

Illustrated Checklist of the Decapoda at Europa Island

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Abstract—An inventory of the Decapoda was compiled during a Biodiversité, Ressources et Conservation des Récifs Coralliens des Iles Eparses (BIORECIE) expedition to Europa Island in 7-12 November 2011 and incorporated in a checklist with previous records. In total, 176 decapods have been collected at Europa Island, including 62 new records. The Decapoda are mainly Indo-West Pacific but a few are endemic to the western Indian Ocean. Two hermit crabs of the genus *Pagurixus* have been recognized as new species and will be published separately. The Europa Island decapods proved slightly depauperate compared to Mayotte Island. This is attributed to the smaller lagoon size and mangroves at Europa as well as to its geographic isolation.

INTRODUCTION

Europa Island is the southernmost Island in the Mozambique Channel, located 550 km from Mozambique and 300 km from Madagascar at 22°21'S, 40°21'E (Fig. 1). It is broadly circular, with a diameter of 6-7 km and surface area of approximately 30 km². Its maximum elevation is 6-7 m and it is surrounded by sand dunes and a fringing reef that can be visited at low tide. The outer reef slope is steep but accessible to scuba divers when the sea is calm. The lagoon is almost empty at low tide and half of its 8 km² surface is occupied by mangrove trees (Caceres, 2003).

Due to its isolation, it has a small human population and, thus, low level of anthropogenic perturbation. The Terres Australes et Antarctiques Françaises (TAAF) administration is therefore prepared to give Europa Island the status of a Marine Protected Area (MPA). The Biodiversité, Ressources et Conservation des Récifs Coralliens des Iles Eparses (BIORECIE) programme (2011-2013), led by the French Institut de Recherche pour le Développement (IRD), has been funded to gain further knowledge on the fauna and flora of the French Iles Eparses in the

Mozambique Channel. We present here results on the Decapoda that were collected during the 7-12 November 2011 leg of BIORECIE to Europa Island.

The first Decapoda recorded at Europa Island were those collected by the German zoologist Alfred Voeltzkow during his 1903-1905 travels in East Africa and the Western Indian Ocean (WIO). His collection was studied by Lenz (1910) who compiled a list of 24 species for Europa including, for example, the ubiquitous land crab *Cardisoma carnifex*. Forty-two years later, Pierre Fourmanoir, a marine biologist at the Nosy Be Office de la Recherche Scientifique et Technique d'Outre-Mer (ORSTOM), Madagascar, paid several visits to the island to assess its fishing potential. His results included an updated list of 64 species of Decapoda (Fourmanoir, 1952). Parts of Fourmanoir's collections are also reported in Crosnier's (1962) studies on the Portunidae and in his later studies (Crosnier, 1965) on the Grapsidae and Ocypodidae.

Raoul Dérijard participated in an expedition to Europa Island organized by the University of Madagascar in 1964, while based at the marine biological station in Tuléar. He collected several Decapoda and published a further list of 60 species, bringing the total number of decapods for Europa at that time to about 100 species (Dérijard, 1966, 1968). Fourmanoir and Dérijard's collections were deposited in the Muséum national d'Histoire naturelle, Paris, and used in later taxonomic studies, such as those of Haig (1966) on the Porcellanidae, Guinot's (1967) checklist of WIO Decapoda, and the studies of Crosnier (1984) and Serène (1984) on the Xanthoidea, Bruce (1978) and Li & Bruce (2006) on the palaemonoidean shrimps, and Poupin & Malay (2009) on the hermit crab *Ciliopagurus tricolor*.

Additional Crustacea were collected at Europa Island during the recent BIORECIE cruise and used to update the earlier species lists

of Fourmanoir (1952) and Dérijard (1966, 1968). A comparison with the decapod fauna of Mayotte, situated in the north of the Mozambique Channel, was possible in view of recent surveys by Bouchard *et al.* (in press) and Poupin *et al.* (in press). This allowed a limited regional consideration of the biogeography of the Decapoda and the selection of a few species that can be used to monitor the health of the Europa marine environment as 'biological indicators'.

MATERIALS and METHODS

Observations and collections were made during four scuba dives on the outer reef at a depth of 1-15 m, eight visits by foot or snorkelling on the reef flat at low tide, and five visits by foot or snorkelling in the mangrove or brackish marshes. Two additional visits were paid by foot to the upper littoral and littoral at night. The area sampled generally incorporated a radius of 50 meters around each station; these are listed in Table 1 and shown in Figure 1. Collections were limited to species not identifiable in the field and these were deposited in the Muséum national d'Histoire

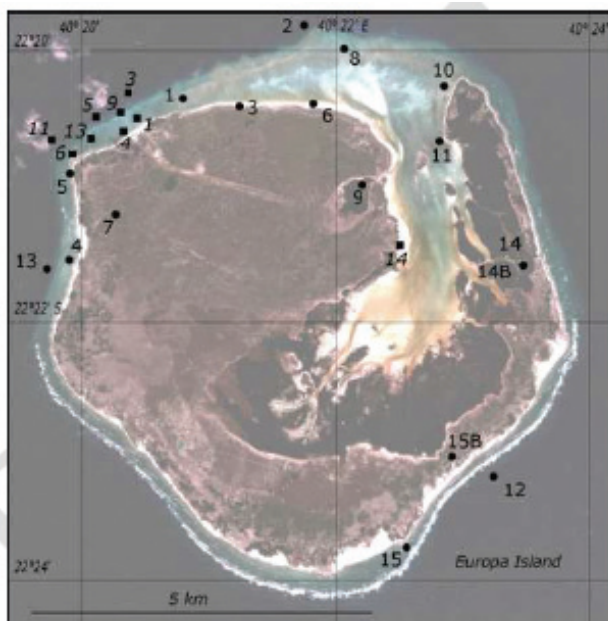


Figure 1. BIORECIE stations (●) surveyed at Europa Island in 2011 and BIOTAS stations (■, with station numbers in italics) where Decapoda were collected in 2009.

naturelle, Paris (MNHN). Species were sought amongst corals or algae, under rocks, in tidal pools, or by snorkelling in shallow water. They were caught by hand, with forceps or fishnets (mesh size 1 mm). Common macro-species (e.g. *Alpheus lottini*, *Calcinus laevimanus*, *Eriphia sebana*, *Grapsus tenuicrustatus*) were not collected but their presence was recorded in field notes and photographs; their abundance was not quantified.

A crustacean collection was also made at Europa Island during the 2009 BIOTAS Expedition. While specimens collected during BIOTAS were not available for this study, several new records could be integrated in the present inventory based on high definition photographs. These were, for example, the lobster *Panulirus*

versicolor, the shrimps *Cuapetes ensifrons*, *Periclimenes imperator*, the hermit crabs *Aniculus ursus*, *Calcinus seurati*, and the crabs *Hapalocarcinus marsupialis*, *Liocarpilodes armiger*, *Liomera monticulosa*, and *Thalamitoides quadridens*. The sampling techniques were similar to those employed during this study and the BIOTAS stations are listed in Table 2 and shown in Figure 1.

Stomatopoda are usually collected with Decapoda and are associated with them in regional inventories. Currently, they remain poorly known at Europa Island, with only three species being reported by Dériard (1966): *Gonodactylus chiragra* (Fabricius, 1781), *Gonodactylus falcatus* (Forskål, 1775), and *Gonodactylus platysoma* Wood-Mason, 1895. They are not considered in this work.

Table 1. BIORECIE 2011 station data for the crustacean collection at Europa Island.

Station	Latitude (°S)	Longitude (°E)	Date	Depth (m)	Description
1	22°20'23.820"S	40°20'46.176"E	07/11/2011	0-0.5	Bio Joseph - Reef flat, coll. Poupin, Gravier-Bonnet, Zubia
2	22°19'45.948"S	40°21'54.288"E	07/11/2011	9-12	EU 7 - Outer reef, coll. scuba divers
3	22°20'22.268"S	40°21'14.458"E	07/11/2011	-	Meteo-Plage - Land and high intertidal, coll. Poupin
4	22°21'34.524"S	40°19'52.320"E	08/11/2011	0.5	Bio 28 - Reef flat, coll. Poupin, Gravier-Bonnet, Zubia, Conan
5	22°20'54.373"S	40°19'53.350"E	08/11/2011	-	Congres-Meteo - High intertidal, coll. Poupin
6	22°20'22.340"S	40°21'50.810"E	08/11/2011	-	Meteo-Nord - High intertidal at night, coll. Poupin
7	22°21'10.458"S	40°20'14.435"E	09/11/2011	-	Piste-Congres - Land at dawn, coll. Poupin
8	22°19'53.976"S	40°22'5.257"E	09/11/2011	0-0.5	Dune Pila - Reef flat, coll. Poupin, Gravier-Bonnet, Zubia
9	22°20'56.105"S	40°22'14.826"E	09/11/2011	-	Mangrove, coll. Poupin
10	22°20'11.184"S	40°23'1.320"E	10/11/2011	0-0.5	Bio 116 - Reef flat and lagoon channel, coll. Poupin, Gravier-Bonnet, Zubia
11	22°20'35.088"S	40°22'54.804"E	10/11/2011	0-0.5	Bio 90 - Lagoon, seagrass beds and corals, mangrove, coll. Poupin, Gravier-Bonnet, Zubia
12	22°23'7.008"S	40°23'18.816"E	10/11/2011	11	Bio 8 - Outer reef, coll. scuba divers
13	22°21'32.436"S	40°19'46.776"E	11/11/2011	12	Bio 14 - Outer reef, coll. scuba divers
14	22°21'31.612"S	40°23'25.789"E	11/11/2011	0-0.5	Grand Lagon - Mangrove, dead coral blocks, coll. Poupin, Gravier-Bonnet, Zubia, Nico Tisné
14B	22°21'32.857"S	40°23'32.651"E	11/11/2011	0-0.5	Grand Lagon - Mangrove, sand flats coll. Poupin, Gravier-Bonnet, Zubia, Nico Tisné
15	22°23'43.044"S	40°22'36.012"E	12/11/2011	0-0.5	Bio 25 - Reef flat, coll. Poupin, Gravier-Bonnet, Zubia, Durville, Nicet
15B	22°23'2.173"S	40°22'57.004"E	12/11/2011	0-1	15B - Brackish marsh, coll. Durville, Zubia
16	22°20'7.116"S	40°23'19.968"E	12/11/2011	10	Bio 12 - Outer reef, coll. scuba divers

Table 2. BIOTAS 2009 station data for the crustacean collection at Europa Island. Crustacea were photographed at stations EURO-1, 3-9, 11, 13-14.

Station	Latitude (°S)	Longitude (°E)	Date	Depth (m)	Description
EURO-1	22°20'30.480"S	40°20'23.820"E	22/04/2009	0-1	Reef flat, coll. Malay, Guillaume, Galves
EURO-2	22°20'21.000"S	40°20'19.980"E	22/04/2009	10-15	Outer reef, coll. Bruggemann, Bourmaud
EURO-3	22°20'24.000"S	40°20'16.980"E	22/04/2009	1-15	Outer reef, coll. Malay, Guillaume, Galves
EURO-4	22°20'37.500"S	40°20'20.460"E	22/04/2009	0-1	Reef flat, coll. Malay, Guillaume, Galves
EURO-5	22°20'28.980"S	40°20'7.980"E	23/04/2009	5-18	Outer reef, coll. Malay, Bourmaud, Rousse
EURO-6,7,8	22°20'47.640"S	40°19'55.320"E	23/04/2009	0-2	Reef flat, intertidal, coll. Bruggemann, Guillaume
EURO-9	22°20'28.140"S	40°20'17.520"E	23/04/2009	3-8	Outer reef flat, coll. Guillaume
EURO-10	22°20'28.020"S	40°20'11.040"E	23/04/2009	12-16	Outer reef, coll. Guillaume, Bruggemann, Galves
EURO-11, 16,	1722°20'41.040"S	40°19'44.040"E	24/04/2009	15-18.5	Outer reef, coll. Guillaume, Bruggemann, Rousse
EURO-12	22°20'45.120"S	40°20'33.780"E	22/04/2009	-	Land, military camp, coll. Malay, Guillaume, Galves
EURO-13,	1822°20'40.980"S	40°19'58.980"E	24/04/2009	0-1	Reef flat, coll. Malay, Bourmaud
EURO-14	22°21'24.540"S	40°22'33.420"E	24/04/2009	0-1	Mangrove, coll. Marteau
EURO-15	22°20'33.000"S	40°19'58.020"E	24/04/2009	8-20	Outer reef, coll. Malay, Bourmaud, Galves

Sizes of specimens are indicated as Sl, shield length (Anomura); Lc, carapace length (shrimps); and Lt, total length, including extended chelipeds (shrimps and Anomura). In crab-like anomurans and crabs, the size is expressed as length x width.

Abbreviations and acronyms are BIORECIE, '*Biodiversité, ressources et conservation des récifs coralliens dans le SO Océan Indien, Iles Eparses*'; BIOTAS, '*The Southwest Indian Ocean biodiversity hotspot: A biota-level study of diversification on land and sea*'; coll., collector/s; ECOMAR, Laboratoire d'Ecologie marine, Université de la Réunion; IRD, Institut de Recherche pour le Développement; MEPA, '*Mission îles Eparses*'; MNHN, Muséum national d'Histoire naturelle, Paris; ORSTOM, Institut Français de Recherche Scientifique pour le Développement en Coopération (changed to IRD since 1998); R/V, Research Vessel; St., Station; TAAF, Terres Australes et Antarctiques Françaises; UF, Florida Museum of Natural History, Gainesville.

Checklist

The classification adopted here follows De Grave *et al.* (2009) and the World Register of Marine Species (WoRMS) at <http://www.marinespecies.org>. The author and date of publication of previous records at Europa Island are provided for each species, followed by sampling location, date of collection, number and sex of individuals, location where specimens deposited and catalogue number, where applicable. Specimens deposited in Paris MNHN collection have numbers such as MNHN-IU-2012-568 or MNHN-IU-2012-569 ex-MNHN-Na14810 and will be useful to source specimens in the MNHN database (<http://coldb.mnhn.fr/>) for further study (e.g. DNA sequencing). While several species are illustrated in colour in this work (Figs 2-10), additional illustrations are available for almost all the others at <http://crustaceamayotte.free.fr/europa.php>.

Data analysis

ORDER DECAPODA

SUBORDER DENDROBRANCHIATA

Superfamily Penaeoidea

Family Penaeidae

Marsupenaeus japonicus (Bate, 1888)

Penaeus japonicus - Dérjard, 1966: 177 (Europa).

SUBORDER PLEOCYEMATA

INFRAORDER STENOPODIDEA

Superfamily Stenopodidea

Family Stenopodidae

Stenopus hispidus (Olivier, 1811)

Stenopus hispidus - Fourmanoir, 1952: 176 (Europa). -

Dérjard, 1966: 177 (Europa). - BIORECIE, St. 10.

INFRAORDER CARIDEA

Superfamily Palaemonoidea

Family Gnathophyllidae

Gnathophyllum americanum Guérin-Méneville, 1855

Gnathophyllum fasciolatus - Dérjard, 1966: 178 (Europa).

Gnathophyllum fasciolatus Stimpson, 1860 is a synonym of *G. americanum* (see De Grave & Fransen, 2011)

Family Hymenoceridae

Hymenocera elegans Heller, 1861

Hymenocera elegans - Dérjard, 1966: 178 (Europa).

Family Palaemonidae

Conchodytes meleagrinae Peters, 1852

Conchodytes meleagrinae - Fourmanoir, 1952: 177 (Europa). - Bruce, 1978: 279 (Europa, 6 May 1952, 2 males, 3 ovigerous females, MNHN-IU-2012-568).

- Li & Bruce, 2006: 628 (Europa, 1 male, MNHN-IU-2012-569 ex-MNHN-Na14810).

Coralliocaris graminea (Dana, 1852)

Coralliocaris graminea - Fourmanoir, 1952: 177 (Europa).

Coralliocaris venusta Kemp, 1922

Coralliocaris venusta - Bruce, 1978: 282 (Europa, 1 ovigerous female, July 1952, MNHN-IU-2012-570).

Coralliocaris viridis Bruce, 1974

Coralliocaris viridis - Bruce, 1978: 283 (Europa, 2 males, 7 females, including 5 ovigerous, MNHN-IU-2012-571).

Cuapetes ensifrons (Dana, 1852)

Cuapetes ensifrons - BIOTAS, specimens MEPA-00272, St. EURO-16, MEPA-00295, St. EURO-17 (Fig. 2B).

Exoclimenella maldivensis Āuriš & Bruce, 1995

Exoclimenella maldivensis - New species for Europa Island, BIORECIE, without station number, intertidal, 1 sp. Lc 2.8 mm, Lt ~14 mm, 1 sp. broken (MNHN-IU-2012-572).

Jocaste japonica (Ortmann, 1890)

Coralliocaris japonica - Fourmanoir, 1952: 177

(Europa). - Bruce, 1978: 281 (Europa, coll. P.

Fourmanoir, 3 ovigerous female, plus 1 specimen, MNHN-IU-2012-573)

Palaemon debilis Dana, 1852

Palaemon debilis - Li & Bruce, 2006: 620 (Europa,

lagoon, coll. P. Fourmanoir, 4 males, 13 females

including 5 ovigerous, MNHN-IU-2012-574 ex-MNHN-Na8460). - BIORECIE, St. 15B, photo P. Durville.

Periclimenes brevicarpalis (Schenkel, 1902)

Periclimenes (Ancyllocaris) brevicarpalis - Dérjard,

1966: 178 (Europa).

Periclimenes imperator Bruce, 1967

Periclimenes imperator - New species for Europa Island,

BIOTAS, specimens MEPA-00209, 00210, 00211, St.

EURO-11 (Fig. 2A).

Superfamily Alpheoidea

Family Alpheidae

Alpheus architectus De Man, 1897

Alpheus bullatus - Dérjard, 1966: 177 (Europa).

Alpheus bullatus Barnard, 1955 is probably a synonym

of *A. architectus* (see De Grave & Fransen, 2011: 378).

Alpheus biscincisus De Haan, 1849

Alpheus biscincisus - Dérjard, 1966: 177 (Europa).

Alpheus collumianus Stimpson, 1861

Alpheus collumianus - Fourmanoir, 1952: 176 (Europa).

Alpheus lobidens De Haan, 1849

Alpheus crassimanus - Dérjard, 1966: 177 (Europa). *Alpheus*

crassimanus Heller, 1862 is a synonym of *A. lobidens* De

Haan, 1849 (see De Grave & Fransen, 2011: 385).

Alpheus lottini Guérin-Méneville, 1829

Alpheus lottini - Fourmanoir, 1952: 176 (Europa). -

BIOTAS, specimens MEPA-00250, 00271, St. EURO-

16, juveniles. - BIORECIE, St. 10, St. 11, remains of

left/small chela (MNHN-IU-2012-575), St. 13.

Alpheus microstylus (Bate, 1888)

Alpheus microstylus - Fourmanoir, 1952: 176 (Europa).

Alpheus pacificus Dana, 1852

Alpheus pacificus - Fourmanoir, 1952: 177 (Europa). -

BIORECIE, St. 15, 2 ovigerous females, Lc 7.5-9.9 mm,

Lt ~28-41 mm (Fig. 2C, MNHN-IU-2012-576).

Alpheus paracrinatus Miers, 1881

Alpheus paracrinatus var. *Bengalensis* (Coutière) - Fourmanoir, 1952: 177 (Europa).

Alpheus pareuchirus Coutière, 1905

Alpheus pareuchirus - Fourmanoir, 1952: 176 (Europa)

Alpheus rapax Fabricius, 1798

Alpheus rapax - Dérijard, 1966: 177 (Europa).

Alpheus strenuus Dana, 1852

Alpheus strenuus - Lenz, 1910: 568 (Europa). - Fourmanoir, 1952: 176 (Europa).

Arete indicus Coutière, 1903

Arete indicus - New species for Europa Island, BIORECIE, St. 10, 1 sp. Lc 2.1 mm, Lt ~5.7 mm (MNHN-IU-2012-577), in sea urchin *Echinometra mataei*.

Athanas djiboutensis Coutière, 1897

Athanas djiboutensis - Fourmanoir, 1952: 177 (Europa). - *Athanas nitescens* (Leach) - Fourmanoir, 1952: 177 (Europa), probably not *A. nitescens*, a species mostly from Atlantic and Mediterranean (see Banner & Banner, 1983: 77).

Synalpheus paraneomeris Coutière, 1905

Synalpheus paraneomeris - Fourmanoir, 1952: 177 (Europa).

Family Hippolytidae*Lysmata kuekenthali* (De Man, 1902)

Hippolysmata kuekenthali - Dérijard, 1966: 178 (Europa).

Saron marmoratus (Olivier, 1811)

Saron marmoratus - Fourmanoir, 1952: 177 (Europa). - Dérijard, 1966: 178 (Europa). - BIORECIE, St. 1, St. 4, coll. N. Gravier-Bonnet, 1 sp. Lc 7.1 mm, Lt ~26 mm (MNHN-IU-2012-578).

INFRAORDER ACHELATA**Family Palinuridae***Panulirus versicolor* (Latreille, 1804)

Panulirus versicolor - New species for Europa Island, BIOTAS, specimens MEPA-00055, St. EURO-1, juvenile colouration (Fig. 2D).

INFRAORDER ANOMURA**Superfamily Galatheoidea****Family Galatheidae***Galathea mauritiana* Bouvier, 1915

Galathea mauritiana - Fourmanoir, 1952: 177 (Europa).

Galathea spinosorostris Dana, 1852

Galathea spinosorostris - Lenz, 1910: 566 (Europa).

Galathea tanegashimae Baba, 1969

Galathea tanegashimae - New species for Europa Island, BIOTAS, specimen MEPA-00270, St. EURO-16.

Family Porcellanidae*Pachycheles garcianesis* (Ward, 1942)

Petrolisthes garcianesis - Haig, 1966: 42 (Europa, coll. Fourmanoir, 1 male 3.4 mm).

Pachycheles sculptus (H. Milne Edwards, 1837)

Pachycheles sculptus - New species for Europa Island, BIORECIE, St. 8, 2 females, 1 broken and 2.7 x 3.2 mm (MNHN-IU-2012-579). These specimens tentatively attributed to *P. sculptus* although no male is available for an unambiguous determination. In *P. sculptus* males have no pleopod whereas in males of *P. garciaensis*, a species very similar and already reported from Europa, pleopods are present. Present determination is based on presence of simple setae on extensor margin of ambulatory legs, front straight, carpi of chelipeds rugose (see Osawa & Chan, 2010: 106).

Petrolisthes asiaticus (Leach, 1820)

Petrolisthes asiaticus - New species for Europa Island, BIORECIE, St. 8, 1 male 5.6 x 5.4 mm (MNHN-IU-2012-580), St. 11, 1 male 7.0 x 7.1 mm, plus two chelae (MNHN-IU-2012-581).

Petrolisthes borradailei Kropp, 1994

Petrolisthes borradailei - New species for Europa Island, BIOTAS specimens MEPA-00029, St. EURO-1 - BIORECIE, St. 4, 1 female 6.0 x 5.8 mm (MNHN-IU-2012-582), St. 8, 2 males 6.1 x 5.9-7.9 x 7.5 mm (MNHN-IU-2012-583), St. 11, 1 male 7.4 x 7.0 mm, 1 female ovigerous 7.3 x 7.1 mm (MNHN-IU-2012-584), St. 15, 2 males 6.9 x 6.3-8.9 x 8.1 mm (Fig. 5A, MNHN-IU-2012-585).

Petrolisthes extremus Kropp & Haig, 1994

Petrolisthes extremus - New species for Europa Island, BIORECIE, St. 8, 1 male 7.7 x 7.5 mm (MNHN-IU-2012-586).

Petrolisthes lamarckii (Leach, 1820)

Petrolisthes lamarckii - Fourmanoir, 1952: 177 (Europa). - Dérijard, 1966: 176 (Europa).

Petrolisthes militaris (Heller, 1862)

Petrolisthes militaris - Haig, 1966: 40 (Europa, coll. Fourmanoir, 1 male).

Petrolisthes tomentosus (Dana, 1852)

Petrolisthes tomentosus - New species for Europa Island, BIORECIE, St. 8, 1 male 6.4 x 6.3 mm, 3 ovigerous females 5.6 x 5.6-7.3 x 7.3 mm (MNHN-IU-2012-587).

Superfamily Hippoidea**Family Hippidae***Hippa adactyla* Fabricius, 1787

Remipes testudinarius - Fourmanoir, 1952: 177 (Europa), *Remipes testudinarius* Latreille, 1806 is a synonym of *H. adactyla*. - *Hippa adactyla* - Dérijard, 1966: 175 (Europa).

Superfamily Paguroidea**Family Coenobitidae**

Coenobita perlatus H. Milne Edwards, 1837

Coenobita cavipes - Dérjard, 1966: 176 (Europa), probably not *C. cavipes* Stimpson, 1859 but *C. perlatus*, ubiquitous on the island and not cited by Dérjard. The two species can be confused but are separated by the stridulating ridge along upper margin on outer face of left chela, present in *C. perlatus*, absent in *C. cavipes*. - *Coenobita perlatus* - BIOTAS, specimens MEPA-00057, 00896, St. EURO-4, MEPA-00542, 00543, St. EURO-13. - BIORECIE, St. 3, St. 5, St. 6, St. 7 (Fig. 3A, C).

Coenobita rugosus H. Milne Edwards, 1837

Coenobita rugosus - Dérjard, 1966: 176 (Europa). - BIOTAS, specimens MEPA-00075, St. EURO-4. - BIORECIE, St. 6, St. 7 (Fig. 3B, D).

Family Diogenidae

Aniculus ursus (Olivier, 1811)

Aniculus ursus - New species for Europa Island, BIOTAS specimens MEPA-00168, 00170, St. EURO-7 (Fig. 5D).

Calcinus guamensis Wooster, 1984

Calcinus guamensis - New species for Europa Island, BIOTAS specimens MEPA-00074, St. EURO-3. - BIORECIE, St. 8, 1 sp. SI 1.3 mm, 1 ovigerous female SI 0.8 mm, plus 4 spp. in shells (MNHN-IU-2012-588)

Calcinus laevimanus (Randall, 1840)

Calcinus herbstii (De Man, 1888) - Fourmanoir, 1952: 177 (Europa). *Calcinus herbstii* de Man, 1888 is a synonym of *C. laevimanus*. - *Calcinus laevimanus* - BIOTAS specimens MEPA-00049, 00050, 00051, St. EURO-1 (Fig. 4B). - BIORECIE, St. 4, St. 8, 1 sp. in shell (MNHN-IU-2012-589), St. 11, St. 14, St. 15.

Calcinus latens (Randall, 1840)

Calcinus latens - New species for Europa Island, BIOTAS, specimens MEPA-00078, 00080, 00081, St. EURO-3 (Fig. 4E). - BIORECIE, St. 4, St. 8, 4 juveniles in shells (MNHN-IU-2012-590), St. 11, St. 14, 1 female SI 3.9 mm (MNHN-IU-2012-591), St. 15.

Calcinus morgani Rahayu & Forest, 1999

Calcinus gaimardii - Dérjard, 1966: 176 (Europa), not *Calcinus gaimardii* (H. Milne Edwards, 1848), a species mostly reported from the Pacific, and confused with *C. morgani* before its description by Rahayu & Forest (1999). - *Calcinus morgani* - BIOTAS specimens MEPA-00068, 00072, St. EURO-3, MEPA-00313, St. EURO-18 (Fig. 4A). - BIORECIE, St. 1, St. 8, 2 juveniles SI 3.5 mm each, 1 sp. in shell (MNHN-IU-2012-592), St. 12.

Calcinus pulcher Forest, 1958 s.l.

Calcinus pulcher s.l. - New species for Europa Island, BIOTAS, specimens MEPA-00266, St. EURO-11. This is the Indian Ocean form of *Calcinus pulcher*, without red patches on carpi of second pereopods, contrary to the typical form described from Vietnam (see Malay & Paulay, 2009).

Calcinus rosaceus Heller, 1861

Calcinus rosaceus - New species for Europa Island, BIOTAS specimens MEPA-00083, 00087, 00088, 00155, 00158, 00159, 00160, 00161, St. EURO-3 (Fig. 4D), MEPA-00287, St. EURO-11. - BIORECIE, St. 7, St. 12, St. 16, 1 male SI 4.2 mm (MNHN-IU-2012-593).

Calcinus seurati Forest, 1951

Calcinus seurati - New species for Europa Island, BIOTAS, specimen MEPA-00197, St. EURO-8 (Fig. 4C).

Calcinus vachoni Forest, 1958 s.l.

Calcinus vachoni s.l. - New species for Europa Island, BIOTAS, specimens MEPA-00329, St. EURO-18. - BIORECIE, St. 16, 1 male SI 2.5 mm (MNHN-IU-2012-594). Malay and Paulay (2009) have indicated that the DNA sequences of *C. vachoni* in the Indian Ocean are distinct from typical sequences of *C. vachoni* s.s. Therefore, all WIO *Calcinus vachoni* records probably belong to a cryptic, undescribed species, affiliated to *C. vachoni* s.s.

Ciliopagurus tricolor Forest, 1995

Trizopagurus sp. - Dérjard, 1966: 176 (Europa). - *Ciliopagurus tricolor* - Poupin & Malay, 2009: 217 (Europa, North reef at low tide, coll. R. Dérjard, April 1964, 2 males 10.1 mm, MNHN-IU-2012-595 ex MNHN Pg 620). - BIOTAS, specimens MEPA-00058, 00059, St. EURO-1 (Fig. 5E), MEPA-00263, St. EURO-11.

Clibanarius eurysternus Hilgendorf, 1878

Clibanarius eurysternus - New species for Europa Island, BIORECIE, St. 4, (Fig. 4F), St. 15, 1 female SI 4.6 mm (MNHN-IU-2012-596)

Clibanarius humilis (Dana, 1851)

Clibanarius humilis - New species for Europa Island, BIORECIE, St. 10, 6 spp. (MNHN-IU-2012-597), 20 spp. (MNHN-IU-2012-598), St. 11, 2 spp. (MNHN-IU-2012-599).

Clibanarius longitarsus (De Haan, 1849)

Clibanarius longitarsus - New species for Europa Island, BIOTAS, specimen MEPA-00241, St. EURO-14 (Fig. 5C). - BIORECIE, St. 6, St. 9, St. 14.

Clibanarius striolatus Dana, 1852

Clibanarius striolatus - New species for Europa Island, BIORECIE, St. 14, 1 male SI 5.9 mm, Lt 36 mm (Fig. 4G, MNHN-IU-2012-600).

Clibanarius virescens (Krauss, 1843)

Clibanarius virescens - Fourmanoir, 1952: 177 (Europa). - BIOTAS, specimen MEPA-00071, St. EURO-3.

Dardanus arrosor (Herbst, 1796)

Dardanus arrosor - Dérjard, 1966: 175 (Europa).

Dardanus deformis (H. Milne Edwards, 1836)

Pagurus deformis - Fourmanoir, 1952: 177 (Europa).

Dardanus gemmatus (H. Milne Edwards, 1848)

Dardanus gemmatus - New species for Europa Island, BIOTAS, specimen MEPA-00069, St. EURO-3.

***Dardanus guttatus* (Olivier, 1812)**

Pagurus guttatus - Fourmanoir, 1952: 177 (Europa). -
Dérijard, 1966: 175 (Europa). - BIORECIE, St. 8.

***Dardanus lagopodes* (Forskål, 1775)**

Dardanus lagopodes - New species for Europa Island,
BIOTAS, specimens MEPA-00054, St. EURO-1, MEPA-
00153, St. EURO-5. - BIORECIE, St. 7, St. 14, 1 male
Sl 6.6 mm, Lt 35 mm (MNHN-IU-2012-601).

***Dardanus megistos* (Herbst, 1804)**

Pagurus megistos - Fourmanoir, 1952: 177 (Europa). -
Dérijard, 1966: 175 (Europa). - BIORECIE, St. 1.

***Dardanus pedunculatus* (Herbst, 1804)**

Dardanus varipes - Dérijard, 1966: 175 (Europa).
Dardanus varipes (Heller, 1861) is a synonym of *D. tinctor*
(Forskål, 1775), a species distributed with certainty only
in the Atlantic and Red Sea. Since Dérijard indicates that
his specimen(s) is conspecific with '*Pagurus pedunculatus*,
Barnard, 1950, p. 429-30, fig. 79e' his record is most
probably *D. pedunculatus*, a species common in the
region. *Dardanus asper* - Dérijard, 1966: 175 (Europa).
Dardanus asper (De Haan, 1849) is a synonym of *D.*
pedunculatus.

***Dardanus scutellatus* (H. Milne Edwards, 1848)**

Dardanus scutellatus - New species for Europa Island,
BIORECIE, St. 14, 1 specimen Sl 4.7 mm Lt 49 mm
(Fig. 5F, MNHN-IU-2012-602)

Family Paguridae***Pagurixus haigae* Komai & Osawa, 2007**

Pagurixus haigae - New species for Europa Island,
BIORECIE, St. 1, 1 male Sl 1.6 mm, 2 ovigerous
females Sl 1.5, 1.6 mm (Fig. 5B, MNHN-IU-2012-603).
First WIO record for this species.

***Pagurixus* sp. nov. 1**

Pagurixus sp. nov. 1 - New species for Europa Island,
BIORECIE, St. 10, 1 male Sl 1.5 mm (MNHN-
IU-2012-604). This male resembles *P. brachydactylus*
Komai & Osawa, 2006 from Japan but it is distinct and will
be described as a new species (Komai & Poupin, 2013).

***Pagurixus* sp. nov. 2**

Pagurixus sp. nov. 2 - New species for Europa Island,
BIORECIE, St. 10, 1 male Sl 1.3 mm (MNHN-
IU-2012-762), 3 males Sl 1.1-1.5 mm (MNHN-
IU-2012-763), 1 juvenile Sl. 0.9 mm (MNHN-
IU-2012-764). These specimens represent a new species
to be described by Komai and Poupin (2013).

INFRAORDER BRACHYURA**Superfamily Dromioidea****Family Dromiidae*****Cryptodromia fallax* (Latreille, in Milbert, 1812)**

Cryptodromia fallax - New species for Europa Island,
BIORECIE, St. 4, 1 male 5.9 x 6.6 mm (MNHN-IU-2012-605).

Superfamily Calappoidea**Family Calappidae*****Calappa gallus* (Herbst, 1803)**

Calappa gallus - Fourmanoir, 1952: 176 (Europa). -
Guinot, 1967: 245 (List, with Europa).

***Calappa hepatica* (Linnaeus, 1758)**

Calappa hepatica - Fourmanoir, 1952: 176 (Europa). -
Dérijard, 1966: 162 (Europa) - Guinot, 1967: 245 (List,
with Europa). - BIORECIE, St. 8 (Fig 8A).

Family Matutidae***Ashtoret lunaris* (Forskål, 1775)**

Matuta lunaris - Dérijard, 1966: 162 (Europa).

Superfamily Carpilioidea**Family Carpiliidae*****Carpilius convexus* (Forskål, 1775)**

Carpilius convexus - Fourmanoir, 1952: 175 (Europa). -
Dérijard, 1966: 164 (Europa). - Guinot, 1967: 262 (List,
with Europa).

Superfamily Dairoidea**Family Dacryopilumnidae*****Dacryopilumnus eremita* Nobili, 1906**

Dacryopilumnus eremita - Crosnier, 1984: 313, pl.
XLVII E, fig. 240-241 (Europa, female 3.8 x 5.3 mm,
MNHN-IU-2012-606, ex-MNHN B8768).

***Dacryopilumnus rathbunae* Balss, 1932**

Dacryopilumnus rathbunae - Dérijard, 1968: 1246
(Europa, 1 ovigerous female 5.2 x 7.7 mm (MNHN-
IU-2012-607). - BIORECIE, St. 8, 1 female 6.5 x 9.4
mm (MNHN-IU-2012-608).

Family Dairidae***Daira perlata* (Herbst, 1790)**

Daira perlata - Dérijard, 1966: 168 (Europa). - Europa,
BIORECIE, St. 15.

Superfamily Eriphioidea**Family Eriphiidae*****Eriphia scabricula* Dana, 1852**

Eriphia scabricula - Dérijard, 1966: 169 (Europa).
- BIOTAS, specimen MEPA-00172, St. EURO-7. -
BIORECIE, St. 8, 1 female juvenile 5.8 x 7.8 mm
(MNHN-IU-2012-609).

***Eriphia sebana* (Shaw & Nodder, 1803)**

Eriphia laevimanus - Fourmanoir, 1952: 175 (Europa),
Eriphia laevimana Guérin, 1829 is a synonym of *E.*
sebana - *Eriphia sebana* - Dérijard, 1966: 169 (Europa).
- Guinot, 1967: 271 (List, with Europa). - BIORECIE, St.
4, St. 10, St. 11, St. 14, St. 15 (Fig. 8B).

Eriphia smithii MacLeay, 1838

Eriphia laevimanus var. *smithii* - Lenz, 1910: 552 (Europa). - *Eriphia sebania smithii* McLay (sic). - Guinot, 1967: 271 (List, with Europa). - BIOTAS, specimen MEPA-00255, St. EURO-11.

Family Oziidae*Epixanthus frontalis* (H. Milne Edwards, 1834)

Epixanthus frontalis - Lenz, 1910: 552 (Europa).

Lydia annulipes (H. Milne Edwards, 1834)

Lydia annulipes - Dérjard, 1966: 168 (Europa). - Crosnier, 1984: 309, Pl. XLVI E, fig. 230-231 (Europa)

Superfamily Majoidea**Family Epialtidae***Huenia grandidierii* A. Milne-Edwards, 1865

Huenia grandidierii - New species for Europa Island, BIORECIE, St. 8, 1 female ovigerous 9.7 (without rostrum) x 9.9 mm (MNHN-IU-2012-610).

Menaethius monoceros (Latreille, 1825)

Menaethius monoceros - New species for Europa Island, BIOTAS, specimen MEPA-00022, St. EURO-1 - BIORECIE, St. 8, 1 female juvenile, 6.4 (without rostrum) x 5.1 mm (MNHN-IU-2012-611).

Tylocarcinus styx (Herbst, 1803)

Tylocarcinus styx. - Lenz, 1910: 542 (Europa, 1 male, 1 female). - BIOTAS, specimens MEPA-00262, St. EURO-11, MEPA-00264, St. EURO-18. - BIORECIE, St. 8, 1 male 10.3 (without horns) x 6.1 mm (MNHN-IU-2012-612), 1 male 13.6 (without horns) x 9.6 mm (MNHN-IU-2012-613).

Family Majidae*Micippa platipes* Rüppel, 1830

Micippa sp. - Fourmanoir, 1952: 176 (Europa), perhaps *M. platipes*, collected during BIORECIE. - *Micippa platipes* - BIORECIE, St. 4, 1 female 19.8 x 16.7 mm (Fig. 7A, MNHN-IU-2012-614), St. 15.

Schizophrys aspera (H. Milne Edwards, 1834)

Schizophrys aspera - New species for Europa Island, BIOTAS, specimen MEPA-00267, St. EURO-16.

Superfamily Pilumnoidea**Family Pilumnidae***Pilumnus ?longicornis* Hilgendorf, 1878

Pilumnus ?longicornis - New species for Europa Island, BIORECIE, St. 8, 1 male 8.4 x 10.5 mm (MNHN-IU-2012-615). This specimen is distinguished from *P. longicornis* by the presence of a dorso-distal spine on each carpus of ambulatory legs. It may therefore belong to another species of the *P. cursor* complex of species. Comparative material is needed to positively identify it.

Superfamily Portunoidea**Family Portunidae***Charybdis (Charybdis) hellerii* (A. Milne Edwards, 1867)

Charybdis (Charybdis) hellerii - Crosnier, 1962: 78, fig. 133-5, pl. V fig. 1 (Europa). - Guinot, 1967: 245 (List, with Europa).

Lissocarcinus orbicularis Dana, 1852

Lissocarcinus orbicularis - Fourmanoir, 1952: 175 (Europa). - Guinot, 1967: 259 (List, with Europa). - Dérjard, 1966: 162, fig. 1-4 (Europa). - BIOTAS, specimen MEPA-00212 à 214, St. EURO-11. - BIORECIE, St. 6, 1 female ovigerous 11.3x12.4 mm (MNHN-IU-2012-616), in sea cucumber *Bohadschia subrubra*.

Portunus (Portunus) convexus De Haan, 1835

Portunus convexus - Dérjard, 1966: 163 (Europa)

Portunus (Xiphonectes) tenuipes (De Haan, 1835)

Portunus tenuipes - Guinot, 1967: 257 (List, with Europa).

Scylla serrata (Forskål, 1775)

Scylla serrata - Fourmanoir, 1952: 176 (Europa). - Guinot, 1967: 258 (List, with Europa). - Dérjard, 1966: 163 (Europa). - BIORECIE, St. 9, St. 14 (Fig. 6B).

Thalamita admete (Herbst, 1803)

Thalamita admete - Crosnier, 1962: 96, fig. 154, 157, 162-4, 168 (Europa). - Guinot, 1967: 255 (List, with Europa).

Thalamita crenata Rüppel, 1830

Thalamita crenata - Fourmanoir, 1952: 176 (Europa). - Guinot, 1967: 256 (List, with Europa). - BIORECIE, St. 9, St. 14, 1 male 31.2 x 46.2 mm (Fig. 6A, MNHN-IU-2012-617).

Thalamita margaritimana Rathbun, 1911

Thalamita margaritimana - Fourmanoir, 1952: 176 (Europa). - Guinot, 1965: 267 (List, with Europa).

Thalamita picta Stimpson, 1858

Thalamita picta - Crosnier, 1962: 138, fig. 237-40, pl. XII, fig. 2 (Europa). - *Thalamita picta* - Guinot, 1967: 256 (List, with Europa). - BIOTAS, specimen MEPA-00171, 00174, St. EURO-7 compared with Vannini & Innocenti (2000: 289, photo 89). - BIORECIE, St. 15, 2 males 10.3 x 14.9-14.3 x 20.7 mm, 2 females ovigerous 10.8 x 14.3-11.4 x 17.4 mm (Fig. 6D, MNHN-IU-2012-618).

Thalamita prymna (Herbst, 1803)

Thalamita tenuipes - Fourmanoir, 1952: 176 (Europa), see comment. - *Thalamita prymna* - Dérjard, 1966: 164 (Europa). *Thalamita tenuipes* Borradaile, 1902 is considered as a junior synonym of *T. prymna* by Davie (2002: 480) while it is listed as valid by Ng *et al.* (2008: 155). As Crosnier (1962) mentions only *T. prymna* in his revision of the portunid crabs from Madagascar and surrounding islands, it seems that Fourmanoir (1952) *T. tenuipes* must be attributed to *T. prymna*, a species reported in Europa (cf. Dérjard, 1966).

Thalamita quadrilobata Miers, 1884
Thalamita aff. admete - Dérjard, 1966: 164 (Europa). -
Thalamita quadrilobata - Dérjard, 1968: 1242, fig. 1-4
 (Europa, same specimen as Dérjard, 1966).

Thalamitoides quadridens A. Milne-
 Edwards, 1869
Thalamitoides quadridens - New species for Europa Island,
 BIOTAS, specimens MEPA-00282, St. EURO-17 (Fig. 6C).

Superfamily Trapezoidea

Family Domeciidae

Domecia hispida Eydoux & Souleyet, 1842
Domecia hispida - Lenz, 1910: 553 (Europa). - Guinot,
 1967: 270 (List, with Europa). - BIORECIE, St. 12.

Family Tetraliidae

Tetralia cinctipes Paul'son, 1875
Tetralia cinctipes - New species for Europa Island,
 BIORECIE, St. 12, 1 female 3.6 x 4.3 mm (MNHN-
 IU-2012-619).

Tetralia glaberrima Herbst, 1790
Tetralia glaberrima - Lenz, 1910: 553 (Europa). -
 Fourmanoir, 1952: 176 (Europa).

Family Trapeziidae

Trapezia bidentata (Forskål, 1775)
Trapezia ferruginea - Lenz, 1910: 553 (Europa). - Fourmanoir,
 1952: 176 (Europa). - *Trapezia ferruginea* Latreille, 1828 is a
 synonym of *T. bidentata*. - BIOTAS, specimens MEPA-00311,
 00320, St. EURO-18. - BIORECIE, St. 8, St. 11, St. 12, 1 male
 4.6 x 5 mm (MNHN-IU-2012-620).

Trapezia cymodoce (Herbst, 1799)
Trapezia cymodoce - Lenz, 1910: 552 (Europa). -
 Fourmanoir, 1952: 176 (Europa).

Trapezia guttata Rüppell, 1830
Trapezia guttata - Fourmanoir, 1952: 176 (Europa).

Trapezia lutea Castro, 1997
Trapezia lutea - New species for Europa Island,
 BIOTAS, specimen MEPA-00283, St. EURO-17 (Fig.
 10A), MEPA-00315, St. EURO-18. - BIORECIE, St. 8,
 1 male 8.9 x 10.6 mm, 2 ovigerous females 6.8 x 8.4-9.4
 x 11.7 mm (MNHN-IU-2012-621).

Trapezia rufopunctata (Herbst, 1799)
Trapezia rufopunctata - Dérjard, 1966: 170, fig. 15
 (Europa).

Superfamily Xanthoidea

Family Xanthidae

Actaeodes consobrinus (A. Milne Edwards,
 1873)
Actea suffuscula - Fourmanoir, 1952: 175 (Europa),
Actaea suffuscula Rathbun, 1911 is a synonym of *A.*
consobrinus. - *Actaea consobrina* - Guinot, 1967: 260
 (List, with Europa).

Actaeodes tomentosus (H. Milne Edwards,
 1834)
Actaea tomentosa - Lenz, 1910: 549 (Mayotte). -
 Dérjard, 1966: 168 (Europa). - Guinot, 1967: 260 (List,
 with Europa).

Atergatopsis signata (Adam & White, 1849)
Atergatopsis flavomaculatus - Lenz, 1910: 546 (Europa),
Atergatopsis flavomaculatus A. Milne-Edwards, 1865
 is a synonym of *A. signata*. - *Atergatopsis signata* -
 Fourmanoir, 1952: 175 (Europa). - *Atergatopsis signatus*
 - Guinot, 1967: 262 (List, with Europa).

Chlorodiella barbata (Borradaile, 1900)
Chlorodiella barbata - Serène, 1984: 260, fig. 170, pl.
 XXXVI A (Europa, intertidal, coll. P. Fourmanoir, 1
 male 6.0 x 9.4 mm, 1 female 6.6 x 10.8 mm, MNHN-
 IU-2012-622, ex-MNHN B-6713).

Chlorodiella laevisissima (Dana, 1852)
Chlorodiella laevisissima - New species for Europa
 Island, BIOTAS, specimen MEPA-00269, St. EURO-16
 (Fig. 10B), MEPA-00289, St. EURO-17, MEPA-00312,
 00316, St. EURO-18. - BIORECIE, St. 8, 1 male 3.7 x
 5.7 mm, 1 female (MNHN-IU-2012-623).

Chlorodiella nigra (Forskål, 1775)
Chlorodiella nigra - Serène, 1984: 258
 (Europa, intertidal coll. P. Fourmanoir, 2 males 9.6 x
 14.2 mm and 11.1 x 16.6 mm, 3 females, largest 12.5 x
 19.9 mm, MNHN-IU-2012-624, ex MNHN B-6727).

Cyclodius obscurus (Hombron & Jacquinet,
 1846)
Phymodius monticulosus - Lenz, 1910: 550 (Europa). -
 Dérjard, 1966: 168, fig. 9-11 (Europa). - Serène, 1984:
 250 (Europa, intertidal, coll. P. Fourmanoir, 1 male 17.9
 x 26.9 mm, MNHN-IU-2012-625, ex-MNHN B-6707).
Phymodius monticulosus (Dana, 1852) is a synonym of
C. obscurus. - *Cyclodius obscurus* - BIORECIE, St. 14,
 1 male 18.3 x 25.3 mm (Fig. 7B, MNHN-IU-2012-626).

Cyclodius unguulatus (H. Milne Edwards,
 1834)
Phymodius unguulatus - Dérjard, 1966: 168 (Europa). -
 Serène, 1984: 251, fig. 158, 161, pl. XXXV E (Europa,
 intertidal, coll. P. Fourmanoir, 2 males 7.4 x 10.3 mm and
 7.7 x 11.2 mm, MNHN-IU-2012-627, ex-MNHN B-6738).

Cymo ?deplanatus A. Milne Edwards, 1873
Cymo ?deplanatus - New species for Europa Island,
 BIOTAS, specimens MEPA-00317, St. EURO-18,
 determined from photographs, to be confirmed by
 careful examination of the specimen.

Cymo quadrilobatus Miers, 1884
Cymo quadrilobatus - New species for Europa Island,
 BIORECIE, St. 13.

Etisus bifrontalis (Edmondson, 1935)

Etisus bifrontalis - New species for Europa Island, BIORECIE, St. 11, 1 male 11.1 x 15.5 mm (MNHN-IU-2012-628).

Etisus laevimanus Randall, 1840

Etisus laevimanus - New species for Europa Island, BIORECIE, St. 14 (Fig. 8C).

Euxanthus rugosus Miers, 1884

Euxanthus rugosus - Fourmanoir, 1952: 175 (Europa). - Guinot, 1967: 262 (List, with Europa).

Gaillardiellus rueppelli (Krauss, 1843)

Actea rüppelii (sic) - Fourmanoir, 1952: 175 (Europa). - *Actaea rupelli* (sic) - Guinot, 1967: 260 (List, with Europa). - *Gaillardiellus rueppelli* - BIOTAS, specimen MEPA-00045, St. EURO-1 (a juvenile, probably of this species; see photo 9 at <http://crustaceamayotte.free.fr/illustration.php?n=9&sp=461>).

Lachnopodus subacutus (Stimpson, 1858)

Carpilodes tristis - Lenz, 1910: 545 (Europa), non *Liomera tristis* (Dana, 1852) but *Lachnopodus subacutus*, according to Serène (1984: 59). - *Lachnopodus subacutus* - Guinot, 1967: 262 (List, with ?Europa). - Serène, 1984: 205 (Europa, in distribution).

Leptodius gracilis (Dana, 1852)

Leptodius gracilis - Serène, 1984: 184 (Europa, coll. P. Fourmanoir, 7 males, largest 14.0 x 22.9 mm, 5 females, largest 10.8 x 16.8 mm, MNHN-IU-2012-629, ex-MNHN B-6641). - BIORECIE, St. 10, 1 male 11.6 x 17.6 mm, 1 female ovigerous 7.4 x 11.1 mm (MNHN-IU-2012-630), St. 11, 1 male 11.4 x 17.0 mm, 1 male, 1 female (MNHN-IU-2012-631).

Leptodius nudipes (Dana, 1852)

Leptodius nudipes - New species for Europa Island, BIORECIE, St. 11, 1 male 7.8 x 11.3 mm, 6 juveniles (MNHN-IU-2012-632), 2 males 6.4 x 9.4-11.4 x 16.9 mm (MNHN-IU-2012-633).

Leptodius sanguineus (H. Milne Edwards, 1834)

Leptodius sanguineus - Lenz, 1910: 548 (Europa). - BIORECIE, St. 11, 1 female ovigerous 10.1 x 14.8 mm (MNHN-IU-2012-634).

Liocarpilodes armiger (Nobili, 1905)

Liocarpilodes armiger - New species for Europa Island, BIOTAS, specimens MEPA-00291, St. EURO-17 (Fig. 10D).

Liomera bella (Dana, 1852)

Carpilodes vaillantianus - Lenz, 1910: 545 (Europa), *Carpilodes vaillantianus* (A. Milne-Edwards, 1862) is a synonym of *L. bella*. - *Liomera bella* - Guinot, 1967: 265 (List, with Europa). - BIORECIE, St. 11, 1 male juvenile 2.4 x 3.8 mm (MNHN-IU-2012-635).

Liomera cinctimana (White, 1847)

Liomera cinctimana - Lenz, 1910: 546 (?Europa). - Guinot, 1967: 265 (List, with Europa).

Liomera monticulosa (A. Milne-Edwards, 1873)

Liomera monticulosa. - New species for Europa Island, BIOTAS, specimens MEPA-00284, St. EURO-17 (Fig. 10C) - BIORECIE, St. 8, 1 male 2.5 x 3.9 mm (MNHN-IU-2012-636).

Liomera rugata (H. Milne Edwards, 1834)

Carpilodes rugatus - Dérjard, 1966: 164, fig. 4-5 (Europa).

Lophozozymus dodone (Herbst, 1801)

Lophozozymus dodone - New species for Europa Island, BIORECIE, St. 10, 1 juvenile 3.8 x 5.3 mm (MNHN-IU-2012-637).

Lophozozymus pulchellus A. Milne-Edwards, 1867

Lophozozymus pulchellus - Dérjard, 1968: 1244, fig. 8-9 (Europa). - Serène, 1984: 170 (Europa).

Lybia tessellata (Latreille, 1812)

Lybia tessellata - New species for Europa Island, BIOTAS, specimen MEPA-00248, St. EURO-16 (Fig. 10F).

Macromedaeus nudipes (A. Milne-Edwards, 1867)

Xantho nudipes - Dérjard, 1968: 1242, fig. 5-7 (Europa).

Neoxanthias impressus (Latreille, in Milbert, 1812)

Xantho impressus - Fourmanoir, 1952: 175 (Europa). - Dérjard, 1966: 166, fig. 8 (Europa). - *Xanthias impressus* - Guinot, 1967: 268 (List, with Europa). - *Neoxanthias impressus* - Serène, 1984: 201, fig. 120, pl. XXVIII E (Europa, intertidal, coll. P. Fourmanoir, 1 male 30.4 x 50.8 mm, MNHN-IU-2012-638, ex-MNHN B-6660).

Paractaea retusa (Nobili, 1905)

Actaea ?retusa - Dérjard, 1968: 1246 (Europa, 1 female 12 x 19 mm). - *Paractaea retusa retusa* - Serène, 1984: 125, fig. 73, pl. XVII A, B, C (Europa, coll. R. Derijard, det. Guinot, 1969, 1 female 12 x 18.7 mm; same specimen as Dérjard, 1968).

Pilodius areolatus (H. Milne Edwards, 1834)

Chlorodopsis areolata - Lenz, 1910: 551 (Europa). - *Pilodius areolatus* - Dérjard, 1968: 1244 (Europa). - Guinot, 1967: 268 (List, with Europa). - BIOTAS, specimens MEPA-00021, 00030, 00031, 00032, 00033, St. EURO-1. - BIORECIE, St. 1 (Fig. 7C), St. 11, 1 male 14.4 x 18.8 mm, 1 female 9.8 x 15.8 mm (MNHN-IU-2012-639).

Pilodius scabriculus Dana, 1852

Pilodius scabriculus - Guinot, 1967: 268 (List, with Europa). - Serène, 1984: 244, fig. 143 i, 149, pl. XXXIV D (Europa, intertidal, coll. P. Fourmanoir, 1 male 7.0 x 11.3 mm, MNHN-IU-2012-640, ex-MNHN B-6732). - BIOTAS, specimens MEPA-00004, 00028, St. EURO-1, MEPA-00326, St. EURO-18. - BIORECIE, St. 1, 1 male 3.5 x 5.3 mm (MNHN-IU-2012-641), St. 11, 1 male 6.5 x 10 mm (MNHN-IU-2012-642).

***Pilodius spinipes* (Heller, 1861)**

Chlorodopsis woodmasoni - Lenz, 1910: 551 (Europa),
Chlorodopsis woodmasoni Alcock, 1898 is a synonym of *Pilodius spinipes* - *Pilodius spinipes* - Dérjard, 1968: 1244 (Europa).

***Heteropilumnus trichophoroides* de Man, 1895**

Pilumnus trichophoroides - Dérjard, 1966: 170
 (Europa, with doubt and this remark “en l’absence de spécimen mâle, c’est sans certitude que je rapporte ces échantillons à l’espèce *P. trichophoroides* de Man”).

***Platypodia cristata* (A. Milne-Edwards, 1865)**

Platypodia cristata - Serène, 1984: 161 (Europa, coll. P. Fourmanoir, 1 male 7.4 x 11.1 mm, MNHN-IU-2012-643, ex-MNHN B-6610).

***Platypodia granulosa* (Rüppell, 1830)**

Platypodia granulosa - Fourmanoir, 1952: 175 (Europa). - Dérjard, 1965: 165, fig. 6-7 (Europa). - Guinot, 1967: 268 (List, with Europa). - BIORECIE, St. 8, 1 female juvenile 8.4 x 12 mm (MNHN-IU-2012-644), not similar to typical *P. granulosa*? perhaps because of juvenile aspect (see photos 3-5 at <http://crustaceamayotte.free.fr/illustration.php?n=5&sp=218>)

***Psaumis cavipes* (Dana, 1852)**

Actaea fossulata - Lenz, 1910: 549 (Europa), ?non
Psaumis fossulata (Girard, 1859), see comment. - *Actaea cellulosa* - Dérjard, 1968: 1245 (Europa),
Actaea cellulosa Dana, 1852 is a synonym of *P. cavipes*. - *Actaea cavipes* - Guinot, 1967: 260 (List, with Europa).

Psaumis fossulata (Girard, 1859) is considered as valid by Ng *et al.* (2008: 196) while Serène (1984: 129) is inclined to consider *P. fossulata* as a synonym of *P. cavipes*, with this remark “... l’identité de *fossulata* avec *cavipes* peut laisser un doute ...”.

***Pseudoliomera variolosa* (Borradaile, 1902)**

Pseudoliomera variolosa - New species for Europa Island, BIOTAS, specimens MEPA-00288 St. EURO-17 (Fig. 10G).

***Xanthias lamareckii* (H. Milne Edwards, 1834)**

Xanthias lamareckii - Dérjard, 1966: 167 (Europa). - Serène, 1984: 195, fig. 112, pl. XXVII B (Europa, intertidal, coll. P. Fourmanoir, 1 female 14.6 x 22.6 mm, MNHN-IU-2012-645, ex-MNHN B-6652). - BIORECIE, St. 8, 1 male 12.7 x 19.4 mm, 1 female juvenile (MNHN-IU-2012-646).

***Zosimus aeneus* (Linnaeus, 1758)**

Zosimus aeneus - Lenz, 1910: 546 (Europa). - Fourmanoir, 1952: 175 (Europa). - Dérjard, 1966: 166 (Europa). - Guinot, 1967: 270 (List, with Europa). - BIORECIE, St. 6.

***Zozymodes cavipes* (Dana, 1852)**

Zozymodes cavipes - Guinot, 1967: 270 (List, with Europa).

***Zozymodes pumilus* (Hombron & Jacquinot, 1846)**

Zozymodes pumilus - New species for Europa Island, BIORECIE, St. 8, 1 female ovigerous 4.3 x 6.3 mm (MNHN-IU-2012-647).

Superfamily Cryptochiroidea**Family Cryptochiridae*****Hapalocarcinus marsupialis* Stimpson, 1859**

Hapalocarcinus marsupialis - New species for Europa Island, BIOTAS, specimen MEPA-00108, st EURO-3 (Fig. 10E), MEPA-00122, St. EURO-9.

Superfamily Grapsoidea**Family Gecarcinidae*****Cardisoma carnifex* (Herbst, 1796)**

Cardisoma carnifex - Lenz, 1910: 562 (Europa). - Dérjard, 1966: 174 (Europa). - Guinot, 1967: 289 (List, with Europa). - BIORECIE, St. 6, St. 9 (Fig. 8D).

Family Grapsidae***Geograpsus crinipes* (Dana, 1851)**

Geograpsus sp. - Fourmanoir, 1952: 176 (Europa). This record is rather arbitrarily linked to *G. crinipes*, the most common species in the area. Objectively, *Geograpsus grayi* (H. Milne Edwards, 1853) could also correspond to the Fourmanoir record as both *Geograpsus* spp. were recently recorded at the nearby island of Juan de Nova (com. pers. and photographs by F. Fromard, May 2011).

***Grapsus albolineatus* Latreille, in Milbert, 1812**

Grapsus strigosus - Lenz, 1910: 559 (Europa). - Fourmanoir, 1952: 176 (Europa), *Grapsus strigosus* Herbst, 1799 is a synonym of *G. albolineatus*. - *Grapsus albolineatus* - Guinot, 1967: 284 (List, with Europa).

***Grapsus fourmanoiri* Crosnier, 1965**

Grapsus fourmanoiri - Dérjard, 1966: 174 (Europa). - BIORECIE, St. 14, 1 male 22.3 x 25.4 mm (Fig. 9C, MNHN-IU-2012-648).

***Grapsus longitarsis* Dana, 1851**

Grapsus longitarsis - New species for Europa Island, BIORECIE, St. 4, 1 female juvenile 8.1 x 9.5 mm (MNHN-IU-2012-649), St. 5, 1 male 20.4 x 24.6 mm (Fig. 9E, MNHN-IU-2012-650). This species is distinguished by a long spine on the carpus of the cheliped and a dark tan colouration on sternites belonging to the chelipeds (see Banerjee, 1960).

***Grapsus tenuicrustatus* (Herbst, 1783)**

Grapsus maculatus - Fourmanoir, 1952: 176 (Europa), non *Grapsus maculatus* H. Milne Edwards, 1853, distributed in the Atlantic and eastern Pacific only. - *Grapsus tenuicrustatus* - Dérjard, 1966: 174 (Europa). - Guinot, 1967: 284 (List, with Europa). - BIOTAS specimen MEPA-00162, St. EURO-6. - BIORECIE, St. 4, St. 5, St. 15 (Fig. 8A).

***Metopograpsus messor* (Forskål, 1775)**

Metopograpsus messor - Fourmanoir, 1952: 176 (Europa). - Guinot, 1967: 285 (List, with Europa).

***Metopograpsus thukuhar* (Owen, 1839)**

Metopograpsus thukuhar - New species for Europa Island, BIORECIE, St. 14, 1 male 13.5 x 17.4 mm

(MNHN-IU-2012-651), 1 male 19.2 x 24.1 mm (Fig. 9D), 11.7 x 15.0 mm, 1 juvenile (MNHN-IU-2012-652), 3 males, 2 females (MNHN-IU-2012-653). These specimens were carefully examined for male pleopods.

***Pachygrapsus minutus* A. Milne Edwards, 1873**

Pachygrapsus minutus - New species for Europa Island, BIOTAS, specimens MEPA-00023, 00027, St. EURO-1. - BIORECIE, St. 1 (Fig. 7E), St. 4, St. 8, 1 male, 1 female (MNHN-IU-2012-654), St. 11, 1 female 4.5 x 7.0 mm (MNHN-IU-2012-655), St. 15, 1 male 4.3 x 6.5 mm, 1 female 3.7 x 5.8 mm (MNHN-IU-2012-656).

***Pachygrapsus planifrons* De Man, 1888**

Pachygrapsus planifrons - New species for Europa Island, BIORECIE, St. 8, 1 male 5.4 x 6.7 (MNHN-IU-2012-657), St. 11, 4 males 2.7 x 3.6-5.2 x 6.6 mm, 3 ovigerous females 3.9 x 4.9-4.3 x 5.5 mm (MNHN-IU-2012-658).

***Pachygrapsus plicatus* (H. Milne Edwards, 1837)**

Pachygrapsus plicatus - New species for Europa Island, BIORECIE, St. 11, 1 male 7.8 x 10.5 mm (MNHN-IU-2012-659).

Family Plagusiiidae

***Percnon abbreviatum* (Dana, 1851)**

Percnon abbreviatum - Dérjard, 1966: 174 (Europa)

***Percnon planissimum* (Herbst, 1804)**

Percnon planissimum - Fourmanoir, 1952: 176 (Europa). - Crosnier, 1965: 90 (Europa). - Dérjard, 1966: 174 (Europa). - Guinot, 1967: 289 (List, with Europa). - BIOTAS, specimens MEPA-00001 à 3, 00037, St. EURO-1 (Fig. 7D), MEPA-00173, St. EURO-7. - BIORECIE, St. 1, St. 8.

Family Sesarmidae

***Parasesarma lenzii* (De Man, 1894)**

Parasesarma lenzii - New species for Europa Island, BIORECIE, St. 14, 1 male 10.0 x 12.4 mm (Fig. 9B, MNHN-IU-2012-660).

Family Varunidae

***Cyclograpsus integer* H. Milne Edwards, 1837**

Cyclograpsus punctatus - Lenz, 1910: 562 (Europa), non *C. punctatus* H. Milne Edwards, 1837, cf. Crosnier (1965). - *Cyclograpsus integer*. - Crosnier, 1965: 79 (Europa) - Guinot, 1967: 287 (List, with Europa).

***Pseudograpsus albus* Stimpson, 1858**

Pseudograpsus albus - New species for Europa Island, BIORECIE, St. 10, 3 ovigerous females 5.9 x 6.6-7.0 x 8.2 mm (MNHN-IU-2012-661).

Superfamily Ocypodoidea

Family Macrophthalmidae

***Chaenostoma lisae* (Poupin & Bouchard, 2010)**

Chaenostoma lisae - New species for Europa Island, BIORECIE, St. 4, 2 males 3.1 x 3.8-3.6 x 4.6 mm (Fig. 7F, MNHN-IU-2012-662).

***Chaenostoma sinuspersici* (Naderloo & Türkay, 2011)**

Macrophthalmus boscii - Fourmanoir, 1952: 176 (Europa). - Crosnier, 1965: 135 (Europa), non *Macrophthalmus boscii* Audouin, 1826, see Naderloo & Türkay, 2011. - *Macrophthalmus sinuspersici* - Naderloo & Türkay, 2011: 510 (Europa, intertidal, coll. P. Fourmanoir, det. A. Crosnier as *M. boscii*, 3 males, 1 female, 1 juvenile, MNHN-IU-2012-663, ex-MNHN B10720). - Naderloo *et al.*, 2011: 30 (Europa, same specimens, MNHN-IU-2012-663, ex-MNHN B10720). - *Chaenostoma sinuspersici* - Bouchard *et al.*, in press: 35, comments for new generic classification.

Family Ocypodidae

***Ocypode ceratophthalmus* (Pallas, 1772)**

Ocypode ceratophthalma - Fourmanoir, 1952: 176 (Europa). - Crosnier, 1965: 95 (Europa). - Dérjard, 1966: 170 (Europa). - Guinot, 1967: 281 (List, with Europa). - BIORECIE, St. 1, St. 3, St. 6, 1 male 16.3 x 17.6 mm (broken, MNHN-IU-2012-664), 5 juveniles, 3 males and 2 females (MNHN-IU-2012-665), St. 8 (Fig. 8F).

***Ocypode cordimanus* Latreille, 1818**

Ocypode cordimanus - Lenz, 1910: 558 (Europa). - Crosnier, 1965: 98 (Europa). - *Ocypode cordimana* - Guinot, 1967: 281 (List, with Europa).

***Ocypode aff. pallidula* Jacquinet, in Hombron & Jacquinet, 1846**

Ocypode aff. pallidula - New species for Europa Island, BIOTAS, specimen MEPA-00034, St. EURO-1 (Fig. 9F), MEPA-00308, 00310, St. EURO-4. Determinations from photographs based on presence of red patches on ambulatory legs (see Fig. 9F). However, it is also possible that these specimens are juveniles of *O. ceratophthalmus*. All small ghost crabs collected during BIORECIE (St. 6, 3 males, 2 females, MNHN-IU-2012-665) and identified as *O. ?pallidula* turned out to be in fact juveniles of *O. ceratophthalmus* after careful examination. Although the occurrence of typical *O. pallidula* in Europa Island cannot be excluded, this still needs to be confirmed.

***Uca (Cranuca) inversa* (Hoffman 1874)**

Uca inversa - Crosnier, 1965: 117 (Europa). - Guinot, 1967: 281 (List, with Europa).

***Uca (Gelasimus) tetragonon* (Herbst, 1790)**

Uca (Gelasimus) tetragonon - New species for Europa Island, BIORECIE, St. 10, 1 male 9.8 x 14.4 mm (MNHN-IU-2012-666).

***Uca (Paraleptuca) chlorophthalmus* (H. Milne Edwards, 1837)**

Uca chlorophthalmus - Fourmanoir, 1952: 176 (Europa). - Dérjard, 1966: 171, fig. 16-19 et 20-23 (Europa). - Guinot, 1967: 281 (List, with Europa). - BIORECIE, remains of chelae and carapace St. 9, St. 10 (MNHN-IU-2012-667), St. 14 (MNHN-IU-2012-668).

DISCUSSION

Species richness

In total, 176 species of Decapoda have now been recorded at Europa Island, including 62 new records in the present study. The number of species by taxa is calculated in Table 3. Crabs are best represented by 105 species (60% of documented species) in three major taxa: the Xanthoidea, Grapsoidea, and Portunoidea. Anomurans and shrimps totalled 40 and 31 species, respectively, with Paguroidea, Alpheoidea, and Palaemonoidea being numerically the most important.

Comparison with Mayotte Island

It was beyond the scope of this study to undertake a complete zoogeographic study of the Decapoda in the Mozambique Channel. Such a global approach would require more regional inventories with updated lists of fauna for Madagascar, the East African coast and several islands (e.g. Juan de Nova, Comoros Is, Glorieuses). However, the decapod fauna of Europa Island can be compared to that of Mayotte, situated in the north of the Mozambique Channel, at which the crustacean fauna were recently surveyed (Bouchard *et al.*, in press; Poupin *et al.*, in press; unpublished list of Brachyura at <http://crustaceamayotte.free.fr/>). This comparison is presented in Table 3.

A few taxa that are present in Mayotte but were not recorded at Europa Island are omitted in Table 3. These are the freshwater species (e.g. shrimps *Caridina* or *Macrobrachium*) that are not found at Europa because it has no freshwater habitats, precluding freshwater taxa such as the shrimps Atyoidea; deepwater species, collected at ≥ 100 m depth around Mayotte but not yet recorded around Europa; and a few other taxa (e.g. Axiidae, Gebiidae, Scyllaridae, Aethridae, Dynomenidae, Goneplacidae and Leucosiidae) that are found at Mayotte but have still not been reported in Europa, probably because of insufficient observations. For example, the large slipper lobster, *Parribacus antarcticus*, which has a wide geographic distribution in the Atlantic

and Indo-West Pacific regions, has been reported by scuba divers around Mayotte Island but not yet at Europa where scuba diving is limited.

The data presented in Table 3 show that the species richness is 61% lower at Europa (176 species) than Mayotte (448 species). In a few taxa such as the Palinuridae and Alpheoidea, the decrease was more pronounced (92 and 73% lower, respectively) but this is again probably linked to insufficient sampling at Europa. The difference was less pronounced in better sampled taxa such as the hermit crab Diogenidae (12%) or Coenobitidae (33%), two groups that are easily sampled on the reef flat and upper intertidal zone. If the comparison between these two islands is calculated using only the taxa that were adequately sampled (Coenobitidae, Diogenidae, Portunidae, Xanthidae, Grapsoidea and Ocypodoidea), then the mean decrease in species richness from Mayotte to Europa is only 41%. A comparison with the coral reef fishes (Chaetodontidae, Pomacanthidae, Pomacentridae, Labridae, Acanthuridae and Scaridae) showed a similar trend, although less pronounced, 478 fish species being found at Mayotte versus 355 at Europa Island, constituting a decrease of 26% (Chabanet *et al.*, 2011).

The depauperate nature of the crustacean fauna of Europa Island can be explained by its geographic isolation and its more limited habitats. The area of Europa lagoon is about 8 km² compared to 1100 km² at Mayotte. Moreover Europa lagoon drains almost dry at low tide, preventing the development of large coral structures such as those found in Mayotte lagoon.

Biogeography

The Decapoda fauna of Europa Island is mainly Indo-West Pacific, most of the species being distributed throughout this region (150 species or 86%). Five species are distributed more widely in the Indo-Pacific region, reaching to the Pacific American coast (*Alpheus pacificus*, *Domestia hispida*, *Hapalocarcinus marsupialis*, *Liomera cinctimana*, and *Trapezia bidentata*). Five

Table 3. Decapoda of Europa Island, with number of species in families and upper classification. For comparative purposes, the right column indicates the number of species for Mayotte based on Bouchard *et al.* (in press), Poupin *et al.* (in press), and unpublished data at <http://crustaceamayotte.free.fr/>. Subtotals for upper classifications are in bold.

	Upper classification	Family	Europa	Mayotte
Shrimps & Lobsters 31 species (18% of decapods)	Penaeoidea	Penaeidae	1	1
	Stenopodidea	Stenopodidae	1	1
	Palaemonoidea		12	37
		Gnathophyllidae	1	1
		Hymenoceridae	1	1
		Palaemonidae	10	34
	Alpheoidea		16	60
		Alpheidae	14	54
	Hippolytidae	2	6	
	Achelata	Palinuridae	1	12
Anomurans 39 species (22% of decapods)	Galatheaidea		11	20
		Galatheididae	3	7
		Porcellanidae	8	12
	Hippoidea	Hippidae	1	0
	Paguroidea		28	41
		Coenobitidae	2	3
		Diogenidae	23	26
		Paguridae	3	12
Crabs 105 species (60% of decapods)	Dromioidea	Dromiidae	1	6
	Calappoidea		3	5
		Calappidae	2	4
		Matutidae	1	1
	Carpilioidea	Carpiliidae	1	1
	Dairoidea		3	1
		Dacryopilumnidae	2	0
		Dairidae	1	1
	Eriphioidea		5	9
		Eriphiidae	3	3
		Oziidae	2	6
	Majoidea		5	18
		Epiplatidae	3	12
		Majidae	2	4
	Pilumnoidea	Pilumnidae	1	9
	Portunoidea	Portunidae	12	33
	Trapezioidea		8	16
		Domeciidae	1	2
		Tetraliidae	2	4
		Trapeziidae	5	10
	Xanthoidea	Xanthidae	41	88
	Cryptochiroidea	Cryptochiridae	1	0
	Grapsioidea		16	23
		Gecarcinidae	1	1
		Grapsidae	10	8
		Plagusidae	2	3
	Sesarmidae	1	7	
	Varunidae	2	4	
Ocypodoidea		8	15	
	Macrophthalmidae	2	6	
	Ocypodidae	6	8	
	Total		176	448

species have a worldwide distribution, occurring in the Indo-West Pacific and the Atlantic Ocean and/or the Mediterranean Sea (*Alpheus paracrinitus*, *Charybdis hellerii*, *Dardanus arrosor*, *Gnathophyllum americanum*, and *Stenopus hispidus*). Fifteen species are distributed only in the WIO, which is indicative of a regional endemism of about 10% (*Calcinus rosaceus*, *Ciliopagurus tricolor*, *Cymo deplanatus*, *Eriphia smithii*, *Euxanthus rugosus*, *Grapsus fourmanoiri*, *Heteropilumnus trichophoroides*, *Huenia grandidierii*, *Liocarpilodes armiger*, *Lysmata kuekenthali*, *Pachycheles garciaensis*, *Paractaea retusa*, *Thalamita margaritimana*, *Uca inversa*, *Uca chlorophthalmus*). Two small-sized hermit crabs of the genus *Pagurixus* were recognized as new species, to be described in a separate publication (Komai & Poupin, 2013). These are potentially endemic to Europa Island, although they may occur elsewhere in the WIO where they have gone unnoticed because of their small size.

Species indicators

An objective of the BIORECIE expedition to Europa Island was to seek potential indicators of disturbance for long-term monitoring of its marine environments. Such 'biological indicators' should manifest a decrease in their population in the presence of pollution or other perturbation, and risk local extermination in extreme situations. A good species indicator must therefore be common in natural conditions, easy to sample and easily recognizable, even by a non-specialist. In contrast to sessile species such as algae, hydrozoans, or corals, crustaceans are mobile and often difficult to find or count because they may be camouflaged, can be very small, and are mostly active at night. In addition, their sensitivity to pollution or environmental change is often unknown. Despite these difficulties, nine fairly widespread Crustacea were selected

for long-term monitoring purposes at Europa Island. All are hermit crabs which have low mobility and can be counted or sampled more easily than shrimps, lobsters or crabs. They are distributed in the upper intertidal zone, (*Coenobita rugosus* and *C. perlatus*), in the intertidal zone, (*Calcinus laevimanus*, *C. latens*, *C. morgani*, *Clibanarius eury sternus*, *C. striolatus*, and *Petrolisthes borradailei*), and in the mangrove of the lagoon (*C. longitarsus*). They are common macro-species which are illustrated in this work and easy to recognize (cf. Figs 3-5). They all occur at Station 6, near the entrance of the lagoon, where *C. longitarsus* was especially common, probably because of the proximity of the mangrove. Being hermit crabs, they are not harvested and therefore subject to human predation, and thus can be used as indicators of external influences, such as storms or pollution events. It is recommended that they be monitored in terms of abundance along a transect through Station 6 from the fore-reef to the upper intertidal zone.

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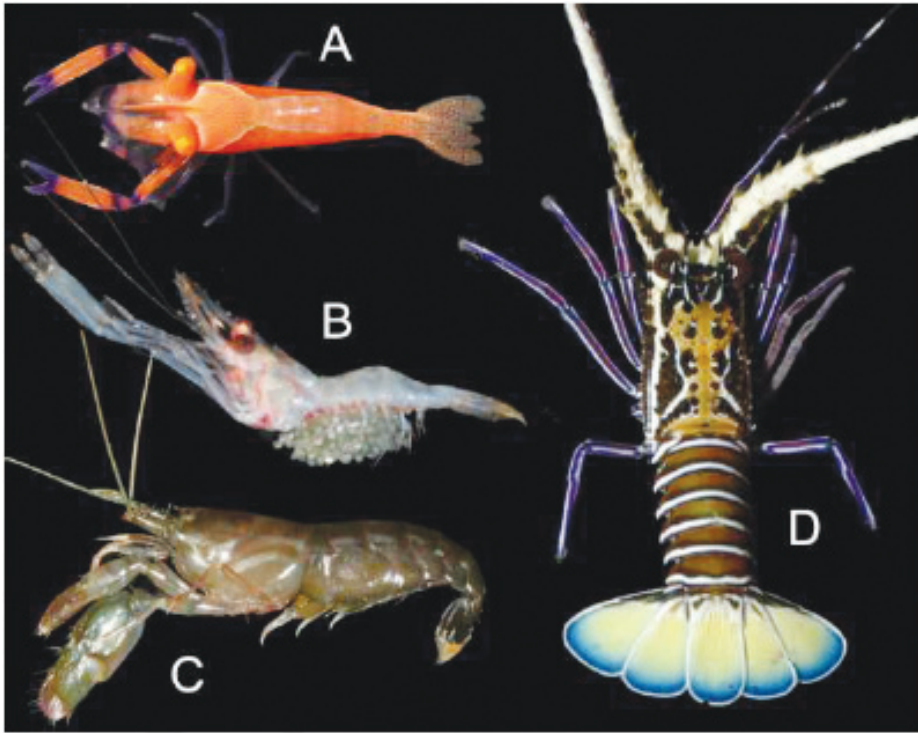


Figure 2. Shrimps and lobster of Europa Island: reef flat and outer reef. A) *Periclimenes imperator*, BIOTAS, St. EURO-11; B) *Cuapetes ensifrons*, BIOTAS, St. EURO-17; C) *Alpheus pacificus*, BIORECIE, St. 15 (MNHN); D) *Panulirus versicolor* (juvenile), BIOTAS, St. EURO-1.



Figure 3. Coenobites of Europa Island: upper intertidal zone. A, C) *Coenobita perlatus*, BIORECIE, St. 3, 5; B, D) *Coenobita rugosus*, BIORECIE, St. 7.

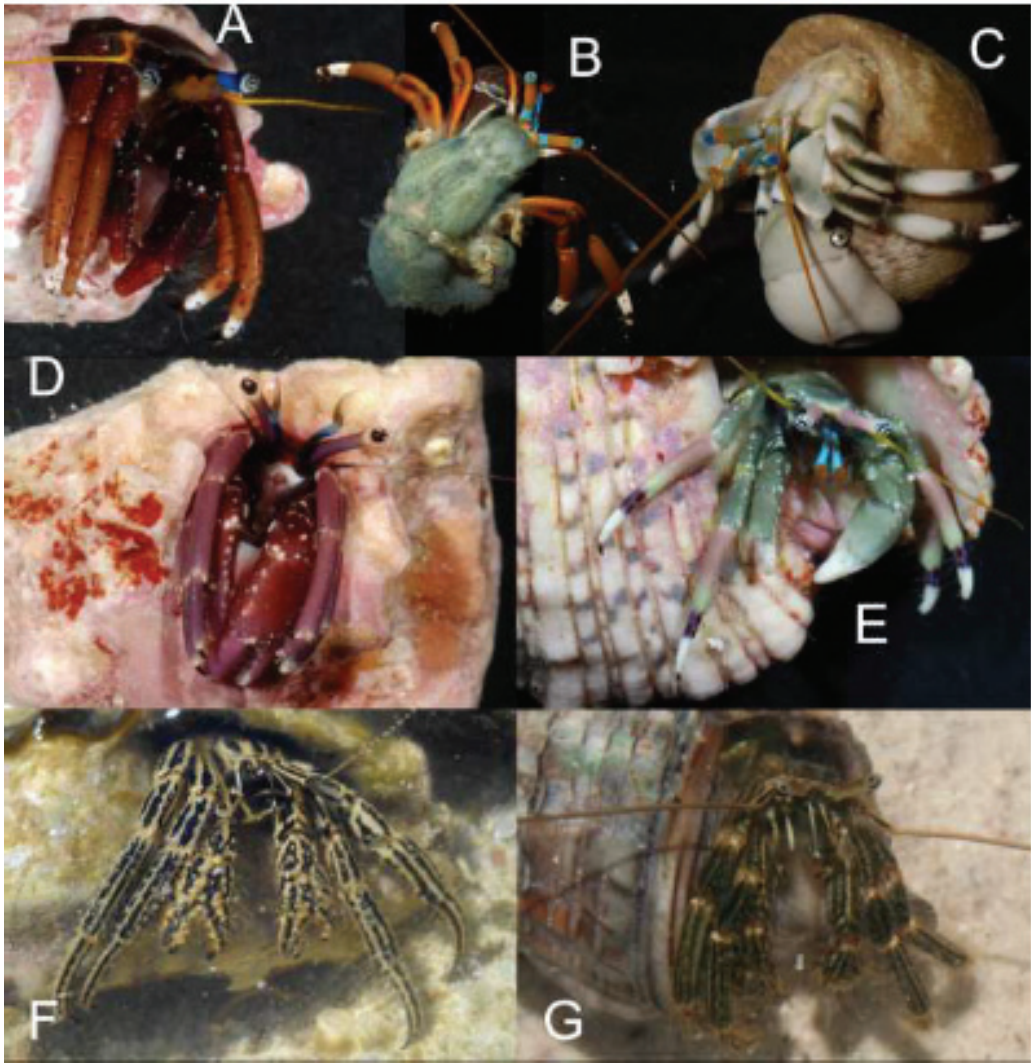


Figure 4. Anomuran *Calcinus* and *Clibanarius* spp. of Europa Island: reef flat and outer reef. A) *Calcinus morgani*, BIOTAS, St. EURO-18; B) *Calcinus laevimanus*, BIOTAS, St. EURO-1; C) *Calcinus seurati*, BIOTAS, St. EURO-8; D) *Calcinus rosaceus*, BIOTAS, St. EURO-3; E) *Calcinus latens*, BIOTAS, St. EURO-3; F) *Clibanarius eurysternus*, BIORECIE, St. 4; G) *Clibanarius striolatus*, BIORECIE, St. 14 (MNHN).

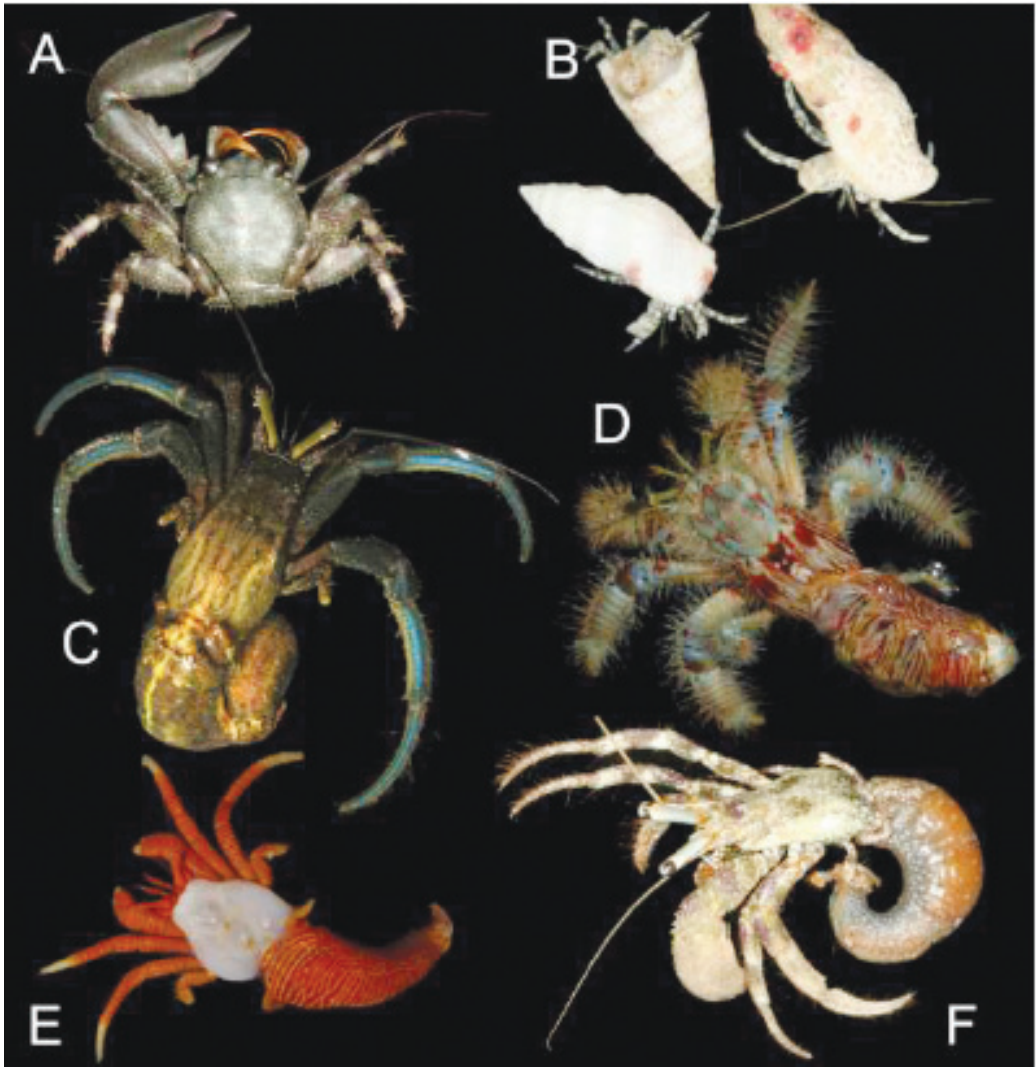


Figure 5. Anomura of Europa Island: mangrove, reef flat and outer reef. A) *Petrolisthes borradailei*, BIORECIE, St. 15 (MNHN); B) *Pagurixus haigae*, BIORECIE, St. 1 (MNHN); C) *Clibanarius longitarsus*, BIOTAS, St. EURO-14; D) *Aniculus ursus*, BIOTAS, St. EURO-7; E) *Ciliopagurus tricolor*, BIOTAS, St. EURO-1; F) *Dardanus scutellatus*, BIORECIE, St. 14 (MNHN)..

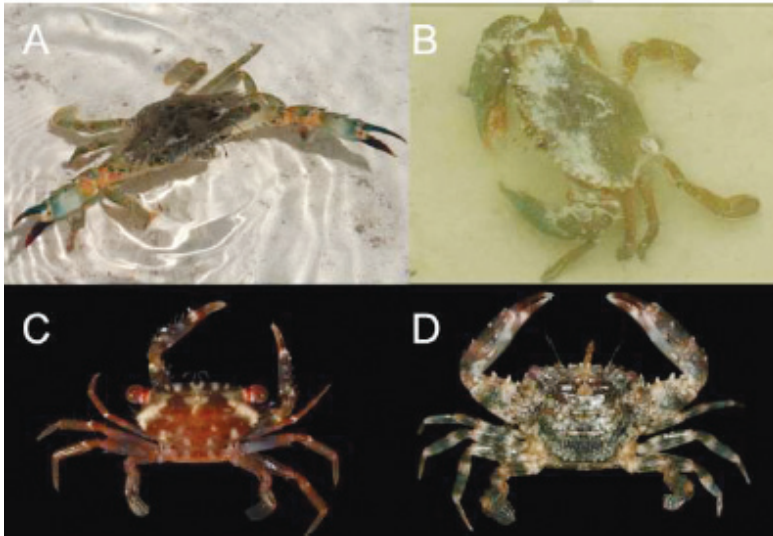


Figure 6. Common portunid crabs of Europa Island. Mangrove: A) *Thalamita crenata*, BIORECIE, St. 14 (MNHN); B) *Scylla serrata*, BIORECIE, St. 14 (photo F. Fromard). Reef flat and outer reef: C) *Thalamitoides quadridens*, BIOTAS, St. EURO-17; D) *Thalamita picta*, BIORECIE, St. 15 (MNHN).

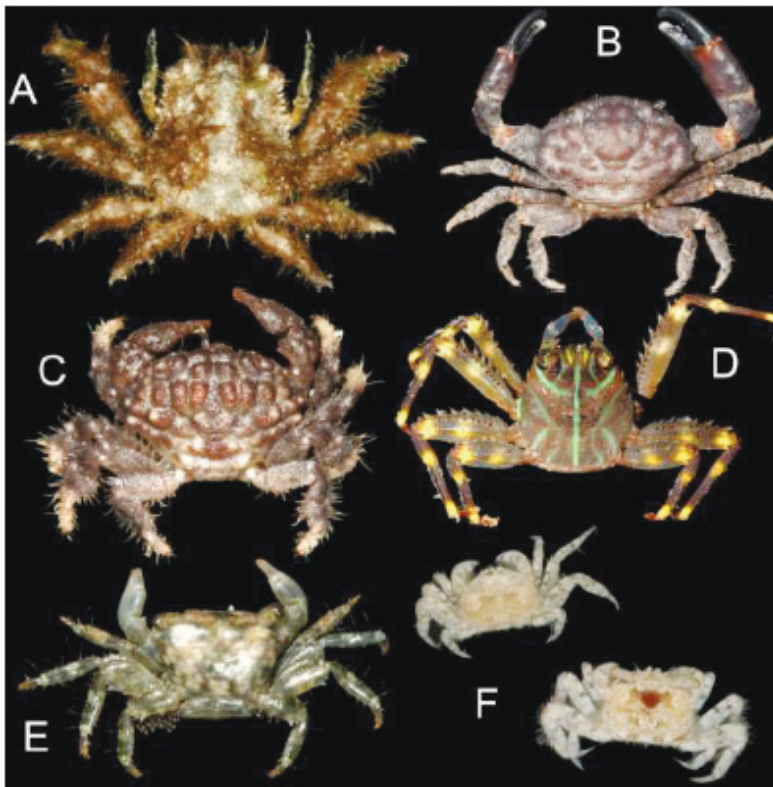


Figure 7. Small and medium-sized crabs of Europa Island: upper intertidal zone and reef flat. A) *Micippa platipes*, BIORECIE, St. 4 (MNHN); B) *Cyclodius obscurus*, BIORECIE, St. 14 (MNHN); C) *Pilodius areolatus*, BIORECIE, St. 1; D) *Pernon planissimum*, BIOTAS, St. EURO-1; E) *Pachygrapsus minutus*, BIORECIE, St. 1; F) *Chaenostoma lisae*, BIORECIE, St. 4 (MNHN).



Figure 8. Medium- and large-sized crabs of Europa Island: land and upper intertidal zone. A) *Calappa hepatica*, BIORECIE, St. 8; B) *Eriphia sebana*, BIORECIE, St. 15; C) *Etisus laevimanus*, BIORECIE, St. 14; D) *Cardisoma carnifex*, BIORECIE, St. 9; E) *Grapsus tenuicrustatus*, BIORECIE, St. 15; F) *Ocypode ceratophthalmus*, BIORECIE, St. 8.

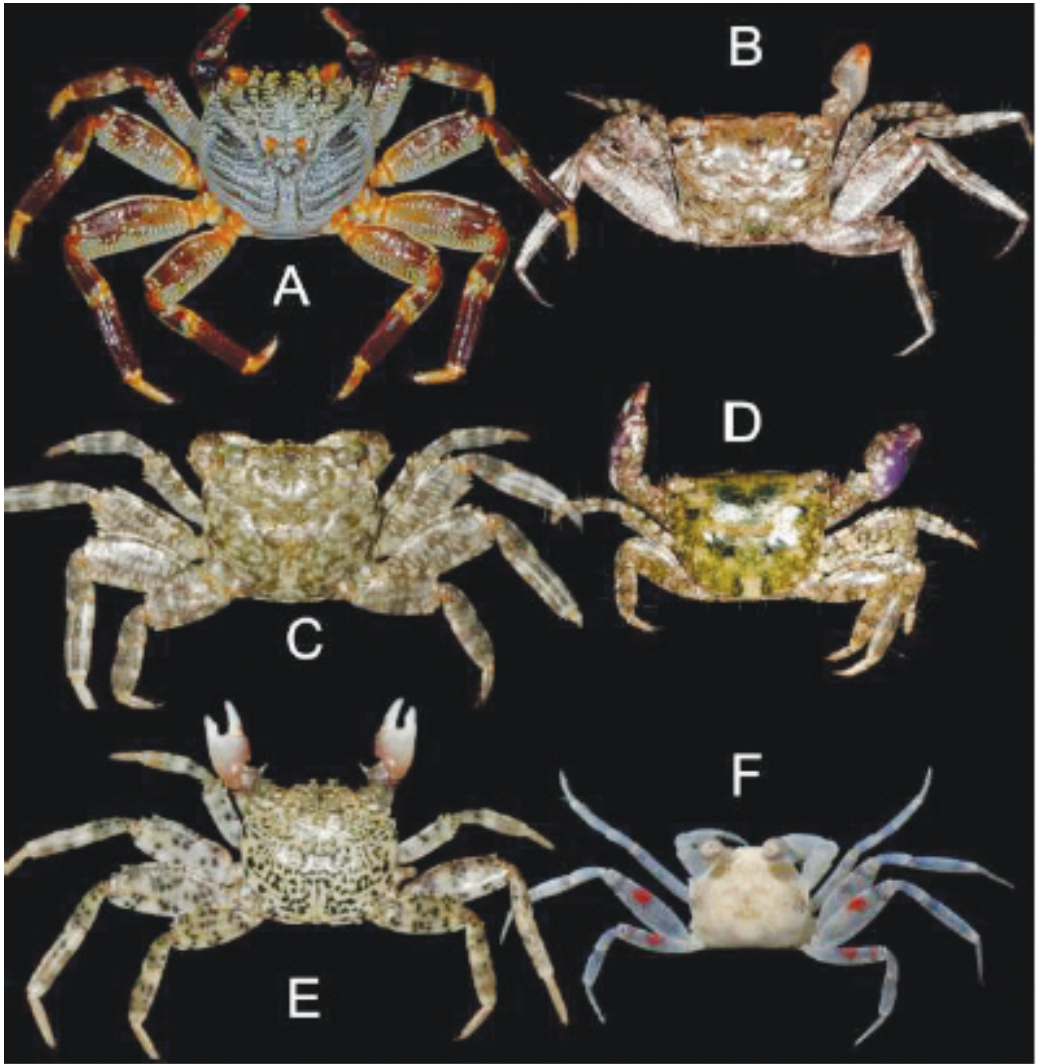


Figure 9. Common Grapsidae and Ocypodidae of Europa Island: mangrove and upper intertidal zone. A) *Grapsus tenuicrustatus*, BIOTAS, St. EURO-13; B) *Parasesarma lenzii*, BIORECIE, St. 14 (MNHN); C) *Grapsus fourmanoiri*, BIOTAS, St. 14 (MNHN); D) *Metopograpsus thukuhar*, BIORECIE, St. 14 (MNHN); E) *Grapsus longitarsis*, BIORECIE, St. 5 (MNHN); F) *Ocypode aff. pallidula*, BIOTAS, St. EURO-1.

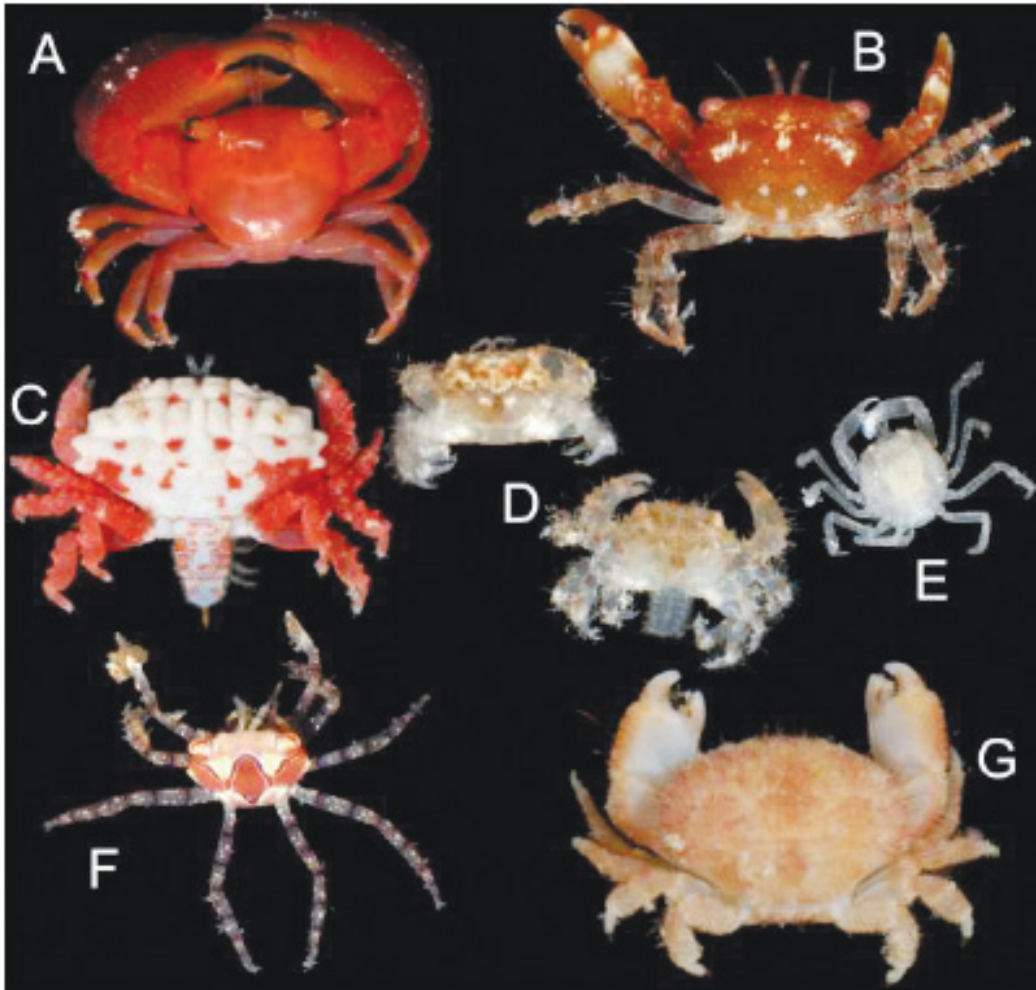


Figure 10. Small-sized crabs of Europa Island: outer reef. A) *Trapezia lutea*, BIOTAS, St. EURO-17, obligate associate of coral; B) *Chlorodiella laevissima*, BIOTAS, St. EURO-16; C) *Liomera monticulosa*, BIOTAS, St. EURO-17; D) *Liocarpilodes armiger* (2 specimens), BIOTAS, St. EURO-17; E) *Hapalocarcinus marsupialis*, BIOTAS, St. EURO-3, obligate associate of coral; F) *Lybia tessellata*, BIOTAS, St. EURO-16; G) *Pseudoliomera variolosa*, BIOTAS, St. EURO-17.

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