

Paraonidae (Annelida: Polychaeta) of the inlet of Zarautz (Basque Coast, Bay of Biscay), with new records from the Atlantic and the Iberian Coasts

Florencio AGUIRREZABALAGA^{1,2} and João GIL³

(¹) EHU/UPV Donostiako Irakasleen Eskola, Oñati plaza 3, 20018 Donostia, Spain

(²) S.C. INSUB, Zemoría 12, Apdo 3223, 20013 Donostia. E-mail: p.agirrezabalaga@ehu.es

(³) Centre d'Estudis Avançats de Blanes (C.S.I.C.), Carrer d'accés a la Cala Sant Francesc, 14, E-17300 Blanes (Girona), Spain. E-mail: gil@ceab.csic.es

Abstract: Numerous polychetes (7132 individuals) belonging to the family Paraonidae (Annelida: Polychaeta) were collected in sublittoral (7 to 50 m depth) sandy and muddy-sand bottoms of the inlet of Zarautz (Basque coast, Bay of Biscay, NE Atlantic). Eleven species belonging to 4 genera *Levinsenia*, *Cirrophorus*, *Paradoneis* and *Aricidea* were identified. Among them, *Paradoneis ilvana* Castelli, 1985 and *Aricidea pseudoarticulata* Hobson, 1972 are new records for the Atlantic and East Atlantic waters, respectively; *Aricidea laubieri* Hartley, 1981 and *Aricidea roberti* Hartley, 1984 are new records for the Iberian Coasts. Also, *A. fragilis mediterranea* Laubier & Ramos (1974) is considered a junior synonym of *A. pseudoarticulata*.

Resumé : *Paraonidae* (Annelida : Polychaeta) de l'anse de Zarautz (Côte Basque, Golfe de Gascogne), nouveaux signalements pour l'Atlantique et les côtes Ibériques. De nombreux polychètes (7132 exemplaires) appartenant à la famille des Paraonidae (Annelida : Polychaeta) ont été collectés sur les fonds meubles sableux et sablo-vaseux de l'étage sublittoral (7 à 50 m de profondeur) de l'anse de Zarautz (Côte Basque, Golfe de Gascogne, Atlantique NE). Onze espèces appartenant aux quatre genres *Levinsenia*, *Cirrophorus*, *Paradoneis* et *Aricidea* ont été identifiées. Parmi elles, les espèces *Paradoneis ilvana* Castelli, 1985 et *Aricidea pseudoarticulata* Hobson, 1972 sont de nouveaux signalements pour l'Océan Atlantique et l'Atlantique Est, respectivement; *Aricidea laubieri* Hartley, 1981 et *Aricidea roberti* Hartley, 1984 sont de nouveaux signalements pour les côtes ibériques. Par ailleurs, *A. fragilis mediterranea* Laubier & Ramos (1974) est considéré comme le synonyme récent de *A. pseudoarticulata*.

Keywords: Polychaeta • Paraonidae • *Paradoneis* • *Aricidea* • New records • Iberian Peninsula • Bay of Biscay • NE Atlantic

Introduction

Paraonidae is a relatively small family of polychaetes widely distributed on all kinds of soft bottom areas. Because they are more abundant on the continental shelf and in bathyal areas than in shallow water, little is known about them (Rouse & Pleijel, 2001). In recent years, the number of known species has increased, mainly due to the use of finer mesh screens and the increasing number of research projects at shelf and slope depths (Blake, 1996). Currently, about a hundred species are distinguished, belonging to seven genera.

From 1988 to 1990, an extensive study on the sublittoral (7 to 50 m depth) soft bottom macrobenthic communities of the inlet of Zarautz (Gipuzkoa) was performed. The studied area extends between the mouth of River Oría eastward, and the Mount San Anton westward. Sandy and muddy-sand sediments are predominant in the area, and hydrodynamism is the main factor that drives composition and structure of the macrobenthic communities.

In this study a great number of paraonid polychetes belonging to 4 genera and 11 species were collected, some of them being new records for the Atlantic and for Iberian coasts.

Material and Methods

Between 1988 and 1990, an extensive study on the sublittoral soft bottom macrobenthic communities of the inlet of Zarautz (Gipuzkoa, Bay of Biscay) was carried out. From August 1988 to July 1989, samples were taken three-monthly at 26 stations distributed on 7 transects (M1-M7)

perpendicular to the coast line and situated at 7, 15, 25, 35 and 50 m depth; during 1990, each month and a half, on the transect M4 (Z) (Fig. 1). Samples were taken using a Van Veen grab of 0.1m² surface area and sieved through screens of 1 mm (samples of 1988 and 1989, M1-7 transects) and of 0.5 mm mesh size (samples of 1990, Z transect). For more details on sampling stations, location and methodology, see Aguirrezabalaga et al. (2000).

Results

FAMILY PARAONIDAE Cerruti, 1909

Genus *Levinsenia* Mesnil, 1897

Levinsenia gracilis (Tauber, 1879)

Aonides gracilis Tauber, 1879: 115. *Levinsenia gracilis* Hartley, 1981: 146.

Material examined.

Only few individuals of this cosmopolitan and eurybathic species have been collected in the studied area: 5 individuals collected in M1 to M7 transects (35 m: 3 ind.; 50m: 2 ind.); 2 individuals on the Z (M4) transect, at 50 m.

Distribution

Cosmopolitan (Atlantic, Pacific, Indian, Arctic, Mediterranean...).

Genus *Cirrophorus* Ehlers, 1908

Cirrophorus branchiatus Ehlers, 1908

Cirrophorus branchiatus Ehlers, 1908: 124-126, figs 5-9.

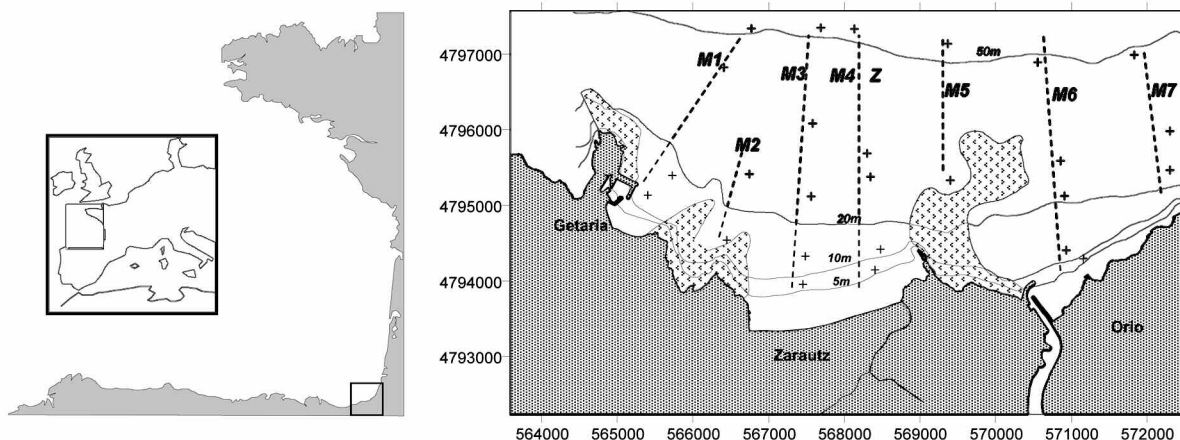


Figure 1. Location of sampling stations.

Figure 1. Localisation géographique des stations d'échantillonnage.

Material examined

Only one individual collected in M1 to M7 transects, at 50 m.

Distribution

Atlantic, Pacific, Mediterranean, Adriatic, Sea of Japan, Red Sea.

Genus *Paradoneis* Hartman, 1965

Paradoneis armata Glémarec, 1966

Paradoneis armata Glémarec, 1966: 1046-1049, figs 1B-C; 2A-C.

Material examined

1814 individuals collected on transects M1 to M7 (7 m: 104 ind.; 15 m: 238 ind.; 25 m: 891 ind.; 35 m: 561 ind.; 50 m: 7 ind.); 1889 individuals on Z (M4) transect, at 15 m (14 ind.), 25 m (1170 ind.), 35 m (701 ind.) and 50 m (4 ind.) depth. This is the most abundant species in the studied area.

Distribution

Northeast Atlantic (to 1200 m), Mediterranean (10-180 m).

Paradoneis ilvana Castelli, 1985

(Figs 2-3 & 6A-B)

Paradoneis ilvana Castelli, 1985: 273-275, figs 3B, E & 4. Tena et al., 1991: 36, fig.4, table 1.

Material examined

250 individuals collected on transects M1 to M7 (25 m: 1 ind.; 35 m: 60 ind.; 50 m: 189 ind.) ; 472 individuals on Z (M4) transect, at 35 m (66 ind.) and 50 m (406 ind.) depth.

Description

A complete individual 10.1 mm long, 0.21 mm maximum width (in branchial region) and with 78 chaetigers.

Prostomium triangular, longer than wide (Figs 2A & 6A). Pair of deep nuchal slits at base of prostomium. Eyes and median antenna absent. Posterior buccal lip formed by several longitudinal folds on chaetiger 1 (Fig. 2B).

11-13 pairs of branchiae starting from chaetiger 4. Branchiae cirriform, rounded distally, with maximum length a little shorter than the interbranchial distance (Fig. 2A).

Notopodial postchaetal lobes short, rounded in prebranchial and branchial regions (Figs 2A & 6A), becoming longer, conical to triangular in postbranchial region (Fig. 3A, B), and long and filiform in posteriormost chaetigers (Fig. 2C). Neuropodial postchaetal lobes absent.

Capillary and lyriform notochaetae. First lyriform

notochaeta present in chaetiger 5, these notochaetae numbering 2-3 per bundle, then and 1-2 in branchial and postbranchial regions, respectively. Tines of lyriform notochaetae of unequal length and with inner sides spinous, of similar thickness in branchial region (Fig. 3C) and of unequal thickness in postbranchial region (Figs 3D & 6B), with the thicker tine as an extension of the shaft and the thinner one as a lateral branch of the shaft.

Neurochaetae all capillaries, those of the postbranchial region long and slender.

Pygidium with one median ventral cirrus and a pair of ventrolateral cirri, long, similar in size to notopodial postchaetal lobes of last chaetigers (Fig. 2C).

Remarks

Paradoneis ilvana was distinguished from *P. lyra* (Southern, 1914) mainly by: (1) the shape of the postbranchial lyriform notochaetae with tines of similar thickness in *P. lyra* and of unequal thickness in *P. ilvana*, (2) the absence of notopodial postchaetal lobes in prebranchial chaetigers in *P. ilvana* and (3) the difference in size of the branchial notopodial postchaetal lobes, short and rounded in *P. ilvana*, longer and digitiform in *P. lyra* (Mackie, 1991).

Our specimens agree with the descriptions of Castelli (1985) and Tena et al. (1991), except by the absence of eyes and the presence of notopodial postchaetal lobes in prebranchial chaetigers. Revised type material loaned by A. Castelli as our specimens also showed short and rounded postchaetal lobes in the first three chaetigers.

Individuals from Galicia, loaned by S. Parra and I. Frutos, and identified as *P. lyra*, have the same characteristics as our specimens and are here referred to *P. ilvana*. Probably, most of individuals collected in littoral samples of the Iberian Atlantic coasts and identified as *P. lyra* belong to *P. ilvana*.

Distribution

Mediterranean (Elba Island, Valencia), Northeast Atlantic: Basque coast (Bay of Biscay), Galicia. This is the first record of the species from Atlantic waters.

Genus *Aricidea* Webster, 1879

Subgenus *Aricidea* sensu stricto

Aricidea (Aricidea) pseudoarticulata Hobson, 1972

(Figs 4-5, 6C-D & 7A-B)

Aricidea pseudoarticulata Hobson, 1972: 550-552, fig. 1B-H. *Aricidea* cf. *pseudoarticulata*: Gaston, 1984: 2-13 to 2-15, figs 2-10. *Aricidea (Aricidea) pseudoarticulata*: Blake, 1996: 45-46, figs 2.8A-G. *Aricidea fragilis mediterranea*: Laubier & Ramos, 1974 [in part]: 1113-1116, fig. 6A-C, F.

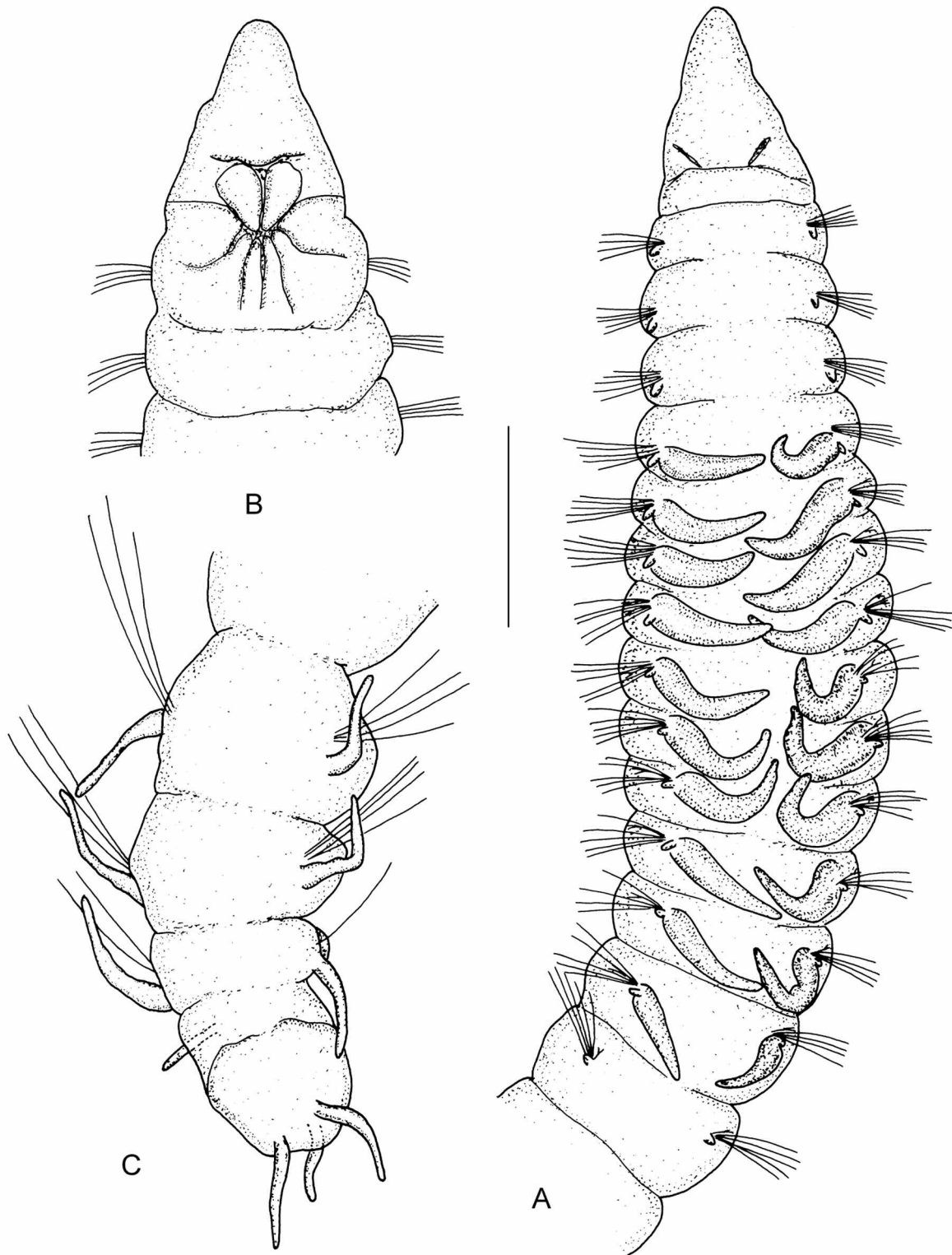


Figure 2. *Paradoneis ilvana*. **A.** Anterior region, dorsal view. **B.** Anterior end, ventral view. **C.** Posterior end, dorsal view. Scale: A = 200 μm ; B = 67 μm ; C = 100 μm .

Figure 2. *Paradoneis ilvana*. **A.** Région antérieure, vue dorsale. **B.** Région antérieure, vue ventrale. **C.** Région postérieure, vue dorsale. Échelle : A = 200 μm ; B = 67 μm ; C = 100 μm .

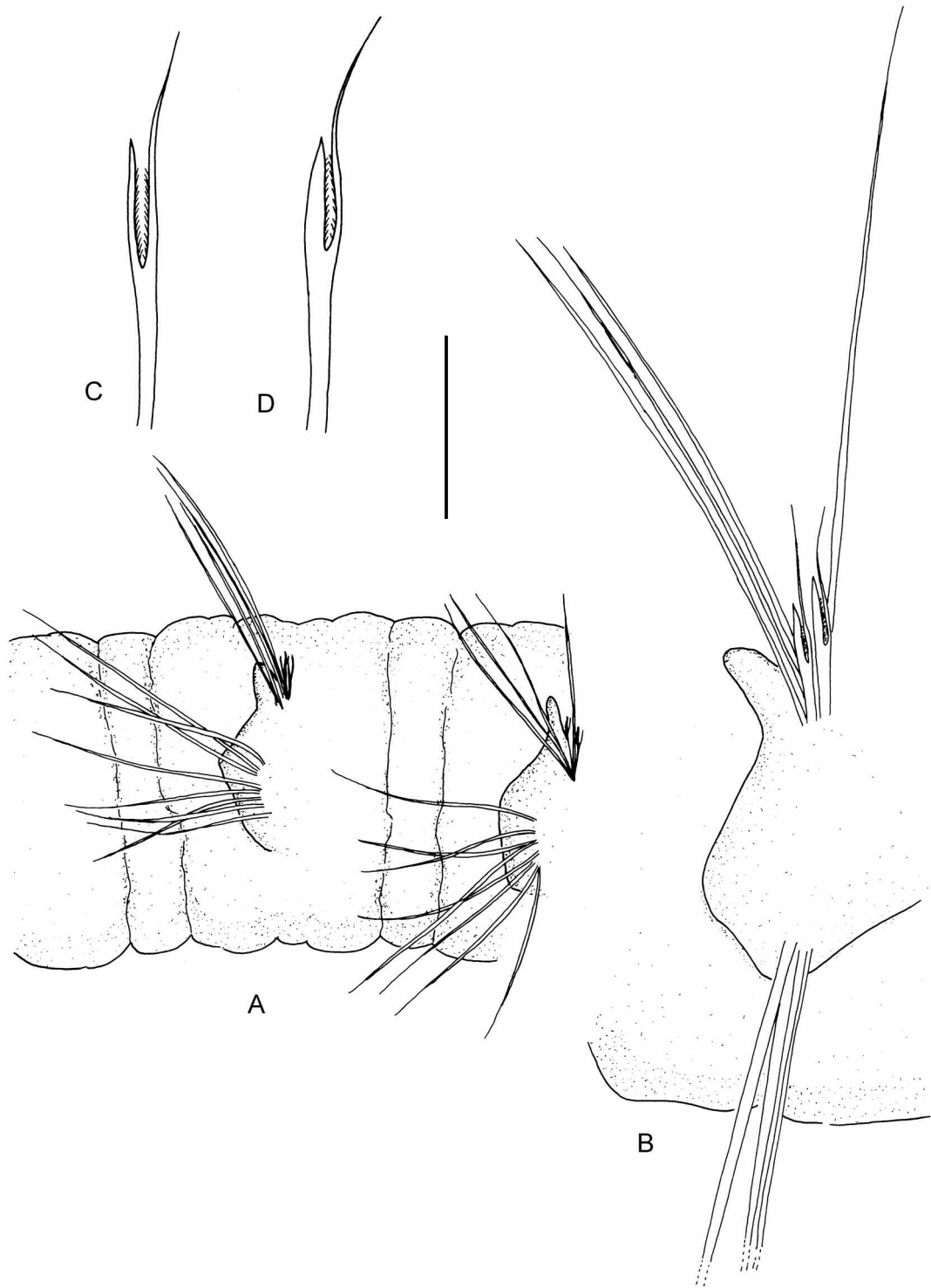


Figure 3. *Paradoneis ilvana*. **A.** Chaetigers 30 and 31, lateral view. **B.** Part of chaetiger 32, lateral view. **C.** Lyriform chaeta of branchial region. **D.** Lyriform chaeta of postbranchial region. Scale: A = 100 μ m; B = 40 μ m; C, D = 20 μ m.

Figure 3. *Paradoneis ilvana*. **A.** Sétigères 30 et 31, vue latérale. **B.** Une partie du sétigère 32, vue latérale. **C.** Soie lyriforme de la région branchiale. **D.** Soie lyriforme de la région postbranchiale. Échelle : A = 100 μ m ; B = 40 μ m ; C, D = 20 μ m.

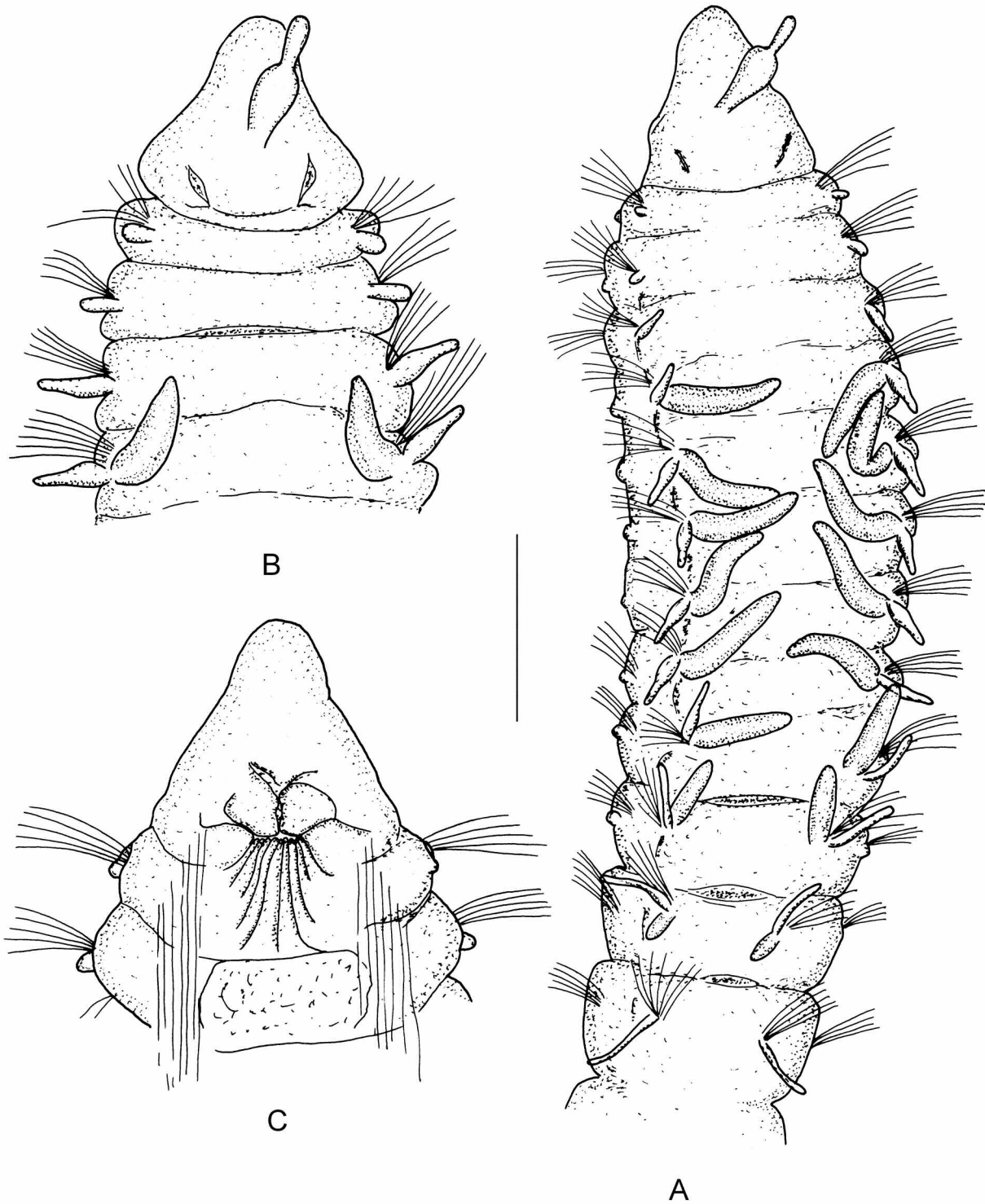


Figure 4. *Aricidea pseudoarticulata*. **A.** Anterior region, dorsal view. **B.** Anterior end, dorsal view. **C.** Anterior end, ventral view. Scale: A-C = 150 μ m.

Figure 4. *Aricidea pseudoarticulata*. **A.** Région antérieure, vue dorsale. **B.** Région antérieure, vue dorsale. **C.** Région antérieure, vue ventrale. Échelle : A-C = 150 μ m.

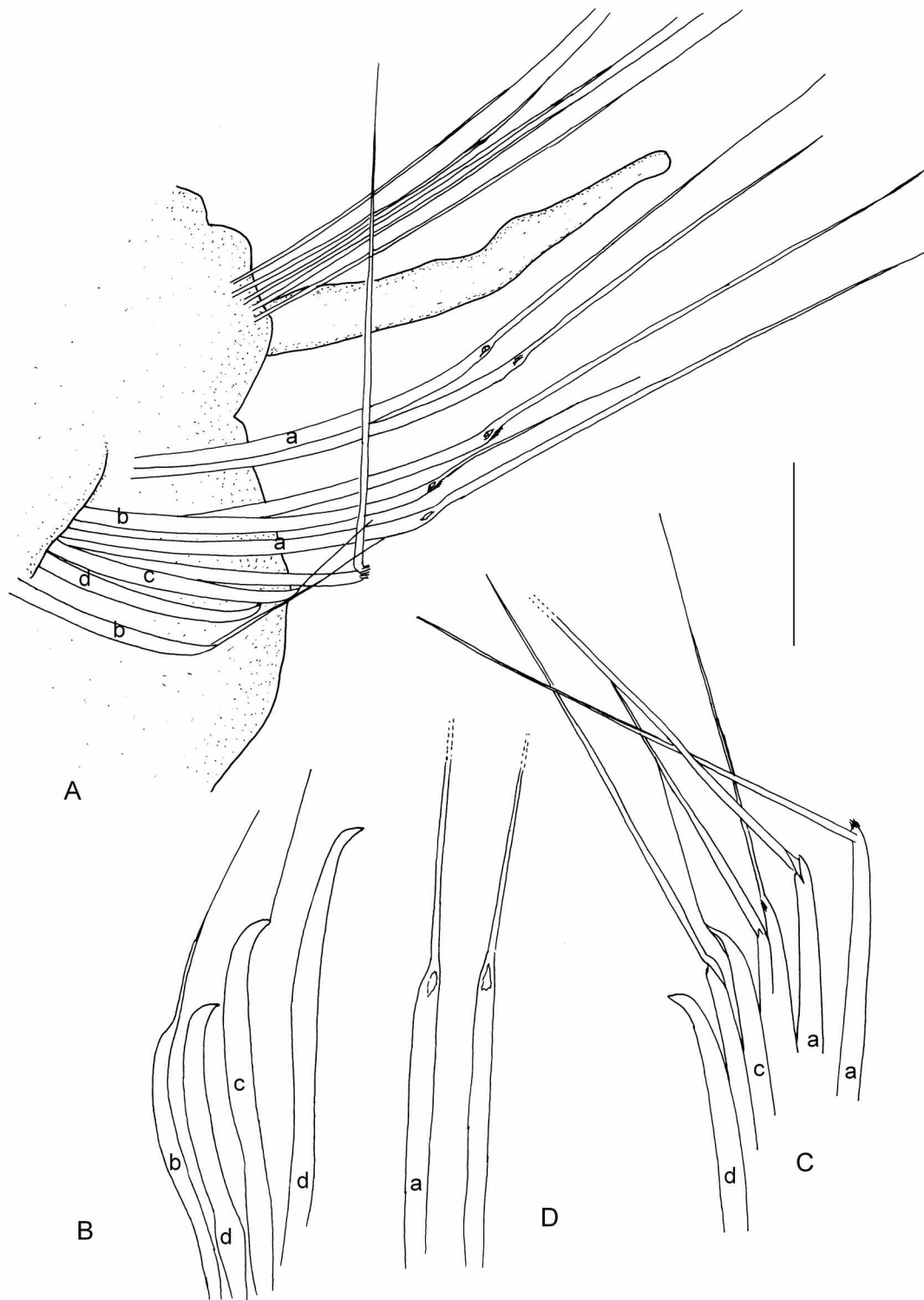


Figure 5. *Aricidea pseudoarticulata*. **A.** Chaetiger 49, lateral view. **B & C.** Modified neurochaetae. **D.** Pseudoarticulate modified neurochaetae, in frontal view. Scale: A = 100 μ m; B-D = 25 μ m.

Figure 5. *Aricidea pseudoarticulata*. **A.** Sétigère 49, vue latérale. **B & C.** Soie ventrale modifiée. **D.** Soie ventrale modifiée pseudo-articulée, vue frontale. Échelle : A = 100 μ m ; B-D = 25 μ m.

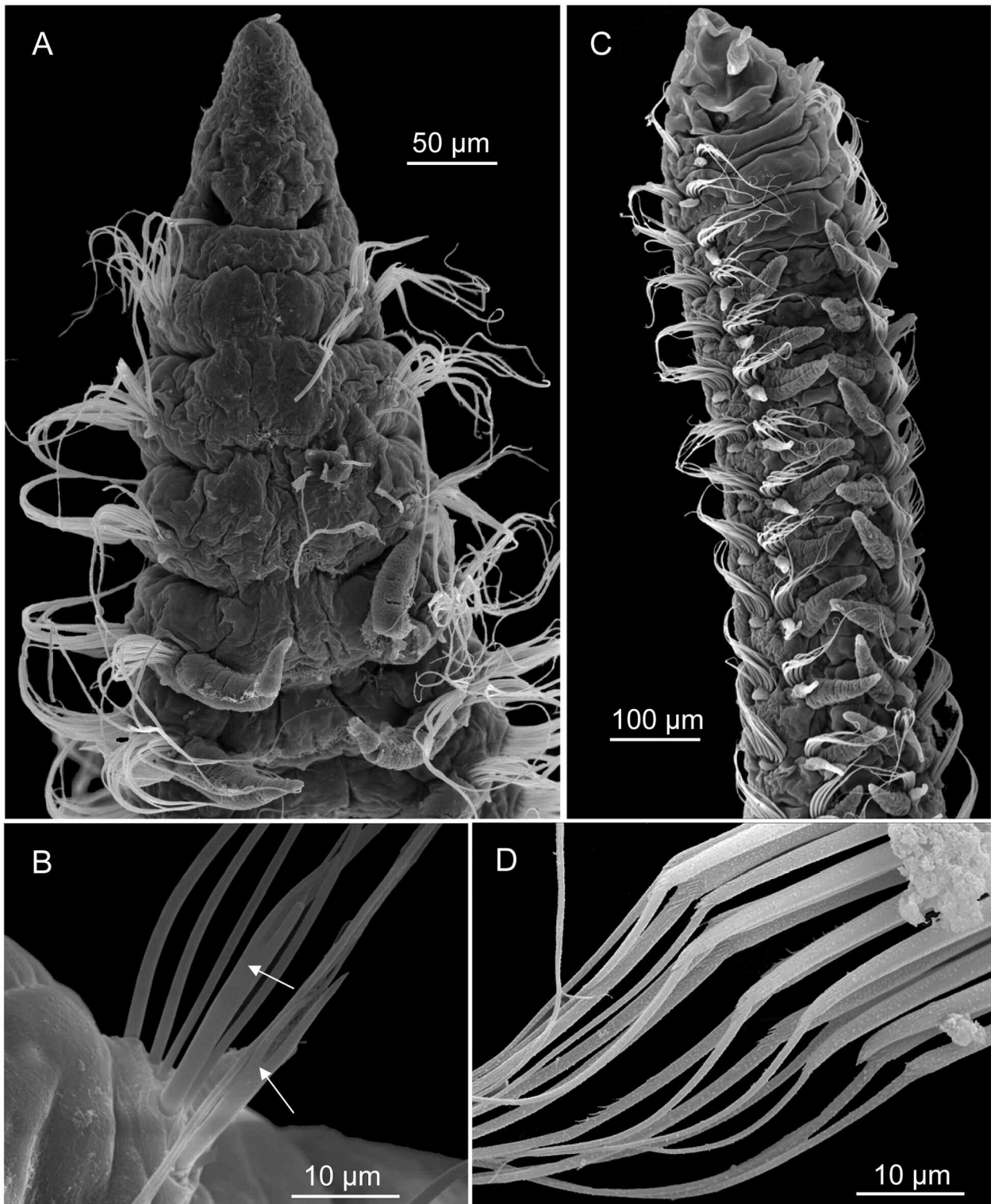


Figure 6. *Paradoneis ilvana*. **A.** Anterior region, dorsal view. **B.** Lyriform chaetae (arrows) of a postbranchial chaetiger. *Aricidea pseudoarticulata*. **C.** Anterior region, dorsal view. **D.** Modified neurochaetae. Scale: A = 50 µm; B, D = 10 µm; C = 100 µm.

Figure 6. *Paradoneis ilvana*. **A.** Région antérieure, vue dorsale. **B.** Soies lyriformes (flèches) d'un sétigère de la région post-branchiale.

Aricidea pseudoarticulata. **C.** Région antérieure, vue dorsale. **D.** Soies ventrales modifiées. Échelle : A = 50 µm ; B, D = 10 µm ; C = 100 µm.

Material examined

46 individuals collected on transects M1 to M7 (25 m: 2 ind.; 35 m: 40 ind.; 50 m: 6 ind.); 505 individuals collected on Z (M4) transect, at 15 m (1 ind.), 25 m (84 ind.), 35 m (315 ind.) and 50 m (106 ind.) depth.

Description

All individuals incomplete. Maximum width varying between 0.17-0.40mm.

Body cylindrical; branchial region wider and dorso-ventrally flattened (Fig. 4A). Prostomium triangular, longer than wide, distally rounded. Median antenna short, bottle-shaped, inserted in the middle of prostomium, reaching anterior margin of chaetiger 1, pointing forward in most individuals (Figs 4A, B & 6C). Two small eyes, not seen in many individuals. A pair of nuchal organs as deep slits in posterior part of prostomium. Posterior buccal lip formed by several longitudinal folds of chaetiger 1 and anterior part of chaetiger 2 (Fig. 4C).

Branchiae from chaetiger 4 (Fig. 6C), numbering generally 11-13 pairs, only 6-7 pairs in smallest animals (= 0.20 mm width), cirriform, tapering to blunt tips, and of similar size throughout branchial region (except for last 1-2 pairs, often not fully developed) (Fig. 4A).

Notopodial postchaetal lobes of chaetigers 1-2 short, with first pair slightly shorter (Fig. 4A, B), from chaetiger 3 longer, with broad base and a narrow skittle-shaped tip, becoming digitiform and slender on postbranchial and posterior regions (Fig. 5A). Neuropodial postchaetal lobes short, from chaetiger 1 to end of branchial region (Figs 4A & 6C).

Notochaetae all capillaries, limbate, somewhat sigmoid, and distally pointed in anterior region, to end of branchial segments long and slender in posterior region. All neurochaetae capillaries similar to notochaetae, except for modified neurochaetae of postbranchial region. First modified neurochaetae appearing on chaetiger 30-35 in largest individuals, and on chaetiger 15-20 in the smallest (= 0.20 mm width) (Fig. 7B). Modified neurochaetae of four types (Figs 5B, C & 6D): (1) pseudoarticulate, with long distal appendage and fine bristles in convex part of the "articulation" that has a transparent circular area in frontal view (Fig. 5D), (2) abruptly tapering to a fine tip, (3) weakly hooked with hairlike tip, (4) chaetae weakly hooked without hair like tip. Appearance of each type of modified chaetae is progressive and depending on animal size. In largest animals, chaetae abruptly tapering to fine tips appearing first, followed by pseudoarticulate. Some chaetigers later (5-10) weakly hooked chaetae starting, with and without hairlike tips. All subsequent chaetigers with four kinds of modified chaetae, pseudoarticulate type the most abundant (Fig. 5A). In small animals (= 0.20 mm

width) first modified neurochaeta appearing as a single weakly hooked chaeta with hairlike tip, increasing in number in following chaetigers. Immediately after, all chaetigers bearing four types of modified neurochaetae, weakly hooked type most abundant.

Pygidium unknown.

Remarks

Our individuals, previously identified as *Aricidea fragilis mediterranea* Laubier & Ramos, 1974, agree with the description of *A. pseudoarticulata* given by Hobson (1972), except for the presence of eyes. In our specimens the eyes are very small and are not seen on many individuals, hence their absence cannot be considered significant. Besides, it is possible that they can fade with long term storage in alcohol. It was not possible to compare our specimens with the type material of both *A. pseudoarticulata* and *A. fragilis mediterranea* but, in our opinion, the specimens from Marseille described as *A. fragilis mediterranea* by Laubier & Ramos (1974), including the holotype of the subspecies, have same characteristics (shape of antenna, branchiae, modified neurochaetae...) than those of *A. pseudoarticulata* and so they belong to this late species and, this way, *A. fragilis mediterranea* becoming a junior synonym of *A. pseudoarticulata*.

We found one specimen of this species in material from Portugal loaned by A. Ravara: BSM549/B4-5-2 (1 specimen).

Distribution

Pacific: California 80-90 m; Northwest Atlantic: Gulf of Mexico, off Florida, 26-27 m; Northeast Atlantic: Basque Coast, 25-50 m, Portugal; Mediterranean: Marseille, 5-7 m. This is the first record of the species from the Northeast Atlantic.

Aricidea (Aricidea) wassi Pettibone, 1965

Aricidea (Aricidea) wassi Pettibone, 1965: 135-138, figs 9A-D, 10A-D & 11 A-C. Strelzov, 1973 (62-64) 70-72, figs 17.2 & 23 C. Katzmann & Laubier, 1975: 582-584, fig. 5.

Material examined

Four individuals collected in M1 to M7 transects, at 50 m depth; 15 individuals collected on Z (M4) transect, at 35 m (1 ind.) and 50 m (14 ind.).

Distribution

Atlantic coast of North America, Gulf of Mexico; Pacific: southern California, Japan, Northeast Atlantic: Basque coast, Portugal; Adriatic.

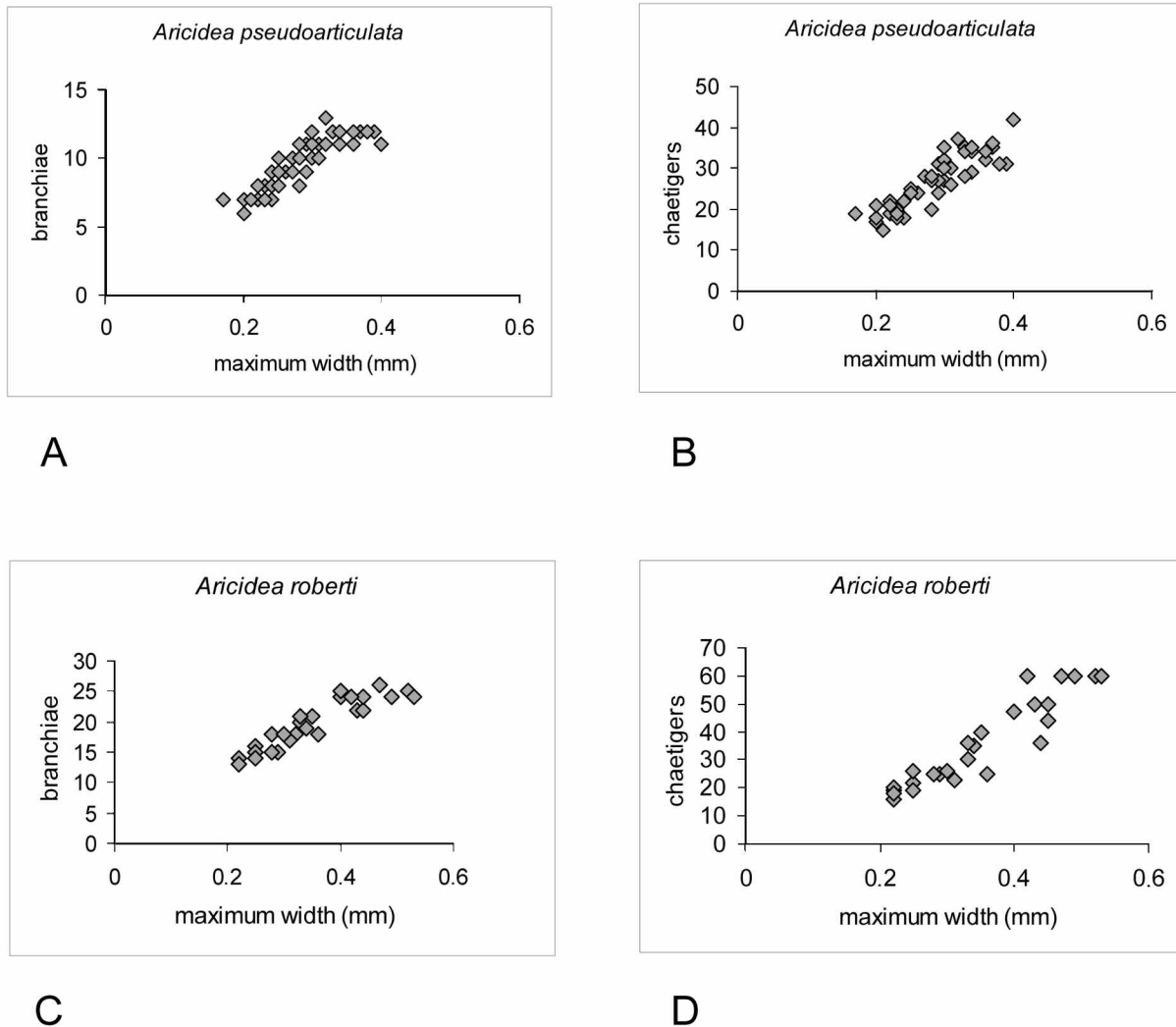


Figure 7. Relationship between number of branchiae and maximum width of body for *Aricidea pseudoarticulata* (A) and *Aricidea roberti* (C) and between position of first chaetiger with modified neurochaetae and maximum width of body for *Aricidea pseudoarticulata* (B) and *Aricidea roberti* (D).

Figure 7. Relation entre le nombre des branchies et la largeur maximale du corps chez *Aricidea pseudoarticulata* (A) et *Aricidea roberti* (C) et entre la position du premier sétigère à soies ventrales modifiées et la largeur maximale du corps chez *Aricidea pseudoarticulata* (B) et *Aricidea roberti* (D).

Subgenus *Allia* Strelzov, 1973

Aricidea (Allia) claudiae Laubier, 1967

Aricidea claudiae Laubier, 1967: 124-128, fig. 8, 9A-E.
Aricidea (Allia) claudiae: Strelzov, 1973: (77-79) 87-90, fig. 17.4, 31A-G.

Material examined

5 individuals collected on transects M1 to M7 transects, at 50 m; 53 individuals collected on Z (M4) transect, at 50 m depth.

Distribution

Mediterranean, Adriatic, Black Sea, Northeast Atlantic (Basque coast) (20-150 m).

Aricidea (Allia) roberti Hartley, 1984
 (Figs 7C-D, 8, 9 & 11A-B)

Aricidea (Allia) roberti Hartley, 1984: 10-13, figs 2A-B & 3A-C.

Material examined

111 individuals collected on transects M1 to M7 (25 m: 2 ind.; 35 m: 41 ind.; 50 m: 68 ind.); 447 individuals collected on Z (M4) transect, at 25 m (21 ind.), 35 m (226 ind.) and 50 m (200 ind.) depth.

Description

Only one complete individual. Maximum width of animals varying between 0.22-0.53 mm. Body cylindrical, with anterior region wider and dorsoventrally flattened (Figs 8A & 11A). Prostomium triangular, slightly longer than wide. Median antenna short, cylindrical, basally slightly enlarged and distally rounded, inserted in middle of prostomium and reaching anterior margin of chaetiger 1 (Figs 8A, B & 11A). Pair of nuchal organs as deep dorsal slits in the posterior part of prostomium. Posterior buccal lip formed by several longitudinal folds of chaetiger 1 and median, anterior part of chaetiger 2 (Fig. 8C).

Branchiae from chaetiger 4, up to 26 pairs in following chaetigers (Figs 7C & 8A,B), first pair small, tapering abruptly to filiform tip, following ones bigger, longer and basally larger, bulbous, tapering abruptly to filiform tip, last pairs (3-4) small, although bulbous (Figs 8A & 11A).

Notopodial postchaetal lobes on chaetiger 1 short, on chaetiger 2 similar in shape but slightly longer (Fig. 8A, B), from chaetiger 3 longer, with broad base and narrow tip (skittle-shaped), becoming progressively longer throughout branchial region (Fig. 8A), long and filiform in postbranchial region (Fig. 9A). Neuropodial postchaetal lobes short (Fig. 8C), digitiform, from chaetiger 1 to end of branchial region.

Notochaetae all capillaries. Those of anterior region, to end of branchial segments, limbate, somewhat sigmoid, and distally pointed. All capillary notochaetae of posterior region long and slender. Capillary neurochaetae similar to notochaetae and posteriorly replaced by modified chaetae. Distribution of modified neurochaetae size depending: in smallest animals from chaetiger 20, and from chaetiger 45-50 in biggest animals (Fig. 7D). Modified neurochaetae like thicker capillary chaetae abruptly tapering to fine tips (Figs 9B & 11B) are typical of the subgenus *Allia*. On most posterior chaetigers modified neurochaetae are weakly hooked with hairlike tips.

Pygidium with short median cirrus and pair of longer (double-size) lateral cirri.

Remarks

Our specimens agree with the description of the species (Hartley, 1984). They only differ in the number of chaetigers involved in the formation of the posterior buccal lip: only chaetiger 1 in Hartley's description, first two chaetigers in our animals. Only, smallest animals show the posterior lip formed by the first chaetiger in our specimens.

We found some specimens of this species in material from Portugal loaned by A. Ravara: G18-3/ GUIA/98 (2 specimens); BSM403/B2-5-2 (1 specimen).

Distribution

North Sea; Northeast Atlantic: Basque coast (Bay of Biscay), Portugal. First record for Iberian waters.

Subgenus *Acmira* Hartley, 1981

Aricidea (Acmira) catherinae Laubier, 1967

Aricidea catherinae Laubier, 1967: 112-118, figs 4A-E, 5A-D. *Aricidea (Acmira) catherinae* Hartley, 1981: 138.

Material examined

170 individuals collected on transects M1 to M7 (15 m: 1 ind.; 25 m: 5 ind.; 35 m: 107 ind.; 50 m: 57 ind.); 1318 individuals collected on Z (M4) transect, at 25 m (2 ind.), 35 m (500 ind.) and 50 m (816 ind.) depth.

Remarks

Our individuals agree with the description given by Laubier (1967), except in the thickening of the median region of the antenna, which is less pronounced.

Distribution

Arctic; Atlantic (from Gulf of Saint Lawrence to Chesapeake Bay), Gulf of Mexico, British Isles, Basque coast, Portugal; Mediterranean; East Pacific: California.

Aricidea (Acmira) laubieri Hartley, 1981

(Figs 10 & 11C-D)

Aricidea (Acmira) laubieri Hartley, 1981: 139-143, fig. 2A-F.

Material examined

1 individual collected on transects M1 to M7, 35 m deep; 7 individuals collected on Z (M4) transect, 50 m depth.

Description

All individuals incomplete. Maximum width of animals varying from 0.22 to 0.44 mm. Anterior region of body flattened dorsoventrally. Prostomium triangular, longer than wide, distally rounded (Figs 10A & 11C). Median antenna short, cylindrical, distally rounded, inserted in middle of prostomium and reaching its posterior margin. Posterior buccal lip formed by several longitudinal folds of chaetiger 1 and anterior part of chaetiger 2 (Fig. 10B).

Branchiae from chaetiger 4 (Figs 10A & 11C), numbering about 21 pairs, uniformly tapering, all of similar size, except last pairs which are smaller.

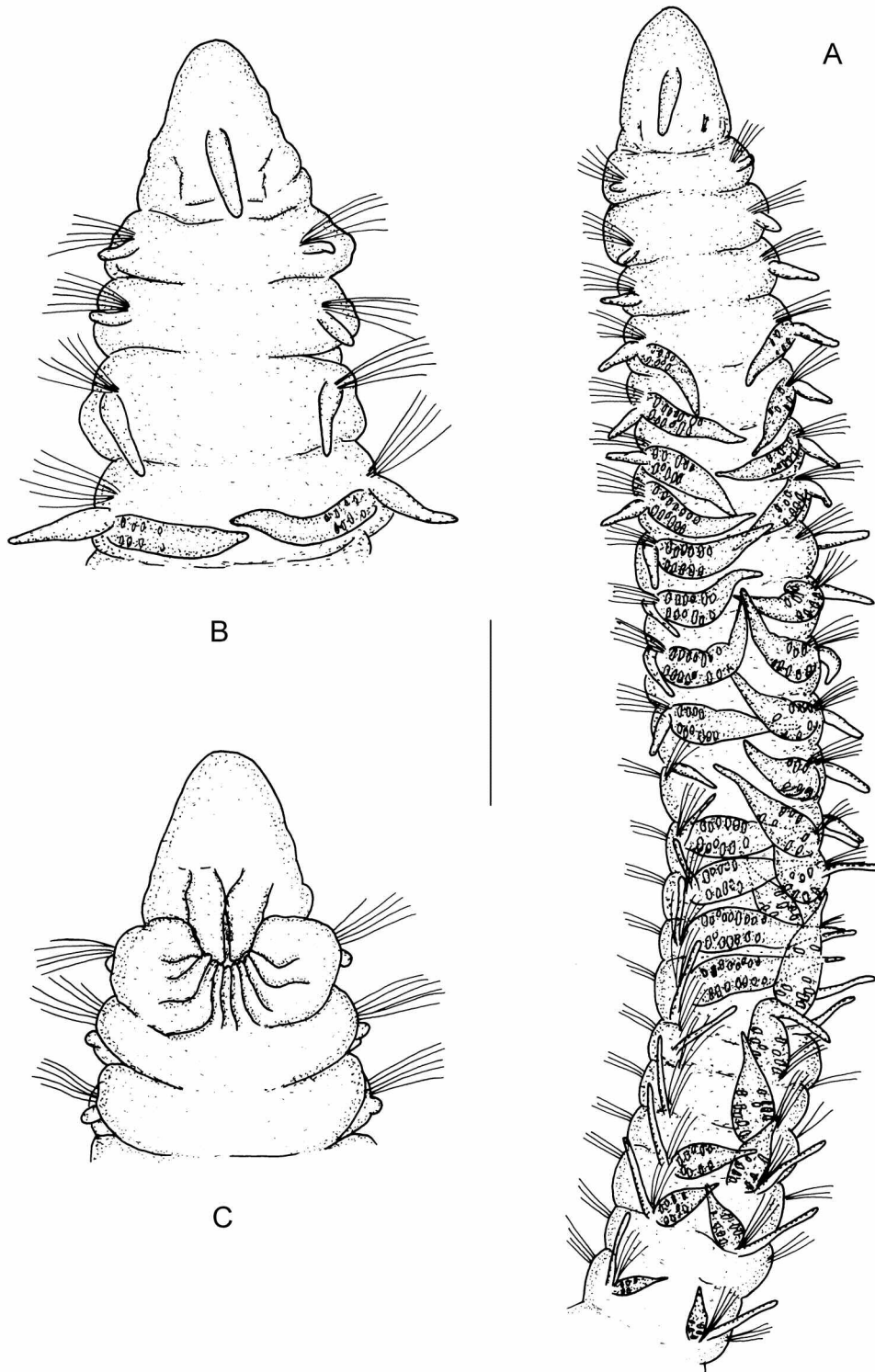


Figure 8. *Aricidea roberti*. **A.** Anterior region, dorsal view. **B.** Anterior end, dorsal view. **C.** Anterior end, ventral view. Scale: A-C = 300 μ m.

Figure 8. *Aricidea roberti*. **A.** Région antérieure, vue dorsale. **B.** Extrémité antérieure, vue dorsale. **C.** Extrémité antérieure, vue ventrale. Échelle : A-C = 300 μ m.

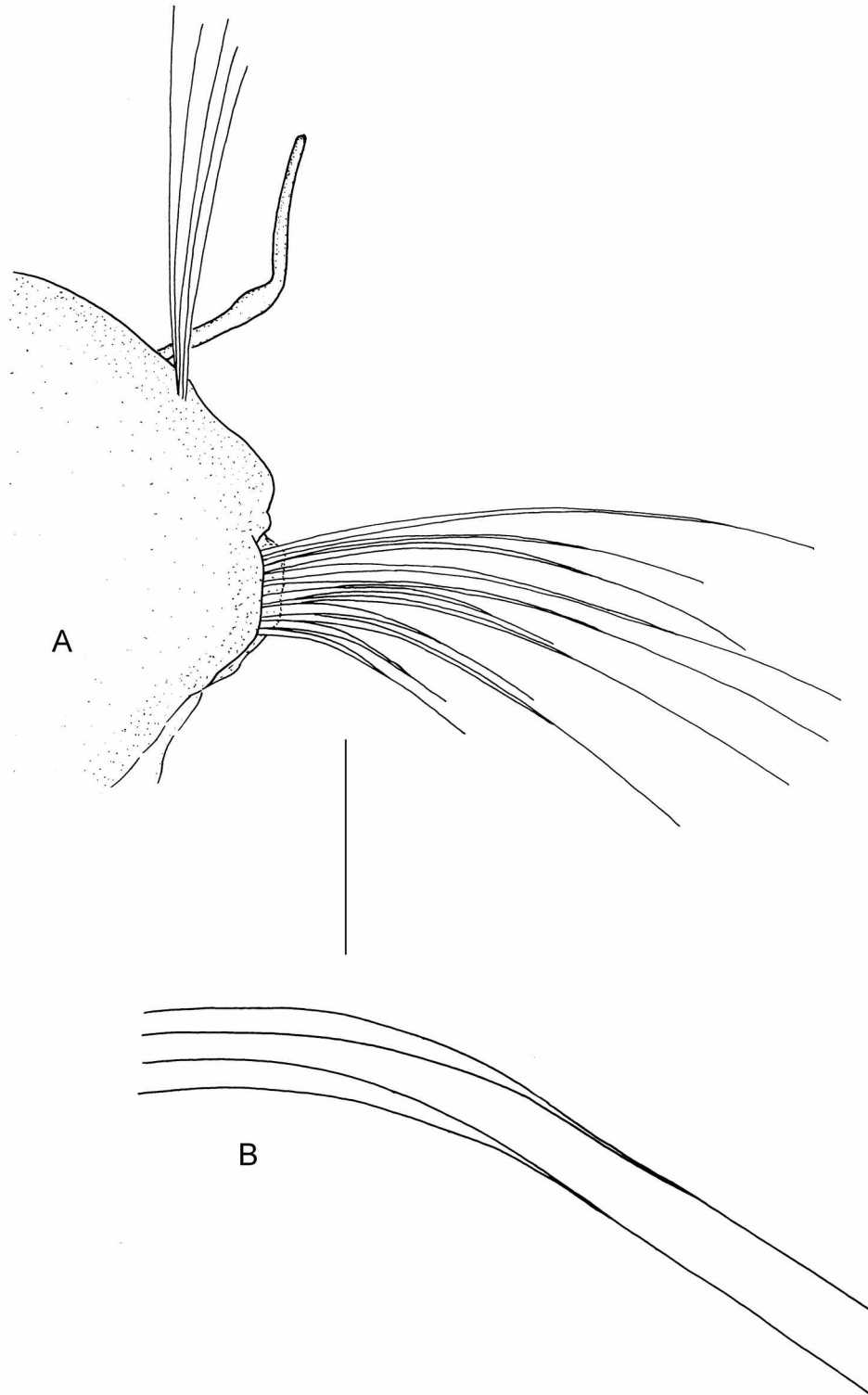


Figure 9. *Aricidea roberti*. **A.** Chaetiger 60. **B.** Modified neurochaetae. Scale: A = 100 μm ; B = 150 μm .
Figure 9. *Aricidea roberti*. **A.** Sétigère 60. **B.** Neurochètes modifiées. Échelle : A = 100 μm ; B = 150 μm .

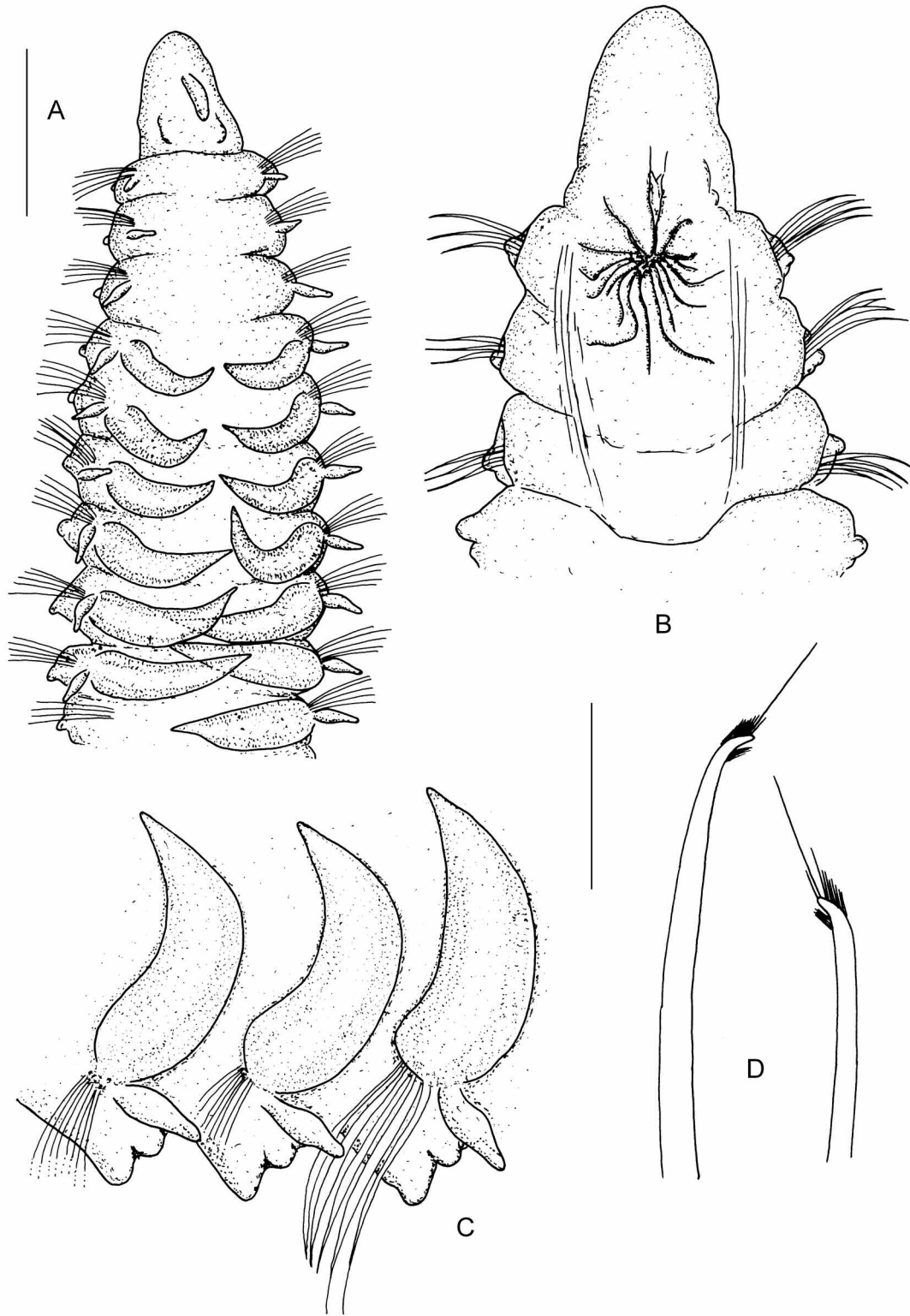


Figure 10. *Aricidea laubieri*. **A.** Anterior region, dorsal view. **B.** Anterior end, ventral view. **C.** Parts of chaetigers 4-6, lateral view. **D.** Modified neurochaetae. Scale: A = 300 μ m; B = 200 μ m; C = 125 μ m; D = 20 μ m.

Figure 10. *Aricidea laubieri*. **A.** Région antérieure, vue dorsale. **B.** Région antérieure, vue ventrale. **C.** Une partie des sétigères 4-6, vue latérale. **D.** Neurochètes modifiées. Échelle : A = 300 μ m ; B = 200 μ m ; C = 125 μ m ; D = 20 μ m.

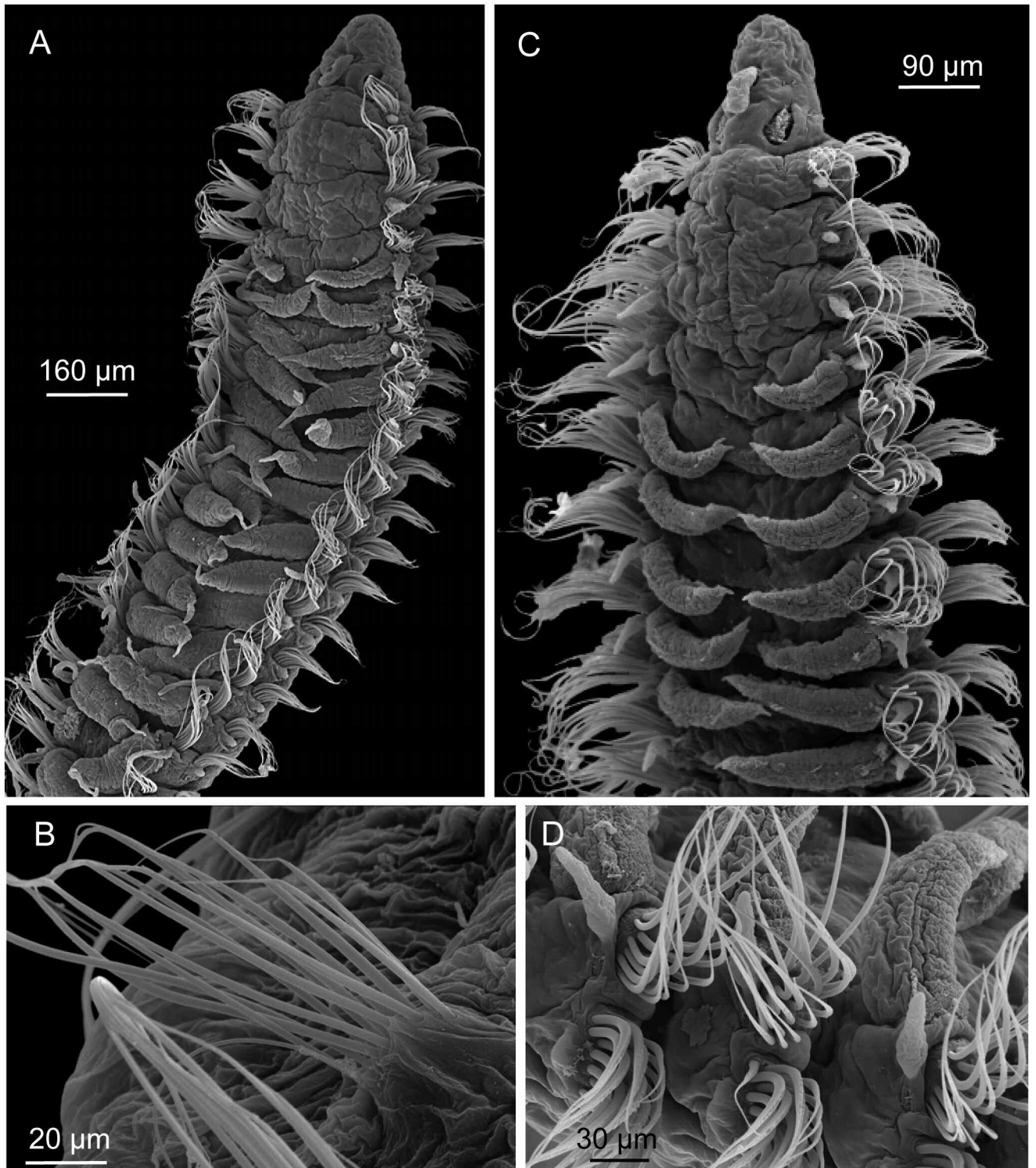


Figure 11. *Aricidea roberti*. **A.** Anterior region, dorsal view. **B.** Posterior neuropodium with modified neurochaetae. *Aricidea laubieri*. **C.** Anterior region, dorsal view. **D.** Chaetigers 6-8, lateral view. Scale: A = 160 µm; B = 20 µm; C = 90 µm; D = 30 µm.

Figure 11. *Aricidea roberti*. **A.** Région antérieure, vue dorsale. **B.** Parapode ventral postérieur avec des soies modifiées. *Aricidea laubieri*. **C.** Région antérieure, vue dorsale. **D.** Sétigères 6-8, vue latérale. Échelle : A = 160 µm ; B = 20 µm ; C = 90 µm ; D = 30 µm.

Notopodial postchaetal lobes on chaetigers 1-2 short, digitate, from chaetiger 3 longer, with broad base and narrow tip (skittle-shaped) (Fig. 10A, C), becoming long and filiform in posterior region. Neuropodial postchaetal lobes short and rounded (Fig. 10B), extending to chaetiger 12-14. One short and rounded interramal papilla on anterior part of each parapodium of anterior chaetigers (Figs 10C & 11D).

Notochaetae all capillaries. Those of anterior region limbate, somewhat sigmoid, and distally pointed. Capillary notochaetae of posterior region all long and slender. Neurochaetae of anterior region capillaries, similar to notochaetae, becoming finer and slender in posterior region. Modified neurochaetae from chaetiger 25-30, acicular, distally hooked, with fine hairs and slender arista on convex side of shaft and fine hairs on concave side (Fig. 10D). 1-2 modified neurochaetae per parapodium at first, increasing in following chaetigers to 5-6 accompanied by 4-6 long and slender capillary neurochaetae.

Remarks

Our individuals agree with the description given by Hartley (1981). The only difference is that our individuals have the posterior lip formed by chaetiger 1 and the anterior part of chaetiger 2, and not only by chaetiger 1, as described by Hartley (1981).

We found some specimens of this species in material from Portugal loaned by A. Ravara: BSM410/B2-6-1 (1 specimen).

Distribution

Northeast Atlantic: Celtic Sea, Irish Sea, North Sea. Basque Coast (Bay of Biscay), Portugal, first record for Iberian waters.

Aricidea (Acmira) simonae Laubier & Ramos, 1974

Aricidea simonae Laubier & Ramos, 1974: 1123-1127, figs 9-10. *Aricidea (Acmira) simonae* Hartley, 1981: 143-145, figs 3C & 4.

Material examined

Only one individual collected on Z (M4) transect, at 50 m depth.

Distribution

Northeast Atlantic: North Sea, Basque coast, Portugal; Mediterranean, Adriatic.

Bathymetrical distribution and ecological preferences

Zarautz inlet, located between the mouth of the River Oria and the Mount San Anton (Getaria), at the west of Donostia, is an exposed inlet opened to dominant winds from NW and to wave action.

In its central region, in front of Zarautz beach (Z transect), as well as in the entire studied area, the predominant sedimentary types are sands and muddy sands.

The mud content in the stations Z-7 m and Z-15 m, is < 1%. Stations Z-25 m, Z-35 m and Z-50 m can be considered as muddy-sand; the mud content ranges between 5-9% (station Z-25 m), between 8-13% (station Z-35 m), and between 6-10% (station Z-50 m). The sedimentary content in organic matter is relatively low and placed between 1.3 and 3.8% (Fig. 12B).

This depth dependent gradient observed in sedimentary characteristics (decrease of median grain size (Fig. 12A), increase of mud and organic matter contents) seems created above all by the hydrodynamism, the main factor that conditions the characteristics of soft bottom exposed littorals (Lagardère, 1971; San Vicente et al., 1992).

This gradient is also evident in the structure and composition of infaunal communities, and inside the family Paraonidae. The analysis of the classification dendrogram of the samples of the Z transect in function of the abundance of paraonid species, enables the recognition of four clusters of samples, each one formed by samples of same depth (from left to right, 15 m, 25 m, 35 m and 50 m) (Fig. 12F). Abundance and species richness of Paraonidae increases gradually with depth (Fig. 12C, D). In Z-7m, no paraonid specimen was collected, while in Z-50m 10 species were identified. Something similar occurs with the diversity values (Fig. 12E), although, in this case, there is a strong increase between 25 m and 35 m, mainly due to the drop of the great dominance that *P. armata* has at 25 m.

The analysis of the classification dendrogram of the paraonid species in function of the distribution of their abundance, enables the recognition of two clusters of species (Fig. 12G), distinguished by their bathymetrical/sedimentary preferences.

The first cluster includes those species which are more abundant in the shallower stations: *P. armata*, *A. pseudoarticulata*, *A. roberti*, *A. catherinae*, and *P. ilvana* (Figs 13A-E, 14A-E & 14I-M). Moreover, inside this clade *P. armata* is clearly distinguished from the other four species, and *A. pseudoarticulata* and *A. roberti* (distributed between 25 and 50 m, with their greater abundance at 35 m depth) can be separated from *A. catherinae* and *P. ilvana* (collected at 35 and 50 m, and with their greatest abundance at 50 m depth).

In the second cluster are found those species whose the

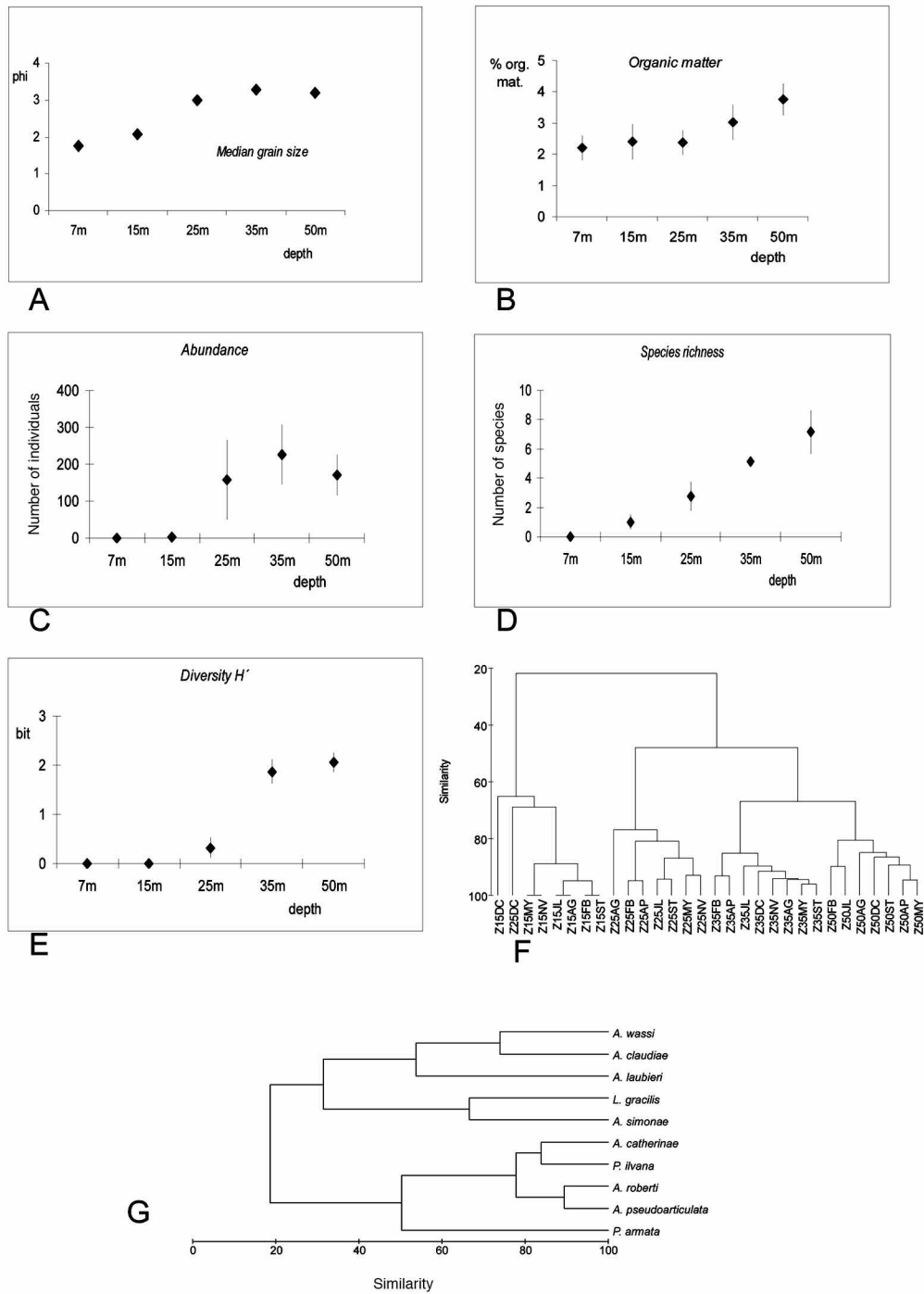


Figure 12. Relation between several factors and depth: **A.** Median grain size. **B.** Organic matter content. **C.** Abundance of paraonid specimens. **D.** Number of paraonid species. **E.** Diversity (H'). **F & G.** Dendrograms calculated from the Bray-Curtis similarity index. **F.** Dendrogram of the samples of the Z transect in function of the abundance of paraonid species. **G.** Dendrogram of the Paraonidae species collected on the Z transect in function of their abundance.

Figure 12. Relation entre divers facteurs et la profondeur: **A.** Taille moyenne des grains de sédiment. **B.** Contenu organique du sédiment. **C.** Abondance des individus récoltés. **D.** Nombre d'espèces de Paraonidae. **E.** Diversité (H'). **F.** Dendrogramme résultant de la classification des échantillons du transect Z en fonction de leur similarité (indice de Bray-Curtis, calculé à partir de l'abondance des diverses espèces de Paraonidae). **G.** Dendrogramme résultant de la classification des diverses espèces de Paraonidae collectées sur le transect Z (indice de Bray-Curtis, calculé à partir de leurs abondances spécifiques).

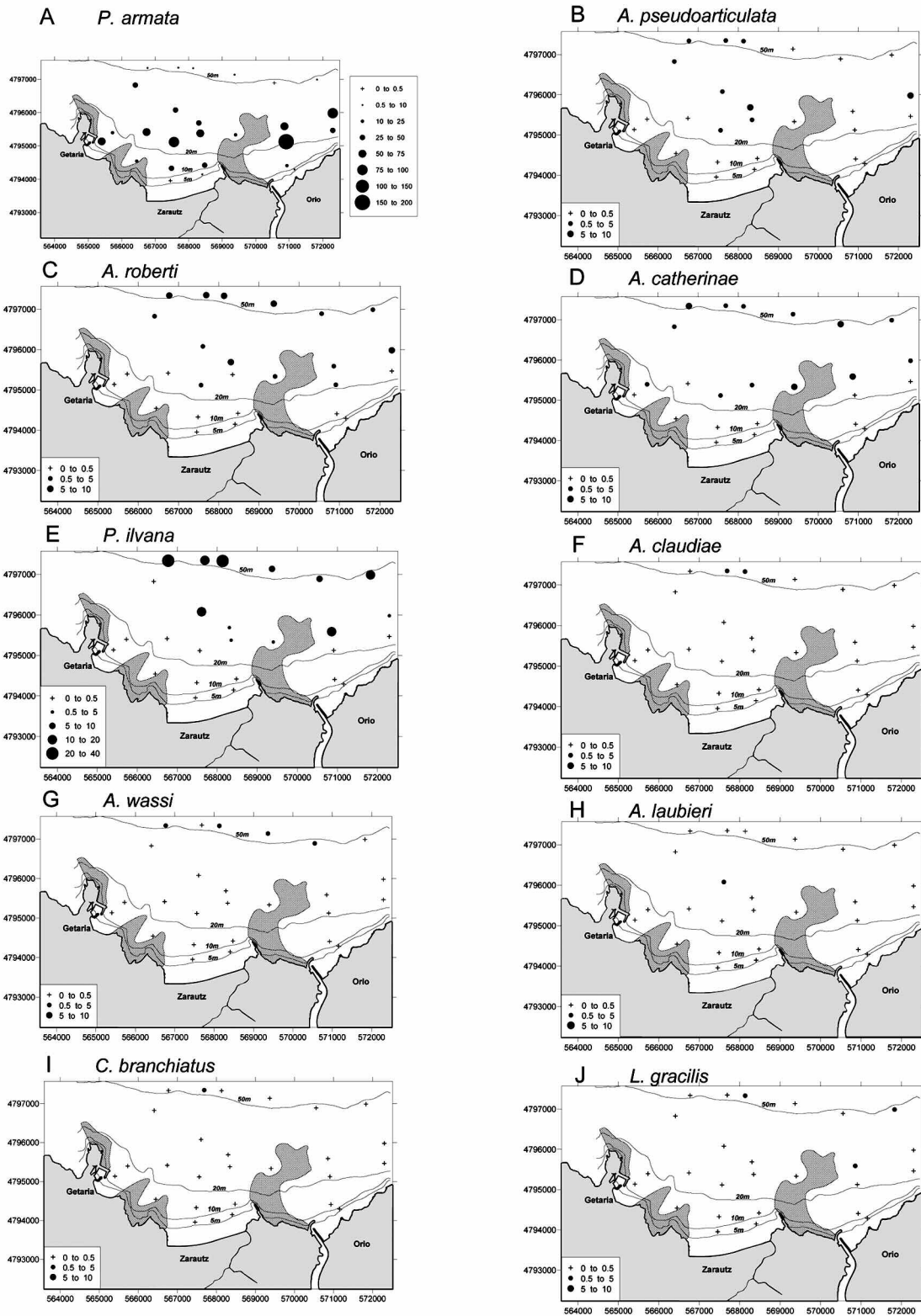


Figure 13. Spatial distributions. A. *Paradoneis armata*. B. *Aricidea pseudoarticulata*. C. *Aricidea roberti*. D. *Aricidea catherinae*. E. *Paradoneis ilvana*. F. *Aricidea claudiae*. G. *Aricidea wassi*. H. *Aricidea laubieri*. I. *Cirrophorus branchiatus*. J. *Levisensia gracilis*.
 Figure 13. Distributions spatiales. A. *Paradoneis armata*. B. *Aricidea pseudoarticulata*. C. *Aricidea roberti*. D. *Aricidea catherinae*. E. *Paradoneis ilvana*. F. *Aricidea claudiae*. G. *Aricidea wassi*. H. *Aricidea laubieri*. I. *Cirrophorus branchiatus*. J. *Levisensia gracilis*.

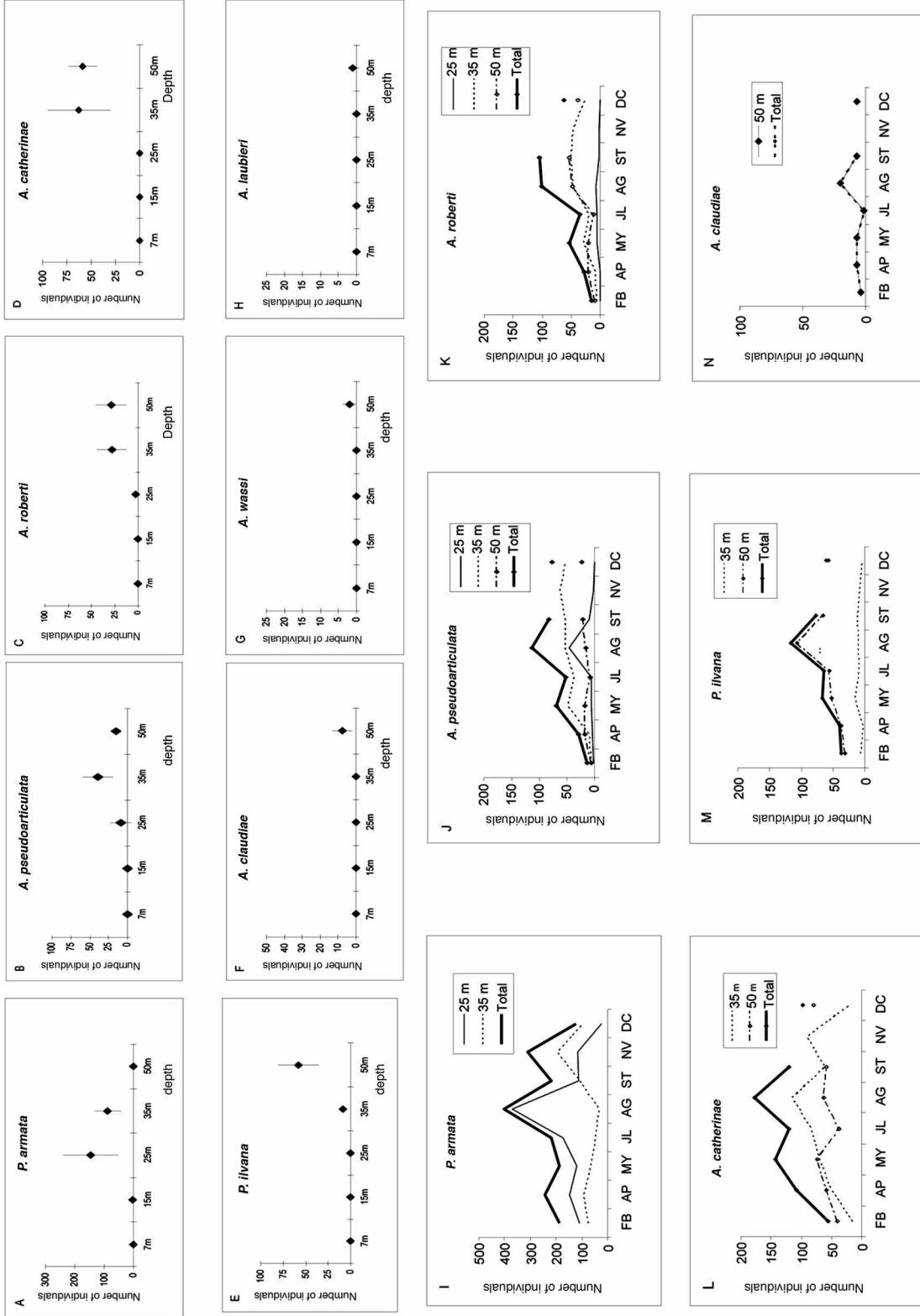


Figure 14. Bathymetrical distributions. A. *Paradoneis armata*. B. *Aricidea pseudoarticulata*. C. *Aricidea roberti*. D. *Aricidea catherinae*. E. *Paradoneis ilvana*. F. *Aricidea claudiae*. G. *Aricidea wassi*. H. *Aricidea laubieri*. Seasonal distributions. I. *Paradoneis armata*. J. *Aricidea pseudoarticulata*. K. *Aricidea roberti*. L. *Aricidea catherinae*. M. *Paradoneis ilvana*. N. *Aricidea claudiae*.

Figure 14. Distributions bathymétriques. A. *Paradoneis armata*. B. *Aricidea pseudoarticulata*. C. *Aricidea roberti*. D. *Aricidea catherinae*. E. *Paradoneis ilvana*. F. *Aricidea claudiae*. G. *Aricidea wassi*. H. *Aricidea laubieri*. Distributions saisonnières. I. *Paradoneis armata*. J. *Aricidea pseudoarticulata*. K. *Aricidea roberti*. L. *Aricidea catherinae*. M. *Paradoneis ilvana*. N. *Aricidea claudiae*.

bathymetrical range has an upper limit at 50 m depth. Following a decreasing order of relevance this group includes *Aricidea claudiae*, *A. wassi*, *A. laubieri*, *Levinsenia gracilis* and *Aricidea simonae* (Figs 13F-J, 14F-H & N). Some bathymetrical and seasonal characteristics of the species are given in the following paragraph.

Paradoneis armata

It is the most abundant species, with a total of 1889 specimens collected (40.2% of all collected paraonids on transect Z). Nearly all the specimens were collected between 25 m and 35 m depth, being more abundant at 25 m (mean = 146 ind.) than at 35 m (mean = 88 ind.). At 15 m depth it is very scanty (mean = 1.75 ind.), but present almost through the whole year. At 25 m it is the dominant paraonid, and at 50 m it disappears almost completely (Figs 13A & 14A). When the hydrodynamism is low, as on transect M1, the species can be found at shallower water (104 ind. collected at 7 m depth) (Fig. 13A). The species seems to show three abundance peaks, one in spring (April), another in summer, at 25 m, and a third one in fall, at 35 m depth (Fig. 14I).

Aricidea pseudoarticulata and *Aricidea roberti*

Of all paraonids collected on transect Z, 505 (10.7%) and 447 individuals (9.5%) respectively, belong to these two species. The bathymetrical distribution of these two species ranges from 25 m to 50 m (and deeper), with its maximum located at the 35 m isobath. *A. pseudoarticulata* is a little more abundant than *A. roberti* at 25 and 35 m, but at 50 m *A. roberti* exceeds *A. pseudoarticulata* slightly in abundance (Figs 13B-C & 14B-C).

A. pseudoarticulata seems to have two abundance peaks, in spring (May), clearly shown at 35 m, and one in summer (August), which is most evident at 25 m (Figure 14J). *A. roberti* has a similar behaviour, but the summer peak is marked at 35-50 m instead of 25 m depth (Fig. 14K).

Aricidea catherinae and *Paradoneis ilvana*

The bathymetrical distribution of these two species extends below 25 m (Figs 13D-E & 14D-E). *A. catherinae* is the second species in abundance, 1316 specimens (28%). Only two specimens of *A. catherinae* were collected at 25 m. At 35 m *A. catherinae* is the second most abundant species (mean = 62.5 ind.), behind *P. armata*. At this depth *P. ilvana* is much less abundant (mean = 8.25 ind.). At 50 m depth both species are the most abundant of the family (mean = 58.57 and 58 ind., respectively).

Aricidea catherinae could present three peaks of abundance (Fig. 14L): in spring (May), mainly at 50 m; in summer (August), mainly at 35 m; and in late fall (November), also marked at 35 m. In *Paradoneis ilvana* it

is possible to distinguish two peaks, in spring (May) and in summer, very marked, mainly at 50 m (Fig. 14M).

Aricidea claudiae and *Aricidea wassi*

The bathymetrical distribution of these two species has its upper limit at 50 m depth (Figs 13F-G & 14F-G). Only a single specimen of *A. wassi* was collected at 35 m. At 50 m, *A. claudiae* is the fifth most abundant species inside the family Paraonidae (mean = 7.57 ind.), and *A. wassi* the sixth (mean = 2 ind.). The number of collected specimens of these species is low (53 and 15 ind., respectively), which makes it impossible to identify seasonal changes. However, *Aricidea claudiae* seems to show a summertime peak (August) (Fig. 14N).

Aricidea laubieri, *Aricidea simonae*, *Cirrophorus branchiatus* and *Levinsenia gracilis*

(Although no specimen of *Cirrophorus branchiatus* was collected in the transect Z - only one specimen was collected in the sample M3-50 JLL89 - we include it in this group).

These four species are very uncommon in the shallower region of the continental shelf (0-50 m depth). This isobath could represent the upper limit of the bathymetrical distribution for these four species in the studied area (Figs 13 H-J; 14H).

Acknowledgements

Thanks are due to Enrique Crespo and Julián Martínez (INSUB, San Sebastián) for their valuable assistance at sea; to A. Castelli (University of Pisa) for the loan of type material of *P. ilvana*; to S. Parra and I. Frutos (IEO La Coruña) and A. Ravara (Universidade de Aveiro) for the loan of paraonid specimens from Galicia and Portugal, respectively; to Iñigo Muxika (AZTI) for his assistance with the software; to Ricardo Andrade and Sergio Fernández (UPV-EHU) and Igor Cruz (INSUB, San Sebastián) for the scanning photographs, and to two anonymous referees for their comments, which have greatly improved this paper.

References

- Aguirrezabalaga F., Gil J. & Viéitez J.M. 2000. Presencia de *Myriochele danielsseni* Hansen, 1879 (Polychaeta, Oweniidae) en las costas de la Península Ibérica. *Boletín de la Real Sociedad Española de Historia Natural (Sección Biología)*, **96**: 57-68.
- Blake J.A. 1996. Chapter 2. Family Paraonidae Cerruti, 1909. In: *Taxonomic Atlas of the Benthic Fauna of the Santa Maria Basin and the Western Santa Barbara Channel*. (J. Blake, B.

- Hilbig & P. Scott eds), Vol. 6, pp. 27-70. Santa Barbara Museum of Natural History.
- Castelli A. 1985.** Paraonidae (Annelida, Polychaeta) des fonds meubles infralittoraux des côtes toscanes. *Cahiers de Biologie Marine*, **26**: 267-279.
- Ehlers E. 1908.** Die Bodensässigen Anneliden aus den Sammlungen der deutschen Tiefsee-Expedition, Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem *Dampfer* Valdivia 1898-1899. **16**: 1-168.
- Gaston G.R. 1984.** Chapter 2. Family Paraonidae Cerruti, 1909. In: *Taxonomic guide to the polychaetes of the northern Gulf of Mexico* (J.M. Uebelacker and P.G. Johnson eds), Vol. 1. pp. 2-1 to 2-53. Barry A. Vittor & Associates, Inc. Mobile, AL.
- Glémarec M. 1966.** Paraonidae de Bretagne. Description de *Paradoneis armata* nov. sp. *Vie et Milieu*, **17**: 1045-1052.
- Hartley J.P. 1981.** The family Paraonidae (Polychaeta) in British waters: a new species and new records with a key to species. *Journal of the Marine Biological Association of the United Kingdom*, **61**: 133-149.
- Hartley J.P. 1984.** Cosmopolitan polychaete species: the status of *Aricidea belgicae* (Fauvel, 1936) and notes on the identity of *A. suecica* Eliason, 1920 (Polychaeta; Paraonidae). Proceedings of the First International Polychaete Conference, Sydney, edited by P.A. Hutchings. Linnean Society of New South Wales, pp. 7-20.
- Hobson K.D. 1972.** Two new species and two new records of the family Paraonidae (Annelida, Polychaeta) from the northeastern Pacific ocean. *Proceedings of the Biological Society of Washington*, **85**: 549-556.
- Katzmann W. & Laubier L. 1975.** Paraonidae (Polychètes sédentaires) de l'Adriatique. *Analnen des Naturhistorischen Museums, Wien*, **79**: 567-588.
- Lagardère F. 1971.** Les fonds de Pêche de la côte ouest de l'Île d'Oleron. Cartographie bionomique. I. Le milieu. *Tethys*, **3**: 57-78.
- Laubier L. 1967.** Sur quelques *Aricidea* (Polychètes, Paraonidae) de Banyuls-sur-Mer. *Vie et Milieu*, **18**: 99-132.
- Laubier L. & Ramos J. 1974.** Paraonidae (Polychètes sédentaires) de Méditerranée. *Bulletin du Muséum National d'Histoire Naturelle*, 3^e série, N° 168, Zoologie, **113**: 1097-1148 (dated 1973, printed March 1974).
- Mackie A.S.Y. 1991.** *Paradoneis eliasoni* sp. nov. (Polychaeta: Paraonidae) from northern European waters, with a redescription of *Paradoneis lyra* (Southern, 1914). *Ophelia (Suppl.)*, **5**: 147-155.
- Pettibone M.H. 1965.** Two new species of *Aricidea* (Polychaeta, Paraonidae) from Virginia and Florida, and redescription of *Aricidea fragilis* Webster. *Proceedings of the Biological Society of Washington*, **78**: 127-140.
- Rouse G.W. & Pleijel F. 2001.** *Polychaetes*. Oxford University Press: New York. 354 pp.
- San Vicente C., Romero A., Aguirrezabalaga F., López J.C. & Ibáñez M. 1992.** Macrobentos de los sustratos blandos infralitorales de medios expuestos en la costa vasca. *Actas del V Simposio Ibérico de Estudios del Bentos Marino*, **2**: 253-272.
- Strelzov V.E. 1973.** Polychaete worms of the family Paraonidae Cerruti, 1909 (Polychaeta, Sedentaria). Amerind Publishing Co. Put. Ltd., New Delhi. 212 pp. (Translation of Russian original).
- Tauber P. 1879.** Annulata Dica. En Kritisk Revision af de i Danmark Fundne Annulata Chaetognatha, Gephyrea, Balanoglossi, Discophoreae, Oligochaeta, Gymnocopa og Polychaeta. Reitzel, Copenhagen. 143pp.
- Tena J., Capaccioni-Azzati R., Porrás R. & Torres-Gavilá F.J. 1991.** Cuatro especies de poliquetos nuevas para las costas mediterráneas españolas en los sedimentos del antepuerto de Valencia. *Miscellània Zoològica*, **15**: 29-41.