On the presence of elusive sea slugs and snails in the western Mediterranean (Mollusca: Gastropoda): new records

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Running head: New records of Mediterranean heterobranchs

Abstract

Citizen science provides us with much information about charismatic taxa such as the opisthobranchs, thus contributing enormously to enlarging the geographic distribution of species. This study collects new records of elusive sea slugs and snails in the Western Mediterranean coast (especially in the Catalan coast and the French Mediterranean coast) and contributes to new ecological information regarding phenology, diet, and behaviour. Out of the 36 species reported here, 20 correspond to new records in the Catalan coast (NE Spain), three are new records of pelagic pteropods for the Spanish coast, and 10 other species are new records for the French Mediterranean coast. All records have been registered at the online database of the NGO named Catalan Opisthobranch Research Group (GROC). This study highlights the importance of sampling at night and, especially, in shallow, often-understudied waters, which usually gather high species diversity. We believe the high-quality pictures and related species' information will serve future researchers and divers find and recognize these species in the Mediterranean basin.

Keywords: opisthobranchs, new records, rare species, Mediterranean Sea, biodiversity

Introduction

Marine heterobranch gastropods, commonly named opisthobranchs, have a worldwide approximate diversity of over 6,000 species (Carefoot, 1987; Wägele *et al.*, 2008). They are especially diverse in tropical and temperate waters where there is usually high mollusc diversity (Valentine & Jablonski, 2015). In the Spanish coast, 523 species have been recorded so far (Cervera *et al.*, 2004) and about a half were found in the NE of the Iberian Peninsula (Catalonia), concretely 205 species (Ballesteros, *et al.*, 2016). Current advances in species molecular assessments in the Mediterranean are helping to discover many new species that, in some cases, respond to hidden or cryptic speciation in taxa with similar morphological characters and, thus, difficult to discern underwater. Recent examples of such studies deal with the genus *Trinchesia* (Korshunova *et al.*, 2019) for which four out of one species have been now raised; also, new species of the elusive genus *Runcina* (Araujo *et al.*, 2019) or the systematic replacement of *Eubbranchus farrani* (Alder & Hancock, 1844), now *Amphorina farrani*, with an additional new species described (Korshunova *et al.*, 2020). Not only new species are described, also historically synonymized taxa are being resurrected to gather the new molecular diversity unveiled, such is the case of the umbraculid genus *Tylodina*, for which recent morpho-anatomical and molecular evidence suggested the resurrection of *T. rafinesquii* Philippi, 1836 (Fernández-Vilert *et al.*, *in press*). Overall, many systematic reassessments aided by molecular tools keep revealing new taxa and further taxonomic readjustments.

During the past decades, numerous cases of allochthonous species arrivals have been detected in the Mediterranean. For instance, the aeolid *Godiva quadricolor* (Barnard, 1927) is an example of how allochthonous species are widening their range through the establishment in new areas (Cervera *et al.*, 2010). Other common sightings from usually altered places with human impact are the sea hares *Bursatella leachii* Blainville, 1817 firstly reported in Israel (O'Donoghue & White, 1940) and now found all over the Mediterranean (Ibáñez-Yuste *et al.*, 2012), and *Aplysia dactylomela* Rang, 1828 with an Atlantic origin (Valdés *et al.*, 2013) currently found from side to side of the Mediterranean (Moles *et al.*, 2017).

Because of all abovementioned reasons, heterobranch diversity and systematics in the Mediterranean are in the curve of change in the decades to come. In such a dynamic system we encourage the use of citizen science platforms to track down rare or new species (e.g., Trainito *et al.*, 2017; Fernández-Vilert *et al.*, *in press*), distribution patterns (see GROC, 2009–2020), and the spread of alien species (e.g., Fernández-Vilert *et al.*, 2018). In that sense, the objective of the present study is to highlight the first or scarce new records of Heterobranchia species along the Mediterranean Spanish and French coasts using data obtained through the Catalan Opisthobranch Research Group (GROC) based on citizen science. Remarkably, the observations reported here were mainly done at shallow waters during night-time prospecting by freediving and across seasons.

Material and Methods

Most specimens were found while freediving from 0 to 6 m depth and photographed underwater with a Nikon D90 and Nikon D7200 coupled with a 60 mm and 105 mm macro lens by X. Salvador. A map of the sampling area was generated at <https://www.simplenappr.net/#tabs=0> and encompass the Southern Mediterranean coast of France (étang de Thau), the Catalan coast (NE Spain), and Granada in the South Eastern Spanish coast (Fig. 1). Species external descriptions are based on our photographic material, total length (L) for the analysed specimens was measured *in situ* with the aid of a ruler or in the lab under a stereomicroscope. All records were deposited in the online database of the Catalan Opisthobranch Research Group (GROC, 2009–2020).

Results

SYSTEMATICS

Order CEPHALASPIDEA P. Fischer, 1883

Family HAMINOEIDAE Pilsbry, 1895

Genus *Haloa* Pilsbry, 1921

***Haloa japonica* (Pilsbry, 1895)**

(Figure 2A)

Material examined: Le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 3-Nov-2017, 2.1 m depth, 1 spc., adult, *L* = 20 mm; 14-Apr-2018, 1.7 m depth, 3 spcs, adults, *L* = 20–30 mm; 21-May-2018, 1.9 m depth, 8 spcs, adults, *L* = up to 35 mm.

External morphology: Shell external, translucent, background colour brown with big orange punctuations. Parapodia darker on top. Head lighter on edge, with darker central part between the eyes.

Ecology: Found at night on soft bottoms, between Ceramiales species and other undetermined red algae. The groups of specimens found during April and May were mating.

Distribution: Japanese coast (Pilsbry, 1895); USA (GBIF, 2020); Spain: Galicia (Cervera *et al.*, 2004), Cantabria (Cervera *et al.*, 2004), Andalucía (Cervera *et al.*, 2004); France (this study).

Remarks: In the area there are species of Japanese origin, such as the alga Wakame [*Undaria pinnatifida* (Harvey) Suringar, 1873] or the oyster [*Magallana gigas* (Thunberg, 1793)], so their presence may be justified by aquaculture.

***HaminoeaORTEAI* Talavera, Murillo & Templado, 1987**

(Figure 2B,C)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10.5"N, 3°2'44.6"E, 16-Oct-2017, 0.6 m depth, >40 spcs, juveniles, adults, and egg masses, *L* = 2–15 mm; 31-Dec-2017, 1.2 m depth, 3 spcs, juveniles and adults, *L* = up to 15 mm; Le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 3-Nov-2017, 1.4 m depth, 2 spcs, adults, *L* = 20 mm; Fòrum pools, Barcelona (Spain), 41°24'34.5"N, 2°13'36.8"E, 25-Nov-2017, 1.7 m depth, 2 spcs, adults and egg masses, *L* = 20 mm; 27-Apr-2018, 0.8 m

depth, 1 spc., adult, $L = 10$ mm; l'Espigó, Roses (Spain), 42°15'39.8"N, 3°10'26.8"E, 28-Feb-2020, 0.8 m

depth, 5 spcs, adults and egg masses, $L = 25$ mm.

External morphology: Shell external, translucent, background colour light brown to grey with dark brown, white and orange punctuations surrounded of little dark red points. Parapodia lighter in colour. Head lighter in colour, area around eyes pigmented.

Ecology: Specimens were found crawling on calcareous rocks with undetermined green algae. Egg masses were observed in November and juveniles in December. Egg masses elongated, forming a "C", with white eggs (Fig. 1C).

Distribution: Açores (Cervera *et al.*, 2004); Spain: Canary Islands (Cervera *et al.*, 2004), Andalucía (Cervera *et al.*, 2004), Spanish levant (Cervera *et al.*, 2004; Talavera *et al.*, 1987), Catalonia (this study); France (this study).

Remarks: *Haminoea* species in the Mediterranean are yet poorly studied (M. A. E. Malaquias pers. comm.) and thus, the morphological characters to distinguish the species are not clear. The visual distinguishing feature of this species is the presence of a pigmented pericocular area. The presence of small orange dots under the shell surrounded by smaller dots of dark purple or black colour, forming a flower pattern is a pattern of colouration that found in all studied specimens.

Family PHILINIDAE Gray, 1850 (1815)

Genus *Philine* Ascanius, 1772

***Philine catena* (Montagu, 1803)**

(Figure 2D)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 13-Dec-2017, 1.3 m depth, 1 spc., adults, $L = 5$ mm; Punta del Romaní, L'Escala (Spain), 42°6'54"N, 3°10'9"E, 30-Dec-2017,

2.5 m depth, 2 spcs, adults, $L = 3-7$ mm; Cala d'Aiguafreda, Begur (Spain), $41^{\circ}57'49''N$, $3^{\circ}13'41''E$, 31-Jan-2018, 1.2 m depth, 1 spc., adult, $L = 5$ mm.

External morphology: Body elongate, narrow, white-beige or brown in colour, with a discontinuous dark-brown band over cephalic shield. Cephalic shield longer than shell. Parapodia short, not overlapping. Shell completely covered by mantle. Probably individuals are hiding among the sediment grains during the day and actively moving at night.

Ecology: The specimens were found crawling at night on rocks with algae and evident sediment loading between rocky outcrops.

Distribution: North Sea (GBIF, 2020); Açores (Cervera *et al.*, 2004); Portugal (Cervera *et al.*, 2004); Spain: Galicia (Cervera *et al.*, 2004), Cantabria (Cervera *et al.*, 2004), Catalonia (this study).

Remarks: Molecular and morphological data reveals this species may not belong to the genus *Philine* (J. Moles unpubl. data).

Order NUDIBRANCHIA Cuvier, 1817

Family AEGIRIDAE P. Fischer, 1883

Genus *Aegires* Lovén, 1844

***Aegires palensis* Ortea, Luque & Templado, 1990**

(Figure 3A)

Material examined: Cala Ventosa, Sant Feliu de Guíxols (Spain), $41^{\circ}47'5''N$, $3^{\circ}2'52''E$, 13-Sep-2017, 1 m depth, 1 spc., adult, $L = 10$ mm; Cala Maset caves, Sant Feliu de Guíxols (Spain), $41^{\circ}47'10''N$, $3^{\circ}2'44''E$, 7-May-2018, 1 m depth, 7spcs, juveniles and adults, $L = 3-15$ mm; Cala d'Aiguafreda, Begur (Spain), $41^{\circ}57'49''N$, $3^{\circ}13'41''E$, 25-May-2018, 1 m depth, 6spcs, juveniles and adults, $L = 6-15$ mm.

External morphology: Body elongate, rough, angulated, with tubercles in the laterals; body colour beige, with small white and light-brown dots; rhinophores, rhinophoral sheaths and apical part of tubercles with dark-brown spots. Branchial leaves protected by three tubercles, curved internally, equal in length.

Ecology: All specimens were found on top of white calcareous sponges of the genus *Sycon* (pss. *S. elegans* (Bowerbank, 1845) and *S. raphanus* Schmidt, 1862) and *Ascandra contorta* (Bowerbank, 1866). Generally found at night at the entrance or inside caves, crawling on walls.

Distribution: Spain: Andalucía, Spanish levant (Cervera *et al.*, 2004), and Catalonia (Cervera *et al.*, 2004; Ballesteros *et al.*, 2012–2020; this study).

Remarks: This species can be differentiated from the other Atlantic species of *Aegires* in the structure and disposition of the tubercles, body colour, and the dark brown dots in the sheaths and apex of the rhinophores (Ortea *et al.*, 1990).

***Aegires sublaevis* Odhner, 1932**

(Figure 3B)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 16-Feb-2018, 1 m depth, 1 spec, adult, *L* = 15 mm.

External morphology: Body elongate, rough, angulated with central part of dorsum flattened, with black marks in dorsum and laterals; body colour white yellowish. Branchial leaves protected by three tubercles, the central one bigger than the laterals. Rhinophores smooth, presenting a brown ring close to the top.

Ecology: Our specimen was found feeding on white calcareous sponges of the genus *Ascandra* and, thus, displaying a whiter colouration.

Distribution: Madeira (Malaquias *et al.*, 2001); Açores (Calado, 2002; Fahey & Gosliner, 2004); Spain: Canary Islands (Odhner, 1931; Altimira & Ros, 1979, as *Serigea sublaevis*; Pérez Sánchez, Ortea, & Bacallado, 1990;

Ortea, et al., 1996; 2001; 2003; Malaquias & Calado, 1997), Spanish Levant (Templado *et al.*, 1987), and Catalonia (this study).

Remarks: According to Ortea *et al.* (1996) its colouration can vary from yellow, beige or white depending on the diet, generally found feeding on *Clathrina coriacea* (Montagu, 1814).

Family AEOLIDIIDAE Gray, 1827

Genus *Anteaeolidiella* M. C. Miller, 2001

***Anteaeolidiella lurana* (Ev. Marcus & Er. Marcus, 1967)**

(Figure 3C)

Material examined: Badia dels Alfacs port, Sant Carles de la Ràpita, Montsià (Spain), 40°37'1"N, 0°35'52"E, 1.3 m depth, 3 spcs, adults, and egg masses, *L* = 15 mm; Valencia's port (Spain), 39°27'39.9"N, 0°19'29.5"W, 18-Jan-2020, 0.2 m depth, 1 spec, adult, H= 10mm.

External morphology: Body elongate, narrow, with a white mark surrounded by orange in dorsum; background colour white, with 2 orange lines in head, united behind eyes. Cerata short, round, background colour grey, white on top. Rhinophores long, equal, white in colour with orange central region.

Ecology: The specimens found in Alfacs bay (Catalonia) were found under rocks mating and laying eggs. However, the specimen found in Valencia was on a vertical wall in the port, moving around hydrozoans at night, thus the species likely presents nocturnal activity.

Distribution: Brazil (Marcus & Marcus, 1967); Italy (Ballesteros *et al.*, 2012–2020); Spain: Balearic Islands (GROC, 2009–2020), Catalonia (this study).

Remarks: The species was described from Brazil and records of its first invasion in the Mediterranean correspond to Italy by Alberto Piras (Cagliari, Italy (1983); Köhler, 2020). The two locations where it was found in this study have fairly eutrophic waters and ship activity, which may be related to its appearance.

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Family CADLINIDAE Bergh, 1891

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Genus *Aldisa* Bergh, 1878

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***Aldisa smaragdina* Ortea, Pérez & Llera, 1982**

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(Figure 3D)

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Material examined: Cala d'Aiguafreda, Begur (Spain), 41°57'49"N, 3°13'41"E, 24-Apr-2015, 3 m depth, 1

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spc., $L = 7$ mm.

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External morphology: Body rounded, flat; light red in colour, with two dark circles on dorsum; yellow-brown

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line present at laterals of body next to the first circle. Gills light red, white on top of branchial leaves.

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Ecology: The specimen was found at a shallow depth under a rock, on top of the sponge *Phorbas topsenti*

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Vacelet & Pérez, 2008.

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Distribution: Spain: Canary Islands (Pruvot-fol (1953) as *Aldisa binotata*; Ortea *et al.*, 1982), Catalonia (this

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study).

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Remarks: In its original description the body was described as red with 2 big dark circles and a white line just

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after the first dark circle. The specimen studied here presents a lighter red colouration and lacks the second

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dark circle. The gills are also light red and white on the top, while the conspecific *A. banyulensis* (Pruvot-Fol,

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1951) presents dark red gills, lacking the white top. Moreover, our specimen presents a yellow line in the

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anterior part of the body, just after the first circle and diagonally towards the front, while in *A. banyulensis*

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the yellow line is found between the first and second dots, displayed slightly towards the posterior part.

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Family DOTIDAE Gray, 1853

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Genus *Doto* Oken, 1815

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***Doto cervicenigra* Ortea & Bouchet, 1989**

217 (Figure 3E)

218 *Material examined:* Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10.5"N, 3°2'44.6"E, 13-Apr-2016,
 219 0.3 m depth, 1 spc., $L = 5$ mm; 31-Dec-2017, 1.2 m depth, 3 spcs, juveniles and adults, $L = 15$ mm; 13-Jan-
 220 2018, 0.4 m depth, 2 spcs, $L = 3-7$ mm; 31-Dec-2017, 1.2 m depth, 3 spcs, juveniles and adults, $L = 15$
 221 mm; Le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 13-Apr-2018, 0.2 m depth, 4 spcs,
 222 adults, $L = 7-10$ mm; 21-May-2018, 0.2 m depth, 12 spcs, adults and egg masses, $L = 7-10$ mm; la Farge,
 223 étang de Thau, Sète (France), 43°25'48"N, 3°42'14"E, 21-May-2018, 0.2 m depth, 17 spcs, adults and egg
 224 masses, $L = 7-10$ mm; Port de Sant Feliu (Spain), 41°46'42.2"N, 3°02'16.4"E, 29-Jan-2020, 0.2 m depth,
 225 11 spcs, adults, juveniles, and egg masses, $L = 2-12$ mm; Arenys de Mar port (Spain), 41°34'38.8"N,
 226 2°33'23.5"E, 15-Feb-2020, 0.2 m depth, 2 spcs, adults, $L = 10$ mm; Port de Blanes (Spain), 41°40'25.5"N,
 227 2°47'48.6"E, 2-Mar-2020, 0.2 m depth, 2 spcs, adults, $L = 6-10$ mm.

228 *External morphology:* Body elongate, narrow, background colour white with black marks all along but more
 229 concentrated in the head area. Rhinophores black with white tips. Cerata with tubercles, apical part black.

230 *Ecology:* The specimens were found at shallow depths, influenced by fresh water, on top of rocks and
 231 hydrozoans, possibly *Obelia* sp., where they were feeding and laying the eggs (short, lineal, with big white
 232 eggs) at the bottom of the colony. They were found more active during the night.

233 *Distribution:* Corsica (Ortea & Bouchet, 1989); Italy (Ballesteros *et al.*, 2012–2020); Spain: Mallorca (GROC,
 234 2009–2020), Catalonia (this study); France (this study).

235 *Remarks:* This species is easily distinguished from other conspecific *Doto* species by the presence of black
 236 rhinophores and the small tubercles with a black dot in the cerata (Ortea & Bouchet, 1989).

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238 ***Doto pygmaea* Bergh, 1871**

239 (Figure 3F)

Material examined: Cala d'Aiguablava, Begur (Spain), 41°56'13.4"N, 3°13'08.6"E, 22-Jun-2018, 0 m depth, 6
 spcs, juvenils and adults, $L = 2-5$ mm; Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10.5"N,
 3°2'44.6"E, 11-Feb-2020, 0.1 m depth, 7spcs, adults and egg masses, $L = 5-10$ mm.

External morphology: Body elongate, narrow, background colour white with black patches to completely black.
 Rhinophores elongate, translucent white. Cerata displayed in a sinuous "S" fashion with white tubercles only
 in external part, the inner part being almost smooth.

Ecology: All specimens were found over floating debris. The specimens from Aiguablava were living over a
 plastic cube eating hydrozoan colonies, probably of the genus *Obelia*. The specimens of Cala Maset were
 living in a floating wood that appeared after a storm. They were mating and laying egg masses, while eating
 hydrozoans of the genus *Tubularia*. Their egg masses are shaped like a winding cord forming an "S", the
 eggs are yellowish.

Distribution: Italy (Schmekel & Portmann, 1982); Spain: Canary Islands (Cervera *et al.*, 2004), Levantine
 Spanish coast (Cervera *et al.*, 2004), Catalonia (this study).

Remarks: This species can be differentiated from other *Doto* species by having a black body, with very
 elongated rhinophores, a smooth edge on the rhinophoral sheath, and "S" shaped cerata, the inner part
 being almost smooth and the external with tubercles aligned longitudinally (Ortea *et al.*, 1997).

Family EUBRANCHIDAE Odhner, 1934

Genus *Amphorina* Quatrefages, 1844

***Amphorina andra* Korshunova, Malmberg, Prkić, Petani, Fletcher, Lundin, Martynov,**

2020

(Figure 3G)

Material examined: Cala d'Aiguafreda, Begur (Spain), 41°57'49"N, 3°13'41"E, 22-Jun-2013, 18 m depth, 1 spec, juvenile, $L = 3$ mm (GROC 2013); Balaruc-les-Bains (France), 43°26'28.8"N, 3°41'3"E, 5-Apr-2014, 2 m depth, 2 spcs, adults, $L = 10$ –15 mm; Barra de l'Arbre, Mataró (Spain), 41°31'57.9"N, 2°28'21.2"E, 1-May-2014, 20 m depth, 1 spec, juvenile, $H = 2$ mm; Punta del Romani, L'Escala (Spain), 42°6'54"N, 3°10'9"E, 12-Apr-2015, 4 m depth, 3 spcs, adults, $L = 10$ –12 mm; Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 16-Jan-2018, 1 m depth, 2 spcs, adults, $L = 10$ mm; 16-Jan-2018, 1 m depth, 2 spcs, adults and egg masses, $L = 10$ –12 mm; 22-Jan-2018, 0.7 m depth, 6 spcs, adults, mating, and egg masses, $L = 12$ –15 mm; 16-Feb-2018, 1.2 m depth, 2 spcs, adults, $L = 8$ –10 mm; 9-Mar-2018, 0.6 m depth, 6 spcs, adults, mating and egg masses, $L = 10$ –15 mm; Punta d'en Bosch, Sant Feliu de Guíxols (Spain), 41°45'54"N, 3°0'11"E, 17-Apr-2018, 1 m depth, 5 spcs, adults mating, $L = 8$ –12 mm; Cova de l'infern (Spain), 42°19'2.75"N, 3°19'12.74"E, 2-Mar-2019, 1 m depth, 3 spcs, adults and egg masses, $L = 10$ –20 mm.

External morphology: Body elongate, narrow, background colour variable, normally white with black and orange marks, some specimens displaying a completely white or orange colouration. Rhinophores and oral tentacles smooth, yellow and white apically. Cerata globular, with white and black marks, apical part yellow.

Ecology: The specimens were found in broad range of depths, always associated to hydrozoan colonies. The specimens of Sant Feliu were found inside a cave, in presence of hydrozoans of the genus *Sertularella*, where they often lay the egg masses. They were most active overnight, mating and laying eggs. During the day they rest at the base of the hydrozoans. The egg mass is spiral shaped, usually laid on rocks, although they can also be on the hydrozoans upon which they feed.

Distribution: Italy and Croatia (Korshunova *et al.*, 2020); France (this study); Spain: Catalonia (this study).

Remarks: This species have been recently described and was formally attributed to its conspecific and sympatric *A. farrani* (Alder & Hancock, 1845; formerly *Eubbranchus farrani*). *Amphorina andra* presents a very variable colouration pattern, from completely white or orange, to a white body with black spots and orange circles on the back. Specimens found at deeper depths were typically small in size, whereas specimens found

at very shallow depths, mostly in caves, were larger and found on hydrozoan colonies of the genus *Obelia* and *Sertularella*, among others. The populations observed in Croatia were very shallow, between 0 and 0.5 m (Korshunova *et al.*, 2020), as was the population studied in Sant Feliu, Catalonia (Spain).

Genus *Eubbranchus* Forbes, 1838

***Eubbranchus prietoi* Llera & Ortea, 1981**

(Figure 3H)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 11 to 16-Feb-2018, 1.5–2 m depth, 13spcs, adults and egg masses, $L = 4\text{--}7$ mm; 9 to 15-Mar-2018, 1.5 m depth, 13spcs, juveniles, adults, and egg masses, $L = 6\text{--}10$ mm; 30-Mar-2018, 1.5 m depth, 7 spcs, juveniles, adults, and egg masses, $L = 7\text{--}15$ mm; 15-Apr-2018, 1.5 m depth, 2 spcs, adults, $L = 8$ mm; 7-May-2018, 0.7 m depth, 2 spcs, adults, $L = 7$ mm.

External morphology: Body elongate, narrow, with a black mark in dorsum (corresponding to digestive gland seen by transparency), starting between the first couple of cerata and finishing at the last group of cerata. Background colour beige with brown and white punctuation. Rhinophores long, equal. Cerata large and fusiform compressed at the middle, transparent with white to dark brown visible digestive gland, white tips.

Ecology: The specimens were found during the day resting at the base of the hydrozoan *Kirchenpaueria halecioides* (Alder, 1859), while actively crawling, mating, and feeding on the colony at night. C-shaped egg masses were found over the hydrozoan.

Distribution: Gibraltar (García-Gómez, 1987); Spain: Cantabria (Ortea & Bacallado, 1981), Catalonia (this study).

Remarks: When active, they present the cerata completely lateralized, camouflaging themselves around the pycnogonids also found on the hydrozoan colonies (X. Salvador pers. obs.). It can be differentiated

externally from other *Eubranchus* species by the insertion of the first cerata groupings and the visible black digestive gland on dorsum between cerata (Llera & Ortea, 1981).

Family FACELINIDAE Bergh, 1889

Genus *Godiva* Macnae, 1954

***Godiva quadricolor* (Barnard, 1927)**

(Figure 4A)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10.5"N, 3°2'44.6"E, 31-Dec-2017, 2 m depth, 1 spc., *L* = 10 mm; 5-Jan-2018, 1.3 m depth, 1 spc., adult, *L* = 25 mm; 22-Jan-2018, 1.3 m depth, 1 spc., adult, *L* = 25 mm; 29-Jan-2018, 1.3 m depth, 1 spc., adult, *L* = 25 mm.

External morphology: Body elongate, narrow, background colour light orange with whitish blue electric marks. Oral tentacles presenting a whitish blue line connecting apical part with base of rhinophores. Rhinophores equal, white yellowish apically. Cerata abundant, smooth, coloured in red at base, orange, blue and yellow towards tip.

Ecology: This species has a very wide diet (Betti *et al.*, 2015), commonly found eating anemones (e.g. the genera *Anemonia* and *Aiptasia*), worms (e.g. *Sabella*), and other heterobranchs such as *Spurilla neapolitana* (Delle Chiaje, 1841).

Distribution: This is an invasive species originally from South Africa and the Pacific Sea (GBIF, 2020), now found in Italy, France, Andalucía (Ballesteros *et al.*, 2012–2020), and Catalonia (this study).

Remarks: This species is a big facelinid with a very characteristic colour pattern, difficult to misidentify. In the étang de Thau the species is very abundant during Spring.

Family GONIODORIDIDAE H. Adams & A. Adams, 1854

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Genus *Okenia* Menke, 1830

***Okenia longiductis* Pola, Paz-Sedano, Macali, Minchin, Marchini, Vitale, Licchelli & Crocetta, 2019**

(Figure 4B)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 23-Sep-2016, 1 m depth, 5 spcs, juveniles, adults, and egg masses, $L = 2-8$ mm; 14-Sep-2017, 1 m depth, 7 spcs, adults and egg masses, $L = 5-13$ mm; 16-Oct-2017, 1 m depth, > 20 spcs, adults and egg masses, $L = 7-13$ mm; Cala Ventosa, Sant Feliu de Guíxols (Spain), 41°47'5"N, 3°2'52"E, 13-Sep-2017, 1 m depth, 2 spcs, adults and egg masses, $L = 5$ mm; Fòrum pools, Barcelona (Spain), 41°24'34.5"N, 2°13'36.8"E, 23-Nov-2017, 2.3 m depth, 7 spcs, adults and egg masses, $L = 5-10$ mm.

External morphology: Body elongate, narrow, background colour light brown or white with irregular brown, black and white punctuations in adults. Papillae smooth, found scattered on dorsum and laterals. Rhinophores presenting a smooth front surface, lamellar in back. Discoidal branchial leaves.

Ecology: All specimens found at each locality were found on the bryozoans *Amathia verticillata* (Delle Chiaje, 1822), laying their egg masses.

Distribution: Recently described in Italy and France (Pola *et al.*, 2019); Spain: Catalonia (this study).

Remarks: Pola *et al.* (2019) recently confirmed the differences between this species and *O. zoobotryon* (Smallwood, 1910), previously recorded in the Mediterranean but originally described from Bermudas. Molecular and morphological analyses in the previous study revealed differences in the reproductive system and the gill branches between these two species. Thus, according to Pola *et al.* (2019) previous records of *O. zoobotryon* in the Mediterranean are misidentifications of *O. longiductis*, and *O. zoobotryon* is only present in the western Atlantic.

Family PISEINOTECIDAE Edmunds, 1970

Genus *Piseinotecus* Er. Marcus, 1955

***Piseinotecus soussi* Tamsouri, Carmona, Moukrim & Cervera, 2014**

(Figure 4C)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 22-Jan-2018, 1.8 m depth, 7 spcs, juveniles, adults, and egg masses, $L = 4\text{--}25$ mm; 29-Jan-2018, 1.6 m depth, 9spcs, adults and egg masses, $L = 12\text{--}25$ mm.

External morphology: Body elongate, narrow, background colour violet or pink. Rhinophores and oral tentacles smooth, white apically with a degraded white punctuation. Cerata smooth, long, translucent, with digestive gland visible in orange; white apically, presenting a profuse white punctuation.

Ecology: Specimens were found mating and laying the egg masses on top of unidentified species of hydrozoans at night and hiding at the base of the colonies during daylight.

Distribution: Morocco (Tamsouri *et al.*, 2014); Italy (Ballesteros *et al.*, 2012–2020), Catalonia (Ballesteros *et al.*, 2016; this study).

Remarks: Originally described from Morocco, it is quite widespread on the Catalan coast. Differs from other similar-looking species, such as *Edmundsella pedata* (Montagu, 1816), by the presence of abundant white spots in the cerata, rhinophores, and oral tentacles.

***Piseinotecus sphaeriferus* (Schmekel, 1965)**

(Figure 4D)

Material examined: Punta del Romani, l'Escala, Girona (Catalunya), 42°6'53.088"N, 3°10'6.765"E, 8-November-2014, 1 spc.; Le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 20-May-2018, 0.4 m depth, 1 spc., adult, $L = 13$ mm.

External morphology: Body elongate, narrow, background colour transparent white. Rhinophores and oral tentacles smooth, translucent with white spots. Cerata smooth, background colour white or beige, base presenting a green iridescent reflection; first and second row of cerata connected with a dark line.

Ecology: The singleton was found on top of the hydrozoan *Obelia* sp. during the night.

Distribution: Ghana (Edmunds, 1977); Portugal (Cervera *et al.*, 2004); Italy and Adriatic Sea (Ballesteros *et al.*, 2012–2020); Spain: Canary Islands (Ortea *et al.*, 2003), Catalonia (Ballesteros *et al.*, 2016; GROC, 2009–2020); France (this study).

Remarks: Elusive species easily diagnosed by a green iridescent sphere at the base of the cerata (Ortea *et al.*, 2003).

Family POLYCERIDAE Alder & Hancock, 1845

Genus *Palio* Gray, 1857

***Palio nothus* (Johnston, 1838)**

(Figure 4E)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 16-Jan-2018, 1.7 m depth, 5 spcs, adults and egg masses, $L = 8\text{--}14$ mm; 7-May-2018, 1.4 m depth, 1 spc., adult and egg masses, $L = 15$ mm; $L = 8\text{--}14$ mm; 11-Mar-2020, 2 m depth, 7 spcs, juveniles.

External morphology: Body short, thick, background colour black with numerous white papillae. Mantle margin white. Rhinophores presenting lamellae, beige or white in colour. Branchial leaves dark brown.

Ecology: The specimens were found mating and laying the egg masses on top of the bryozoans *Amathia lendigera* (Linnaeus, 1758) on walls. The egg masses are white with a soft brown tone in a “C” shape, laid over the bryozoans. Juvenile specimens only found in 2020 also on top of *A. lendigera*. They are more active overnight and go unnoticed during the day.

Distribution: North Sea (England and Norway; Johnston, 1838); Spain: Catalonia (Ballesteros *et al.*, 2016; this study).

Remarks: This species has an amphi-Atlantic and boreo-artic distribution, but its identity may need confirmation since is easily confused with *Palio dubia* (M. Sars, 1829) and several records may have been misidentified (Thompson & Brown, 1984).

Genus *Polycera* A. E. Verrill, 1880

***Polycera hedgpethi* Er. Marcus, 1964**

(Figure 4F)

Material examined: Le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 8-Apr-2017, 1.2 m depth, 7 spc., adults and egg masses, *L* = 10–25 mm; 4-Oct-2017, 0.8 m depth, 3 spcs, adults, *L* = 20–25 mm; 21-May-2018, 1.5 m depth, 1 spc., adult, *L* = 45 mm; 1-Nov-2018, 1 m depth, 5 spcs, adults and egg masses, *L* = 15–30 mm; l'Espigó, Roses (Spain), 42°15'39.8"N, 3°10'26.8"E, 28-Feb-2020, 0.6 m depth, 8 spcs, adults and egg masses, *L* = 10–20 mm.

External morphology: Body short, thick, background colour black. Mantle margin white with numerous appendixes black and yellow in colour, yellow close to apex, white papillae scattered all over body. Rhinophores lamellar, black forwards and white backwards, yellow on top. Gill leaves black, tips yellow.

Ecology: All specimens found in each locality were found in shallow waters on the bryozoan *Bugula neritina* (Linnaeus, 1758), feeding and laying the egg masses on top.

Distribution: Originally off the Pacific coast of America, this species is reported in Australia, Japan, South-Africa, Morocco (Moro *et al.*, 2017); Cantabrian Sea (Cervera *et al.*, 2004); and in the Mediterranean Sea in Italy, Croatia (Ballesteros *et al.*, 2012–2020); France (GBIF, 2020; this study); Spain: Catalonia (this study).

Remarks: Its prey grows on boat hulls, and thus, may be their way of propagation. Although this bryozoan is very abundant within Ports, *P. hedgpethi* has not been recorded in the biofouling samplings containing *B. neritina*. Some of the data on this species in the Mediterranean are in environments with variable salinity, such as the étang de Thau, or the Espigó de Roses, where there is freshwater supply.

Genus *Polycerella* A. E. Verrill, 1880

***Polycerella emertoni* A. E. Verrill, 1880**

(Figure 4G)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 23-Aug-2017, 1 m depth, 11 spcs, juveniles, adults, and egg masses, *L* = 2–5 mm; Alfacs mussel farms, Sant Carles de la Ràpita, Montsià (Spain), 40°37'20.1"N, 0°39'48.5"E, 12-Sep-2018, 0.7 m depth, >20 spcs, adults and egg masses, *L* = 4–5 mm; le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 1-Nov-2018, 1.2 m depth, 7 spcs., adults and egg masses, *L* = 5–7 mm.

External morphology: Body short, narrow, background colour white with irregular black and white yellowish punctuation. Gills composed of 3 leaves, with short, smooth papillae found behind. Rhinophores smooth.

Ecology: All specimens found at each locality were found on the bryozoans *Amathia verticillata* where they lay the egg masses.

Distribution: Invasive species originally from the east coast of North America (GBIF, 2020); now found in Morocco, Portugal, and the south of Spain (Cervera *et al.*, 2004); France (this study) and Catalonia (Camps & Prado, 2018; this study).

Remarks: Originally described from the North American Atlantic coast (Verrill, 1881), this species has been cited in much of the American Atlantic, and the Mediterranean Spanish and African coast. Its prey is commonly found attached to boat hulls. In the case of the specimens found in Catalonia, it has been recorded in ports or in bays and places with abundant nutrient accumulation.

448

449

Genus *Thecacera* J. Fleming, 1828

450

***Thecacera pennigera* (Montagu, 1813)**

451

(Figure 4H)

452

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 14-Feb-2018, 1.5

453

m depth, 1 spc., adult, *L* = 20 mm.

454

External morphology: Body short, thick, background colour white with numerous black and yellow dots.

455

Rhinophores lamellar, protected by two papillae, the posterior one longer than the frontal. Gill leaves

456

discoid in shape, protected by long posterior papillae.

457

Ecology: The singleton was found on top of an unidentified bryozoan species of the genus *Bugula*. Species

458

with nocturnal activity. During the day the specimens are found hiding at the base of bryozoans.

459

Distribution: Originally described from the North Sea (England; Montagu, 1813); Northeast American coast,

460

Portugal and Italy (GBIF, 2020); Spain: Canary Islands, Cantabric Sea (Cervera *et al.*, 2004), Catalonia (this

461

study).

462

Remarks: This species has a worldwide distribution and usually found in temperate waters (Dekker, 1986).

463

In the Atlantic it has peaks of abundance where in a few days large numbers of specimens appear (Willan

464

& Coleman, 1984).

465

Family TRINCHESEIIDAE F. Nordsieck, 1972

466

Genus *Tenellia* A. Costa, 1866

467

***Tenellia adpersa* (Nordmann, 1845)**

468

(Figure 5A)

469

Material examined: Port de Blanes (Spain), 41°40'25.5"N, 2°47'48.6"E, 21-Jan-2019, 0.1 m depth, 1 spcs,

470

adults, *L* = 7 mm.

External morphology: Body elongate, narrow, background colour black. Rhinophores smooth, oral veil very developed, without oral tentacles. Cerata lateral, elongated; tip redounded.

Ecology: The specimen was found in a mass of hydrozoans in a floating walkway with other heterobranchs.

Distribution: Northeast Atlantic (OBIS, 2020); Pacific North American coast (OBIS, 2020); Portugal (Encarnação *et al.*, 2020); Spain: Canary Islands, Atlantic Andalusian coast, Galicia, Levantine coast (Cervera *et al.*, 2004), Catalonia (this study).

Remarks: This species has a widespread and cosmopolitan distribution (Roginskaya, 1970), found in oceanic and brackish water areas (Thompson & Brown, 1984). This species is differentiated from other *Tenellia* species by having a characteristic oral veil connecting the oral tentacles and the cerata arranged in groups (Evertsen, *et al.*, 2004). Normally the body and cerata are coloured in white but, depending on the diet, their colouration varies, as is the case in this study. Encarnação *et al.* (2020) found this species associated with the invasive hydrozoan *Cordylophora caspia* (Pallas, 1771) on artificial structures.

Genus *Trinchesia* Er. Ihering, 1879

***Trinchesia cuanensis* Korshunova, Picton, Furfaro, Mariottini, Pontes, Prkić, Fletcher, Malmberg, Lundin & Martynov, 2019**

(Figure 5B)

Material examined: Punta del Romani, L'Escala (Spain), 42°6'54"N, 3°10'9"E, 10-Feb-2014, 7 m depth, 1 spec, juvenile, *L* = 3 mm; 14-Feb-2015, 14 m depth, 1 spec., adult, *L* = 10 mm; Le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 14-Apr-2018, 1 m depth, 3 spec., adults, *L* = 7–20 mm; Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 15-Apr-2018, 0.6 m depth, 15 spcs, juveniles, adults, and egg masses, *L* = 4–15 mm; 6-Jun-2018, 0.6 m depth, 20 spcs, adults and egg masses, *L* = 10–15 mm; 11-Mar-2020, 0.5 m depth, 12 spcs, adults and mating, *L* = 7–15 mm; Tamariu beach (Spain), 41°55'0.5"N, 3°12'27.1"E, 11-Feb-2019, 2 m depth, 4 spcs, adults, *L* = 6–10 mm.

External morphology: Body elongate, narrow, background colour white or light yellow. Rhinophores and oral tentacles smooth, more intensely white than the body. Red or orange mark between eyes and in central dorsum. Cerata globular, displaying a bright yellow-blue-yellow colouration.

Ecology: Specimens were found mating and laying the eggs on top of the hydrozoans *Sertularella mediterranea* Hartlaub, 1901 and *Sertularella polyzonias* (Linnaeus, 1758) inside superficial caves.

Distribution: Northeast Atlantic (Korshunova *et al.*, 2019); Adriatic Sea (Ballesteros *et al.*, 2012–2020); France (this study); Spain: Catalonia (this study).

Remarks: This species was recently described and observed in the North Atlantic and the Mediterranean Sea (Korshunova *et al.*, 2019). It is clearly different from other similar species of *Trinchesia* by having a red mark between the eyes and in the middle part of the back. It has a shorter life cycle than *T. morrowae* (Korshunova *et al.*, 2019), since it has only been observed in the winter and spring months, whereas *T. morrowae* is observed all year round and *T. caerulea* (Montagu, 1804) only during spring and autumn and deeper (X. Salvador pers. obs.).

Order PTEROPODA Cuviers, 1804

Family CRESEIDAE Rampal, 1973

Genus *Creseis* Rang, 1828

***Creseis virgula* (Rang, 1828)**

(Figure 5C)

Material examined: Ullastres 3, Llafranc (Spain), 41°53'14.1"N, 3°12'26.0"E, 27-Feb-2019, 0.5 m depth, 3 spcs, adults, *L* = 10 mm; Cala Sa Tuna, Begur (Spain), 41°57'38"N, 3°13'52"E, 9-Mar-2019, 0.8 m depth,

517 1 spec, adult, $L = 10$ mm; Montiel, Tamariu (Spain), 41°54'55.9"N, 3°12'46.3"E, 13-Mar-2019, 1 m depth,
518 20 spcs, adults, $L = 5$ –10 mm.

519 *External morphology*: Shell narrow, elongated, conical, back end slightly curved, smooth. Parapodia
520 transparent, with the inner part thicker than the external.

521 *Ecology*: Found in open waters, close to the surface around other pelagic pteropod and salp species.

522 *Distribution*: Cosmopolitan, in the Mediterranean Sea this species is reported in the eastern part, and in the
523 western, in the Malta stretch and between Mallorca and Sicilia (OBIS, 2020). This is the first report in the
524 Mediterranean Spanish coast.

525 *Remarks*: Almost all records in the Mediterranean are based on shell observations or are caught in plankton
526 campaigns, in open waters and either at superficial depths (0–10 m) or at greater depths, (600–700 m; OBIS,
527 2020). Our specimens were found in February and March along the massive arrival of pelagic zooplankton
528 at superficial waters.

529

530 Genus *Hyalocylis* Fol, 1875

531 ***Hyalocylis striata* (Rang, 1828)**

532 (Figure 5D)

533 *Material examined*: Cala Sa Tuna, Begur (Spain), 41°57'38"N, 3°13'52"E, 9-Feb-2019, 1 m depth, 1 spc, adult,
534 $L = 6$ mm; Montiel, Tamariu (Spain), 41°54'55.9"N, 3°12'46.3"E, 13-Mar-2019, 1 m depth, 4 spcs, adults,
535 $L = 6$ –10 mm; 14-Mar-2019, 1 m depth, 3 spcs, adults, $L = 6$ –10 mm.

536 *External morphology*: Shell wide, striated, conic, translucent. Parapodia large, transparent. Statocysts visible
537 between shell and parapodia.

538 *Ecology*: Found in open waters, close to the surface around other pelagic pteropod and salp species.

Distribution: Cosmopolitan, in the Mediterranean Sea it is commonly reported in the eastern part (Koukouras, 2010; OBIS, 2020) and the Italian coast (OBIS, 2020). This is the first report in the Mediterranean Spanish coast.

Remarks: As for *C. virgula*, almost all records in the Mediterranean are based on shells or specimens caught with plankton nets, in open waters and at great depths (OBIS, 2020). Our specimens were found in February and March along the massive arrival of pelagic zooplankton.

Family PNEUMODERMATIDAE Latreille, 1825

Genus *Pneumodermopsis* Keferstein, 1862

***Pneumodermopsis canephora* Pruvot-Fol, 1924**

(Figure 5E)

Material examined: Montiel, Tamariu (Spain), 41°54'55.9"N, 3°12'46.3"E, 13-Feb-2019, 1 m depth, 9 spcs, adults, $L = 7-10$ mm.

External morphology: Body rounded, transparent, with numerous glands, dark chromatophores can be seen in by transparency all over body. Lateral gill extremely long, posterior gill absent. Posterior end presenting two ciliated bands. Head with 2 apical tentacles.

Ecology: Found in open waters, close to the surface with other pteropods and proliferation of pelagic salps.

Distribution: North Atlantic (OBIS, 2020); Mediterranean Sea (Pruvot-Fol, 1924); this the first report in the Catalan coast (Spain).

Remarks: Mostly found in North Atlantic waters (Pruvot-Fol, 1924). Out of the eight specimens collected, two disappeared as well as some other species of pteropods collected inside the same container, likely meaning that in stressful situations they may be cannibalistic.

562 Order RUNCINIDA

563 Family RUNCINIDEA H. Adams & A. Adams, 1854

564 Genus *Runcina* Forbes [in Forbes & Hanley], 1851

565 ***Runcina ornata* (Quatrefages, 1844)**

566 (Figure 5F)

567 *Material examined:* Cala d'Aiguafreda, Begur (Spain), 41°57'49"N, 3°13'41"E, 13-Oct-2017, 0.1 m depth, 7
 568 spcs, adults, *L* = 2–3 mm; 21-Nov-2017, 0.1 m depth, 1 spec, adult, *L* = 2 mm; 31-Jan-2018, 0.1 m depth,
 569 9 spcs, adults, *L* = 2–3 mm; 23-Apr-2018, 0.1 m depth, 2 spcs, adults, *L* = 3 mm; 25-May-2018, 0.1 m
 570 depth, 2 spcs, adults, *L* = 3 mm; Punta del Romani, L'Escala (Spain), 42°6'54"N. 3°10'9"E, 10-Jan-2018,
 571 0.2 m depth, 4 spcs, adults, *L* = 2–3 mm; 24-Apr-2018, 0.2 m depth, 3 spcs, adults, *L* = 2–3 mm; 7-Dec-
 572 2018, 0.2 m depth, 7 spcs, adults, *L* = 2–3 mm; Punta d'en Bosch, Sant Feliu de Guíxols (Spain),
 573 41°45'54"N, 3°0'11"E, 17-Apr-2018, 0.1 m depth, 5 spcs, adults, *L* = 1–3 mm.

574 *External morphology:* Body elongate, narrow, translucent, black or brown in colour, rear tail darker. Foot large.

575 *Ecology:* The specimens were found grazing on biofouling during the night over calcarean red algae or
 576 boulders, at very superficial waters.

577 *Distribution:* Spain: Canary Islands and Strait of Gibraltar (Cervera *et al.*, 2004), Catalonia (this study).

578 *Remarks:* This species is rarely observed and very small. Easily distinguishable by the absence of spots and
 579 white marks and its uniform black colour (Quatrefages, 1844).

580

581 Superorder SACOGLOSSA Ihering, 1876

582 Family HERMAEIDAE H. Adams & A. Adams, 1854

583 Genus *Aplysiopsis* Deshayes, 1853

Aplysiopsis elegans Deshayes, 1853

(Figure 5G)

Material examined: Cova de l'infern (Spain), 42°19'2.75"N, 3°19'12.74"E, 19-Nov-2017, 1.2 m depth, 5 spcs, adults and egg masses, $L = 15\text{--}20$ mm; Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 13-Sep-2019, 1.3 m depth, 1 spc., adult, $L = 15$ mm.

External morphology: Body elongate, narrow, background colour white with longitudinal dark red lines in dorsum and laterals. Cerata long, smooth; background colour green whit white punctuation, dark red vertical lines, pink on tips.

Ecology: The specimens were found feeding on the green alga *Cladophora prolifera* (Roth) Kützing, 1843. The egg mass is whitish, cylindrical, found inside the algal masses. The specimen observed in 2019 was found at night crawling over algae, while the 2017 specimens were hidden inside algae. This could mean that they are mostly nocturnal, hiding in the algal masses during the day.

Distribution: Greece (OBIS, 2020); Croatia (Mavrič *et al.*, 2014); Spain: Canary Islands (Ortea *et al.*, 1998, 2001), Balearic Islands (Ballesteros & Templado, 1996), Catalonia (this study).

Remarks: This species is rarely observed, found among algal samples, especially in *Cystoseira* and *Cladophora* as well as *Halogetis scoparia* (Linnaeus) Sauvageau, 1904 (Mavrič *et al.*, 2014) and probably feeding on it.

Genus *Caliphylla* A. Costa, 1867

Caliphylla mediterranea A. Costa, 1867

(Figure 5H)

Material examined: Cala d'Aiguafreda, Begur (Spain), 41°57'49"N, 3°13'41"E, 5-Sep-2017, 0.8 m depth, 2 spcs, adults, $L = 17$ mm; CalaVentosa, Sant Feliu de Guíxols (Spain), 41°47'5"N, 3°2'52"E, 13-Sep-2017, 1.5 m depth, 1 spc., adult, $L = 20$ mm; Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N,

3°2'44"E, 5-Dec-2017, 0.7 m depth, 9 spcs, adults and egg masses, $L = 5-40$ mm; Fòrum pools, Barcelona (Spain), 41°24'34.5"N, 2°13'36.8"E, 5-Dec-2017, 0.7 m depth, 8 spcs, juveniles, adults, and egg masses, $L = 5-40$ mm; Cova de l'infern (Spain), 42°19'2.75"N, 3°19'12.74"E, 18-Sep-2018, 1.3 m depth, 1 spc., adult and egg masses, $L = 40$ mm.

External morphology: Body elongate, thick, background colour light green with brown and white small dots along body, white pigmented area between eyes. Cerata numerous, flat; transparent with green lines running towards apex. Rhinophores long, folded, divided in “Y” shape, tips divided into two unequal parts.

Ecology: The specimens have been found both at night and during the day on top of the green algae *Bryopsis duplex* (De Notaris, 1844) and *Cladophora prolifera* laying their egg masses. At night they were actively crawling and laying the egg masses, while by day they hide in the algal masses.

Distribution: Eastern coast of North America; Brazil (GBIF, 2020); Gibraltar (García-Gómez, 2002); Spain: Canary islands (Moro *et al.*, 2003; Ortea *et al.*, 1999, 2001; Ortea & Bacallado, 1981), Andalucía (García Raso *et al.*, 1992; Luque, 1983; Ocaña *et al.*, 2000), Levantine coast (Templado *et al.*, 1987, 2002), Balearic Islands (GROC, 2009–2020), Catalonia (this study).

Remarks: This species is distinguished from other similar ones like *C. viridis* (Deshayes, 1857) (formerly *Polybranchia viridis*) by the presence of a ramified digestive gland in the cerata (see *Polybranchia viridis* (Rudman, 2020)).

Genus *Cyerce* Bergh, 1870

***Cyerce graeca* Thompson T., 1988**

(Figure 6A)

Material examined: Cala d'Aiguafreda, Begur (Spain), 41°57'49"N, 3°13'41"E, 26-Aug-2015, 0.5 m depth, 1 spc., adult, $L = 15$ mm; 3-Aug-2017, 2.3 m depth, 1 spc., adult; Cala Ventosa, Sant Feliu de Guíxols (Spain), 41°47'5"N, 3°2'52"E, 13-Sep-2017, 1.3 m depth, 1 spc., adult; Cala Maset caves, Sant Feliu de

Guíxols (Spain), 41°47'10"N, 3°2'44"E, 29-Jan-2018, 1.2 m depth, 1 spc., adult; 14-Feb-2018, 0.7 m depth, 1 spc., juvenile, $L = 3$ mm; 22-Feb-2019, 1 m depth, 1 spec, adult, $L = 12$ mm; 20-Feb-2020, 0.7 m depth, 1 spec, adult, $L = 10$ mm.

External morphology: Body elongate, thick, background colour transparent beige with darker notum. Cerata rounded, globular, beige, semi-transparent in colour, with blunt and dark brown digitations on top, white dots concentrated under these digitations. Rhinophores divided in “Y” shape.

Ecology: All specimens were found on top of unidentified red algae; juveniles were found in February. Actively found crawling at night and usually under rocks in areas with abundant algae during the day.

Distribution: Originally described from Greece (Thompson, 1988); Adriatic Sea and Italy (Ballesteros *et al.*, 2012–2020); Spain: Balearic Islands (GROC, 2009–2020), Catalonia (Ballesteros *et al.*, 2016; this study).

Remarks: This species is more abundant in the eastern Mediterranean basin. Easily differentiated from other Mediterranean *Cyerce* species by the presence of a rounded parapodial margin and digitate cerata tips, whereas *C. cristallina* present an angular parapodial margin and roughened but not digitated cerata apices (Thompson, 1988).

Genus *Hermaea* Lovén, 1844

***Hermaea bifida* (Montagu, 1816)**

(Figure 6B)

Material examined: Cala d'Aiguafreda, Begur (Spain), 41°57'49"N, 3°13'41"E, 31-Mar-2017, 1 m depth, 9 spcs, adults, $L = 7$ –12 mm; 25-Dec-2017, 1 m depth, 5 spcs, adults and juveniles; Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 31-Dec-2017, 0.7 m depth, 2 spcs, juvenile and adult, $L = 2$ –6 mm; 8-Mar-2018, 1.4 m depth, 2 spcs, adults and egg masses, $L = 12$ mm; Cala Sa Tuna, 41°57'38"N, 3°13'52"E, 3-Jan-2018, 0.8 m depth, 4 spcs, adults, $L = 5$ –7 mm; Punta del Romaní, L'Escala (Spain),

42°6'54"N, 3°10'9"E, 6-Jan-2018, 0.7 m depth, 1 spc., juvenile, $L = 2$ mm; Cala Trons, Lloret de Mar (Spain), 41°41'57"N, 2°51'52"E, 20-Jan-2018, 1.7 m depth, 1 spc., adult, $L = 12$ mm.

External morphology: Body elongate, narrow, background colour red semi-transparent, with dispersed white dots more concentrated around head, cerata, and rhinophore apices. Cerata globular, leave-shaped, semi-transparent, with internal lines of red colour running towards apex, this surrounded by four tubercles. Rhinophores beige, internally rolled, apex slightly longer than inferior part.

Ecology: All specimens were found on top of the red alga *Bornetia secundiflora* (J.Agardh) Thuret, 1855 where they were mating and laying the eggs. The egg mass is whitish, cylindrical, and C- shaped (Fig. 5B, close-up); they were laid under the algae around, but never over *B. secundiflora*.

Distribution: Central American coast and England (GBIF, 2020); Portugal (Cervera *et al.*, 2004); Gibraltar (García-Gómez, 2002); Spain: Galicia (Rolán, 1983), Andalucía (Cervera *et al.*, 1988), Levantine coast (Templado, 1982, 1984; Templado *et al.*, 1983; Marín & Ros, 1988), Balearic Islands (GROC, 2009–2020), Catalonia (Ballesteros *et al.*, 2016; this study); France (Rudman, 2020).

Remarks: While in the Balearic Islands it was reported on the invasive alga *Lophocladia lallemandii* (Montagne) F. Schmitz, 1893 (GROC, 2009–2020), here we commonly found it on *B. secundiflora*. Juvenile specimens acquire a fluorescent orange colouration on the cerata, similar in colour to the latter alga.

***Hermaea cantabra* Caballer & Ortea, 2015**

(Figure 6C)

Material examined: Es Caials, Cadaqués (Spain), 42°17'5.1"N, 3°17'50"E, 20-Feb-2010, 10 m depth, 2 spcs, adults, $H = 6$ –10 mm; Tamariu beach (Spain), 41°55'0.5"N, 3°12'27.1"E, 11-Feb-2019, 5 m depth, 1 spec, adult, $L = 5$ mm.

External morphology: Body elongate, narrow, background colour semi-transparent, with two lateral and two dorsal red narrow lines close to eyes, diffuse at the end. Cerata globular, semi-transparent, with red digestive

gland seen by transparency running towards apex, external white punctuations scattered but more concentrated into two tubercles before the top. Rhinophores beige in apical part, with a central red line and white dots scattered.

Ecology: The specimen was found in a red filamentous algae sample at superficial depths.

Distribution: North Spanish coast (Caballer & Ortea, 2015); Catalonia (GROC, 2009–2020; this study).

Remarks: This species is distinguished from *H. bifida* by the presence of red lines that go from the rhinophores between the eyes to the back, the absence of oral appendages (present in *H. bifida*), and a less ramified digestive gland (Caballer & Ortea, 2015). The description of *H. cantabra* is recent thus, some previous records of *H. bifida* in the Iberian Peninsula could be misidentifications as for e.g., Ortea (1977) and Salvat (1968).

***Hermaea paucicirra* Pruvot-Fol, 1953**

(Figure 6D)

Material examined: Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 5-Jan-2018, 0.4 m depth, 3 spcs, adults and copulation, $L = 2-3$ mm.

External morphology: Body elongate, narrow, background colour translucent white, with red lines on dorsum going from apex of rhinophores to tail, and running on laterals from eyes, white opaque dots scattered on dorsum. Cerata club-shaped, red in colour, with white punctuation more concentrated in apex. Rhinophores internally rolled, back side longer than anterior part, transparent white whit opaque white dots.

Ecology: The specimens were found feeding and mating on the red alga *Antithamnion cruciatum* (C.Agardh) Nägeli, 1847 and were active at night.

Distribution: The description of this species occurred in Morocco (Pruvot-fol, 1953); Portugal (Cervera *et al.*, 2004); Gibraltar (Cervera & García-Gómez, 1986); Spain: Canary Islands, Andalucía, Galicia, Cantabric Sea, Levantine coast (Cervera *et al.*, 2004), Catalonia (Ballesteros *et al.*, 2016; this study).

Remarks: This species is distinguished from *H. bifida* by having a more globular and rounded cerata, and a more abundant white punctuation (Salvat, 1968). *Hermæa paucicirra* can be differentiated from its sympatric species *H. cantabra* by the presence of a more opaque white body, with a red mark on the eyes, and the because the red pigmentation on the dorsum barely allows to see the digestive gland as it also happen with the cerata (Caballer & Ortea, 2015).

Family LIMAPONTIIDAE Gray, 1847

Genus *Limapontia* Johnston, 1836

***Limapontia capitata* (O. F. Müller, 1774)**

(Figure 6E)

Material examined: Le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 18-May-2017, 1 m depth, 2 spcs, adults, *L* = 3 mm.

External morphology: Body short, thick, background colour dark brown, periocular area and tail white. Rhinophores very short, crest like. Parapodia absent. Protuberance caused by pericardial system seen in dorsum.

Ecology: The specimens were found in brackish waters on bottoms extensively covered by *Ulva lactuca* Linnaeus, 1753.

Distribution: Originally described is the North Sea (England and Norway; Muller, 1773); Portugal (Cervera *et al.*, 2004); Spain: Cantabric Sea, Galicia, Levantine coast (Templado *et al.*, 1983; Cervera *et al.*, 2004); France (this study).

Remarks: The species has been cited in other eutrophic areas with variable salinity, although it has been attributed to the fact that they were washed away by the waves (Rudman, 2020). It has always been found linked to green algae of the genus *Cladophora*, *Ulva*, and *Bryopsis*. It is distinguished from *L. senestra* (Quatrefages, 1844) by lacking long rhinophores and from *L. depressa* Alder & Hancock, 1862 by presenting this particularly shaped crests (Gascoigne, 1952).

Genus *Placida* Trinchese, 1876

***Placida tardyi* (Trinchese, 1874)**

(Figure 6F)

Material examined: Fòrum pools, Barcelona (Spain), 41°24'34.5"N, 2°13'36.8"E, 23-Nov-2017, 0.4 m depth, 12 spcs, juveniles, adults, and egg masses, *L* = 3–20 mm; le Ponton, étang de Thau, Sète (France), 43°25'28.5"N, 3°42'E, 21-May-2018, 0.5 m depth, 3 spcs, adults, *L* = 17–25 mm; Cala Maset caves, Sant Feliu de Guíxols (Spain), 41°47'10"N, 3°2'44"E, 19-Dec-2018, 2 m depth, 2 spcs, adults and egg masses, *L* = 10–15 mm; 1-Jan-2019, 1.3 m depth, 3 spcs, adults, *L* = 13–15 mm; Cala Sa Tuna, Begur (Spain), 41°57'38"N, 3°13'52"E, 31-Jan-2019, 0.5 m depth, 1 spec, juvenile, *L* = 3 mm; Tamariu Beach (Spain), 41°55'0.5"N, 3°12'27.1"E, 10-Sep-2019, 1 m depth, 4 spec, adults with egg masses, *L* = 10–20 mm.

External morphology: Body elongate, narrow, background colour white semi-transparent with a central white circle on back, laterals, and foot with dark brown or purple colour. Cerata long, smooth; background colour green, with white spots, tip dark garnet in colour. Rhinophores smooth, large, with white dots concentrated at the apexes. Oral tentacles wide and short.

Ecology: The specimens were found in masses of the green alga *Bryopsis duplex*, mating and laying whitish and cylindrical egg masses at the base of the alga. This species appears completely unnoticed within the algal masses and moves actively during the night.

Distribution: Originally described from Italy: Genoa (Trinchese, 1874), Gulf of Naples (Gascoigne & Sordi., 1980); Portugal (Calado *et al.*, 2003); Gibraltar (Cervera *et al.*, 1988); Spain: Catalonia (this study); France (this study).

Remarks: This species can be misidentified with *P. vidiris* (Trinchese, 1874), but it is distinguished by the presence of brown or purple body margins and the tip of the cerata darkly coloured in garnet (Pruvot-Fol, 1954).

***Placida viridis* (Trinchese, 1874)**

(Figure 6G)

Material examined: Cala Ventosa, Sant Feliu de Guíxols (Spain), 41°47'5"N, 3°2'52"E, 13-Sep-2017, 0.1 m depth, 5 spcs, adults and egg masses, *L* = 7–20 mm; Cala Sa Tuna, 41°57'38"N, 3°13'52"E, 8-Mar-2018, 0.1 m depth, 6spcs, juveniles and adults, *L* = 2–15 mm; Punta d'en Bosch, Sant Feliu de Guíxols (Spain), 41°45'54"N, 3°0'11"E, 17-Apr-2018, 0.1 m depth, 5 spcs, adults and egg masses, *L* = 12–20 mm.

External morphology: Body elongate, narrow, background colour white semi-transparent with digestive branches of dark green. Cerata long, smooth; background colour dark green, with white punctuation, apex white. Rhinophores long, translucent white with green branches and white punctuation on tips.

Ecology: The specimens have been found on top of the green alga *Bryopsis mucosa* (J.V. Lamouroux, 1809) laying their cylindrical and white egg masses. Specimens in this study were found within a few centimetres' depth feeding on *B. mucosa*, which is commonly found at subtidal depths.

Distribution: Israel (Monselise & Mienis, 1977); Greece and Black Sea (OBIS, 2020); Italy (Ballesteros *et al.*, 2012–2020); Spain: Catalonia (Cervera *et al.*, 2004; this study); France (this study).

Remarks: See Remarks section on *P. tardyi* above.

Family PLAKOBRANCHIDAE Gray, 1840

Genus *Elysia* Risso, 1818

***Elysia flava* Verrill, 1901**

(Figure 6H)

Material examined: Cala d'Aiguafreda, Begur (Spain), 41°57'49"N, 3°13'41"E, 30-Jul-2015, 2.3 m depth, 6 spcs, adults, $L = 5\text{--}12$ mm; Roque de los 14, La Herradura (Spain), 36°43'13.2"N 3°43'43.5"W, 18-Sep-2016, 1.6 m depth, 3 spcs, adults, $L = 7\text{--}10$ mm.

External morphology: Body elongate, narrow, background colour green yellowish, dark green in parapodia, margin of parapodia wavy, white in colour. Rhinophores short, apex white, presenting two white spots between eyes.

Ecology: The specimens were found mating in July on top of unidentified algae. This species is a strictly nocturnal, found during the day under rocks and at night on walls over masses of algae, especially green filamentous algae such as *Cladophora*.

Distribution: Caribbean Sea (GBIF, 2020); Madeira (Cervera *et al.*, 2004); Açores (Malaquias *et al.*, 2009); Greece and Adriatic Sea (Ballesteros *et al.*, 2012–2020); Spain: Canary Islands, Levantine coast, Catalonia (Cervera *et al.*, 2004, this study), Andalucia (this study).

Remarks: This species is clearly differentiated from other sympatric *Elysia* species by the yellowish colour of the body as well as the green dark colour in the parapodia (Thompson & Jaklin, 1988).

Discussion

In the present study, we provide high-quality images, descriptions, and ecological remarks on 36 Mediterranean elusive species, corresponding to 20 new records in the Catalan coast (NE Spain). Our new data together with the recently described *Trinchesia morrowae* (Korshunova *et al.*, 2019) and *Tylodina rafinesquii*

(Fernández-Vilert *et al.*, *in press*) increase the overall diversity of marine heterobranchs in this region up to 10%, with a total of 227 species. We also provide a new record from the southern Spanish Mediterranean coast, the sacoglossan *Elysia flava*. Moreover, the three species of pelagic pteropods are new records for Spain (i.e. *Creseis virgula*, *Hyalocylis striata* and *Pneumodermopsis canephora*) and 10 other species are new records for the French Mediterranean coast (i.e. *Haloa japonica*, *Haminoea orteai*, *Doto cervicenigra*, *Piseinotecus sphaeripherus*, *Polycerella emertoni*, *Amphorina andra*, *Trinchesia cuanensis*, *Limapontia capitata*, *Placida tardyi*, and *Placida viridis*). Regarding the alien species, we enlarge the knowledge on the distribution of five, *Haloa japonica* (in France), *Anteaeolidiella lurana* (in Spain: Catalonia and Valencia), *Godiva quadricolor* (in Catalonia), *Polycerella emertoni* (in France and Catalonia), and *Polycera hedgpethi* (in France and Catalonia).

Besides the new records of the native and invasive species, further information on the body morphology, phenology, egg mass morphology, and ecology of many species is provided. Briefly: regarding nudibranchs, numerous specimens of *Eubranchius prietoi* were firstly observed displaying lateralized cerata while being active. The specimen on *Aldisa smaragdina* reported here lacked the second dark circle present in its original description thus, suggesting a molecular revaluation of specimens of this genus would be useful to ascertain whether such chromatic variability corresponds to either population or species molecular diversity. Specimens of *Doto cervicenigra* were found along hydrozoans collected in harbours at one-meter depth. Another species of *Doto*, *D. pygmaea*, was found over floating objects (especially plastics) transported by sea currents and feeding on the hydrozoan *Tubularia* sp., while only previously found feeding on *Obelia geniculata* (Linnaeus, 1758) by Ortea *et al.* (1997). Also, we found phenologic differences between the recently erected species of *Trinchesia*, while *T. cuanensis* have been observed in winter and spring, *T. morrowae* is present all year long, and *T. caerulea* only in spring and autumn. A rare species found in the Mediterranean, *Palio notus*, was regularly found in vertical walls that lacked direct sunlight, and it was found feeding on the bryozoan *Amathia lendigera*. Concerning the Pteropoda, the elusive *Pneumodermopsis canephora* was observed to have a cannibalistic behaviour, and life pictures of the three described species are some of the few published so far. Regarding sacoglossans, we provide new data on the diet of several species. For instance, specimens of *Hermaea bifida* were recorded here over the red alga *Bornetia secundiflora* for the first time (reviewed in Caballer

& Ortea, 2015) at a few meters of depth, in vertical walls without sun radiation; when consumed, algal fronds acquired a fluorescent orange colour, also displayed in juvenile slugs.

Overall, we found 17 species that are active at night hours and most of the records were made in shallow depths while freediving, normally not going further down than 5 meters depth. Thereby, we believe many of the common records of heterobranch species living under rocks may actually have nocturnal activity, also that rare species may actually be common species with an opposite behaviour to our sampling methods (day hours, depths, and localities), and probably changing our habits would increase the diversity of a particular area, as we have seen in this study. Here we prove the importance of citizen science participation in this particularly attractive group, the heterobranchs, the diving community through the use of underwater photography and online platforms such as GROC (GROC, 2009–2020) or OPK (Ballesteros, *et al.*, 2012–2020) represent a powerful tool to find new records, track the spread of alien species, and contributing to the increase the knowledge in ecology and phenology of this group. Up to date, specifically in our association (GROC, 2009–2020), a total of 194 collaborators have entered 23,660 observations, corresponding to 74,781 specimens belonging to 233 species for a total of 2,963 diving spots along the Spanish and southern French Mediterranean coast, way too far from the observations that our scientific community could have done alone.

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1065 **Figure 1.** Distribution map from the Western Mediterranean coast showing the main sampling stations.

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1067 **Figure 2.** Live pictures of the Cephalaspidea species: A – *Haloa japonica*. B – *Haminoea orteai*. C – Egg mass
1068 of *Haminoea orteai*. D – *Philine catena*.

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1070 **Figure 3.** Live pictures of the Nudibranchia species: A – *Aegires palensis*. B – *Aegires sublaevis*. C – Two
1071 specimens of *Anteaeolidiella lurana* and their egg masses. D – *Aldisa smaragdina* on top of the sponge *Phorbas*
1072 *topsenti*. E – *Doto cervicenigra*. F – *Doto pygmaea*. G – *Amphorina andra* surrounded by hydrozoans of the genus
1073 *Sertularella*. H – *Eubbranchus prietoi* on the hydrozoan *Kirchenpaueria halecioides*.

1075 **Figure 4.** Live pictures of the Nudibranchia species: A – *Godiva quadricolor*. B – *Okenia longiductis* on the
1076 bryozoan *Amathia verticillata*. C – Three specimens of *Piseinotecus soussi* and their egg massess. D – *Piseinotecus*
1077 *sphaeriferus* on top of the hydrozoan *Obelia* sp. E – *Palio nothus* and its egg mass. F – *Polycera hedgpethi*. G
1078 – *Polycerella emertoni* and egg mass on *Amathia verticillata*. H – *Thecacera pennigera* on top of the bryozoan *Bugula*
1079 sp.

1081 **Figure 5.** Live pictures of the Nudibranchia species: A – *Tenellia adspersa*. B – *Trinchesia cuanensis* on top of
1082 the hydrozoan *Sertularella* sp. Pteropoda: C – *Creseis virgula*. D – *Hyalocylis striata*. E – *Pneumodermopsis caneophora*.
1083 Runcinida: F – *Runcina ornata*. Sacoglossa: G – *Aphysiopsis elegans*. H – *Caliphylla mediterranea*

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1085 **Figure 6.** Live pictures of the Sacoglossa species: A – *Cyerce graeca*. B – *Hermaea bifida* and close-up on its
1086 egg mass at the base of an alga. C – *Hermaea cantabra*. D – *Hermaea paucicirra*. E – *Limapontia capitata* on *Ulva*
1087 *lactuca*. F – *Placida tardyi*. G – *Placida viridis*. H – *Elysia flava*.