

An account on the marine Heterobranchia gastropods collected during the Mission “GAMPA Graciosa 2014” (Archipelago of the Azores, mid-north Atlantic)

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In the current account we report on the species of marine heterobranchs collected during the coastal monitoring mission “GAMPA Graciosa 2014” (20–26 July 2014). Sampling was carried out by SCUBA diving down to 30 m depth on 10 sampling locations. Animals were collected by hand after direct observation, and later in the laboratory separated by morpho-species, photographed, databased, and preserved after relaxation in 96% ethanol. Fourteen species were collected, of which 13 represent new records for the fauna of Graciosa Island (~93%), highlighting the need for additional sampling efforts across the whole Archipelago.

Key words: Aplysiida, biodiversity, conservation, faunistics, Nudibranchia, sea slugs

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INTRODUCTION

The marine Heterobranchia gastropods, a group which includes the previous opisthobranchs (e.g., sensu Cervera *et al.* 2004), marine pulmonates (Systellommatophora and Ellobiida), and shelly forms collectively assembled under the informal name “Lower Heterobranchia” (Bouchet *et al.* 2017), are a fairly well-known group of marine invertebrates in the Archipelago of the Azores, mid-north Atlantic (reviewed in Malaquias 2001; Martins 2001; Cervera *et al.* 2004; Cordeiro *et al.* 2015). Nevertheless, there is a significant regional

bias in this knowledge, with approximately 95% of cited species belonging to the traditional “opisthobranch” lineages (anaspids, cephalaspids, nudibranchs, pleurobranchids, sacoglossans, umbraculids), known only from the islands of Faial and São Miguel, where the departments and research institutes of the University of the Azores working on marine sciences are located.

In July 2014, a scientific campaign took place in Graciosa Island under the coastal marine protected areas, species and habitats monitoring programme, organized by the working group on marine protected areas of the Azores (GAMPA).

In the current account, we report on the species of marine heterobranchs collected during that mission.

MATERIAL AND METHODS

Sampling took place in Graciosa Island (Archipelago of the Azores) between 20–26 July

2014 by SCUBA diving down to 30 m on 10 sampling sites (Figure 1, Table 1). Animals were collected by hand after direct observation. In the laboratory specimens were separated to morpho-species, photographed, frozen overnight in sea water, defrosted the day after, and fixed in 96% ethanol.

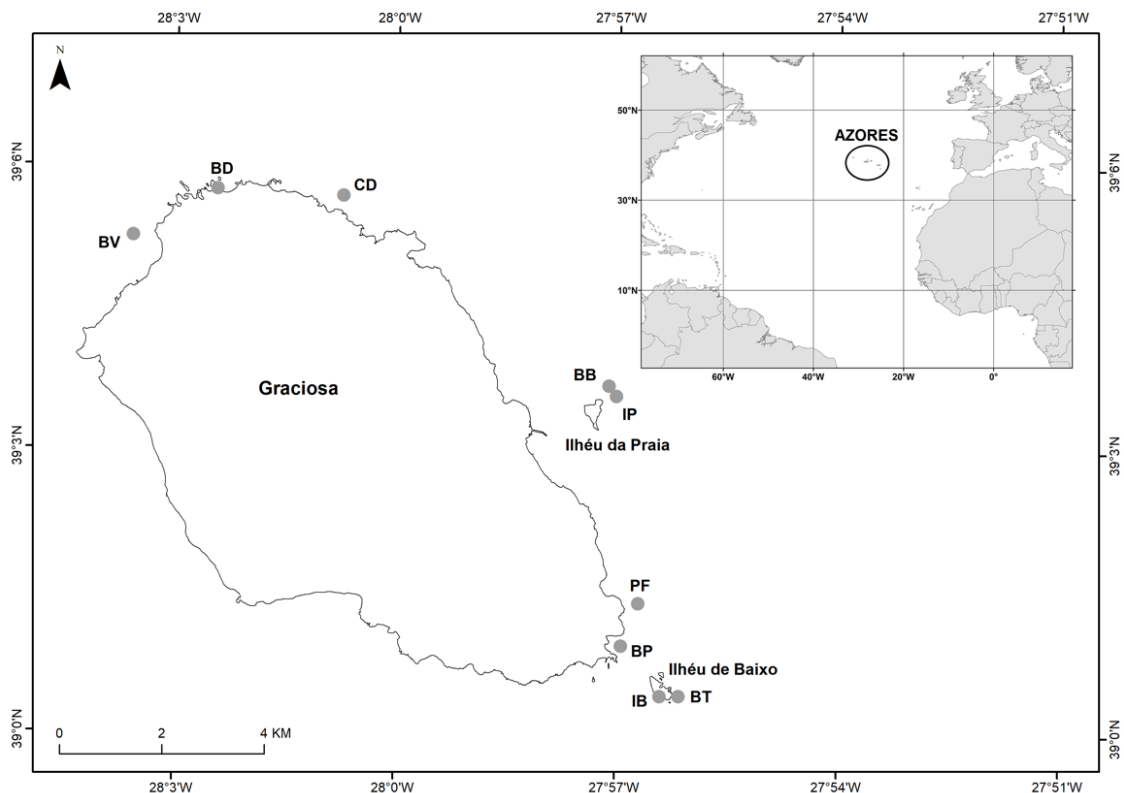


Fig. 1. Map of the archipelago with the Graciosa Island showing sampling sites.

RESULTS

Fourteen species of Heterobranchia were collected. An annotated list of species is presented below, with the code of the sampling station in bold followed by a voucher number, date of collection, number of specimens collected,

and length of specimens (see Table 1). Taxa that are here cited for the first time for Graciosa are preceded by an asterisk (*). Abbreviations: L = maximum length; ZMBN = Department of Natural History, University Museum of Bergen, University of Bergen, Norway.

Table 1. Sampling stations with geographical coordinates, and biophysical descriptions.

Sampling station	Code	Coordinates	Description
Baixa dos Badejos, Ilhéu da Praia	BB	39°03.692N–27°57.116W	Rocky wall with algae and sponges; 10–20 m
Baía da Vitória	BV	39°05.253N–28°03.588W	Under boulders; 12 m
South side of Ilhéu de Baixo	IB	39°00.412N–27°56.398W	Rocky substrates with algae and sponges; 15–20 m
Baixa do Terceirence, Ilhéu de Baixo	BT	39°00.412N–27°56.141W	Rocky substrates with algae and sponges; 10–30 m
North side of Baía da Poça	BP	39°00.942N–27°56.928W	Rocky substrates with algae, sponges, and bryozoan <i>Bugula</i> sp.; 10–22 m
Baía de Diagaves	BD	39°05.718N–28°02.512W	Rocky wall with algae, and stones at the bottom; 15–21 m
Cabeço de Dentro, Baixa dos Ferreiros	CD	39°05.684N–28°00.741W	Rocky wall with algae, and boulders at the bottom; 18–25 m
East side of Ilhéu da Praia	IP	39°03.582N–27°57.016W	Rocky wall with algae, and boulders at the bottom; 17–22 m
Ponta do Feliciano	PF	39°01.390N–27°56.697W	Rocky wall with sponges and boulders with algae; 15–27 m

Taxonomic list:

Order Aplysiida

Family Aplysiidae Lamarck, 1809

Aplysia fasciata* Poiret, 1789BV**, ZMBN 97205, 24 July 2014, 1 sp., L = 90 mm.**Aplysia punctata* (Cuvier, 1803)**BV**, ZMBN 97189, 22 July 2014, 2 spcs, L = 120 mm.**Aplysia juliana* Quoy & Gaimard, 1832**BD**, ZMBN 97200, 24 July 2014, 15 spcs, L = 30–60 mm.

Remarks: This species was first cited in the Archipelago of the Azores by Malaquias *et al.* (2009) who nevertheless have drawn attention to the fact that the worldwide distribution of *A. juliana* originally described from the Indian Ocean (Eales, 1960; Martínez, 1995), could mask the existence of a species complex. This was demonstrated by Golestani *et al.* (2019) for the “globally” distributed *A. parvula*. Molecular phylogenetic evidence and examination of morphological characteres revealed *A. parvula* to be a complex of at least 10 species.

The taxonomy of many worldwide aplysiids is doubtful and, until a sound anatomical and molecular phylogenetic study is available, the correct identification of many species across the world will continue to be challenging, including those occurring in the Azores. Therefore, it is here retained the name *A. juliana* for individuals occurring in the Azores of small size (*ca.* 6 cm), mature, with mottled colouration, and lacking a black stripe around the margins of the parapodial lobes.

Order Nudibranchia Cuvier, 1817

Suborder Doridina

Family Chromodorididae Bergh, 1891

**Felimare tricolor* (Cantraine, 1835)

BB, ZMBN 97186, 21 July 2014, 1 sp., L = 28 mm. **BT**, ZMBN 97193, 23 July 2014, 4 spcs, L = 8–23 mm. **BD**, ZMBN 97203, 24 July 2014, 1 sp., L = 22 mm. **CD**, ZMBN 97207, 24 July 2014, 6 spcs, L = 15–22 mm. **IP**, ZMBN 97212, 25 July 2014, 9 spcs, L = 18–25 mm. **PF**, ZMBN 97217, 25 July 2014, 2 spcs, L = 25, 27 mm. **BB**, ZMBN 97220, 21 July 2014, 2 spcs, L = 25 mm.

****Felimare picta* (R. A. Philippi, 1836)**

IC, ZMBN 97190, 22 July 2014, 4 spcs, L = 20–27 mm. **BT**, ZMBN 97194, 23 July 2014, 1 spc., L = 52 mm. **BP**, ZMBN 97197, 23 July 2014, 2 spcs, L = 20, 28 mm. **BD**, ZMBN 97202, 24 July 2014, 2 spcs, L = 30 mm. **CD**, ZMBN 97206, 24 July 2014, 1 spc., L = 32 mm. **IP**, ZMBN 97211, 25 July 2014, 3 spcs, L = 28–32 mm. **PF**, ZMBN 97216, 25 July 2014, 2 spcs, L = 27, 30 mm.

****Felimare fontandraui* (Pruvot-Fol, 1951)**

BD, ZMBN 97201, 24 July 2014, 1 spc., L = 40 mm.

****Felimida purpurea* (Risso, 1831)**

BP, ZMBN 97199, 23 July 2014, 1 spc., L = 11 mm. **BD**, ZMBN 97204, 24 July 2014, 4 spcs, L = 10 mm. **IP**, ZMBN 97213, 25 July 2014, 3 spcs, L = 10 mm.

****Felimida binza* (Ev. Marcus & Er. Marcus, 1963)**

BB, ZMBN 97187, 21 July 2014, 6 spcs, L = 10–20 mm. **CD**, ZMBN 97208, 24 July 2014, 1 spc., L = 21 mm. **PP**, ZMBN 97218, 25 July 2014, 1 spc., L = 20 mm.

Family Discodorididae Bergh, 1891

****Peltodoris atromaculata* Bergh, 1880**

BP, ZMBN 97215, 25 July 2014, 1 spc., L = 45 mm.

Family Calycidorididae Roginskaya, 1972

****Diaphorodoris alba* Portmann & Sandmeier, 1960**

BB, ZMBN 97188, 21 July 2014, 1 spc., L = 4 mm. **BP**, ZMBN 97196, 23 July 2014, 2 spcs, L = 7 mm.

Remarks: This species has been cited previously in the Azores as *Diaphorodoris luteocincta* (M. Sars, 1870) (e.g. Wirtz & Martins 1993), but Furfaro *et al.* (2016) showed that individuals with a white background and a yellow/orange line on the upper and under sides of the edge of the mantle, belong to the species *D. alba* which before was considered a synonym of *D. luteocincta*.

Family Polyceridae Alder & Hancock, 1845

***Polycera quadrilineata* (O. F. Müller, 1776)**

IC, ZMBN 97191, 22 July 2014, 2 spcs, L = 2, 4 mm. **BP**, ZMBN 97198, 23 July 2014, 11 spcs, L = ~8 mm.

Remarks: This species was previously cited in Graciosa Island by Sørensen *et al.* (2020).

****Crimora papillata* Alder & Hancock, 1862**

CD, ZMBN 97209, 24 July 2014, 1 spc., L = 9 mm.

Suborder Cladobranchia Willan & Morton, 1984

Family Trinchesiidae F. Nordsieck, 1972

****Trinchesia foliata* (Forbes & Goodsir, 1839)**

IC, ZMBN 97192, 22 July 2014, 1 spc., L = 3 mm.

Family Flabellinidae Bergh, 1889

****Edmundsella pedata* (Montagu, 1816)**

BT, ZMBN 97195, 23 July 2014, 1 spc., L = 12 mm.

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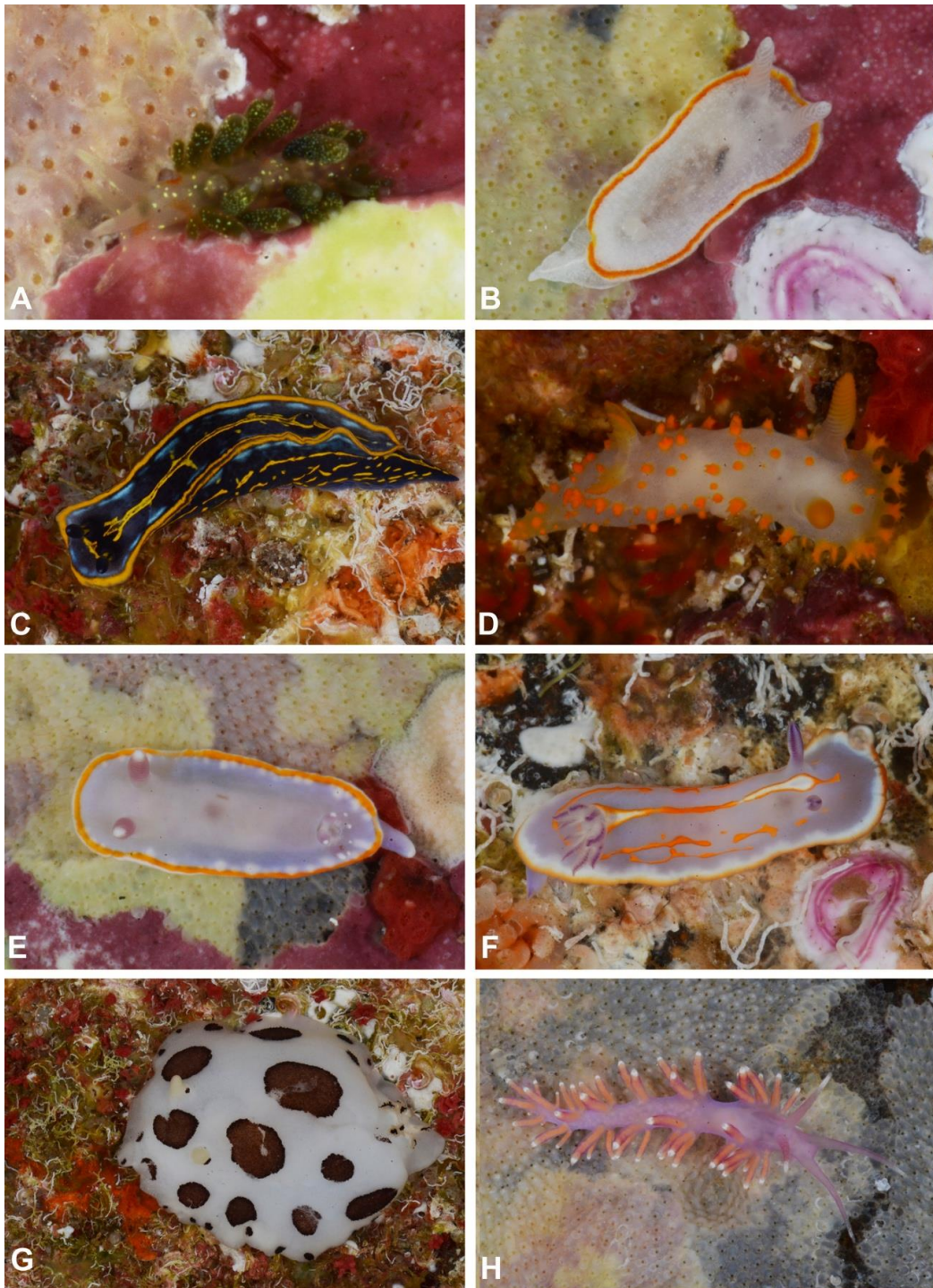


Fig.2. **A**, *Trinchestia foliata*, ZMBN 97192. **B**, *Diaphorodoris alba*, ZMBN 97188. **C**, *Felimare fontandraui*, MBN 97201. **D**, *Crimora papillata*, ZMBN 97209. **E**, *Felimida purpurea*, ZMBN 97199. **F**, *Felimida binza*, ZMBN 97218. **G**, *Peltodoris atromaculata*, ZMBN 97215. **H**, *Edmundsella pedata*, ZMBN 97195.

DISCUSSION

Thirteen out of the 14 species collected and reported here represents new records for the fauna of Graciosa Island, corresponding to 93% of the assembled diversity. This high percentage of new records, together with the fact that most of the sampled species are relatively common in other islands of the Azores (e.g., Faial or São Miguel; Malaquias 2009; 2015), highlights the regional bias in the current knowledge about the composition and distribution of biodiversity across the Azorean islands.

The fact that Graciosa Island is particular in coastal diversity and, probably, oceanographic phenomena of localized scale (e.g., Neto *et al.* 2020; Tempera *et al.* 2021), and thus, of considerable conservation and management interest (GAMPA, 2015), reinforces this gap and calls for additional sampling efforts in the island, and through the whole Archipelago.

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