



## Fragmented knowledge on West-European and Iberian Caudofoveata and Solenogastres

### Conocimiento fragmentado de los Solenogastros y Caudofoveados de Europa occidental y Península Ibérica

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#### ABSTRACT

A basic problem in our knowledge of the aplacophoran molluscs, viz. the Caudofoveata and the Solenogastres, is the poor availability of faunistic samplings. This lacunarity even concerns the European waters; in the present contribution, particular attention is paid to the gap in the records along the French and Iberian shelf regions. This is underlined by presenting an updated geographic distribution of eight caudofoveate and thirteen solenogastre species. Benthos investigators are called upon to focus more intensively on sampling the smaller marine fauna from mobile bottoms of the West-European shelf regions.

#### RESUMEN

Un problema esencial para el conocimiento de los Caudofoveados y Solenogastros (moluscos aplacóforos) es la insignificante disponibilidad de material recogido en diferentes muestreos faunísticos. Esta carencia todavía afecta al Atlántico europeo y particularmente concierne a la falta de muestras en la plataforma continental de Francia y de la Península Ibérica. Esta situación se pone en evidencia con la recopilación actualizada de la distribución geográfica de ocho especies de Caudofoveados y trece de Solenogastros. Se hace una invitación especial a los investigadores del bentos para que intensifiquen su atención por la pequeña fauna marina de sustratos blandos en la plataforma occidental europea.

KEY WORDS: Caudofoveata, Solenogastres, Aplacophora, new records, distribution, Europe.

PALABRAS CLAVE: Caudofoveados, Solenogastros, Aplacophora, nuevas citas, distribución, Europa.

#### INTRODUCTION

This contribution is restricted to a very simple, but momentous problem: the dearth of faunistic information with all its consequences in both classes of aplacophorous molluscs, the Caudofoveata (formerly Chaetodermomorpha) and the Solenogastres (formerly Neomeiomorpha).

Members of the Caudofoveata and the Solenogastres live predominantly in marine offshore habitats below 50 meters depth and are in general not really rare members of benthic biotopes (see SALVINI-PLAWEN 1990). The Caudofoveata (average size 2-15 mm) are micro-omnivores burrowing within muddy sedi-

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ments, whereas the Cnidaria-ivorous Solenogastres (average size 2-20 mm) are bound to clay, secondary hard bottoms or cnidarian colonies. Our scarce knowledge about species diversity, biology and zoogeography of the representatives of both groups is in part due to the intricate, high-effort and expensive sampling methods for benthic meiofauna (ships, cable winches, benthic sledge-dredges). Due to these technical and financial difficulties, investigation of marine meiofauna is generally restricted to the "home turf" of marine biological stations or fishery institutes as typified by Plymouth/UK or Naples/Italy. For more than a century, this has resulted in an unbalanced biogeographic and systematic knowledge of small fauna, even in European waters, restricting the informative data predominantly to animals of the North and Mediterranean Seas. Surprisingly, there are only poor records from the shelf region off France and the Iberian peninsula (delimited in Figure 1 by the 200 m isobath).

Therefore, a special invitation is addressed to all Spanish, Portuguese, and French colleagues who perform benthic offshore investigations to include in their projects the sampling of meiofauna from mobile bottoms. It is only with the help of such cooperative collecting work that examination, determination and research on small benthic animals such as Caudofoveata and Solenogastres can be satisfactorily carried out. This cooperation is vital to adequately enlarge our knowledge about the organization, biology and biogeography of these primitive molluscan groups that still bear calcareous bodies instead of a shell. Furthermore, this knowledge is essential to also understand Mollusca in general.

Finally, it must be underlined once more that the determination of members of both classes requires detailed examinations (see SALVINI-PLAWEN, 1975 *versus* ODHNER, 1921, for Caudofoveata; serial sections for most Solenogastres).

The nature of the problem becomes more evident when one examines the concrete documentation. With respect to the presently-known caudofoveate and sole-

nogastre fauna in Northeast-Atlantic (European) waters, there is a distinct gradient between the Scandinavian-British records (cf. SALVINI-PLAWEN, 1975; SEAWARD, 1982, 1991) and the West-European reports. Except for a recent collection from four sites off the coast of Galicia (in connection with the project "Fauna Ibérica"; in preparation), other knowledge of aplacophoran representatives from French and Iberian shelf regions is restricted to a few random findings. On the other hand, investigations and records of both Caudofoveata and Solenogastres are again available from the Mediterranean Sea. For Europe as a whole, this results in an almost "bipolar" pattern of intraspecific distribution. Clearly, in contrast to the regular sampling in Scandinavian, British and Mediterranean seas (cf. SALVINI-PLAWEN, 1972, 1975, 1977a, b, 1988; SEAWARD, 1991), no purposeful offshore samplings have been conducted on the Iberian and French shelf in the past to obtain at least an overview of West-Europe's small benthic fauna including Caudofoveata and Solenogastres (the French BIOGAS and POLYGAS samplings lie beyond the European shelf region).

The overall knowledge on Caudofoveata and Solenogastres has significantly increased during the last decades, but is still very poor when compared with other Mollusca (for an organisational and structural overview see SALVINI-PLAWEN, 1985b, and SCHELTEMA, TSCHERKASSKY AND KUZIRIAN, 1994, respectively; their phylogenetic status is analysed in SALVINI-PLAWEN AND STEINER, 1996). The poor, random information on their occurrence in West-European waters also negatively affects our knowledge on the full range of organisation (systematics, comparative anatomy) as well as on biological conditions and circumstances.

The above-mentioned "bipolarity" in intraspecific distribution, with the intervening West-European gap, becomes obvious when considering all aplacophoran representatives known from both northern and southern waters; these are documented below. Other species with an up to now purely Mediterranean or North-European distribution have a potential West-European occurrence (Lusi-



Figure 1. Section of the West-European Atlantic demonstrating the off-shore shelf region down to the 200 m isobath (followed by the continental decline to 3000 m depth).

Figura 1. Sección del Atlántico europeo mostrando la zona de la plataforma continental, hasta la isóbara de 200 m (seguida de la zona del talud continental hasta los 3000 m de profundidad).

tanic region and/or Bay of Biscay); examples given below are the caudofoveates *Psilodens tenuis* and *Chaetoderma strigis-*

*quamatum* as well as the solenogastres *Biserramenia psammobionta* and *Anamenia gorgonophila*.

## CAUDOFOVEATA

The Caudofoveata burrow within mobile bottoms and have adapted a vermiform body with reduced pedal sole

(midventral fusion of the lateral mantle rims). Generally, sampling in muddy biotopes (sledge-dredges, grabs) success-

fully yields specimens. This group (formerly Chatodermomorpha) was separated from the Solenogastres and elevated to class rank due to the paraphyletic status of its aplacophorous organisation (see SALVINI-PLAWEN AND STEINER, 1996). It includes 98 named species classified into three families (Limifossoridae, Prochaetodermatidae, Chaetodermatidae). Seventeen European representatives have been described so far, six of which occur in the Mediterranean including three endemic species (cf. SALVINI-PLAWEN, 1990).

All species of the West-European shelf region along with the Iberian waters of the Mediterranean will be documented. Thus, among the Prochaetodermatidae, the deep-sea species *Prochaetoderma yongei* Scheltema, *P. clenchi* (Scheltema), and *P. (Chevroderma) turnerae* (Scheltema) from the BIOGAS-cruises are not considered. These three species also inhabit

the basin of the Bay of Biscay (2° 10' - 9° W) at depths of 1175-2006 m (*P. yongei*), 1913-2430 m (*P. clenchi*) and 2124-4760 m (*P. turnerae*) (see SCHELTEMA, 1985; for taxonomy cf. SALVINI-PLAWEN, 1992).

Besides *Falcidens aequabilis*, other species of *Falcidens* (Chaetodermatidae) are likewise of biogeographical interest: at least among the known species which are provided with a slender, tail-like posterior body, each appears to inhabit a well-defined, non-overlapping geographic region. Thus, *F. gutturosus* (Kowalevsky, 1901) is Mediterranean (endemic), while *F. crossotus* Salvini-Plawen has a Scandinavian-British distribution. A third "tailed" species, *Falcidens vasconiensis* Salvini-Plawen, comes from the Gulf of Gasconne (SALVINI-PLAWEN, 1996), and future (not yet recorded) Lusitanic representatives may well belong to yet another species.

#### Family LIMIFOSSORIDAE

##### *Scutopus ventrolineatus* Salvini-Plawen, 1968

*Known distribution* (Figure 2A): Scandinavian coast (Skagerrak to Tromsø), North Sea, West-Scotland, Irish Sea, southern Bay of Biscaya, Alborán Sea (off Vélez-Málaga), Gulf of Lion (off Banyuls, off Marseille), SE Africa (off Durban); 40-1248 m.

*Remarks:* The occurrence of this very slender and often coiled species has been summarised in SALVINI-PLAWEN (1975, 1977b). Supplementary records

come from the North Sea (Hartley, 1984) and from off Barcelona/Catalonia with the cruises RETRO I (41° 08' 07" N, 02° 04' 32" E, 510 m) and ESPERMA 89 (41° 04' 37" N, 01° 59' 33" E, 600 m) carried out by Luis Dantart; a recent finding comes from off Vélez-Málaga (4° 03' W) at 400 m. This species is of special interest insofar as it has also been recorded from off Southeast Africa, which indicates a distribution along all East-Atlantic.

##### *Scutopus robustus* Salvini-Plawen, 1970

*Known distribution* (Fig. 2B): Off the Norwegian coast with larger gaps from Oslofjord to North of Trondheimsfjord, scattered in the Western Mediterranean Sea to 9° East; 50-3542 m.

*Remarks:* There are no additional records referring to this slender, up to 10 mm species beyond the occurrence summarised in SALVINI-PLAWEN (1975, 1977a).

##### *Psilodens tenuis* Salvini-Plawen, 1977

*Known distribution* (Fig. 2C): Lusitanic Atlantic S of Cap São Vicente; 2500 m.

*Remarks:* There is a single record only, as communicated in SALVINI-PLAWEN (1977a).

Family PROCHAETODERMATIDAE

*Prochaetoderma raduliferum* (Kowalevsky, 1901)

*Chaetoderma radulifera* Kowalevsky, 1901, *Archs. Zool. exp. gén.*, sér. 3, 9: 264.

*Known distribution:* Endemic in the Mediterranean Sea, known from the Sea of Marmara in the East to off the Algerian coast in the West; 30-2415 m.

*Remarks:* To date, this species is known only from the Mediterranean Sea (see map Abb. 5 in SALVINI-PLAWEN, 1977b). Unlike most other members of the Prochaetodermatidae, *P. raduliferum* is not a true deep-sea species. As is demonstrated by Adriatic and Ionic samplings (30-215 m) as well as by records from off Banyuls (60-275 m)

summarised in SALVINI-PLAWEN (1977b), it is quite regularly found on muddy offshore bottoms. In accordance with this, there are new records from off the West coast of Malta at 120-160 m (MIFSUD, 1996; the specimen photographed by MIFSUD Fig. 2, however, is a broken *Falcidens guttuosus*, see below), from off Barcelona/Catalonia by Luis Dantart (four stations at 41° 04' 37"-41° 09' 06" N, 01° 59' 33"-02° 07' 11" E, 350-680 m), and most recently from off Vélez-Málaga to off Málaga (80-300 m).

Family CHAETODERMATIDAE

*Falcidens guttuosus* (Kowalevsky, 1901)

*Chaetoderma guttuosum* Kowalevsky, 1901, *Archs. Zool. exp. gén.*, sér. 3, 9: 281.

*Known distribution:* Endemic in the Mediterranean Sea, known from off Palestine and from the Sea of Marmara in the East to off Málaga in the West; 40-866 m.

*Remarks:* *Falcidens guttuosus* is a fairly common species characterised by a slender, tail-like posterior body with an orange-red terminal tassel. Beyond the already known, purely Mediterranean distribution (see map

Abb. 2 in SALVINI-PLAWEN, 1977b), there are new samplings from off the West coast of Malta at 120-160 m (MIFSUD, 1994, 1996), by L. Dantart from off Barcelona (see SALVINI-PLAWEN, 1996) and by A. Zenetos from the Gulf of Korinth as well as from the Gulf of Petalión (56 m; Greece); most recently, specimens were recorded from off Vélez Málaga (40 m) and off Málaga (211 m).

*Falcidens vasconiensis* Salvini-Plawen, 1996

*Known distribution:* Gulf of Gascogne; 141-170 m.

*Remarks:* Up to present there is a single record only from off the Cap Breton in

the southeastern Bay or Biscaya (SALVINI-PLAWEN, 1996). Its distribution throughout the shelf region of the Gulf of Gascogne is to be expected.

*Falcidens aequabilis* Salvini-Plawen, 1972

*Known distribution:* Endemic in the Mediterranean Sea, ranging from the Aegean Sea to the western Mediterranean deep-sea bottom as far as the Greenwich meridian; 132-3542 m.

*Remarks:* This species appears to inhabit deeper and/or far offshore bottoms. Because of the technical effort involved, it is consequently less frequently recorded than *F. guttuosus* or

*Prochaetoderma raduliferum*, but is well-documented from the West-Mediterranean deep-sea (Campagne Polymède, cf. SALVINI-PLAWEN, 1977a and 1977b: map

Abb. 2). There is a new record by Luis Dantart from off Barcelona/Catalonia (RETRO I: 41° 09' 06" N, 02° 03' 54" E, 350-426 m).

*Chaetoderma (?) strigisquamatum* Salvini-Plawen, 1977

*Known distribution* (Fig. 2C): Basin of Alborán (W-Mediterranean Sea); 1491 m.

*Remarks*: There is a single record of this chaetodermatid species, whose generic classification needs confirmation (radula

apparatus; cf. SALVINI-PLAWEN, 1977a). Based on the known distribution of Caudofoveata in the Mediterranean Sea in general (SALVINI-PLAWEN, 1977b), a Lusitanic occurrence of this species might be expected.

## SOLENOGASTRES

The Solenogastres (= "those with a belly furrow") include narrowed aplousobranch molluscs that still bear a pedal groove to glide upon (formerly Neomeniomorpha). A total of some 190 species has been described which, in accordance with integumentary characters, is grouped into four orders (Pholidoskepia, Neomeniamorpha, Sterrofustia, Cavi-belonia). To date, 46 species are known in European waters, of which 26 (including 19 "endemics") are represented in the Mediterranean Sea. However, little is known about their biogeography: most species have been recorded only once, and inaccurate descriptions (see e. g. *Wirenia*, below) additionally contribute to difficulties in classification, resulting in insufficient faunistic information. Thus, the poorly described *Nematomenia (?) corallophila* (Kowalevsky, 1881), recorded from off La Calle/Algeria at 73-183 m (37° N, 8° 30' E) as living epizoically on *Corallium rubrum* (Linné),

could only be recognised in the future and re-described if it is rediscovered again on a red coral (its alledged finding in the Bay of Rosas/Costa Brava is a mistranslation by MARS, 1965, from MALUQUER, 1917).

Most species documented here, together with a few others, belong to the small number of representatives found several times. Records of these findings are very much tied to sampling methods and habitat. For example, the well-known *Neomenia carinata* was never recorded by means of sledge-dredges (muddy bottoms), as predominantly used by the author and his group. In another example, those Solenogastres living on thecaphoran Hydrozoa or Octocorallia (e. g. *Nematomenia* and *Anamenia*, below), are more often sampled from secondary hard bottoms (e. g. with Agassiz-trawls) or by workers studying cnidarians. Thus, all these circumstances help explain our fragmented biogeographic knowledge.

### Order PHOLIDOSKEPIA

#### Family DONDERSIIDAE

#### *Nematomenia flavens* (Pruvot, 1890)

*Dondersia flavens* Pruvot, 1890, *Archs. Zool. ex. gén.*, sér. 2, 8: XXII.

*Known distribution* (Fig. 2D): Off Banyuls - Costa Brava, Shetland Islands; 45-167 m.

*Remarks*: This slender, up to 4 cm long species has a showy lemon-yellow colour. It is not rare along the

rocky (French and Spanish) Catalan coast, feeding upon Hydrozoa-Thecaphora at 45-90 m (PRUVOT, 1891; MALUQUER, 1917; MARS, 1965). Another record refers to the Shetland Islands at 167 m, epizoic upon *Lafoea dumosa* SARS; the anatomical examination revealed the presence of a vestigial radula and the necessity for a family reclassification (SALVINI-PLAWEN, 1978: 39-40).

Recently, the Irish Sea Survey (MACKIE, OLIVER AND REES, 1995: 192) collected eleven samples of *N. banyulensis* (see below); however, there is no

information about the exact method of determination applied. The sampled material had been fixed in formalin and then preserved in alcohol (MACKIE ET AL., 1995: 15-16); the specific body-colour of both *N. banyulensis* (red) and *N. flavens* (yellow) is no longer visible after such treatment. Therefore, it might well be that some of the *N. banyulensis*-records in reality belong to the externally very similar *N. flavens*. Only an accurate histological determination (serial sections) can provide the exact specific classification of these specimens.

### *Nematomenia banyulensis* (Pruvot, 1890)

*Dondersia banyulensis* Pruvot, 1890, *Archs. Zool. ex. gén.*, sér. 2, 8: XXII.

*Nematomenia banyulensis* var. *norvegica* Odhner, 1921, *Bergens Mus. Aarb. 1918-19, Naturvid. række* 3: 43.

*Myzomenia* Simroth, 1893, *Zeitschr. wiss. Zool.*, 56: 324.

*Known distribution* (Fig. 2E): Off Dalmatia, Gulfs of Naples and Salerno, Côte Vermeille, off Roscoff, Plymouth Sound to Irish Sea to W-Scotland, off Northumberland, Trondheimsfjord-Fill (an)fjord; 31-300 m.

*Remarks*: This well-known species likewise lives epizoically upon Hydrozoa-Thecaphora. Its slender body reaches a length of up to 3 cm and is red (as are also two other Mediterranean species). Its distribution is summarised in NIERSTRASZ AND STORK (1940) and more recently in SEAWARD (1982, 1991) for the British waters. It has also recently been found several times by the

Irish Sea Survey (MACKIE ET AL., 1995: 192), but compare the above remarks with *N. flavens*. Geographically new records include samples from off Sebenico/Sibenik (Adriatic Sea) at 57 m, 61 m and 67-68 m (see also SALVINI-PLAWEN, 1986) and from the Fill (an)fjord = north-eastern Hitra Island off Trondheimsfjord (Mus. Uppsala).

A comparative examination of Mediterranean and Norwegian (syntype) individuals, particularly with respect to the mantle scales, revealed no differences which would vindicate a separation of the Norwegian specimens (as variation or subspecies proper).

### *Stylomenia salvatori* Pruvot, 1899

*Known distribution*: Off Banyuls, (?)Costa Brava; about 60-80 m.

*Remarks*: This species had been found together with *Rhopalomenia aglaopheniae* (q. v.) in an aquarium filled with benthic material from off Banyuls-sur-Mer; based on the presence of *Rh. aglaopheniae*, this indicates an original depth of about 60-80 m (see PRUVOT,

1891: 721). MALUQUER (1916: 244, 1917: 37-38) reports finding animals similar to *S. salvatori* from the Bay of Rosas and off Llansà (Costa Brava). Even if the occurrence of this species is to be expected there, the record needs to be confirmed because no accurate determination (histological examination) was performed.

Family LEPIDOMENIIDAE

*Tegulaherpia myodoryata* Salvini-Plawen, 1988

"Species D" in Salvini-Plawen, 1968a, *Sarsia*, 31: 132.

*Tegulaherpia celtica* Caudwell, Jones and Killeen, 1995, *Journ. Conch. (London)*, 35: 258.

*Known distribution* (Fig. 2F): Off Livorno, off Banyuls-sur-Mer, southern Bay of Biscay (North of Asturias, THALASSA-Stat. W-415)?, Celtic Sea, area around Bergen (Raunefjord, Hjeltefjord), area around Trondheim (Fill (an)fjord, Trondheimsfjord); 75-470 (75-860/1150?) m.

*Remarks:* This Mediterranean species is likewise native to Northern Europe. In the course of examining more comprehensive Solenogastres material from the North Atlantic, the already communicated "Species D" (SALVINI-PLAWEN, 1968a) and *T. celtica* (CAUDWELL, JONES AND KILLEEN, 1995), according to histological examination by series sections, turned out to be conspecific with *T. myodoryata* from the Western Mediterranean Sea as described

in SALVINI-PLAWEN (1988). Moreover, several other Norwegian individuals (Hjeltefjord, 200 m; Fill (an)-fjord, Trondheimfjord, 470 m) likewise belong to this species.

A single specimen from the THALASSA-Cruise (Stat. W-415, 43° 55' 06" N, 06° 11' 18" W; 860-1150 m), forwarded in 1971 by F. Monniot (Paris) to the author, possibly also represents *T. myodoryata*, since the mantle scales fully fit into the range of shape, outline and size of the *myodoryata*-scales. However, the animal was useless for histological examination, and the record from a depth between 860 and 1150 m lends doubt to a conspecificity as long as no bathymetrically interbridging and/or additional samples are taken.

Family WIRENIIDAE

*Wirenia argentea* Odhner, 1921

*Aesthoherpia glandulosa* Salvini-Plawen, 1985, *The Mollusca* (Academic Press), 10: 94.

"Species B" in Salvini-Plawen, 1968a, *Sarsia*, 31: 131.

*Aesthoherpia glandulosa* Salvini-Plawen and "Species D" Haszprunar, 1986, *Zool. Anz.*, 217: 345-360.

*Known distribution* (Fig. 3A): Area around Bergen/Norway, Hardangerfjord, area of Trondheimsfjord, Adriatic Sea, Aegean Sea; 95-700 m.

*Remarks:* A most recent examination of the hitherto missing type material of *Wirenia argentea* Odhner (now in the Naturhistoriska Rijksmuseet, Stockholm) revealed that *Aesthoherpia glandulosa* Salvini-Plawen is conspecific with it. Despite some inaccurate and insufficient presentations by ODHNER (1921: 31-34; foregut, no radula, and so on), which led to the description of *Aesthoherpia* (see SALVINI-

PLAWEN, 1988: 383-384), *Wirenia* has nomenclatorial priority. The organisation of the species and its presently known geographic distribution are communicated (as *Aesthoherpia glandulosa*) in SALVINI-PLAWEN (1988). Some additional findings come from recently examined Norwegian samples: area Northwest of Bergen (Hjeltefjord, 280 m; Herdla fjord, 200 m; Mangerfjord, 350 m) and Fill (an)fjord-Trondheimsfjord (95 m, 185 m, 320 m, 470 m and 490-500 m). The record of "*Wirenia argentea*" by HARTLEY (1984) from the North Sea needs specific confirmation.

Family MACELLOMENIIDAE

*Macellomenia palifera* (Pruvot, 1890)

*Paramenia palifera* Pruvot, 1890, *Archs. Zool. exp. gén.*, sér. 2, 8: XXIII.

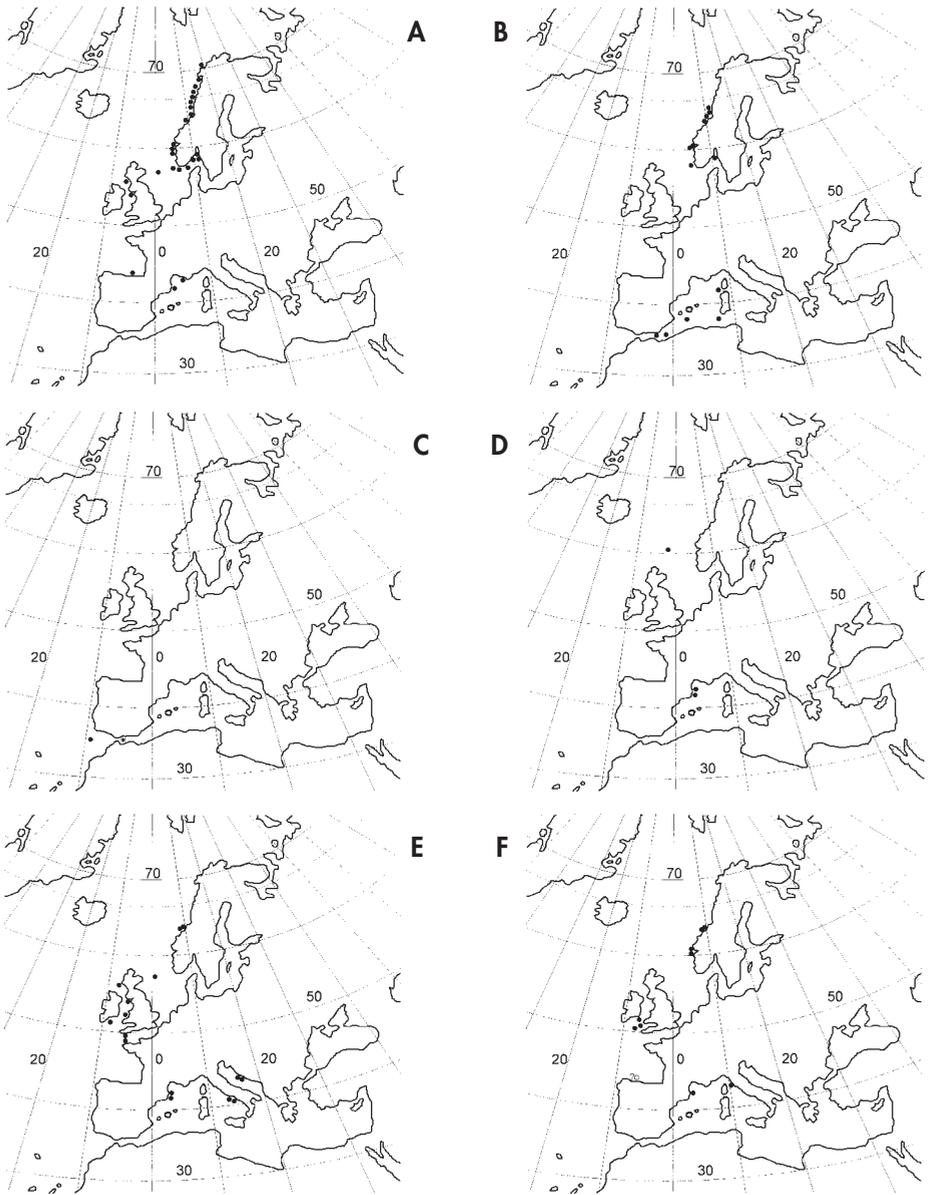


Figure 2. A-C. Caudofoveata. Known European distribution. A: *Scutopus ventrolineatus* Salvini-Plawen, 1968; B: *Scutopus robustus* Salvini-Plawen, 1970; C: Known records of *Psilodens tenuis* Salvini-Plawen, 1970 (black circle) and of *Chaetoderma(?) strigisquamatum* Salvini-Plawen, 1971 (asterisk). D-F: Solenogastres. Known distribution. D: *Nematomenia flavens* (Pruvot, 1890); E: *Nematomenia banyulensis* (Pruvot, 1890); F: *Tegulaherpia myodoryata* Salvini-Plawen, 1988.

Figura 2. A-C. Caudofoveados. Distribuciones conocidas. A: *Scutopus ventrolineatus* Salvini-Plawen, 1968; B: *Scutopus robustus* Salvini-Plawen, 1970; C: Citas conocidas de *Psilodens tenuis* Salvini-Plawen, 1970 (círculo negro) y de *Chaetoderma(?) strigisquamatum* Salvini-Plawen, 1971 (asterisco). D-F: Solenogastros. Distribuciones conocidas. D: *Nematomenia flavens* (Pruvot, 1890); E: *Nematomenia banyulensis* (Pruvot, 1890); F: *Tegulaherpia myodoryata* Salvini-Plawen, 1988.

*Known distribution* (Fig. 3B): Côte Vermeille, Irish Sea (?); 80-120 m.

*Remarks:* This species, with its particular calcareous mantle-bodies, was originally recorded with a single specimen North of Port Vendres (Côte Vermeille; southeastern France) on muddy bottom at 80 m. Two individuals recently sampled from the Irish Sea at 80 m and

120 m come very close to *M. palifera* (CAUDWELL ET AL., 1995). In view of the "bipolar" occurrence of other species (demonstrated herein), there is a high probability that the species are identical. However, as the British animals have not been investigated anatomically (series sections), true conspecificity remains uncertain.

## Order NEOMENIAMORPHA

### Family NEOMENIIDAE

#### *Neomenia carinata* Tullberg, 1875

*Solenopus nitidulus* Koren and Danielssen, 1877, *Arch. Math. Naturvid. (Kristiania)*, 2: 124.

*Solenopus affinis* Koren and Danielssen, 1877, *Arch. Math. Naturvid. (Kristiania)*, 2: 127.

*Neomenia grandis* Thiele, 1894, *Zeitschr. wiss. Zool.*, 58: 223.

*Known distribution* (Fig. 3C): Northern Kattegat and Bohuslän (W-Sweden), Norwegian coast between Oslofjord and Sognesjøen/Sognefjord, Romsdalsfjord, Trondheimsfjord, South of Lofoten, Iceland, Shetland Islands, British Isles, off Roscoff, Costa Brava, Gulf of Genova, Gulf of Naples, off Messina; 10-565 m.

*Remarks:* This up to 3 cm long species has a stoutish shape and is well documented along the coast of Scandinavia and around the British Isles (KOREN AND DANIELSSEN, 1879; WIRÉN, 1892; ODHNER,

1921; MUUS, 1959; SEAWARD, 1982, 1991) including Strindfjord/ Trondheimsfjord (Mus. Copenhagen) and the Hebrides (Mus. Leiden). The Mediterranean records include *N. affinis* (Koren and Danielssen) which, according to certain, minor anatomical differences (pers. obs.), can be classified as a subspecies only (SALVINI-PLAWEN 1986); the same holds true for *N. grandis* Thiele (NIERSTRASZ AND STORK, 1940). A remarkable record refers to Iceland (KNUDSEN, 1949), a region in which *Neomenia dalyelli* (Koren and Danielssen) is generally found.

## Order CAVIBELONIA

### Family PARARRHOPALIIDAE

#### *Eleutheromenia sierra* (Pruvot, 1890)

*Paramenia sierra* Pruvot, 1890, *Archs. Zool. exp. gén.*, 8: XXIII.

*Known distribution* (Fig. 3D): Costa Brava, Bretagne; Irish Sea; Trondheim region; 40-128 m.

*Remarks:* PRUVOT (1891) typifies the species from a single specimen (Cap Creus/Costa Brava; 80 m) and in 1897 he reports another finding from off Roscoff at about 40 m (PRUVOT, 1897). A single specimen of typical appearance (lobed dorso-medial keel) from Stjörn (North or Trondheim/Norway), despite the geographical distance, after serial section reve-

aled to be *Eleutheromenia sierra*. Consequently, the questioned presence or this species in the southwestern Cartigan Bay (Irish Sea, 52 m; see HARTLEY 1984, SEAWARD, 1991: 14) as well as the specimens from nine samples or the Irish Sea Survey referred to *E. sierra* (CAUDWELL ET AL., 1995: 266; MACKIE ET AL., 1995: 192; not documented in Fig. 3D) are indirectly confirmed to really belong to this species.

On the other hand, the Pararrhopaliidae represent a fairly diverse group of sys-

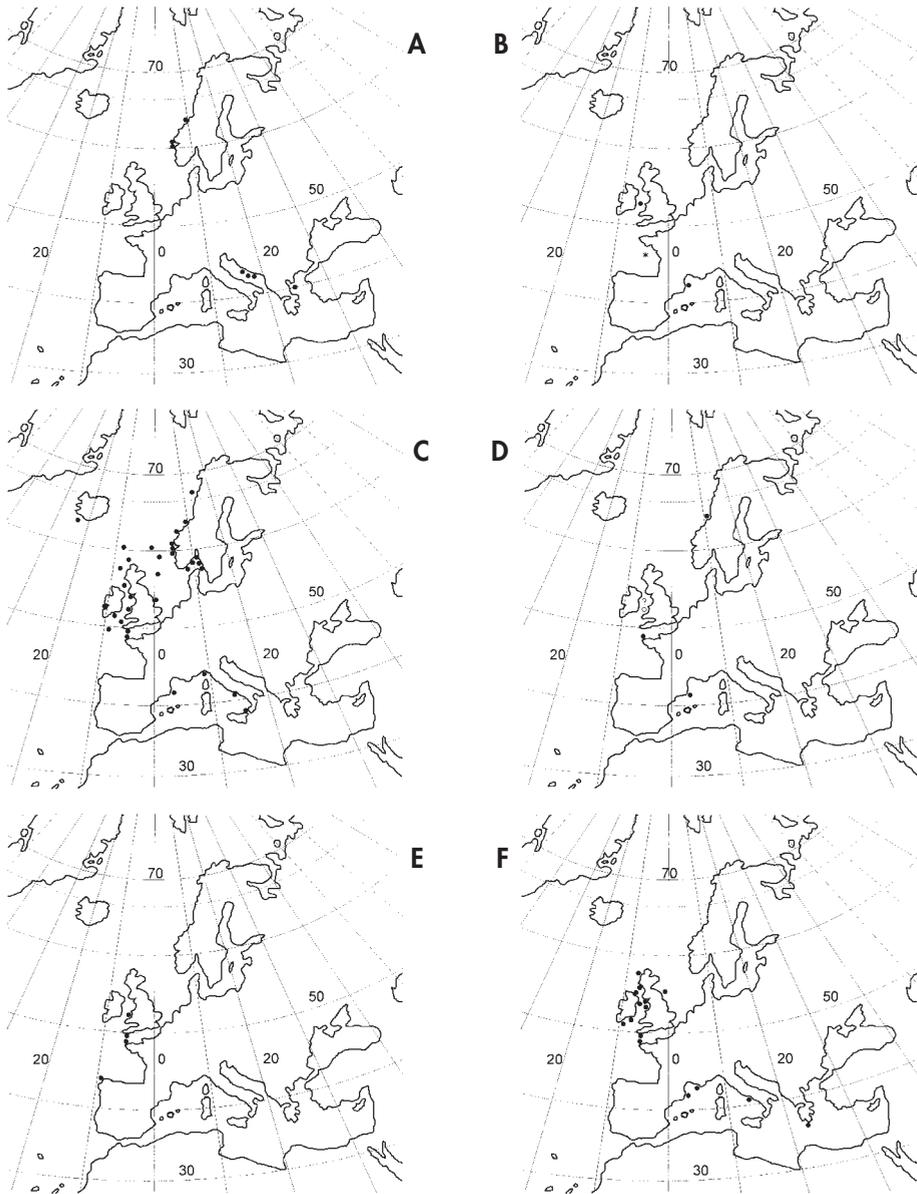


Figure 3. Solenogastres. A: Known distribution of *Wirenia argentea* Odhner, 1921; B: Records of *Macellomenia palifera* (Pruvot, 1890) (black circles) and of *Meromenia hironellei* Leloup, 1949 (asterisk); C: Known distribution of *Neomenia carinata* Tullberg, 1875; D: Records of *Eleutheromenia sierra* (Pruvot, 1890), see text; E: Known distribution of *Biserramenia psammobionta* Salvini-Plawen, 1968; F: Known European distribution of *Rhopalomenia aglaopheniae* (Kowalevsky and Marion, 1887).

Figura 3. Solenogastros. A: Distribución conocida de *Wirenia argentea* Odhner, 1921; B: Citas de *Macellomenia palifera* (Pruvot, 1890) (círculos negros) y de *Meromenia hironellei* Leloup, 1949 (asterisco); C: Distribución conocida de *Neomenia carinata* Tullberg, 1875; D: Citas de *Eleutheromenia sierra* (Pruvot, 1890), véase texto; E: Distribución conocida de *Biserramenia psammobionta* Salvini-Plawen, 1968; F: Distribución europea de *Rhopalomenia aglaopheniae* (Kowalevsky y Marion, 1887).

tematically very difficult representatives (see SALVINI-PLAWEN, 1978); several geographically close records of Pararrhopaliidae may represent different species (or even genera). Thus, another record from

the Irish Sea (*Pruvotina* sp. in CAUDWELL ET AL., 1995: 265-267) clearly does not belong to *E. sierra*; the same can be said about two THALASSA-specimens from off Galicia and off Asturias (Bay of Biscay)

#### Family SIMROTHIELLIDAE

##### *Biserramenia psammobionta* Salvini-Plawen, 1968

*Known distribution* (Fig. 3E): Irish Sea, Plymouth area, Bretagne, Galicia; 8-30 m.

*Remarks:* In addition to the type material from off Roscoff at 8-10 m (SALVINI-PLAWEN, 1968b; see also MONNIOT, 1965), several individuals have recently been recorded in Plymouth Sound at 9-11 m (50° 20' 43" N, 4° 09' 05" W; see also KIKINGER AND SALVINI-PLAWEN, 1995). Moreover, a single specimen has been sampled by Ian Killeen during the Irish Sea Survey from the Cardigan Bay/Wales (Stat. 46, 52° 19' 12" N, 04° 37' W) at 30 m, provided by Cathy Caudwell to the author (see also CAUDWELL ET AL., 1995). Finally, the 12 Solenogastres referred to as "*Lepidomenia* sp." by Celia Besteiro in her Ph. D. thesis (1986) from Galicia/Spain (Ría de Ferrol, "Bajo de la Palma"; 43° 27' 59" N, 08° 16' 23" W; 14 m) also represent *Biserramenia psammobionta*. They all come from coarse sand or shell gravel bottoms and at least those from Roscoff, Plymouth and Galicia are interstitially living animals (cf. SALVINI-PLAWEN, 1985a; also OTT AND BOCHDANSKY, 1991, for the Plymouth animals).

The histological examination of these specimens revealed some details beyond the original description (SALVINI-PLAWEN, 1968b). First, the characteristic circular musculature around the spawning ducts and the posterior mantle

cavity is not yet elaborated in juveniles. The slender pericardioducts with a tiny lumen still open from dorsal into the spawning ducts close to their rostral ends, these ducts being paired throughout with a wide lumen. Further differentiation thus includes a curving elongation of the rostral portion of the spawning ducts, which results in the adult spawning ducts bending dorso-posteriorly (as described in 1968). Here, the pericardioducts join their ends not axially but ventrally, thus causing a bulgy enlargement or even a slight bend in the continuous lumen. This bulged enlargement is the site of sperm storage, thus functioning as receptacula seminis; well-defined, set-off seminal pouches (vesiculae seminales, as described earlier), however, are not present. The paired lateral pouch of the ventrostral mantle cavity is well differentiated only in fully-grown individuals and often merely represents two simply lobulated, more or less distinct sacculations opening medially through a short duct or pore into the pallial space. Rather than being paired in the sense of two singular, separate ganglia, the cerebral ganglia are fused together in the middle third of their extension. In some specimens a small dorsoterminal sense organ could be detected at the rear of the body.

#### Family AMPHIMENIIDAE

##### *Meromenia hirondellei* Leloup, 1949

*Known distribution* (Fig. 3B): Northern Bay of Biscay; 166 m.

*Remarks:* A single fragment of this species had been recorded from the continental platform in the northern Bay of

Biscay (46° 27' N, 4° 09' 45" W) at 166 m depth. Due to the unknown organisation of the anterior body, the generic classification is uncertain (LELOUP, 1950: 21-23; SALVINI-PLAWEN, 1972: 224-225).

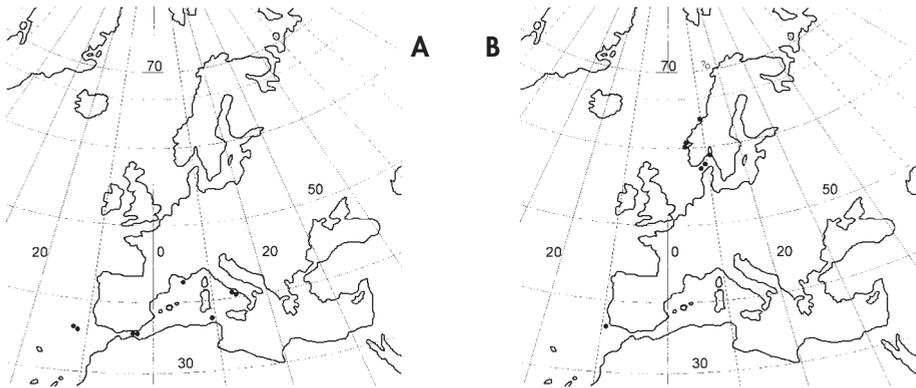


Figure 4. Solenogastres. A: Known European distribution of *Anamenia gorgonophila* (Kowalevsky, 1880); an additional record refers to the Azores; B: Known distribution of *Dorymenia sarsii* (Koren and Danielssen, 1877).

Figura 4. Solenogastros. A: Distribución europea de *Anamenia gorgonophila* (Kowalevsky, 1880); una cita adicional se refiere a las islas Azores; B: Distribución conocida de *Dorymenia sarsii* (Koren y Danielssen, 1877).

#### Family RHOPALOMENIIDAE

##### *Rhopalomenia aglaopheniae* (Kowalevsky and Marion, 1887)

*Rhopalomenia eisigi* Thiele, 1894, *Zeitschr. wiss. Zool.*, 58: 269.

**Known distribution** (Fig. 3F): Off Cap Matapan/Tainaron (South-Peleponnes), Gulf of Naples, off Marseille, Côte Vermeille, off Roscoff, British Isles; 50-137 m.

**Remarks:** This well-known species lives upon Hydrozoa-Thecaphora, almost exclusively upon *Lytocarpia myriophyllum*

(Linné). The distribution is compiled in NIERSTRASZ AND STORK (1940), SALVINI-PLAWEN (1972) and SEAWARD (1982, 1991). The identification of several specimens from off Monrovia/Liberia (THIELE, 1906: 324) needs re-examination and/or confirmation.

#### Family STROPHMENIIDAE

##### *Anamenia gorgonophila* (Kowalevsky, 1880)

*Proneomenia nierstraszi* Stork [in Nierstrasz and Stork], 1940, *Zoologica (Stuttgart)*, 99: 57.

*Anamenia heathi* Leloup, 1947, *Bull. Mus. roy. Hist. Nat. Belgique*, 23 (26): 1-11.

**Known distribution** (Fig. 4A): Gulfs of Naples and Salerno, off La Calle (easternmost Algeria), off Marseille, Sea of Alborán, Gorringe-Bank (WSW of Cap São Vicente), Azores; 65-845 m.

**Remarks:** The records of this species have been revised by SALVINI-PLAWEN (1972). The investigation of numerous Solenogastres recorded more recently from the SW of the Isle of Alborán (see TEMPLADO, GARCÍA-

CARRASCOSA, BARATECH, CAPACCIONI, JUAN, LÓPEZ-IBOR, SILVESTRE AND MASSÓ, 1986: 101-102) revealed that they in part belong to *A. gorgonophila*, and the known distribution of the species supports the assumption of its presence in Lusitanian waters as well. This species lives upon *Gorgonaria*, predominantly upon *Paramuricea clavata* (Risso) = *P. chamaeleon* (Koch), but also upon *Eunicella* spp. and others.

Family PRONEOMENIIDAE

*Dorymenia sarsii* (Koren and Danielssen, 1877)

*Simrothiella sarsi* Auctt. (see Opinion 1185 ICZN)

*Known distribution* (Fig. 4B): Trondheimfjord, Sognefjord, Bergen area, Oslofjord, Skagerrak, Gorringe Bank (off Cap Sao Vicente); North Atlantic-Arctic Ocean outside Tromsø?; 183-681 m (1134 m?).

*Remarks:* The up to 7 cm long, slender species was redescribed by ODHNER (1921) and is externally characterised by a distinct (dorso-)terminal extension of the body; a photograph is given in SALVINI-PLAWEN (1968a: Abb. 23). Some recently examined material from Scandinavian collections extends the known distribution (see Fig. 4B); the North Atlantic-Arctic specimens (71° 25' N, 15° 41' E, 1134 m; see ODHNER, 1921, and JAECKEL, 1954) only doubtfully belong to *D. sarsii* based on the geographic and bathymetric distribution. In addition to the polystichous radula, a

pair of copulatory stylets and the presence of a dorsoterminal sense organ typical for the genus, histological investigations underline two particular specific characters in mature animals: the anterior portion of the pericardioducts bears small pockets serving as vesiculae seminales, and the posterior portion of the spawning ducts ("lower gametoducts") in front of their fusion each elaborate a ventral enlargement or voluminous sacculation (pocket). Both these characters allow this particular *Dorymenia* species to be identified in SCHELTEMA ET AL. (1994: Figs. 22 E and 24 G) as *D. sarsii* (Koren and Danielssen). The geographic distribution of this species is thus enlarged to the Gorringe Bank of the Iberian shelf region (36° 50' N, 9° 15' W, 681 m; cf. SCHELTEMA ET AL., 1994: 18).

Family LEPIDOMENIIDAE

*Lepidomenia* ? spp.

*Lepidomenia hystrix* Auctt. non Marion and Kowalevsky, 1886

*Lepidomenia* (?) *swedmarki* Salvini-Plawen, 1985, *Stygologia*, 1 (1): 103.

*Remarks:* Some records of small, mesopammic Solenogastres from off Marseille, Bretagne and off Belfast/Northern Ireland have been systematised as *Lepidomenia hystrix* Marion and Kowalevsky (see SALVINI-PLAWEN, 1985a; SEAWARD, 1991). Referring to the discussion in SALVINI-

PLAWEN (1985a), the classification of these animals (not having been investigated anatomically) as *L. hystrix* is unwarranted and misleading. The specimens should be determined by means of serial sections rather than simply naming them based on accessory features.

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