

New data on holoplanktonic gastropods from NW Spain

J.G.M. (HAN) RAVEN 

Naturalis Biodiversity Center, Leiden, P.O. Box 9517, 2300 RA Leiden, The Netherlands; han.raven@naturalis.com.

ALVARO ALONSO SUÁREZ

Infiesto 7, 6º J, 33207 Gijón, Spain; malakoiberia@yahoo.es



RAVEN, J.G.M. & SUÁREZ, A.A., 2023. New data on holoplanktonic gastropods from NW Spain. – *Basteria*, 87 (2): 140-147. Leiden. Published 25 November 2023.

Key words: Atlantidae, Cavoliniidae, Cliidae, Creseidae, Heliconoididae, Limacinidae, Peraclidae, Spain

Dedicated to A.W. Janssen (1937-2021)

Summary

This paper presents an overview of all holoplanktonic gastropods thus far known from NW Spain. Shells of such molluscs are rarely beached. However, holoplanktonic gastropods may live close to the coast in embayments adjoining deeper water, and shells of several species have been found on beaches along such bays. Seven species are newly recorded from the Cantabrian Sea, one is new for NW Spain. In addition, new records from the Galicia Bank west of the Iberian Peninsula and records from Hendaye, just north of the Spanish-French border, are included.

Sumario

Esta publicación presenta un resumen de todos los gasterópodos holoplanctónicos conocidos del NO de España. Las conchas de estos moluscos rara vez llegan a la costa. Sin embargo, estos moluscos pueden vivir cerca de la costa en bahías contiguas a aguas más profundas, en cuyas playas han sido encontrados. Se registran siete especies nuevas para el Cantábrico, una para el NO de España. Además, se incluyen nuevas citas del Banco de Galicia al oeste de la Península Ibérica y citas de Hendaya, justo al norte de la frontera Española-Francesa.

INTRODUCTION

Holoplanktonic gastropods comprise several groups (Janssen, 2007 and Janssen et al., 2020 are followed regarding

groups to include). They spend their whole life as plankton and occur in large quantities in different oceanic water layers. *Janthina* species live at the ocean/air interface and occasionally reach the coast causing mass strandings. Atlantidae and the speciose Pteropoda feed deeper during the day and reach the surface during the night (Janssen & Peijnenburg, 2017). They have very thin and light shells. Generally, such molluscs are collected in the open ocean by research vessels using specialised nets or from sediment samples (e.g., Locard, 1897; Rampal, 2002).

Although various authors (e.g. Burckhardt, 1920; Emiliani, 1991) concluded that, based on its Greek root, the term planktonic should be replaced by planktic, we follow the pragmatic approach proposed by Hutchinson (1974) to continue the generally accepted use of the term planktonic.

Previous studies focused on material from deep water (Locard, 1897; Rolán & Pérez Gandaras, 1981; Rolán, 1983), whereas Hidalgo (1917) records various species floating at the sea surface. Others provide listings without specific records (Trigo et al., 2018). This paper adds new records based on beach collected material, and some records from deep water. Holoplanktonic molluscs are rarely recorded from beaches along the Atlantic coast of Europe, where they occur locally in very fine shell grit on beaches facing the ocean with nearby deep water. These beaches experience warm surface water and transient coastal upwelling delivering cool dense offshore water (Edwards et al., 1996), thus supplying material from different ocean layers. On three beaches along the coast of the Cantabrian Sea (which has a narrow shelf, Fig. 1) shells of various species of holoplanktonic molluscs have been found. The largest number of specimens and species was found on Salvé beach at Laredo (Cantabria, Spain), which is renowned for its shell grit rich in micromolluscs. Smaller numbers were found on the San Lorenzo beach at Gijón (Asturias, Spain) and Hendaye (Pyrénées-Atlantiques, France), just across the border from Spain. On these beaches planktonic larvae of gastropods are more frequent than elsewhere.

As there is no overview of holoplanktonic gastropods living in NW Spain, this study also summarises all previous records of these animals from the area concerned.



Fig. 1. Map of NW Spain and surrounding seas. Sample localities in yellow, those off the coast of Galicia are indicated by triangles. Note the narrow continental shelf along the western and northern sides of the Iberian peninsula, and the wide shelf along the northern side of the Bay of Biscay. Base map Google Earth.

MATERIAL AND METHODS

In this study, we examined large quantities of shell grit collected along the shores of the Cantabrian Sea in Asturias and Cantabria (NW Spain, Fig. 1). Alvaro Alonso and Han Raven collected material at Gijón (through decades of observation) and Laredo (Cantabria). Much more material from Laredo was collected by A. Haandrikman, G. Geuze, F. van Nieulande and R. Outryve, then picked and identified by D. Hoeksema, H. Keukelaar, T. Keukelaar-van den Berge and G. and E. Simons and preserved in the collections Hoeksema and Simons. Independently, H.J. and J. Hoenselaar visited Laredo on several occasions and deposited their material in ZMA (now Naturalis). Interestingly, H.J. and J. Hoenselaar also made several visits to the beach of Hendaye, Pyrénées-Atlantiques, France, where they collected fine shell grit that contained a few holoplanktonic species, which are included in the listings. Also, two specimens of pteropods were found at Poniente beach in Gijón, the sand of which was dredged from the shelf NE of Luanco (Asturias). Shell grit from numerous other beaches was studied (e.g., the localities mentioned in Alonso & Raven, 2020), but did not deliver shells of holoplanktonic molluscs.

In September 2020, Alvaro Alonso and Javier Martínez Pérez collected plankton by towing a plankton net from a

sailing boat in the Gijón embayment. Besides numerous other organisms, a few specimens of *Atlanta* Lesueur, 1814 and a substantial number of living pteropods of the genus *Limacina* Bosc, 1817 were collected. The material was photographed on board, but not kept, so no firm identifications are available.

In the Naturalis collections, some lots are present from the Galicia Bank, NW of Galicia, and nearby deep water (Fig. 1) collected as part of the Ocean Margin Exchange Study OMEX II on upwelling along the margin of the Iberian Peninsula (1997-2000). The Galicia Bank is a seamount with its summit between 650 and 1500 m water depth, surrounded by abyssal platforms more than 4000 m deep. E. Flach donated this material to ZMA (now Naturalis) where it was sorted and identified by Leon Hoffman and Bart van Heugten.

The late Arie (A.W.) Janssen checked the identifications of the material from the Galicia Bank in Naturalis and part of the identifications of material from Gijón and Laredo. Many of the lots he checked and also many of the lots he did not see were initially misidentified.

Van der Spoel (1967) realised that the shedding of the juvenile shell is a normal biological phenomenon in some species of Cavoliniidae. Sometimes a closing membrane can be seen (Figs 9-11). He used the terminology proto-

			Lista Patrón	Atlantic Ocean			Bay of Biscay				
							Cantabrian Sea				
		Species	Norte	Galicia Bank	deep water	Galicia	Asturias (Gijón)	Cantabria (Laredo)	Basque Region (Hendaye)	deep water	
Caenogastropoda	unassigned	Epitoniidae									
		<i>Janthina exigua</i> Lamarck, 1816				C, T, U					
		<i>Janthina janthina</i> (Linnaeus, 1758)	LP				C, T, U	O			
		<i>Janthina pallida</i> W. Thompson, 1840	LP				T, U				
	Littorinomorpha	Atlantidae									
		<i>Atlanta peronii</i> Lesueur, 1817			• R				•		
		Carinariidae									
		<i>Carinaria lamarckii</i> Blainville, 1817	LP							H, L	
Pteropoda	Euthecosomata	Cavoliniidae									
		<i>Cavolinia inflexa</i> (Lesueur, 1813)	LP	• RP, R	•	R, T, U, V	•	•		L	
		<i>Cavolinia tridentata</i> (Forsskål, 1775)		• RP	•						
		<i>Diacria trispinosa</i> (Blainville, 1821)	LP	• RP, R	•	H, R, T, U, V	•	•	•		
		Cliidae									
		<i>Clio cuspidata</i> (Bosc, 1801)									L
		<i>Clio pyramidata</i> Linnaeus, 1767	LP	• RP, R	•	H, S, T, U, V	•				L
		<i>Clio recurva</i> (Children, 1823)	LP								H
		Creseidae									
		<i>Creseis acicula</i> (Rang, 1828)	LP				C, U	O	•		
		<i>Creseis conica</i> Eschscholtz, 1829	LP				U				
		<i>Creseis virgula</i> (Rang, 1828)		R, T			U		•		
		<i>Styliola subula</i> (Quoy & Gaimard, 1827)					R		•	•	L
	Heliconoididae										
	<i>Heliconoides inflatus</i> (d'Orbigny, 1835)	LP	R			H, U		•	•	L	
	Limacinidae										
	<i>Limacina bulimoides</i> (d'Orbigny, 1835)	LP	R			U				L	
	<i>Limacina helicina</i> (Phipps, 1774)	LP	R			H, U				H, L	
	<i>Limacina lesueurii</i> (d'Orbigny, 1836)						• cf.			H, L	
	<i>Limacina retroversa</i> (Fleming, 1823)	LP	• RP, R	S		R, U		•	•	L	
	Pseudothecosomata	Cymbuliidae									
		<i>Cymbulia peronii</i> Blainville, 1818	LP				U				
		Peraclidae									
<i>Peraclis diversa</i> (Monterosato, 1875)										L	
<i>Peraclis elata</i> (G. Seguenza, 1875)										L	
<i>Peraclis moluccensis</i> (J. J. Tesch, 1903)		•									
Gymnosomata	Notobranchaeidae										
	<i>Notobranchaea hjorti</i> (Bonnievie, 1913)	LP				U					
	<i>Pneumoderma violaceum</i> d'Orbigny, 1835	LP				U					
<i>Spongiobranchaea intermedia</i> Pruvot-Fol, 1926	LP				U						
		27	17	11	4	18	6	8	4	13	

Table 1. Records of holoplanktonic molluscs from NW Spain. The grey blocks indicate records from the present study. Other records are literature data: C = Cadée (1968); H = Hidalgo (1917); L = Locard (1897); LP = Lista Patrón (version 2017; introduced in Gofás et al., 2017); O = Ortea (1977); R = Rolán (1983); RP = Rolán & Pérez Gandaras (1981); S = Sykes (1905); T = Trigo et al. (2018); U = Urgorri et al. (2017); V = Vayssiére (1915).

conch 1 (P₁) for the minuscule, often droplet shaped, initial shell and protoconch 2 (P₂) for the rest of the juvenile shell. Following Janssen (2007, 2012) and Wall-Palmer et al. (2014), herein the name protoconch is preserved for protoconch 1, whilst the remainder of the juvenile shell is called larval shell. In many papers only adult shells are figured. Protoconchs, larval shells and cross-sections thereof are rarely illustrated, with the exception of Janssen (2007, 2012) and Wall-Palmer et al. (2014), in which many species are figured.

In the systematic part of this paper, only species with new records are discussed, with short descriptions based on material from NW Spain for less common species or juvenile shells. For several species of Cavoliniidae and Creseidae apertural views of juvenile shells are illustrated, as these were found to help in the differentiation between species. In the figures the non-standard apertural and apical views are specifically indicated; ventral, dorsal and lateral views not. An overview for the whole area, including literature records, is given in Table 1.

Abbreviations:

A	collection Alvaro Alonso Suárez, Gijón, Asturias, Spain
H	collection Dick Hoeksema, Middelburg, The Netherlands
HH	H. J. and J. Hoenselaar (Naturalis)
Naturalis	Naturalis Biodiversity Center, Leiden, The Netherlands
OMEX II	Upwelling study Iberian Peninsula (Naturalis)
R	collection Han Raven, The Hague, The Netherlands
RMNH	Rijksmuseum van Natuurlijke Historie, now part of Naturalis
S	collection George Simons, Middelburg, The Netherlands
ZMA	Zoölogisch Museum Amsterdam, now part of Naturalis
sp.	specimen(s)

Note: The abbreviations used in Table 1 are independent of the above.

SYSTEMATICS

Eleven species of holoplanktonic molluscs were found on the beaches, pertaining to various orders. All are small (<1 cm), with some only a few mm wide. For several species, the shells of juvenile specimens have been found in shell grit on the beach, some in large numbers. In Table 1 an overview is given of the species found and literature data which are mostly based in oceanic settings further offshore. Includ-

ing literature data (some of which are based on a single specimen), a total of 27 species is known from NW Spain.

Order Littorinimorpha Golikov & Starobogatov, 1975

Superfamily Pterotracheoidea Rafinesque, 1814

Family Atlantidae Rang, 1827

Genus *Atlanta* Lesueur, 1817

Atlanta peronii Lesueur, 1817

Figs 2-3

Material examined. — **Spain**, GALICIA: Galicia Bank, OMEX-II.G100, box core, 774 m, 42°74818N, 11°74883W, (RMNH.MOL.117143/1); CANTABRIA: Salvé beach, Laredo (H 3816/11).

Description. — Very fragile shell, flat discoid, deep sutures, whorls quickly increase in size, marked keel.

Remarks. — This species has been recorded before from the Galicia Bank (Rolán & Pérez Gandaras, 1981). The specimen from Laredo is the first from the Cantabrian Sea. The animals seen alive in the Gijón embayment probably belong to the same species. The shell can reach a width of 12 mm, but the specimens found are much smaller.

Order Pteropoda Cuvier, 1804

Suborder Euthecosomata Meisenheimer, 1905

The classification of the Euthecosomata has recently been reviewed by Rampal (2019), which is followed here. Janssen (2020) had various objections to the Rampal paper, but these do not affect this classification.

Superfamily Cavolinoidea J. E. Gray, 1850

Family Cavoliniidae J. E. Gray, 1850

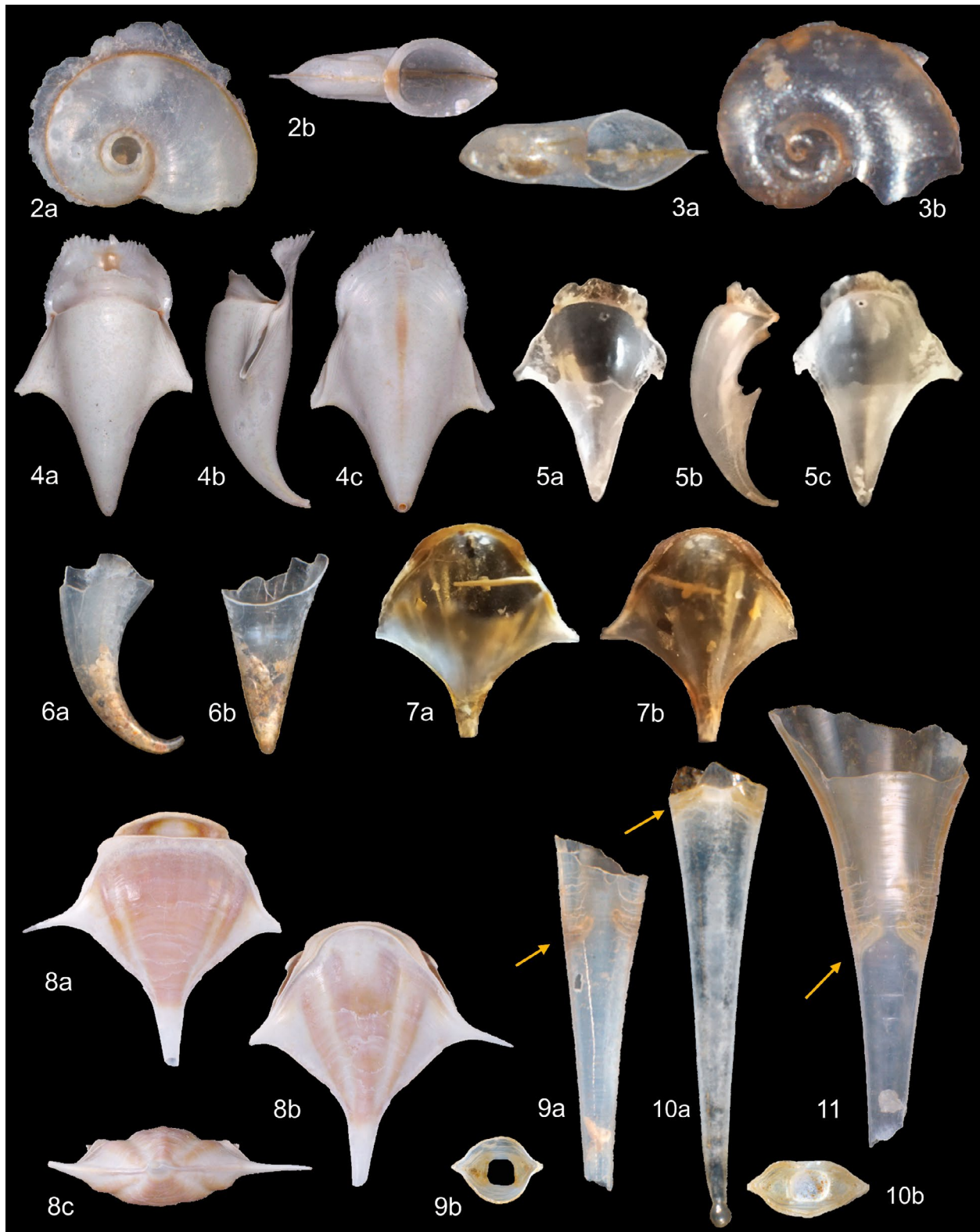
Subfamily Cavoliniinae J. E. Gray, 1850

Genus *Cavolinia* Abildgaard, 1791

Cavolinia inflexa (Lesueur, 1813)

Figs 4-6

Material examined. — **Spain**, GALICIA: Galicia Bank, OMEX-II.G56, box core, 2372 m, 42°66583N, 10°72283W, (RMNH.MOL.117203/5); OMEX-II.G100, box core, 774 m, 42°74818N, 11°74483W, (RMNH.MOL.117261/20); deep water W of Galicia: OMEX-II.CG, box core, 3800 m, 43°9.92N, 11°61.26W, (RMNH.MOL.117260/1); OMEX-II.G25, box core, 2278 m, 42°63683N, 10°04017W, (RMNH.MOL.117202/3); OMEX-II.G30, box core, 2626 m, 42°66767N, 10°166830W, (RMNH.MOL.117204/2); OMEX-II.G36, box core, 1522 m,



Figs 2-3. *Atlanta peronii* Lesueur, 1817. **2.** Galicia Bank, OMEX-II.G100, 774 m (RMNH.MOL.117143, W 3.6 mm). **3.** Salvé beach, Laredo, Cantabria (H 3816, W 1.2 mm). **Figs 4-6.** *Cavolinia inflexa* (Lesueur, 1813). **4.** Adult, Galicia Bank, OMEX-II.G30, 2626 m (RMNH.MOL.117204, H 6.1 mm). **5.** Adult, Poniente beach, Gijón, Asturias, leg. AA (AA 0798, L 3.5 mm). **6.** Larval shell, Salvé beach, Laredo, Cantabria (H 3839, L 3.5 mm). **Figs 7-11.** *Diacria trispinosa* (Blainville, 1821). **7.** Adult, San Lorenzo beach, Gijón, Asturias, leg. AA (AA 0885, L 7.2 mm). **8.** Adult, Galicia Bank, OMEX-II.G100, 774 m (RMNH.MOL. 117264, L 8.9 mm). **8c.** View from apex. **9-11.** Larval shells, the arrows point to the septa, Salvé beach, Laredo, Cantabria. **9.** (S 3943, L 2.7 mm). **9b.** Apertural view, with open septum. **10.** (S 3943, L 3.2 mm). **10b.** Apertural view, the septum is closed. **11.** Leg. HH (ZMA.MOLL.2277549, L 5.3 mm).

43°68233N, 9°4465W, (RMNH.MOL.117201/11); ASTURIAS: Poniente beach, Gijón (A 0798-A/2); Caladero de los Picos de San Antolín, near Llanes, 100 m depth between sediment from fishing net, leg. Javier Martínez Pérez (Javier Martínez Pérez 5 juv.); CANTABRIA: Salvé beach, Laredo (H 3839, 76 larval shells, 1 lateral spine, 1 larger fragment subadult shell; R 01299/24; S 3755, 19 larval shells; S 3939, 33 larval shells).

Description. — Shell (L to 4.5 mm) elongate, with flat side, two broad and short, slightly abapically pointed lateral spines located above the middle, and a broad, markedly dorsally curved central spine formed by the larval shell that is typically retained on the adult shell. The aperture is rather narrow, but the dorsal (upper) lip is markedly broad extending well beyond the ventral (lower) lip. The shell is translucent, often yellowish in colour.

Remarks. — Whereas the teleoconch of this species is quite large and instantly recognisable, only one such specimen has been found, whereas numerous shells of juveniles have been collected from shell grit.

The species was recorded from the Galicia Bank and from Galicia (Table 1), whilst the only records from the Bay of Biscay are from deep water north of Spain (Locard, 1897) and from the south coast of Brittany (France; Rampal, 2002). Therefore, this are the first records from Asturias and Cantabria, and from the Cantabrian Sea. In Asturias, a damaged adult shell was found on Poniente beach, Gijón, and 5 juveniles on the remains of a fishing net at 100 m depth off the coast of Llanes. The sand from Poniente beach originates from dredgings north of Luanco. The large number of larval specimens collected at Laredo in different years suggests that the species is abundant in the Bay of Biscay or the surrounding part of the Atlantic Ocean. As adults typically preserve the early stages (e.g., Janssen et al., 2019: figs 45-46), the juveniles found, must be specimens that had died before becoming adults.

Subfamily Diacriinae Rampal, 2019

Genus *Diacria* J. E. Gray, 1840

Diacria trispinosa (Blainville, 1821)

Figs 7-11

Material examined. — **Spain**, GALICIA: Galicia Bank, OMEX-II.G56, box core 2372 m, 42°66583N 10°72283W (RMNH.MOL.117263/1); OMEX-II.G100, box core 774 m, 42°74818N 11°74483W (RMNH.MOL.117264/2); deep water W of Galicia OMEX-II.G36, box core 1522 m, 43°68233N 9°4465W (RMNH.MOL.117262/1); ASTURIAS: San Lorenzo beach, Gijón (A 0885-A/1); CANTABRIA: Salvé beach, Laredo, H 3841, 1 larval shell; S 3943, 7 larval shells); leg. HH (ZMA.MOLL.2277549, 3 larval shells); **France**, PYRÉNÉES-ATLANTIQUES: Hendaye,

leg. HH (ZMA.MOLL.2277605, 1 larval shell).

Description. — The adult shell is easily recognisable by the flattened shell with two outward pointing lateral spines, third posterior spine and overall brownish colour (Figs 7-8). Protoconch rounded, with marked constriction towards the larval shell (Fig. 10). Larval shell (L 3 mm; Figs 9-10) consists of a narrow wedge that has parallel sides, apart from the last 1/3rd that widens more quickly. This latter part may have whitish irregular radial lines, and has an overall pale corneous colour. At the intersection between larval shell and adult shell there is a constriction or a septum, which is visible through the shell as ribs pointing towards the adult shell, but the angle varies (Figs 9-11). In apertural view the larval shell has an elliptical shape with a carina on either side, which is open on the inside (Fig. 9b). The ventral and dorsal sides become more flattened (Fig. 10b).

Remarks. — Adult shells of this relatively large species are easily recognisable and have repeatedly been recorded from Galicia (Hidalgo, 1917; Vayssiere, 1915; Rolán, 1983; Trigo et al., 2018) and from the Galicia Bank (Rolán & Pérez Gandaras, 1981; Rolán, 1983; several records herein). Adult shells appear to be rare in the Cantabrian Sea: we record the first specimen washed up on the beach at Gijón (June 2021), though several larval shells have been found. They are much narrower than the broad triangular larval shells of *Clio pyramidata*, do not show the straight growth lines, and the wider parts are corneous brown instead of white. The protoconchs of *Clio cuspidata* (Bosc, 1801) are also drop-shaped, with a marked constriction, but have a short spine at the end. The protoconch is preserved in few of the larval shells of *Diacria trispinosa* that were found (e.g., Fig. 10).

Family Cliidae Jeffreys, 1869

Genus *Clio* Linnaeus, 1767

Clio pyramidata Linnaeus, 1767

Figs 15-16

Material examined. — **Spain**, GALICIA: Galicia Bank, OMEX-II.G100, box core, 774 m, 42°74818N, 11°74483W, (RMNH.MOL.117266/4); deep water W of Galicia: OMEX-II.G36, box core, 1522 m, 43°68233N, 9°4465W, (RMNH.MOL.150216/1); OMEX-II.C41, box core, 2200 m, 43°75717N, 9°54.683W, (RMNH.MOL.117265, 1 juv.); ASTURIAS: Poniente beach, Gijón (A 0749-A/4); San Lorenzo beach, Gijón (R 01144, 1 juv.).

Description. — Protoconch elongated (missing in the figured specimens), narrowing towards the larval shell. Larval shell triangular, transparent. The upper half expands more rapidly, resulting in concave sides. In apertural view the larval shell is initially mostly round, but gradually becomes boat shaped with round ventral (lower) side, two quickly



Fig. 12. *Creseis acicula* (Rang, 1828), Salvé beach, Laredo, Cantabria (S 3957, L 3.2 mm). **12b.** Apertural view. **Figs 13-14.** *Styliola subula* (Quoy & Gaimard, 1827), Salvé beach, Laredo, Cantabria. **13.** Juvenile shell with protoconch (S 3942, L 1.6 mm). **13b.** Apertural view. **14.** Juvenile shell without protoconch (S 3942, L 2.3 mm). **14b.** Apertural view. **Figs 15-16.** *Clio pyramidata* Linnaeus, 1767. **15.** Half grown, Poniente beach, Gijón, Asturias, leg. AA (AA 0749, L 3.5 mm). **15b.** Apertural view. **16.** Broken shell of adult, Galicia Bank, OMEX-II.G36, 1522 m (RMNH.MOL.117201, L 5.5 mm). **16b.** Apertural view.

expanding, marked carinas that are open on the inside, and a convex dorsal (upper) side (Figs 15b, 16b).

Remarks. — Whereas the teleoconch of this species is quite large (L ~11 mm, Janssen et al., 2019: fig. 36), only the shells of juveniles and subadults (to a length of 6 mm) have been collected from shell grit. Arie Janssen identified the specimen OMEX-II.G36 from Galicia Bank (Fig. 16) in *Naturalis* as forma *lanceolata* (Lesueur, 1813). The species has been recorded previously from the Galicia Bank (Rolán & Pérez Gandaras, 1981), Vigo Bay, Galicia (Sykes, 1905; Hidalgo, 1917), the northern coast of Galicia (Vayssiére, 1915).

Family Creseidae Rampal, 1973

Genus *Creseis* Rang, 1828

***Creseis acicula* (Rang, 1828)**

Fig. 12

Material examined. — **Spain, CANTABRIA:** Salvé beach, Laredo, (H 3842/1; S 3957/4).

Description. — Very slender, needle-shaped shell (L to 25 mm, diameter 1.5 mm). Basal part of the larval shell not substantially inflated. Shell translucent and colourless.

Remarks. — This species has been recorded from Galicia

(Urgorri et al., 2017). Ortea (1977) apparently found the species in Asturias, but his thesis was never published and is inaccessible, therefore no record is available. This record is the first from Cantabria.

Creseis virgula (Rang, 1828)

Material examined. — **Spain**, CANTABRIA: Salvé beach, Laredo (R 01300/2)

Description. — Broad conical shell (L to 6 mm, diameter 2 mm) with marked kink (40°) at 1/3rd from the apex. Basal part of the larval shell slightly inflated. Shell translucent and colourless.

Remarks. — This species is easily recognised by the typical kink in the teleoconch. The specimens went missing before they could be photographed. Thus far, the species has only been recorded from the Galicia Bank (Rolán & Pérez Gandaras, 1981). This is the first record from the Cantabrian Sea.

Genus *Styliola* J. E. Gray, 1847

Styliola subula (Quoy & Gaimard, 1827)

Figs 13-14

Material examined. — **Spain**, CANTABRIA: Salvé beach, Laredo (H 3840, 4 juv.; R 01278/6 juv.; S 3942, 4 juv.; leg. HH (ZMA.MOLL.2277564, 2277549, 35 juv.); **France**, PYRÉNÉES-ATLANTIQUES: Hendaye, leg. HH (ZMA.MOLL.334766, 1 juv.).

Description. — Elongated, bullet shaped protoconch narrowing towards the teleoconch, shiny ring hinting at presence of a septum between protoconch and teleoconch. Teleoconch conical, transparent, with marked growth lines. The upper half expands more rapidly, resulting in concave sides, and is white in colour. In apertural view, the shell is mostly round (Fig. 13b), but gradually becomes boat shaped with a round ventral (lower) side and a convex dorsal (upper) side (Fig. 14b).

Remarks. — All specimens found are juveniles to 2.6 mm long, whereas adult shells can reach 10 mm (Muñoz Ferrera de Castro et al., 2018). The shell is figured in Muñoz Ferrera de Castro et al. (2018: 185) and Wall-Palmer et al. (2014: pl. 2 fig. 9). It differs from *Creseis* in not having a round outline in apertural view, but that character is generally not displayed in any figure. In apertural view it is somewhat similar to *Clio pyramidata* (Figs 13b-14b vs. 16b-16b), but that species has a larval shell with a triangular outline.

Locard (1897) recorded the species from 1694 m depth in the Bay of Biscay N of Spain. Rolán (1983) recorded a single doubtful specimen from Galicia. Thus, the records herein

are the first confirmed records from NW Spain and the Cantabrian Sea.

Superfamily Limacinoidea J. E. Gray, 1840

Family Heliconoididae Rampal, 2019

Genus *Heliconoides* d'Orbigny, 1836

Heliconoides inflatus (d'Orbigny, 1835)

Fig. 17

Material examined. — **Spain**, CANTABRIA: Salvé beach, Laredo, leg. HH (ZMA.MOLL.2277560/8); **France**, PYRÉNÉES-ATLANTIQUES: Hendaye, leg. HH (ZMA.MOLL.2277563/2).

Description. — Sinistral, planorbid shaped shell (diameter to 1.4 mm), concave upper side and deep and narrow umbilicus. Shell transparent, surface smooth.

Remarks. — Usually shells of this species have an extended basal part of the aperture, but this is damaged in the specimens found. Previously the species has been recorded from the Galicia Bank (Rolán, 1983) and Galicia (Hidalgo, 1917).

Family Limacinidae J. E. Gray, 1840

Genus *Limacina* Bosc, 1817

Limacina cf. *lesueurii* (d'Orbigny, 1836)

Material examined. — **Spain**, ASTURIAS: Gijón embayment, plankton net, ix.2020, leg. Javier Martínez Pérez (not kept).

Description. — Sinistral shell, broad, low spire (much wider than high), columella straight, umbilicus wide and deep.

Remarks. — Several specimens of *Limacina* spec. were collected alive by towing a plankton net behind a sailing boat in the Gijón embayment (Asturias). It indicates living animals can be found very close to the coast.

As *Limacina helicina* (Phipps, 1774) was recorded from various points in the NW of the peninsula: deep water in the Bay of Biscay (Locard, 1897), floating at the surface in the Bay of Biscay and near Vigo (Hidalgo, 1917), and the Galicia Bank (Rolán, 1983; Table 1) it was assumed the specimens represented this species. But Locard (1897) already mentions that is a cold-water-species, and an anonymous reviewer of the manuscript seriously doubts it occurs in the study area. The specimens previously recorded could concern *Limacina lesueurii* (d'Orbigny, 1836), which has a shell that is similar to that of juveniles of *L. helicina*, but with spirals on its base and narrower umbilicus (Janssen et al., 2019). As none of the specimens of *L. helicina* recorded thus far from NW Spain has been figured, further sampling and study is required.

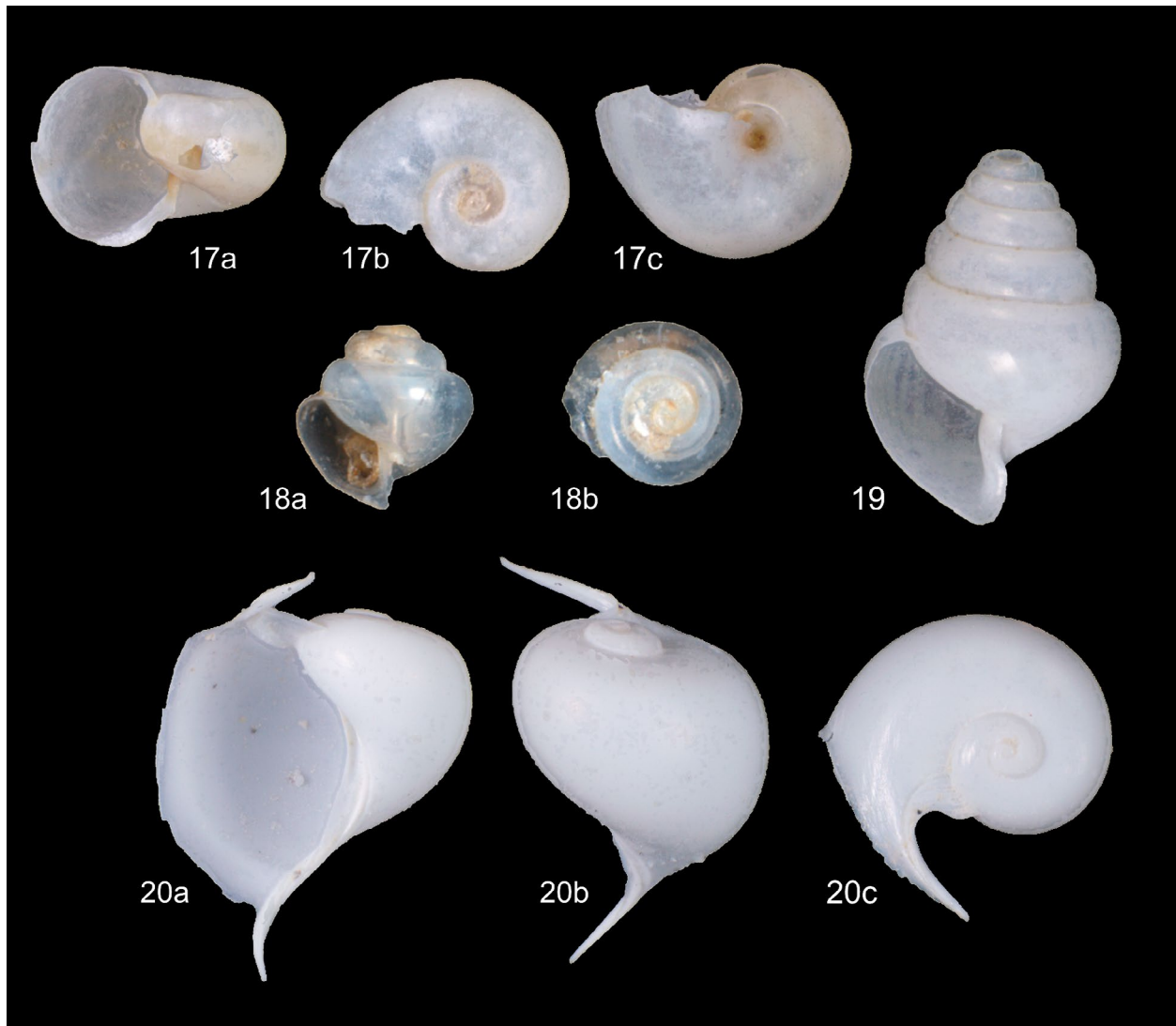


Fig. 17. *Heliconoides inflatus* (d'Orbigny, 1835). Salvé beach, Laredo, Cantabria, leg. HH (ZMA.MOLL.2277560, W 1.4 mm). **Figs 18-19.** *Limacina retroversa* (J. Fleming, 1823). **18.** Juvenile, Salvé beach, Laredo, Cantabria (S 3921, L 0.75 mm). **19.** Adult, Galicia Bank, OMEX-II.G100, 774 m (RMNH.MOL.117264, L 2.4 mm). **Fig. 20.** *Peracle moluccensis* (J. J. Tesch, 1903). Galicia Bank, OMEX-II.G56, 2372 m (RMNH.MOL.117269, L 2.5 mm).

***Limacina retroversa* (J. Fleming, 1823)**

Figs 18-19

Material examined. — **Spain**, GALICIA: Galicia Bank, OMEX-II.G100, box core 774 m, 42°74818N 11°74483W (RMNH.MOL.117264/5); CANTABRIA: Salvé beach, Laredo (S 3921/2), leg. HH (ZMA.MOLL.2277590/2); **France**, PYRÉNÉES-ATLANTIQUES: Hendaye, leg. HH (ZMA.MOLL.2277588/1).

Description. — Sinistral coiled shell (L to 2.4 mm), broad, high spire (overall slightly higher than wide). Straight columella, resulting in pointed aperture.

Remarks. — Several species of *Limacina* are known from NW Spain. Most widespread is *Limacina helicina*, but that species has a much lower spire and a deep umbil-

icus. *Limacina retroversa* has a very high spire, but that is only partially visible in the juvenile specimen (Fig. 18). Note that Rolán (1983) recorded both *L. retroversa* and *Limacina balea* (O.F. Müller, 1841) from the Galicia Bank, but both concern the same species. *Limacina lesueurii* (d'Orbigny, 1836) also has a straight columella, but the lower part of the aperture bends far more downwards. *Limacina retroversa* is known from Galicia (Lista Patrón, 2017), deep water off Galicia (Sykes, 1905), the Galicia Bank (Rolán & Pérez Gandaras, 1981, Rolán, 1983) and deep water in the Bay of Biscay (Locard, 1897). This is the first record from Cantabria.

Order Pseudothecosomata Meisenheimer, 1905
Superfamily Cymbulioidea J. E. Gray, 1840
Familiy Peraclidæ J. J. Tesch, 1913
Genus *Peracle* Forbes, 1844

***Peracle moluccensis* (J. J. Tesch, 1903)**

Fig. 20

Material examined. — **Spain**, GALICIA: Galicia Bank: OMEX-II.G56, box core 2372 m, 42°66'58"N 10°72'28"W (RMNH.MOL.117269/2); OMEX-II.G100, box core 774 m, 42°74'81"N 11°74'48"W (RMNH.MOL.117270/1).

Description. — Sinistral coiled shell (L to 2.5 mm), very low spire with quickly increasing size of whorls, columella concave, aperture wide, with long and pointed appendages on top and base. Last whorl with flat subsutural area and a keel, bending outward towards upper appendage, colour white.

Remarks. — This species is easily identified based on its very low spire and the appendages on the top and base of the aperture, as wells as the absence of shell ornamentation. *Peracle diversa* (Monterosato, 1875) is much more elongate, with higher spire, appendage only on the base of the aperture and honeycomb pattern all over the shell. *Peracle elata* (G. Seguenza, 1875) has an involute shell with appendages on the top and base of the aperture, the aperture being much larger than in *P. moluccensis*.

Peracle moluccensis is known from the northern Atlantic Ocean and the Caribbean Sea (van der Spoel, 1967), Mediterranean (Janssen, 2012) and Indo-West Pacific (Janssen et al., 2020). These are the first records for NW Spain. Rolán (1983) recorded a *Limacina* spec. from the Galicia Bank. The SEM photograph and drawing are not very helpful, but appear to represent a juvenile of *P. moluccensis*.

DISCUSSION

Based on beach collections, *Styliola subula* is now confirmed to occur in NW Spain, *Atlanta peronii*, *Cavolinia inflexa*, *Clio pyramidata*, *Diacria trispinosa*, *Creseis virgula*, *Heliconoides inflatus* and *Limacina retroversa* are first recorded from the Cantabrian Sea, and *Creseis acicula* from the region Cantabria. The records of *Peracle moluccensis* from the Galicia Bank are the first from NW Spain.

Locard (1897) described material recovered from deep-water dredgings north of Spain, specifically off the coast of Cantabria and the Basque Country. The species listed are: *Cavolinia inflexa*, *Clio cuspidata* (Bosc, 1801) [as *Cleodora cuspidata*], *Clio pyramidata* [as *Cleodora pyramidata*], *Styliola subula* [as *Styliola subulata* Quoy & Gaimard], *Limacina bulimoides* (d'Orbigny, 1835), *L. retroversa* [also as *Limacina balea* Møller, 1841], *L. spec.* [as *L. helicina*, see

above], *Heliconoides inflatus* [as *Limacina inflata*], *Peracle elata* [as *Protomedea triacantha* (P. Fischer, 1882)] and *P. diversa* (Monterosato, 1875).

Rolán & Pérez Gandaras (1981) already recorded several holoplanktonic molluscs from the Galicia Bank, to which Rolán (1983) added a few species, but none are mentioned in the check list of Gofas et al. (2021). Check lists (e.g. Urgorri et al., 2017) and overview works (e.g. Trigo et al., 2018) record presence or absence in Galicia, but do not provide specific records, e.g. to indicate the presence of species in the Cantabrian Sea along the northern coast of Galicia, or to separate shallow-water records from those for the Galicia Bank. That is why the column Galicia (Table 1) likely includes an inflated number of species. Thus far, no specific records of holoplanktonic species from the Galician part of the Cantabrian Sea are available. When this paper was already in review Machin (2023) posted a photograph of the soft shell of *Cymbulia peronii* Blainville, 1818 which he found beached at Zarautz, Vizcaya, Basque region. The species is known from the study area (Table 1), but the find shows more species may be found beached.

Janthina taxa live holopelagic, and may wash up on beaches adjoining oceans, though this occurs only very rarely (Rolán & Otero-Schmitt, 1996: 83). Three species are known from Galicia (Table 1). Ortea (1977) mentions *Janthina janthina* (Linnaeus, 1758) from Asturias, but no further details are known as his thesis was never published.

Pteropods are known to live in the open sea and ocean. In the Gijón embayment living specimens of *Limacina* and planktonic larvae of several other benthic gastropods were collected very close to the shore (< 1 km). The abundance of planktonic larvae and holoplanktonic gastropods on the San Lorenzo beach (Gijón, Asturias) and especially at Salvé beach (Laredo, Cantabria) bordering the Cantabrian Sea indicates a special condition compared to other beaches. Both are situated along large embayments bordering deeper waters. Due to this geographic situation, living plankton comes very close to the beach on which the fragile shells settle without being crushed by powerful waves. At Salvé beach planktonic larvae of numerous species of gastropods are found, including species for which no adults have been found. It is possible that the embayment is a breeding area for species such as *Cavolinia inflexa*, *Clio cuspidata*, *Clio pyramidata*.

For each of these three key localities (Gijón, Laredo, Hendaye) many tens of litres of shell grit from repeated collections were studied. This shows that holoplanktonic molluscs typically occur in very low numbers. Only at Laredo did shell grit samples (even one litre volumes) comprise from one to several holoplanktonic molluscs. Although the study of holoplanktonic molluscs based on beached specimens is not as informative as samples of living specimens collected with plankton nets or seabed grabs, the few

beach collections for holoplanktonic molluscs available for the Cantabrian Sea, suggest that the molluscs live in the adjoining embayments and nearby ocean. Interestingly, the species for which beached shells have been found are quite different from those found in deep waters north of the Cantabrian Sea (Table 1). On the other hand, all but one have also been recorded from Galicia.

As the animals have a pelagic life, their shells can rain down onto different types of sediment, irrespective of depth. However, the concentration of shells will also depend on the speed of sediment supply and the current that might remove sediment. Rolán (1983) recorded larger quantities of *Cavolinia inflexa* from between corals at 900 m water depth of Galicia Bank. This may be an exception to the rule, as corals have been observed (at least occasionally) to eat large numbers of pteropods (*Creseis acicula*), albeit in shallow water in the Red Sea (Henk Dekker, pers. comm.; Blatterer, 2019: figs 7g-i).

ACKNOWLEDGEMENTS

This paper is dedicated to the late Arie Janssen who greatly advanced the knowledge of holoplanktonic molluscs and mentored the first author regarding the study of molluscs. He recommended writing a paper on the beach finds as, in western Europe, such finds are rare. He also checked the identification of many of the discussed lots. The comments of two reviewers, David Marshall (Universiti Brunei Darussalam) and an anonymous reviewer, improved the manuscript. We thank Dick Hoeksema and George Simons for allowing us to study the material from Laredo in their collections. Javier Martínez Pérez shared some data. Bram van der Bijl and Jeroen Goud (Naturalis) allowed access to the collection. Frank Wesselingh (Naturalis) made the stereomicroscope available for making the photographs.

REFERENCES

ALONSO SUÁREZ, A. & RAVEN, J.G.M., 2020. Primeras citas de varios moluscos marinos para la costa de Asturias (NO de España). I. — *Elona*, 2: 102-113.
 BLATTERER, H., 2019. Mollusca of the Dahab region (Gulf of Aqaba, Red Sea). — *Denisia*, 43: 1-480.
 BURCKHARDT, G., 1920. Zum Worte Plankton. *Schweizerische Zeitschrift für Hydrologie*, 1: 190-192.
 CADÉE, G.C., 1968. Molluscan biocoenoses and thanatocoenoses in the Ría de Arosa, Galicia: 1-121. E.J. Brill, Leiden.
 EDWARDS, A., JONES, K., GRAHAM, J.M., GRIFFITHS, C.R., MAC DOUGALL, N., PATCHING, J., RICHARD, J.M. & RAINE, R., 1996. Transient coastal upwelling and water

circulation in Bantry Bay, a ria on the south-west coast of Ireland. — *Estuarine, Coastal and Shelf Science*, 42 (2): 213-230.
 EMILIANI, C., 1991. Planktic/planktonic, nektic/nectonic, benthic/bentonic. — *Journal of Palaeontology*, 65 (2): 329.
 GOFAS, S., LUQUE, A., TEMPLADO, J. & SALAS, C., 2017. A national checklist of marine Mollusca in Spanish waters. — *Scientia Marina*, 81 (2): 241-254.
 GOFAS, S., LUQUE, Á.A., OLIVER, J.D., TEMPLADO, J. & SERRANO, A., 2021. The Mollusca of Galicia Bank (NE Atlantic Ocean). — *European Journal of Taxonomy*, 785: 1-114. <https://doi.org/10.5852/ejt.2021.785.1605>
 HIDALGO, J.G., 1917. Fauna malacológica de España, Portugal y Baleares. Moluscos testáceos marinos. — *Trabajos del Museo Nacional de Ciencias Naturales, Serie Zoológica*, N° 30: 1-752.
 HUTCHINSON, G.E., 1974. De rebus planctonicis. — *Limnology and Oceanography*, 19 (2): 360-361.
 JANSSEN, A.W., 2007. Holoplanktonic Mollusca (Gastropoda: Pterotracheoidea, Janthinoidea, Thecosomata and Gymnosomata) from the Pliocene of Pangasinan (Luzon, Philippines). — *Scripta Geologica*, 135: 29-177.
 JANSSEN, A.W., 2012. Late Quaternary to Recent holoplanktonic Mollusca (Gastropoda) from bottom samples of the eastern Mediterranean Sea: systematics, morphology. — *Bollettino Malacologico*, 48 (Suppl. 9): 1-105.
 JANSSEN, A.W., 2020. Notes on the systematics, morphology and biostratigraphy of holoplanktonic Mollusca, 27. Comments on a paper discussing Pteropoda (Gastropoda, Heterobranchia) systematics, recently (2019) published in *Bollettino Malacologico*. — *Basteria*, 84 (1-3): 65-75.
 JANSSEN, A.W., BIJL, B., VAN DER GOUD, J., PEIJNENBURG, K.T.C.A., POWWER, R., WALL-PALMER, D. & WESSELINGH, F.P., 2020: The Naturalis collections of pelagic Gastropoda (Mollusca). — *Basteria* 84 (4/6): 215-264.
 JANSSEN, A.W., BUSH, S.L. & BEDNARŠEK, N., 2019. The shelled pteropods of the northeast Pacific Ocean (Mollusca: Heterobranchia, Pteropoda). — *Zoosymposia*, 13: 305-346.
 JANSSEN, A.W. & PEIJNENBURG, K.T.C.A., 2013. Holoplanktonic Mollusca: Development in the Mediterranean Basin during the last 30 million years and their future. In: GOFFREDO, S. & Z. DUBINSKY (eds.), *The Mediterranean Sea. Its history and present challenges*: 341-362. Springer, Dordrecht.
 LOCARD A., 1897-1898. Expéditions scientifiques du Travailleur et du Talisman pendant les années 1880, 1881, 1882 et 1883. Mollusques testacés. Tome 1: 1-516, pls 1-22 (1897); Tome 2: 1-515, pls 1-18 (1898). Masson, Paris.
 MUÑOZ FERRERA DE CASTRO, J.L., SÁNCHEZ HERNÁNDEZ, J., RÍOS JIMÉNEZ, F., MARTÍNEZ CHACÓN, M. TORRES ALBA, J.S. & MENESES SORES, V., 2018. Guía de los moluscos marinos y continentales del Campo de Gibraltar:

- 1-405. Junta de Andalucía, Sevilla.
- ORTEA, J.A., 1977. Moluscos marinos gasterópodos y bivalvos del litoral asturiano entre Ribadesella y Ribadeo con especial atención a la subclase de los opisthobranchios. Universidad de Oviedo, Unpublished doctoral tesis.
- RAMPAL, J., 2002. Biodiversité et biogéographie chez les Cavoliniidae (Mollusca, Gastropoda, Opisthobranchia, Euthecosomata). Régions faunistiques marines. — *Zoosystema*, 24 (2): 209-258.
- RAMPAL, J., 2019. Euthecosomata (Mollusca: Gastropoda: Thecosomata). A taxonomic review. — *Bollettino Malacologico*, 55 (2): 145-186.
- ROLÁN, E., 1983. Moluscos de la Ría de Vigo (I Gasterópodos). — *Thalassas*, 1 (1), Anexo 1: 1-383.
- ROLÁN, E. & OTERO-SCHMITT, J., 1996. Guía dos moluscos de Galicia: 1-317. Galaxia, Vigo.
- ROLÁN, E. & PÉREZ GANDARAS, G., 1981. Molluscs collected at the Galicia Bank (Spain). — *La Conchiglia*, 150-151: 6-7, 10.
- SPOEL, S. VAN DER, 1967. Euthecosomata, a group with remarkable developmental stages (Gastropoda. Pteropoda): 1-375. Bohn, Scheltema & Holkema, Utrecht.
- SYKES, E.R., 1905. On the Mollusca procured during the “Porcupine” expeditions, 1869-1870. Supplemental notes, part II. — *Proceedings of the Malacological Society of London*, 6 (6): 322-332.
- TRIGO, J.E., DÍAZ AGRAS, G., GARCÍA ÁLVAREZ, O., GUERRA, A., MOREIRA DA ROCHA, J., PÉREZ DIESTE, J., ROLÁN, E., TRONCOSO, J., URGORRI, V., 2018. Guía de los Moluscos marinos de Galicia: 1-832. Servizo de Publicacións da Universidade de Vigo.
- URGORRI, V., TRIGO, J.E., GARCÍA-ÁLVAREZ, O. ROLÁN-MOSQUERA, E., DÍAZ-AGRAS, G, SEÑARIS, M.P. & TRONCOSO, J.S., 2017. FILO Mollusca, CLASE Gastropoda. In: BAÑÓN, R. (ed.), *Inventario de la biodiversidad marina de Galicia: Proyecto LEMGAL*. Consellería do Mar, Xunta de Galicia, Santiago de Compostela.
- VAYSSIÈRE, A., 1915. Mollusques euptéropodes (ptéropodes thécosomes) provenant des campagnes des yachts Hironnelle et Princesse-Alice (1885-1913). Résultats des Campagnes Scientifiques accomplies sur son yacht par Albert I^{er}, Prince souverain de Monaco, 47: 1-226.
- WALL-PALMER, D., SMART, C.W., HART, M.B., LENG, M.J., BORGHINI, M., MANINI, E., ALIANI, S. & CONVERSI, A., 2014. Late Pleistocene pteropods, heteropods and planktonic foraminifera from the Caribbean Sea, Mediterranean Sea and Indian Ocean. — *Micropaleontology*, 60 (6): 557-578.

Online sources

- LISTA PATRÓN DE ESPECIES SILVESTRES DE ESPAÑA (version 2017) [Accessed at https://www.miteco.gob.es/es/biodiversidad/servicios/banco-datos-naturaleza/informacion-disponible/BDN_Listas_Patron_2017.aspx_on2022-10-15; the 2022 version could not be used as it only lists species for the whole Iberian Peninsula]
- MACHIN, A. 2023. Record of *Cymbulia* cf. *peronii* from Zarautz beach. Facebook, Malacología Ibérica [posted 2023-04-29].
- SPOEL, S. VAN DER, 1980. Pelagic Molluscs 2.0 at: https://pelagic-molluscs.linnaeus.naturalis.nl/linnaeus_ng/app/views/introduction/topic.php?id=3394&epi=169
- WALL-PALMER, D., 2017. Shelled heteropod identification portal <https://www.planktonic.org/> [last consulted 2022-12-15].