

**Syllidae from the continental shelf off Aveiro (NW Portugal)  
with the description of a new species, *Syllis licheri*  
(Annelida, Polychaeta, Syllidae)**

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Abstract

Eighteen species belonging to eleven genera of the family Syllidae were collected in 1994 and 1995, during two cruises carried out on the continental shelf off Aveiro (40°30'–40°50' N, 8°40'–9°20' W). Syllids were mostly confined to the mid shelf, where sediments are coarser than in the inner and the outer parts of the shelf. Six species are cited for the first time for Portugal. A new species, *Syllis licheri*, is described. The new species is characterised by having unidentate or indistinctly bidentate, short, triangular blades on the compound chaetae, with short spines or smooth on margin, without a marked dorso-ventral or antero-posterior gradation in size. It has a large, straight aciculum protruding out from the parapodial lobes, and a long pharynx and proventricle. The holotype of the new species is deposited at Museo Nacional de Ciencias Naturales de Madrid, Spain; paratypes are there and at Senckenberg-Museum, Frankfurt am Main, Germany. Habitat, known world distribution, occurrence in Portugal, a brief comment on the biogeography and, for some species, taxonomic notes are presented.

**Keywords:** Iberian Peninsula, East Atlantic, new species, taxonomy.

Introduction

Little is known about the benthic communities of the Portuguese continental coast, especially at higher depths. During the summers of 1994 and 1995, two oceanographic surveys were carried out with the aim of studying these communities and their relation to some environmental parameters on the shelf off Aveiro. These surveys resulted from collaboration between the universities of Aveiro and Bordeaux and were supported by a Portuguese-French oceanological program (JNICT, French embassy) and by the French CIRMAT-CNRS.

The shelf off Aveiro presents a well-defined sediment pattern, with finer sand in the inner (0–20 m depth) and the outer (100–200 m depth) parts of the shelf and coarser sediments in the mid shelf. The benthic assemblages are closely related to this pattern, showing different specific composition and structure in each of the three areas. Syllids occur almost exclusively in the mid shelf, where they significantly contribute to the species richness (~7 %) and total abundance (~5 %) of the benthic community.

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Eighteen species of the family Syllidae GRUBE 1850 were collected, six of which are cited for the first time for Portugal. One new species, *Syllis licheri*, is described.

### Material and methods

A total of 43 stations were sampled along six transects perpendicular to the coast and covering an area between 40°30' N and 40°50' N and 8°40' W and 9°20' W, within a depth range of 10 to 200 m (Fig. 1). The abbreviations of the stations (in the material sections below) and further geographical coordinates and depth of each station are given in Table 1 together with sampling dates and values of several environmental parameters. Sediment type was determined according to the Wentworth scale (BUCHANAN & KAIN 1971).

Organic content was obtained by loss of weight on ignition at 450 °C for 5 hours using 1 g of dried sediment. Water salinity and temperature were measured at some stations using a STD probe.

The macrofauna was sampled with a Smith-McIntyre grab (0.1 m<sup>2</sup>). Three replicates were taken at each station. Samples were fixed in 10 % neutral formalin, stained with rose bengal, and later washed with freshwater and transferred to 70 % ethanol. Observations and measurements were made under a compound microscope with interferencial optics system (Nomarsky) and drawings were made using a drawing tube.

The holotype and some paratypes of the new species were deposited in the Museo Nacional de Ciencias Naturales de Madrid (MNCN, Spain). Some representative specimens were deposited in the Senckenberg-Museum, Frankfurt am Main (SMF, Germany; including paratypes), and in the collection of the Biology Department of the University of Aveiro (DBUA, Portugal).

### Results

A total of 960 specimens were collected belonging to eighteen species of the family Syllidae. All four subfamilies were represented: Syllinae (3 genera, 6 species, 566 specimens), Exogoninae (3 genera, 5 species, 230 specimens), Eusyllinae (4 genera, 5 species, 162 specimens) and Autolytinae (1 genera, 2 species, 2 specimens). The number of specimens collected per station is given within brackets after the reference for the station. A new species is described and six new records are given for Portugal. For each species the habitat where it was collected is mentioned, along with the occurrence in Portugal (mostly according to DEXTER 1992) and the known world distribution. For some species taxonomic notes are included.

#### Family Syllidae GRUBE 1850

#### Subfamily Syllinae GRUBE 1850

#### Genus *Eurysyllis* EHLERS 1864

#### *Eurysyllis tuberculata* EHLERS 1864

*Eurysyllis tuberculata*: EHLERS (1864: 264)

*Eurysyllis paradoxa* LANGERHANS 1879 — LANGERHANS (1879: 574, fig. 27), SOUTHERN (1914: 34).

*Eurysyllis tuberculata* — FAUVEL (1923: 271, figs. 101 i–o), LAUBIER (1968: 93, figs. 7, 8), HARTMANN-SCHRÖDER (1977: 87, figs. 44–46), CAMPOY (1982: 300), SAN MARTÍN (1984: 264, fig. 60; 2003: 296, figs. 162, 163), NÚÑEZ et al. (1992: 113, figs. 1 A–B).

Material: B3–2(1); B3–4(4); B4–4(1).

Habitat: Found at depths between 32 and 72 m, in coarse to very coarse sand with 0.6–0.9 % organic content.

Distribution: Atlantic (from the North Sea to Canary Islands, Gulf of Mexico and Carolina), Mediterranean, Red Sea. In Portugal: Peniche, Madeira Island.

#### Genus *Syllis* SAVIGNY 1818

#### *Syllis garciai* (CAMPOY 1982)

*Langerhansia garciai*: CAMPOY (1982: 386, figs. 36–38).

*Langerhansia cornuta* (non RATHKE 1843) — SAN MARTÍN et al. (1981: 76, fig. 16).

*Syllis garciai* — SAN MARTÍN (1984: 364, fig. 92; 2003: 400, figs. 219–221); NÚÑEZ et al. (1992: 121, figs. 3 J, 5 F).

Material: B2–2(55); B2–3(11); B2–4(1); B3–2(29); B3–3(19); B3–4(11); B4–2(3); B4–3(14); B4–4(7); A2–4(16); A2–6(16); A2–8(30); A3–8(4); B1–1(12); B1–2(3).

Habitat: Found at depths between 30.8 and 79.0 m, in medium sand and gravel with 0.33–1.46 % organic content.

Distribution: Atlantic (Iberian Peninsula, Canary Islands, Cabo Verde, Cuba), Mediterranean, Pacific (Panama). In Portugal: Rio Sado estuary, continental shelf off Lisbon.

#### *Syllis parapari* SAN MARTÍN & LÓPEZ 2000

*Syllis parapari*: SAN MARTÍN & LÓPEZ (2000: 426, figs. 1, 2); SAN MARTÍN (2003: 409, figs. 224, 225).

*Langerhansia cornuta* (non RATHKE 1843) — CAMPOY (1982: 378, figs. 34–35).

*Syllis cornuta* — PARAPARI et al. (1996 b: 59).

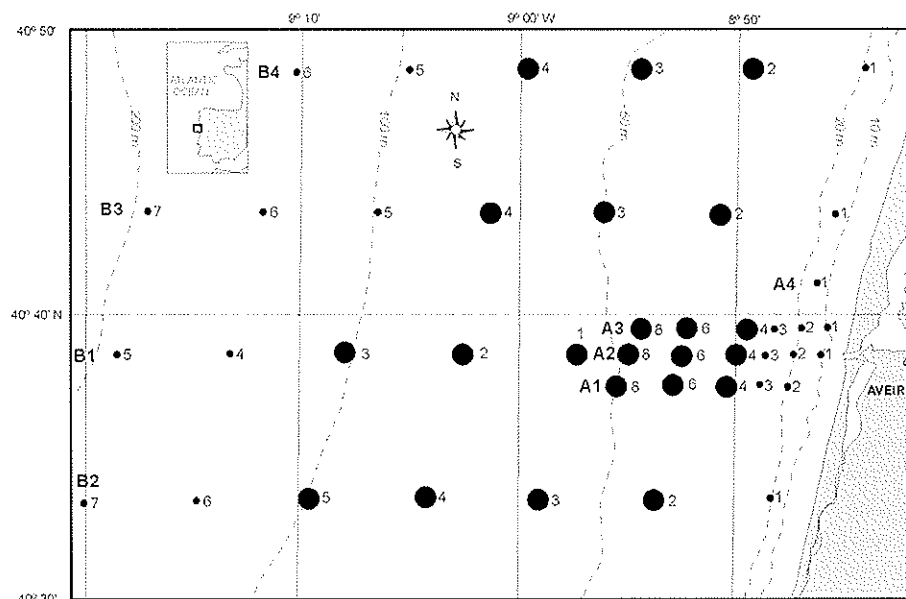


Figure 1. Map of study area on the continental shelf off Aveiro with location of sampling stations (•). — ● = stations where syllis were found.

Material: B2-2(2); B2-3(1); B2-5(1); B3-2(3); B3-3(7); B4-2(3); A3-4(1); A3-8(1); B1-3(1).

Habitat: Found at depths between 29 and 100 m, in fine to very coarse sand with 0.4–1.4 % organic content.

Remarks: This species has been formerly reported as *Syllis cornuta* but in a recent work the status of new species was proposed (SAN MARTÍN & LÓPEZ 2000). The main differences between the two species are: the length of the dorsal cirri, which is generally longer in *S. cornuta* and short and spindle-shaped in the midbody of *S. parapar*; the length of the pseudospiniger chaetae, which are shorter in *S. cornuta*; and the shape of acicula which are straight with acute tips in *S. cornuta* and enlarged subdistally with an oblique tip in *S. parapar* (see SAN MARTÍN & LÓPEZ 2000).

Distribution: Atlantic (Iberian Peninsula). In Portugal: First record for Portugal.

#### *Syllis pontxioi* SAN MARTÍN & LÓPEZ 2000

*Syllis pontxioi*: SAN MARTÍN & LÓPEZ (2000: 429, fig. 3).

*Typosyllis gerlachi* non HARTMANN-SCHRÖDER 1960 — CAMPOY (1982: 410, fig. 45).

*Syllis gerlachi* — PARAPAR et al. (1996 b: 59).

Material: B2-2(35); B2-3(8); B2-4(8); B3-2(17); B3-3(3); B4-2(15); B4-3(5); B4-4(3); A1-4(19); A1-6(12); A1-8(22); A2-4(1); A2-6(10); A2-8(28); A3-4(11); A3-6(4); A3-8(7); B1-1(3); B1-2(2).

Habitat: Found at depths between 29 and 79 m, mainly in coarse sand and gravel with 0.3–1.5 % organic content.

Remarks: This species was separated from *Syllis gerlachi* (HARTMANN-SCHRÖDER 1960) for having very short and slender antennae, tentacular and dorsal cirri; for the shape of its midbody and posterior falciger chaetae (very short blades with enlarged proximal tooth); for its

thick, bidentate ventral simple chaetae and for its stout posterior acicula that have tips which are provided with a hollow and convex edge (see SAN MARTÍN & LÓPEZ 2000).

Distribution: Atlantic (Iberian Peninsula), Western Mediterranean. In Portugal: First record for Portugal.

#### *Syllis licheri* sp. n.

Fig. 2

Holotype: 1 specimen: Atlantic, continental shelf off Aveiro, Stn. B4-3 (40°48.030'–40°48.192' N, 8°54.461'–8°54.538' W), Smith-McIntyre grab, 46.1 m, coarse sand, Aveiro 95 Cruise, 1. viii. 1995, MNCN 16.01/8842 a. Length ca. 16 mm; width ca. 0.7 mm; 130 chaetigers. Deposited in Museo Nacional de Ciencias Naturales de Madrid (MNCN, Spain). — Paratypes (in total 6 specimens): 3 specimens, same locality, same station, MNCN 16.01/8842 b (in MNCN). 3 specimens, same locality, same station, SMF 11588 and SMF 11589 (in Senckenberg-Museum, Frankfurt am Main, Germany).

Additional material (all 24 additional specimens were collected in the type area using a Smith-McIntyre grab): 7 specimens: Stn. B3-3 (40°43.169'–40°43.346' N, 8°55.823'–8°55.863' W), 48.2 m, Aveiro 95 Cruise, 29. vii. 1995, MNCN 16.01/8843 and 16.01/8844. 7 specimens: Stn. A2-8 (40°38.490'–40°38.613' N, 8°55.221'–8°55.235' W), 48.3 m, granule, Aveiro 94 Cruise, 21. vii. 1994, MNCN 16.01/8845 and 16.01/8846. 3 specimens: Stn. B1-3 (40°38.370'–40°38.615' N, 9°7.815'–9°7.974' W), 100.5 m, fine sand, Aveiro 94 Cruise, 29. vii. 1994, MNCN 16.01/8847. 6 specimens: Stn. B2-3 (40°33.380'–40°33.472' N, 8°58.496'–8°58.681' W), 59.1 m, very coarse sand, Aveiro 95 Cruise, 28. vii. 1995, DBUA 589. 1 specimen: Stn. B3-4 (40°43.261'–40°43.472' N, 9°1.301'–9°1.496' W), 71.7 m, very coarse sand, Aveiro 95 Cruise, 29. vii. 1995, DBUA 589.

Etymology: The species is named after Dr. Frank LICHER, who reviewed the group and provided an excellent monography which allows the study of worldwide material of this difficult group.

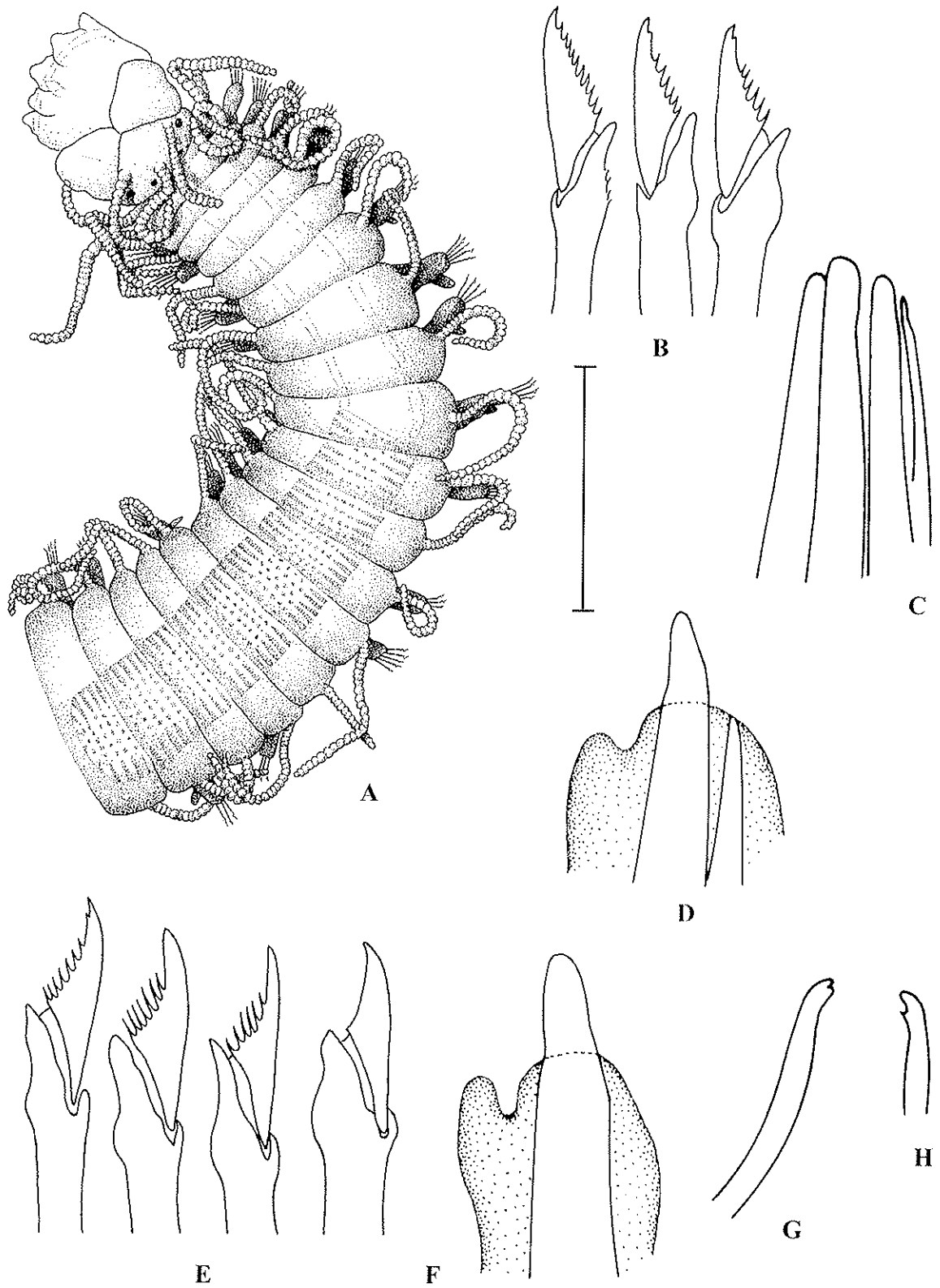


Figure 2. *Syllis licheri*, sp. n. A, anterior end, dorsal view of a paratype. B, dorsal compound chaetae, anterior parapodium. C, aciculae, anterior parapodium. D, midbody parapodial lobe (dorsal view) and aciculae. E, compound chaetae, posterior parapodium. F, posterior parapodial lobe and acicula. G, dorsal simple chaeta. H, ventral simple chaeta. — Scale: A: 0.5 mm; D, F: 25  $\mu$ m; B, C, E, H: 20  $\mu$ m.

**Diagnosis:** *Syllis licheri* is characterised by having unidentate or indistinctly bidentate, short, triangular blades on the compound chaetae, with short spines or smooth on margin, without a marked dorso-ventral or antero-posterior gradation in size. It has a large, straight acicula protruding out from the parapodial lobes, and a long pharynx and proventricle.

**Description:** Body long and slender, cylindrical, without colour markings. The holotype is the only complete specimen, with a length of 16 mm and a width of 0.65 mm for 130 chaetigers. Prostomium distinctly pentagonal (Fig. 2 A), with 4 eyes in open trapezoidal arrangement. Median antenna with about 16–21 articles, originating slightly in front of posterior pair of eyes; lateral antennae inserted in front of anterior pair of eyes, with about 16–19 articles. Palps broad, robust and triangular. Pharynx and proventricle long and narrow; pharynx usually everted, provided with a crown of 10 soft papillae and a median dorsal tooth; proventricle through 10 segments, with 40 muscle cell rows. Peristomium shorter than following segments. Dorsal tentacular cirri with about 26 articles, ventral tentacular cirri somewhat longer than half of length of dorsal ones. Dorsal cirri slender and delicate, shorter than body width on each segment and with some alternation in length; in mid-body, long dorsal cirri each with about 26–28 articles and short dorsal cirri with about 13–17 (Fig. 2 A). Ventral cirri digitiform, longer in the posterior part of the body. Parapodia conical, distally bilobed, with a small anterior lobe and a large posterior lobe (Figs. 2 D, F). Anterior parapodia each with about 20 compound chaetae, with smooth or nearly smooth shafts, and blades short, triangular, smooth on more ventral blades and provided with short spines in margin of more dorsal ones. All anterior chaetae are very slightly bidentate (Fig. 2 B), with small dorso-ventral gradation in length of blades, 20–14  $\mu\text{m}$ . Number of chaetae per parapodium progressively decreasing to only 4–5 on the posterior ones. On the posterior parapodia the chaetae have blades distinctly unidentate with short spines on margin and smooth on most ventral chaetae. The tip is distally dressed and blades of most dorsal compound chaetae have a minute proximal tooth (Fig. 2 E). Posteriormost compound chaetae have very small dorso-ventral gradation in blades length, all about 14  $\mu\text{m}$ . Number of acicula per parapodium progressively decreasing towards the posterior segments. Four aciculae on each anterior parapodium, 3 similar, moderate in width, with rounded tips, 1 thinner and pointed distally (Fig. 2 C). Two aciculae in midbody, with acute tips and very different lengths, emerging from parapodial lobe (Fig. 2 D). Posterior parapodia each with solitary, large, straight acicula, distinctly protruding out of parapodial lobes (Fig. 2 F). Solitary dorsal and ventral simple chaetae only observed on last segment of holotype; dorsal simple chaetae smooth, bidentate (Fig. 2 G); ventral simple chaetae similar to dorsal one, indistinctly bidentate (Fig. 2 H). Pygidium

small, triangular, with an unpaired appendage and 2 anal cirri, similar to dorsal cirri, with 34 articles.

**Remarks:** These specimens do not agree with the descriptions of any other species of the genus, and are therefore described as a new species. Other species of the Iberian area with unidentate blades on the compound chaetae are *S. armillaris* (O. F. MÜLLER 1776), *S. ferrani* ALÓS & SAN MARTÍN 1987, and *S. vittata* GRUBE 1840, all of them re-described in the monography on the Iberian Syllidae (SAN MARTÍN 2003). *S. vittata* differs from the new species on having all blades of compound chaetae unidentate with a somewhat hooked tip, much longer dorsal cirri and acuminate aciculae; *S. armillaris* has much shorter and thicker dorsal cirri, with different aciculae and also somewhat hooked blades. *S. ferrani* has similar compound chaetae, but it has also thick simple chaetae by loss of blades and enlargement of shafts, very different dorsal cirri and aciculae, and a marked colour pattern. *Syllis variegata* GRUBE 1860, *S. alternata* MOORE 1908, and *S. pontxioi* SAN MARTÍN & LÓPEZ 2000, also have thick, straight aciculae, emergent from parapodial lobes, but all the compound chaetae have strongly bidentate blades (see CAMPOY 1982, SAN MARTÍN 1984, 2003, SAN MARTÍN & LÓPEZ 2000).

Recently, LICHER (1999) reviewed the Genus *Typosyllis*, in which this new species would be included according to his proposed taxonomy for this group. However, the name *Typosyllis* LANGERHANS 1879 is herein abandoned in favour of *Syllis* for the reasons argued in SAN MARTÍN (1992). In spite of the different genus name used, LICHER's revision includes redescriptions of old species and keys for identification of all species of the group, that are most useful to recognise *S. licheri* as a new species. The most similar species to *Syllis licheri* sp. n. is *Syllis fasciata* MALMGREN 1867, from arctic and sub-arctic areas, because it has unidentate blades and posterior aciculae straight, thick, emerging distinctly from parapodial lobes (see LICHER 1999: 245, Fig. 102); however, *S. fasciata* has longer dorsal cirri, with more articles, a lower number of compound chaetae on each anterior parapodium, and longer blades of the compound chaetae (40–50  $\mu\text{m}$  on anterior parapodia, 30–40  $\mu\text{m}$  on posterior ones), with somewhat hooked tips, and spines that are short and uniform all along the margin.

**Habitat:** Found at depths between 46 and 101 m, mainly in medium sand and gravel with 0.3–1.4 % organic content.

#### Genus *Trypanosyllis* CLAPARÈDE 1864

##### *Trypanosyllis coeliaca* CLAPARÈDE 1868

*Trypanosyllis coeliaca*: CLAPARÈDE (1868: 203)

*Trypanosyllis coeliaca* — LANGERHANS (1879: 557), FAUVEL (1923: 270, figs. 101 f–h), LAUBIER (1968: 93, fig. 10 b), RULLIER & AMOUREUX (1970: 118), HARTMANN-SCHRÖDER (1977: 85, figs. 23–24), PERKINS (1981:

Table 1. Position and depth of sampling stations. Near-bottom water temperature (°C), salinity and surface sediment characteristics: sediment type, organic matter content (O.M., %). — Other abbreviations: VFS: very fine sand; FS: fine sand; MS: medium sand; CS: coarse sand; VCS: very coarse sand; G: gravel; —: not measured.

Station	Date	Position		Depth [m]	Sediment type	O.M. [%]	Temp. [°C]	Salinity [‰]
		Latitude (N)	Longitude (W)					
A1-2	21. VII. 1994	40°37.594'–40°37.683'	8°47.574'–8°47.631'	17.7	VFS	1.63	—	—
A1-3	21. VII. 1994	40°37.604'–40°37.604'	8°48.861'–8°48.861'	25.8	VFS	1.14	—	—
A1-4	21. VII. 1994	40°37.641'–40°37.657'	8°50.151'–8°50.189'	33.9	MS	0.44	—	—
A1-6	21. VII. 1994	40°37.591'–40°37.613'	8°52.904'–8°52.922'	42.0	CS	0.39	—	—
A1-8	21. VII. 1994	40°37.615'–40°37.663'	8°55.425'–8°55.528'	50.3	CS	0.61	—	—
A2-1	21. VII. 1994	40°38.596'–40°38.625'	8°45.985'–8°46.985'	8.9	FS	0.83	—	—
A2-2	21. VII. 1994	40°38.564'–40°38.601'	8°47.293'–8°47.305'	13.8	FS	1.03	13.5	36.0
A2-3	21. VII. 1994	40°38.541'–40°38.626'	8°48.591'–8°48.636'	21.9	VFS	0.90	—	—
A2-4	21. VII. 1994	40°38.546'–40°38.603'	8°49.971'–8°50.038'	30.8	CS	0.43	—	—
A2-6	21. VII. 1994	40°38.619'–40°38.632'	8°52.583'–8°52.586'	39.3	G	0.57	13.2	36.1
A2-8	21. VII. 1994	40°38.490'–40°38.613'	8°55.221'–8°55.235'	48.3	G	0.90	—	—
B1-1	29. VII. 1994	40°38.559'–40°38.570'	8°57.198'–8°57.201'	57.3	G	1.46	13.1	36.2
B1-2	29. VII. 1994	40°38.480'–40°38.561'	9°02.632'–9°02.683'	79.0	G	0.80	12.9	36.2
B1-3	29. VII. 1994	40°38.370'–40°38.615'	9°07.815'–9°07.974'	100.5	FS	1.35	12.8	36.2
B1-4	29. VII. 1994	40°38.401'–40°38.537'	9°13.049'–9°13.114'	131.5	G	4.21	12.7	36.2
B1-5	29. VII. 1994	40°38.507'–40°38.583'	9°18.269'–9°18.363'	162.8	MS	3.06	—	—
A3-1	22. VII. 1994	40°39.631'–40°39.643'	8°45.705'–8°45.723'	11.1	FS	1.33	13.5	35.9
A3-2	22. VII. 1994	40°39.566'–40°39.633'	8°46.916'–8°47.014'	14.0	FS	1.14	—	—
A3-3	22. VII. 1994	40°39.560'–40°39.634'	8°48.238'–8°48.327'	21.9	MS	0.68	—	—
A3-4	22. VII. 1994	40°39.596'–40°39.608'	8°49.561'–8°49.596'	28.8	G	1.05	—	—
A3-6	22. VII. 1994	40°39.570'–40°39.617'	8°52.265'–8°52.357'	38.6	G	0.64	—	—
A3-8	22. VII. 1994	40°39.564'–40°39.610'	8°54.911'–8°54.949'	46.4	CS	0.57	—	—
A4-1	2. VIII. 1994	40°41.097'–40°41.134'	8°46.192'–8°46.303'	13.6	VFS	1.07	—	—
B2-1	28. VII. 1995	40°33.407'–40°33.528'	8°48.170'–8°48.293'	13.7	FS	0.74	14.5	36.2
B2-2	28. VII. 1995	40°33.521'–40°33.558'	8°53.490'–8°53.541'	40.9	VCS	0.36	13.8	36.2
B2-3	28. VII. 1995	40°33.380'–40°33.472'	8°58.496'–8°58.681'	59.1	VCS	0.70	13.6	36.1
B2-4	28. VII. 1995	40°33.273'–40°33.478'	9°03.983'–9°04.046'	76.8	—	1.29	—	—
B2-5	28. VII. 1995	40°33.241'–40°33.514'	9°09.133'–9°09.746'	93.9	FS	0.76	—	—
B2-6	28. VII. 1995	40°33.215'–40°33.215'	9°14.179'–9°14.179'	130.1	FS	2.53	—	—
B2-7	28. VII. 1995	40°33.367'–40°33.648'	9°19.551'–9°19.793'	157.7	MS	2.57	—	—
B3-1	29. VII. 1995	40°43.429'–40°43.549'	8°45.147'–8°45.273'	12.7	VFS	0.99	14.2	36.2
B3-2	29. VII. 1995	40°43.141'–40°43.601'	8°50.718'–8°51.212'	31.8	VCS	0.58	13.9	36.2
B3-3	29. VII. 1995	40°43.169'–40°43.346'	8°55.823'–8°55.863'	48.2	—	0.72	13.7	36.2
B3-4	29. VII. 1995	40°43.261'–40°43.472'	9°01.301'–9°01.496'	71.7	VCS	0.78	—	—
B3-5	29. VII. 1995	40°43.085'–40°43.674'	9°06.254'–9°06.387'	97.5	FS	0.98	—	—
B3-6	29. VII. 1995	40°43.486'–40°43.604'	9°11.743'–9°11.955'	134.9	MS	2.14	—	—
B3-7	29. VII. 1995	40°43.505'–40°43.600'	9°16.924'–9°16.969'	184.1	FS	2.83	12.6	36.3
B4-1	1. VIII. 1995	40°48.626'–40°48.570'	8°44.174'–8°44.211'	15.6	—	—	—	—
B4-2	1. VIII. 1995	40°48.396'–40°48.472'	8°49.093'–8°49.192'	34.9	CS	0.42	—	—
B4-3	1. VIII. 1995	40°48.030'–40°48.192'	8°54.461'–8°54.538'	46.1	CS	0.33	—	—
B4-4	1. VIII. 1995	40°47.833'–40°48.299'	8°59.674'–8°59.745'	68.9	CS	0.85	—	—
B4-5	3. VIII. 1995	40°47.620'–40°48.647'	9°04.853'–9°05.013'	96.3	—	—	—	—
B4-6	3. VIII. 1995	40°48.493'–40°48.503'	9°10.240'–9°10.449'	124.6	—	—	—	—

1155, figs. 33, 34), CAMPOY (1982: 354, fig. 28), SAN MARTÍN (1984: 274, fig. 63; 2003: 308, figs. 169, 170), NÚÑEZ et al. (1992: 114, fig. 2 B).

Material: B2-2(3); B2-3(3); B2-4(1); B3-2(12); B3-3(7); B3-4(2); B4-2(1); A1-4(1); A1-6(4); A2-4(1); A2-6(3); A2-8(3); A3-4(16); A3-6(2); A3-8(3); B1-1(3).

Habitat: Found at depths between 29 and 77 m, mainly in coarse sand and gravel with 0.4–1.5 % organic content.

Distribution: Atlantic (from Ireland to Madeira Island, Florida), Mediterranean (to Marmara sea), Pacific (Salomon Islands). In Portugal: Coast from Cabo Carvoeiro to Ponta do Surdão, Madeira Island.

#### Subfamily Exogoninae LANGERHANS 1879

##### Genus *Exogone* ÖRSTED 1845

##### *Exogone (Exogone) naidina* ÖRSTED 1845

*Exogone (Exogone) naidina*: ÖRSTED (1845: 20)

*Exogone naidina* — LANGERHANS (1879: 563), HARTMANN-SCHRÖDER (1974: 52, 1977: 88), CAMPOY (1982: 295), SAN MARTÍN (1984: 208, Fig. 46; 2003: 262, figs. 142, 143), NÚÑEZ et al. (1992: 47).

*Exogone gemmifera* — FAUVEL (1923: 305, figs. 117 a–d), DAY (1967: 274, figs. 12.10 p–u).

Material: B3-3(2).

Habitat: Found at 48 m depth, in sediment with 0.7 % organic content. No information on sediment type.

Distribution: Cosmopolitan. In Portugal: Rio Sado estuary, Ria Formosa, Madeira Islands.

##### Genus *Parapionosyllis* FAUVEL 1923

##### *Parapionosyllis cabezali* PARAPAR, SAN MARTÍN & MOREIRA 2000

*Parapionosyllis cabezali*: PARAPAR, SAN MARTÍN & MOREIRA (2000: 527), San Martín (2003: 291, figs. 160, 161).

*Parapionosyllis* cf. *gestans* (non *Parapionosyllis gestans* PIERANTONI 1903) — CAMPOY (1982: 267, fig. 18), PARAPAR et al. (1994: 96, fig. 2).

*Parapionosyllis cabezali* — PARAPAR et al. (2000: 527, figs. 1, 2).

Material: B2-2(13); B2-3(1); B3-2(4); B3-3(5); B3-4(3); B4-2(1); B4-3(2); A1-4(16); A1-6(1); A1-8(2); A2-4(1); A3-4(2); A3-6(4); A3-8(1).

Remarks: This species has been reported by CAMPOY (1982) and PARAPAR et al. (1994) as *Parapionosyllis* cf. *gestans*; however, a recent study suggested that it represents a different species, *P. cabezali* (PARAPAR et al. 2000). Unlike *P. gestans*, this species shows a moderate dorso-ventral gradation in the length of the blades of the

compound chaetae and numerous parapodial glands of two kinds and different sizes.

Habitat: Found at depths between 29 and 72 m, mainly in coarse sand and gravel with 0.3–1.1 % organic content.

Distribution: Atlantic (Spain). In Portugal: First record for Portugal.

##### Genus *Sphaerosyllis* CLAPARÈDE 1863

##### *Sphaerosyllis bulbosa* SOUTHERN 1914

*Sphaerosyllis bulbosa*: SOUTHERN (1914: 20, pl. 1–2, figs. 2 A–G).

*Sphaerosyllis bulbosa* — FAUVEL (1923: 304, figs. 116 h–r), CAMPOY (1982: 276), PARAPAR et al. (1994: 98, fig. 4), SAN MARTÍN (2003: 191, figs. 98, 99).

Material: B2-2(1); B2-3(19); B2-4(48); B3-2(21); B3-3(11); B3-4(5); B4-3(1); B4-4(7); A3-6(2); A3-8(1); B1-1(1); B1-2(29).

Habitat: Found at depths between 31.8 and 79.0 m, in coarse sand and gravel with 0.33–1.46 % organic content.

Distribution: Atlantic, from English Channel to Mediterranean, Black Sea. In Portugal: Rio Sado estuary, Sines.

##### *Sphaerosyllis hystrix* CLAPARÈDE 1863

*Sphaerosyllis hystrix*: CLAPARÈDE (1863: 45)

*Sphaerosyllis hystrix* — FAUVEL (1923: 301, figs. 115 g–k), SAN MARTÍN et al. (1981: 71, figs. 13 A, 14 E–G), CAMPOY (1982: 281, figs. 19 e–g [in part]), KIRKEGAARD (1983: 219), SAN MARTÍN (1984: 245, fig. 57; 2003: 203, figs. 106, 107).

Material: B2-2(3); B2-3(1); B2-4(1); B3-3(3); B3-4(3); B4-4(4).

Habitat: Found at depths between 39 and 77 m, in coarse to very coarse sand with 0.4–1.3 % organic content.

Distribution: Cosmopolitan. In Portugal: Ria de Aveiro, Rio Sado estuary, Lagoa de S.<sup>o</sup> André, Peniche, Arrábida, continental shelf off Algarve.

##### *Sphaerosyllis taylori* PERKINS 1981

*Sphaerosyllis taylori*: PERKINS (1981: 1140, fig. 26)

*Sphaerosyllis taylori* — SAN MARTÍN (1984: 247, fig. 58; 2003: 206, fig. 108), RUSSEL (1991: 71).

Material: B2-2(1); B2-4(3); B3-2(6); B3-4(1).

Remarks: This species is very similar to *S. hystrix* from which it can be distinguished by having pharynx and proventricle of nearly equal length and anterior compound chaetae with shorter blades and strong pectination, without dorso-ventral gradation (PERKINS 1981, PARAPAR et al. 1994).

**Habitat:** Found at depths between 32 and 72 m, in very coarse sand with 0.4–0.8 % organic content.

**Distribution:** Atlantic (from Galicia to Canary Islands; Gulf of Mexico; Caribbean sea); Mediterranean. In Portugal: Rio Sado estuary.

Subfamily Eusyllinae MALAQUIN 1893

Genus *Dioplosyllis* GIDHOLM 1962

*Dioplosyllis cirrosa* GIDHOLM 1962

*Dioplosyllis cirrosa*: GIDHOLM (1962: 253, figs. 2 A–F, pl. 1, figs. A–B).

*Dioplosyllis cirrosa* — CAMPOY (1982: 309); SAN MARTÍN (2003: 110, fig. 50).

**Material:** B3–3(2).

**Habitat:** Found at 48 m depth, in sediment with 0.7 % organic content. No information on sediment type.

**Distribution:** North-East Atlantic (Roscoff and Gulf of Biscay) and Mediterranean. In Portugal: Rio Sado estuary and SW coast of Portugal.

Genus *Paraehlersia* SAN MARTÍN 2003

*Paraehlersia ferrugina* (LANGERHANS 1881)

*Ehlersia ferrugina*: LANGERHANS (1881: 104, pl. 4, fig. 10)

*Ehlersia ferrugina* — LAUBIER (1968: 85, fig. 3), SAN MARTÍN (1984: 306, figs. 73, 74), NÚÑEZ & SAN MARTÍN (1996: 207, figs. 3 D–I).

*Syllis (Ehlersia) ferrugina* — SOUTHERN (1914: 38), AUGENER (1918: 279), FAUVEL (1923: 269, figs. 100 k–n), FAUVEL (1936: 29).

*Syllis (Langerhansia) ferrugina* — DAY (1967: 244, figs. 12.2 o–r).

*Langerhansia ferrugina* — SAN MARTÍN et al. (1981: 76, fig. 17), CAMPOY (1982: 400, fig. 44).

*Paraehlersia ferrugina* SAN MARTÍN (2003: 61, figs. 19–21)

**Material:** B2–3(3); B2–4(1); B3–3(15); B4–3(1); A1–8(1); A2–4(16); A2–6(2); A2–8(1); A3–6(2); A3–8(3); B1–1(3).

**Habitat:** Found at depths between 31 and 77 m, in coarse sand to gravel with 0.3–1.5 % organic content.

**Distribution:** Cosmopolitan in temperate and tropical seas. In Portugal: Lagoa de Óbidos, Lagoa de Albufeira, Peniche, continental shelf off Algarve.

Genus *Opisthodonta* LANGERHANS 1879

*Opisthodonta morena* LANGERHANS 1879

*Opisthodonta morena*: LANGERHANS (1879: 547, fig. 12).

*Opisthodonta morena* — CAMPOY (1982: 307), NÚÑEZ & SAN MARTÍN (1996: 206, figs. 3 A–C), SAN MARTÍN (2003: 54, figs. 15, 16).

**Material:** B2–4(1); B3–3(13); B3–4(3); B4–3(9); B4–4(2).

**Habitat:** Found at depths between 46 and 77 m, in coarse to very coarse sand with 0.3–1.3 % organic content.

**Distribution:** Atlantic (Madeira and Canary Islands), Mediterranean, Red Sea. In Portugal: SW coast of Portugal, Madeira.

*Opisthodonta pterochaeta* SOUTHERN 1914

*Opisthodonta pterochaeta*: SOUTHERN (1914: 30, pl. 4, figs. 6 A–G).

*Opisthodonta pterochaeta* — FAUVEL (1923: 274, figs. 102 d–l), CAMPOY (1982: 304, fig. 24), BACHELET (1990: 173, fig. 1), SAN MARTÍN (2003: 51, figs. 13, 14).

**Material:** B2–2(1); B2–3(1); B2–4(6); B3–3(9); B4–3(5); B4–4(3); A1–8(2); A2–8(4); B1–1(4).

**Remarks:** This species differs from the previous one mainly by having thick acicula with enlarged tip (see CAMPOY 1982).

**Distribution:** Atlantic (from North Sea to Gulf of Biscay). In Portugal: First record for Portugal.

**Habitat:** Found at depths between 41 and 77 m, in coarse sand and gravel with 0.3–1.5 % organic content.

Genus *Palposyllis* HARTMANN-SCHRÖDER 1977

*Palposyllis prosostoma* HARTMANN-SCHRÖDER 1977

*Palposyllis prosostoma*: HARTMANN-SCHRÖDER (1977: 87)

*Palposyllis prosostoma* — SAN MARTÍN & AGUIRREZABALAGA (1988: 30, fig. 1), SAN MARTÍN (2003: 57, figs. 17, 18).

*Pionosyllis propeweismanni*: DAUVIN & LEE (1983: 30, fig. 1; original incorrect spelling: "prope-weismanni" [sic]).

**Material:** B2–2(2); B2–3(15); B3–2(2); B3–3(2); B3–4(2); B4–3(5); A1–4(3); A1–6(3); A1–8(4); A2–4(2); A2–6(1); A3–4(3); A3–8(1); B1–1(4).

**Remarks:** This species was described by DAUVIN & LEE (1983) as *Pionosyllis propeweismanni*, but SAN MARTÍN & AGUIRREZABALAGA (1988) synonymised it to *Palposyllis prosostoma*, originally described by HARTMANN-SCHRÖDER (1977), and proposed a new diagnosis of the genus *Palposyllis* along with a redescription of the species.

**Habitat:** Found at depths between 29 and 59 m, mainly in coarse sand and gravel with 0.3–1.5 % organic content.

**Distribution:** Atlantic (Zumaia and Roscoff). In Portugal: First record for Portugal.

Subfamily Autolytinae LANGERHANS 1879

Genus *Autolytus* GRUBE 1850

*Autolytus brachycephalus* (MARENZELLER 1874)

*Proceraea brachycephala*: MARENZELLER (1874: 460).

*Autolytus brachycephalus* — FAUVEL (1923: 316, figs. 121 g–h), GIDHOLM (1967: 188, figs. 7 b, 14 b, 15, 19 a).



HAMOND (1969: 291), CAMPOY (1982: 240), SAN MARTÍN (1984: 420, fig. 115; 2003: 500, fig. 277), PARAPAR et al. (1996 a: 142, fig. 1 b, pl. 1, figs. C–D), NÚÑEZ & SAN MARTÍN (1996: 213, figs. 5 H–J).

Material: B3–4(1).

Habitat: Found at 72 m depth, in very coarse sand with 0.8 % organic content.

Distribution: East Atlantic (from Scandinavia to Canary Islands) and Mediterranean. In Portugal: Ria de Aveiro and Madeira Island.

*Autolytus cf. benazzi* COGNETTI 1953

*Autolytus benazzi*: COGNETTI (1953: 89, fig. 1).

*Autolytus benazzi* — SAN MARTÍN (1984: 415, fig. 112; 2003: 478, figs. 261, 262); NÚÑEZ & SAN MARTÍN (1996: 214, figs. 5 N–Q); PARAPAR et al. (1996 a: 140, fig. 1 a, pl. 1, fig. B).

Material: B3–2(1).

Remarks: This species differs from the previous one by having the teeth of the trepan all of the same size, and long cirrophores (longer than the cirrus) on the dorsal cirri (SAN MARTÍN 1984). The only specimen examined is very small and incomplete.

Habitat: Found at 31.8 m depth, in very coarse sand with 0.58 % organic content.

Distribution: Mediterranean and East Atlantic (Canary Islands and Galicia). In Portugal: First record for Portugal.

## Discussion

The syllids in the continental shelf off Aveiro occur mainly in coarse and very coarse sand, with low organic content, at depths between 28.8 and 100.5 m. Only three species, *Opisthodonta morena*, *O. pterochaeta* and *Syllis licheri*, appear to have a more restricted distribution within the shelf, as they occur mainly between 40.9 and 79.0 m depth. Nevertheless, a few specimens of *S. licheri* were also found at 100.5 m, together with *S. parapari*.

The best represented subfamily is the Syllinae, with 566 specimens (59 % of the total), mainly due to the species *Syllis garciai* (231 specimens) and *S. pontxioi* (213 specimens), that occur at nearly all stations to a depth of 79.0 m.

The studied area is located in the Lusitanian province of the Mediterranean-Atlantic region, which extends from the Western entrance of the English Channel to Cap Verde Islands, including the Mediterranean (BRIGGS 1974). The biogeographic analysis of the studied material revealed that the Eusyllinae and Autolytinae species are mainly distributed within the Mediterranean-Atlantic region. On the other hand, Syllinae and Exogoninae species can also be found at similar latitudes in the Western part of the Atlantic and the former even in the Pacific and Indian oceans. Curiously, within the subfamily Eusyllinae there are two groups with different

distributions. One is composed by the species *Opisthodonta pterochaeta* and *Palposyllis prosostoma*, recorded in the Northern part of the East Atlantic (from North Sea to Gulf of Biscay); the other includes *Paraehlersia ferrugina* and *O. morena*, recorded in southern areas (from Gulf of Biscay to Canary Islands and to Mediterranean). This suggests that the Portuguese coast, where these four species occur, probably represents the southernmost limit for the former group and the northernmost limit for the latter.

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## *Mesochaetopterus sagittarius*: an example of a biogeography discrepancy between larval and adult boundaries: implication for recruitment studies

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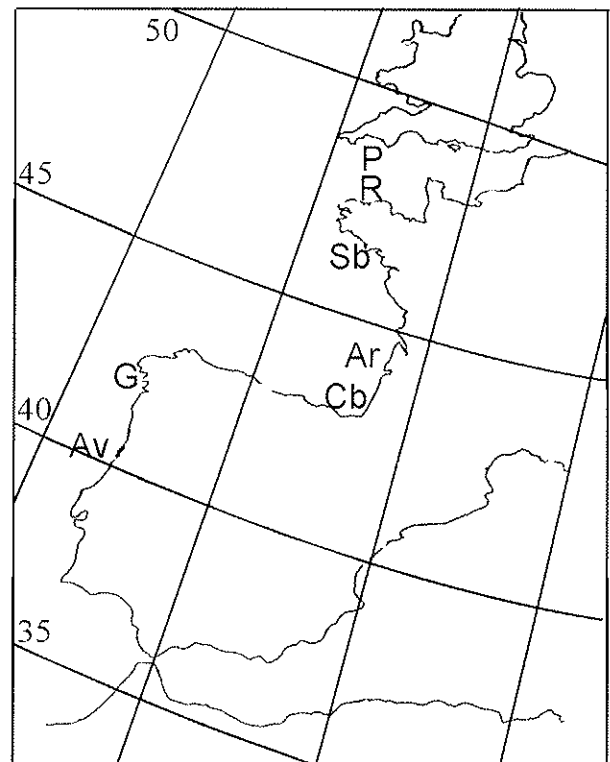
A geographic discrepancy between the distribution boundaries for larvae and adults of the chaetopterid *Mesochaetopterus sagittarius* was recorded. The most northerly position where benthic individuals, probably not reproductive, have been collected in the Atlantic corresponds to the latitude of Aveiro (Portugal). The most northerly position for larvae corresponds to that of Arcachon (France). The larvae found off Arcachon constitute an influx of subtropical origin. They rarely succeed in passing the fixation stage, and when they do, the benthic stage is not capable of reproduction. The occupation of a very large zone by planktonic larvae spread over 4° of latitude (500 km), eventually resulting in sterile benthic populations, confirms that environmental constraints are less severe on larvae than on adults. This work emphasizes, through the integration of different oceanographic disciplines, the importance of knowing the structure of the spatial distribution of adults when seeking to achieve a better understanding of local recruitment.

### INTRODUCTION

This work is an attempt to establish links between the distribution of benthic adults and planktonic larvae, and the hydrodynamic conditions at the northernmost boundary for the species *Mesochaetopterus sagittarius*. There are three reasons for studying species' distribution boundaries: (i) to show how ecological constraints on the species are in balance with the environmental characteristics; (ii) to take advantage of processes that are more clear-cut at the boundaries than in the centre of the distribution; and (iii) to understand time-related changes of a distribution, in order to build up palaeogeographic interpretations. The first two points are directly related to the objectives of the present study. Temperature range and the physiological boundaries differ for the different stages of development: the larvae, the juveniles, the vegetative adults and the sexually mature adults. These differences are particularly clear when the climate varies over a limited horizontal distance, giving rise to a front. These numerous factors and constraints which refer to seasonal temperatures, hydrodynamics, nature of substratum, check each stage of development. This is why the spatial distribution of a species is subdivided into zones that account for each stage of an entire life cycle, to a greater or lesser extent (Bhaud, 1998).

### MATERIALS AND METHODS

The area of investigation spreads from Aveiro (Portugal) to the south coast of Brittany (Figure 1 & Table 1). The target species *Mesochaetopterus sagittarius* (Polychaeta: Chaetopteridae) (syn. *M. minutus*) is well known both in adult and larval stages. The planktonic



**Figure 1.** Map of the different locations identified in the study. For the Atlantic Ocean, the northernmost report of larvae appears to be off Arcachon (45°N). The northernmost report of adults appears to be off 40°N (Portugal). Accordingly larval drift extends at least over 5° with no corresponding representatives in the benthic fauna. Locations and references used to substantiate larval or adult presence of *Mesochaetopterus sagittarius* are given in Table 1.