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First inventory of the Crustacea (Decapoda, Stomatopoda) of Juan de Nova Island with ecological observations and comparison with nearby islands in the Mozambique channel (Europa, Glorieuses, Mayotte)

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ABSTRACT

Crustacea Decapoda and Stomatopoda are inventoried for the first time in Juan de Nova Island, Iles Eparses, Mozambique channel. In total, 112 species are reported: 69 crabs, 28 anomurans, 11 shrimps, 3 mantis shrimps and 1 lobster. A comparison is made with nearby islands in the Mozambique channel: Glorieuses Islands (157 species), Europa Island (178 species), and Mayotte Island (505 species). The lower species richness at Juan de Nova is explained by the small size of the island and by the difficulties to collect the crustaceans on the reef flat hardly accessible at low tide. The crustaceans are listed by main habitats from land to outer reef (2–20 m). The presence of the coconut crab (*Birgus latro*), an endangered species vulnerable to human predation, is confirmed.

1. Introduction

Juan de Nova Island, 17°03′S, 42°43′E, is situated in the Mozambique channel, 175 km off Madagascar and 280 km off the Mozambique coast. A complete presentation of the Island, including geopolitical, geomorphology, and natural history is in Caceres (2003). This small island, with greater length of only 6 km and surface area of 5 km^2, is administrated by France since 1897 as part of the Iles Eparses (Scattered Islands) counting Europa, Bassas de India, Juan de Nova, Glorieuses, and Tromelin. A military detachment is stationed at Juan de Nova all year round and actively participate to the protection of the marine and terrestrial environments of this natural reserve.

The present study was conducted as part of the BIORECIE research program, 2010–2013. It presents the first inventory of the Crustacea Decapoda and Stomatopoda in Juan de Nova. A comparison is made with islands previously studied in the Iles Eparses during BIORECIE fieldworks, Europa in 2011 (Poupin et al., 2013a) and Glorieuses Islands in 2012 (Poupin et al., 2013b). A comparison is also made with Mayotte Island where the crustaceans were studied in 2009 (Bouchard et al., 2013; Legall and Poupin, 2015; Poupin et al., 2013c). The ecological distribution of Juan de Nova crustaceans is presented by habitats, using the following divisions: terrestrial, supra and intertidal, sand bottoms of the reef flat, hard bottoms of the reef flat, front reef, and outer reef (2–20 m).

2. Material and methods

The BIORECIE 3 fieldwork (December 3–19, 2013) was conducted onboard the sail ship *Antsiva*, 28 m long, captain Nicola Tisné. The crustaceans were mainly sampled by hand or with dip nets by a team camping on the Island (7–17 December). The reef flat was visited on foot, daily, at low tide. Twenty stations were realized (Fig. 1; Table A1); st. 20, situated in front of the camp, was sampled almost each day. A few observations were also made on the outer reef by the scuba divers onboard the *Antsiva* sail ship.

Abbreviations: FLMNH, Florida Museum of Natural History; MNHN, Muséum national d'Histoire naturelle, Paris; NHMW, Naturhistorisches Museum, Wien; Lc, cephalothorax length; Lt, total length; st., station; sp./spp, specimen(s); WIO, Western Indian Ocean.

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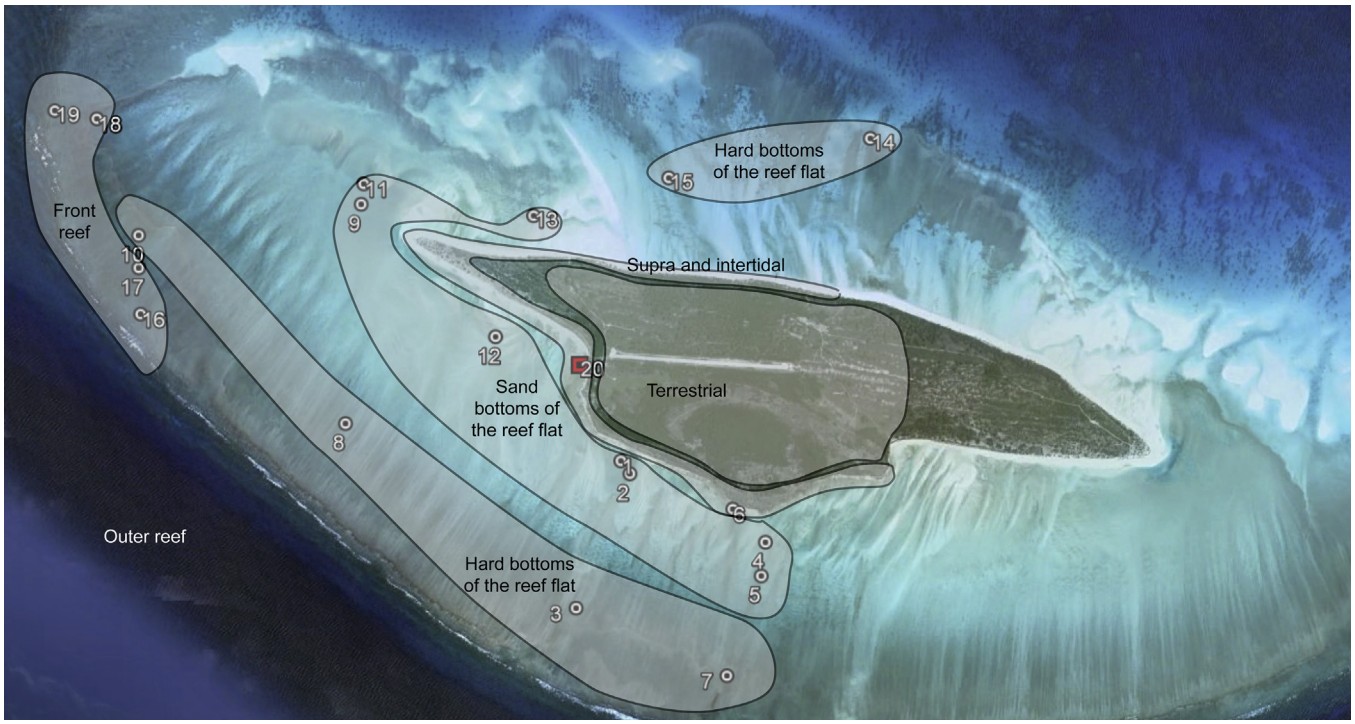

Fig. 1. Juan de Nova Island with indication of reef flat stations during BIORECIE 3 fieldwork (st. 1–20). The stations are grouped by main habitats, using: supra and intertidal, sand bottoms of the reef flat, hard bottoms of the reef flat, and front reef. These stations can be displayed using Google Earth and kmz file at http://doi.pangaea.de/10.1594/PANGAEA.836272.

Station 31 of this team is arbitrarily selected to locate these observations. The terrestrial habitat was also prospected every night during 2–3 h, between 9 and 12 h pm (Fig. 4).

To complement BIORECIE 3 observations, previous observations made at Juan de Nova in 2009 during an expedition called BIOTAS, research vessel *Marion Dufresne*, have been also integrated into this study. This collection, deposited in the Florida Museum of Natural History (FLMNH), was not available for this study. However, a set of high definition color photographs taken during BIOTAS (pers. com. M. Malay) was examined and allows confident records of several additional species for Juan de Nova. These species are labeled 'BIOTAS (FLMNH)' in the list of Appendix B.

Previous records of Decapoda and Stomatopoda in Juan de Nova have been also searched for in taxonomic revisions. This research has given limited results. Nonetheless three more species can be added to the list presented herein: *Callianidea typa* (in Poore, 1997), *Pseudozius caystrus* (in Crosnier, 1984), and *Zozymodes pumilus* (in Serène, 1984).

All the determinations have been made by the author except for *Gonodactylaceus falcatus*, *Mesacturoides crinitus* (det. S.T Ahyong), *Parascytoleptus tridens* (det. P. Dworschak), and *Pagurixus haigae* (det. confirmed by T. Komai).

Specimens collected are deposited and registered in the Muséum national d'Histoire naturelle, Paris (MNHN) with a duplicate specimen of *Parascytoleptus tridens* also deposited in the Naturhistorisches Museum, Wien (NHMW).

Color of live specimens is often important to recognize the crustaceans species. For that reason almost all species listed in this work are also illustrated in Legall and Poupin (2015) internet database that can be accessed using a filter for Juan de Nova Island at http://crustiesfroverseas.free.fr/search_result.php?refisland=Juan+de+Nova.

3. Results and discussion

3.1. Statistics for Juan de Nova and comparisons with others islands of the Mozambique channel

In total 112 species are reported from Juan de Nova, including 69 crabs, 28 anomurans, 11 shrimps, 3 mantis shrimps and 1 lobster (Appendix B). For the Decapoda, the statistics by family (Table 1) are compared with previous results obtained in the Iles Eparses, Europa in 2011 (Poupin et al., 2013a; Komai and Poupin, 2013) and Glorieuses in 2012 (Poupin et al., 2013b). A comparison is also made with Mayotte inventoried during a fieldwork conducted in 2009 (Bouchard et al., 2013; Legall and Poupin, 2015; Poupin et al., 2013c).

Within the Ile Eparses Juan de Nova diversity of Decapoda is the lowest with 109 species versus 157 species (Glorieuses) and 175 species (Europa). This can be attributed to more limited ecological niches around the Juan de Nova which surface is only 5 km^2, compared to 7 km^2 for Glorieuses and 30 km^2 for Europa. Moreover, Europa has an internal lagoon of about 8 km^2 half occupied by a large mangrove (Caceres, 2003) while in Juan de Nova this habitat is almost missing, limited to a small nascent mangrove without mudflats (Fig. 2.1 and 4). Juan de Nova lower diversity can also be explained by the difficulty to correctly sample the outer reef during BIORECIE 3. The reef flat of the Island is very wide, 2–3 km in most directions (Fig. 1) and it has poorly uncovered at ebb during the fieldwork. Therefore, collections were often made by snorkeling in shallow waters sometimes against strong currents. These conditions are not favorable for collecting crustaceans, especially shrimps (e.g. Palaemonidae, Alpheidae), that are much more easily noticed and captured at low tide on a dried reef in tide pools or under rocks.

With 491 species Mayotte has a much higher diversity than

Table 1
Number of Decapoda species computed by family at Juan de Nova Island compared with nearby islands in the Mozambique channel (Glorieuses, Europa, Mayotte) (Family figures are summed in bold figures for Higher taxa).

	Higher taxa	Family	Juan de Nova	Glorieuses	Europa	Mayotte
Shrimps and lobsters	Penaeoidea			**2**	**1**	**13**
		Aristeidae				2
		Benthesicymidae				5
		Penaeidae		1	**1**	3
		Sicyoniidae		1		2
		Solenoceridae				1
	Stenopodidea	Stenopodidae	**1**	**1**	**1**	**1**
	Pasiphaeoidea	Pasiphaeidae				**2**
	Atyoidea	Atyidae				**5**
	Oplophoroidea	Oplophoridae				**9**
	Nematocarcinoidea					**6**
		Nematocarcinidae				1
		Rhynchocinetidae				5
	Palaemonoidea		**1**	**8**	**12**	**61**
		Anchistioididae				1
		Gnathophyllidae		1	1	1
		Hymenoceridae			1	1
		Palaemonidae	1	7	10	58
	Alpheoidea		**7**	**6**	**16**	**60**
		Alpheidae	6	5	14	54
		Hippolytidae	1	1	2	6
	Crangonoidea	Crangonidae		**1**		**3**
	Astacidea	Enoplometopidae				**1**
	Axiidea		**2**			**10**
		Axiidae	1			6
		Callianassidae				2
		Callianideidae	1			1
		Strahlaxiidae				1
	Gebiidea	Laomediidae				**1**
	Achelata		**1**	**4**	**1**	**7**
		Palinuridae	1	3	1	5
		Scyllaridae		1		2
Anomurans	Galatheoidea		**5**	**9**	**11**	**20**
		Galatheidae	1	2	3	7
		Munididae				1
		Porcellanidae	4	7	8	12
	Hippoidea	Hippidae			**1**	**1**
	Paguroidea		**23**	**27**	**27**	**47**
		Coenobitidae	3	4	2	5
		Diogenidae	18	21	23	26
		Paguridae	2		2	12
		Parapaguridae		2		1
		Pylochelidae				3
Crabs	Dromioidea			**7**	**1**	**7**
		Dromiidae		3	1	6
		Dynomeniidae		4		1
	Calappoidea		**3**	**3**	**3**	**5**
		Calappidae	2	2	2	4
		Matutidae	1	1	1	1
	Carpilioidea	Carpiliidae	**1**	**1**	**1**	**1**
	Dairoidea		**1**		**3**	**1**
		Dacryopilumnidae			2	
		Dairidae	1		1	1
	Eriphioidea		**3**	**5**	**5**	**9**
		Eriphiidae	3	3	3	3
		Oziidae		2	2	6
	Goneplacoidea		**1**	**1**		**2**
		Acidopsidae				1
		Euryplacidae	1	1		
		Goneplacidae				1
	Leucosioidea	Leucosiidae		**1**		**10**
	Majoidea		**3**	**4**	**5**	**18**
		Epialtidae	3	3	3	12
		Inachidae				2
		Majidae		1	2	4
	Parthenopoidea	Parthenopidae		**1**		**4**
	Pilumnoidea	Pilumnidae	**1**	**1**	**1**	**9**
	Portunoidea	Portunidae	**6**	**10**	**12**	**33**
	Pseudozioidea	Pseudoziidae	**1**	**1**		**1**
	Trapezioidea		**6**	**9**	**8**	**16**
		Domeciidae	2	3	1	2
		Tetraliidae		1	2	4

(*continued on next page*)

Table 1 (*continued*)

	Higher taxa	Family	Juan de Nova	Glorieuses	Europa	Mayotte
		Trapeziidae	4	5	5	10
	Xanthoidea	Xanthidae	**27**	**38**	**41**	**88**
	Cryptochiroidea	Cryptochiridae	**1**		**1**	
	Grapsoidea		**11**	**15**	**16**	**23**
		Gecarcinidae	1	2	1	1
		Grapsidae	7	9	10	8
		Percnidae	1	3	2	2
		Plagusiidae	1	1		1
		Sesarmidae			1	7
		Varunidae	1		2	4
	Ocypodoidea		**4**	**2**	**8**	**17**
		Dotillidae				1
		Macrophthalmidae	1		2	7
		Ocypodidae	3	2	6	9
		Total	**109**	**157**	**175**	**491**

Fig. 2. Key habitats identified at Juan de Nova for the Crustacea (Decapoda, Stomatopoda). From top to bottom and left to right: 1) Terrestrial: forest with sparse filao trees (*Casuarina equisetifolia*); mangrove trees (*Rhizophora mucronata)* in the small mangrove (n°1 of Fig. 4); brackish water pond in karstic area near mangrove. 2) Supra littoral and intertidal: herbaceous coverage and rocks in supra littoral; fine sand beach of the intertidal; dead corals, coral slab, and fine sandy-muddy sediment in between, at st. 20. 3) Sand bottom of the reef flat at st. 4. 4) Hard bottom of the reef flat at st. 8. 5) Reef front at st. 19. 6) Outer reef, at st. 31.

the Iles Eparses (Table 1). This can be attributed to a better sampling around Mayotte in 2009 where three weeks of effort (3 scuba divers and 2 collectors in the intertidal) were dedicated only to crustaceans with collections made in the mangrove, the intertidal, and in the lagoon by using baited trap and day and night scuba diving operations with brushing of coral and suction pump for the smallest species (Bouchard et al., 2013; Poupin et al., 2013c). Mayotte's higher diversity is also due to the larger surface of the main island (374 km^2) and therefore more terrestrial and intertidal habitats for the crustaceans. For example there are rivers that are colonized by Atyidae shrimps, a family absent in the Iles Eparses, and the large mangroves of Mayotte are colonized by many crabs (Sesarmidae, Macrophthalmidae, Ocypodidae) that are not found in the Iles Eparses. Mayotte has also a vast lagoon, one of the largest in the world (about 1500 km^2), which also offers many more ecological niches for crustaceans than in the Iles Eparses. Data for Mayotte in Table 1 also integrate a few deep-water species (Aristeidae, Benthesicymidae, Crangonoidea, Dromioidea, Goneplacoidea, Oplophoroidea, Parapaguridae, and Pylochelidae) collected at >100 m around the island during the 1977 BENTHEDI Expedition (see Poupin et al., 2013c, Fig. 1) while this deep habitat is still unstudied around the Iles Eparses.

To summarize the respective influence of biotopes and sampling efforts on species richness in the Iles Eparses and Mayotte, the number of species (Decapoda, Stomatopoda) was computed from CRUSTA database (Legall and Poupin, 2015) using a simplified splitting into 6 biotopes: Terrestrial, Freshwater, Mangrove and Mudflats, Supra and Intertidal, Lagoon and Reef, Deep or Bathypelagic. The results thus obtained are presented in Table 2 together with a few parameters characterizing each biotope. Main land areas and coastline lengths are from Caceres (2003), for the Iles Eparses, and Cremades (2013), for Mayotte; number of rivers and lakes are from Cremades (2013); reef coverage is from Andrefouët et al. (2003); and ZEE areas are from SHOM (2015). Sampling efforts are appreciated by the author after participating to all fieldworks in these islands, between 2009 and 2013. The results presented in Table 2 show that:

- Species richness of terrestrials species is not linked to main land area. There are for example almost as many terrestrial Decapoda in Glorieuses (7 km^2) than in Mayotte (374 km^2).
- Mayotte's freshwater biotope accounts for 12 more species in this island.
- Mangrove extension accounts for species richness. However, while Mayotte's mangroves were quite well sampled, totalizing 24 species, Europa's mangrove was sampled only during one day which probably accounts for only 4 species recorded there.
- Coastline length accounts for species richness in the intertidal. Although the data of this work are too scarce to conclude positively there is a logarithmic relationship between the number of species in the intertidal and the length of the coastline (n species = 6.7689 × ln(length in km) + 12.035, $r^2 = 0.9251$)
- Larger reef coverage in Mayotte probably accounts for higher species richness in this Island. However, this result is also influenced by the massive sampling conducted there in 2009 during a fieldwork dedicated to crustaceans only. In Europa, Glorieuses and Juan de Nova, the species richness appears more related to distinct sampling efforts than to reef coverage.
- The deep zone remains poorly studied for crustaceans in all places, with only a few deep operations conducted around Mayotte and Glorieuses.

3.2. Habitats in Juan de Nova

One objective of BIORECIE 3 fieldwork was the mapping of marine habitats around the island, especially for sessile groups such as algae, corals, or hydrozoans. The reef flat stations were selected for this objective (Table A1). However, for marine crustaceans, often very mobile (e.g. swimming crabs of the Portunidae) and sometimes ubiquitous and observed almost everywhere on the reef flat (e.g. the hermit crab *Calcinus latens*) this splitting is too discrete. Therefore, the reef stations at Juan de Nova have been grouped into five simplified key habitats (supra littoral and intertidal; reef flat, sand bottoms; reef flat, hard bottoms; front reef; outer reef) with addition of the terrestrial habitat to take into account the land crustaceans (Fig. 1). These habitats are illustrated in Fig. 2 and species lists by habitat are in Appendix C.

3.2.1. Terrestrial

Juan de Nova's main elevation is only 12 m. Its terrestrial habitat is characterized by sand dunes, karstic areas, herbaceous places, and sparse forests mostly of filao trees on each side of the airstrip (Fig. 4). The flora coverage is detailed by Gigord et al. (2014). The island has no rivers but brackish ponds can be found in karstic areas along the south coast. There is an small nascent mangrove in the

Table 2
Number of species (Decapoda, Stomatopoda) at Juan de Nova compared with nearby islands in the Mozambique channel (Glorieuses, Europa, Mayotte). The species are classified according to 6 main biotopes. Sampling effort estimated as good (***), medium (**), poor (*).

	Juan de Nova	Glorieuses	Europa	Mayotte
Main Land	*5 Km^2*	*7 Km^2*	*30 Km^2*	*374 Km^2*
Terrestrial species	**6**	**8**	**4**	**9**
Sampling Effort	***	***	***	***
Rivers & Lakes	*Absent*	*Absent*	*Absent*	*24 rivers, 1 lake*
Freshwater species				**12**
Sampling Effort				***
Mangrove and Mudflats	Nascent	Absent	4 Km^2	6,67 Km^2
Mangrove & Mudflat species	**1**		**4**	**24**
Sampling Effort	***		**	***
Coastline	*12 Km*	*10 Km*	*21 Km*	*185 Km*
Supra & Intertidal species	**27**	**26**	**37**	**49**
Sampling Effort	***	***	***	***
Reef coverage	*213 Km^2*	*202 Km^2*	*50 Km^2*	*413 Km^2*
Lagoon & Reef species	**78**	**115**	**133**	**372**
Sampling Effort	*	**	**	***
Oceanic (pelagic and benthic > 100 m)	*ZEE (71 000 Km^2)*	*ZEE (51 000 Km^2)*	*ZEE (140 00 Km^2)*	*ZEE (62 000 Km^2)*
Deep or bathypelagic species	**0**	**8**	**0**	**39**
Sampling Effort	Not prospected	*	Not prospected	**

south of the island (Fig. 4, n°1). The terrestrial habitat has been prospected by day and almost every night between 9 and 12 h pm.

Six Decapoda have been seen in the terrestrial habitat (Fig. 3, Appendix C1): three anomurans (*Birgus latro*, *Coenobita perlatus*, *C. rugosus*) and three crabs (*Cardisoma carnifex*, *Geograpsus grayi*, *G. crinipes*). This fauna appears more diverse than in Europa Island where *Birgus latro* and *Geograpsus grayi* are not present (Poupin et al., 2013a). On the contrary, two species seen in Glorieuses, *Coenobita brevimanus* and *Discoplax rotunda* (Poupin et al., 2013b), were not seen at Juan de Nova. The two coenobitids (*C. perlatus*, *C. rugosus*) are also listed with the supra littoral species (Appendix C2) as they are often found near the coastline and made frequent excursions on the beaches at night. The abundance of the two crabs *Geograpsus* is inverted in Juan de Nova when compared to observations made in Glorieuses in 2012 (Poupin et al., 2013b). At Juan de Nova *Geograpsus crinipes* was commonly observed at night while a single specimen was observed in Glorieuses during the whole fieldwork made in 2012. On the contrary, a single specimen of *Geograpsus grayi* was seen at Juan de Nova, near the brackish pond of Fig. 4 (n°2), while this species was almost everywhere at night in the coconut forest of Glorieuses. The land crab *Cardisoma carnifex* is not abundant and was only seen in the mangrove and around brackish ponds (Fig. 4, n°1–2).

The coconut crab (*Birgus latro*) is listed in the IUCN red list of threatened species (http://www.iucnredlist.org/) because it is vulnerable to human predation and tends to disappear from inhabited islands without strict protection measures. Before BIORECIE 3 it was first reported from Juan de Nova only in April 2011 and then in March 2013 (pers. com. by J. Hivert in Poupin et al., 2013b). It is obviously scarce on the island as it was not observed during BIORECIE 3 despite careful search almost every night, including visits to the small mangrove (Fig. 4, n°1) and brackish ponds (Fig. 4, n°2) where the chance of finding seemed higher. However, a living individual was observed a few days before BIORECIE 3 near 'Maison Patureau' (pers. com. P. Got, Fig. 4, n°7) and a dead specimen was observed a few days after BIORECIE 3 (pers. com., B. Pellerin de la Vergne, gendarme at Juan de Nova, Fig. 4, n°6). All places of occurrence of the coconut crab since 2011 are recapitulated in Fig. 4. It does not seem to have a favorite terrestrial habitat as it was found in varied places such as dry karstic areas (Fig. 4, n°5), filao forests (Fig. 4, n°3, 7), and sand areas within and near the camp 'Séga' (Fig. 4, n°4, 6).

3.2.2. Supra littoral and intertidal

The supra littoral is composed of an herbaceous coverage on a substrate of either sand or dead corals with karstic areas (Fig. 2.2 first photo). Along the north coast the intertidal habitat is composed of long beaches of fine white sand (Fig. 2.2 second photo) while the south coast is more rocky with rubbles of dead corals or coral slabs (Fig. 2.2 first and third photos). This habitat has been visited daily at low tide within the area indicated on Fig. 1 with special attention to st. 20 which was near the base camp (Fig. 4, 'Camp Meteo'). St. 6 of the 'reef flat stations' is in fact included in this habitat. The eastern coast of the island was not prospected because too far away from the base camp. The crustaceans of this habitat are listed in Appendix C2.

The supra littoral habitat is colonized by the two coenobitids already reported in the terrestrial habitat. Sally lightfoot crabs are also common with *Grapsus fourmanoiri* being much more abundant than *Grapsus tenuicrustatus*. In the intertidal the commonest species listed in Appendix C2 are the hermit crab *Calcinus laevimanus* and the crabs *Eriphia sebana*, *E. smithii*, *Metopograpsus thukuhar*, and *Pachygrapsus minutus*, in places with coral rubbles or coral slabs, and the ghost crabs *Ocypode* spp., always associated to fine sand beaches where they can dig their deep burrows.

Mudflats are almost non-existant in the intertidal except for a few places of sandy-muddy sediment at st. 20, between large coral slabs. This is enough to allow the settlement of the fiddler crab *Uca tetragonon*, a species typical of mudflats often associated with mangroves. In comparison, in Europa where there is a larger mangrove with much more mudflats, three fiddler crabs species were found in 2011 (*Uca chlorophthalmus*, *Uca inversa*, *U. tetragonon*; Poupin et al., 2013a); in Glorieuses without mudflats no fiddler crab was found in 2012 (Poupin et al., 2013b).

3.2.3. Sand bottoms of the reef flat

The distinction of sand and hard bottoms of the reef flat (Fig. 1) is a simplified approach to classify the habitats occupied by the crustaceans. In the field the two habitats were sometimes found on a single reef flat station for example at st. 15 where two species

Fig. 3. Terrestrial Decapoda found at Juan de Nova Island, from left to right and top to bottom: *Birgus latro* (photo P. Got), *Cardisoma carnifex*, *Geograpsus grayi*, *G. crinipes*, *Coenobita perlatus*, *C. rugosus*.

Fig. 4. Places of observation of the coconut crab (*Birgus latro*) at Juan de Nova in 2011 and 2013 (squares 3–7) and of the land crab (*Cardisoma carnifex*) during BIORECIE 3 (circles: 1, mangrove; 2, brackish ponds). These places can be displayed using Google Earth and kmz file at http://doi.pangaea.de/10.1594/PANGAEA.836272.

typical of sand bottoms (*Ashtoret lunaris*, *Parascytoleptus tridens*) were found in small sand areas in between coral bommies. In comparison of this simplified approach not less than 36 distinct reef flat micro-habitats were considered for sessile species such as algae or hydrozoans.

The crustaceans species of sand bottoms are listed in Appendix C3. Most of them are able to quickly bury into the sediment either to avoid predation or to watch for their prey. The commonest species observed in this habitat were the hermit crabs *Calcinus latens* (ubiquitous around Juan de Nova) and *Dardanus lagopodes*, the swimming crabs *Charybdis obtusifrons*, and *Thalamita* spp., and the box crabs *Calappa* spp.

3.2.4. Hard bottoms of the reef flat

The list of species in this habitat is in Appendix C4. They are mostly small to medium sized crabs collected by breaking dead coral blocks, such as *Actaeodes tomentosus*, *Chlorodiella laevissima*, *Etisus demani*, *Pachygrapsus planifrons*, *Paractaea rufopunctata*, *Pilodius areolatus*, *P. spinipes*, or *Xanthias lamarckii*. Smaller and more mobile species, such as the Alpheidae or Palaemonidae shrimps were often seen but not successfully captured. These groups are therefore still poorly inventoried on the hard bottoms of Juan de Nova reef flat where the sampling is uneasy and sometimes dangerous because of strong currents and sharks.

3.2.5. Front reef

The stations prospected on the front reef (Fig. 1, st. 16–19, Table A1) are about 3 km far from the base camp. They were visited at low tide by using a motorboat and two kayaks during a single day operation (December 16th). This habitat is characterized by a narrow front reef exposed to the swell of the open sea and washed up by very strong currents (Fig. 2.5). A few species that can firmly hang to the substrate with their strong legs and claws are typical of this habitat. In the list of Appendix C5 these are the hermit crabs *Calcinus elegans* and *C. morgani*, and the crabs *Daira perlata* and *Eriphia scabricula* (very common on the front reef).

3.2.6. Outer reef

During BIORECIE 3 only a few sporadic observations were made on the outer reef habitat by the scuba divers based on *Antsiva* sail ship. Additional records on Juan de Nova outer reef are from observations made during BIOTAS 2009 (see Methods). In total 41 outer reef crustaceans are listed in Appendix C6. They are small species commonly associated with living corals either obligate (*Alpheus lottini*, *Cherusius triunguiculatus*, *Cymo quadrilobatus*, *Hapalocarcinus marsupialis*, *Domecia hispida*, *Trapezia bidentata*, *T. digitalis*, *T. lutea*, *T. rufopunctata*) or facultative (*Calcinus guamensis*, *C. pulcher*, *C. rosaceus*, *Liocarpilodes integerrimus*, *Pagurixus carinimanus*, *P. haigae*, *Perinia tumida*). Others small species are found in dead coral blocks or coral rubbles such as *Chlorodiella laevissima*, *Liomera monticulosa*, *L. stimpsonii*, *Lophozozymus pulchellus*, *Lybia tessellata*, *Platyozius laevis*, *Polyonyx biunguiculatus*, or *Tweedieia laysani*. Larger species were observed or photographed wandering on the sea bottom or under coral slabs such as *Ciliopagurus tricolor*, *Dardanus guttatus*, *D. lagopodes*, *D. megistos*, *Etisus anaglyptus*, *E. dentatus*, *E. splendidus*, or *Stenopus hispidus*. A single outer reef lobster was observed, *Panulirus versicolor*. This is also the single species reported at Europa while two species are known at Glorieuses (*P. versicolor* and *Panulirus longipes*).

4. Conclusion

The BIORECIE 3 fieldwork at Juan de Nova was the first opportunity to make an inventory of the Decapoda and Stomatopoda of

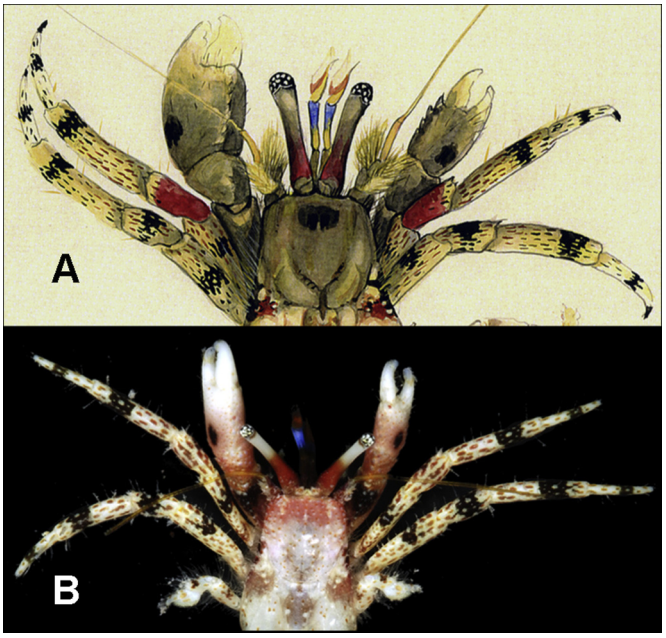

Fig. 5. Recognition of a cryptic form of *Calcinus pulcher* Forest, 1958 at Juan de Nova: A) Typical specimen from Vietnam, showing red patches on the carpi of second pereopods; B) Specimen from Juan de Nova (probably FLMNH 20709) without red patches on the carpi of second pereopods. A) Watercolor from R. Serène field notes; B) Photo from BIOTAS Expedition at Juan de Nova, outer reef, 7–11 m, April 29, 2009 (MEPA-00707, courtesy M. Malay).

this isolated island. Although regional inventories are still far from being complete, preliminary comparisons can also be made with others Islands of the Mozambique channel that were recently studied for their crustacean fauna (Europa, Glorieuses, Mayotte).

The Stomatopoda are still insufficiently sampled in the Iles Eparses counting only 6 species in total: 3 at Juan de Nova, 3 at Europa, none at Glorieuses. In comparison 14 species are reported at Mayotte by Legall and Poupin (2015).

Within the Iles Eparses the Decapoda have the lowest diversity at Juan de Nova (109 species) compared to Glorieuses (157 species) and Europa (175 species). This is explained by the smaller size of Juan de Nova Island and by the difficulty to correctly sample its reef flat at low tide. Mayotte Island has a much higher biodiversity than the Iles Eparses (491 species). This is explained by a better sampling at Mayotte together with the larger size of the Island with much more ecological niches for crustaceans species.

Three species are endemic to the Iles Eparses: the swimming crab *Thalamita pseudospinifera*, described by Crosnier (1975) from Glorieuses, and the tiny hermit crabs *Pagurixus annulus* and *P. europa*, described by Komai and Poupin (2013) from Europa. However, these species are probably more widely distributed in the western Indian ocean (WIO) where they remain unreported because of insufficient sampling.

Among the Crustacea endemic to WIO region, 21 species occur in the Iles Eparses: *Areopaguristes abbreviatus*, *Calcinus rosaceus*, *Ciliopagurus tricolor*, *Eriphia smithii*, *Euxanthus rugosus*, *Gonodactylellus spinosus*, *Grapsus fourmanoiri*, *Leptodius exaratus* (sensu stricto), *Lysmata kuekenthali*, *Mesacturoides crinitus*, *Metadynomene crosnieri*, *Metapenaeopsis incisa*, *Pagurixus annulus*, *P. europa*, *Panulirus longipes*, *Pisidia delagoae*, *Thalamita margaritimana*, *T. pseudospinifera*, *Trizocheles hoensonae*, *Uca chlorophthalmus*, and *U. inversa*. *Calcinus pulcher* should also be added to this list as observations made in the Iles Eparses (Europa, Glorieuses, Juan de Nova) confirm that there is a cryptic form of *C. pulcher* in WIO. In the Iles Eparses (and also Réunion) *C. pulcher* do not have red patches on the carpi of second pereopods (Fig. 5A) while these are present in specimens from the type locality (Fig. 5B, Vietnam) as well as in specimens from the western Pacific (Japan, Taiwan, New Caledonia). Molecular data have also confirmed that the two populations are distinct (Malay and Paulay, 2009).

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Appendix A. List of stations.

Table A1
Station list for the Crustacea Decapoda and Stomatopoda collected at Juan de Nova during BIORECIE 3.

St.	Date	Latitude (S)	Longitude (E)	Depth. (m)	Tide coefficient	Low tide time	Collectors	Remarks
1	08/12/2013	−17.06051	42.71354	0.5	76	14h00	BIORECIE 3 whole team	Dead corals with sediments, sponges, *Halimeda* algae
2	08/12/2013	−17.06136	42.71416	0.2	76	14h00	BIORECIE 3 whole team	Coral slabs, sand, dead corals, *Halimeda* algae
3	09/12/2013	−17.07019	42.71046	0.5	62	15h30	M. Zubia, N. Gravier-Bonnet, J. Poupin, T. Mulochau, S. Turay	Dead corals with sediments, sponges, *Halimeda* algae
4	10/12/2013	−17.06586	42.72348	0.5	49	16h30	M. Zubia, N. Gravier-Bonnet, J. Poupin	Dead corals with sediments, sponges, *Halimeda* algae
5	10/12/2013	−17.06807	42.72319	0.5	49	16h30	M. Zubia, N. Gravier-Bonnet, J. Poupin	Dead corals with sediments, sponges, *Halimeda* algae

Table A1 (*continued*)

St.	Date	Latitude (S)	Longitude (E)	Depth. (m)	Tide coefficient	Low tide time	Collectors	Remarks
6	10/12/2013	−17.06368	42.72123	0	49	16h30	M. Zubia, N. Gravier-Bonnet, J. Poupin	Fossil reef
7	11/12/2013	−17.07463	42.72083	0.5	42	18h00	M. Zubia, J. Poupin	Coral slabs with algae, *Padina*, *Hydroclathrus*, *Dictyota*
8	12/12/2013	−17.05806	42.69461	0.5	43	7h00	M. Zubia, N. Gravier-Bonnet	not indicated
9	12/12/2013	−17.04365	42.69569	0.5	43	7h00	M. Zubia, N. Gravier-Bonnet	not indicated
10	13/12/2013	−17.04569	42.68039	0.5	45	8h15	M. Zubia, N. Gravier-Bonnet, J. Poupin	not indicated
11	14/12/2013	−17.04231	42.69587	0.5	54	9h00	M. Zubia, N. Gravier-Bonnet, J. Poupin	not indicated
12	14/12/2013	−17.05236	42.70493	0.2	54	9h00	M. Zubia, N. Gravier-Bonnet, J. Poupin	not indicated
13	14/12/2013	−17.04440	42.70754	0.5	54	9h00	M. Zubia, N. Gravier-Bonnet, J. Poupin	not indicated
14	15/12/2013	−17.03932	42.73068	1	64	10h30	M. Zubia, N. Gravier-Bonnet, J. Poupin	Reef flat near front reef, live coral, fishes, strong currents, algae *Halimeda*, *Caulerpa*, *Portieria*
15	15/12/2013	−17.04192	42.71683	1	64	10h30	M. Zubia, N. Gravier-Bonnet, J. Poupin	Coral *Acropora*, sand bottoms, cyanobacteria, fishes
16	16/12/2013	−17.05087	42.68053	2	73	11h30	M. Zubia, N. Gravier-Bonnet, J. Poupin, T. Mulochau, S. Andrefouët	Front reef, visited with kayaks and powerboat
17	16/12/2013	−17.04783	42.68040	1	73	11h30	M. Zubia, N. Gravier-Bonnet, J. Poupin, T. Mulochau, S. Andrefouët	Front reef, visited with kayaks and powerboat
18	16/12/2013	−17.03803	42.67752	0.5	73	11h30	M. Zubia, N. Gravier-Bonnet, J. Poupin, T. Mulochau, S. Andrefouët	Front reef, visited with kayaks and powerboat
19	16/12/2013	−17.03749	42.67463	1	73	11h30	M. Zubia, N. Gravier-Bonnet, J. Poupin, T. Mulochau, S. Andrefouët	Front reef, visited with kayaks and powerboat
20	8–16/12/2013	−17.0542	42.710731	0.5	43-76	6-18H	J. Poupin	Fringing reef, in front of the camp. Coral slabs, fine muddy sand in between. Visited daily.
31	13/12/2013	−16.943	42.7094	18–19		14H	Thierry Mulochau	Outer reef, coral bommies, scuba dive, 18–19 m.

Appendix B. List of species

Taxonomy according to De Grave et al. (2009), goes down to the genus, and species following WoRMS (2014). Abbreviations and acronyms are explained in Abbreviations and Material and Methods sections. When specimens have been collected they are registered and deposited in MNHN collections, Paris (see MNHN-IU-2013 numbers). Color photographs of almost all species are available in Legall and Poupin (2015) using a filter for Juan de Nova Island at http://crustiesfroverseas.free.fr/search_result.php?refisland=Juan+de+Nova.

Order Stomatopoda Latreille, 1817

Superfamily Gonodactyloidea Giesbrecht, 1910

Family Gonodactylidae Giesbrecht, 1910

Gonodactylaceus falcatus (Forskål, 1775) – 1 male Lc 8.2 mm, Lt about 39.2 mm, st. 12. (MNHN-IU-2013–16069; det. S. Ahyong, corrected from *G. ternatensis*).

Gonodactylellus spinosus (Bigelow, 1893) – 1 sp. Lc 5.6 mm, Lt about 21.2 mm, st. 14. (MNHN-IU-2013–16070).

Family Takuidae Manning, 1995

Mesacturoides crinitus (Manning, 1962) – Determination S.T. Ahyong, 1 sp. Lc 5.7 mm, Lt about 22.8 mm, st. 10. (MNHN-IU-2013–16071)

Order Decapoda Latreille, 1802

Infraorder Stenopodidae Bate, 1888

Family Stenopodidae Claus, 1872

Stenopus hispidus (Olivier, 1811) – st. 7, st. 31.

Infraorder Caridea Dana, 1852

Family Palaemonidae Rafinesque, 1815

Periclimenes soror Nobili, 1904-1 ovigerous female, st. 18 (on sea star *Culcita*, MNHN-IU-2013–16073); 1 ovigerous female, st. 31, dive, coll. T. Mulochau. (MNHN-IU-2013-16072).

Family Alpheidae Rafinesque, 1815

Alpheus aff. *bucephalus Coutière*, 1905-1 sp. Lc 4.3 mm, Lt 18.7 mm, st. 12. (MNHN-IU-2013–16074).

Alpheus ?*collumianus* Stimpson, 1860-BIOTAS (FLMNH).

Alpheus dolerus A.H. Banner, 1956-1 male, Lc 3.9 mm, Lt 20 mm, st. 15. (MNHN-IU-2013–16075).

Alpheus lottini Guérin-Méneville, 1829-BIOTAS (FLMNH)

Alpheus aff. *paralcyone* Coutière, 1905-1 sp. Lc 3.3 mm, Lt 14.5 mm (MNHN-IU-2013–16076), 1 sp. Lc 3.7 mm, Lt 15.4 mm, st. 15 (MNHN-IU-2013-16077).

Aretopsis amabilis de Man, 1910-BIOTAS (FLMNH)

Family Hippolytidae Bate, 1888

Thinora maldivensis (Borradaile, 1915) – BIOTAS (FLMNH)

Infraorder Axiidea de Saint Laurent, 1979

Family Axiidae Huxley, 1879

Parascytoleptus tridens (Rathbun, 1906), 1 ovigerous female, st. 15 (sand patch), determination P. Dworschak (sp. deposited in Vienna collections, NHMW 25608), 1 ovigerous female Lc 5.3, Lt 19.6 mm, st. 12 (MNHN-IU-2013-7217).

Family Callianideidae Kossmann, 1880
Callianidea typa H. Milne Edwards, 1837-from Poore (1997).

Infraorder Achelata Scholtz and Richter, 1995

Family Palinuridae Latreille, 1802
Panulirus versicolor (Latreille, 1804) – st. 31.

Infraorder Anomura MacLeay, 1838

Family Galatheidae Samouelle, 1819
Galathea tanegashimae Baba, 1969-BIOTAS (FLMNH).
Family Porcellanidae Haworth, 1825
Neopetrolisthes maculatus (H. Milne Edwards, 1837) – BIOTAS (FLMNH)
Pachycheles sculptus (H. Milne Edwards, 1837) – BIOTAS (FLMNH)
Petrolisthes borradailei Kropp, 1983-1 female, st. 2. (MNHN-IU-2013–16078).
Polyonyx biunguiculatus (Dana, 1852) – BIOTAS (FLMNH).
Family des Coenobitidae Dana, 1851
Birgus latro (Linnaeus, 1767) – Terrestrial.
Coenobita perlatus H. Milne Edwards, 1837-Terrestrial.
Coenobita rugosus H. Milne Edwards, 1837-Terrestrial.
Family Diogenidae Ortmann, 1892
Areopaguristes abbreviatus (Dechancé, 1963) – BIOTAS (FLMNH)
Calcinus elegans (H. Milne Edwards, 1836) – st. 16–19.
Calcinus guamensis Wooster, 1984-st. 31, BIOTAS (FLMNH).
Calcinus laevimanus (Randall, 1840) – st. 6, st. 20; also 8 spp. juveniles almost without color on ambulatory legs, st. 5 (MNHN-IU-2013–16079).
Calcinus latens (Randall, 1840) – Ubiquitous, reef flat (sand and hard bottoms) and front reef.
Calcinus morgani Rahayu & Forest, 1999-st. 16–19.
Calcinus pulcher Forest, 1958-BIOTAS (FLMNH).
Calcinus rosaceus Heller, 1861-BIOTAS (FLMNH).
Calcinus seurati Forest, 1951-st. 6, 20.
Ciliopagurus tricolor Forest, 1995-BIOTAS (FLMNH)
Clibanarius englaucus Ball & Haig, 1972-1 male Lc 2.58 mm, st. 3 (MNHN-IU-2013–16080).
Clibanarius eurysternus (Hilgendorf, 1879) – st. 20.
Clibanarius striolatus Dana, 1852-6 spp., st. 20, photo 1 sp. Lc 3.9 mm, Lt 25 mm (MNHN-IU-2013–16083).
Clibanarius virescens (Krauss, 1843) – st. 20.
Dardanus guttatus (Olivier, 1812) – st. 31.
Dardanus lagopodes (Forskål, 1775) – st. 5, st. 31.
Dardanus megistos (Herbst, 1804) – st. 12, st. 31.
Dardanus scutellatus (H. Milne Edwards, 1848) – st. 4, 5.
Family Paguridae Latreille, 1802
Pagurixus aff. *carinimanus* Komai & Osawa, 2006-BIOTAS (FLMNH).
Pagurixus haigae Komai & Osawa, 2007-3 spp., st. 10 (MNHN-IU-2013-16082); 1 ovigerous female, Lc 1.6 mm, st. 15 (MNHN-IU-2013-16081), st. 16.

Infraorder Brachyura Linnaeus, 1758

Family Calappidae De Haan, 1833
Calappa gallus (Herbst, 1803) – 1 male (exuvia) 17.4 × 21.2 mm, st. 9 (MNHN-IU-2013–16084).
Calappa hepatica (Linnaeus, 1758) –- st. 12.
Family Matutidae De Haan, 1835
Ashtoret lunaris (Forskål, 1775) –- 1 female 39 × 40 mm, st. 15 (sand patch) (MNHN-IU-2013–16085).
Family Carpiliidae Ortmann, 1893
Carpilius convexus (Forskål, 1775) – st. 7, 8.
Family Dairidae Serène, 1965
Daira perlata (Herbst, 1790) – st. 19.
Family Eriphiidae MacLeay, 1838
Eriphia scabricula Dana, 1852-st. 16, 17.
Eriphia sebana (Shaw and Nodder, 1803) – st. 6, 20.
Eriphia smithii MacLeay, 1838-st. 6, 20.
Family Euryplacidae
Platyozius laevis (Borradaile, 1902) – 1 female 9.7 × 12.3 mm, st. 31, dive 18–19 m (MNHN-IU-2013–16086).
Family Epialtidae MacLeay, 1838
Huenia grandidierii A. Milne-Edwards, 1865-1 female 14.0 × 11.9 mm, st. 18. (MNHN-IU-2013–16087).
Perinia tumida Dana, 1851-BIOTAS (FLMNH).
Tylocarcinus styx (Herbst, 1803) – 1 male, st. 17 (MNHN-IU-2013-16089); 1 male 19.5 × 13.9 mm, st. 10. (MNHN-IU-2013-16088).
Family Pilumnidae Samouelle, 1819
Glabropilumnus dispar (Dana, 1852) – 1 male 3.9 × 5.6 mm, st. 20 (similar to G. laevimanus, but with anterolateral spines spinulose) (MNHN-IU-2013–16090).
Family Portunidae Rafinesque, 1815
Charybdis obtusifrons Leene, 1937-st. 9, 12, 20.
Cycloachelous granulatus (H. Milne Edwards, 1834) – st. 2, 13.
Lissocarcinus orbicularis Dana, 1852-st. 9; 1 female 5.6 × 5.6 mm, st. 31, coll. T. Mulochau. (MNHN-IU-2013-16091).
Thalamita admete (Herbst, 1803) – 1 male 6.8 × 9.8 mm, st. 12 (MNHN-IU-2013-16092), 1 ovigerous female, st. 10 (MNHN-IU-2013-16093); also in Crosnier (1962).
Thalamita crenata Rüppell, 1830-st. 1, 2; 1 juv. st. 20 (MNHN-IU-2013-16094).
Thalamita gloriensis Crosnier, 1962-1 ovigerous female 4.4 × 5.9 mm, st. 15 (MNHN-IU-2013-16095); 3 juv., st. 12 (MNHN-IU-2013-16096).
Family Pseudoziidae Alcock, 1898
Pseudozius caystrus (Adams and White, 1849) – from Crosnier (1984).
Family Domeciidae Ortmann, 1893
Cherusius triunguiculatus (Borradaile, 1902) - BIOTAS (FLMNH).
Domecia hispida Eydoux & Souleyet, 1842-BIOTAS (FLMNH).
Family Trapeziidae Miers, 1886
Trapezia bidentata (Forskål, 1775) – st. 31.
Trapezia digitalis Latreille, 1828-st. 31.
Trapezia lutea Castro, 1997-1 male 6.5 × 7.2 mm, st. 10 (MNHN-IU-2013–16097); st. 31.
Trapezia rufopunctata (Herbst, 1799) – st. 31.
Family Xanthidae MacLeay, 1838
Actaeodes tomentosus (H. Milne Edwards, 1834) – 1 male juv. 5.4 × 7.9 mm, st. 12 (in dead coral) (MNHN-IU-2013–16102), 1 male 12.2 × 18.7 mm, st. 17 (MNHN-IU-2013-16098).
Chlorodiella laevissima (Dana, 1852) – 1 male 4.2 × 6.5 mm, st. 10 (MNHN-IU-2013–16099).
Cymo quadrilobatus Miers, 1884-BIOTAS (FLMNH)
Etisus anaglyptus H. Milne Edwards, 1834-st. 16, BIOTAS (FLMNH)
Etisus demani Odhner, 1925-1 ovigerous female 14.8 × 21.4 mm, st. 17 (MNHN-IU-2013–16100).
Etisus dentatus (Herbst, 1785) – st. 31.
Etisus splendidus Rathbun, 1906-st. 31.

Euxanthus exsculptus (Herbst, 1790) – st. 15.
Kraussia rugulosa (Krauss, 1843) – 1 male 8.3 × 9.9 mm, st. 12 (MNHN-IU-2013–16101).
Leptodius exaratus (H. Milne Edwards, 1834) – 1 juv. st. 5 (MNHN-IU-2013-16103); 1 female 7.8 × 11.7 mm, st. 20 (MNHN-IU-2013-16104).
Leptodius sanguineus (H. Milne Edwards, 1834) – 4 spp. with color pattern variable, st. 6 (MNHN-IU-2013-16106); 1 female 22.3 × 33.7 mm, st. 1. (MNHN-IU-2013-16105).
Liocarpilodes harmsi (Balss, 1934) – 1 male 5.0 × 7.3 mm, st. 20. (MNHN-IU-2013–16107).
Liocarpilodes integerrimus (Dana, 1852) – BIOTAS (FLMNH).
Liomera monticulosa (A. Milne-Edwards, 1873) – st. 31.
Liomera stimpsonii (A. Milne-Edwards, 1865) – BIOTAS (FLMNH).
Lophozozymus pulchellus A. Milne-Edwards, 1867-BIOTAS (FLMNH)
Lybia plumosa Barnard, 1947-1 male 5.7 × 7.0 mm, st. 14. (MNHN-IU-2013–16108).
Lybia tessellata (Latreille, in Milbert, 1812) – BIOTAS (FLMNH)
Paractaea rufopunctata (H. Milne Edwards, 1834) – photo ARVAM Juan de Nova.
Pilodius areolatus (H. Milne Edwards, 1834) – 1 female, st. 10 (MNHN-IU-2013–16109).
Pilodius spinipes (Heller, 1861) – 1 male 11.3 × 17.1 mm, st. 15 (MNHN-IU-2013–16110)
Tweedieia laysani (Rathbun, 1906) – BIOTAS (FLMNH).
Xanthias lamarckii (H. Milne Edwards, 1834) – st. 10, 14.
Zosimus aeneus (Linnaeus, 1758) – st. 2 (in dead coral), st. 31.
Zozymodes cavipes (Dana, 1852), 1 male, st. 20 (MNHN-IU-2013-16112).
Zozymodes pumilus (Hombron and Jacquinot, 1846), 1 male 3.9 × 6.1 mm, 1 ovigerous female 3.7 × 5.7 mm, st. 17. (MNHN-IU-2013-16111), st. 5 (in dead coral).
Zozymodes xanthoides (Krauss, 1843) – from Serène (1984).

Family Cryptochiridae Paul'son, 1875
Hapalocarcinus marsupialis Stimpson, 1859-BIOTAS (FLMNH).

Family Gecarcinidae MacLeay, 1838
Cardisoma carnifex (Herbst, 1796) – Terrestrial.

Family Grapsidae MacLeay, 1838
Geograpsus crinipes (Dana, 1851) – Terrestrial.
Geograpsus grayi (H. Milne Edwards, 1853) – Terrestrial.
Grapsus fourmanoiri Crosnier, 1965-st. 6, 20.
Grapsus tenuicrustatus (Herbst, 1783) – st. 6, 20.
Metopograpsus thukuhar (Owen, 1839) – 1 female juvenile 8.5 × 11.6 mm, 2 juveniles, st. 1 (near intertidal) (MNHN-IU-2013–16113); 1 male 19.5 × 23.6 mm, 1 female, st. 20. (MNHN-IU-2013-16114).
Pachygrapsus minutus A. Milne-Edwards, 1873-1 male, 1 ovigerous female, st. 17 (MNHN-IU-2013-16115); 1 male, st. 20 (MNHN-IU-2013-16116).
Pachygrapsus planifrons De Man, 1888-1 male, 1 ovigerous female 7.3 × 8.7 mm, 1 female ov., st. 20 (MNHN-IU-2013-16117); 1 female, st. 1 (near intertidal) (MNHN-IU-2013-16118).

Family Percnidae Števcic, 2005
Percnon guinotae Crosnier, 1965-BIOTAS (FLMNH).

Family Plagusiidae Dana, 1851
Plagusia immaculata Lamarck, 1818-1 female 17.6 × 17.8 mm, st. 13 (drifting under a buoy) (MNHN-IU-2013–16119).

Family Varunidae H. Milne Edwards, 1853
Thalassograpsus harpax (Hilgendorf, 1892) – 9 males, 3 females, 8 ovigerous females, st. 6 (MNHN-IU-2013-16120); 2 males, 3 females (color pattern variable), st. 6 (MNHN-IU-2013-16121).

Family Macrophthalmidae Dana, 1851
Chaenostoma sinuspersici (Naderloo and Türkay, 2010) = *Chaenostoma boscii* (Audouin, 1826) in WoRMS – 1 female 7.3 × 8.7 mm, st. 2 (near intertidal) (MNHN-IU-2013–16122).

Family Ocypodidae Rafinesque, 1815
Ocypode ceratophthalmus (Pallas, 1772) – st. 20.
Ocypode pallidula Jacquinot, in Hombron & Jacquinot, 1846-1 male, 11.8 × 14.8 mm, st. 1 (near intertidal), stridulating ridge with 33 striae (MNHN-IU-2013–16123).
Uca tetragonon (Herbst, 1790) – 1 male 13.1 × 18.9 mm (MNHN-IU-2013–16124), 1 female (broken) 10.1 × 14.3 mm, st. 20 (MNHN-IU-2013-16125).

Appendix C. Species classified by habitats

Crustaceans species (Decapoda and Stomatopoda) of Juan de Nova classified by key habitats (Fig. 1–2). Ubiquitous species, i.e. observed in two key habitats or more, are in bold. Reef flat stations of Fig. 1 and Table A1 are indicated for each habitat.

C.1 Terrestrial species

Birgus latro, Cardisoma carnifex, ***Coenobita perlatus***, ***C. rugosus***, *Geograpsus crinipes, G. grayi.*

C.2 Supra and Intertidal (st. 6, 20)

Calcinus laevimanus, C. seurati, Chaenostoma sinuspersici, **C**harybdis ***obtusifrons***, *Clibanarius englaucus, C. eurysternus, C. striolatus, C. virescens,* **C**oenobita ***perlatus***, ***C. rugosus***, *Eriphia sebana, E. smithii, Glabropilumnus dispar, Grapsus fourmanoiri, G. tenuicrustatus, Leptodius exaratus, L. sanguineus, Liocarpilodes harmsi, Metopograpsus thukuhar, Ocypode ceratophthalmus, O. pallidula,* **P**achygrapsus ***minutus***, *P. planifrons, Petrolisthes borradailei, P. lamarckii, Pseudozius caystrus,* **T**halamita ***crenata***, *Thalassograpsus harpax, Uca tetragonon,* ***Zozymodes cavipes***.

C.3 Reef flat, sand bottoms (st. 1–2, 4–5, 9, 11–13)

Alpheus aff. bucephalus, Ashtoret lunaris, Calappa gallus, C. hepatica, ***Calcinus latens***, *Callianidea typa,* **C**harybdis ***obtusifrons***, *Cycloachelous granulatus,* ***Dardanus lagopodes***, ***D. megistos***, *D. scutellatus, Gonodactylaceus ternatensis, Kraussia rugulosa,* ***Lissocarcinus orbicularis***, *Parascytoleptus tridens,* **T**halamita ***admete***, ***T. crenata***, ***T. gloriensis***.

C.4 Reef flat, hard bottoms (st. 3, 7–8, 10, 14–15)

Actaeodes tomentosus, *Alpheus aff. paralcyone, A. dolerus,* **C**alcinus ***latens***, *Carpilius convexus, Chlorodiella laevissima, Etisus demani, Euxanthus exsculptus, Galathea tanegashimae, Gonodactylellus spinosus, Lybia plumosa, Mesacturoides crinitus,* ***Neopetrolisthes maculatus***, *Pachycheles sculptus, Pachygrapsus planifrons,* ***Pagurixus haigae***, *Paractaea rufopunctata, Percnon guinotae, Pilodius areolatus, P. spinipes,* ***Stenopus hispidus***, **T**halamita ***admete***, ***T. gloriensis***, **T**rapezia ***lutea***, ***Tylocarcinus styx***, *Xanthias lamarckii,* ***Zosimus aeneus***, ***Zozymodes cavipes***, *Z. pumilus, Z. xanthoides.*

C.5 Front reef (st. 16–19)

Actaeodes tomentosus, Calcinus elegans, C. latens, C. morgani, Daira perlata, Eriphia scabricula, Etisus anaglyptus, E. demani, Huenia grandidierii, Pachygrapsus minutus, Pagurixus haigae, Periclimenes soror, Tylocarcinus styx.

C.6 Outer reef (st. 31)

Alpheus collumianus, *A. lottini*, *Areopaguristes abbreviatus*, *Aretopsis amabilis*, *Calcinus guamensis*, *C. pulcher*, *C. rosaceus*, *Cherusius triunguiculatus*, *Chlorodiella laevissima*, *Ciliopagurus tricolor*, *Cymo quadrilobatus*, *Dardanus guttatus*, ***D. lagopodes***, ***D. megistos***, *Domecia hispida*, ***E***tisus ***anaglyptus***, *E. dentatus*, *E. splendidus*, *Hapalocarcinus marsupialis*, *Liocarpilodes integerrimus*, *Liomera monticulosa*, *L. stimpsonii*, ***Lissocarcinus orbicularis***, *Lophozozymus pulchellus*, *Lybia tessellata*, ***Neopetrolisthes maculatus***, *Pagurixus carinimanus*, ***P. haigae***, *Panulirus versicolor*, ***Periclimenes soror***, *Perinia tumida*, *Plagusia immaculata*, *Platyozius laevis*, *Polyonyx biunguiculatus*, ***Stenopus hispidus***, *Thinora maldivensis*, *Trapezia bidentata*, *T. digitalis*, ***T. lutea***, *T. rufopunctata*, *Tweedieia laysani*, ***Zosimus aeneus***.

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