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To cite this article: V. Micaroni, F. Strano, D. Di Franco, F. Crocetta, D. Grech, S. Piraino & F. Boero (2018) Project “Biodiversity MARE Tricase”: a biodiversity inventory of the coastal area of Tricase (Ionian Sea, Italy) – Mollusca: Heterobranchia, The European Zoological Journal, 85:1, 180-193, DOI: 10.1080/24750263.2018.1462413

To link to this article: https://doi.org/10.1080/24750263.2018.1462413

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Published online: 30 Apr 2018.

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Project “Biodiversity MARE Tricase”: a biodiversity inventory of the coastal area of Tricase (Ionian Sea, Italy) – Mollusca: Heterobranchia

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(Received 20 February 2018; accepted 31 March 2018)

Abstract
The marine biodiversity of the Tricase coastal area (Ionian Sea, Italy) was investigated at the MARE Outpost (Avamposto MARE) between 2016 and 2017, with the help of citizen scientists and trained taxonomists. Among the most interesting groups encountered, heterobranch molluscs deserve a special mention. Altogether, 268 specimens were ascribed to this group and referred to 49 taxa. Notwithstanding the extensive literature on Mediterranean heterobranchs, two species proved to be new to the Italian coasts, the records of eight species represented their easternmost sightings in the Mediterranean Sea, and 13 taxa represented new records for the Ionian Sea. In addition, several feeding habits and phenological events were new to science. Although the European Union’s Marine Strategy Framework Directive lists “Biodiversity is maintained” as the first descriptor in achieving “Good Environmental Status”, our results highlighted the presence of conspicuous gaps in the knowledge of species distribution, taxonomy and ecology of heterobranch molluscs, indicating the necessity of even small-scale species checklists to understand biodiversity changes in worldwide biota.

Keywords: Mediterranean Sea, biodiversity, Avamposto MARE, checklist, sea slugs

Introduction
Biodiversity is the result of billions years of evolution and supplies all the goods and services humans need to live (Haines-Young & Potschin 2010). The European Union fully recognises the importance of biodiversity, but the unsustainable development of human societies threatens its integrity (Sandifer et al. 2015; Thiede et al. 2016). Along this line, the European Union’s Marine Strategy Framework Directive lists “Biodiversity is maintained” as the first descriptor in achieving “Good Environmental Status” (EU Marine Strategy Framework Directive 2008). In spite of the stated importance of biodiversity, and even within the widely studied Mediterranean fauna, important gaps still exist in basic knowledge, such as taxonomy, distribution, abundance and temporal trends of almost all taxonomic groups (Coll et al. 2010). In addition, there is now enough evidence that over the last few decades the distribution, phenology and physiology of many animal and plant species have been altered due to climate change, with feedbacks on local abundances and geographic ranges (Hughes 2000; Puce et al. 2009; Rivetti et al. 2014; Boero et al. 2016). Therefore, there is an urgent need for data, together with long-term data sets to assess the impact of global climate change on ecosystems (Visser & Both 2005; Boero et al. 2015). In 2015, the University of Salento, in collaboration with the CIHEAM IAM Bari (Mediterranean Agronomic...
Institute of Bari), the Regional Park “Costa Otranto – Santa Maria di Leuca e Bosco di Tricase”, the Municipality of Tricase and the local association “Magna Grecia Mare” established the MARE Outpost (Avamposto Mare) to study the local marine biodiversity. The MARE Outpost is situated in the northern portion of the Ionian Sea (Tricase Porto, Salento Peninsula, Italy), according to the traditional borders of this sea, along the eastern coast of Italian Peninsula, in the middle of the Mediterranean Sea. It is not only a research facility for biodiversity research and promotion, but also a place of international cooperation for the sustainable development of Mediterranean coastal communities. The project “Biodiversity MARE Tricase” aims at monitoring Mediterranean biodiversity, promoting its wise management. In the framework of this project, species were collected whenever possible in collaboration with “citizen scientists” (European Citizen Science Association 2015) (e.g. fishermen, divers, local citizens, tourists, bathers, school students and any other any non-professional scientist who becomes engaged in a scientific enterprise, providing data and observations to professional taxonomists) and further analysed with the help of taxonomists. Results obtained so far have led to many interesting records, revealing a still-fragmented knowledge not only of the local fauna but of the Italian marine fauna as a whole. Among the explored taxa, the study of sea slugs (Mollusca: Gastropoda: Heterobranchia), formerly known as Opisthobranchia, led to novel results.

According to recent phylogenetic analyses based on morphological, embryological and molecular data, the taxon Opisthobranchia was found to be not monophyletic, and sea slugs are now placed within the clade Heterobranchia (Schrödl et al. 2011; Wägele et al. 2014). A large literature regarding these molluscs covers the Mediterranean Sea, especially concerning taxonomy, faunal studies and, more recently, non-indigenous species (see discussions in Gosliner et al. 2008). Regarding Italian waters, biodiversity assessments were recently carried out in different geographic areas (e.g. Trainito & Doneddu 2015; Furfaro & Mariottini 2016; Vitale et al. 2016; Zenetos et al. 2016), although the absence of specialists in the Salento Peninsula led to the fact that this taxonomic group has been poorly studied in the past, with the main articles published so far dating back to around 30 years ago (e.g. Perrone 1983, 1986). The scope of the present work, a starting point towards creating an overall biodiversity inventory of Tricase (Apulia, Italy), is to provide a preliminary checklist of sea slugs inhabiting the Tricase coastal area. In addition, remarks regarding taxonomy, reproduction, biogeography and feeding behaviour of selected species are provided so as to fill gaps in current knowledge of Mediterranean heterobranchs.

Materials and methods

Study site and samplings

Samplings were carried out along the coast between Otranto and Santa Maria di Leuca (Lecce, Italy), in the Otranto Channel (Ionian Sea), between 25 March 2016 and 16 September 2017. Most samplings were conducted in an area of ~33 km² here defined as the Tricase area (T), having as its northern boundary the latitude 39°59′30.7″N (WGS84), its southern boundary the latitude 39°54′13.5″N, its western boundary the coastline, and its eastern boundary a bathymetric depth of 70 m. The area has been defined as such because for the species found by citizen scientists (i.e. local fishermen) the exact sampling location was not available. The investigated site is characterised by steeply slanting rocky substrates from the surface to about 18 m depth. Below, the slope decreases and coralligenous platforms alternate with sand and mud down to about 70 m depth. Many marine karst caves and karst freshwater springs are also scattered along the whole coast. Moreover, the study site includes the harbour of Tricase, a small marina composed by an exposed natural inlet with a cement quay (the old harbour) and a semiclosed artificial harbour (the new harbour), characterised by the presence of several freshwater springs (Parenzan 1983; Onorato et al. 1999). In addition to the Tricase area, four sites located within the Otranto Channel were sampled, namely: (1) Acquaviva’s cave (A) – 39°59′32.4″N, 18°24′55.5″E; (2) Bortones’ cave (B) – 40°03′43.9″N, 18°28′46.6″E; (3) Ciolo’s cave (C) – 39°50′39.4″N, 18°23′10.4″E; (4) Castro’s mussel farm (M) – 39°59′40.3″N, 18°25′37.0″E (Figure 1).

Specimens were collected by skin diving, scuba diving, nylon gillnets and trammels. In addition, citizen scientists (e.g. fishermen, divers, local citizens, tourists, bathers, etc.) were involved in the collection of animals. Overall, there were 72 sampling sessions. Samplings were not uniform during the year and most of them were performed during spring (52 during the month of April, May, and June). When possible, organisms were photographed in the field before collection with Canon Power-Shot D30, Sony Rx100 and Nikon AW130 cameras.

Laboratory work

Once sampled, organisms were brought to the laboratory of Avamposto MARE, maintained in
aerated tanks, and identified alive. Soon after, they were either released into the sea or fixed in EtOH 80% for further analysis. Species identification was made using books (e.g. Cattaneo-Vietti et al. 1990; Trainito & Doneddu 2014) and/or original descriptions and taxonomic literature (see below under single taxa). Species were referred to higher taxa following recent reviews and molecular phylogenies (e.g. Bouchet et al. 2017 and references therein), whereas lower taxonomy and nomenclature follow the World Register of Marine Species (WoRMS Editorial Board 2017).

Results

Altogether, 268 heterobranch specimens were found. They were referred to 49 taxa (Table I; Figures 2–4). Citizen scientists collected 11 species (22%). Most specimens were identified at the species level, but four were only tentatively assigned to a species due to their complex taxonomy. In addition, four specimens were identified to family or genus level only: an unidentified Onchidorididae specimen, a Trinchesia and two Haminoea species (Figure 4). The 49 taxa censused here belong to two main clades (cohorts Ringipleura and Tectipleura), seven orders (Pleurobranchida, Nudibranchia, Umbraculida, Cephalaspidea, Runcinida, Aplysiida and Sacoglossa) (Table I; Figure 2), 27 families, and at least 34 genera.

The orders showing the highest biodiversity were Nudibranchia, with 17 families and 30 species, followed by Cephalaspidea and Sacoglossa, with three families and five species each, and by Runcinida, with one family and four species (Table I; Figure 2). Regarding families, the richest in species number was Chromodorididae with five taxa, followed by Runcinidae and Dotidae, with four species each (Table I).

From an ecological point of view, Doto pygmaea was very common, with 145 individuals found in 15 sampling events, followed by Cratena peregrina with 15 individuals, and Felimare picta with 13 individuals. All the other species were rarely encountered. In addition, 10 feeding habits and five phenological events were recorded, some of which are new to science.

The records of two species are new for the Italian coasts: Runcina cf. brenkoae and Runcina cf. ornata. In fact, despite their tentative identification, no Runcina specimens referable to our species have ever before been reported from Italy. However, their identification may be assessed with certainty only after a molecular review of the Mediterranean Runcinidae is carried out. The records of eight species represented their easternmost sightings in the Mediterranean Sea (Doto acuta, D. cf. koemneckeri, D. paulinae, D. pygmaea, Runcina adriatica, R. cf. brenkoae, R. cf. ornata and Ercolania viridis), and all of them are also new records for the Salento Peninsula and the Ionian Sea, together with
Table I. List of the heterobranch taxa found during the “Biodiversity MARE Tricase” project, with notes on depth or depth range (in metres), substrate, phenology and finding area. New records marked in bold (see Taxonomic remarks). Phenology: Mat. – Mating event. Area: A – Acquaviva’s cave; B – Bortones’ cave; C – Ciolo’s cave; M – Castro’s mussel farm; T – Tricase area. In phenology, roman numerals indicate the month of observation.

| Taxa | Depth | Substrate | Phenology | Area |
|------|-------|-----------|-----------|------|
| Cohort RINGIPLEURA Subcohort NUDIPLEURA Order PLEUROBRANCHIDA Family PLEUROBRANCHAEIDAE Pleurobranchaea meckeli (Blainville, 1825) | 34 | On sand | - | M |
| Order NUDIBRANCHIA Family CALYCIDORIDIDAE Diaphorodoris papillata Portmann & Sandmeier, 1960 | 30 | On coralligenous formations | - | T |
| Family ONCHIDORIDIDAE | | | | |
| Doris ocelligera (Bergh, 1881) | 40 | Amidst dead coralligenous formations | - | T |
| Family DENDRODORIDIDAE Peltodoris atrumaculata Bergh, 1880 | 18–30 | On Petrosia ficiformis (Porifera) | Eggs (VI) | T |
| Platyodoris argo (Linnaeus, 1767) | 22 | On coralligenous formations | - | T |
| Family DORIDIDAE Doris ocelligera (Bergh, 1881) | 40 | Amidst dead coralligenous formations | - | T |
| Family DISCODORIDIDAE Peltodoris atrumaculata Bergh, 1880 | 18–30 | On Petrosia ficiformis (Porifera) | Eggs (VI) | T |
| Platyodoris argo (Linnaeus, 1767) | 22 | On coralligenous formations | - | T |
| Family POLYCERIDAE | | | | |
| Family CHROMODORIDIDAE Felimare picta (Schult in Philippi, 1836) | 8–18 | On Peyssonnelia sp. (Rhodophyta) | - | T |
| Felimare tricolor (Cantraïne, 1835) | 14 | On algae | - | T |
| Felimare villafranca (Rioso, 1818) | 10 | On Peyssonnelia sp. (Rhodophyta) | - | T |
| Felimida krohni (Vérany, 1846) | 40 | Amidst dead coralligenous formations | - | T |
| Felimida luteorosea (Rapp, 1827) | 40 | On coralligenous formations | - | T |
| Family DOTIDAE | | | | |
| Doto acuta Schmekel & Kress, 1977 | 1 | Feeding on Corydendrium parasiticum (Hydrozoa) | - | T |
| Doto cf. koennekeri Lemche, 1976 | 2 | Feeding on Aglaophenia octodonta (Hydrozoa) | - | T |
| Doto paulinae Trinchese, 1881 | 2 | Feeding on Aglaophenia octodonta (Hydrozoa) | - | T |
| Doto pygmaea Oken, 1815 | 0 | Feeding on Clytia hemisphaerica (Hydrozoa) | Eggs (VII) | T |
| Family TRITONIIDAE | | | | |
| Tritonia manicata Deshayes, 1853 | 1 | On algae | - | T |
| Family FLABELLINIDAE | | | | |
| Calmella cavolini (Vérany, 1846) | 1 | On Eudendrium sp. (Hydrozoa) | - | T |
| Flabelinia affinis (Gmelin, 1791) | 10 | On Eudendrium sp. (Hydrozoa) | - | T, B |
| Family SAMOLIDAE | | | | |
| Luisella babai (Schmekel, 1972) | 22 | On coralligenous formations | - | T |
| Family AEOLIDIIDAE | | | | |
| Berghia coerulescens (Laurillard, 1832) | 1 | On algae | - | T |
| Spurilla neapolitana (Delle Chiaje, 1841) | 4 | On rocks, in a marine cave | - | A, T |
| Family FACELINIDAE | | | | |
| Cratena peregrina (Gmelin, 1791) | 21–25 | Feeding on Eudendrium racemosum (Hydrozoa) | - | T |
| Facelina annulicornis (Chamisson & Eysenhardt, 1821) | 4 | On rocks | - | B |
| Family EUBRANCHIDAE | | | | |
| Eubranchus exiguis (Alder & Hancock, 1848) | 0 | Feeding on Clytia hemisphaerica (Hydrozoa) | - | T |
| Family FIONIDAE | | | | |
| Fiona pinnata (Eschscholtz, 1831) complex | 0 | Feeding on Lepas pectinata (Crustacea) | Eggs (V) | T |
| Family TRINCHESIIDAE | | | | |
| Trinchesia caerulea (Montagu, 1804) | 2 | Feeding on Sertularella ellisi (Hydrozoa) | - | T |
| Trinchesia sp. | 34 | On the bottom of a mussel farm | - | M |
| Cohort TECTIPLEURA Subcohort EUOPISTHOBRANCHIA Order UMBRACULIDA | | | | |
| Family UMBRACULIDAE (Continued) | | | | |
Table I. (Continued).

| Taxa                                      | Depth | Substrate                          | Phenology | Area |
|-------------------------------------------|-------|------------------------------------|-----------|------|
| *Umbraculum umbraculum* (Lightfoot, 1786) | 1–3   | On *Spirastrella cunctatrix* (Porifera) | -         | T    |
| **Order CEPHALASPIDEA**                   |       |                                    |           |      |
| Family AGLAJIDAE                          |       |                                    |           |      |
| *Aglaja tricolorata* Renier, 1807          | 34    | On sand                            | -         | M    |
| Family BULLIDAE                           |       |                                    |           |      |
| *Bulla striata* Bruguière, 1792            | 10    | -                                  | -         | T    |
| Family HAMINOEIDAE                        |       |                                    |           |      |
| *Haminoea* sp. 1                          | 40    | Amidst dead coralligenous formations | -         | T    |
| *Haminoea* sp. 2                          | 1     | On *Corydendrium parasiticum* (Hydrozoa) | -         | T    |
| *Weinhausia turbidula* (Forbes, 1844)     | 40    | On coralligenous formations        | -         | T    |
| **Order RUNCINIDA**                       |       |                                    |           |      |
| Family RUNCINIDAE                         |       |                                    |           |      |
| *Runcina adriatica* T. Thompson 1980      | 20–40 | On coralligenous formations        | -         | T    |
| *Runcina* cf. *brenhoeae* T. Thompson 1980| 2     | On algae                           | -         | T    |
| *Runcina* ferruginea Kress, 1977           | 40    | Amidst dead coralligenous formations | -         | T    |
| *Runcina* cf. *ornata* (Quatrefages, 1844)| 20    | On coralligenous formations        | -         | T    |
| **Order APLYSIIDA [ANASPIDEA]**            |       |                                    |           |      |
| Family APLYSIIDAE                         |       |                                    |           |      |
| *Aplysia depilans* Gmelin, 1791           | 2     | On algae                           | Mat. (IX) | T    |
| *Aplysia fasciata* Poiret, 1789           | 3     | On algae                           | Mat. (VII)| T    |
| *Aplysia* cf. *parvula* Mörch, 1863       | 10    | Feeding on Laurencieae (Florideophyceae) | Mat. (II) | T, A |
| **Subcohort PANPULMONATA**                |       |                                    |           |      |
| **Superorder SACOGLOSSA**                 |       |                                    |           |      |
| Family LIMAPONTIIDAE                      |       |                                    |           |      |
| *Ercolania viridis* (A. Costa, 1866)      | 0     | Feeding on *Chaetomorpha linum* (Chlorophyta) | -         | T    |
| Family BOSELLIIDAE                        |       |                                    |           |      |
| *Bosellia mimetica* Trinchese, 1891       | 21    | On *Flabellia petiolata* (Chlorophyta) | Eggs (VI) | T    |
| Family PLAKOBRANCHIDAE                    |       |                                    |           |      |
| *Elysia timida* (Risso, 1818)             | 7     | On algae                           | -         | T    |
| *Elysia viridis* (Montagu, 1804)          | 10    | Feeding on *Flabellia petiolata* (Chlorophyta) | -         | T    |
| *Thuridilla hopei* (Vérany, 1853)         | 7     | On algae                           | -         | T    |

**Figure 2.** Main clades belonging to the heterobranch assemblage found during the “Biodiversity MARE Tricase” project and the overall number of species (divided per orders). Abbreviations used: PLE – Pleurobranchida; NUD – Nudibranchia; UMB – Umbraculida; CEP – Cephalaspidea; RUN – Runcinida; APL – Aplysiida; SAC – Sacoglossa.
Diaphorodoris papillata, Doris ocelligera, Facelina annulicornis, Eubranchus exiguus and specimens belonging to the Fiona pinnata complex. Finally, Kaloplocamus ramosus deserves a mention: already reported from the Ionian Sea on the Amendolara Seamount at about 70 m depth (Perrone 1985), our record constitutes a confirmation of its presence in the area, 32 years since the first sighting. It was based on a single specimen found 26 May 2016 at 70 m depth on a colony of the bryozoan Cellaria salicornioides Lamouroux, 1816, a food item recently reported by Vanhaelen et al. (2014).

Data reported above are fully explained in the Faunal remarks section.
Faunal remarks

Family Calycidorididae Roginskaya, 1972
Genus Diaphorodoris Iredale & O’Donoghue, 1923
Diaphorodoris papillata Portmann & Sandmeier, 1960
(Figure 3A)

Material examined. One specimen, 9 mm length, Rio (39°55'09.6"N, 18°23'55.0"E), 16 September 2017, 30 m depth, on algal turfs on coralligenous formations.

Mediterranean distribution. Diaphorodoris papillata has a wide Mediterranean distribution, ranging from the western to the eastern parts of the basin, including the Adriatic Sea (e.g. Sammut & Perrone 1998; Cervera et al. 2004; Mienis 2015; Ciriaco & Poloniato 2016; Zenetos et al. 2016). In Italy, it was recorded in the Ligurian Sea, the Tyrrenhenian Sea and the Adriatic Sea (e.g. Schmekel & Portmann 1982; Cattaneo-Vietti et al. 1990; Trainito & Doneddu 2015; Ciriaco & Poloniato 2016; Furfaro & Mariottini 2016 – specimen from Sistiana (Trieste): Ciriaco & Poloniato pers. comm.; Betti et al. 2017), whilst Cattaneo-Vietti and Giovine (2008) listed its presence in “sector 5” (south-eastern tip of Sicily, Pelagie Islands, and the Maltese archipelago), but this record refers to Malta (see Sammut & Perrone 1998).

Family Dorididae Rafinesque, 1815
Genus Doris Linnaeus, 1758
Doris ocelligera (Bergh, 1881)
(Figure 3B)

Material examined. One specimen, 8.7 mm length, Funnuvojere’s shoal (39°53'11.0"N, 18°24'51.9"E), 6 August 2017, 40 m depth, amidst dead coralligenous formations mostly composed by the arborescent bryozoans Schizoretepora serratimargo (Hincks, 1886) and Myriapora truncata (Pallas, 1766).

Mediterranean distribution. Doris ocelligera has a wide Mediterranean distribution, ranging from the western to the eastern parts of the basin, including the Adriatic Sea (e.g. Koutsoubas & Koukouras 1993; Sammut & Perrone 1998; Cervera et al. 2004; Zenetos et al. 2016). In Italy, it was recorded in the Ligurian Sea, the Tyrrenhenian Sea and the Adriatic Sea (e.g. Sordi & Majidi 1956; Macali et al. 2013; Trainito & Doneddu 2015; Zenetos et al. 2016), whilst its presence in “sector 5”
(south-eastern tip of Sicily, Pelagie Islands, and the Maltese archipelago) listed by Cattaneo-Vietti and Giovine (2008) refers to Malta (see Sammut & Perrone 1998).

**Material examined.** Ten specimens, 2.5–5.4 mm

**Remarks.** Doto acuta feeds on hydroids

**Mediterranean distribution.** Doto acuta has a restricted Mediterranean distribution, being only known from the western part of the basin (e.g. Schmekel & Portmann 1982; Cervera et al. 2004; Trainito & Doneddu 2015). In Italy, it was only recorded in the Tyrrhenian Sea (Schmekel & Portmann 1982; Cervera et al. 2004; Ballesteros et al. 2016). In Italy, it was only recorded in the Ligurian Sea and the Tyrrhenian Sea (e.g. Trinchese 1881; Schmekel & Portmann 1982; Cervera et al. 2004; Ballesteros et al. 2016). In Italy, it was only recorded in the Ligurian Sea and the Tyrrhenian Sea (e.g. Trinchese 1881; Schmekel & Portmann 1982; Trainito & Doneddu 2015).

**Remarks.** Doto acuta feeds on hydroids (McDonald & Nybakken 1997). In particular, Schmekel and Portmann (1982) reported Obelia geniculata (Linnaeus, 1758) as its food item. To the best of our knowledge, our sightings not only widen its known food items but overall constitute the first report of a nudibranch feeding on C. parasiticum.

**Doto cf. koenneckeri** Lemche, 1976

**Material examined.** One specimen, 2.8 mm length, Monte Purtusu (39°55ʹ53.4ʺN, 18°23ʹ45.6ʺE), 20 April 2016, 2 m depth, feeding on the hydrozoan Aglaophenia octodonta Heller, 1868.

**Mediterranean distribution.** Doto koenneckeri has a restricted Mediterranean distribution, being only known from the western part of the basin (e.g. Cervera et al. 2004; Betti et al. 2015; Trainito & Doneddu 2015). In Italy, it was only recorded in the Ligurian Sea and the Tyrrhenian Sea (Betti et al. 2015; Trainito & Doneddu 2015).

**Remarks.** Doto koenneckeri feeds exclusively on hydroids of the genus Aglaophenia Lamouroux, 1812. In the Mediterranean Sea, this species is known to feed on A. octodonta, and other Aglaophenia taxa (McDonald & Nybakken 1997; Pujals et al. 2014; Betti et al. 2015).

**Doto paulinae** Trinchese, 1881

**Material examined.** One specimen, 2.7 mm length, Avamposto MARE (39°55ʹ36.1ʺN, 18°23ʹ45.2ʺE), 23 April 2016, 2 m depth, feeding on the hydrozoan Aglaophenia octodonta Heller, 1868.

**Mediterranean distribution.** Doto paulinae has a restricted Mediterranean distribution, being only recorded in the western Mediterranean Sea (e.g. Trinchese 1881; Haefelfinger 1960; Schmekel & Portmann 1982; Cervera et al. 2004; Ballesteros et al. 2016). In Italy, it was only recorded in the Ligurian Sea and the Tyrrhenian Sea (e.g. Trinchese 1881; Schmekel & Portmann 1982; Cervera et al. 2004; Trainito & Doneddu 2015).

**Remarks.** Doto paulinae is an almost unmistakable species, only showing slight similarities with Doto floridicola Simroth, 1888. However, D. paulinae specimens figured in the current literature show some differences (e.g. see Trinchese 1881; Marin & Ros 1991; Trainito & Doneddu 2015; Ballesteros et al. 2016; present paper), which led to the suspicion that undiscovered cryptic diversity may be present within this taxon. Doto paulinae is known to feeds on hydroids (McDonald & Nybakken 1997); reported food items are Aglaophenia plumula (Linnaeus, 1758), Obelia geniculata (Linnaeus, 1758), and Eudendrium Ehrenberg, 1834 taxa (Schmekel & Portmann 1982; Marin & Ros 1991). Aglaophenia octodonta proved to be an additional food item.

**Doto pygmaea** Oken, 1815

**Material examined.** One hundred and forty-five specimens, 1.1–9.9 mm length, Tricase area, between 3 May 2016 and 20 June 2017, 0 m depth, on floating debris, feeding on the hydrozoan Clytia hemisphaerica (Linnaeus, 1767).

**Mediterranean distribution.** Doto pygmaea has a restricted Mediterranean distribution, being only recorded in the western Mediterranean Sea (e.g. Schmekel & Portmann 1982; Ballesteros et al. 2016). In Italy, it was only recorded in the Tyrrhenian Sea (Schmekel & Portmann 1982).

**Remarks.** Doto pygmaea can be easily identified by the characteristic shape of the cerata, showing an asymmetric form with the internal side very arched, without tubers and pseudobranchs (Bergh 1871; Ortea et al. 1997). It was found commonly and in high densities during our samplings, mostly living on floating objects, such as plastic debris, and always feeding on C. hemisphaerica stolons (Figure 3G).

Previously, D. pygmaea was only reported to feed
on Aglaophenia pluma (Linnaeus, 1758) and Obelia geniculata (Linnaeus, 1758) (Schmekel & Portmann 1982; McDonald & Nybakken 1997); therefore, our sightings widen its food range. Egg masses were found in July.

Family Facelinidae Bergh, 1889
Genus Facelina Alder & Hancock, 1855
Facelina annulicornis (Chamisso & Eysenhardt, 1821)
(Figure 3H)

Material examined. One specimen, 32 mm length, Bortones’ cave (40°03'43.9"N, 18°28'46.6"E), 22 March 2017, 4 m depth, on a limestone boulder.

Mediterranean distribution. Facelina annulicornis has a wide Mediterranean distribution, ranging from the western to the eastern parts of the basin, including the Adriatic Sea (e.g. Cervera et al. 2004; Öztürk et al. 2014; Zenetos et al. 2016). In Italy, it was recorded in the Tyrrhenian Sea, the Strait of Sicily, Pelagie Islands and the Maltese archipelago) listed by Cattaneo-Vietti and Giovine (2008) refers to Malta (see Sammut & Perrone 1998).

Family Eubranchidae Odhner, 1934
Genus Eubranchus Forbes, 1838
Eubranchus exigus (Alder & Hancock, 1848)
(Figure 3I)

Material examined. Two specimens, 3–4 mm length, Tricase area, 2 June 2017, on a floating plastic bag, feeding on the hydrozoan Clytia hemisphaerica (Linnaeus, 1767).

Mediterranean distribution. Eubranchus exigus has a wide Mediterranean distribution, ranging from the western to the eastern parts of the basin, including the Adriatic Sea (e.g. Cervera et al. 2004; Crocetta et al. 2015; Zenetos et al. 2016). In Italy, it was recorded in the Tyrrhenian Sea and the Adriatic Sea (e.g. Schmekel & Portmann 1982; Cattaneo-Vietti et al. 1990; Vazzana 2010; Zenetos et al. 2016), whilst its presence in “sector 5” (south-eastern tip of Sicily, Pelagie Islands and the Maltese archipelago) listed by Cattaneo-Vietti and Giovine (2008) refers to Malta (see Sammut & Perrone 1998).

Remarks. Eubranchus exigus has a wide diet breadth, composed by hydrozoans of the genera Abietinaria Kirchenpauer, 1884, Bougainvillia Lesson, 1830, Clytia Lamouroux, 1812, Cordylophora Allman, 1844, Coryne Gaertner, 1774, Halecium Oken, 1815, Hydrallmania Hincks, 1868, Kirchenpaueria Jickeli, 1883, Laomedea Lamouroux, 1812, Obelia Péron & Lesueur, 1810, Plumularia Lamarck, 1816, Sertularia Linnaeus, 1758, and Tubularia Linnaeus, 1758 (Todd 1981; McDonald & Nybakken 1997). It was previously found on C. hemisphaerica, but never feeding on it (Swennen 1961; Swennen & Dekker 1987).

Family Fionidae Gray, 1857
Genus Fiona Alder & Hancock [in Forbes & Hanley], 1853
Fiona pinnata (Eschscholtz, 1831) complex
(Figure 3J)

Material examined. Four specimens, 15–31 mm length, Tricase area, 23 May 2017 and 29 May 2017, on a floating plastic object and on a floating piece of wood, feeding on the cirriped crustacean Lepas pectinata Spengler, 1793.

Mediterranean distribution. Fiona pinnata had been widely recorded from the Mediterranean Sea, from the western to the eastern parts of the basin, but never from the Adriatic Sea (e.g. Barash & Danin 1972; Cervera et al. 2004; Crocetta et al. 2015; Zenetos et al. 2016). In Italy, it was recorded in the Ligurian Sea and the Tyrrhenian Sea (e.g. Trainito & Doneddu 2015; Betti et al. 2017), whilst its presence in “sector 5” (south-eastern tip of Sicily, Pelagie Islands and the Maltese archipelago) listed by Cattaneo-Vietti and Giovine (2008) refers to Malta (see Sammut & Perrone 1998).

Remarks. Fiona pinnata occurs exclusively on macroalgal rafts and other floating substrates. Although commonly considered a cosmopolitan species, recent studies suggest it could be a species complex (Trickey et al. 2016). It is known to feed on both neustonic colonial hydrozoans such as Porpita porpita (Linnaeus, 1758) and Velella Lamarck, 1801 taxa, and on cirrped crustaceans, such as those belonging to the genera Alepas Rang, 1829, Dosima Gray, 1825, and Lepas Linnaeus, 1758 (McDonald & Nybakken 1997). Lepas pectinata proved here to be an additional food item. Egg masses were found in May.

Family Runcinidae H. Adams & A. Adams, 1854
Genus Runcina Forbes [in Forbes & Hanley], 1851
Runcina adriatica T. Thompson, 1980
(Figure 3K,L)

Material examined. Three specimens, 1–2.4 mm length, Funnuvjøjere’s shoal (39°53'11.0"N, 18°24'51.9"E), 6 August 2017, 40 m depth, on dead
Mediterranean distribution. *Runcina adriatica* has a wide Mediterranean distribution, ranging from the western to the central parts of the basin, including the Adriatic Sea (e.g. Thompson 1980; Cachia et al. 2001; Ballesteros et al. 2016; Zenetos et al. 2016). In Italy, it was recorded in the Tyrrhenian Sea (e.g. Schmekel & Cappellato 2002; Klussmann-Kolb 2004), whilst its presence in Croatia and Slovenia (Lipej et al. 2008), and in Malta (see Sammut & Perrone 1998) was doubtful, and with Ballesteros et al. (2016), as its presence in “sectors 8 and 9 (central and northern Adriatic Sea, from the Gulf of Manfredonia to Istria)” listed by Cattaneo-Vietti and Giovine (2008) refer to Croatia. These records were mistakenly included by Zenetos et al. (2016) as held in the Italian Adriatic Sea, based on a misreading of Cattaneo-Vietti and Giovine (2008).

*Runcina brenkoae* sensu Thompson (1980) ascribed to *R. capreensis* (Mazzarelli, 1894) (references in Cervera et al. 2004) were subsequently considered by Gosliner (1977), originally described from Plymouth (Great Britain). We provisionally decided to report this taxon as a synonym of *R. ferruginea* (Kress, 1977), although this identification was subsequently questioned and virtually moved to *R. ornata* by Rudman (1999). Cattaneo-Vietti and Giovine (2008) noticed this, and listed its presence in “sector 5” (south-eastern tip of Sicily, Pelagie Islands and the Maltese archipelago) as doubtful, referring to Malta. Further specimens that may be conspecific to ours are those from Croatia described by Thompson (1980) as *R. zavodniki*, although this taxon was subsequently considered by Schmekel and Cappellato (2002) to be a synonym of *Runcina ferruginea* (Kress, 1977), originally described from Plymouth (Great Britain). We provisionally decided to report this taxon as “*Runcina cf. ornata* (Quatrefages, 1844)” to highlight the occurrence of a runcinid taxon with such a colour pattern in the studied area, pending further studies on the taxonomic relationships between topotypical *R. ferruginea*, *R. ornata* and *R. zavodniki* specimens, as well as on the specimens from the central Mediterranean Sea shown here and already recorded from Malta.
Family **Limapontiidae** Gray, 1847
Genus **Ercolania** Trinchese, 1872
**Ercolania viridis** (A. Costa, 1866)
(Figure 3O)

*Material examined.* One specimen, 4 mm length, Avamposto MARE (39°55'44.1"N, 18°23'41.2"E), 25 May 2016, tide level in a rock pool, grazing on the green algae *Chaetomorpha linum* (O.F. Müller) Kützing.

**Mediterranean distribution.** *Ercolania viridis* published distribution was restricted to the western part of the basin (e.g. Trinchese 1872; Schmekel & Portmann 1982; Cervera et al. 2004; Ballesteros et al. 2016) until Vitale et al. (2016) reported its presence from the central Mediterranean, based on samples from Faro Lake (Strait of Messina). Despite the fact that our sighting constitutes the easternmost Mediterranean record of this taxon, it is noteworthy to highlight that *E. viridis* has also been recorded from the Black Sea, where it is considered a non-indigenous species introduced through shipping from the Caribbean (Son 2010), and that its unpublished presence was noticed herein from Tunisia and Croatia (Rudman 2003; Ballesteros et al. 2012–2018).

**Remarks.** *Ercolania viridis* is known to graze on several Chlorophyta, such as *C. linum, Chaetomorpha aerea* (Dillwyn) Kützing and *Chaetomorpha capillaris* (Kützing) Borgesen, as well as on *Cladophora* Kützing, 1843 and *Cladophoropsis* Borgesen, 1905 taxa (Händeler & Wägele 2007).

**Discussion and conclusions**

Sea slugs are important components of marine biodiversity. However, although the Mediterranean malaco fauna is the most studied worldwide, and heterobranch taxa, for their charm, attract interest even among SCUBA divers, the knowledge of Mediterranean sea slugs is still far from complete (Gosliner et al. 2008). This seems to be also confirmed by the fact that the majority of the species newly reported from the area are straightforward to identify and have already been censused along the Italian coastline, and mostly from the Tyrrhenian Sea and the Adriatic Sea. Therefore, they presumably have a distribution wider than reported but have simply been overlooked due to the absence of focused field studies.

A different situation regards species belonging to two families dealt with here. In particular, in the Mediterranean Sea, Runcinidae have been widely studied only in the Iberian Peninsula (e.g. Cervera et al. 1991; Ballesteros et al. 2016), the French coast (e.g. Schmekel & Cappellato 2002), and the northern Adriatic Sea (e.g. Thompson 1980, 1988). The almost complete lack of data from other biogeographic areas, including the whole eastern Mediterranean, explains our two new records for Italy. This is due to the shortage of experts able to identify these tiny molluscs, and to their cryptic behaviour and small sizes, which leave them overlooked during general biodiversity studies. This again suggests that these species are presumably much commoner than what the current literature reports. Dotidae is another heterobranch clade usually neglected because of a lack of taxonomists and because of the considerable complexity of their identification. All the species found during this project represented new records for the Ionian Sea and overall the easternmost records in the Mediterranean Sea. *Doto pygmaea*, usually living in association with pelagic *Sargassum* mats, deserves a mention. Once very rare in the Mediterranean Sea, it was recorded on almost every piece of floating plastic found in the area during this study. This suggests that at least this taxon may be a real newcomer in the area, and has presumably spread farther during the last decades in the Mediterranean basin, enhanced by the increase in plastic debris (Aliani & Molcard 2003).

This study confirms that despite the long history of faunistic studies in the Mediterranean Sea and the importance given to biodiversity during the last few decades, there is still much work to be done. In addition, the present study further corroborates the usefulness of science projects involving citizen scientists, not only in early warning and monitoring of marine invasive species (Boero 2013) but also as a potential tool for ecological data collection and environmental awareness enhancement. Increasing knowledge on species distribution and phenology is fundamental for understanding the effects of climate change and human actions on ecosystems and to assess “Good Environmental Status” as the Marine Strategy Framework Directive requires. Therefore, there is an urgent need for long-term biodiversity
monitoring, observational articles and new taxonomists able to identify species and perform research on marine organisms (Giangrande 2003; Boero 2013). Inspired by the seminal work held by Salvatore Lo Bianco in the Gulf of Naples (Lo Bianco 1909), this biodiversity project represents an important addition to the knowledge of local heterobranch biodiversity, a starting point for several new studies, and, at the same time, a way to promote nature and biodiversity conservation in the Italian peninsula and the Mediterranean Sea.

Acknowledgements

This work was possible thanks to the availability of Avamposto MARE, a marine laboratory founded within the territorial cooperation project BIG (Greece–Italy 2007–2013). Samplings were made by two of the authors (V.M. and F.S.) in collaboration with “Itinirismo Anime Sante” (Daniele Cazzato, Francesco Cazzato and Rocco Cazzato), “Deep Water Divers” (Salvatore Bortone and Anna Rita Chiuri), and the young marine biologists from the primary school, Lucio and Giulio. Olivier Vangheluwe (France), Jade Sourisse (France), Anna Beri (Italy) and Jessica de Felice (Italy) contributed to the samplings during their internships at Avamposto MARE. Riccardo Cattaneo-Vietti (Italy), Saul Ciriaco (Italy), Cinzia Gravili (Italy), Jakov Prkic (Croatia), Diego Poloniatò (Italy), Carissa Shipman (USA), and Egidio Trainito (Italy) offered various forms of support. The Italian Zoological Union (U.Z.I.) and the Scientific Committee for the Italian Fauna (C.S.F.I.) supported the project through a prize for the best poster on the Italian Fauna at the First National Joint Conference of the Italian Society of Ecology (S.I.E.), Italian Zoological Union (U.Z.I.), and Italian Society of Biogeography (S.I.B.).

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The project “Biodiversity MARE Tricase” (www.biodiversitymaretricase.org) was partially funded by the PADI Foundation grant 2017.

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References

Aliani S, Molcard A. 2003. Hitch-hiking on floating marine debris: Macrobenthic species in the Western Mediterranean Sea. Hydrobiologia 503:59–67. DOI:10.1007/s10759-002-0276-6 8.
Ballesteros M, Madrenas E, Pontes M. 2012–2018. Ectocoryx viridis. Available: http://opistobranquios.info/en/ITuQT. Accessed Jan 2018 12.
Ballesteros M, Madrenas E, Pontes M. 2016. Actualización del catálogo de los moluscos opistobranquios (Gastropoda: Heterobranchia) de las costas catalanas. Spera 6:1–28. [In Spanish.]
Barash A, Danin Z. 1972. Opistobranchia (Mollusca) from the Mediterranean waters of Israel. Israel Journal of Zoology 20:151–200. DOI:10.1080/002122120.1971.10688332.
Bergh L.S. 1871. Beitrage zur kenntnis der Mollusken des Sargassomeeres. Verhandlungen der Kaiserlich-königlichen Zoolo­gisch-botanisch Gesellschaft in Wien 21:1273–1306. [In German.]
Betti F, Bava S, Cattaneo-Vietti R. 2017. Composition and seasonality of a heterobranch assemblage in a sublittoral, unconsolidated, wave-disturbed community in the Mediterranean Sea. Journal of Molluscan Studies 83:325–332. DOI:10.1093/mollus/eye019.
Betti F, Cattaneo-Vietti R, Bava S. 2015. First records from the Ligurian Sea of the cold water species Okenia aspersa and Doto koenemacher (Gastropoda: Nudibranchia). Marine Biodiversity Records 8:1–5. DOI:10.1017/S1755267215000846.
Boero F. 2013. Observational articles: A tool to reconstruct ecological history based on chronicling unusual events. F1000Research 2:168. DOI:10.12688/f1000research.2-168.v1.
Boero F, Brozzi L, Gibbons MJ, Piraino S, Zampardi S. 2016. Impacts and effects of ocean warming on jellyfish. In: Laffoley D, Baxter JM, editors. Explaining ocean warming: causes, scale, effects and consequences. Full report. Gland, Switzerland: IUCN. pp. 213–237.
Boero F, Krabberg AC, Krause G, Wiltshire KH. 2015. Time is an affliction: Why ecology cannot be as predictive ad physics and why it needs time series. Journal of Sea Research 101:12–18. DOI:10.1016/j.seares.2014.07.008.
Bouchet P, Rocroi JP, Hausdorf B, Kaim A, Kano Y, Nützel A, Ballesteros M, García-Gómez JC, Megina C. 2004. An annotated and updated checklist of the opisthobranchs (Mollusca: Gastropoda) from Spain and Portugal (including islands and archipelagos). Boletín Instituto Español de Oceanografía 20:129–122.
Cachia C, Mifsud C, Sammut PM. 2001. The marine Mollusca of the Maltese Islands: sub-class Prosobranchia to sub-class Pulmonata, order Basommatophora. Kerkwerve: Backhuys Publishers.
Cattaneo-Vietti R, Chemello R, Giannuzzi-Savelli R. 1990. Atlas of mediterranean nudibranchs. Rome: La Conchiglia.
Cattaneo-Vietti R, Giovinc F. 2008. Opistobranchia. Biologia Marina Mediterranea 15:279–295.
Cervera JL, Calado G, Gavia C, Malaquias MAE, Templado J, Ballesteros M, Garcia-Gómez JC, Megina C. 2004. An annotated and updated checklist of the opisthobranchs (Mollusca: Gastropoda) from Spain and Portugal (including islands and archipelagos). Boletín Instituto Español de Oceanografía 20:1–122.
Cervera JL, García-Gómez JC, García FJ. 1991. The Genus Runcina Forbes and Hanley, 1851 (Opistobranchia: Cephalaspidea) in the Strait of Gibraltar, with the description of a new species from the Bay of Algeciras. Journal of Molluscan Studies 57:199–208. DOI:10.1093/mollus/57.Supplement_Part_4.199.
Ciriaco S, Poloniatò D. 2016. Guida illustrata dei nudibranchi del golfo di Trieste. Roma: Pandion Edizioni. [In Italian.]
Coll M, Piroddi C, Steenbeck J, Kaschner K, Lasram FBR, Aguzzi J, Ballesteros E, Bianchi CN, Corbera J, Dalinias T, Danovaro R, Estrada M, Foglia C, Galil BS, Gasol JM, Gertwagen R, Gil J, Guilhaumon F, Kesner-Reyes K, Kitsos MS, Koukouras A, Lampadarious N, Laxamana E, López-Pé de la Cuadra CM, Lotez HK, Martin D, Mouillot D, Oro D, Raicevich S, Rius-Barile J, Saíz-Salinas JI, San Vicente C, Somot S, Templado J, Turon X, Vafidis D, Villanueva R, Voultsiadiou E. 2010. The biodiversity of the Mediterranean Sea: Estimates, patterns, and threats. PLoS One 5:11842. DOI:10.1371/journal.pone.0011842.

Correa M, Toll L, Ballesteros M 2012. Las especies de Rumina (Opisthobranchia: Ruminacea) del litoral catalán, XVII Iberian Symposium of Marine Biology Studies (SIEBM), 11–14 September, Donostia-San Sebastián. [In Spanish.]

Crocetta F, Poursanidis D, Tringali LP. 2015. Biodiversity of sea slugs and shelled relatives (Mollusca: Gastropoda) of the Cretan Archipelago (Greece), with taxonomic remarks on selected species. Quaternary International 390:56–68. DOI:10.1016/j.quaint.2015.02.061.

EU Marine Strategy Framework Directive. 2008. Marine strategy framework directive: Directive 2008/56/EC of the European parliament and of the council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy. Official Journal of the European Union 164:19–40.

European Citizen Science Association. 2015. Ten principles of citizen science. Available: https://ecsa.citizen-science.net/docs/ Accessed Mar 2015 12.

Furfaro G, Mariottini P. 2016. Check-list of the Nudibranchs (Mollusca: Gastropoda) from the Ionian Sea: Estimates, patterns, and threats. PLoS One 5:11842. DOI:10.1371/journal.pone.0011842.

Hughes L. 2000. Biological consequences of global warming: Is the signal already apparent? Trends in Ecology & Evolution 15:56–61. DOI:10.1016/S0169-5347(99)01764-4.

Klussmann-Kolb A. 2004. Phylogeny of the Aplysiidae (Gastropoda, Opisthobranchia) with new aspects of the evolution of sea slugs. Zoologica Scripta 33:439–462. DOI:10.1111/j.0300-3254.2004.00158.x.

Koutsoubas D, Koukouras A. 1993. An account of our knowledge on the opisthobranch mollusc fauna of the Aegean Sea. Bolletino Malacologico 29:191–200.

Lipej L, Dobracj Ž, Matvič B, Šamu S, Alajbegović S. 2008. Opisthobranch molluscs (Mollusca: Gastropoda) from Slovenian coastal waters (northern Adriatic). Annales, Series Historia Naturalis 18:213–226.

Lo Bianco S. 1909. Notizie biologiche riguardanti specialmente il periodo di maturità sessuale degli animali del golfo di Napoli. Pubblicazioni della Stazione Zoologica di Napoli 19:513–692. [In Italian.]

Macalí A, Conde A, Smiriglio C, Mariottini P, Crocetta F. 2013. The evolution of the Molluscan biota of Sabaudia Lake: A matter of human history. Scientia Marina 77:649–662. DOI:10.3989/scimar.03858.05M.

Martin A, Ros J. 1991. Presence of intracellular zooxanthellae in Mediterranean nudibranchs. Journal of Molluscan Studies 57:87–101. DOI:10.1093/mollus/57.Supplement_Part.4.87.

Mazzarelli G. 1894. Ricerche sulle Peltidae del Golfo di Napoli. Atti della Reale Accademia delle scienze fisiche e matematiche di Napoli 6:1–18. [In Italian.]

McDonald GR, Nybakken JW. 1997. List of the worldwide food habits of nudibranchs. Veliger 40:157–159.

Miens HK. 2015. On the phylogeny of Sacoglossa and a compilation of their food organisms. Bonner zoologische Beiträge 55:231–462. DOI:10.1002/aqc.584.

Runcina D, Villanueva R, Pujals A, Riesgo A, Ballesteros M 2014. Estudio faunístico, taxonomico, ecológico y ecología de las especies del género Doto (Mollusca: Nudibranchia) del litoral catalán, XVII Iberian Symposium of Marine Biology Studies (SIEBM), 11–14 September, Donostia-San Sebastián. [In Spanish.]

Ortea J, Moro L, Espinosa J. 1997. El género Doto Oken, 1815 (Mollusca: Nudibranchia) en las Islas Canarias y de Cabo Verde. Avicennia 6:125–136. [In Spanish.]

Ortega S, Alajbegović D, Villanueva R, Pujals A, Riesgo A, Ballesteros M 2014. Estudio faunístico, taxonomico, ecológico y ecología de las especies del género Doto (Mollusca: Nudibranchia) del litoral catalán, XVII Iberian Symposium of Marine Biology Studies (SIEBM), 11–14 September, Donostia-San Sebastián. [In Spanish.]

Ortega S, Alajbegović D, Villanueva R, Pujals A, Riesgo A, Ballesteros M 2014. Estudio faunístico, taxonomico, ecológico y ecología de las especies del género Doto (Mollusca: Nudibranchia) del litoral catalán, XVII Iberian Symposium of Marine Biology Studies (SIEBM), 11–14 September, Donostia-San Sebastián. [In Spanish.]

Ortega S, Alajbegović D, Villanueva R, Pujals A, Riesgo A, Ballesteros M 2014. Estudio faunístico, taxonomico, ecológico y ecología de las especies del género Doto (Mollusca: Nudibranchia) del litoral catalán, XVII Iberian Symposium of Marine Biology Studies (SIEBM), 11–14 September, Donostia-San Sebastián. [In Spanish.]

Perrone AS. 1983. Opistobranchi (Aplysiomorpha, Pleurobrancomorpha, Sacoglossa, Nudibranchia) del litoral salentino (Mar Jonio) (Elenco - contributo primo). Thalassia Salentina 13:67–116. DOI:10.1285/i15910725v23p67. [In Italian.]

Perrone AS. 1985. Report on the biological survey of the Amendolara seamount: Nudibranchia of Amendolara seamount. Journal of Molluscan Studies 51:102. DOI:10.1093/mollus/jeo065877.

Perrone AS. 1986. Opistobranchi (Aplysiomorpha, Pleurobrancomorpha, Sacoglossa, Nudibranchia) del litoral salentino (Mar Jonio) (Elenco - contributo primo). Thalassia Salentina 13:11–144. [In Italian.]

Perrone AS. 1986. Opistobranchi (Aplysiomorpha, Pleurobrancomorpha, Sacoglossa, Nudibranchia) del litoral salentino (Mar Jonio) (Elenco - contributo primo). Thalassia Salentina 13:11–144. [In Italian.]

Perrone AS. 1986. Opistobranchi (Aplysiomorpha, Pleurobrancomorpha, Sacoglossa, Nudibranchia) del litoral salentino (Mar Jonio) (Elenco - contributo primo). Thalassia Salentina 13:11–144. [In Italian.]

Perrone AS. 1986. Opistobranchi (Aplysiomorpha, Pleurobrancomorpha, Sacoglossa, Nudibranchia) del litoral salentino (Mar Jonio) (Elenco - contributo primo). Thalassia Salentina 13:11–144. [In Italian.]

Perrone AS. 1986. Opistobranchi (Aplysiomorpha, Pleurobrancomorpha, Sacoglossa, Nudibranchia) del litoral salentino (Mar Jonio) (Elenco - contributo primo). Thalassia Salentina 13:11–144. [In Italian.]

Pujals A, Riesgo A, Ballesteros M 2014. Estudio faunístico, filogénético y filogeográfico de las especies del género Doto Oken, 1815 (Gastropoda, Heterobranchia, Nudibranchia) del litoral catalán, XVIII Simposio Ibérico de Estudios de Biología Marina (SIEBM), 2–5 September, Gijón. [In Spanish.]

Quattrefages ILA. 1844. Sur les Gasteropodes Phlébentériés (Phlebenterata Nob.), ordre nouveau de la classe des Gastéropodes, proposé d’après l’examen anatomique et physiologiques genres Zéphyrine (Zéphyrina Nob.), Actéon (Acteōn Oken), Actéonie (Actéonie Nob.), Amphorine (Amphorina Nob.), Pavois (Pala Nob.), Chalide (Chalidē Nob.). Annales des Sciences Naturelles 1:129–183. [In French.]

V. Micaroni et al.
Rivetti I, Fraschetti S, Lionello P, Zambianchi E, Boero F. 2014. Global warming and mass mortalities of benthic invertebrates in the Mediterranean Sea. PLoS ONE 9:e115655. DOI:10.1371/journal.pone.0115655.

Rudman WB. 1999. Runcina ornata (Quatrefages, 1844). Available: http://www.seaslugforum.net/factsheet/runcorna. Accessed Feb 2018 12.

Rudman WB. 2003. Ercolania viridis (A. Costa, 1866). Available: http://www.seaslugforum.net/factsheet/ercoviri. Accessed Feb 2018 12.

Sabelli B, Taviani M. 2014. The making of the mediterranean Molluscan biodiversity. In: Goffredo S, Dubinsky Z, editors. The Mediterranean sea. Dordrecht: Springer. pp. 285–306. DOI:10.1007/978-94-007-6704-1_16.

Sammut C, Perrone AS. 1998. A preliminary check-list of Opisthobranchia (Mollusca, Gastropoda) from the Maltese Islands. Basteria 62:221–240.

Sandifer PA, Sutton-Grier AE, Ward BP. 2015. Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. Ecosystem Services 12:1–15. DOI:10.1016/j.ecoser.2014.12.007.

Schmekel L, Cappellato D. 2002. Contributions to the Runcinidae, II: Three new species and comparative studies on five established species of Runcina (Opisthobranchia Cephalaspidea) in the Mediterranean. Vie Milieu 52:86–102.

Schmekel L, Portmann A. 1982. Opisthobranchia des Mittelmeeres. Berlin: Springer.

Sordi M, Jöger KM, Klussmann-Kolb A, Wilson NG. 2011. Bye bye “Opisthobranchia”? A review on the contribution of mesophasmic sea slugs to euteuthyneuran systematics. Thalassas 27:101–112.

Son MO. 2010. Alien mollusks within the territory of Ukraine: Sources and directions of invasions. Russian Journal of Biological Invasions 3:39–44. DOI:10.1134/S207511710010008X.

Sordi M, Majidi P. 1956. Osservazioni sui Nudibranchi e gli Ascosagossi (Gastropodi Opistobranchi) del litorale Livornese. Bolletino di Pesca, Piscicoltura e Idrobiologia 1:37–40. [In Italian.]

Swennen C. 1961. Data on distribution, reproduction and ecology of the nudibranchiate molluscs occurring in the Netherlands. Netherlands Journal of Sea Research 1:191–240. DOI:10.1016/0077-7579(61)90005-9.

Swennen C, Dekker R. 1987. De Nederlandse Zeenaatsklakken (Gastropoda Opisthobranchia: Sacoglossa en Nudibranchia). Wetenschappelijke Mededelingen Koninklijke Nederlandse Natuurhistorische Vereniging 183:1–52. [In German.]

Thiede J, Aksnes D, Bathmann U, Betti M, Boero F, Boxshall G, Cury P, Dowell M, Emmerson R, Estrada M, Fine M, Grigelis A, Herman P, Herndl G, Kuparinen J, Martinsohn JT, Prüsil O, Serrão Santos R, Soomere T, Synolakis C. 2016. Marine Sustainability in an age of changing oceans and seas. EASAC policy report 28. Luxembourg: Publications Office of the European Union. Available: http://www.interacademies.net/File.aspx?id=29455. Accessed Feb 2018 12.

Thompson TE. 1980. New species of the Bullomorph genus Runcina from the Northern Adriatic Sea. Journal of Molluscan Studies 46:154–157. DOI:10.1093/oxfordjournals.mollus.a065528.

Thompson TE, Brodie G. 1988. Eastern Mediterranean Opisthobranchia: Runcinidae (Runcinacea), with a review of runcinid classification and a description of a new species from Fiji. Journal of Molluscan Studies 54:339–346. DOI:10.1093/mollus/54.3.339.

Todd CD. 1981. The ecology of nudibranch molluscs. Oceanography & Marine Biology Annual Review 19:141–234.

Trainito E, Doneddu M. 2014. Nudibranchi del Mediterraneo. Milan: Edizione Il Castello. [In Italian.]

Trainito E, Doneddu M. 2015. Contribution to the knowledge of the Molluscan fauna in the marine protected area Tavolara-Punta Coda Cavallo: Ordo Nudibranchia. Bollettino Malacologico 51:54–70.

Trickey JS, Thiel M, Waters JM. 2016. Transoceanic dispersal and cryptic diversity in a cosmopolitan rafting nudibranch. Invertebrate Systematics 30:290–301. DOI:10.1071/is15052.

Trinchese S. 1872. Un nuovo genere della famiglia degli eolidei Cephalaspidea) in the Mediterranean. Vie Milieu 52:86–102.

Trinchese S. 1881. Aeolidiae et famiglie affini del Porto di Genova. Part 2. Anatomia, Fisiologia, Embriologia delle Phyllolobranchiades, Hermaeidae, Aeolidiae, Proconotonitidae, Dotonidae del Porto di Genova. Memorie della Classe di scienze fisiche, matematiche e naturali 3:1–142. [In Italian.]

Vanhaelen A, Massin C, Martin J, Laffargue P. 2014. Kaloplocamus ramosus (Cantraine, 1835) (Gastropoda: Polyceridae): New records in the Bay of Biscay, with notes on distribution and food. Iberus 32:53–64.

Vazzana A. 2010. La malacofauna del circalitorale di Scilla (Stretto di Messina). Bollettino Malacologico 46:65–74. [In Italian.]

Visser ME, Both C. 2005. Shifts in phylogeny due to global climate change: The need for a yardstick. Proceedings of the Royal Society of London B: Biological Sciences 272:2561–2569. DOI:10.1098/rspb.2005.3356.

Vitali D, Giacolbe S, Spinelli A, De Matteo S, Cervera L. 2016. “Opisthobranch” (mollusks) inventory of the Faro Lake: A Sicilian biodiversity hot spot. Italian.

Wägele H, Klussmann-Kolb A, Verbeek E, Schrödl M. 2014. Flashback and foreshadowing—A review of the taxonomy Opisthobranchia. Organisms Diversity and Evolution 14:133–149. DOI:10.1007/s13127-013-0151-5.

WoRMS Editorial Board. 2017. World register of marine species. Available: http://www.marinespecies.org. Accessed Feb 2018 12. DOI: 10.14284/170.

Zenetos A, Mačić V, Jaklin A, Lipej L, Poursanidis D, Cattaneo-Vietti R, Beqiraj S, Betti F, Poloniato D, Kashta L, Katsanevakis S, Crocetta F. 2016. Adriatic ‘opisthobranchs’ (Gastropoda, Heterobranchia): Shedding light on biodiversity issues. Marine Ecology 37:1239–1255. DOI:10.1111/mec3.12306.