



Diversity of the Marine Heterobranchia Fauna at the Island of Pantelleria, Sicily Channel, Mediterranean Sea: First Contribution

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Abstract: The present study was carried out along the coasts of the Island of Pantelleria (Italy, Mediterranean Sea), a volcanic island located at the centre of the Sicily Channel. The aim was to provide the first faunistic list of the marine heterobranchs at the Pantelleria Island. Through both scuba dives and snorkelling/apnoea activities, 33 species were found: two species of the Pleurobranchida, 23 of the Nudibranchia, one of the Umbraculida, two of the Aplysiida and five of the Sacoglossa. Among these, the findings of *Felimida elegantula*, *Okenia picoensis* and *Polybranchia* sp. are discussed due to the particular interest at them. The present list represents the baseline information in the study of the marine Heterobranchia fauna of the Pantelleria Island and contributes to characterising it as a hotspot of the marine biodiversity.

Key words: *Felimida elegantula*, *Okenia picoensis*, Pelagic Islands, *Polybranchia*, Sea slugs.

Introduction

The Island of Pantelleria (formerly known as “*Cossyra*”) is a volcanic island located in the Sicily Channel, between Italy and Tunisia. It extends over approximately 83 km² and has an irregular elliptical shape, with a major axis NW–SE (PALADINO et al. 1935). This island can be subdivided into two morphologically distinct parts: the SE slopes are mostly represented by highlands while the part of NW has a lowland and hilly areas (PALADINO et al. 1935). On the island, there is a national park since 2016 (“*Isola di Pantelleria*”) of ca. 6.560 ha of land (ENTE PARCO NAZIONALE ISOLA DI PANTELLERIA 2022). In contrast, the marine realm has no environmental protection, despite the proposal submitted 20 years ago to

establish a Marine Protected Area (MPA) for the Island of Pantelleria (PICCHETTI et al. 2010). BIANCHI & ACRI (2003) highlighted that, although the island was scarcely studied from the point of view of marine biology, the few studies carried out have shown a high level of biodiversity of the marine biota along coasts. These studies were principally focused on the phytobenthic component of rocky substrates (GIACCONE & SORTINO 1974, BARONE et al. 1978, CALVO & SORTINO 1979, GIACCONE et al. 1994, ALONGI et al. 2004). On the zoobenthic component, there was only one study (ALBERTELLI et al. 2015).

Without any doubt, one of the most popular groups of marine invertebrates among underwater photographers is that of marine heterobranchs. This can be deduced from the high number of books and

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web sites devoted to them. The members of this group of gastropod molluscs (once known as opisthobranchs) are widespread in all the world's oceans and seas (from the intertidal to abyssal depths). This group includes approximately 6000 species worldwide (ca. 550 in the Mediterranean basin). Marine heterobranchs are characterised by a large number of extravagant body shapes, which originated from the evolutionary tendency towards shell reduction and loss (PRKIĆ et al. 2018). Concerning the marine Heterobranchia fauna of the Pantelleria Island, no studies have ever been carried out and there is no list of species present in the area. The only scientific report on the marine heterobranchs at the Pantelleria Island mentioned a sighting of the sacoglossan *Elysia timida* (Risso, 1818) (PRUVOT-FOL 1954). There are also a few observations of some species documented through photographs and videos on the internet (PICCHETTI 2015). To date, therefore, the only data on this group are those concerning nine species reported by PICCHETTI (2015) (see Table 1).

In light of this, given the almost complete lack of faunistic data on this group of marine molluscs, we aimed to produce a faunistic list of the marine heterobranchs of the Pantelleria Island. This list may provide the basis for future studies on these distinctive gastropods in an area of a high conservational potential.

Materials and Methods

This study was carried out throughout the first week of July 2022 in several coastal localities of the Pantelleria Island (Fig. 1) through both scuba dives and snorkelling / apnoea activities. The scuba dives of an average duration of one hour were all conducted during the morning at three sites on the island (for coordinates locations and dates, see Table 2). The site of Punta Spadillo has a sloping seabed with boulders down to depth (c. 55–60 m). The site of Cala Tramontana has a seabed formed by rocky walls extending seawards to a depth of 30–40 m and tending to form small underwater canyons, with meadows of *Posidonia oceanica* (L.) Delile situated within or above them. The seabed of the site Faraglione di Cala Levante is formed by the rocky walls meeting the sandy bottom at a depth of c. 30 m.

The snorkelling / apnoea sessions (generally lasting 2–3 h) were carried out in both morning and afternoon at five stretches of coastline on the island (for coordinates and dates, see Table 3).

The site called Mursia Resort (located in front of a hotel with the same name) has a relatively shallow seabed (0.5–1 m) consisting of boulders of

various shapes and scattered rocks and pebbles. Towards the small gulf in the south of this site, the seabed becomes deeper, being formed by larger rocky boulders and small walls. The site of Mursia Cuddie Rosse has a shallow seabed (c. 0.5 m) in the south and deeper in the north. Furtherly in the same direction, there are several inlets in the cliffs forming small basins with boulders and pebbles of various sizes. The site of Mursia Nord – Arenella is formed by a shallow seabed (c. 0.5 m), which forms a type of large terrace stretching out towards the sea and northwards. In the latter direction, the terracing becomes almost flat and is at water level; small boulders and pebbles can be found in this area. The site of Mursia Sud presents a small shallow basin with scattered boulders and pebbles that deepens 1–2 m towards the sea, in between several rock masses with numerous inlets. The site of Martingana has a seabed with walls (c. 3–6 m deep) with boulders at the base and a cave.

The data were collected through the technique of “photographic capture” (LOMBARDO & MARLETTA 2020): each marine heterobranch specimen encountered at every site was photographed through an Olympus TG-4 underwater camera and the depth at which it was found was documented. Subsequently, through the examination of photographs at the computer and the consultation of reference literature (EALS 1960, SCHMEKEL & PORTMANN 1982, VALDÉS et al. 1996, JENSEN 1997, TRAINITO & DONEDDU 2014, MEDRANO et al. 2018, GHANIMI et al. 2020, GALIÀ-CAMPS et al. 2022), it was possible to identify the species. Finally, a faunal list was drawn up using LibreOffice. In Table 4, it is presented the list of species found at the Island of Pantelleria, with includes the taxon name, sites where the species was found and the depth range. Each species was shown in one or more photos, which highlight its morphological features (Figs. 2–9).

Results

We observed 33 marine heterobranch species along the coasts of the Island of Pantelleria (Table 4; Figs. 2–9). They were two species of Pleurobranchida, 23 of Nudibranchia, one of Umbraculida, two of Aplysiida and five of Sacoglossa. Among the sites where scuba diving was carried out (Punta Spadillo, Cala Tramontana and Faraglione di Cala Levante), the highest number of species was recorded at Punta Spadillo (19). This high number, almost twice as much as the other two sites (10 and 11), is probably due to the fact that in this site two dives were carried out; thus, it was possible to search for sea slugs for a

Table 1. Species recorded at the Pantelleria Island by PICCHETTI (2015). The question mark indicates no data.

Taxa	Site	Date	Depth
Order Nudibranchia			
Suborder Doridina			
Family Chromodorididae Bergh, 1891			
<i>Felimare fontandraui</i> (Pruvot-Fol, 1951) [as <i>Hypselodoris messinensis</i>]	?	?	?
<i>Felimare picta</i> (Philippi, 1836) [as <i>Hypselodoris valenciennesi</i> and <i>H. elegans</i>]	Punta Spadillo & Cala 5 Denti	1997/08/26 1998/08/15	15 m
<i>Felimida elegantula</i> (Philippi, 1844) [as <i>Chromodoris elegantula</i>]	Punta Spadillo	1997/08/08	16 m
Suborder Cladobranchia			
Family Facelinidae Bergh, 1889			
<i>Cratena peregrina</i> (Gmelin, 1791)	Punta Rubisacchi	1997/08/05	15 m
Family Myrrhinidae Bergh, 1905			
<i>Nanuca trainitoi</i> (Furfaro & Mariottini, 2020) [as <i>Facelina</i> sp.]	Punta Limarsi	1997/09/17	18 m
Family Aeolidiidae Gray, 1827			
<i>Berghia coerulescens</i> (Laurillard, 1832)	Punta della Caldaia	1998/08/09	10 m
Order Aplysiida			
Family Aplysiidae Lamarck, 1809			
<i>Notarchus punctatus</i> Philippi, 1836	Punta Limarsi	1996/08/03	15 m
Superorder Sacoglossa			
Family Plakobranchiidae Gray, 1840			
<i>Elysia timida</i> (Risso, 1818)	Cala Gadir	1997/08/06	12 m
Family Hermaeidae H. Adams & A. Adams, 1854			
<i>Cyerce cristallina</i> (Trinchese, 1881)	?	?	?

Table 2. Locations, coordinates and dates of scuba diving activities.

Locations	Coordinates	Dates
Punta Spadillo	36.82455556°; 12.01405556°	2022/07/04, 2022/07/05
Cala Tramontana	36.80025000°; 12.04905556°	2022/07/04
Faraglione di Cala Levante	36.79886111°; 12.05272222°	2022/07/05

Table 3. Locations, coordinates and dates of snorkelling / apnoea activities.

Locations	Coordinates	Dates
Mursia Resort (morning)	from 36.81513889°; 11.92636111° to 36.81344444°; 11.92713889°	2022/07/06
Mursia Cuddie Rosse (afternoon)	from 36.81666667°; 11.92633333° to 36.81886111°; 11.92680556°	2022/07/06
Mursia Nord-Arenella (morning)	from 36.82533333°; 11.92844444° to 36.82950000°; 11.93283333°	2022/07/07
Mursia Sud (afternoon)	from 36.81166667°; 11.92786111° to 36.81286111°; 11.92738889°	2022/07/07
Martingana (morning)	from 36.74730556°; 12.04461111° to 36.74891667°; 12.04588889°	2022/07/08

longer time (in contrast to the other two sites where a single dive was conducted). Nevertheless, in general, it was noted that these three sites presented pronounced similarities, both in the number of species and in their faunistic composition. In fact, in each of these sites (considering that two scuba dives were carried out at Punta Spadillo), we found 10–11 species. At the same time, their faunistic composition was essentially identical, i.e. we found representa-

tives of the families Calycidorididae Roginskaya, 1972, Goniodorididae H. Adams & A. Adams, 1854, Chromodorididae Bergh, 1891, Phyllidiidae Rafinesque, 1814, Flabellinidae Bergh, 1889, Trinchesiidae F. Nordsieck, 1972, Facelinidae Bergh, 1889, Tylodiniidae Gray, 1847 and Plakobranchiidae Gray, 1840.

Instead, considering the stretches of coastline where snorkelling / apnoea sessions were conduct-

Table 4. List of the marine Heterobranchia species found during this study. “X” indicates the presence of a species at a site; “*” indicates the presence of egg masses. For *Aplysia dactylomela* and *A. depilans*, “*?” indicates uncertainties about belonging of the egg masses to these species.

Taxa	Punta Spadillo	Cala Tramontana	Faraglione di Cala Levante	Mursia Resort	Mursia Cuddie Rosse	Mursia Nord-Arenella	Mursia Sud	Martingana	Depth range (m)
Order Pleurobranchida									
Family Pleurobranchidae Gray, 1827									
<i>Berthella</i> cf. <i>stellata</i> (Risso, 1826)						X*			< 1
<i>Pleurobranchus testudinarius</i> Cantraine, 1835	X*								8.9
Order Nudibranchia									
Suborder Doridina									
Family Calycidorididae Roginskaya, 1972									
<i>Diaphorodoris alba</i> Portmann & Sandmeier, 1960	X								36.4
<i>Diaphorodoris papillata</i> Portmann & Sandmeier, 1960			X						30.4
Family Goniidorididae H. Adams & A. Adams, 1854									
<i>Okenia picoensis</i> Paz-Sedano, Ortigosa & Pola, 2017	X	X							6.6–29
Family Onchidorididae Gray, 1827									
<i>Acanthodoris</i> cf. <i>pilosa</i> (Abildgaard [in Müller], 1789)				X					< 1
Family Chromodorididae Bergh, 1891									
<i>Felimare fontandraui</i> (Pruvot-Fol, 1951)	X*	X	X						15.5–42.4
<i>Felimare picta</i> (Philippi, 1836)			X						5.3–5.8
<i>Felimare tricolor</i> (Cantraine, 1835)			X						6.9–21.8
<i>Felimida binza</i> (Ev. Marcus & Er. Marcus, 1963)	X								14
<i>Felimida elegantula</i> (Philippi, 1844)	X		X						7.2–31.4
<i>Felimida krohni</i> (Vérany, 1846)	X	X							21.8–31.9
<i>Felimida luteorosea</i> (Rapp, 1827)	X	X							22.8–33.4
Family Discodorididae Bergh, 1891									
<i>Peltodoris atromaculata</i> Bergh, 1880	X			X*			X		< 1–42.4
Family Phyllidiidae Rafinesque, 1814									
<i>Phyllidia flava</i> Aradas, 1847	X		X						24.3–30.8
Family Dendrodorididae O’Donoghue, 1924									
<i>Dendrodoris limbata</i> (Cuvier, 1804)				X					< 1
<i>Dendrodoris</i> sp.				X		X			< 1
<i>Doriopsilla</i> sp.				X					< 1
Suborder Cladobranchia									
Family Flabellinidae Bergh, 1889									
<i>Flabellina affinis</i> (Gmelin, 1791)	X*	X*	X*						11.2–52.6
Family Trinchesiidae F. Nordsieck, 1972									
<i>Trinchesia morrowae</i> Korshunova et al., 2019	X	X							13.5–31.9
Family Facelinidae Bergh, 1889									
<i>Caloria elegans</i> (Alder & Hancock, 1845)	X								8.7
<i>Cratena peregrina</i> (Gmelin, 1791)	X	X*	X*						6–31.2
<i>Facelina rubrovittata</i> (Costa A., 1866)	X	X		X			X		< 1–7.8
Family Aeolidiidae Gray, 1827									
<i>Aeolidiella alderi</i> (Cocks, 1852)						X	X		< 1

Table 4. Continuation.

Taxa	Punta Spadillo	Cala Tramontana	Faragione di Cala Levante	Mursia Resort	Mursia Cuddie Rosse	Mursia Nord-Arenella	Mursia Sud	Martingana	Depth range (m)
<i>Berghia coerulescens</i> (Laurillard, 1832)				X					< 1
Order Umbraculida									
Family Tylodinidae Gray, 1847									
<i>Tyrodina perversa</i> (Gmelin, 1791)	X		X						12.3–31.4
Order Aplysiida									
Family Aplysiidae Lamarck, 1809									
<i>Aplysia dactylomela</i> Rang, 1828				X	X	X	X	*?	< 1
<i>Aplysia depilans</i> Gmelin, 1791				X	X			*?	< 1
Superorder Sacoglossa									
Family Plakobrachidae Gray, 1840									
<i>Bosellia mimetica</i> Trinchese, 1891	X	X	X*	*	X		X		< 1–28
<i>Elysia flava</i> Verrill, 1901						X			< 1
<i>Elysia timida</i> (Risso, 1818)	X			X	X	X			< 1–11.1
<i>Thuridilla hopei</i> (Vérany, 1853)	X	X	X				X		< 1–39.6
Family Hermaeidae H. Adams & A. Adams, 1854									
<i>Polybranchia</i> sp.				X					< 1

ed, it was noted that Mursia Resort was the stretch with the highest number of species (11), while the other stretches of coastline presented a comparable number of species (4–6). The only site where no marine heterobranchs were found was Martingana (only two aplysiid egg masses were detected). This numerical difference could be easily explained by the fact that the Mursia Resort presented several small rocky outcrops (shallow and full of crevices) and small boulders and pebbles, in which the various species of marine heterobranchs could be found (above, between or below them). Martingana had a different morphology characterised by smooth rocky walls (3–6 m depth), with large smooth boulders at their base. The latter morphological features were not very suitable to host numerous heterobranch species. Although with several differences, the other stretches of coastlines (Mursia Cuddie Rosse, Mursia Nord – Arenella and Mursia Sud) showed morphological features similar to those of the Mursia Resort. The most representative families of the examined stretches of coastlines were Discodorididae Bergh, 1891, Dendrodorididae O’Donoghue, 1924, Facelinidae Bergh, 1889, Aeolidiidae Gray, 1827, Aplysiidae Lamarck, 1809 and Plakobrachidae Gray, 1840.

Discussion

Considering the data obtained in the course of the present study and the observations of PICCHETTI (2015), the number of marine heterobranchs of the Pantelleria Island reached 36 species (two Pleurobranchida, 24 Nudibranchia, one Umbraculida, three Aplysiida and six Sacoglossa). Leaving out the common species, the findings of some species reported in the present study and by PICCHETTI (2015) are remarkable. Probably, the most noteworthy species is the nudibranch dorid *Felimida elegantula* (Philippi, 1844) (Fig. 5B, 5C). This species, which is endemic of the Mediterranean, has been considered for many years as rare, even though it has been observed during the last years as expanding its distribution range within the basin (TRAINITO & DONEDDU 2014). *Felimida elegantula* was documented in several Mediterranean areas (ORTIGOSA et al. 2014, TRAINITO & DONEDDU 2014, FURFARO et al. 2016) in various areas. These included Palermo (Italy), Napoli (Italy) (where its presence is doubtful), Villafranche sur Mer (France), Meloria Shoals (Italy), Maltese Archipelago (Malta), Pantelleria Island (Italy), several sites of Sardinia (Italy), Malgrats Island (Balearic Islands, Spain), Latium coast

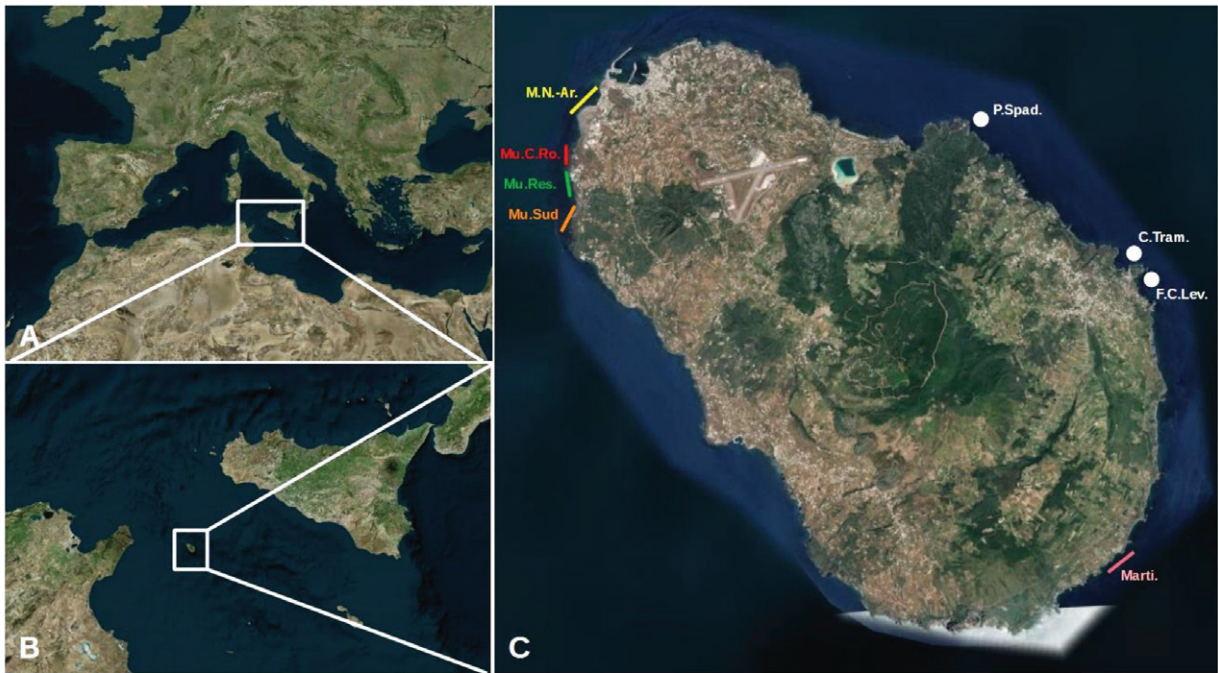


Fig. 1. A. Mediterranean basin. B. Sicily Channel. C. Pantelleria Island; white circles = Scuba diving, coloured sites = apnoea / snorkelling activities.

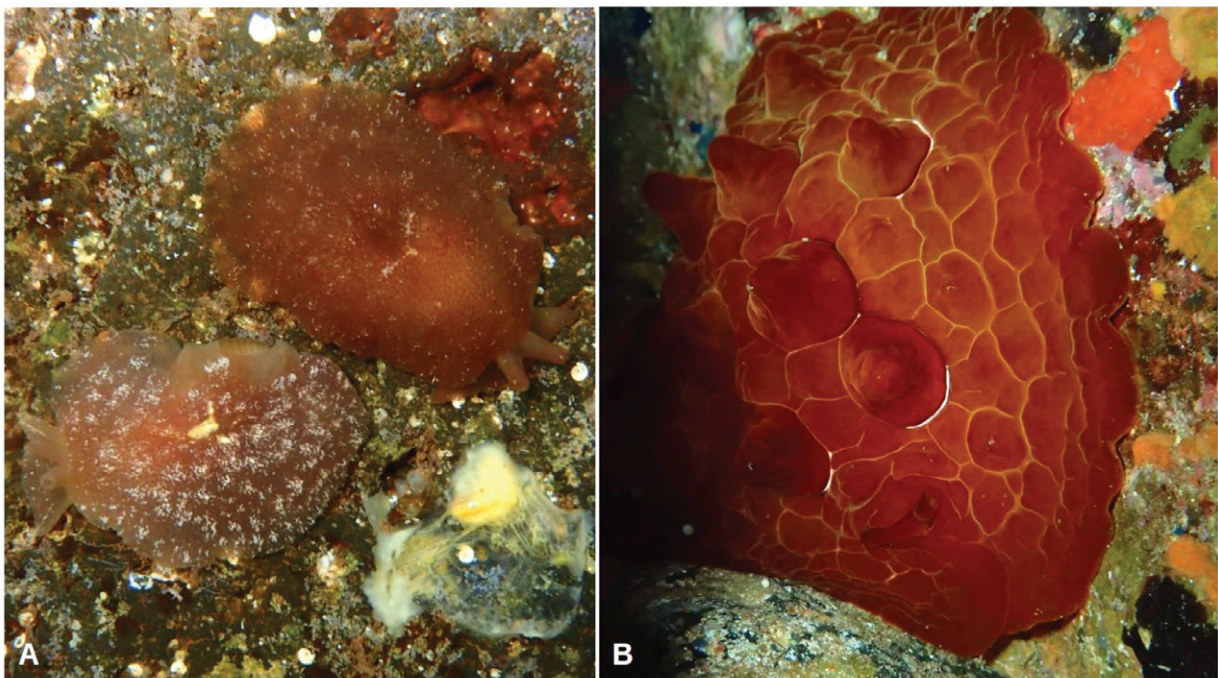


Fig. 2. A. Two specimens of *Berthella cf. stellata*. B. *Pleurobranchus testudinarius*. Photos A. Lombardo.

(Italy), Adrasan e Be adalar (Turkey) and Kerkenah Islands (Tunisia). Given the presumed rarity of this species, the fact that it has been found in both 1997 (PICCHETTI 2015) and 2022 (present study) at the same site (Punta Spadillo) may indicate that this area is one of the places where this species is

constantly present. There are a few places in the Mediterranean where *F. elegantula* had been repeatedly recorded such as the stretch of NE Sardinian coastline between the river Padrogianus and Comino Cape where the species was found in 1993–2013 (TRAINITO & DONEDDU 2014). As hypothesised by

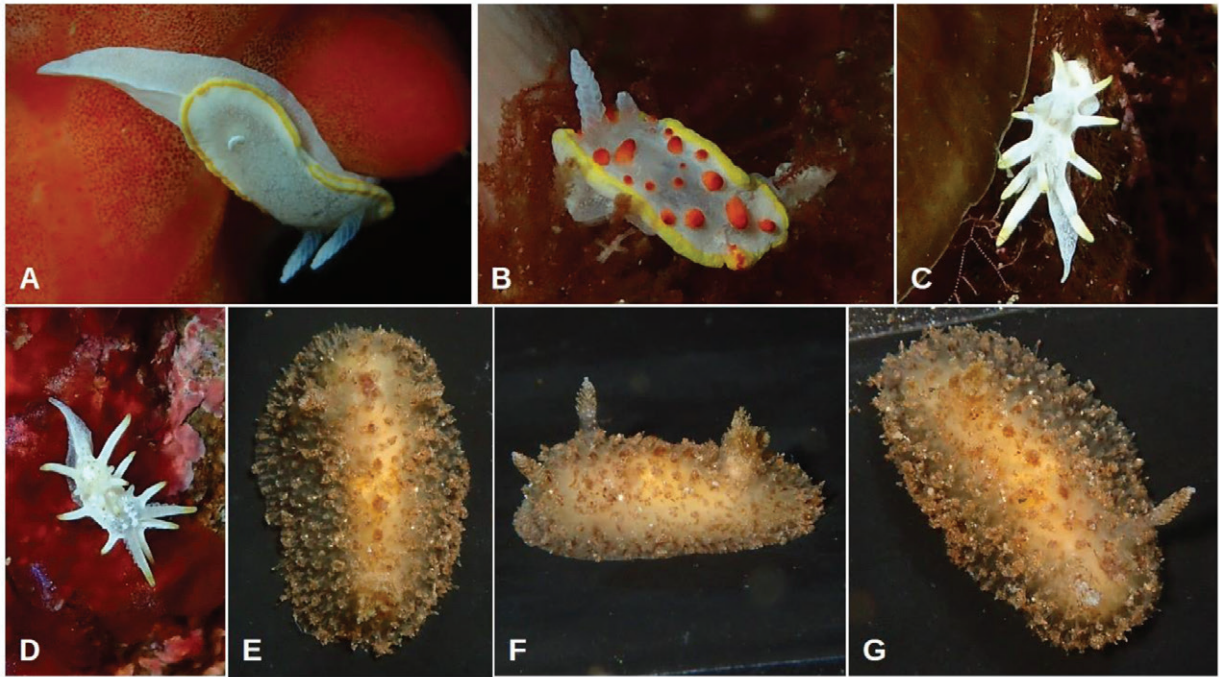


Fig. 3. A. *Diaphorodoris alba*. B. *D. papillata*. C. *Okenia picoensis*. D. Another specimen of *O. picoensis*. E. Dorsal view of *Acanthodoris cf. pilosa*. F. Left lateral view. G. Right dorso-lateral view. Photos A. Lombardo.

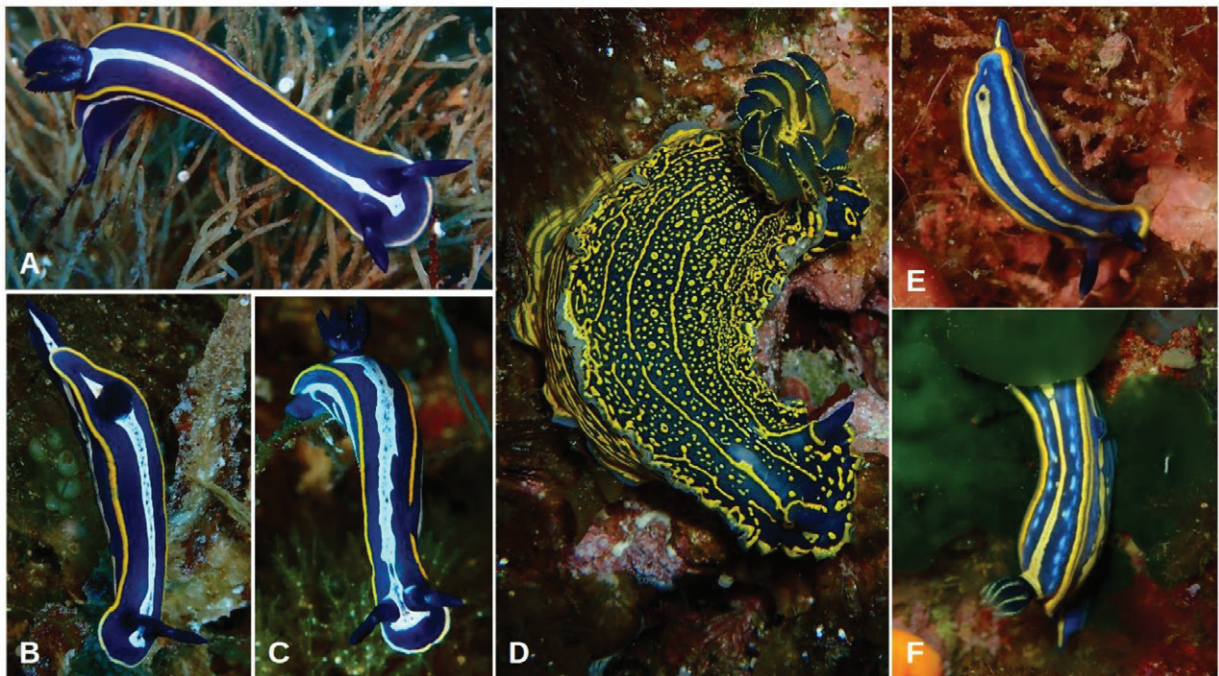


Fig. 4. A. A specimen of *Felimare fontandraui* with a simple chromatic pattern. B. Intermediate chromatic pattern. C. Developed chromatic pattern. D. *F. picta*. E. An individual of *F. tricolor* with a simple chromatic pattern. F. Developed chromatic pattern. Photos A. Lombardo.

RUDMAN (2005), this is because *F. elegantula* is a species with direct development [sensu THOMPSON (1976)], thus potentially capable of maintaining a population indefinitely in a given area. Consequently, the NE side of the Pantelleria Island could repre-

sent a very relevant area for the distribution range of *F. elegantula*.

Another interesting finding was that of the dorid *Okenia picoensis* Paz-Sedano, Ortigosa & Pola, 2017 (Fig. 3C, 3D). This species was considered na-

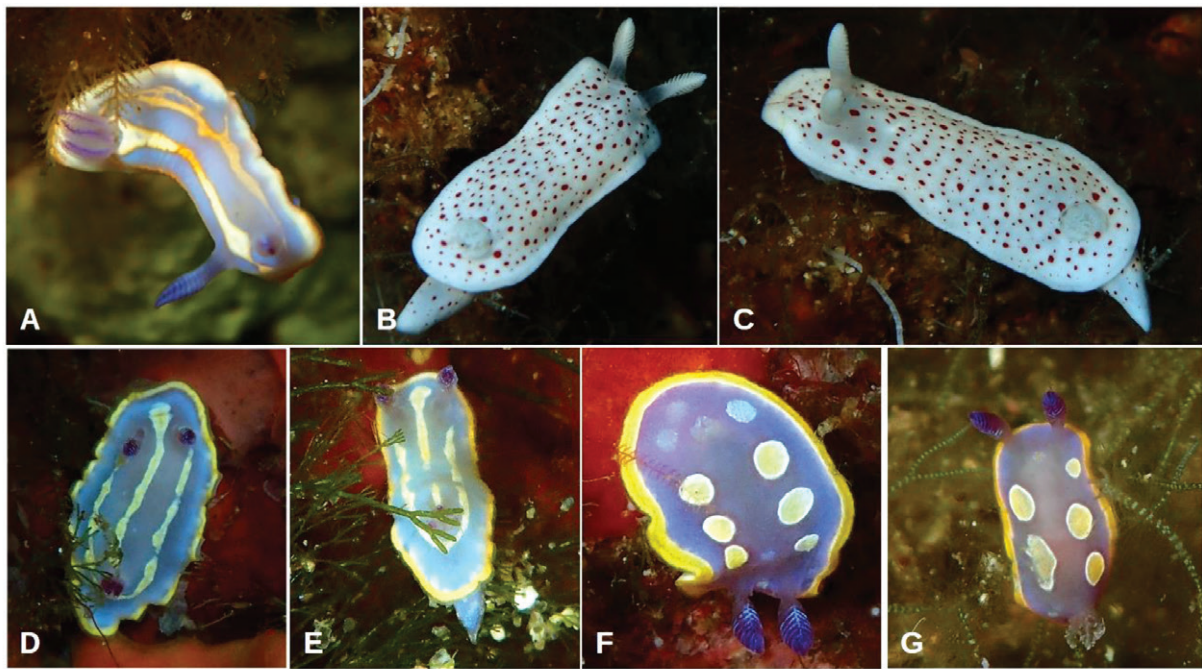


Fig. 5. A. *Felimida binza*. B. Dorsal view of a specimen of *F. elegantula*. C. Left latero-dorsal view. D. *F. krohni*. E. A slightly pale specimen. F. *F. luteorosea*. G. An individual with a different blotches pattern. Photos A. Lombardo.

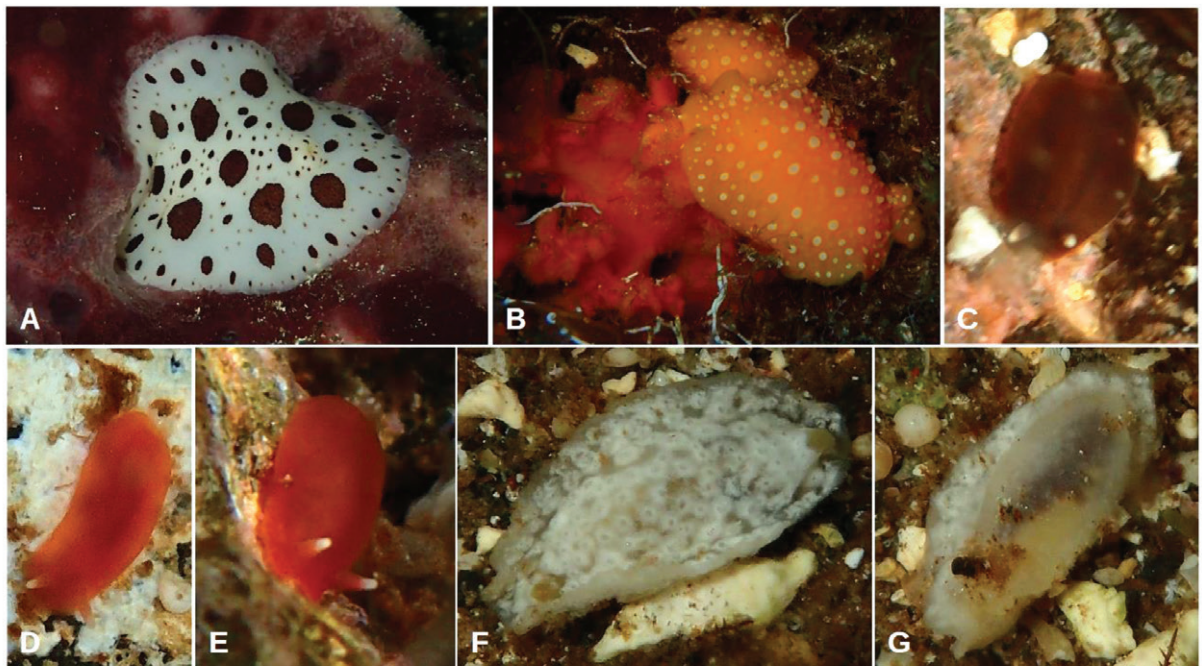


Fig. 6. A. *Peltodoris atromaculata*. B. *Phyllidia flava*. C. *Dendrodoris limbata*. D. *Dendrodoris* sp.. E. Right latero-dorsal view. F. *Doriopsilla* sp.. G. Ventral view. Photos A. Lombardo.

tive to the Azores (PAZ-SEDANO et al. 2017) and, in a few years since its first Mediterranean report in November 2020 in Malta (ORFANIDIS et al. 2021), colonised many areas of the basin (TRAINITO et al. 2022). The sudden appearance of *O. picoensis* in several Mediterranean areas suggested that this nudibranch is an allochthonous species that has entered the Med-

iterranean naturally or through human action (ORFANIDIS et al. 2021, CROCETTA et al. 2021, LOMBARDO & MARLETTA 2021). LOMBARDO & MARLETTA (see CROCETTA et al. 2021) did not rule out the possibility that this species might be native to the Mediterranean and was unnoticed until its recent expansion in the basin. Similarly, other authors (TRAINITO et al.

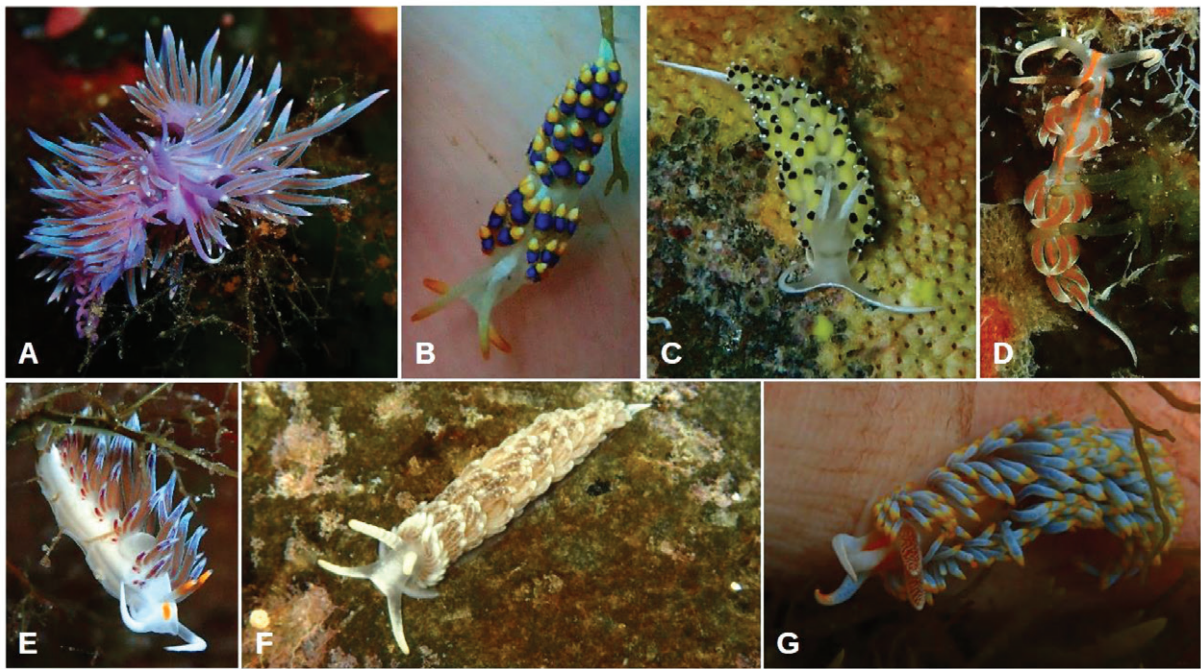


Fig. 7. A. *Flabellina affinis*. B. *Trinchesia morrowae*. C. *Caloria elegans*. D. *Facelina rubrovittata*. E. *Cratena peregrina*. F. *Aeolidiella alderi*. G. *Berghia coerulescens*. Photos A. Lombardo.

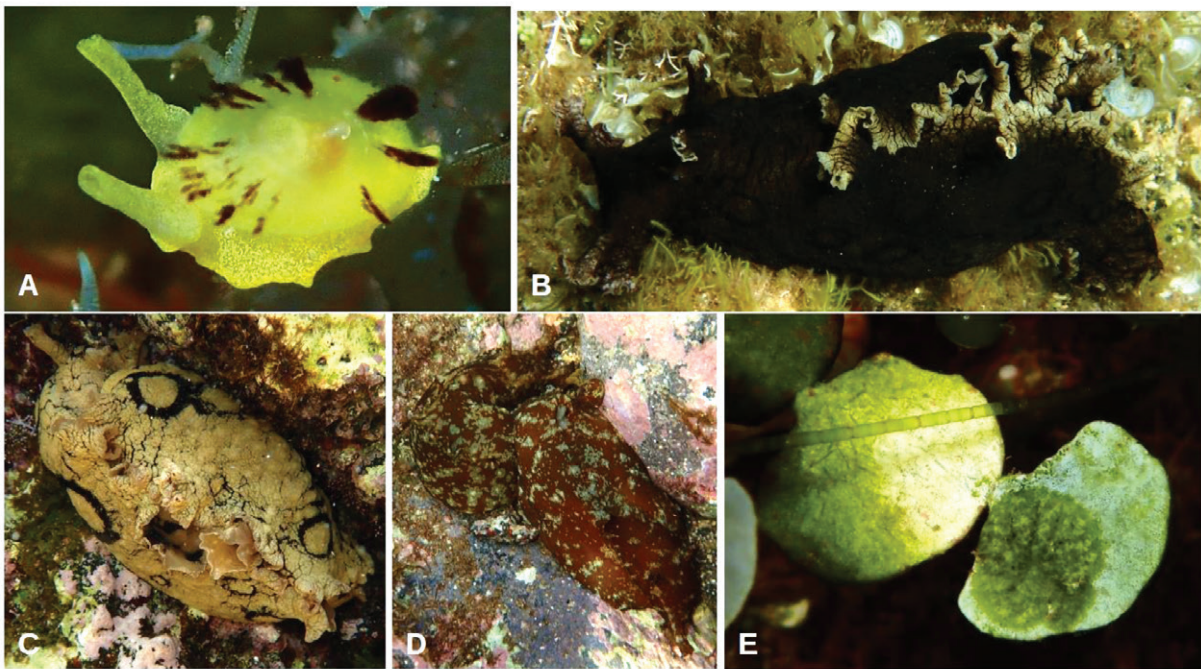


Fig. 8. A. *Tyloedina perversa*. B. A dark-brown coloured specimen of *Aplysia dactylomela*. C. an individual with the common colouration. D. two *A. depilans* specimens. E. *Bosellia mimetica*. Photos A. Lombardo.

2022) hypothesised that *O. picoensis* was a species with an Atlantic-Mediterranean distribution, which had only been noticed due to its recent demographic explosion. In the present study, eight specimens of *O. picoensis* were found at Punta Spadillo and one was detected at Cala Tramontana. Consequently, the Pantelleria Island represents a further locality where

this species is registered in the Mediterranean basin.

As concerns the cladobranch nudibranchs, it is worth noting the finding of *Nanuca trainitoi* Furfaro & Mariottini, 2020, which was recorded in September 1997 at Pantelleria at the locality of Punta Limarsi by PICCHETTI (2015) and identified by him as *Facelina* sp. (Table 1). This quite rare Mediterra-

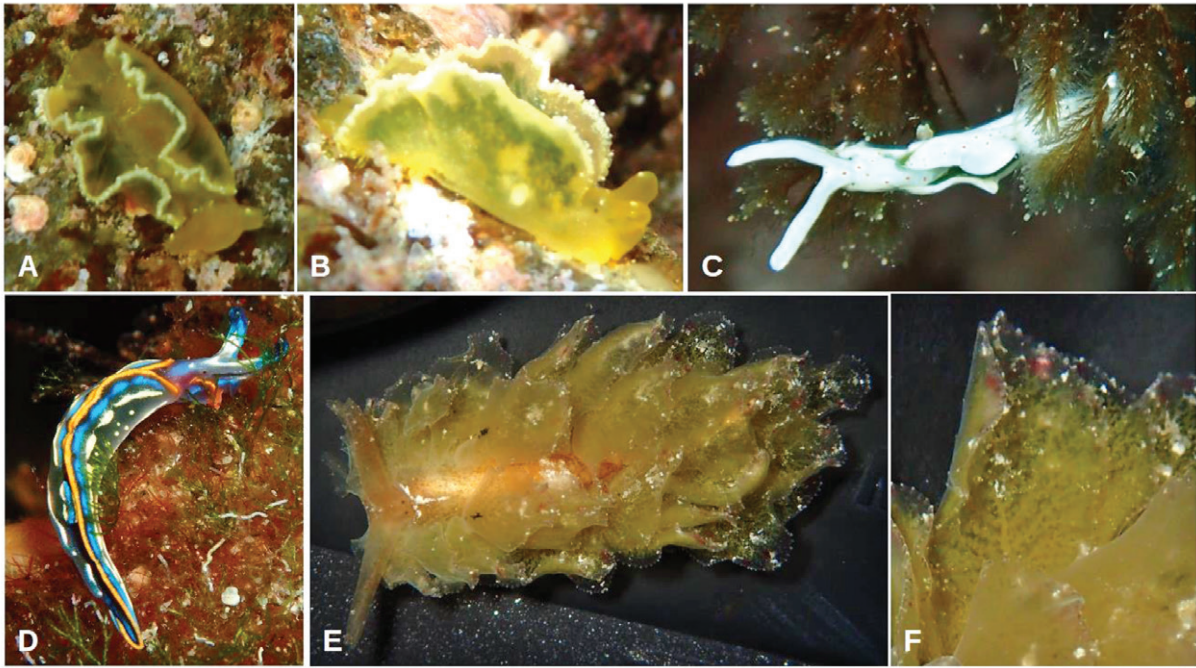


Fig. 9. A. *Elysia flava*. B. Right lateral view. C. *Elysia timida*. D. *Thuridilla hopei*. E. *Polybranchia* sp. F. Detail of a cerata. Photos A. Lombardo.

nean nudibranch was described only recently (FURFARO & MARIOTTINI 2020). It has been found in the few locations (GEROVASILEIOU et al. 2020): Portofino (Genoa, Italy), Civitavecchia (Rome, Italy), Procida (Naples, Italy), Santa Maria La Scala (Acireale, Italy) and Crete (Greece). Consequently, PICCHETTI (2015) was the first author who photographically documented this species, 24 years before its description. Unfortunately, due to adverse marine weather conditions, it was not possible to examine the site of Punta Limarsi throughout the present study in order to check the current presence this species. Nevertheless, the Pantelleria Island can be counted among the localities where this species has been found.

The last of the most important findings was that of the sacoglossan *Polybranchia* sp. (Fig. 9E, 9F), which was found under a rock at the site Mursia Resort. This report was of a particular interest since to date no species of this genus has been found in the Mediterranean (MEDRANO et al. 2018, MOLLUSCA BASE 2022). *Polybranchia* spp. present nocturnal habits by remaining hidden under rocks during the day and moving to feed during the night (MEDRANO et al. 2018). This lifestyle makes the species of this genus difficult for observations and studies, which may explained the scarcity of data on them (MEDRANO et al. 2018). Consequently, the report of a *Polybranchia* specimen in the Island of Pantelleria could represent important record in view of future studies on this genus within the Mediterranean basin.

Considering the number of species (33) recorded in the short period of the study (five days), it can be assumed that the waters of the Pantelleria Island possess high potential diversity of marine heterobranchs. For comparison, long-term studies recorded the following species numbers at various areas along the Italian coasts: Gulf of Naples – 121 (SCHMEKEL 1968), Ligurian Sea – 69 (CATTANEO VIETTI 1986), Conero Riviera – 58 (BETTI 2011), Tavolara-Punta Coda Cavallo – 98 (TRAINITO & DONEDDU 2015), Salento Peninsula – 160 (FURFARO et al. 2020) and central eastern coast of Sicily – 95 (LOMBARDO & MARLETTA 2020). It is likely that in-depth and long-term studies at the Pantelleria Island will record a higher number of species. This expectation is plausible given the position of the island in the centre of the Sicily Channel, which would favour the dispersion of allochthonous larvae from various areas of the Mediterranean.

In conclusion, the present list provides the baseline information on the marine Heterobranchia fauna of the Pantelleria Island, which in the near future may contribute to generate new insights on this group of marine gastropods.

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