



Two new species of *Diplocirrus* (Polychaeta: Flabelligeridae) from the southern Irish Sea and South Africa

TERESA DARBYSHIRE¹ & ANDREW S. Y. MACKIE

Department of Biodiversity & Systematic Biology, Amgueddfa Cymru—National Museum Wales, Cathays Park, Cardiff CF10 3NP, Wales, U.K.

¹Corresponding author: E-mail: Teresa.Darbyshire@museumwales.ac.uk

Abstract

Two new species of *Diplocirrus* Haase, 1915 are described from the southern Irish Sea and South Africa. *Diplocirrus stopbowitzi* sp. nov., identified from several surveys around the Irish Sea in recent years, favors coarser sediments than *D. glaucus* (Malmgren, 1867), the only other species of *Diplocirrus* identified from the area. It is morphologically closest to *D. capensis* Day, 1961 from South Africa, due to a combination of characters (multiarticulated, hooked neurochaetae, cephalic cage absent) that have previously been considered unique to *D. capensis* within the genus. The other new species, *D. incognitus*, is described from material identified by Day as *D. capensis* and deposited in the Natural History Museum, London. In appearance, it approaches *D. glaucus* but differs most noticeably in the relative size of adherent sediment particles and in the length of papillae clustered around the notochaetae. The two new species exhibit characters that bridge the gap between *D. capensis*, previously considered anomalous, and the other members of the genus. The significance of hooked neurochaetae is discussed following the discovery of such chaetae on specimens of *D. glaucus* and *D. hirsutus*. *Diplocirrus glaucus*, *D. capensis*, and the two new species each possess the same two branchial forms: stout, cuneiform with longitudinal ciliated ridges and cirriform with transverse ciliated rings. Comparisons are also made with the morphologically similar genera *Bradiella* Rullier, 1965 and *Diversibranchius* Buzhinskaja, 1994.

Key words: cephalic cage, hooked neurochaetae, branchiae, papillae, *Bradiella*, *Diversibranchius*

Introduction

Haase (1915) erected a new genus, *Diplocirrus*, for three species—*D. glaucus* (Malmgren, 1867), *D. hirsutus* (Hansen, 1879) and *D. longisetosus* (Marenzeller, 1890)—all previously in the genus *Stylarioides* Delle Chiaje, 1830. The basis for separation was the presence of branchiae of two different sizes and thickness, and the articulated capillary neurochaetae being like the notochaetae, but stouter. *Stylarioides* was later synonymized with *Pherusa* Oken, 1807 by Støp-Bowitz (1948).

Day (1961) emended the generic description in order to include a new species, *D. capensis*, from South Africa. This new species had only a single branchial form, neurochaetae with a minute blunt hook, and no cephalic cage, characters that differed from the other species of the genus. The same species was also later identified from the northwest Atlantic in North Carolina (Day 1973) and the Gulf of Mexico (Milligan 1984).

Diplocirrus erythroporus Gallardo, 1968 was described from Nha Trang, South Viet Nam in the South China Sea. A more recent survey in the Natuna Islands (Al-Hakim & Glasby 2004), also in the

South China Sea, recorded the species and the material was said to match the description of Gallardo well. The species has only six pairs of branchiae as opposed to the eight possessed by all other *Diplocirrus* species, and is named for the circular red pores present ventrally near the neuropodia from chaetiger 3 to 11 or 13.

Diplocirrus micans was described by Fauchald (1972) from western Mexico, off Baja California and Cabo Corrientes. This species was more like the original members of the genus in having a cephalic cage and articulated capillary neurochaetae. The branchiae were not described.

A subspecies of *Diplocirrus*, *D. glaucus orientalis*, was described by Gibbs (1971) from the Solomon Islands in the western Pacific Ocean. It was distinguished from *D. glaucus* by the presence of orange globular papillae on the ventral surface below the neuropodia between chaetigers 4 and 14 or 16.

In 1973, Day transferred *Ilyphagus octobranchus* Hartman, 1965, described from New England and off northeastern South America, into *Diplocirrus*. The generic definition, emended by Day in 1961 for *D. capensis* as described above, was seen to encompass *I. octobranchus*, which had a single branchial form as described for *D. capensis*, but differed from *D. capensis* in lacking eyes and having finely tipped neurochaetae instead of minute hooks.

Neither *D. erythroporus* nor *D. micans* have been recorded from the North Atlantic region and *D. octobranchus* and *D. capensis* only from the northwest. *Diplocirrus glaucus*, *D. hirsutus*, and *D. longisetosus* have all been recorded from the northeast Atlantic although, in U.K. waters, only *D. glaucus* has been recorded south of the northern North Sea. *Diplocirrus hirsutus* has been identified from both U.K. and Norwegian sides of the northern North Sea (NMW collections; Støp-Bowitz 1948). *Diplocirrus longisetosus* is found in the northern North Sea and further north (Støp-Bowitz 1948) although it has not yet been found in U.K. waters. *Diplocirrus glaucus* is the most commonly recorded species of *Diplocirrus* in the U.K. and the only described species recorded in the Irish Sea to date.

In the collections of Amgueddfa Cymru—National Museum Wales, *D. glaucus* is recorded from both the northern and southern North Sea, to the east of the U.K., and the Irish Sea to the west. Within the southern Irish Sea, several extensive surveys were carried out between 1989 and 2008, from which the new species of *Diplocirrus* was regularly recorded (Mackie et al. 1995; Wilson et al. 2001; Darbyshire et al. 2002; Robinson et al. 2009), although it is not as common as *D. glaucus*. However, it was not identified from an extensive survey of the nearby Outer Bristol Channel (Mackie et al. 2006) although *D. glaucus* was found. Initially, it was immediately distinguished from *D. glaucus* due to the lack of encrusting sand grains on the body and the absence of a cephalic cage. In the Irish Sea samples, *D. stopbowitzi* sp. nov. is recorded from coarse sediments, mostly sandy gravels and gravelly sands, and a range of depths (28–135 m), whereas *D. glaucus* is recorded from finer sediments (mostly muddy sands, 18–145 m).

Specimens collected and identified by Day as *Diplocirrus capensis* were obtained from the Natural History Museum, London. Unfortunately, these specimens turned out not to be *D. capensis* but were instead an undescribed species of *Diplocirrus*, described here as *D. incognitus* sp. nov.

The holotype of *D. capensis* was located in the Iziko South African Museum. Observation of this specimen and another non-type enabled comparison with *D. stopbowitzi* sp. nov. and reassessment of its position within the genus.

Materials and methods

The British specimens were all collected during surveys carried out by National Museum Wales

between 1989 and 2008 in the southern Irish Sea (Mackie et al. 1995; Wilson et al. 2001; Darbyshire et al. 2002; Robinson et al. 2009).

Samples were obtained using a 0.1-m² Van Veen grab, 0.2-m² Hamon grab, Tjärnö dredge, or Anchor dredge, sieved through a 0.5-mm-mesh sieve and fixed in formalin. Most samples were stained with Rose Bengal. The *Diplocirrus* specimens collected in 2008 were relaxed in a 7% solution of magnesium chloride in seawater and fixed in formaldehyde, glutaraldehyde, or Bouin's fluid. Identified specimens were later preserved in 80% alcohol with 2% propylene glycol (see Mackie & Oliver 1996).

The South African specimens of *D. incognitus* sp. nov. were all from one station sampled in 1960 as part of a wider grab and dredge survey off the south coast of Africa. Samples were sieved through a 1-mm-mesh sieve (Day 1963). No further details on the treatment of specimens or samples were recorded.

The holotype of *D. capensis* was collected using a 30-inch rock dredge. Station information for the other specimen of *D. capensis* was limited.

All drawings and measurements were made using a camera lucida attachment on a Nikon Labophot-2 compound microscope or a Nikon Eclipse E400 binocular microscope. Photographs were taken using AutoMontage™ software.

Most material is deposited in National Museum Wales, Cardiff. Paratypes of *Diplocirrus stopbowitzi* sp. nov. are also deposited in Natural History Museum of Los Angeles County (LACM-AHF), Natural History Museum, London (BMNH), Iziko South African Museum (SAM) and the Zoological Museum, University of Copenhagen (ZMUC).

Results

Family Flabelligeridae

Genus *Diplocirrus* Haase, 1915

Type Species: *Trophonia glauca* Malmgren, 1867

Diagnosis (emended). Body arenicoliform, sometimes with tail region of moniliform segments. Surface densely covered with adhesive papillae. Anterior end invaginable and includes branchial plate bearing 6–8 branchiae of one or two forms. Prostomial swelling often with eyes and pair of stout, grooved palps on either side; mouth with poorly marked lips. Notochaetae and neurochaetae are multiarticulated capillaries; neurochaetae shorter, stouter with tips bent (fine) or hooked (blunt). Chaetae of first 1, 2, or 3 chaetigers may be elongated to form cephalic cage. Gonopodial lobes sometimes visible on chaetiger 5.

Remarks. The above generic diagnosis essentially follows Day (1961) but some terminology has been emended following advice from Sergio Salazar-Vallejo. Branchial plate terminology follows the description by Salazar-Vallejo et al. (2008). Diagnosis remains correct pending confirmation of two characters: (1) whether tips of the neurochaetae of all *Diplocirrus* species are blunt and hooked, not fine and (2) that all *Diplocirrus* species exhibit two different forms of branchiae, not one.

Diplocirrus stopbowitzi sp. nov.

Figures 1–3A; Table 1

Material Examined: North Anglesey, Sta. 22A (53°38.631'N, 004° 21.157'W), coarse sandy gravel,

54 m, holotype (NMWZ.2008.059.0001), 1 paratype (NMWZ.2008.059.0002), 20 Sep 2008; West Anglesey, Sta. 20 (53°35.180'N, 004° 46.430'W), gravelly muddy sand, 94 m, 1 paratype (NMWZ.2008.059.0003), 20 Sep 2008; Caernarfon Bay, Sta. 34a (52°56.170'N, 004°41.480'W), sandy gravel, 38 m, 1 paratype (NMWZ.2005.014.0001), 29 Jul 2005; Caernarfon Bay, Sta. 36b (52°54.890'N, 004°40.308'W), muddy sandy gravel, 38.3 m, 1 paratype (NMWZ.2005.014.0002), 29 Jul 2005; Celtic Deep, Sta. 51b (51°51.111'N, 006°01.065'W), gravelly sand, 110 m, 2 paratypes (NMWZ.2005.014.0003-4), 01 Aug 2005; Celtic Deep, Sta. 56b (51°56.876'N, 005°55.567' W), sandy gravel, 104 m, 2 paratypes (NMWZ.2005.014.0005-6), 03 Aug 2005; Celtic Deep, Sta. 57b (51°57.168'N, 005°55.327'W), gravelly sand, 103 m, 2 paratypes (NMWZ.2005.014.0007; LACM-AHF POLY 2200), 03 Aug 2005; Celtic Deep, Sta. 58a (52°01.743'N, 005°45.129'W), gravelly sand, 104 m, 3 paratypes (NMWZ.2005.014.0008-9; BMNH 2008.3457), 03 Aug 2005; Celtic Deep, Sta. 58b (52°01.695'N, 005°45.041'W), gravelly sand, 104 m, 1 paratype (NMWZ.2005.014.0010), 03 Aug 2005; South Cardigan Bay, Sta. 59b (52°09.826'N, 005°30.427'W), sandy gravel, 94 m, 2 paratypes (NMWZ.2005.014.0011-12), 03 Aug 2005; North Anglesey, Sta. 18.2 (53°30.458'N, 004°57.310'W), gravelly sand, 92 m, paratype (NMWZ.2005.014.0013), 11 Aug 2005; St George's Channel, Sta. 101d (52°35.490'N, 005°19.300'W), gravelly sand, 101 m, 1 paratype (NMWZ.1997.050.0001), 07 Jul 1997; St George's Channel, Sta. 133b (52°11.390'N, 005°47.950'W), gravelly sand, 88 m, 1 paratype (NMWZ.1997.050.0002), 13 Jul 1997; St George's Channel, Sta. 134c (52°14.390'N, 005°39.480'W), sandy gravel, 95 m, 3 paratypes (NMWZ.1997.050.0003; SAM; ZMUC-POL-1982), 13 Jul 1997; Devil's Ridge, South Llyn, Sta. 16 (52°45.585'N, 004°39.364'W), gravelly sand, 28 m, 1 paratype (NMWZ.2001.050.1428), 27 Jul 2001; St George's Channel, NW of St David's Head, Sta. 15 (52°01.700'N, 005°45.100'W), gravelly sand, 112 m, 2 paratypes (NMWZ.1989.104.2567-2568), 12 Jul 1989; St George's Channel, Sta. 65 (51°51.000'N, 006°01.100'W), silty coarse sand, 105 m, 2 paratypes (NMWZ.1991.075.3810-3811), 05 Aug 1991.

Description: Holotype complete, 3.1 mm max. width (anterior), 45.3 mm long with 43 chaetigers. Complete paratypes with 14–46 chaetigers, length to 28.1 mm, anterior width to 2.5 mm.

Body shape arenicoliform, with swollen anterior region (Fig. 1A). Segmental boundaries not sharply defined anteriorly, but more apparent from about chaetiger 8 as the anterior end tapers, becoming moniliform posteriorly. Body circular in cross-section and slightly flattened as body tapers. Epidermis densely covered with small adhesive papillae. Body light muddy brown color (regardless of whether Rose Bengal stain had been applied to sample).

Cephalic cage chaetae absent, all chaetae of similar length throughout body. An expanded biannulate cephalic sheath often apparent anterior to chaetiger 1 (Fig. 1A) enveloping head region. Podial lobes absent. Notochaetae multiarticulate, smoothly tapering capillaries (Fig. 1B). Neurochaetae, multiarticulate, similar in length but stouter than notochaetae with tip curving over forming minute hook (Fig. 1C). Anterior chaetigers have 1–3 notochaetae and 1–2 neurochaetae, increasing up to six notochaetae at start of tail region in larger specimens with two, rarely three, neurochaetae.

Papillae cover epidermis along entire body; all distally swollen, only slightly flared at base compared to trunk. Anteriorly, papillae short, squat (Fig. 1D) but lengthening slightly along body, papillae on the last 1–2 segments becoming particularly elongate (Fig. 1E). Papillae on same segment varying slightly in length, although most noticeable on last few chaetigers. Fine silt adhering strongly to each papilla creating a uniform globular appearance obscuring true shape of papilla (Fig. 1F).

Head in most specimens retracted within cephalic sheath and comprising ventral mouth, pair of centrolateral palps, and eight ciliated branchiae (Fig. 2A–D). Mouth bordered by two conspicuous

medial lips and a single ventral lip; dorsal lip not pronounced. Branchiae arranged as a row of four distal filaments around outer margin of branchial plate plus two proximal groups, each of two filaments, located either side of a prostomial ridge. Distal and proximal groups separated by two rounded lobes (Fig. 2A). Two different forms of branchiae present. Distal filaments stout, wedge-shaped with ciliated longitudinal ridges (Fig. 2B–C). Position of outer pair inverted relative to middle pair. Upper surface of middle pair and corresponding concave lower surface of outer pair without ridges. Transverse ciliated pad (Fig. 2B–C) on both faces of middle pair but only inner face of outer pair. Proximal filaments cirriform with transverse ciliated bands (Fig. 2D); several short longitudinal ridges basally.

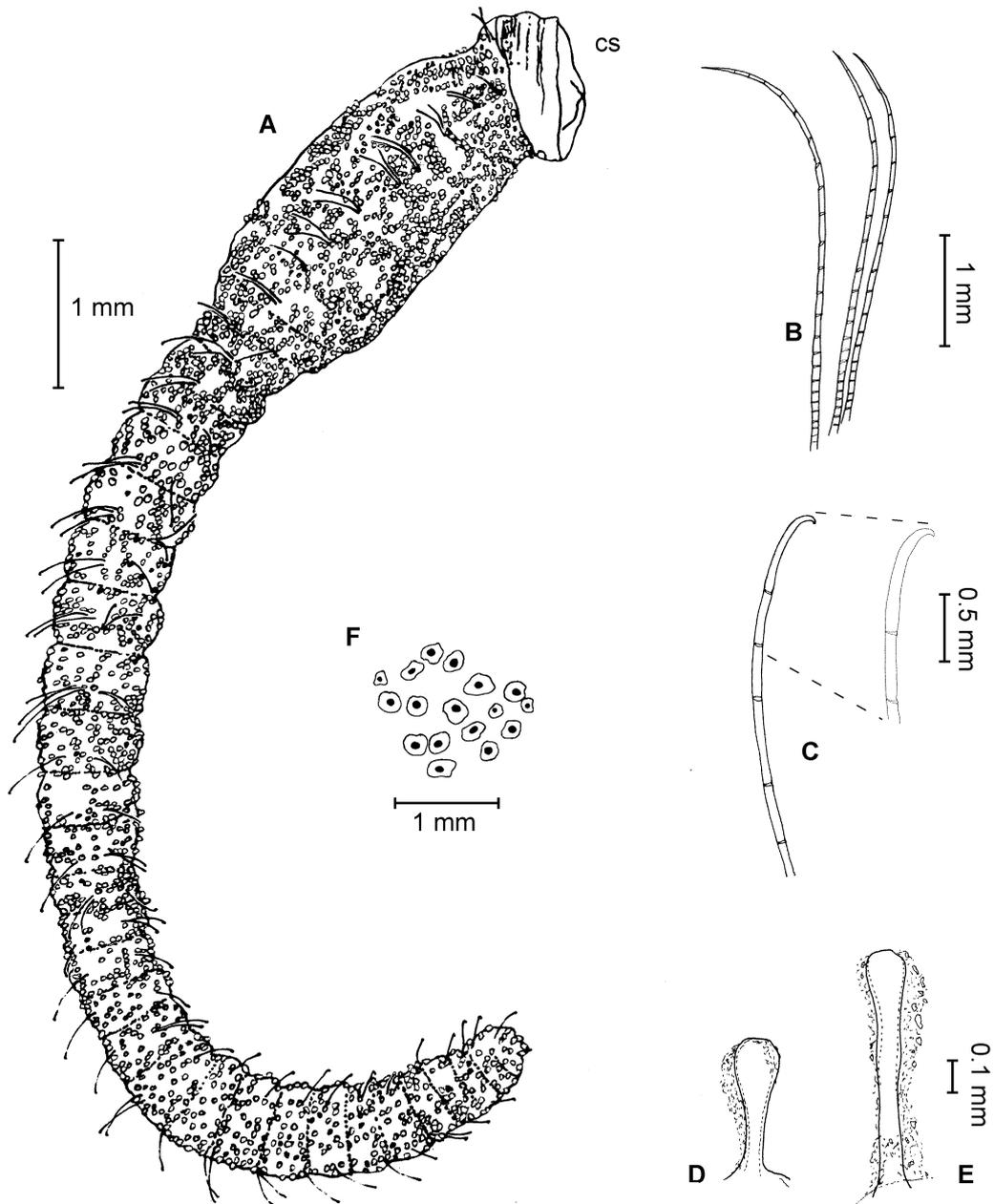


FIGURE 1. *Diplocirrus stopbowitzi* sp. nov. (A, F: NMWZ.1989.104.2568; B–C: NMWZ.1997.050.0004; D–E: NMWZ.1991.075.3810) A, whole animal, lateral view (cs = cephalic sheath); B, notochaetae, chaetiger 22, posterior view; C, neurochaeta, chaetiger 22, posterior view, with enlargement of tip; D, papilla, chaetiger 12; E, papilla, chaetiger 40; F, silt-covered epidermal papillae, dorsal view.

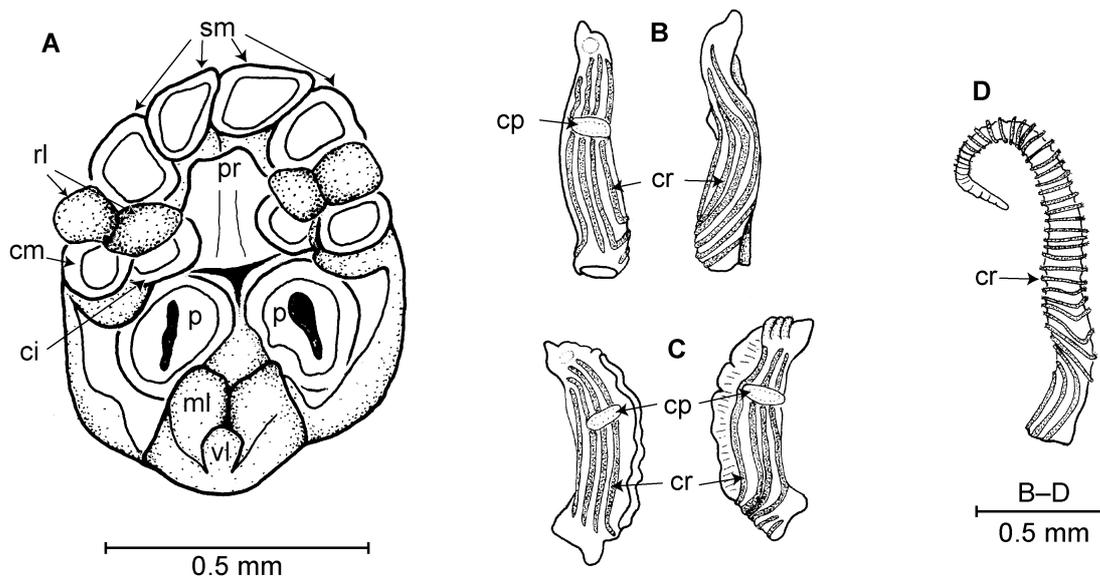


FIGURE 2. *Diplocirrus stopbowitzi* sp. nov. (A, D: NMWZ.2008.059.0002; B–C: NMWZ.2008.059.0003) A, head region, frontal view; B, right dorsolateral stout branchia, left & right views; C, right dorsal stout branchia, left & right views; D, cirriform branchia (right outer). Abbreviations: ci = cirriform inner branchia (scar); cm = cirriform marginal branchia (scar); sm = stout marginal branchiae (scars); rl = rounded lobe; ml = medial lip; vl = ventral lip; pr = prostomial ridge; p = palp (scar); cp = ciliated pad; cr = ciliated ridge.

Pygidium rounded, anus terminal, no anal papillae.

Etymology. This species is named after the late Carl Støp-Bowitz in recognition of his series of papers dealing with Arctic and North Atlantic polychaete fauna, and especially his work on the Flabelligeridae of the northeast Atlantic.

Habitat. The new species is found in coarse sediments, mainly sandy gravels and gravelly sands. As yet, it is only known from the southern Irish Sea region.

Remarks. This species is most similar to *Diplocirrus capensis* Day, 1961 and also bears some resemblance to *Diversibranchius nicolaji* Buzhinskaja, 1994. The form of the branchiae can be used to differentiate the two genera. *Diversibranchius nicolaji* exhibits a complex structure of the branchiae with “hillocks” and numerous folds, neither of which were present on any branchiae of the four *Diplocirrus* species examined here. Conversely, the ciliated ridges and pads, described for *Diplocirrus stopbowitzi* sp. nov. and the other *Diplocirrus* species examined (including *D. glaucus*, Fig. 3C–D), are absent on *Diversibranchius*. Additionally, simple, striated capillaries are present in both rami of *Diversibranchius nicolaji*, but are absent from *Diplocirrus* species (Table 1). *Diplocirrus stopbowitzi* sp. nov. and *D. capensis* differ in the shape of the papillae (flask or bottle-shaped in *D. capensis*), the clusters of elongated papillae around the chaetae of *D. capensis* (no clusters on *D. stopbowitzi*) and the numbers of chaetae along the body (both noto- and neurochaetae are up to twice as abundant on *D. capensis*).

Diplocirrus capensis Day, 1961

Table 1

Material Examined. South coast of the Cape Province, Sta. SCD 9 (34°15'S, 025°05'E), shell and rock, 11 m, holotype (SAM A20994), 19 Apr 1958; False Bay(?), Sta. FBY 78.X, 1 specimen, 13 Jul 1967 (no other station information available).

TABLE 1. Main characteristics separating the species of *Diplocirrus* and two other similar genera.

Feature	<i>D. micans</i>	<i>D. longisetosus</i>	<i>D. glaucus</i>	<i>D. hirsutus</i>	<i>D. octobranchus</i>	<i>D. incognitus</i> sp. nov.	<i>D. erythroporus</i>	<i>D. capensis</i>	<i>D. stopbovitzii</i> sp. nov.	<i>Diversibranchius</i> <i>nicolaji</i>	<i>Bradiella</i> <i>branchiata</i>
Cephalic Cage	Present	Present	Present	Present	Present	Present	Unknown	Absent	Absent	Absent	Absent
Chaetigers forming cage	1–2	1–2	1	1	1	1	Unknown	—	—	—	—
Notochaetae	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, fine tip; simple, striated capillaries	Multiaarticulate capillaries, fine tip			
Neurochaetae	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, blunt hooked tip	Multiaarticulate capillaries, fine tip	Multiaarticulate capillaries, blunt hooked tip	Multiaarticulate capillaries, fine or blunt (not hooked) tip	Multiaarticulate capillaries, blunt hooked tip	Multiaarticulate capillaries, blunt hooked tip	Multiaarticulate capillaries, hooked tip; simple striated capillaries	Multiaarticulate capillaries, fine tip
Papillae	Random; clusters around chaetae	Random	Random; clusters around chaetae	Random	Random; clusters around chaetae	Random	Random	Random			
Branchiae	Unknown	2	2	2?	1	2	2	2	2	2	1
Different forms	8	8	8	8	8	8	6	8	8	Unknown	8
No. branchiae	Unknown	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Present	Present
Lamella structure?											

Description: Holotype incomplete with 18 chaetigers, dissected. No cephalic cage. Notochaetae multiarticulate, tapering capillaries with fine tips. Neurochaetae multiarticulate capillaries with blunt, hooked tips, shorter and stouter than notochaetae. Body muddy brown, covered with adhesive papillae randomly spread over epidermis. Silt accumulated around base of these papillae, giving a more globular appearance than in actuality, distal ends free of silt. Elongated papillae cluster around notochaetae and, to lesser extent, neurochaetae. These papillae not covered with silt.

Branchiae, unlike original description, are of two types. Only five branchiae present, although eight were described originally. Of these, three are stout, wedge-shaped, two are cirriform (one damaged, missing tip). Ciliated ridges and transverse pads observed on stout branchiae as described earlier for other species of *Diplocirrus*. All branchiae very dark (black-brown), obscuring differences between them.

Except for branchiae, holotype as described by Day (1961).

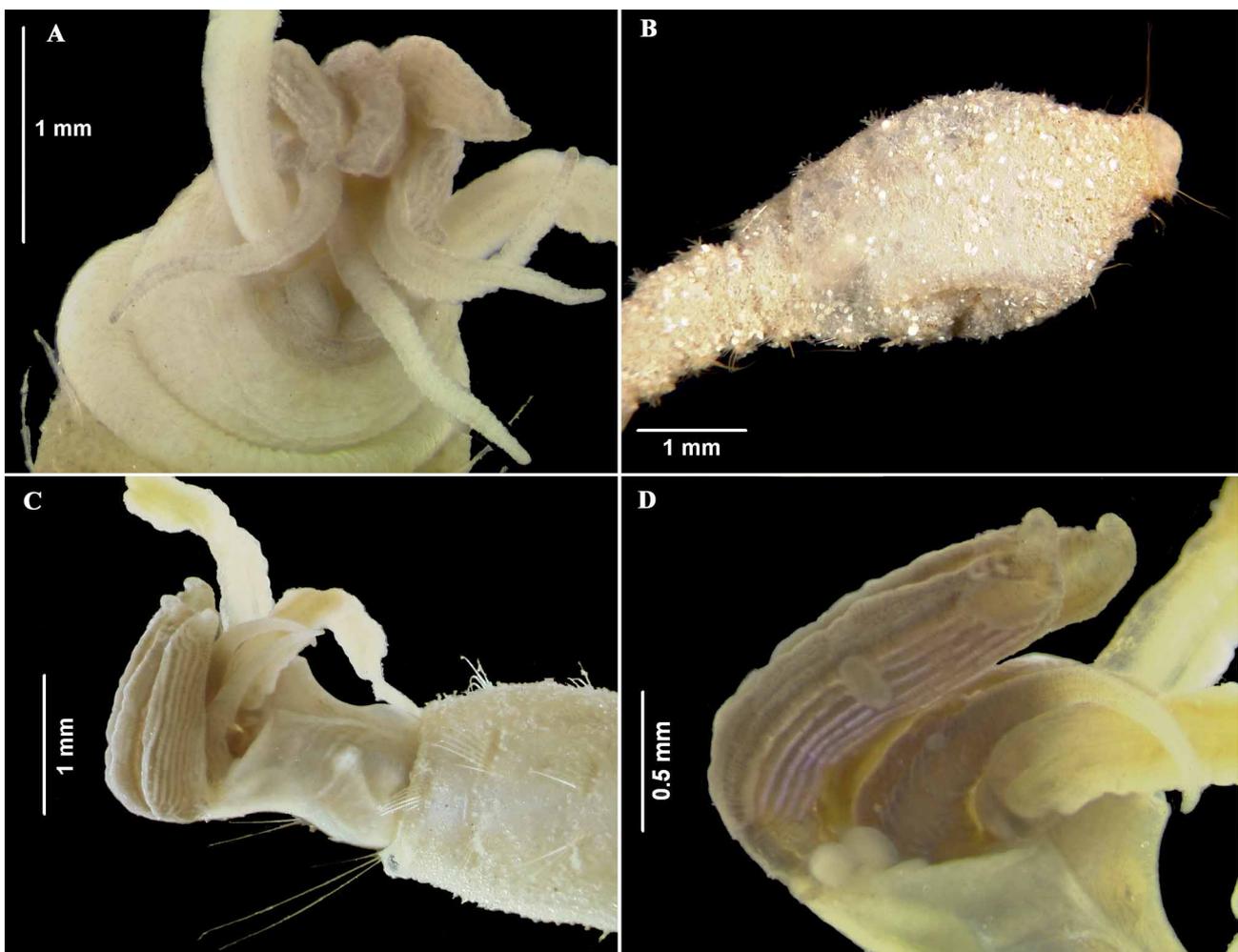


FIGURE 3. A. *Diplocirrus stopbowitzi* sp. nov., holotype (NMWZ.2008.059.0001) showing branchiae, palps and mouth region protruding from cephalic sheath; B. *Diplocirrus incognitus* sp., holotype (BMNH.1961.19.694), dorsal view; C, *Diplocirrus glaucus* (NMWZ.2008.059.0004), head region, right lateral view, all branchiae attached; D, *Diplocirrus glaucus*, close-up view, outer cirriform and dorsolateral stout branchiae removed.

Diplocirrus incognitus sp. nov.

Figures 3B, 4; Table 1

Material Examined. South coast of the Cape Province, Sta. SCD 187 (34°10'S, 023°32'E), green mud, 97 m, holotype (BMNH.1961.19.694), 5 paratypes (BMNH.1961.19.695/700), 30 Nov 1960.

Description. Holotype incomplete, 2.5 mm wide anteriorly, 13.0 mm long with 36 chaetigers. Incomplete paratypes with 11–18 chaetigers, length to 6.6 mm, anterior width to 2.5 mm.

Body shape arenicoliform, with swollen anterior region (Fig. 3B, 4A). Segmental boundaries not clear anteriorly but becoming more apparent from about chaetiger 8 as anterior end tapers, becoming moniliform posteriorly. Body oval in cross-section, flattened as body tapers. Epidermis densely covered with encrusting sand grains and sparse papillae giving body pale brown color.

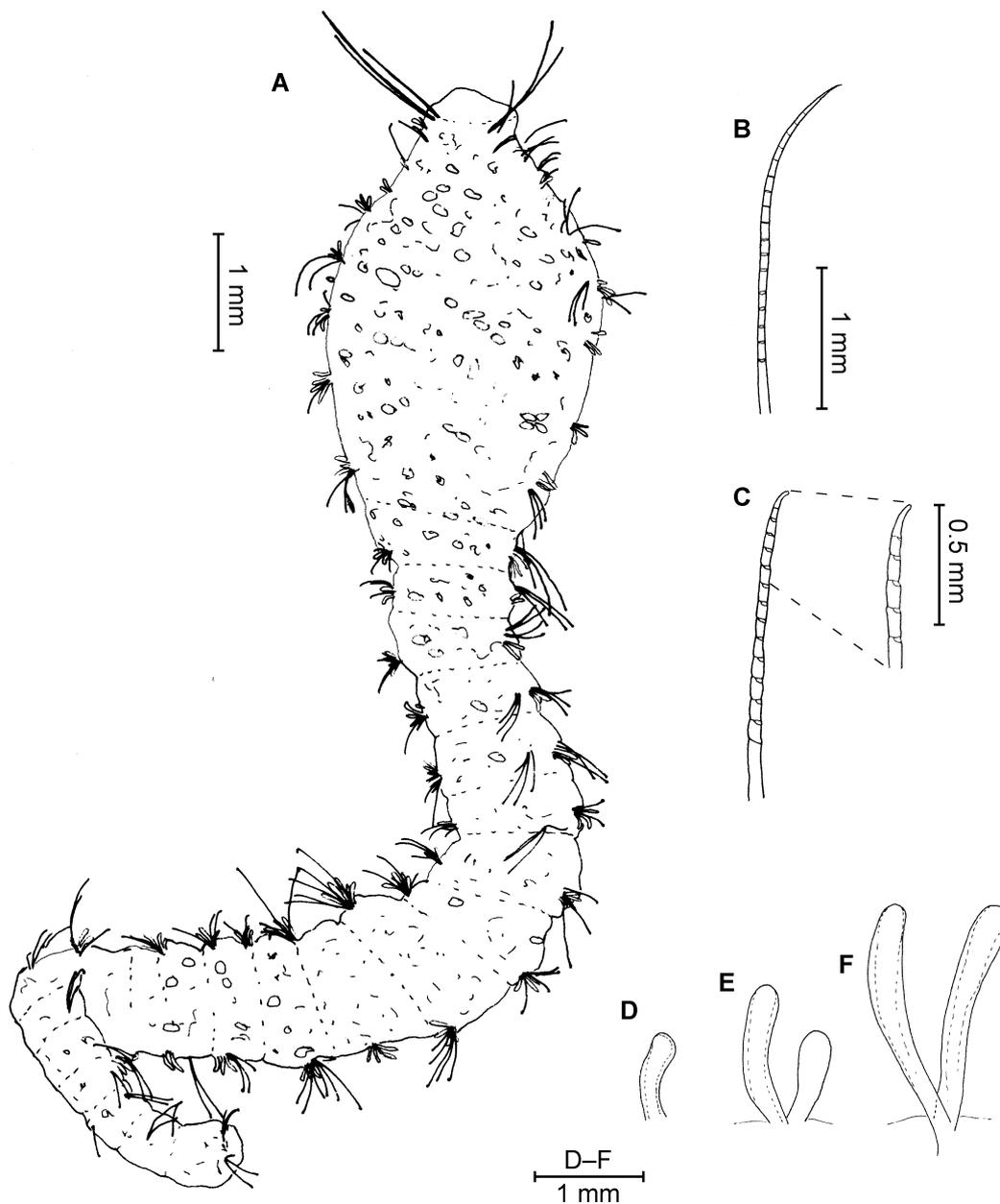


FIGURE 4. *Diplocirrus incognitus* sp. nov. (BMNH.1961.19.694) A, whole animal, dorsal view; B, notochaeta, posterior view; C, neurochaeta, posterior view, with enlargement of tip; D, epidermal papilla, anterior; E, notochaetal papillae, chaetiger 6; F, notochaetal papillae, posterior chaetiger.

Cephalic cage present, comprising 2–3 elongated notopodial capillaries of chaetiger 1 only. Elongated notochaetae at least three times as long as notochaetae of chaetiger 2 and subsequent chaetigers. Neuropodial capillaries on chaetiger 1 not elongated. No expanded cephalic sheath apparent anterior to chaetiger 1. Podial lobes absent. Notochaetae multiarticulate, smoothly tapering capillaries (Fig. 4B). Neurochaetae multiarticulate, shorter and slightly stouter than notochaetae with tip that curves over to form a minute, blunt hook (Fig. 4C). Anterior chaetigers have 3–6 notochaetae, increasing up to ten notochaetae at start of tail region in larger specimens, and 6–7 neurochaetae reduced to 5–6 neurochaetae posteriorly.

Digitiform papillae randomly distributed over entire epidermis (Fig. 4D), elongating slightly along length of body. Clusters of up to 8–10 elongated papillae, up to six times length of body papillae, occur around notochaetae (Fig. 4E–F). A smaller, shorter (up to three times length of body papillae) cluster of 2–3 papillae surround neurochaetae. Silt and sand grains adhere to epidermis but not particularly to papillae.

Head retracted requiring dissection; comprises ventral mouth, pair of centrolateral palps and eight very dark, ciliated branchiae. Branchiae arranged as a row of four distal filaments around outer margin of branchial plate plus two proximal groups, each of two filaments, located either side of a prostomial ridge (as in Fig. 2A). Distal and proximal groups separated by two rounded lobes. Two different forms of branchiae present. Distal filaments stout, wedge-shaped with ciliated longitudinal ridges. Position of outer pair inverted relative to middle pair. Upper surface of middle pair and corresponding lower, concave surface of outer pair without ridges. Transverse ciliated pad on both faces of middle pair but only inner face of outer pair. Proximal filaments cirriform with transverse ciliated bands.

Pygidium unknown.

Etymology. The name is from the Latin *incognitus* meaning “unexamined, unknown” referring to its previously unrecognized status.

Habitat. The recorded habitat is a single station, described as green mud, 97 m, off the south coast of the Cape Province.

Remarks. *Diplocirrus incognitus* sp. nov. is morphologically most similar to *D. glaucus*. The two species can be distinguished by examination of the clusters of elongated papillae around the chaetae. *Diplocirrus incognitus* sp. nov. has a cluster of 8–10 papillae, up to six times the length of the body papillae, around the notochaetae compared to approximately five papillae, up to four times the length of the other papillae, around the notochaetae of *D. glaucus*. Additionally, 2–3 elongated papillae are also apparent around the neurochaetae of *D. incognitus* sp. nov. but not the neurochaetae of *D. glaucus* (although occasionally one or two longer papillae may occur, it is not a common feature).

Discussion

Diplocirrus previously contained seven species, most described with two different forms of branchiae. *Diplocirrus capensis* was the only *Diplocirrus* species that lacked a cephalic cage and had hooked neurochaetae, and was described as having only a single branchial type. The generic description of *Diplocirrus* was emended for these characters by Day (1961), specifically to include *D. capensis* within the genus. This change led to the inclusion of *D. octobranchus* (Hartman, 1965), formerly placed in *Ilyphagus*. *Diplocirrus octobranchus* also had a single branchial type although a cephalic cage was formed by the chaetae of the first segment and the neurochaetae were finely tipped, not hooked.

Diversibranchius is monotypic for the species *D. nicolaji* Buzhinskaja, 1994. This species, from the Sea of Japan, has no cephalic cage, two different branchial forms, and hooked neurochaetae very much like those of *D. capensis*, *D. stopbowitzi* sp. nov., and *D. incognitus* sp. nov. Both branchial forms, however, were described as having a unique form with folds of fused gill filaments and hillocks on the upper surface. *Bradiella branchiata* Rullier, 1965 is the only other species described with a branchial structure involving fused lamellae similar to that of *Diversibranchius*. Such structures are absent from any of the branchiae known for *Diplocirrus* species. *Diversibranchius nicolaji* is also described as having simple, striated capillaries in both rami in addition to the multiarticulate noto- and neurochaetae. This character separates it from both *Bradiella* and *Diplocirrus* species which have only multiarticulated chaetae. However, Salazar-Vallejo et al. (2008) considered *Diversibranchius* a possible synonym of *Bradiella* on the basis of a molecular analysis of flabelligerid genera.

Another species, *Diplocirrus* cf. *capensis* from Moreton Bay (Queensland, Australia), was mentioned both by Spies (1975) and Buzhinskaja (1994). This species differs from the *D. capensis* of Day in the branchial structure, which is more akin to that described for *Bradiella* and *Diversibranchius*, and this, together with the branchial arrangement figured (Spies 1975: fig. 7) also differ from the species of *Diplocirrus* examined here. Buzhinskaja suggested that *D. cf. capensis* belonged in a separate genus of its own. The branchial structure would appear to place *Diversibranchius* and *D. cf. capensis* closer together than to any other species.

Diplocirrus stopbowitzi sp. nov. has been placed in *Diplocirrus* on the basis of its affinity to *D. capensis*. Observation of the holotype of *D. capensis* determined that the branchiae, previously described as being all cirriform, were, in fact, of the same two types, stout and cirriform, as found in the other *Diplocirrus* species described here. Live collection of good quality specimens of both *D. stopbowitzi* sp. nov. and *D. glaucus* in September 2008 aided the description of *Diplocirrus* branchiae as the bands of cilia on, and the arrangement of, the different branchiae were visible and clear. Careful relaxation and fixation of specimens preserved these bands for later observation.

One striking difference between *D. stopbowitzi* sp. nov., *D. capensis*, and *D. octobranchus* and the other *Diplocirrus* species is the lack of encrusting sand grains on the body wall. Instead, fine silt/clay adheres to the papillae but not to the epidermis.

The description of *D. incognitus* sp. nov. apparently adds a third species to the genus *Diplocirrus* to exhibit the character of hooked neurochaetae and would make it the only species with both hooked neurochaetae and a cephalic cage. However, a reexamination of *D. glaucus*, including material from the type locality in the Koster area of Sweden (NMWZ.1986.108; NMWZ.1989.125), has now revealed that the neurochaetae of the latter species are also bluntly hooked. Similarly, the neurochaetae of a single specimen of *D. hirsutus* (NMWZ.1987.067.0951) were also found to share this character. Such observations now cast doubt on the description of the neurochaetae of other *Diplocirrus* species and this character will require re-assessment before being used to distinguish species of this genus.

Initial observations place *D. stopbowitzi* sp. nov. and *D. capensis* with each other primarily due to the “globular” appearance of the silt-covered papillae and the absence of a cephalic cage. On closer inspection, elongated papillae cluster around the notochoetae of *D. capensis* but are absent from *D. stopbowitzi* sp. nov. Encrusting sand grains and a cephalic cage on both *D. incognitus* sp. nov. and *D. glaucus* give these two species a similar initial appearance. Close inspection of the branchiae and elongated papillae clustered around the chaetae is necessary though, to distinguish these two species.

It is difficult to make a comparison of any of the *Diplocirrus* species with *D. erythroporus* due to the minimal description of the latter in the literature. Gallardo (1968) made no mention of the

presence or absence of a cephalic cage or of any encrusting sediment particles. However, the description states only six pairs of branchiae (four broad, two cirriform), which immediately distinguishes *D. erythroporus* from the other species. Al-Hakim & Glasby (2004) added no further details to the description, stating that their specimens matched Gallardo's description well.

Table 1 compares the main identifying features within *Diplocirrus* and additionally includes *Diversibranchius* and *Bradiella*. The introduction of the two new species, *D. stopbowitzi* and *D. incognitus*, shows that the characters of cephalic cage presence or absence, neurochaetal structure, and distribution of epidermal papillae are variable and appear independently within the genus. The branchial structure, however, may be more defining and consistent within the genus although investigation of other *Diplocirrus* species will be necessary to confirm this. Branchial structure is the primary characteristic separating *Diplocirrus* from *Bradiella* and *Diversibranchius*.

Acknowledgements

Thanks are due to the masters and crews of the research vessels we have used over the years for our surveys (R.V. *Prince Madog* [new and old] & R.V. *Celtic Voyager*) and those who have helped us in the sampling work and later sorting of samples in the laboratory. Funding was provided by Amgueddfa Cymru—National Museum Wales for all work with additional project-specific funding provided by Countryside Council for Wales (Welsh Sandbanks Survey) and EU-INTERREG Ireland-Wales (SWISS & HABMAP projects). For the loan of specimens thanks are due to Emma Sherlock at the Natural History Museum, London, and Wayne Florence and Elizabeth Hoenson at the Iziko South African Museum, Cape Town. Also, thanks to Roger Bamber and Dylan Clarke for their help in obtaining specimens.

References

- Al-Hakim, I. & Glasby, C.J. (2004) Polychaeta (Annelida) of the Natuna Islands, South China Sea. *The Raffles Bulletin of Zoology*, 11, 25–45.
- Buzhinskaja, G.N. (1994) *Diversibranchius nicolaji* gen. et sp. n. from the Sea of Japan with unique branchial structure (Polychaeta: Flabelligeridae). *Zoosystematica Rossica*, 2, 229–231.
- Chiaje, S. Delle (1830) *Memorie su la storia e notomia degli animali senza vertebre del regno di Napoli, Volume IV*. Societa Tipografica, Napoli, pp. 1–116.
- Darbyshire, T., Mackie, A.S.Y., May, S.J. & Rostron, D. (2002) *A macrofaunal survey of Welsh sandbanks*. Countryside Council for Wales *CCW Report*, 539, 1–113.
- Day, J.H. (1961) The polychaet fauna of South Africa. Part 6. Sedentary species dredged off Cape coasts with a few new records from the shore. *Journal of the Linnean Society of London, Zoology*, 44(299), 463–560.
- Day, J.H. (1963) The polychaete fauna of South Africa. Part 8. New species and records from grab samples and dredgings. *Bulletin of the British Museum (Natural History), Zoology*, 10(7), 383–445.
- Day, J.H. (1967) *A monograph on the Polychaeta of Southern Africa. Part I. Errantia; Part II. Sedentaria*. British Museum (Natural History), London, Publication no. 656, 1–878.
- Day J.H. (1973) New Polychaeta from Beaufort, with a key to all species recorded from North Carolina. *NOAA Technical Report of the National Marine Fisheries Service, Circular*, 375, 1–153.
- 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.
- Gallardo, V.A. (1968) Polychaeta from the Bay of Nha Trang, South Viet Nam. *Naga Report*, 4(3), 35–279.
- Gibbs, P.E. (1971) The Polychaete fauna of the Solomon Islands. *Bulletin of the British Museum (Natural History)*,

Zoology, 21 (5), 99–211.

- Haase, P. (1915) Boreale und arktische Chloraemiden. *Wissenschaftliche Meeresuntersuchungen der Kommission zur Wissenschaften Untersuchung der Deutschen Meere, Abteilung Kiel, Neue Folge*, 17, 169–228, pls 1–2.
- Hansen, G.A. (1879) Annelider fra den norske Nordhavsexpedition i 1876. *Nyt Magazin Naturvidenskaberne Christiania*, 24, 1–17, pls 1–10.
- Hartman, O. (1965) Deep-water benthic polychaetous annelids off New England to Bermuda and other North Atlantic areas. *Allan Hancock Foundation Publications Occasional Papers*, 28, 1–378.
- Mackie, A.S.Y. & Oliver, P.G. (1996) Marine macrofauna: polychaetes, molluscs and crustaceans. In: Hall, G. S. (Ed.), *Methods for the examination of organismal diversity in soils and sediments*. CAB International, Wallingford, 263–284.
- Mackie, A.S.Y., Oliver, P.G. & Rees, E.I.S. (1995) Benthic biodiversity in the southern Irish Sea. *Studies in Marine Biodiversity and Systematics from the National Museum of Wales. BIOMÔR Reports*, 1, 1–263.
- Mackie, A.S.Y., James, J.W.C., Rees, E.I.S., Darbyshire, T., Philpott, S.L., Mortimer, K., Jenkins, G.O. & Morando, A. (2006) The Outer Bristol Channel Marine Habitat Study. *Studies in Marine Biodiversity and Systematics from the National Museum of Wales. BIOMÔR Reports*, 4, 1–249 + Appendix, 1–228, + Data facility/interactive DVD (2007).
- Malmgren, A.J. (1867) Annulata polychaeta Spetsbergiae, Grönlandiae, Islandiae et Scandinaviae hactenus cognita. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar, Stockholm*, 24 (4), 127–235.
- Marenzeller, E. von (1890) Annulaten des Beringsmeeres. *Annalen des Naturhistorischen Hofmuseums Wien*, 5, 1–18.
- Milligan, M.R. (1984) Family Flabelligeridae. In Uebelacker, J.M. & Johnson, P.G. (eds), *Taxonomic guide to the polychaetes of the northern Gulf of Mexico*. Final report to the Minerals Management Service, contract 14-12-001-29091. Barry A. Vittor & Associates, Mobile, Alabama, 47, 1–20.
- Oken, L. (1807) *Göttingische gelehrte Anzeigen*, 2 (117), 1161–1168.
- Robinson, K., Darbyshire, T., Van Landeghem, K., Lindenbaum, C., McBreen, F., Creaven, S., Ramsay, K., Mackie, A.S.Y., Mitchell, N.C., Wheeler, A., Wilson, J.G. & O'Beirn, F. (2009) Habitat mapping for conservation and management of the Southern Irish Sea (HABMAP). I: Seabed surveys. *Studies in Marine Biodiversity and Systematics from the National Museum of Wales. BIOMÔR Reports*, 5 (1), 1–234.
- Rullier, F. (1965) Contribution à la faune des annélides polychètes de l'Australie. *Papers, Department of Zoology, University of Queensland*, 2(9), 163–201.
- Salazar-Vallejo, S.I., Carrera-Parra, L.F. & Fauchald, K. (2008) Phylogenetic affinities of the Flabelligeridae (Annelida, Polychaeta). *Journal of Zoological Systematics and Evolutionary Research*, 46(3), 203–215.
- Spies, R.B. (1975) Structure and function of the head in flabelligerid polychaetes. *Journal of Morphology*, 147, 187–208.
- Støp-Bowitz, C. (1948) Les flabelligériens norvégiens. *Bergens Museums Årbok 1946–47, Naturvitenskapelig rekke*, 2, 1–59.
- Wilson, J.G., Mackie, A.S.Y., O'Connor, B.D.S., Rees, E.I.S. & Darbyshire, T. (2001) Benthic biodiversity in the southern Irish Sea 2. The South-West Irish Sea Survey. *Studies in Marine Biodiversity and Systematics from the National Museum of Wales. BIOMÔR Reports*, 2(1), 1–143.