

Article

# Crustacea Decapoda from the Rhodes Island Area (Eastern Mediterranean): New Records and an Updated Checklist

Gerasimos Kondylatos <sup>1,\*</sup>, Fabio Crocetta <sup>2,\*</sup>, Maria Corsini-Foka <sup>1</sup> and Carlo Frogliã <sup>3</sup>

<sup>1</sup> Hellenic Centre for Marine Research, Hydrobiological Station of Rhodes, Cos Street, GR-85100 Rhodes, Greece; mcorsini@hcmr.gr

<sup>2</sup> Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, I-80121 Naples, Italy

<sup>3</sup> C.N.R.—Institute for the Biological Resources and Marine Biotechnologies (IRBIM), Largo Fiera della Pesca, I-60125 Ancona, Italy; c.frogliã@alice.it

\* Correspondence: gkondylatos@hcmr.gr (G.K.); fabio.crocetta@szn.it (F.C.); Tel.: +30-224-107-8320

Received: 22 May 2020; Accepted: 10 June 2020; Published: 15 June 2020

**Abstract:** Decapod crustaceans are ecologically and commercially important members of marine communities. Faunal surveys constitute essential tools for the understanding of local diversity, especially in areas subjected to significant alterations of community composition due to climate changes, anthropogenic impacts, and biological invasions. Following a literature review and the study of new samples, we hereby update on the Crustacea Decapoda from the Rhodes Island area (Greece), situated in a key position in the eastern Mediterranean Sea. Published data yielded records of 120 species, whereas 28 taxa are recorded here for the first time from the study area. Among them, the collection of *Liocarcinus bolivari* widens its distribution to the eastern Mediterranean. Details on material examined and distributional/faunal remarks are provided for the species newly recorded and for some other native and alien species rarely reported from Rhodes. The present paper raises the local decapod biodiversity to 148 species, accounting for ~50% of the Hellenic Aegean decapod fauna and provides a useful baseline for analysing the long-term changes in the local fauna and the westward spreading of Lessepsian species. Despite present advances, the lack of records of many common Mediterranean species may be still due to limited fieldwork in some habitats rather than a true absence.

**Keywords:** Decapoda; biodiversity; distribution; native and alien species; *Liocarcinus bolivari*; Aegean Sea

---

## 1. Introduction

Decapod crustaceans are one of the most important groups in the marine ecosystem, not only from a biodiversity point of view, but also as fishery resources [1]. Despite of that, knowledge of decapods diversity and distribution, even in a “well-known” basin such as the Mediterranean Sea, is still an ongoing process. Moreover, in habitats diversified and heavily affected by biological invasions, faunal surveys are not only essential for improving knowledge of the local diversity, but also constitute an useful baseline for analysing long-term changes in the composition and functioning of the biota, and eventual biodiversity loss [2].

In fact, the warming of the Mediterranean Sea, and in particular of its eastern part [3–5], the temporary changes in the south Aegean water mass characteristics, that have considerably influenced the thermohaline circulation of the eastern Mediterranean (Eastern Mediterranean Transient) [6,7],

along with anthropogenic impacts and biological invasions, considerably affect the distribution of marine organisms and their communities' structure and function both at a basin and at a local scale [8,9].

Rhodes is an island located in the southeastern Aegean Sea, close to the northwestern Levant Sea. The position of the island is interesting from the oceanographical and biological point of view, due to the intense hydrological phenomena of the surrounding marine area, such as the Rhodes gyre and the Asia Minor Current, while its pelagic and subtropical marine environment is favorable to the native thermophilic biota and to the tropical or subtropical alien biota as well [10,11].

This key position led to a flourishing of zoological studies, and the knowledge on the decapod crustacean diversity along the coasts of Rhodes Island has been the subject of several studies in the recent decades. In the first decapods checklist for the area, Lewinsohn [12], listed 45 marine species including those reported in previous literature. The local checklist was subsequently updated to 83 species by Kevrekidis & Galil [13], and lastly to 109 species by Corsini-Foka and Pancucci-Papadopoulou [14]. Since then, additional single species records were reported by various researchers as a result of intensification of biological surveys on previously undersampled habitats and of increasing interest and contribution of citizen scientists in observing and recording species (e.g., [15–18]). These last contributions raised the final list to 120 species.

Notwithstanding the efforts mentioned above, these numbers suggest that local biodiversity is still underexplored. We hereby update the current knowledge of the Rhodian decapod biota based on published literature and the study of new samples and provide new information on decapod distribution in the Aegean and the eastern Mediterranean Sea. Data reported on alien and native species rarely recorded in the area may assist in the overall assessment of the Hellenic and eastern Mediterranean biodiversity.

## 2. Materials and Methods

### 2.1. Study Area

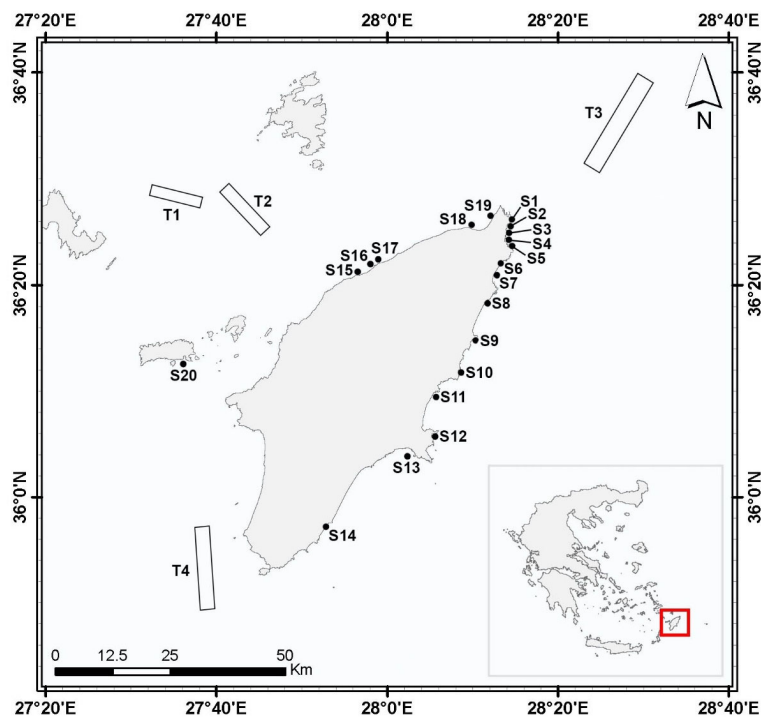
The sea floor of Rhodes presents a very narrow continental shelf, with coastal areas characterized by a variety of intermingling substrates, spanning from sands and muds with or without *Posidonia oceanica* (Linnaeus) Delile patches or meadows to pebbly and rocky bottoms [19]. Greater depths are characterized by muddy substrates, and presence of several submarine canyons [19]. In the last decades, the area has been widely colonized by alien species (e.g., [20,21]).

### 2.2. Sampling

The material analysed here came from 20 sampling sites widely distributed along the Rhodes coastline and four trawling grounds (Table 1; Figure 1). Sampling areas were either chosen by us according to their proximity to the Hydrobiological Station of Rhodes (HSR) or according to the fishing areas exploited by local fishermen. The material was mostly obtained from May 2013 to November 2019, although it was later increased by additional samples from 2008 onwards. Samples altogether come from three different sources: (i) targeted activities carried out by the HSR; (ii) a COST Action TD1209-ALIEN Challenge held in 2014; (iii) the analysis of the by-catch of Italian commercial trawlers fishing for “red shrimps” off Rhodes. Shallow waters (0–3 m) were investigated by snorkelling, and the specimens were picked by hand or with the help of a hand net (HN). Hard and soft infralittoral grounds down to ~30 m were investigated with gill nets (GN) and trammel nets (TN) as well as with boat-seine with 8 mm mesh size in the cod-end (BS, Danish method), operated by a professional fishing vessel (length 10.8 m, engine power 53 Kw). *Posidonia oceanica* meadows down to ~20 m were sampled during night hours with an epibenthic sledge (ES), with a bag made of plankton net with 1 mm mesh size, towed from a fishing vessel (length 8.25 m, engine power 38 Kw). Sandy and muddy circalittoral bottoms (~80–200 m) were investigated only with shrimp traps (ST) (diameter 60–70 cm, mesh opening 20 mm), deployed by a fishing vessel (length 9 m, engine power 18.6 Kw). Finally, bathyal samples (~600–750 m) were obtained from Italian commercial bottom trawlers (BT), fishing with otter-board trawl nets with 50 mm mesh opening in the cod-end.

**Table 1.** Sampling sites and trawling grounds shown in Figure 1, with coordinates (rounded to degrees and minutes) and depth range (in meters).

|     | Sites           | Coordinates       | Depth Range |
|-----|-----------------|-------------------|-------------|
| S1  | Mandraki Marina | 36°26' N–28°14' E | 1–2         |
| S2  | Zefiros         | 36°25' N–28°14' E | 0.5–21      |
| S3  | Karakonero      | 36°25' N–28°14' E | 0–1         |
| S4  | Aghia Marina    | 36°24' N–28°13' E | 5–20        |
| S5  | Kalitheia       | 36°24' N–28°14' E | 14–20       |
| S6  | Faliraki beach  | 36°22' N–28°13' E | Tidal       |
| S7  | Faliraki        | 36°20' N–28°13' E | 0.5–30      |
| S8  | Afandou Bay     | 36°18' N–28°12' E | 130–187     |
| S9  | Kolimbia        | 36°15' N–28°10' E | 1           |
| S10 | Stegna          | 36°11' N–28°08' E | 20          |
| S11 | Haraki          | 36°09' N–28°06' E | 80–150      |
| S12 | Lindos Bay      | 36°05' N–28°05' E | 0.5–15      |
| S13 | Pefki           | 36°04' N–28°02' E | 8–20        |
| S14 | Aghios Georgios | 35°57' N–27°53' E | 0           |
| S15 | Kalavarda       | 36°21' N–27°56' E | 8–20        |
| S16 | Fanes           | 36°22' N–27°58' E | 23          |
| S17 | Soroni          | 36°22' N–27°59' E | 10–15       |
| S18 | Ixia            | 36°26' N–28°10' E | 5–30        |
| S19 | Kritika         | 36°26' N–28°12' E | 4–11        |
| S20 | Chalki Island   | 36°12' N–27°33' E | Tidal       |
| T1  | NW of Rhodes    | 36°27' N–27°38' E | ~720        |
| T2  | NW of Rhodes    | 36°25' N–27°45' E | ~570        |
| T3  | NE of Rhodes    | 36°30' N–28°26' E | 600–650     |
| T4  | SW of Rhodes    | 35°55' N–27°35' E | 650–750     |



**Figure 1.** Study area with the location of Rhodes Island within Greece (red square). Sampling sites (S1–S20) and trawling grounds (T1–T4) as reported in Table 1.

### 2.3. Laboratory Work

Samples obtained through the first two sources were sorted out from the material collected and subsequently photographed alive. Samples obtained from commercial trawlers were frozen onboard and subsequently delivered to the authors. Following identification, specimens were sorted by sex, keeping record of the presence of ovigerous females (ov), and measured. Measurements were taken to the nearest 0.1 mm with a digital caliper or by means of an ocular micrometer under stereomicroscope. Size is given as: (i) carapace length (CL), from rear margin of orbit to mid-dorsal posterior margin of carapace in shrimps, or from front margin (tip of rostrum) to posterior margin of carapace in crabs; (ii) shield length (SL), from front margin to posterior margin of cervical groove in hermit crabs.

Species identification was based on Zariquiey Álvarez [22], or on more recent specialistic reviews (references under single species). Updated nomenclature was based on World Register of Marine Species [23]. Voucher specimens, preserved in 80% ethanol, were deposited in the collections of the Hydrobiological Station of Rhodes (HSR, Greece) and of the Museum of Natural History of Verona (MSNVR, Italy).

## 3. Results

### 3.1. New Records and Updated Checklist

We report here unpublished data for 39 taxa. Twenty-eight of them are new records for the Rhodes Island area [12–14], whereas the remaining 11 species, mainly non-indigenous, are rather common nowadays, despite the paucity of published records of their presence in the area.

Single records are briefly discussed in next section, with new records from Rhodes and alien species highlighted respectively with \* (asterisk) and (A) after the species name.

Present data raise the number of decapod species known from the area to 148, accounting for 56 families. Among the species listed here, 126 are natives (86%), whilst 22 are alien (14%), with the latter species mostly distributed in the families Portunidae (7 taxa) and Penaeidae (6 taxa).

In the updated checklist (Table 2), references for the first record of each species are also provided.

**Table 2.** Updated checklist (December 2019) of the order Decapoda Latreille, 1802 recorded from the Rhodes Island area (Greece, eastern Mediterranean) with references to first records. Alien species are marked with an (A) after the scientific name.

| Taxa  | References                                |
|---|---|
| <b>Suborder DENDROBRANCHIATA Spence Bate, 1888</b>                        |   |
| <b>Family ARISTEIDAE Wood-Mason in Wood-Mason &amp; Alcock, 1891</b>      |   |
| <i>Aristaeomorpha foliacea</i> (Risso, 1827)                              | present study                             |
| <i>Aristeus antennatus</i> (Risso, 1816)                                  | present study                             |
| <b>Family BENTHESICYMIDAE Wood-Mason in Wood-Mason &amp; Alcock, 1891</b> |   |
| <i>Gennadas elegans</i> (Smith, 1882)                                     | [24]                                      |
| <b>Family PENAEIDAE Rafinesque, 1815</b>                                  |   |
| <i>Metapenaeopsis aegyptia</i> Galil & Golani, 1990 (A)                   | [25]                                      |
| <i>Metapenaeopsis mogiensis consobrina</i> (Nobili, 1904) (A)             | [25]                                      |
| <i>Parapenaeus longirostris</i> (Lucas, 1846)                             | [13]                                      |
| <i>Penaeus aztecus</i> Ives, 1891 (A)                                     | [26]                                      |
| <i>Penaeus hathor</i> (Burkenroad, 1959) (A)                              | [27]                                      |
| <i>Penaeus kerathurus</i> (Forskål, 1775)                                 | [28] as <i>Penaeus caramote</i>           |
| <i>Penaeus pulchricaudatus</i> Stebbing, 1914 (A)                         | [29] as <i>Penaeus japonicus</i>          |
| <i>Trachysalambria palaestinensis</i> (Steinitz, 1932) (A)                | [25] as <i>Trachypenaeus curvirostris</i> |
| <b>Family SICYONIIDAE Ortmann, 1898</b>                                   |   |
| <i>Sicyonia carinata</i> (Brünnich, 1768)                                 | [13]                                      |
| <b>Family SOLENO CERIDAE Wood-Mason in Wood-Mason &amp; Alcock, 1891</b>  |   |
| <i>Solenocera membranacea</i> (Risso, 1816)                               | [13]                                      |
| <b>Family SERGESTIDAE Dana, 1852</b>                                      |   |

|   |  |
|---|--|
| <i>Robustosergia robusta</i> (Smith, 1882)            | present study                                      |
| <b>Family LUCIFERIDAE De Haan, 1849</b>               |  |
| <i>Lucifer typus</i> H. Milne Edwards, 1837           | [30] as <i>Lucifer reynaudii</i>                   |
| <hr/>   |  |
| <b>Suborder PLEOCYEMATA Burkenroad, 1963</b>          |  |
| <hr/>   |  |
| <b>Family STENOPODIDAE Claus, 1872</b>                |  |
| <i>Stenopus spinosus</i> Risso, 1827                  | [14]   |
| <b>Family PASIPHAEIDAE Dana, 1852</b>                 |  |
| <i>Pasiphaea multidentata</i> Esmark, 1866            | [24]   |
| <i>Pasiphaea sivado</i> (Risso, 1816)                 | present study                                      |
| <b>Family ACANTHEPHYRIDAE Spence Bate, 1888</b>       |  |
| <i>Acanthephyra pelagica</i> (Risso, 1816)            | [24] as <i>Acanthephyra multispina</i>             |
| <i>Acanthephyra eximia</i> Smith, 1884                | [31]   |
| <b>Family PALAEMONIDAE Rafinesque, 1815</b>           |  |
| <i>Gnathophyllum elegans</i> (Risso, 1816)            | [14]   |
| <i>Brachycarpus biunguiculatus</i> (Lucas, 1846)      | present study                                      |
| <i>Palaemon elegans</i> Rathke, 1837                  | [32] as <i>Leander squilla</i> var. <i>elegans</i> |
| <i>Palaemon serratus</i> (Pennant, 1777)              | present study                                      |
| <i>Palaemon xiphias</i> Risso, 1816                   | [12]   |
| <i>Periclimenes scriptus</i> (Risso, 1822)            | present study                                      |
| <i>Pontonia pinnophylax</i> (Otto, 1821)              | [32] as <i>Pontonia custos</i>                     |
| <b>Family ALPHEIDAE Rafinesque, 1815</b>              |  |
| <i>Alpheus dentipes</i> Guérin, 1832                  | [12]   |
| <i>Athanas nitescens</i> (Leach, 1814)                | present study                                      |
| <i>Synalpheus gambarelloides</i> (Nardo, 1847)        | [32] as <i>Synalpheus laevimanus</i>               |
| <b>Family HIPPOLYTIDAE Spence Bate, 1888</b>          |  |
| <i>Hippolyte inermis</i> Leach, 1816                  | present study                                      |
| <b>Family THORIDAE Kingsley, 1879</b>                 |  |
| <i>Eualus cranchii</i> (Leach, 1817)                  | present study                                      |
| <i>Eualus occultus</i> (Lebour, 1936)                 | present study                                      |
| <b>Family LYSMATIDAE Dana, 1852</b>                   |  |
| <i>Lysmata seticaudata</i> (Risso, 1816)              | [14]   |
| <b>Family PROCESSIDAE Ortmann, 1896</b>               |  |
| <i>Processa acutirostris</i> Nouvel & Holthuis, 1957  | [13]   |
| <i>Processa edulis</i> (Risso, 1816)                  | present study                                      |
| <i>Processa macrophthalma</i> Nouvel & Holthuis, 1957 | [13]   |
| <b>Family PANDALIDAE Haworth, 1825</b>                |  |
| <i>Plesionika edwardsii</i> (Brandt, 1851)            | [33]   |
| <i>Plesionika martia</i> (A. Milne-Edwards, 1883)     | present study                                      |
| <i>Plesionika narval</i> (Fabricius, 1787)            | [33,34]  |
| <b>Family CRANGONIDAE Haworth, 1825</b>               |  |
| <i>Aegaeon cataphractus</i> (Olivi, 1792)             | [13]   |
| <i>Philocheras fasciatus</i> (Risso, 1816)            | present study                                      |
| <i>Philocheras trispinosus</i> (Hailstone, 1853)      | present study                                      |
| <b>Family CALLIANASSIDAE Dana, 1852</b>               |  |
| <i>Callianassa subterranea</i> (Montagu, 1808)        | [35]   |
| <i>Gourretia denticulata</i> (Lutze, 1937)            | [35] as <i>Gourretia serrata</i>                   |
| <i>Pestarella candida</i> (Olivi, 1792)               | [12] as <i>Callianassa pestai</i>                  |
| <i>Pestarella tyrrhena</i> (Petagna, 1792)            | [13] as <i>Callianassa tyrrhena</i>                |
| <b>Family UPOGEBIIDAE Borradaile, 1903</b>            |  |
| <i>Gebiacantha talismani</i> (Bouvier, 1915)          | [35] as <i>Upogebia talismani</i>                  |
| <i>Upogebia deltaura</i> (Leach, 1816)                | present study                                      |
| <i>Upogebia mediterranea</i> Noël, 1992               | [36,37]  |
| <i>Upogebia pusilla</i> (Petagna, 1792)               | [13]   |
| <i>Upogebia stellata</i> (Montagu, 1808)              | [35]   |
| <i>Upogebia tipica</i> (Nardo, 1869)                  | [12]   |
| <b>Family POLYCHELIDAE Wood-Mason, 1875</b>           |  |
| <i>Polycheles typhlops</i> Heller, 1862               | present study                                      |
| <b>Family PALINURIDAE Latreille, 1802</b>             |  |

|   |   |
|---|---|
| <i>Palinurus elephas</i> (Fabricius, 1787)                          | [28] as <i>Palinurus vulgaris</i>       |
| <b>Family SCYLLARIDAE Latreille, 1825</b>                           |   |
| <i>Scyllarides latus</i> (Latreille, 1803)                          | [28]                                    |
| <i>Scyllarus arctus</i> (Linnaeus, 1758)                            | [38] as <i>Scyllarus arctos</i>         |
| <i>Scyllarus pygmaeus</i> (Bate, 1888)                              | [12]                                    |
| <b>Family DIOGENIDAE Ortmann, 1892</b>                              |   |
| <i>Calcinus tubularis</i> (Linnaeus, 1767)                          | [12] as <i>Calcinus ornatus</i>         |
| <i>Clibanarius erythropus</i> (Latreille, 1818)                     | [32] as <i>Clibanarius misanthropus</i> |
| <i>Dardanus arrosor</i> (Herbst, 1796)                              | [38] as <i>Pagurus striatus</i>         |
| <i>Dardanus calidus</i> (Risso, 1827)                               | [12] as <i>Dardanus callidus</i>        |
| <i>Diogenes pugilator</i> (Roux, 1829)                              | [12]                                    |
| <i>Paguristes eremita</i> (Linnaeus, 1767)                          | [32] as <i>Paguristes oculatus</i>      |
| <b>Family PAGURIDAE Latreille, 1802</b>                             |   |
| <i>Anapagurus bicorniger</i> A. Milne-Edwards & Bouvier, 1892       | [14]                                    |
| <i>Anapagurus breviaculeatus</i> Fenizia, 1937                      | [12] as <i>Anapagurus laevis</i>        |
| <i>Anapagurus petiti</i> Dechancé & Forest, 1962                    | [14]                                    |
| <i>Cestopagurus timidus</i> (Roux, 1830)                            | [12] as <i>Catapaguroides timidus</i>   |
| <i>Pagurus anachoretus</i> Risso, 1827                              | [12]                                    |
| <i>Pagurus cuanensis</i> Bell, 1845                                 | present study                           |
| <i>Pagurus excavatus</i> (Herbst, 1791)                             | present study                           |
| <i>Pagurus prideaux</i> Leach, 1815                                 | [12] as <i>Pagurus prideauxi</i>        |
| <b>Family GALATHEIDAE Samouelle, 1819</b>                           |   |
| <i>Galathea intermedia</i> Lilljeborg, 1851                         | [39]                                    |
| <i>Galathea machadoi</i> Barrois, 1888                              | [40]                                    |
| <i>Galathea squamifera</i> Leach, 1814                              | [32]                                    |
| <i>Galathea strigosa</i> (Linnaeus, 1761)                           | [38]                                    |
| <b>Family MUNIDIDAE Ah Yong, Baba, Macpherson &amp; Poore, 2010</b> |   |
| <i>Munida curvimana</i> A. Milne-Edwards & Bouvier, 1894            | [14]                                    |
| <b>Family PORCELLANIDAE Haworth, 1825</b>                           |   |
| <i>Pisidia bluteli</i> (Risso, 1816)                                | [12]                                    |
| <i>Porcellana platycheles</i> (Pennant, 1777)                       | [12]                                    |
| <b>Family ALBUNEIDAE Stimpson, 1858</b>                             |   |
| <i>Albunea carabus</i> (Linnaeus, 1758)                             | [15]                                    |
| <b>Family DROMIIDAE De Haan, 1833</b>                               |   |
| <i>Dromia personata</i> (Linnaeus, 1758)                            | [38] as <i>Dromia vulgaris</i>          |
| <b>Family HOMOLIDAE De Haan, 1839</b>                               |   |
| <i>Homola barbata</i> (Fabricius, 1793)                             | [13]                                    |
| <b>Family LATREILLIIDAE Stimpson, 1858</b>                          |   |
| <i>Latreillia elegans</i> Roux, 1830                                | [13]                                    |
| <b>Family ETHUSIDAE Guinot, 1977</b>                                |   |
| <i>Ethusa mascarone</i> (Herbst, 1785)                              | [13]                                    |
| <b>Family DORIPPIDAE MacLeay, 1838</b>                              |   |
| <i>Medorippe lanata</i> (Linnaeus, 1767)                            | present study                           |
| <b>Family CALAPPIDAE De Haan, 1833</b>                              |   |
| <i>Calappa granulata</i> (Linnaeus, 1758)                           | [38]                                    |
| <b>Family MATUTIDAE De Haan, 1835</b>                               |   |
| <i>Matuta victor</i> (Fabricius, 1781) (A)                          | [41]                                    |
| <b>Family LEUCOSIIDAE Samouelle, 1819</b>                           |   |
| <i>Coleusia signata</i> (Paulson, 1875) (A)                         | [42] as <i>Leucosia signata</i>         |
| <i>Iliia nucleus</i> (Linnaeus, 1758)                               | [13]                                    |
| <i>Ixa monodi</i> Holthuis & Gottlieb, 1956 (A)                     | [7]                                     |
| <i>Myra subgranulata</i> Kossmann, 1877 (A)                         | [43]                                    |
| <b>Family INACHIDAE MacLeay, 1838</b>                               |   |
| <i>Inachus communissimus</i> Rizza, 1839                            | [13]                                    |
| <i>Inachus dorsettensis</i> (Pennant, 1777)                         | [13]                                    |
| <i>Inachus leptochirus</i> Leach, 1817                              | [13]                                    |
| <i>Inachus thoracicus</i> Roux, 1830                                | [13]                                    |
| <i>Macropodia czernjawska</i> (Brandt, 1880)                        | present study                           |

|  |   |
|--|---|
| <i>Macropodia longirostris</i> (Fabricius, 1775)             | present study                               |
| <i>Macropodia rostrata</i> (Linnaeus, 1761)                  | [39]  |
| <b>Family MAJIDAE Samouelle, 1819</b>                        |   |
| <i>Eurynome aspera</i> (Pennant, 1777)                       | [39]  |
| <i>Maja crispata</i> Risso, 1827                             | [44] as <i>Maja verrucosa</i>               |
| <i>Maja squinado</i> (Herbst, 1788)                          | [38]  |
| <i>Neomaja goltziana</i> (d'Oliveira, 1888)                  | [14] as <i>Maja goltziana</i>               |
| <b>Family EPIALTIDAE MacLeay, 1838</b>                       |   |
| <i>Acanthonyx lunulatus</i> (Risso, 1816)                    | [32]  |
| <i>Herbstia condyliata</i> (Fabricius, 1787)                 | [43]  |
| <i>Lissa chiragra</i> (Fabricius, 1775)                      | [14]  |
| <i>Pisa armata</i> (Latreille, 1803)                         | [13]  |
| <i>Pisa hirticornis</i> (Herbst, 1804)                       | [12] as <i>Pisa corallina</i>               |
| <i>Pisa muscosa</i> (Linnaeus, 1758)                         | [13]  |
| <i>Pisa tetraodon</i> (Pennant, 1777)                        | [45]  |
| <b>Family PARTHENOPIDAE MacLeay, 1838</b>                    |   |
| <i>Derilambrus angulifrons</i> (Latreille, 1825)             | [14]  |
| <i>Spinolambrus macrochelos</i> (Herbst, 1790)               | [14]  |
| <b>Family PIRIMELIDAE Alcock, 1899</b>                       |   |
| <i>Pirimela denticulata</i> (Montagu, 1808)                  | present study                               |
| <b>Family CARCINIDAE MacLeay, 1838</b>                       |   |
| <i>Portumnus latipes</i> (Pennant, 1777)                     | present study                               |
| <b>Family PORTUNIDAE Rafinesque, 1815</b>                    |   |
| <i>Callinectes sapidus</i> Rathbun, 1896 (A)                 | [43,46]                                     |
| <i>Carupa tenuipes</i> Dana, 1852 (A)                        | [47]  |
| <i>Charybdis hellerii</i> (A. Milne-Edwards, 1867) (A)       | [48]  |
| <i>Charybdis (Goniohellenus) longicollis</i> Leene, 1938 (A) | [7]   |
| <i>Gonioinfradens giardi</i> (Nobili, 1905) (A)              | [49] as <i>Gonioinfradens paucidentatus</i> |
| <i>Portunus hastatus</i> (Linnaeus, 1767)                    | [38] as <i>Neptunus hastatus</i>            |
| <i>Portunus segnis</i> (Forskål, 1775) (A)                   | [50] as <i>Portunus pelagicus</i>           |
| <i>Thalamita poissonii</i> (Audouin, 1826) (A)               | [51]  |
| <b>Family POLYBIIDAE Ortmann, 1893</b>                       |   |
| <i>Bathynectes maravigna</i> (Prestandrea, 1839)             | present study                               |
| <i>Liocarcinus bolivari</i> (Zariquiey Álvarez, 1948)        | present study                               |
| <i>Liocarcinus corrugatus</i> (Pennant, 1777)                | [38] as <i>Portunus corrugatus</i>          |
| <i>Liocarcinus depurator</i> (Linnaeus, 1758)                | [38] as <i>Portunus depurator</i>           |
| <i>Liocarcinus navigator</i> (Herbst, 1794)                  | [32] as <i>Portunus arcuatus</i>            |
| <i>Liocarcinus zariquieyi</i> (Gordon, 1968)                 | [12] as <i>Macropipus zariquieyi</i>        |
| <b>Family GERYONIDAE Colosi, 1923</b>                        |   |
| <i>Chaceon mediterraneus</i> Manning & Holthuis, 1989        | [52]  |
| <i>Geryon longipes</i> A. Milne-Edwards, 1882                | present study                               |
| <b>Family PROGERYONIDAE Števcíć, 2005</b>                    |   |
| <i>Paragalene longicrura</i> (Nardo, 1869)                   | [14]  |
| <b>Family GONEPLACIDAE MacLeay, 1838</b>                     |   |
| <i>Goneplax rhomboides</i> (Linnaeus, 1758)                  | [39]  |
| <b>Family ERIPHIIDAE MacLeay, 1838</b>                       |   |
| <i>Eriphia verrucosa</i> (Forskål, 1775)                     | [44] as <i>Eriphia spinifrons</i>           |
| <b>Family XANTHIDAE MacLeay, 1838</b>                        |   |
| <i>Actaeodes tomentosus</i> (H. Milne Edwards, 1834) (A)     | [53]  |
| <i>Atergatis roseus</i> (Rüppell, 1830) (A)                  | [51]  |
| <i>Monodaesus guinotae</i> Forest, 1976                      | [13]  |
| <i>Paractaea monodi</i> Guinot, 1969                         | [14]  |
| <i>Xanthias lamarckii</i> (H. Milne Edwards, 1834) (A)       | [16]  |
| <i>Xantho granulicarpus</i> Forest in Drach & Forest, 1953   | [12]  |
| <i>Xantho poressa</i> (Olivieri, 1792)                       | [32]  |
| <b>Family PILUMNIDAE Samouelle, 1819</b>                     |   |
| <i>Pilumnus hirtellus</i> (Linnaeus, 1761)                   | [32]  |
| <i>Pilumnus villosissimus</i> (Rafinesque, 1814)             | [14]  |

|   |  |
|---|--|
| <b>Family GRAPSIDAE MacLeay, 1838</b>               |  |
| <i>Pachygrapsus marmoratus</i> (Fabricius, 1787)    | [32]                                   |
| <i>Pachygrapsus transversus</i> (Gibbes, 1850)      | present study                          |
| <i>Planes minutus</i> (Linnaeus, 1758)              | [14]                                   |
| <b>Family PERCNIDAE Štević, 2005</b>                |  |
| <i>Percnon gibbesi</i> (H. Milne Edwards, 1853) (A) | [54]                                   |
| <b>Family MACROPHTHALMIDAE Dana, 1851</b>           |  |
| <i>Macrophthalmus indicus</i> Davie, 2012 (A)       | [55] as <i>Macrophthalmus graeffei</i> |
| <b>Family OCYPODIDAE Rafinesque, 1815</b>           |  |
| <i>Ocyopode cursor</i> (Linnaeus, 1758)             | [56,57]                                |
| <b>Family PALICIDAE Bouvier, 1898</b>               |  |
| <i>Palicus caronii</i> (Roux, 1828)                 | [13]                                   |

### 3.2. Systematics of Species with Specimens Examined

#### Family ARISTEIDAE Wood-Mason in Wood-Mason & Alcock, 1891

##### *Aristaeomorpha foliacea* (Risso, 1827) \*

*Aristaeomorpha foliacea* – Zariquiey Álvarez [22]: 42, Figures 22a,b and 24a.

**Material examined:** T3, 600–650 m (BT), 8.xi.2019: 3♂ CL 32.1–38.2 mm, 6♀ CL 34.3–55.9 mm; T4, 650–750 m (BT), 19.xi.2019: 2♂ CL 30.7–31.4 mm, 3♀ CL 27.6–54.8 mm.

**Remarks:** A cosmopolitan species known from Indo-Pacific, western and eastern Atlantic, and Mediterranean [58]. This highly prized shrimp is the target of commercial trawlers fishing off Rhodes.

##### *Aristeus antennatus* (Risso, 1816) \*

*Aristeus antennatus* – Zariquiey Álvarez [22]: 46, Figures 17b, 22c,d, and 23a–c.

**Material examined:** T3, 600–650 m (BT), 8.xi.2019: 1♂ CL 29.3 mm, 9♀ CL 27–53.6 mm; T4, 650–750 m (BT), 19.xi.2019: 8♂ CL 19.1–32.2 mm, 7♀ CL 18–49.5 mm.

**Remarks:** Known from Indian Ocean, eastern Atlantic, and Mediterranean [58]. This highly prized shrimp is the target of commercial trawlers fishing off Rhodes.

#### Family PENAEIDAE Rafinesque, 1815

##### *Penaeus aztecus* Ives, 1891- (A)

*Farfantepenaeus aztecus* (Ives, 1891) – Deval et al. [59]: 1534, Figure 1.

**Material examined:** S7, 1–2 m on sand and pebbles (HN), 20.iii.2015: 1♂ CL 24.1 mm.

**Remarks:** Native from western Atlantic [60], this alien species recently spread in Mediterranean (e.g., [26,59,61,62]). First observed in Chalki Island (Rhodes Island area) in 2014 [26], it is now sold in Greek fish markets (e.g., Rhodes, Athens, and Corfu) and displayed in the HSR Aquarium.

#### Family SERGESTIDAE Dana, 1852

##### *Robustosergia robusta* (Smith, 1882) \*

*Sergestes robustus* – Zariquiey Álvarez [22]: 61, Figure 18a.

*Robustosergia robusta* – Vereshchaka et al. [63]: 22.

**Material examined:** T2, ~570 m in the mouth of *Lampanyctus crocodilus* (Risso, 1810) (BT), 29.ix.2018: 1♂ CL 15.2 mm.

**Remarks:** A mesopelagic species known from northern Atlantic and Mediterranean [64].

#### Family PASIPHAEIDAE Dana, 1852

##### *Pasiphaea multidentata* Esmark, 1866

*Pasiphaea multidentata* – Zariquiey Álvarez [22]: 73, Figures 8a, 10a and 31.

**Material examined:** T3, 600–650 m (BT), 8.xi.2019: 1♂ CL 32.9 mm, 1♀ CL 33.5 mm.

**Remarks:** Known from eastern Atlantic and Mediterranean [58]. Previously known from Rhodes area from a juvenile specimen (31 mm total length) collected by the “Thor” expedition [24].



*Pasiphaea sivado* (Risso, 1816) \*

*Pasiphaea sivado* – Zariquiey Álvarez [22]: 70, Figures 6a and 30a–d.

**Material examined:** T1, ~720 m (BT), 28.ix.2018: 2♀ CL 18.6–19.3 mm.

**Remarks:** Known from eastern Atlantic and Mediterranean [58]. On meso-bathyal grounds *Pasiphaea sivado* stay close to the bottom at daytime, when it is caught by bottom-trawlers, whereas it migrates in the upper water column at night.

## Family PALAEMONIDAE Rafinesque, 1815

*Brachycarpus biunguiculatus* (Lucas, 1846) \* - Figure 2A

*Brachycarpus biunguiculatus* – Zariquiey Álvarez [22]: 161, figures 64b and 69a.

**Material examined:** S3, 1 m on sand and rocks with algal cover, during night, 15.ix.2015: 1 specimen (not measured); S12, 0.5–4 m on hard substrate with photophilic algae, 3.xi.2016: 1 specimen (not measured).

**Remarks:** A circumtropical species known from Red Sea, Indian Ocean, eastern Pacific, eastern and western Atlantic, and Mediterranean [58]. This species is considered uncommon in the Mediterranean as it may pass unnoticed due to its behaviour, hidden in crevices or caves during daytime and mostly active at night. According to local divers, the species is present in Rhodes since at least 2010.

*Palaemon serratus* (Pennant, 1777) \*

*Palaemon serratus* – Zariquiey Álvarez [22]: 165, Figures 68a–c and 71a; González-Ortegón & Cuesta [65]: 100, Figures 1B–I, 2I and 4C,E.

**Material examined:** S7, 0.5–1 m on hard substrate (HN), 17.vi.2015: 1♀ CL 14.7 mm.

**Remarks:** Known from northeastern Atlantic, Mediterranean Sea, and Black Sea [58].

*Periclimenes scriptus* (Risso, 1822) \*

*Periclimenes scriptus* – Zariquiey Álvarez [22]: 180, figures 3a and 76a–d; Grippa & d’Udekem d’Acoz [66]: 403, Figure 2a and plate 1a.

**Material examined:** S19, 4.5–7 m (ES), 19.vi.2018: 1♀ ov. CL 4 mm.

**Remarks:** Mediterranean endemic [58].

## Family ALPHEIDAE Rafinesque, 1815

*Athanas nitescens* (Leach, 1814) \* - Figure 2B

*Athanas nitescens* – Zariquiey Álvarez [22]: 137, Figures 3d, 59a and 60.

**Material examined:** S2, 19.5–21 m (ES), 20.vi.2018: 1♀ ov. CL 3.3 mm; S19, 4.5–10 m (ES), 19.vi.2018: 1♂ and 1 unsexed, CL 2–2.1 mm.

**Remarks:** Known from eastern Atlantic, Mediterranean, and Black Sea [58].

## Family HIPPOLYTIDAE Spence Bate, 1888

*Hippolyte inermis* Leach, 1816 \* - Figure 2C

*Hippolyte inermis* – Zariquiey Álvarez [22]: 119, Figures 3b, 4d, 5c,d, 49a, 51b,c and 52f; d’Udekem d’Acoz [67]: 27, Figures 11–15.

**Material examined:** S2, 12–14.5 m (ES), 20.vi.2018: 4♀ ov. CL 2.5–2.6 mm; 19.5–21 m (ES), 20.vi.2018: 11♀ CL 2.2–5.3 mm; S5, 15–19.5 m (ES), 21.vi.2018: 2♀ ov. CL 3.1–3.3 mm; 14–17.5 m (ES), 21.vi.2018: 1♂ CL 2.8 mm, 3♀ ov. CL 3–3.5 mm; S19, 4–7.5 m (ES), 18.vi.2018: 20♀ ov. CL 2.6–5.2 mm, 4 unsexed CL 2.2–2.8 mm; 5.5–6 m (ES), 22.vi.2018: 4♀ ov. CL 2.6–4.5 mm.

**Remarks:** A common inhabitant of seagrass meadows, known from eastern Atlantic, Mediterranean, and Black Sea [58].

## Family THORIDAE Kingsley, 1879

*Eualus cranchii* (Leach, 1817) \* - Figure 2D

*Thoralus cranchii* – Zariquiey Álvarez [22]: 125, Figures 5a,b, 49d, 51a and 52c–d.

**Material examined:** S2, 12–14 m (ES), 20.vi.2018: 1♀ ov. CL 2.1 mm; 19.5–21 m (ES), 20.vi.2018: 3♀ ov. CL 1.8–2.1 mm; S5, 14–19.5 m (ES), 21.vi.2018: 2♀ ov. CL 1.9–4.0 mm; S19, 6–8 m (ES), 18.vi.2018: 2♀ ov. CL 2–2.9 mm; 4.5–8 m (ES), 19.vi.2018: 1 unsexed (broken) CL 2 mm.

**Remarks:** Known from eastern Atlantic, Mediterranean, and Marmara Sea [58].

*Eualus occultus* (Lebour, 1936) \*

*Eualus occultus* – Zariquiey Álvarez [22]: 127, Figures 4b,c, 51d and 52a,b.

**Material examined:** S19, 6–8 m (ES), 18.vi.2018: 1♀ CL 3.1 mm.

**Remarks:** Known from eastern Atlantic, Mediterranean, and Marmara Sea [58]. Identified on the presence of biarticulate palp in the mandible, lacking in *Eualus cranchii* (Leach, 1817) [22,68].

Family PANDALIDAE Haworth, 1825

*Plesionika martia* (A. Milne-Edwards, 1883) \*

*Plesionika martia* – Zariquiey Álvarez [22]: 105, Figures 36a, 38b, 39a,b and 40a–c; Crosnier & Forest [69]: 212, Figures 63d, 64c and 66a.

**Material examined:** T4, 650–750 m (BT), 19.xi.2019: 6♂ CL 17.1–20.1 mm, 4♀ CL 17.5–20 mm, 4♀ ov. 17.5–20.2 mm.

**Remarks:** A cosmopolitan species, common in the Mediterranean on mesobathyal grounds [58]. It constitutes, together with *Plesionika edwardsii* (Brandt, 1851), a significant fraction of the commercial bycatch of the bottom trawlers targeting “red shrimps” off Rhodes.

Family PROCESSIDAE Ortmann, 1896

*Processa edulis* (Risso, 1816) \*

*Processa edulis edulis* – Zariquiey Álvarez [22]: 153, Figures 65 a–g.

**Material examined:** S2, 12–14.5 m (ES), 20.vi.2018: 1♀ ov. CL 6.1 mm; S5, 14–18 m (ES), 21.vi.2018: 1♂ CL 6.1 mm, 1♀ CL 6.9 mm; S19, 6–8 m (ES), 18.vi.2018: 6♂ CL 3.3–5.4 mm, 2♀ CL 5.1 mm, 4♀ ov. CL 4.9–6.4 mm; 4.6–11 m (ES), 19.vi.2018: 1♀ 6.6 mm, 3♀ ov. CL 5.5–7.6 mm.

**Remarks:** A common inhabitant of seagrass meadows, known from eastern Atlantic, Mediterranean, and Black Sea [58]. In our samples it was found in sympatry with *Processa macrophthalma* Nouvel & Holthuis, 1957 and *Processa acutirostris* Nouvel & Holthuis, 1957.

Family CRANGONIDAE Haworth, 1825

*Philocheras fasciatus* (Risso, 1816) \*

*Philocheras fasciatus* – Zariquiey Álvarez [22]: 195, Figure 82h.

**Material examined:** S2, 19.5–21 m (ES), 20.vi.2018: 1♀ ov. CL 2.6 mm.

**Remarks:** Known from eastern Atlantic, Mediterranean, and Black Sea [58].

*Philocheras trispinosus* (Hailstone in Hailstone & Westwood, 1835) \* - Figure 2E

*Philocheras trispinosus* – Zariquiey Álvarez [22]: 197, Figure 82k.

**Material examined:** S2, 0.5 m (HN), 6.xii.2019: 2♂ CL 3.9–4.0 mm, 1♀ ov. CL 4.2 mm.

**Remarks:** Common inhabitant of mediolitoral fine sands, known from eastern Atlantic, Mediterranean, and Black Sea [58].

Family UPOGEBIIDAE Borradaile, 1903

*Upogebia deltaura* (Leach, 1816) \* - Figure 2F

*Upogebia deltaura* – Ngoc-Ho [37]: 508, Figures 26 and 27.

**Material examined:** S19, 6–8 m (ES), 18.vi.2018: 1♂ CL 4.1 mm; 5.5–6 m (ES), 22.vi.2018: 1♀ CL 5.0 mm.

**Remarks:** Known from eastern Atlantic and Mediterranean [58], although some earlier records may refer to the closely related *Upogebia mediterranea* Noël, 1992, also living in Rhodes [36]. Identified on the basis of the pleura of the first abdominal segment pointed and the third article of the antennal peduncle with a distal spine on the ventral margin (*vs* pleura with rounded margin and unarmed antennal peduncle in *U. mediterranea*) [37].

## Family POLYCHELIDAE Wood-Mason, 1875

*Polycheles typhlops* Heller, 1862 \*

*Polycheles typhlops* – Zariquiey Álvarez [22]: 209, Figure 86b; Galil [70]: 354, Figure 30.

**Material examined:** T3, 600–650 m (BT), 8.xi.2019: 1♂ CL 22.9 mm, 5♀ CL 27.5–47.7 mm.

**Remarks:** Known from bathyal grounds of all the oceans except eastern Pacific [70].

## Family PAGURIDAE Latreille, 1802

*Anapagurus breviaculeatus* Fenizia, 1937 \*

*Anapagurus breviaculeatus* – Zariquiey Álvarez [22]: 257; García-Gomez [71]: 66, Figure 20.

**Material examined:** S19, 9.0–11 m (ES), 19.vi.2018: 1♀ov. SL 1 mm.

**Remarks:** A Mediterranean species, with a single record from Atlantic northern Spain [71]. Holthuis & Gottlieb [72], regarded *Anapagurus breviaculeatus* as a junior synonym of *Anapagurus laevis* (Bell, 1845) and reported the material collected off Israel under the latter name. Lewinsohn [12], followed the previous authors and reported *A. laevis* as the only *Anapagurus* species collected from Rhodes, although highlighting that ‘trotzdem es den Merkmalen nach auch zu *A. breviaculeatus* (Fenizia, 1937) gehören konnte’ [it has the characteristics of *A. breviaculeatus*]. Both Ingle [73] and García-Gomez [71] remarked that all the eastern Mediterranean specimens previously identified as *A. laevis* that they could re-examine did not belong to that species and most of them were *A. breviaculeatus*. Based on the present material, *A. breviaculeatus* is added to the fauna of Rhodes and the early record of *A. laevis* is considered a probable misidentification.

*Pagurus cuanensis* Bell, 1845 \* - Figure 2G

*Pagurus cuanensis* – Zariquiey Álvarez [22]: 247, Figures 89d, 90a,n and 91h; Ingle [73]: 129, Figures 101–104.

**Material examined:** S2, 19.5–21 m (ES), 20.vi.2018: 2♂ SL 4.2–6.5 mm; S19, 6–8 m (ES), 18.vi.2018: 1♀ SL 3.8 mm.

**Remarks:** Known from eastern Atlantic and Mediterranean [58].

*Pagurus excavatus* (Herbst, 1791) \*

*Pagurus excavatus* – Ingle [74]: 762, Figures 4, 10, 14, 20, 48, 59 and 65; Ingle [73]: 141, Figures 113–116.

**Material examined:** S13, 150–200 m (ST), 30.x.2016: 1♂ SL 9.6 mm.

**Remarks:** Known from northeastern Atlantic and Mediterranean Sea [58].

## Family DORIPPIDAE MacLeay, 1838

*Medorippe lanata* (Linnaeus, 1767) \*

*Dorippe lanata* – Zariquiey Álvarez [22]: 312, Figures 2f, 14b, 105a,b and 106d.

*Medorippe lanata* – Manning & Holthuis [75]: 31, figures 4a–h.

**Material examined:** S11, ~100 m, muddy-sandy bottom (ST), 8.xii.2013: 1♀ CL 24.1 mm.

**Remarks:** Known from eastern Atlantic, Mediterranean, and Marmara Sea [58].

## Family INACHIDAE MacLeay, 1838

*Macropodia czernjawszkii* (Brandt, 1880) \*

*Macropodia czernjawszkii* – Zariquiey Álvarez [22]: 479, Figures 161a and 162d.

**Material examined:** S5, 15–16.5 m (ES), 21.vi.2018: 1♂ CL 5.7 mm.

**Remarks:** Known from eastern Atlantic, Mediterranean, and Black Sea [58].

*Macropodia longirostris* (Fabricius, 1775) \*

*Macropodia longirostris* – Zariquiey Álvarez [22]: 481, Figures 161d, 162c and 164a,b.

**Material examined:** S5, 14–17.5 m (ES), 21.vi.2018: 1♂ CL 22.4 mm.

**Remarks:** Known from eastern Atlantic, Mediterranean, and Black Sea [58].

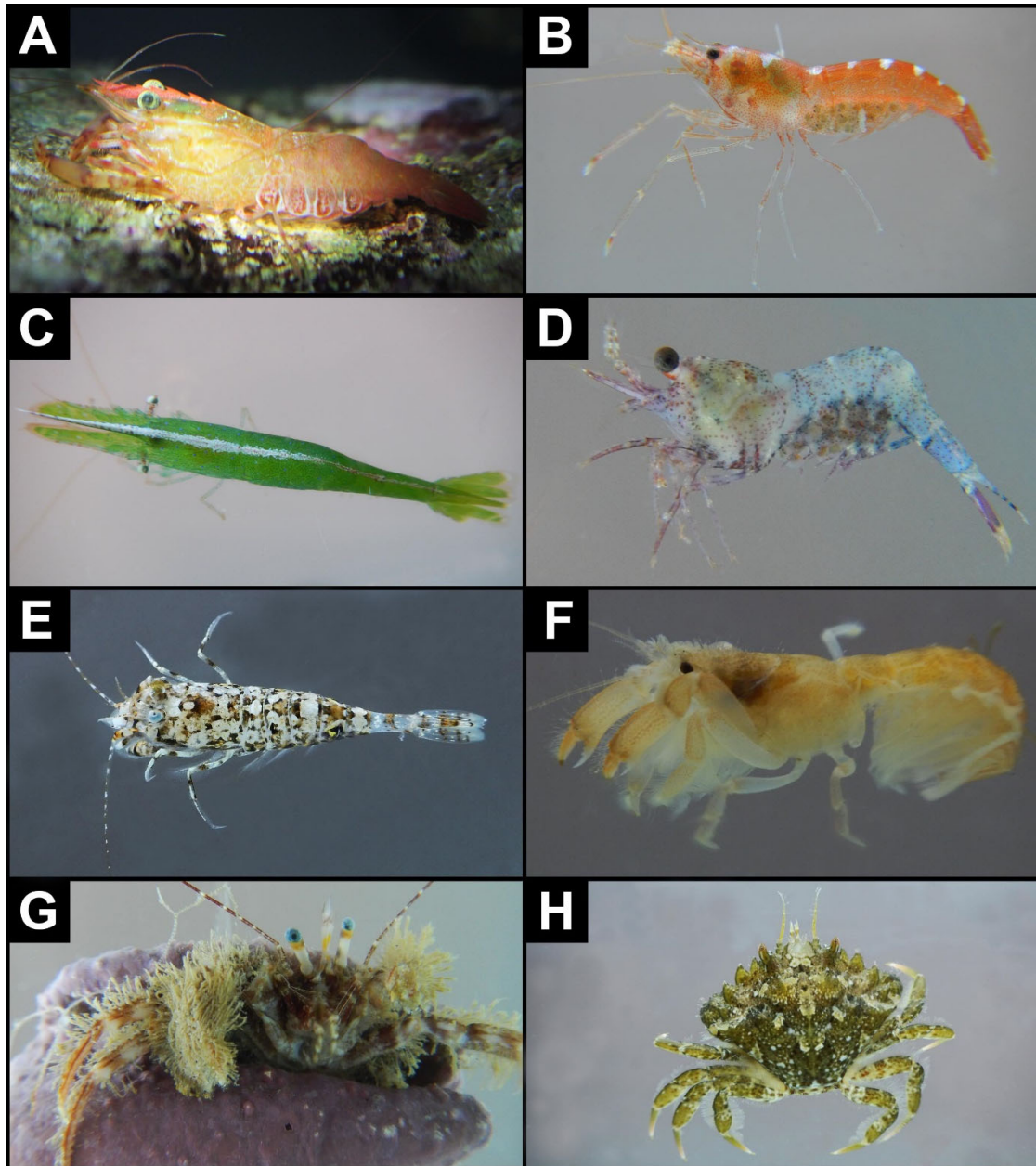
## Family PIRIMELIDAE Alcock, 1899

*Pirimela denticulata* (Montagu, 1808) \* - Figure 2H

*Pirimela denticulata* – Zariquiey Álvarez [22]: 350, Figures 7a, 11d, 112a and 113a.

**Material examined:** S2, 0.5 m among algae (HN), 23.vii.2019: 1♂ CL 13.3 mm, 1♀ CL 9.5 mm.

**Remarks:** Known from eastern Atlantic, Mediterranean, and Black Sea; recorded once from the Suez Canal [58].



**Figure 2.** Decapods from Rhodes area, in colours. (A) *Brachycarpus biunguiculatus*, not measured; (B) *Athanas nitescens*, CL 3.3 mm; (C) *Hippolyte inermis*, CL 2.6 mm; (D) *Eualus cranchii*, CL 2.1 mm; (E) *Philocheras trispinosus*, CL 4.0 mm; (F) *Upogebia deltaura*, CL 5.0 mm; (G) *Pagurus cuanensis*, SL 4.2 mm; (H) *Pirimela denticulata*, CL 13.3 mm.

#### Family CARCINIDAE MacLeay, 1838

*Portumnus latipes* (Pennant, 1777) \* - Figure 3A

*Portumnus latipes* – Forest [76]: 8, Figures 3, 4 and 6a,b, Pl II Figure 2, Pl. III Figures 2 and 4, Pl IV Figures 4 and 5; Zariquiey Álvarez [22]: 357, Figures 1f, 12h, 14c and 116a,b.

**Material examined:** S9, 1 m on sandy bottom with sparse small rocks with algal cover (HN), 14.v.2013: 1♂ CL 27.2 mm.

**Remarks:** Known from northeastern Atlantic, Mediterranean, and Black Sea [58]. Noteworthy, in a study on the distribution in Greece of *Portumnus latipes* and its congeneric species *Portunus lysianassa* (Herbst, 1796), Chartosia et al. [77] did not find any of the two species in the three sites sampled in eastern Rhodes.

#### Family PORTUNIDAE Rafinesque, 1815

##### *Carupa tenuipes* Dana, 1852 - (A) - Figure 3B

*Carupa tenuipes* – Apel & Spiridonov [78]: 172, Figure 4, Pl. 1.

**Material examined:** S7, 8–10 m in the mouth of a *Scorpaena* species (GN), 3.iv.2012: 1♀ CL 25.2 mm; 25–30 m (TN), 27.iii.2018: 1♂ CL 15.2 mm; S15, 8–10 m (TN), 29.viii.2011: 1♂ CL 12.7 mm; S18, 8–10 m (GN), 11.iv.2011: 1♀ CL 25.1 mm.

**Remarks:** Native from Indo-Pacific, including Red Sea [78], this alien species was first recorded in the Mediterranean off Israel [79] and latter collected off Rhodes [47]. It is now established all around the island on rocky substrates with algal cover.

##### *Charybdis hellerii* (A. Milne-Edwards, 1867) - (A)

*Charybdis hellerii* – Apel & Spiridonov [78]: 194, Figures 13–15 and 17.

**Material examined:** S10, 20 m on mixed bottom with sand and rocks (GN), 18.iv.2011: 1♀ CL 40.3 mm; S13, 10–15 m on mixed bottom with sand and rocks (TN), 2.xii.2010: 1♀ CL 19.9 mm; S17, 10 m on mixed bottom with sand and rocks (TN), 23.xii.2010: 2♂ CL 38.1–43.5 mm; 10–15 m on mixed bottom with sand and rocks (TN), 30.v.2013: 1♂ CL 44.9 mm.

**Remarks:** Native from Indo-Pacific, including Red Sea [78], this alien species has demonstrated a high invasive capacity, not only in the eastern Mediterranean, where it entered via the Suez Canal, but also in the western Atlantic, where it arrived with ballast waters [80]. First observed in Rhodes in 2004 [48], it is now established all around the island on rocky substrates with algal cover and is displayed in the HSR Aquarium [81].

##### *Charybdis (Goniohellenus) longicollis* Leene, 1938 - (A)

*Charybdis (Goniohellenus) longicollis* – Apel & Spiridonov [78]: 214, Figures 32 and 34.

**Material examined:** S8, 130–187 m (ST), 26.vi.2019: 1♀ CL 19.9 mm; S11, 80 m (ST), iv.2010: 1♀ ov. CL 23.2 mm; S13, 8–10 m (TN), 8.iv.2008: 1♀ CL 21.4 mm.

**Remarks:** Native from western Indian Ocean, including Red Sea [78], this alien species is now abundant off Turkey and off Israel on sandy and muddy bottoms in 30–60 m depths, although it was collected down to 250 m [82]. First observed in Rhodes in 1996 [7], the species is only known so far from scattered specimens collected over a wide bathymetric range.

##### *Gonioinfradens giardi* (Nobili, 1905) - (A) - Figure 3C

*Charybdis (Gonioinfradens) giardi* – Galil et al. [83]: 512, Figures 2, 3A–D, 4A–D, 5A and 6.

**Material examined:** S7, 8–20 m rocky bottoms with sandy patches (GN), 24.vi.2011: 2♂ CL 25.2–35.3 mm, 1♀ CL 21.2 mm, 1♀ ov. CL 23.8 mm; 16.xi.2012: 2♂ CL 39–49.9 mm; 12.xi.2014: 2♀ CL 19.8–21.3 mm; 4.iv.2017: 4♂ CL 31.3–37.9 mm, 1♀ CL 20 mm; vii.2017: 1♂ CL 40.5 mm; 8.viii.2017: 1♂ CL 35.0 mm; 3.iii.2018: 3♂ CL 28.2–36.9 mm; iv.2018: 2♂ CL 29.9–30.5 mm; S15, 8–20 m rocky bottoms with sandy patches (GN), 29.viii.2011: 1♂ CL 17.4 mm; S4, 10.vi.2011: 1♂ CL 16.2 mm.

**Remarks:** Native from western Arabian Sea, including Persian Gulf and Red Sea, this alien species recently spread in the eastern Mediterranean [83]. First recorded in the Mediterranean from Rhodes in 2010 as *Gonioinfradens paucidentatus* (A. Milne Edwards, 1861) [49], and then from other localities in the eastern Mediterranean [84,85]. More recently, Galil et al. [83], from results of molecular analysis, reinstated the validity of *Gonioinfradens giardi*, a species previously considered a junior synonym of *G. paucidentatus*, and reported it from Israel, suggesting that previous Mediterranean records of the latter species should be referred to *G. giardi*. We keep here present specimens as *G. giardi*, although this should be confirmed by molecular data as they

could not be unequivocally identified on the distinctive morphological characters illustrated in Galil et al. [83].

*Thalamita poissonii* (Audouin, 1826) - (A) - Figure 3D

*Thalamita poissonii* – Apel & Spiridonov [78]: 253, Figures 73–75.

**Material examined:** S1, 2 m (HN), 3.i.2011: 1♀ CL 9.0 mm; S3, 0–1 m (HN), 3.xi.2011: 1♂ CL 20.0 mm; S4, 5 m on rocks (HN), 9.iv.2010: 1♂ CL 13 mm; S7, 3 m (HN), 1.xii.2010: 2♂ CL 20.4–23.8 mm; 3 m (HN), 9.xii.2010: 2♂ CL 24.9–25.2 mm, 1♀ CL 21.0 mm; 1 m (HN), 15.xii.2010: 1♀ ov. CL 20.8 mm; 1 m (HN), 12.xi.2014: 1♂ CL 21.4 mm; 1 m (HN), 10.xi.2017: 1♂ CL 23.5 mm; S11, 100 m (ST), 8.xii.2013: 1♂ CL 11.2 mm, 1♀ CL 7.3 mm; S13, 100 m (ST), 2.xii.2010: 1♂ (not measured); S16, 23 m sandy-rocky bottom with vegetation (HN), 5.x.2009: 1♂ CL 15.1 mm; S18, 5–30 m in the stomach of a *Lagocephalus sceleratus* (Gmelin, 1789) (BS), 7.iii.2008: 1 carapace CL 6.3 mm; 5–30 m, sandy-muddy bottom with vegetation (BS), 10.viii.2008: 1♂ CL 19.3 mm; 5–30 m (BS), 22.i.2015: 1♀ CL 9.4 mm.

**Remarks:** Native from western Indian Ocean, including Red Sea [78], this alien species recently spread in the eastern Mediterranean (e.g., [86]). First observed in Rhodes in 2007 [51], it is now locally established, used as bait for fishing rod, and commonly displayed in the HSR Aquarium [81].

Family POLYBIIDAE Ortmann, 1893

*Bathynectes maravigna* (Prestandrea, 1839) \* Figure 3E,F

*Bathynectes superbus* – Zariquiey Álvarez [22]: 382, Figure 127g.

*Bathynectes maravigna* – Deval & Froglija [87]: 328, Figure 3(left).

**Material examined:** T3, 600–650 m, 8.xi.2019: 1♀ CL 26.5 mm; T4, 650–750 m, 19.xi.2019: 5♂ CL 17.5–42.2 mm, 4♀ CL 18.2–28.0 mm, 1♀ ov. 26.7 mm.

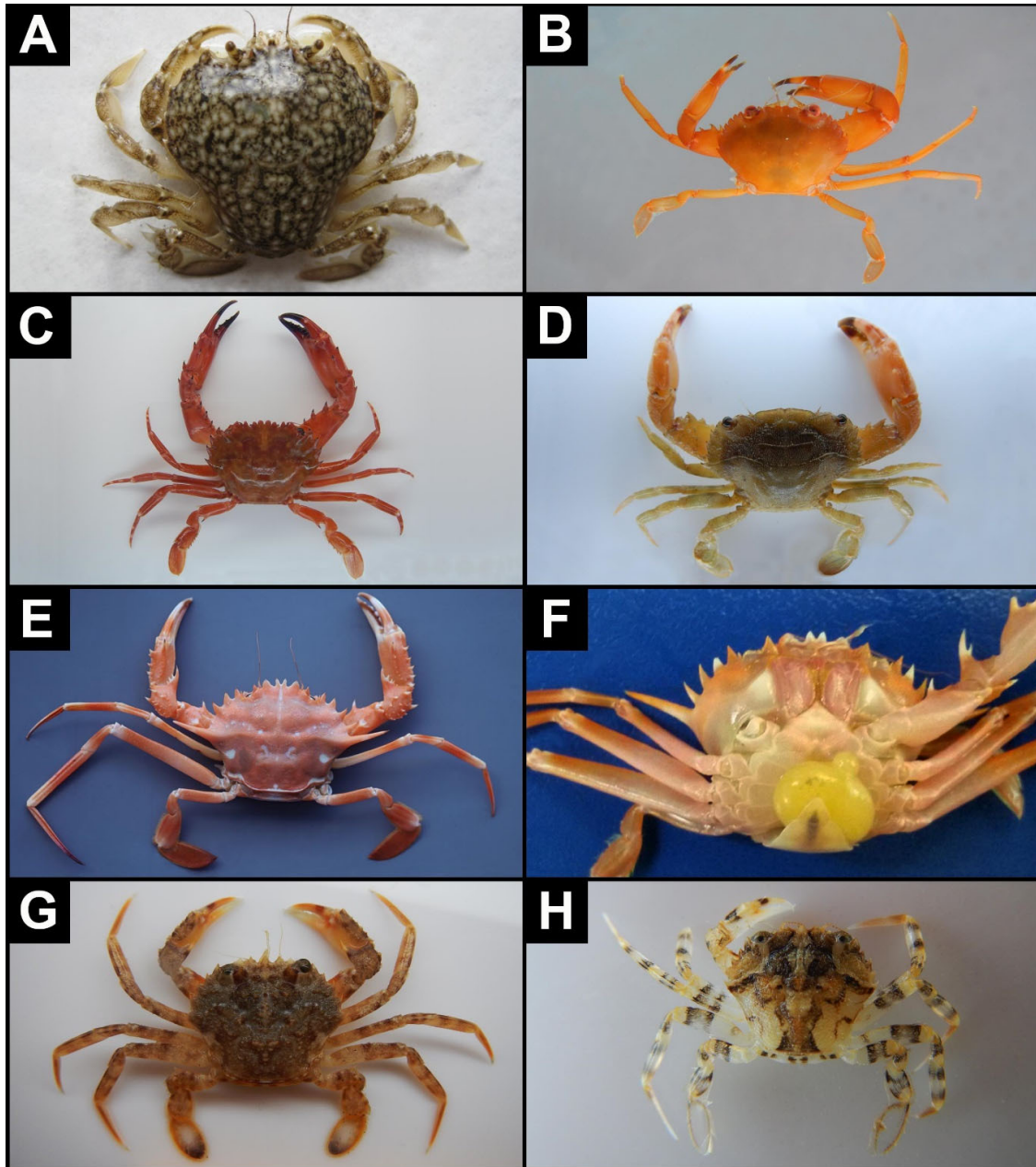
**Remarks:** Known from eastern Atlantic and Mediterranean Sea [58]. Two females examined here (CL 19 mm, the other smashed) were parasitized by *Sacculina* (see figure 3F). Øksnebjerg [88], reported one specimen of *B. maravigna* from eastern Ionian Sea parasitized by *Sacculina carcini* Thompson, 1836. However, Polybiidae hosting *S. carcini* usually occur on shallow grounds in depths of less than 50 m, whereas *B. maravigna* is restricted to bathyal grounds, from 300 to 1000 m. Moreover, the present externae (4.6 and 4.8 mm in size) have the mantle opening placed at the top of a rather long papilla, less developed in *S. carcini* [88] (front-cover), and thus we suspect that these specimens do not belong to *S. carcini*.

*Liocarcinus bolivari* (Zariquiey Álvarez, 1948) \* - Figure 3G,H

*Macropipus bolivari* – Zariquiey Álvarez [22]: 375, Figure 127a,b.

**Material examined:** S5, 14–17.5 m (ES), 21.vi.2018: 1♂ CL 8.6 mm; S8, 130–187 m (ST), 26.vi.2019: 2♂ CL 20.6–21.8 mm, 1♀ CL 17.7 mm; S11, 100 m (ST), 15.v.2010: 2♂ CL 15.6–19.6 mm, 1♀ CL 18.7 mm; 150 m (ST), 21.vi.2011: 1♀ CL 17 mm.

**Remarks:** Known from western and south-central Mediterranean, with single records from the Gulf of Cadiz (outside Gibraltar) and northern Adriatic [58]. Here, it is recorded for the first time in the eastern Mediterranean. *Liocarcinus bolivari* is closely related to *Liocarcinus depurator* (Linnaeus, 1758) and *Liocarcinus vernalis* (Risso, 1827). In addition to the morphological differences that allow separation of long-time preserved specimens [22], *L. bolivari* can be recognized at a glance in the field for the presence of dark bands on articles of walking legs (Figure 3H), versus a uniform colour in *L. depurator* and *L. vernalis*, and the distal part of dactylus of the fifth pereopod, blue-violet only in *L. bolivari* and *L. depurator*.



**Figure 3.** Decapods from Rhodes area, in colours. (A) *Portumnus latipes*, CL 27.2 mm; (B) *Carupa tenuipes*, CL 15.2 mm; (C) *Gonioinfradens giardi*, CL 36.9 mm; (D) *Thalamita poissonii*, CL 21.4 mm. (E) *Bathynectes maravigna*, CL 42.2 mm; (F) *Bathynectes maravigna*, CL 19 mm, parasitized by *Sacculina* sp.; (G) *Liocarcinus bolivari*, CL 20.6 mm; (H) *Liocarcinus bolivari*, CL 8.6 mm, juvenile.

#### Family GERYONIDAE Colosi, 1923

*Geryon longipes* A. Milne-Edwards, 1882 \*

*Geryon longipes* – Zariquiey Álvarez [22]: 388, Figure 135a.

**Material examined:** T4, 650–750 m (BT), 19.xi.2019: 1♀ CL 25.5 mm.

**Remarks:** Known from eastern Atlantic and Mediterranean [58].

#### Family XANTHIDAE MacLeay, 1838

*Atergatis roseus* (Rüppell, 1830) - (A)

*Atergatis roseus* – Serène [89]: 147, Figure 86, Pl. XXIA.

**Material examined:** S12, 8–15 m (TN), 2.v.2010: 1♂ CL 61.5 mm; S18, 8–15 m (TN), 20.xi.2015: 1♀ CL 49.3 mm.

**Remarks:** Native from Indo-West Pacific, including Red Sea [89], this alien species recently spread in the eastern Mediterranean (e.g., [90]). First observed in Rhodes in 2009 [51], it is now established all around the island on rocky substrates and it is regularly displayed in the HSR Aquarium since 2009 [81].

#### Family GRAPSIDAE MacLeay, 1838

*Pachygrapsus transversus* (Gibbes, 1850) \*

*Pachygrapsus transversus* – Zariquiey Álvarez [22]: 425, Figure 140c; Poupin et al. [91]: 44 (partim), Figures 13a–e, 14l and 15l.

**Material examined:** S1, 1 m on hard substrate with algae (HN), 10.iv.2014: 1♀ CL 7.4 mm.

**Remarks:** Known from western and eastern Atlantic, including many Islands groups, and Mediterranean [92]. Recorded only once in the Aegean Sea, at Karpathos Island [93]. The specimen herein reported was collected in a local marina, suggesting that the intense maritime traffic in the area may have played a role in this finding.

*Planes minutus* (Linnaeus, 1758)

*Planes minutus* – Chace [94]: 81, Figures 1a, 2a,d,g–l; Zariquiey Álvarez [22]: 427, Figure 143e.

**Material examined:** S6, near a stranded male *Caretta caretta* (Linnaeus, 1758) (carapace curved length 81 cm), 4.iii.2014: 1♂ CL 15.2 mm; S20, tidal rocky substrate (HN), 3.xi.2014: 1♂ CL 9.6 mm.

**Remarks:** Known from eastern and western Atlantic and Mediterranean [58]. The species is usually associated with floatsam (natural or artificial) and sea turtles in the pelagic realm [95] and was first collected in the Aegean in 2010 at Rhodes [14]. The present findings represent the second and third records of the species in the Aegean Sea.

#### Family OCYPODIDAE Rafinesque, 1815

*Ocyrode cursor* (Linnaeus, 1758)

*Ocyrode cursor* – Holthuis & Gottlieb [72]: 99, plate 3, Figure 14; Sakai & Türkay [96]: 702, Figures 2B,13 and 35.

**Material examined:** S14, on a sandy beach during night (HN), 14.ix.2016: 9♂ CL 14.4–27.1 mm, 1♀ CL 28.8 mm (specimens released after measurements and photos).

**Remarks:** Known from the western coasts of Africa and eastern and central Mediterranean [56,97]. As consequence of global warming, the species is currently expanding westwards to the central Mediterranean from the Levant Sea, which may have acted as refugium during the last glacial period [57]. Kinzelbach [56] reported *Ocyrode cursor* from southern Aegean (including Rhodes) based on a specimen displayed at the HSR museum and another one from Karpathos Island.

## 4. Discussion

To date, a number of approximate 400 decapods have been listed in the Mediterranean Sea [98], of which about 24% are aliens [99], and less than 300 species are known from the Hellenic Aegean Sea (Authors' unpublished data), of which 25 are aliens [100]. In the present work, 28 species of decapods are reported for the first time for the Rhodes Island area, including eight deep-water species detected from material collected by “red-shrimp” bottom trawlers, six species discovered during snorkeling in shallow waters, twelve species obtained from night sampling with epibenthic sledge on *Posidonia oceanica* meadows, and two more species collected with shrimp traps on the continental shelf. The number of marine decapod species recorded for Rhodes (148) accounts now for about 50% of the Hellenic Aegean decapod fauna.

All the new records are native species with a wide distribution in the Mediterranean, with the exception of *Liocarcinus bolivari*, rarely recorded in the West and Central Mediterranean and here documented for the first time in the eastern Mediterranean, and *Pachygrapsus transversus*, although



for the latter species also a human-mediated range extension may be involved. Among species already recorded from Rhodes, but only from a limited number of specimens, *Ocypode cursor* needs a mention, being the only decapod species listed in the Annex II (strictly protected fauna species) of the Convention on the Conservation of European Wildlife and Natural Habitats (Berne Convention). The uncontrolled development of mass tourism in the last decades and the unlimited use of the beaches [101] requires a monitoring of the local population of this crab in beaches heavily impacted by tourism activities, such as those of Prasonisi and Tsampika.

It is also worth a mention that when the coastal waters of the island were first investigated (about 50 years ago) for the presence of species of Indo-Pacific origin, no alien decapods were collected [12]. Nowadays twenty-two of the 148 species reported in the checklist are aliens and there is evidence that biological pollution is locally increasing at a steady rate, with several species becoming established, especially in the last decade. Also records of alien decapods in stomach contents of both native and alien fishes suggest they became a component of the local food web with effects on the whole biota. The local ratio alien *vs* native decapod species of 0.17 appears slightly higher than the 0.13 calculated for bony fishes [102]. This may be partially explained by the fact that fishes are not only more easily spotted due to their larger sizes and commercial value, but even more easily identified by various sea lovers, including non-professional ones like scuba divers and citizen scientists.

Finally, improving knowledge of diversity of the major marine groups, as also requested by the MSFD Annex I 2008/56/EC, provide data useful as descriptor of the environmental status of regions highly affected by the influx of alien species and contribute in monitoring possible changes in the diversity of marine biota [103]. Notwithstanding past and present research efforts, the list of the decapod biota of the Rhodes Island area is presumably far from being complete. Future surveys, carried out with as many professional fishing gears and scientific samplers as possible, and in different habitats, from shallow to deep waters, including areas all around the island, will presumably reveal the presence of many unrecorded native species and additional Lessepsian immigrants.

**Author Contributions:** Conceptualization, G.K., F.C., M.C.F. and C.F.; methodology, G.K., F.C., M.C.F. and C.F.; investigation, G.K., F.C., M.C.F. and C.F.; data curation, G.K., F.C., M.C.F. and C.F.; writing—original draft preparation, G.K. and M.C.F.; writing—review and editing, G.K., F.C., M.C.F. and C.F. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Acknowledgments:** The unpublished material reported here was obtained thanks to the COST Action TD1209-ALIEN Challenge carried out in Rhodes in 2014, H. Hatzialexiou and M. Savviou who helped during snorkelling activities, M. Limperis, S. Vagianos, and I. Karaosman, respectively captains of the fishing vessels “Captain Manolis”, “Saratoga”, and “Taxiarchis”, who, together with their crews, supported fieldwork, F. Fiorentino (CNR-IRBIM, Mazara del Vallo, Italy) who supplied the material from the Italian shrimp trawlers fishing off Rhodes, and the Port Authority of Rhodes. Vassiliki Loukaidi from HCMR contributed in the GIS map. We are grateful to all of them.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Anderson, S.C.; Mills Flemming, J.; Watson, R.; Lotze, H.K. Rapid global expansion of invertebrate fisheries: Trends, drivers, and ecosystem effects. *PLoS ONE* **2011**, *6*, e14735, doi:10.1371/journal.pone.0014735.
2. Bianchi, C.N.; Corsini-Foka, M.; Morri, C.; Zenetos, A. Thirty years after—Dramatic change in the coastal marine habitats of Kos Island (Greece), 1981–2013. *Mediterr. Mar. Sci.* **2014**, *15*, 482–497, doi:10.12681/mms.678.
3. Nykjaer, L. Mediterranean Sea surface warming 1985 to 2006. *Clim. Res.* **2009**, *39*, 11–17, doi:10.3354/cr00794.
4. Raitsos, D.E.; Beaugrand, G.; Georgopoulos, D.; Zenetos, A.; Pancucci-Papadopoulou, M.A.; Theocharis, A.; Papathanassiou, E. Global climate change amplifies the entry of tropical species into the Mediterranean Sea. *Limnol. Oceanogr.* **2010**, *55*, 1478–1484, doi:10.4319/lo.2010.55.4.1478.

5. Sisma-Ventura, G.; Yam, R.; Shemesh, A. Recent unprecedented warming and oligotrophy of the eastern Mediterranean Sea within the last millennium. *Geophys. Res. Lett.* **2014**, *41*, 5158–5166, doi:10.1002/2014GL060393.
6. Theocharis, A.; Klein, B.; Nittis, K.; Roether, W. Evolution and status of the Eastern Mediterranean Transient (1997–1999). *J. Mar. Syst.* **2002**, *33*, 91–116, doi:10.1016/S0924-7963(02)00054-4.
7. Galil, B.S.; Kevrekidis, K. Exotic decapods and a stomatopod off Rhodes (Rodos, Greece) and the Eastern Mediterranean Transient. *Crustaceana* **2002**, *75*, 925–930.
8. Bianchi, C.N. Biodiversity issues for the forthcoming tropical Mediterranean Sea. *Hydrobiologia* **2007**, *580*, 7–21, doi:10.1007/s10750-006-0469-5.
9. Bianchi, C.N.; Morri, C.; Chiantore, M.; Montefalcone, M.; Parravicini, V.; Rovere, A. Mediterranean Sea biodiversity between the legacy from the past and a future of change. In *Life in the Mediterranean Sea: A Look at Habitat Changes*; Stambler, N., Ed.; Nova Science Publishers: New York, NY, USA, 2012; pp. 1–55.
10. Pancucci-Papadopoulou, M.A.; Raitsos, D.E.; Corsini-Foka, M. Biological invasions and climatic warming: implications for South Eastern Aegean ecosystem functioning. *J. Mar. Biol. Assoc. UK* **2012**, *92*, 777–789, doi:10.1017/S0025315411000981.
11. Skliris, N. Past, present and future patterns of the thermohaline circulation and characteristic water masses of the Mediterranean Sea. In *The Mediterranean Sea: Its History and Present Challenges*; Goffredo, S., Dubinsky, Z., Eds.; Springer: London, UK, 2014; pp. 29–48, doi:10.1007/978-94-007-6704-1\_3.
12. Lewinsohn, C. Crustacea decapoda von der Insel Rhodos, Griechenland. *Zool. Meded.* **1976**, *49*, 237–254.
13. Kevrekidis, K.; Galil, B.S. Decapoda and Stomatopoda (Crustacea) of Rodos island (Greece) and the Erythrean expansion NW of the Levantine Sea. *Mediterr. Mar. Sci.* **2003**, *4*, 57–66, doi:10.12681/mms.241.
14. Corsini-Foka, M.; Pancucci-Papadopoulou, M.A. Inventory of Crustacea Decapoda and Stomatopoda from Rhodes Island (Eastern Mediterranean Sea), with emphasis on rare and newly recorded species. *J. Biol. Res. (Thessalon.)* **2012**, *18*, 359–371.
15. Corsini-Foka, M.; Kalogirou, S. First record of *Albunea carabus* (Linnaeus, 1758) (Decapoda: Anomura: Hippoidea) in the Aegean Sea. *Cah. Biol. Mar.* **2013**, *54*, 297–299, doi:10.21411/CBM.A.AD3E1818.
16. Corsini-Foka, M.; Kondylatos, G.; Pancucci-Papadopoulou, M.A. A new alien crab for the Mediterranean Sea: *Xanthias lamarckii* (H. Milne Edwards, 1834) (Crustacea: Decapoda: Brachyura: Xanthidae). *Mediterr. Mar. Sci.* **2013**, *14*, 295–297, doi:10.12681/mms.441
17. Zenetos, A.; Koutsogiannopoulos, D.; Ovalis, P.; Poursanidis, D. The role played by citizen scientists in monitoring marine alien species in Greece. *Cah. Biol. Mar.* **2013**, *54*, 419–426, doi:10.21411/CBM.A.F59BBF3E.
18. Giovos, I.; Kleitou, P.; Poursanidis, D.; Batjakas, I.; Bernardi, G.; Crocetta, F.; Doumpas, N.; Kalogirou, S.; Kampouris, T.E.; Keramidas, I.; et al. Citizen-science for monitoring marine invasions and stimulating public engagement: A case project from the eastern Mediterranean. *Biol. Invasions* **2019**, *21*, 3707–3721, doi:10.1007/s10530-019-02083-w.
19. Hatiris, G.A. *INTEREG III GR-CY Project “AKTI”*; Technical Report; HCMR: Athens, Greece, 2014.
20. Corsini-Foka, M.; Zenetos, A.; Crocetta, F.; Çinar, M.E.; Koçak, F.; Golani, D.; Katsanevakis, S.; Tsiamis, K.; Cook, E.; Frogli, C.; et al. Inventory of alien and cryptogenic species of the Dodecanese (Aegean Sea, Greece): Collaboration through COST action training school. *Manag. Biol. Invasion* **2015**, *6*, 351–366, doi:10.3391/mbi.2015.6.4.04.
21. Crocetta, F.; Gofas, S.; Salas, C.; Tringali, L.P.; Zenetos, A. Local ecological knowledge versus published literature: A review of non-indigenous Mollusca in Greek marine waters. *Aquat. Invasions* **2017**, *12*, 415–434, doi:10.3391/ai.2017.12.4.01.
22. Zariquiey Álvarez, R. Crustáceos Decapodos Ibéricos. *Inv. Pesq.* **1968**, *32*, 1–510.
23. World Register of Marine Species (WoRMS). World Register of Marine Species (WoRMS). Available online: <http://www.marinespecies.org> at VLIZ (accessed on 20 March 2020).
24. Stephensen, K. Decapoda-Macrura. excl. Sergestidae. (Penaeidae, Pasiphaeidae, Hoplophoridae, Nematocarinidae, Scyllaridae, Eryonidae, Nephropsidae, Appendix). Report on the Danish Oceanographical Expeditions 1908–1910 to the Mediterranean and adjacent Seas **1923**, *2*, 1–85.
25. Kevrekidis, K.; Galil, B.S.; Kevrekidis, T. Three lessepsian migrant penaeids (Decapoda) in Rodos Island (Greece). *Crustaceana* **1998**, *71*, 474–478, doi:10.1163/156854098X00563.

26. Zenetos, A.; Akel, E.; Apostolidis, C.; Bilecenoglu, M.; Bitar, G.; Buchet, V.; Chalari, N.; Corsini-Foka, M.; Crocetta, F.; et al. New Mediterranean Biodiversity Records (April 2015). *Mediterr. Mar. Sci.* **2015**, *16*, 266–284, doi:10.12681/mms.1292.
27. Kondylatos, G.; Corsini-Foka, M. *Penaeus hathor* (Burkenroad, 1959) (Crustacea: Decapoda: Penaeidae) in Rhodian waters (Aegean Sea). *Cah. Biol. Mar.* **2017**, *58*, 491–495, doi:10.21411/CBM.A.5DE3A203.
28. Maldura, C.M. La pesca nelle Isole Italiane dell’Egeo. *Boll. Pesca Piscic. Idrobiol.* **1938**, *14*, 460–481.
29. Kevrekidis, K.; Kevrekidis, T. The occurrence of *Penaeus japonicus* Bate (Decapoda, Penaeidae) in the Aegean Sea. *Crustaceana* **1996**, *69*, 925–928, doi:10.1163/156854096X00349.
30. Adensamer, T. Zoologische Ergebnisse. XI. Decapoden gesammelt auf S.M. Schiff “Pola” in den Jahren 1890-1894. Berichte der Commission fur Erforschung des Ostlichen Mittelmeres, XXII. *Denkschr. Kaiserl. Akad. Wiss. Math. Naturwiss. (Kl.)* **1898**, *65*, 597–628.
31. Kitsos, M.; Doulgeraki, S.; Tselepides, A.; Koukouras, A. Diet composition of the bathyal crabs, *Chaceon mediterraneus* Manning & Holthuis and *Geryon longipes* A. Milne-Edwards (Decapoda, Geryonidae) collected at different depths in the eastern Mediterranean. *Crustaceana* **2005**, *78*, 171–184, doi:10.1163/1568540054020569.
32. Santucci, R. Alcuni crostacei decapodi delle isole Egee. *Arch. Zool. Ital.* **1928**, *12*, 345–354.
33. Thessalou-Legaki, M.; Frantzis, A.; Nassiokas, K.; Hatzinikolaou, S. Observations on *Parapandalus narval* (Fabricius, 1787) (Crustacea, Decapoda, Pandalidae) from Rhodos Island (Greece). *Rapp. Comm. Int. Mer. Medit.* **1986**, *30*, 13.
34. Chan, T.-Y.; Crosnier, A. Crustacea decapoda: Studies of the *Plesionika narval* (Fabricius, 1787) group (Pandalidae) with descriptions of six new species. *Mém. Mus. Natl. Hist. Nat. Ser. A Zool.* **1991**, *152*, 413–461.
35. Thessalou-Legaki, M. Preliminary data on the occurrence of Thalassinidea (Crustacea, Decapoda) in the Greek seas. *Biol. Gallo-Hell.* **1986**, *12*, 181–187.
36. Asgaard, U.; Bromley, R.G.; Hanken, N.M. Recent firmground burrows produced by a upogebiid crustacean: Paleontological implications. *Cour. Forsch. Inst. Senckenberg* **1997**, *201*, 23–28.
37. Ngoc-Ho, N. European and Mediterranean Thalassinidea (Crustacea, Decapoda). *Zoosystema* **2003**, *25*, 439–555.
38. Tortonese, E. Note intorno alla fauna e flora marine dell’Isola di Rodi (Mar Egeo). *Boll. Pesca Piscic. Idrobiol.* **1947**, *23*, 13–20.
39. Pancucci-Papadopoulou, M.A.; Simboura, N.; Zenetos, A.; Thessalou-Legaki, M.; Nicolaidou, A. Benthic invertebrate communities of NW Rodos (Rhodes) island (SE Aegean Sea) as related to hydrological regime and geographical location. *Isr. J. Zool.* **1999**, *45*, 371–393, doi:10.1080/00212210.1999.10689006.
40. Koukouras, A.; Dounas, C. Decapod crustaceans new to the fauna of the Aegean Sea. *Crustaceana* **2000**, *73*, 497–502, doi:10.1163/156854000504462.
41. Kondylatos, G.; Corsini-Foka, M.; Perakis, E. First record of the isopod *Idotea hectica* (Pallas, 1772) (Idoteidae) and of the brachyuran crab *Matuta victor* (Fabricius, 1781) (Matutidae) in the Hellenic waters. *Mediterr. Mar. Sci.* **2018**, *19*, 656–661, doi:10.12681/mms.18106.
42. Corsini-Foka, M.; Margies, P.; Santorinios, E. First record of the exotic brachyuran *Leucosia signata* from Rhodes. In Proceedings of the 8th Pan-Hellenic Symposium of Oceanography and Fisheries, Thessaloniki, Greece, 4–8 June 2006; p. 4.
43. Corsini, M.; Kondylatos, G. On the occurrence of two brachyurans, *Myra subgranulata* and *Herbstia condyliata*, on Rhodes Island (SE Aegean Sea). *Crustaceana* **2006**, *79*, 167–174, doi:10.1163/156854006776952919.
44. Parisi, B. Escursioni zoologiche del Dott. Enrico Festa nell’Isola di Rodi. Decapodi. *Boll. Mus. Zool. Anat. Comp. R. Univ. Torino* **1913**, *28*, 1–2.
45. Pretzmann, G. Ergebnisse der von Dr. O. Paget und Dr. E. Kritscher auf Rhodos durchgeführten zoologischen Exkursionen. X. Brachyura. *Ann. Nat. Hist. Mus. Wien* **1964**, *67*, 661–666.
46. Kinzelbach, R. Die Blaue Schwimmkrabbe (*Callinectes sapidus*), ein Neuburger im Mittelmeer. *Natur und Museum* **1965**, *95*, 293–296.
47. Pancucci-Papadopoulou, M.A.; Corsini-Foka, M.; Tsiamis, K.; Kalogirou, S. The occurrence of *Carupa tenuipes* Dana, 1851 (Crustacea: Brachyura: Portunidae) from Rhodos Island (SE Aegean Sea, Greece). *Aquat. Invasions* **2009**, *4*, 713–714, doi:10.3391/ai.2009.4.4.21.
48. Kirmitzoglou, I.; Kitsos, M-S.; Thessalou-Legaki, M.; Tselepides, A.; Koukouras, A. Investigation of the progress and possible expansion of the limits of the lessepsian migratory current regarding Decapoda

- (Crustacea). In Proceeding of the 10th International Congress on the Zoogeography and Ecology of Greece and Adjacent Regions (ICZEGAR), Patras, Greece, 26–30 June 2006; p. 51.
49. Corsini-Foka, M.; Pancucci-Papadopoulou, M.A.; Kondylatos, G.; Kalogirou, S. *Gonioinfradens paucidentatus* (A. Milne Edwards, 1861) (Crustacea, Decapoda, Portunidae): A new alien crab in the Mediterranean Sea. *Mediterr. Mar. Sci.* **2010**, *11*, 331–340, doi:10.12681/mms.80.
  50. Corsini-Foka, M.; Kondylatos, G.; Economidis, P.S. Occurrence of the lessepsian species *Portunus pelagicus* (Crustacea) and *Apogon pharaonis* (Pisces) in the marine area of Rhodes Island. *Mediterr. Mar. Sci.* **2004**, *5*, 83–89, doi:10.12681/mms.213.
  51. Corsini-Foka, M.; Pancucci-Papadopoulou, M.A. The alien brachyuran *Atergatis roseus* (Rüppell, 1830) (Decapoda, Xanthidae) in Rhodes Island (Greece). *Mar. Biodivers. Rec.* **2010**, *3*, e76, doi:10.1017/S1755267210000667.
  52. Koukouras, A.; Kitsos, M.; Tselepidis, A. The genera *Chaceon* Manning and Holthuis and *Geryon* Krøyer (Decapoda, Geryonidae) in the Eastern Mediterranean. *Crustaceana* **2000**, *73*, 107–113.
  53. Corsini-Foka, M.; Kondylatos, G. First occurrence of *Actaeodes tomentosus* (H. Milne Edwards, 1834) (Brachyura: Xanthidae: Actaeinae) in the Mediterranean Sea. *Mediterr. Mar. Sci.* **2015**, *16*, 201–205, doi:10.12681/mms.1113.
  54. Thessalou-Legaki, M.; Zenetos, A.; Kambouroglou, V.; Corsini-Foka, M.; Kouraklis, P.; Dounas, C.; Nicolaidou, A. The establishment of the invasive crab *Percnon gibbesi* (H. Milne Edwards, 1853) (Crustacea: Decapoda: Grapsidae) in Greek waters. *Aquat. Invasions* **2006**, *1*, 133–136, doi:10.3391/ai.2006.1.3.6.
  55. Pancucci-Papadopoulou, M.A.; Corsini-Foka, M.; Naletaki, M. *Macrophthalmus graeffei* A. Milne Edwards, 1873 (Crustacea: Brachyura: Macrophthalmidae): A new Indo-Pacific guest off Rhodes Island (SE Aegean Sea, Greece). *Mediterr. Mar. Sci.* **2010**, *11*, 195–200, doi:10.12681/mms.103.
  56. Kinzelbach, R. Neue Nachweise der Reiterkrabbe, *Ocypode cursor* (Linnaeus, 1758), in der Ägäis (Decapoda, Brachyura, Ocypodidae). *Crustaceana* **1970**, *18*, 318–320, doi:10.1163/156854070X00284.
  57. Vecchioni, L.; Marrone, F.; Deidun, A.; Adepo-Guerene, A.B.; Frogli, C.; Sciberras, A.; Bariche, M.; Çiçek, B.A.; Corsini-Foka, M.; Arculeo, M. DNA Taxonomy confirms the identity of the widely-disjunct Mediterranean and Atlantic populations of the tufted ghost crab *Ocypode cursor* (Crustacea: Decapoda: Ocypodidae). *Zool. Sci.* **2019**, *36*, 322–329, doi:10.2108/zs180191.
  58. d’Udekem d’Acoz, C. Inventaire et distribution des crustacés décapodes de l’Atlantique nord-oriental, de la Méditerranée et des eaux continentales adjacentes au nord de 25°N. *Patrimoines Naturels (M.N.H.N. /S.P.N.)* **1999**, *40*, 1–383.
  59. Deval, M.C.; Kaya, Y.; Güven, O.; Gökoglu, M.; Frogli, C. An unexpected find of the western Atlantic shrimp, *Farfantepenaeus aztecus* (Ives, 1891) (Decapoda, Penaeidae) in Antalya Bay, eastern Mediterranean Sea. *Crustaceana* **2010**, *83*, 1531–1537, doi:10.1163/001121610X538859.
  60. Pérez Farfante, I.; Kensley, B. Penaeoid and sergestoid shrimps and prawns of the world, keys and diagnoses for the families and genera. *Mem. Mus. Natl. Hist. Nat. (Paris)* **1997**, *175*, 1–233.
  61. Mytilineou, C.; Akel, E.; Babali, N.; Balistreri, P.; Bariche, M.; Boyaci, Y.; Cilenti, L.; Constantinou, C.; Crocetta, F.; Çelik, M.; et al.: New Mediterranean Biodiversity Records (November, 2016). *Mediterr. Mar. Sci.* **2016**, *17*, 794–821. doi:10.12681/mms.1976.
  62. Scannella, D.; Falsone, F.; Geraci, M.L.; Frogli, C.; Fiorentino, F.; Giusto, G.B.; Colloca, F. First report of Northern brown shrimp *Penaeus aztecus* Ives, 1891 in Strait of Sicily. *BioInvasions Rec.* **2017**, *6*, 67–72, doi:10.3391/bir.2017.6.1.11.
  63. Vereshchaka, A.L.; Olesen, J.; Lunina, A.A. Global diversity and phylogeny of pelagic shrimps of the former genera *Sergestes* and *Sergia* (Crustacea, Dendrobranchiata, Sergestidae), with definition of eight new genera. *PLoS ONE* **2014**, *9*, e112057, doi:10.1371/journal.pone.0112057.
  64. Judkins, D.C. Geographical distribution of pelagic decapod shrimp in the Atlantic Ocean. *Zootaxa* **2014**, *3895*, 301–345, doi:10.11646/zootaxa.3895.3.1.
  65. González-Ortegón, E.; Cuesta, J.A. An illustrated key to species of *Palaemon* and *Palaemonetes* (Crustacea: Decapoda: Caridea) from European waters, including the alien species *Palaemon macrodactylus*. *J. Mar. Biol. Ass. UK* **2006**, *86*, 93–102, doi:10.1017/S0025315406012896.
  66. Grippa, G.B.; d’Udekem d’Acoz, C. The genus *Periclimenes* Costa, 1844 in the Mediterranean Sea and the Northeastern Atlantic Ocean: Review of species and description of *Periclimenes sagittifer aegylius* subsp. nov. (Crustacea, Decapoda, Caridea, Pontoniinae). *Atti Soc. Ital. Sci. Nat. Mus. Civ. Stor. Nat. (Milano)* **1996**, *135*, 401–412.

67. d'Udekem d'Acoz, C. The genus *Hippolyte* Leach, 1814 (Crustacea: Decapoda: Caridea: Hippolytidae) in the East Atlantic Ocean and the Mediterranean Sea, with a checklist of all species in the genus. *Zool. Verh.* **1996**, *303*, 1–133.
68. d'Udekem d'Acoz, C.; Wirtz, P. Observations on some interesting coastal Crustacea Decapoda from the Azores, with a key to the genus *Eualus* Thallwitz, 1892 in the Northeastern Atlantic and the Mediterranean. *Arquipelago* **2002**, *19*, 67–84.
69. Crosnier, A.; Forest, J. Les crevettes profondes de l'Atlantique orientale tropicale. *Faune Tropicale* **1973**, *19*, 1–409.
70. Galil, B.S. Crustacea Decapoda: Review of the genera and species of the family Polychelidae Wood-Mason, 1874. *Mém. Mus. Natl. Hist. Nat.* **2000**, *184*, 285–387.
71. García-Gómez, J. The systematics of the genus *Anapagurus* Henderson, 1886, and a new genus for *Anapagurus drachi* Forest (Crustacea, Decapoda, Paguridae). *Zool. Verh.* **1994**, *295*, 1–131.
72. Holthuis, L.B.; Gottlieb, E. An annotated list of the Decapod crustacea of the Mediterranean coast of Israel, with an appendix listing the Decapoda of the Eastern Mediterranean. *Bull. Res. Council. Isr.* **1958**, *7B*, 1–126.
73. Ingle, R.W. Hermit Crabs of the Northeastern Atlantic Ocean and the Mediterranean Sea. An Illustrated Key. Chapman & Hall: London, UK, 1993; pp. 1–495.
74. Ingle, R.W. Northeastern Atlantic and Mediterranean hermit crabs (Crustacea: Anomura: Paguroidea: Paguridae). I. The genus *Pagurus* Fabricius, 1775. *J. Nat. Hist.* **1985**, *19*, 745–769.
75. Manning, R.B.; Holthuis, L.B. West African Brachyuran Crabs (Crustacea: Decapoda). *Smithson. Contr. Zool.* **1981**, *306*, 1–379.
76. Forest, J. Sur une collection de Crustacés Décapodes de la région de Porto Cesareo. Description de *Portunus pestai* sp. nov. *Thalassia Salent.* **1967**, *2*, 3–29.
77. Chartosia, N.; Koukouras, A.; Mavidis, M.; Kitsos, M. Preliminary estimation of the factors influencing the distribution of the midlittoral crab *Portunus lysianassa* (Herbst, 1796). *Hydrobiologia* **2006**, *557*, 97–106, doi:10.1007/s10750-005-1312-0.
78. Apel, M.; Spiridonov, V.A. Taxonomy and zoogeography of the portunid crabs (Crustacea: Decapoda: Brachyura: Portunidae) of the Arabian Gulf and adjacent waters. *Fauna of Arabia* **1998**, *17*, 159–331.
79. Galil, B.S. *Carupa tenuipes* Dana, 1851: An Indo-Pacific swimming crab new to the Mediterranean (Decapoda, Brachyura, Portunidae). *Crustaceana* **2004**, *77*, 249–251.
80. Tavares, M. Alien Decapod Crustaceans in the Southwestern Atlantic Ocean. In *In the Wrong Place—Alien Marine Crustaceans: Distribution, Biology and Impacts*; Galil, B.S., Clark, P.F., Carlton, J.T., Eds.; Springer: London, UK, 2011; pp. 251–268.
81. Corsini-Foka, M.; Kondylatos, G.; Santorinios, E. The role of the Aquarium of Rhodes (Eastern Mediterranean Sea) on raising public awareness to marine invasions, with a note on the husbandry and trade of marine aliens. *Cah. Biol. Mar.* **2014**, *55*, 173–182, doi:10.21411/CBM.A.8221A005.
82. Innocenti, G.; Stasolla, G.; Goren, M.; Stern, N.; Levitt-Barmats, Y.; Diamant, A.; Galil, B.S. Going down together: invasive host, *Charybdis longicollis* (Decapoda: Brachyura: Portunidae) and invasive parasite, *Heterosaccus dollfusi* (Cirripedia: Rhizocephala: Sacculinidae) on the upper slope off the Mediterranean coast of Israel. *Mar. Biol. Res.* **2017**, *13*, 229–236, doi:10.1080/17451000.2016.1240873.
83. Galil, B.S.; Douek, J.; Gevili, R.; Goren, M.; Yudkovsky, Y.; Paz, G.; Rinekvich, B. The resurrection of *Charybdis (Gonioinfradens) giardi* (Nobili, 1905), newly recorded from the SE Mediterranean Sea. *Zootaxa* **2018**, *4370*, 580–590, doi:10.11646/zootaxa.4370.5.9.
84. Karhan, S.U.; Yokes, M.B. An earlier record of the Indo-Pacific swimming crab *Gonioinfradens paucidentatus* (A. Milne-Edwards, 1861) (Decapoda, Brachyura, Portunidae) off the Mediterranean coast of Turkey. *Crustaceana* **2012**, *85*, 117–121, doi:10.2307/23212886.
85. Kondylatos, G.; Kampouris, T.; Kouloumperis, V.; Corsini-Foka, M. The Indo-Pacific brachyuran *Charybdis (Gonioinfradens) paucidentatus* (A. Milne-Edwards, 1861) (Brachyura, Portunidae) in the Cyclades, Aegean Sea. *Turk. J. Zool.* **2017**, *41*, 1118–1120, doi:10.3906/zoo-1612-48.
86. d'Udekem d'Acoz, C. Contribution à la connaissance des Crustacés Décapodes Helléniques I: Brachyura. *BIOS (Maced. Greece) Sci. Ann. School Biol.* **1994**, *1*, 9–47.
87. Deval, M.C.; Froglija, C. New records of deep-sea decapod crustaceans in the Turkish Mediterranean Sea (North Levant Sea). *Zool. Middle East* **2016**, *62*, 323–330, doi:10.1080/09397140.2016.1250709.
88. Øksnebjerg, B. The Rhizocephala (Crustacea: Cirripedia) of the Mediterranean and Black Sea: Taxonomy, biogeography and ecology. *Isr. J. Zool.* **2000**, *46*, 1–102, doi:10.1560/RCLC-NM2U-HV5L-6Q52.

89. Serène, R. Crustacés Décapodes Brachyours de l'Océan Indien occidental et de la Mer Rouge. Xanthoidea: Xanthidae Trapeziidae. *Faune Tropicale* **1984**, *24*, 1–349.
90. Crocetta, F.; Agius, D.; Balistreri, P.; Bariche, M.; Bayhan, Y.; Çakir, M.; Ciriaco, S.; Corsini-Foka, M.; Deidun, A.; El Zrelli, R.; et al.: New Mediterranean Biodiversity Records (October 2015). *Mediterr. Mar. Sci.* **2015**, *16*, 682–702. doi:10.12681/mms.1477.
91. Poupin, J.; Davie, P.J.F.; Cexus, J.C. A revision of the genus *Pachygrapsus* Randall, 1840 (Crustacea: Decapoda: Brachyura, Grapsidae), with special reference to the Southwest Pacific species. *Zootaxa* **2005**, *1015*, 1–66.
92. Crocetta, F.; Mifsud, S.; Paolini, P.; Piscopo, J.; Schembri, P.J. New records of the genus *Pachygrapsus* (Crustacea: Decapoda) from the central Mediterranean Sea with a review of its Mediterranean zoogeography. *Mediterr. Mar. Sci.* **2011**, *12*, 75–93, doi:10.12681/mms.54.
93. Kinzelbach, R. *Pachygrapsus transversus* (Gibbes, 1850) in der Aegäis (Crustacea Decapoda). *Bonn. Zool. Beitr.* **1964**, *15*, 266–267.
94. Chace, F.A. The oceanic crabs of the genera *Planes* and *Pachygrapsus*. *Proc. U.S. Natl. Mus.* **1951**, *101*, 65–103.
95. Dellinger, T.; Davenport, J.; Wirtz, P. Comparison of social structure of Columbus crabs living on loggerhead turtles and inanimate flotsam. *J. Mar. Biol. Assoc. UK* **1997**, *77*, 185–194, doi:10.1017/S0025315400033865.
96. Sakai, K.; Türkay, M. Revision of the genus *Ocypode* with description of a new genus, *Hoplocypode* (Crustacea: Decapoda: Brachyura). *Mem. Queensl. Mus. Nat.* **2013**, *56*, 665–793.
97. Deidun, A.; Crocetta, F.; Sciberras, A.; Sciberras, J.; Insacco, G.; Zava, B. The protected taxon *Ocypode cursor* (Linnaeus, 1758) (Crustacea: Decapoda: Ocypodidae)—Documenting its well-established presence in the central Mediterranean. *Eur. Zool. J.* **2017**, *84*, 96–103, doi:10.1080/11250003.2017.1281355.
98. Coll, M.; Piroddi, C.; Steenbeek, J.; Kaschner, K.; Ben Rais Lasram, F.; Aguzzi, J.; Ballesteros, E.; Bianchi, C.N.; Corbera, J.; Dailianis, T.; et al. The biodiversity of the Mediterranean Sea: Estimates, patterns, and threats. *PLoS ONE* **2010**, *5*, e11842, doi:10.1371/journal.pone.0011842.
99. Galil, B.S.; Froglia, C.; Noël, P. Looking back, looking ahead: The CIEM Atlas, Crustaceans. *Manag. Biol. Invasion* **2015**, *6*, 171–175, doi:10.1371/journal.pone.0011842.
100. Zenetos, A.; Corsini-Foka, M.; Crocetta, F.; Gerovasileiou, V.; Karachle, P.K.; Simboura, N.; Tsiamis, K.; Pancucci-Papadopoulou, M.A. Deep cleaning of alien species records in the Greek Seas (2018 update). *Manag. Biol. Invasion* **2018**, *9*, 209–226, doi:10.3391/mbi.2018.9.3.04.
101. Corsini-Foka, M.; Kondylatos, G.; Santorinios, E. Increase of sea turtles stranding records in Rhodes Island (Eastern Mediterranean Sea): update of a long-term survey. *J. Mar. Biol. Assoc. UK* **2013**, *93*, 1991–2002, doi:10.1017/S0025315413000556.
102. Corsini-Foka, M.; Mastis, S.; Kondylatos, G.; Batjakas, I.E. Alien and native fish in gill nets at Rhodes, eastern Mediterranean (2014–2015). *J. Mar. Biol. Assoc. UK* **2017**, *97*, 635–642, doi:10.1017/S0025315417000467.
103. Crise, A.; Kaberi, H.; Ruiz, J.; Zatsepin, A.; Arashkevich, E.; Giani, M.; Karageorgis, A.P.; Prieto, L.; Pantazi, M.; Gonzalez-Fernandez, D.; et al. A MSFD complementary approach for the assessment of pressures, knowledge and data gaps in Southern European Seas: the PERSEUS experience. *Mar. Pollut. Bull.* **2015**, *95*, 28–39, doi:10.1016/j.marpolbul.2015.03.024.

