.org/page/41340542>]
- Dean, H.K. (1995) A new species of *Raricirrus* (Polychaeta: Ctenodrilidae) from wood collected in the Tongue of the Ocean, Virgin Islands. *Proceedings of the Biological Society of Washington*, 108 (2), 169–179. [<https://www.biodiversitylibrary.org/page/34571999>]
- Dean, H.K. & Blake, J.A. (2007) *Chaetozone* and *Caulleriella* (Polychaeta: Cirratulidae) from the Pacific Coast of Costa Rica, with description of eight new species. *Zootaxa*, 1451, 41–68.
<https://doi.org/10.11646/zootaxa.1451.1.2>
- Dean, H.K. & Blake, J.A. (2009) *Monticellina* (Polychaeta: Cirratulidae) from the Pacific coast of Costa Rica with descriptions of six new species. *Zoosymposia*, 2, 105–126.
<https://doi.org/10.11646/zoosymposia.2.1.10>
- Dean, H.K. & Blake, J.A. (2016) *Aphelochaeta* (Polychaeta: Cirratulidae) from the Pacific coast of Costa Rica, with a description of five new species. *Zootaxa*, 4103 (2), 101–116.
<https://doi.org/10.11646/zootaxa.4103.2.1>
- Díaz-Díaz, O. & Salazar-Vallejo, S.I. (2009) Chapter 12. Cirratulidae Ryckholt, 1851. In: de León-González, J.A., Bastida-Zavala, J.R., Carrera-Para, L.F., García-Garza, M.E., Peña-Rivera, A., Salazar-Vallejo, S.I. & Solís-Weiss, V. (Eds.), *Poliquetos (Annelida, Polychaeta) de México y América Tropical. Vol. 1*. Universidad Autónoma de Nuevo Leon, Monterrey, México, pp. 131–147.
- Díaz-Díaz, O. & Salazar-Vallejo, S.I. (2021) Chapter 13. Cirratulidae Ryckholt, 1851. In: de León-González, J.A., Bastida-Zavala, J.R., Carrera-Para, L.F., García-Garza, M.E., Salazar-Vallejo, S.I., Solís-Weiss, V. & Tovar-Hernández, M.A. (Eds.), *Anélidos Marinos de México y América Tropical*. Universidad Autónoma de Nuevo Leon, Monterrey, México, pp. 187–207.
- Doner, S.A. & Blake, J.A. (2009) Two new species of *Aphelochaeta* (Polychaeta: Cirratulidae) from deep-water off northern California. *Zoosymposia*, 2, 127–137.
<https://doi.org/10.11646/zoosymposia.2.1.11>

- Eilertsen, M.H., Songsrud, J.A., Tandberg, A.H.S., Alvestad, T., Budaeva, N.M. & *et al.* (2024) Diversity, habitat endemism and trophic ecology of the fauna of Loki's Castle vent field on the Arctic Mid-Ocean Ridge. *Scientific Reports*, 14, 103. <https://doi.org/10.1038/s41598-023-46434-z>
- Freitas, R., Ribeiro, R.P. & Ruta, C. (2022) *Kirkegaardia* Blake, 2016 (Annelida: Cirratulidae) from Southeastern Brazil with description of nine new species. *Plos One*, 17 (5), e0265336. <https://doi.org/10.1371/journal.pone.0265336>
- Fauchald, K. (1972) Benthic polychaetous annelids from deep water off western Mexico and adjacent areas in the eastern Pacific Ocean. *Allan Hancock Monographs in Marine Biology*, 7, 1–575, 68 plates. [<https://repository.si.edu/handle/10088/6207>]
- Grosse, M., Kongsrud, J.A., Alvestad, T., Eilertsen, M.H. & Budaeva, N. (2025) A new species and a new record of Cirratulidae (Annelida, Cirratulida) from Loki's vent field. *European Journal of Taxonomy*, 987, 1–25. <https://doi.org/10.5852/ejt.2025.987.2855>
- Hartman, O. (1936) Nomenclatural changes involving California polychaete worms. *Journal of the Washington Academy of Sciences*, 26, 31–32. [<https://biodiversitylibrary.org/page/39872214>]
- Hartman, O. (1948) The polychaetous annelids of Alaska. *Pacific Science*, 2, 1–58. [<http://hdl.handle.net/10125/8890>]
- Hartman, O. (1960) Systematic account of some marine invertebrate animals from the deep basins of Southern California. *Allan Hancock Pacific Expeditions*, 22, 69–215. [<https://www.biodiversitylibrary.org/page/4682240>]
- Hartman, O. (1961) Polychaetous annelids from California. *Allan Hancock Pacific Expeditions*, 25, 1–226, 34 plates. [<https://www.biodiversitylibrary.org/page/5214831>]
- Hartman, O. (1963) Submarine Canyons of Southern California. Part III. Systematics: Polychaetes. *Allan Hancock Pacific Expeditions*, 27 (3), 1–93. [<https://www.biodiversitylibrary.org/page/4683354>]
- Hartman, O. (1969) *Atlas of the Sedentary Polychaetous Annelids from California*. Allan Hancock Foundation, University of Southern California, Los Angeles, 812 pp.
- Hiley, A.S., Green, K.R. & Rouse, G.W. (2025) Seven new species of scaleworms (Lepidonotopodini, Polynoidae, Polychaeta, Annelida) from deep-sea chemosynthetic-based ecosystems. *Marine Biodiversity*, 55, 106. <https://doi.org/10.1007/s12526-025-01580-7>
- Jimi, N., Fujimoto, S., Yoshihiro, F., Oguchi, K. & Miura, T. (2022) Four new species of *Ctenodrilus*, *Raphidrilus*, and *Raricirrus* (Cirratuliformia, Annelida) in Japanese waters, with notes on the phylogenetic position. *PeerJ*, 10, e13044. <https://doi.org/10.7717/peerj.13044>
- Johnson, H.P. (1901) The Polychaeta of the Puget Sound Region. *Proceedings of the Boston Society of Natural History*, 29 (1), 381–437. [<https://www.biodiversitylibrary.org/page/56803706>]
- Kinberg, J.G.H. (1866) Annulata Nova. *Öfversigt af Konglich Vetenskapsakademiens förhandlingar*, Stockholm, 22 (4), 239–258. [<https://biodiversitylibrary.org/page/32339515>]
- Laubier, L. (1961) *Monticellina heterochaeta* n. g., **sp. nov.**, Ctenodrilide (Polychètes Sedentaires) des vases côtières de Banyuls sur-Mer. *Vie et Milieu*, 11, 601–604. [https://www.php.obs-banyuls.fr/Viemilieu/images/Archives_1950-2002/vie-et-milieu/VOLUME_1960_11_fasc4.pdf]
- Lamarck, J.B. de. (1818) *Histoire naturelle des Animaux sans Vertèbres, présentant les caractères généraux et particuliers de ces animaux, leur distribution, leurs classes, leurs familles, leurs genres, et la citation des principales espèces qui s'y rapportent; précédées d'une Introduction offrant la détermination des caractères essentiels de l'Animal, sa distinction du végétal et des autres corps naturels, enfin, l'Exposition des Principes fondamentaux de la Zoologie*. Deterville, Paris, 612 pp. [<http://biodiversitylibrary.org/page/12886879>]
- Langerhans, P. (1881) Die Wurmfauna von Madeira. III. *Zeitschrift für wissenschaftliche Zoologie*, 34 (1), 87–143. [<https://biodiversitylibrary.org/page/42353743>]
- Magalhães, W.F. & Bailey-Brock, J.H. (2013) Bitentaculate Cirratulidae (Annelida: Polychaeta) from the northwestern Pacific Islands with a description of nine new species. *Zootaxa*, 3630 (1), 80–116. <https://doi.org/10.11646/zootaxa.3630.1.3>
- Magalhães, W.F., Linse, K. & Wiklund, H. (2017) A new species of *Raricirrus* (Annelida: Cirratuliformia) from deep-water sunken wood off California. *Zootaxa*, 4353 (1), 51–68. <https://doi.org/10.11646/zootaxa.4353.1.3>
- Malmgren, A.J. (1867) Annulata Polychaeta Spetsbergiae, Groenlandiae, Islandiae et Scandinaviae hactenus cognita. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar*, 24, 127–235. <https://doi.org/10.5962/bhl.title.13358>
- Monticelli, F.S. (1910) Di un nuovo Ctenodrilide del Golfo di Napoli. *Rendiconto dell'Accademia delle Scienze Fisiche e Matematiche (Sezione della Società Reale di Napoli)*, Serie 3, 16 (3–4), 61–64. [<https://babel.hathitrust.org/cgi/pt?id=njp.32101064104308&seq=505>]
- Montagne, D. (1984) Expanded definition of *Raricirrus maculatus*. *SCAMIT Newsletter*, 3 (6), 1–2. [<https://scamit.org/newsletters/1984-09.pdf>]
- Montagu, G. (1808) Description of several marine animals found on the south coast of Devonshire. *Transactions of the Linnean Society of London*, 9, 81–114, plates 2–8. <https://doi.org/10.1111/j.1096-3642.1818.tb00327.x>
- Moore, J.P. (1903) Polychaeta from the coastal slope of Japan and from Kamchatka and Bering Sea. *Proceedings of the Philadelphia Academy of Natural Sciences*, 55, 401–490, plates 23–27. [<https://www.biodiversitylibrary.org/page/6600785>]

- Moore, J.P. (1904) New Polychaeta from California. *Proceedings of the Philadelphia Academy of Natural Sciences*, 56, 484–503, plates 37–38. [<https://biodiversitylibrary.org/page/6367345>]
- Moore, J.P. (1909) Polychaetous annelids from Monterey Bay and San Diego, California. *Proceedings of the Philadelphia Academy of Natural Sciences*, 61, 235–295, plates 7–9. [<https://www.biodiversitylibrary.org/page/12715216>]
- Moore, J.P. (1923) Polychaetous annelids dredged by the U.S.S. *Albatross* off the coast of southern California in 1904. Spionidae to Sabellariidae. *Proceedings of the Philadelphia Academy of Natural Sciences*, 75, 179–259, plates 17–18. <https://doi.org/10.5962/bhl.title.12425>
- Müller, O.F. (1776) *Zoologiae Danicae Prodromus, seu Animalium Daniae et Norvegiae indigenarum characteres, nomina, et synonyma imprimis popularium*. Havniae, 282 pp. <https://doi.org/10.5962/bhl.title.13268>
- Örsted, A.S. (1843) *Annulatorum danicorum conspectus*. *Naturhistorisk Tideskrift København*, 4, 1–52, 8 text figs. + 7 plates. Maricolae. Copenhagen, 52 pp. <https://doi.org/10.5962/bhl.title.11849>
- Petersen, M.E. (1991) A review of asexual reproduction in Cirratulidae (Annelida: Polychaeta), with redescription of *Cirratulus gayheadius* (Hartman, 1965), new combination and emendation or reinstatement of some cirratulid genera. In: Reish, D.J. (Ed.), *Third International Polychaete Conference held at California State University, Long Beach, California August 1969*. *Bulletin of Marine Science*, 48 (2), 592 (Abstract).
- Petersen, M.E. & George, J.D. (1991) A new species of *Raricirrus* from Northern Europe, with notes on its biology and discussion of the affinities of the genus (Polychaeta: Ctenodrilidae). In: Petersen, M.E. & Kirkegaard, J.B. (Eds.), *Systematics, Biology and Morphology of World Polychaeta. Proceedings of the 2nd International Polychaete Conference, Copenhagen 1986*. *Ophelia*, Supplement 5, 185–208. https://doi.org/10.1163/9789004629745_019
- Read, G. & Fauchald, K. (Ed.) (2025a) World Polychaeta Database. Cirratulidae Ryckholt, 1851. World Register of Marine Species, Available from: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=919> (accessed 24 May 2025)
- Read, G. & Fauchald, K. (Ed.) (2025b) World Polychaeta Database. *Aphelochaeta* Blake, 1991. World Register of Marine Species, Available from: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=129240> (accessed 24 May 2025)
- Read, G. & Fauchald, K. (Ed.) (2025c) World Polychaeta Database. *Chaetocirratulus* Blake, 2018. World Register of Marine Species, Available from: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=1316610> (accessed 19 April 2025)
- Read, G. & Fauchald, K. (Ed.) (2025d) World Polychaeta Database. *Kirkegaardia* Blake, 2016. World Register of Marine Species, Available from: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=884676> (accessed 10 April 2025)
- Read, G. & Fauchald, K. (Ed.) (2025e) World Polychaeta Database. *Cirratulus* Lamarck, 1818. World Register of Marine Species, Available from: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=129243> (accessed 28 May 2025)
- Read, G. & Fauchald, K. (Ed.) (2025f) World Polychaeta Database. *Raricirrus* Hartman, 1961. World Register of Marine Species, Available from: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=129254> (accessed 01 Mar 2025)
- Rioja, E. (1960) Estudios Anelidológicos. XXIII. Contribucion al conocimiento de Los Anelidos poliquetos de las Islas de Revillagigedo. *Anales del Instituto de Biología*, 37 (1–2), 243–259. [<https://anales.ib.unam.mx/index.php/anales/article/view/1136/1282>]
- Ryckholt, Philippe de (Baron) (1851) Mélanges paléontologiques. Part 1. *Memoires Couronnes et Memoires des Savants Etrangers de l'Academie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique*, 24, 1–176, pls. 1–10. [<https://biodiversitylibrary.org/page/2718124>]
- Seid, C.A., Hiley, A.S., McCowin, M.F., Carvajal, J.I., Cha, H., Ah Yong, S.T., Ashford, O.S., Odalisca, B., Eernisse, D.J., Goffredi, S.K., Hendrickx, M.E., Kocot, M., Mah, L., Miller, A.K., Mongiardino, N., Mooi, R., O'Hara, T.D., Pleijel, F., Stiller, J., Tilic, E., Valentich-Scott, P., Warén, A., Wicksten, M.K., Wilson, N.G., Cordes, E.E., Levin, L.A., Cortés, J. & Rouse, G.W. (2025) A faunal inventory of methane seeps on the Pacific margin of Costa Rica. *Zookeys*, 1222, 1–250. <https://doi.org/10.3897/zookeys.1222.134385>
- Schmidt, O. (1857) Zur Kenntnis der Turbellaria rhabdocoela und einiger anderer Würmer des Mittelmeeres. *Sitzungsberichte der Kaiserliche Akademie der Wissenschaften, Wien, Mathematisch-Naturwissenschaftliche Klasse*, 23, 347–366, pls. 1–5. [<http://biodiversitylibrary.org/page/36386704>]
- Tasso, V., Haddad, M.E., Assadi, C., Canales, R., Aguirre, L. & Velez-Auaxo, X. (2018) Macrobenthic fauna from an upwelling coastal area of Peru (Warm Temperate South-eastern Pacific province–Humboldtian ecoregion). *Biodiversity Data Journal*, 6, e2893e7. <https://doi.org/10.3897/BDJ.6.e2893e7>
- Westblad, E. (1953) New Turbellaria parasites of echinoderms. *Arkiv för Zoologi*, Series 2, 5, 269–288.
- Webster, H.E. & Benedict, J.E. (1887) The Annelida Chaetopoda, from Eastport, Maine. *U.S. Commission of Fish & Fisheries. Report of the United States Commissioner of Fisheries*. 1885. Part 13, II. Appendix to report of Commissioner, D.22. 707–758, pls. 1–8. [<http://biodiversitylibrary.org/page/15839855>]
- Wilfert, M. (1974) *Aphropharynx heterochaeta* nov. gen. nov. spec., ein neuer polychaet aus der familie Ctenodrilidae Kennel 1882. *Cahiers de Biologie Marine*, 15 (4), 495–504. <https://doi.org/10.21411/CBM.A.F5889AF8>