

New records of marine invertebrates from the coast of Gabon, Eastern Atlantic.



Peter WIRTZ

Thomas MENUT
Lucas BÉRENGER

Mathias PRAT

Patrick LOUISY

Catherine ROQUEFORT

New records of marine invertebrates from the coast of Gabon, Eastern Atlantic

Peter Wirtz : Prof. Dr., peterwirtz2004@yahoo.com

Thomas Menut : Directeur d'études milieux marins, tmenut@biotope.fr

Lucas Bérenger : Chef de projets milieux marins, lberenger@biotope.fr

Mathias Prat : Directeur de production, plongeur naturaliste, mprat@biotope.fr

Patrick Louisy : Biologiste marin, association Peau-Bleue, patrick.louisy@wanadoo.fr

Catherine Roquefort : Plongeuse naturaliste, cathyserval@gmail.com

Citation : Wirtz P., Menut T., Bérenger L., Prat M., Louisy P. & Roquefort C. (2020) - New records of marine invertebrates from the coast of Gabon, Eastern Atlantic. Les cahiers de la fondation Biotope 32 : 1 - 41.

Résumé :

Une mission d'inventaire subaquatique a été menée en novembre 2017 par six naturalistes sur la côte rocheuse au nord du Gabon située entre le Cap Esterias et le Cap Santa Clara.

Les vingt-six espèces suivantes sont recensées **pour la première fois** sur la côte du Gabon : le protozoaire *Zoothamnium niveum*, le Cnidaire octocoralliaire *Carijoa riisei*, l'anémone de mer *Actinostella flosculifera*, le Plathelminthe *Pseudobiceros wirtzi*, neuf Mollusques opisthobranches, l'Annelide polychète *Eurythoe* sp., la crevette fouisseuse *Neaxius mclaughlinae*, sept espèces de crevettes, un bernard-l'ermite non encore décrit, une squille *Protosquilla* sp., le Cirripède *Conopea saotomensis*, et le concombre de mer *Isostichopus* cf *badionotus*. Pour certaines de ces signalisations, il s'agit ainsi d'une grande extension de l'aire de répartition connue jusqu'alors pour l'espèce. Les petits fonds côtiers peu explorés du Gabon abritent encore apparemment de nombreuses espèces non répertoriées.

Abstract :

An underwater inventory mission was conducted in November 2017 by six naturalists on the north rocky coast of Gabon between Cape Esterias and Cape Santa Clara.

The following twenty-six species are recorded from the coast of Gabon for the first time : the protozoan *Zoothamnium niveum*, the octocoral *Carijoa riisei*, the sea anemone *Actinostella flosculifera*, the plathelminth *Pseudobiceros wirtzi*, nine opisthobranch molluscs, the polychaete *Eurythoe* sp., the mudshrimp *Neaxius mclaughlinae*, seven species of true shrimps, a possibly undescribed pagurid hermit crab, the mantis shrimp *Protosquilla* sp., the cirriped *Conopea saotomensis*, and the sea cucumber *Isostichopus* cf *badionotus*. For some of these species, this is a large extension of the known range of distribution. The poorly explored coasts of Gabon apparently harbour many still undetected species.



Summary



- INTRODUCTION

- MATERIAL & METHODS

- RESULTS

• «PROTOZOA» PERITRICHIA

• CNIDARIA OCTORALLIA

• CNIDARIA ANTHOZOA

• PLATHELMINTHES

• MOLLUSCA «OPISTHOBRANCHIA»

A - *Navanax orbignyanus* (Rochebrune, 1881)

B - *Oxynoe olivacea* (Rafinesque, 1814)

C - *Felimare* cf. *francoisae* (Bouchet, 1980)

D - *Felimida luteorosea* (Rapp, 1827)

E - *Paraflabellina ischitana* (Hirano and Thompson, 1990)

F - *Luisella babai* (Schmekel, 1972)

G - Three unidentified species

• ANNELIDA POLYCHAETA

• CRUSTACEA AXIIDEA

• CRUSTACEA CARIDEA

A - *Alpheus rugimanus* (A. Milne-Edwards, 1878)

B - *Athanas nitescens* (Leach, 1813)

C - *Nennalpheus gabonensis* (Anker, 2019)

D - *Cinetorhynchus gabonensis* (Duris, Sobanova and Wirtz, 2019)

E - *Palaemon vicinus* (Ashelby, 2009)

F - *Periclimenes* cf. *scriptus*

G - *Pseudocoutierea wirtzi* (Udekem d'Acoz, 2001)

H - *Rapipontonia platalea* (Holthuis, 1951)

I - *Thorulus cranchii* (Leach, 1817)

• CRUSTACEA ANOMURA

• CRUSTACEA STOMATOPODA

• CRUSTACEA CIRRIPIEDIA

• ECHINODERMATA HOLOTHUROIDEA

- DISCUSSION

- ACKNOWLEDGEMENTS

- REFERENCES



The Gabonese coast explored during this mission was covered with rainforest (photo Patrick Louisy)

INTRODUCTION

Gabon is situated in the Guinea Current Large Marine Ecosystem, one of the world's most productive ocean regions, which is rich in fishery resources, petroleum production, and is crucial to the lives of the region's 300 million coastal residents. Despite this importance, the marine biodiversity of Gabon is poorly known owing to limited financial resources, lack of regional expertise, and a greater emphasis on extractive resources (McGlade et al. 2002, Friedlander et al. 2014). The only marine groups studied in greater detail are cetaceans (e.g. Weir et al 2012a), fishes of commercial interest (e.g. Bianchi 1992, de Bruyne 2013, Weir et al 2012b), and large molluscs (e.g. Bernard 1984, Rolan 2005). Friedlander et al (2014) studied the marine life associated with offshore oil platforms in some detail. For other marine groups there exist only sporadic publications, e.g. on algae (John & Lawson 1974), foraminiferans (Langer et al 2016), corals (Laborel 1974), and decapod crustaceans (Holthuis 1951, Rossignol 1957, 1962). Lawson (1966) and Le Loeuff and van Cosel (1998) summarized the distribution patterns of selected marine invertebrates along the tropical eastern Atlantic coast.

During an expedition to the rocky shores north of Libreville, from Cap Esterias to Cap Santa Clara, the authors collected information on the marine fauna and flora. Corals (Scleractinia), an undescribed alpheid shrimp (Decapoda Alpheidae) and porcellanid crabs (Decapoda Porcellanidae) will be dealt with in separate publications by experts for these groups. **We here note the presence of various marine invertebrate species apparently not yet recorded from the coast of Gabon.**

MATERIAL AND METHODS

Explo. number	Min-Max depth	Date	Type
1	0 - 2,5 m	22 nov 2017	Snorkeling
2	7 - 10 m	23 nov 2017	Dive
3	0 - 2,5 m	23 nov 2017	Snorkeling
4	6 - 10,5 m	24 nov 2017	Dive
5	0 - 5 m	24 nov 2017	Dive
6	0 - 2,5 m	24 nov 2017	Dive
6bis	0 - 2 m	24 nov 2017	Snorkeling
7	7 - 10,7 m	25 nov 2017	Dive
8	6 - 10 m	25 nov 2017	Dive
9	7 - 9 m	26 nov 2017	Dive
10	6 - 9 m	26 nov 2017	Dive
11	11 - 15 m	27 nov 2017	Dive
12	9 - 12 m	27 nov 2017	Dive
13	6 - 8,5	28 nov 2017	Dive
14	5 - 7 m	28 nov 2017	Dive
15	0 - 1m	29/30 nov 2017	Fishing by the shore
/	2 m	24 nov 2017	Fishing
/	2 m	25 nov 2017	Fishing
16	0 - 1m	28 nov 2017	Fishing by the shore

We explored the littoral zone from Cape Santa Clara (0°31'06''N, 9°18'26''E) along the Arboretum Raponda Walker to Cape Esterias (0°36'50''N, 9°18'59''E) from 22 to 27 November 2017 (fig. 1). This zone is characterised by rocky flats and outcrops, a rare geological formation in the Gulf of Guinea, where sandy, and muddy and mangrove shores dominate.

In this area, six divers did nine scuba dive sessions between 8 and 11 m depth and two additional dives ca 7 km NW of Cap Esterias on a small sea mount (0°40'47''N, 9°16'24''E) in 13 m depth. **Total time under water was 84 hours.** The divers did not follow transects but simply recorded what they encountered while swimming in random directions. The same six divers also explored the shallow zones in this area during three snorkeling excursions. **Total time spent snorkeling was 32 hours** (see fig. 2 and following table).

The species described here were photographed under water and, where necessary for identification, collected by hand or with the help of a small hand-held aquarium net and a solution of clove oil in alcohol. Specimens are now at California Academy of Sciences (Conopea), Oxford Natural History Museum (shrimps), Vienna Natural History Museum (Neaxius), and Zoologische Staatssammlung München (hermit crabs, opisthobranchs).

Figure 1 : The study area, between Cape Santa clara and Cape Esterias, in Gabon

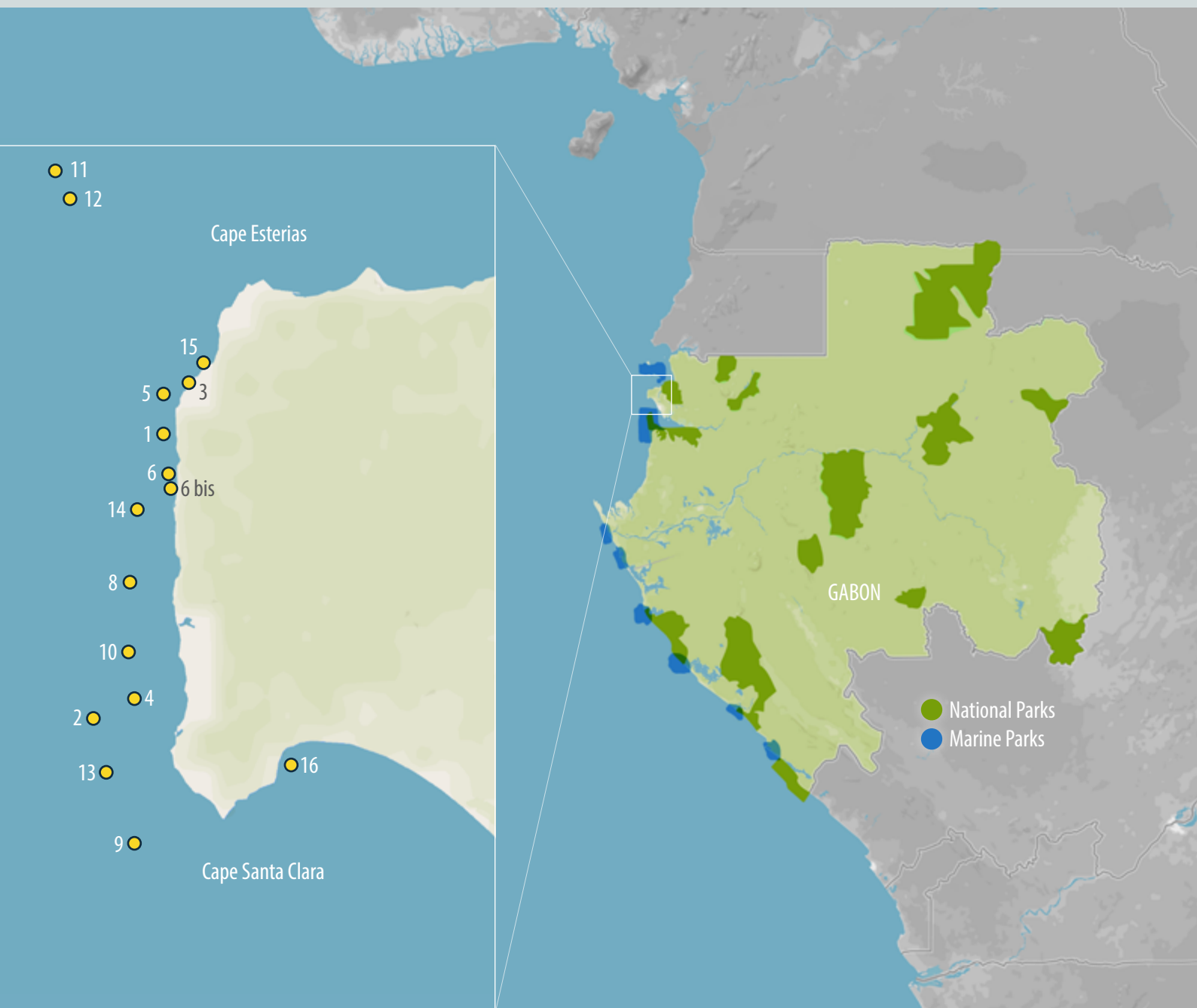
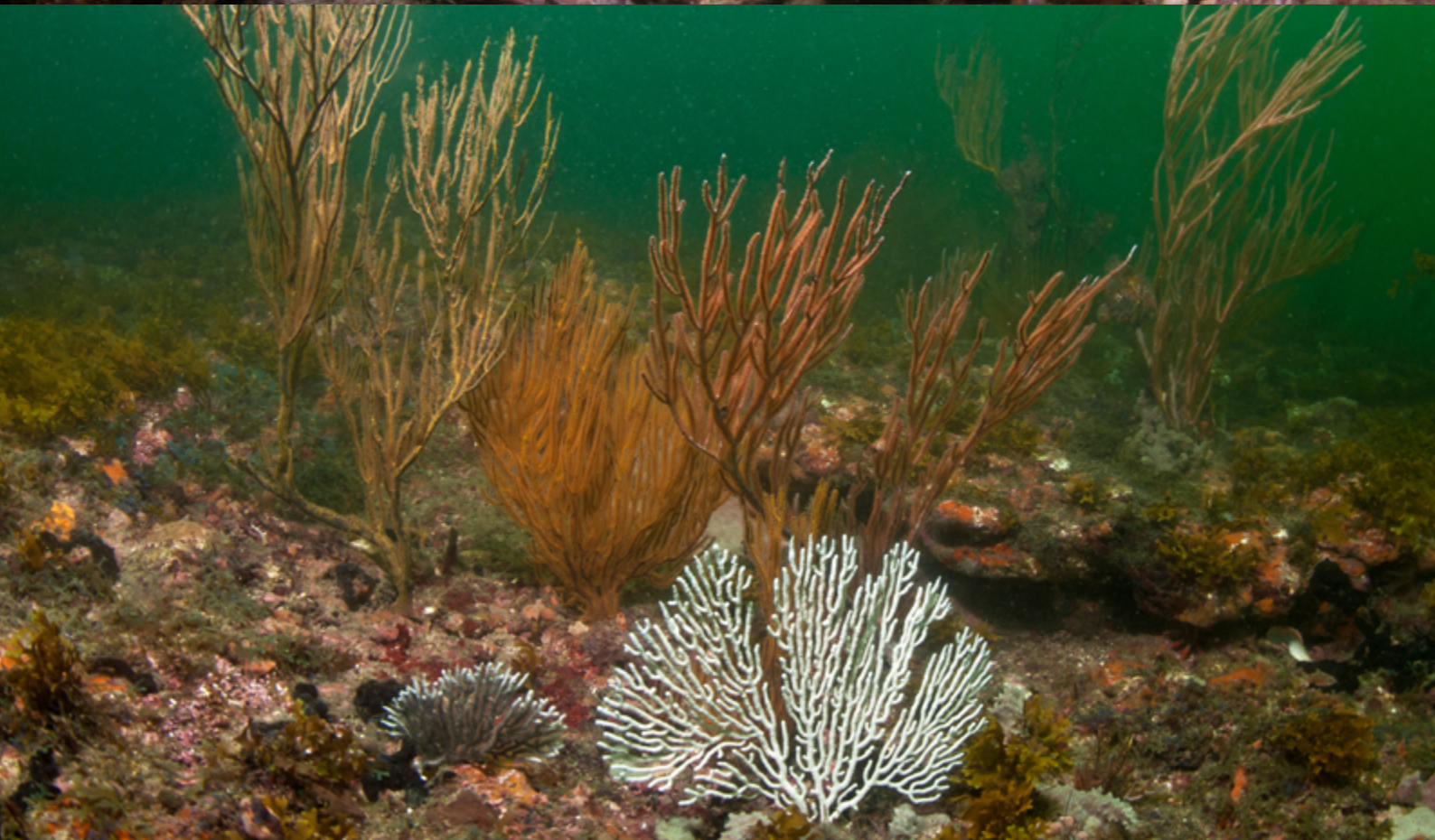


Figure 2 : Dives and snorkeling sessions

Three different atmospheres of subaquatic natural habitats (photos Patrick Louisy (2) and Thomas Menut)





RESULTS

• «PROTOZOA» PERITRICHIA

Zoothamnium niveum (Hemprich & Ehrenberg, 1831)

Zoothamnium niveum (Hemprich & Ehrenberg, 1831) is a giant, colonial marine ciliate from sulfide-rich habitats; it is covered with chemoautotrophic sulfide-oxidizing bacteria that give a snow-white appearance to the animal; the feather-like colonies reach a size of up to 1.5 cm. The species has been reported from rotting plant material in the Red Sea, from Florida and the Caribbean, from Lanzarote Island in the eastern Atlantic, from Corsica and Giglio Islands in the western Mediterranean Sea and from Cyprus Island in the eastern Mediterranean Sea and from the Pacific Ocean (references in Wirtz 2008 and Bright et al. 2014). It has since also been recorded from Cuba and Guadeloupe Islands (M. Bright pers. comm. to PW, 15 Feb 2017), from Madeira Island and from São Tomé Island (Wirtz 2018).

When turning over a large stone in about 1m depth at (0°36'64''N, 9°18'43''E), a dense mat of bacterial filaments was noted. Among the filaments, some feather-shaped *Zoothamnium niveum* were evident; a film from this site, showing the typical twitching movement of *Z. niveum*, can be seen at https://www.researchgate.net/publication/321946138_Zoothamnium_niveum_at_the_coast_of_Gabon.



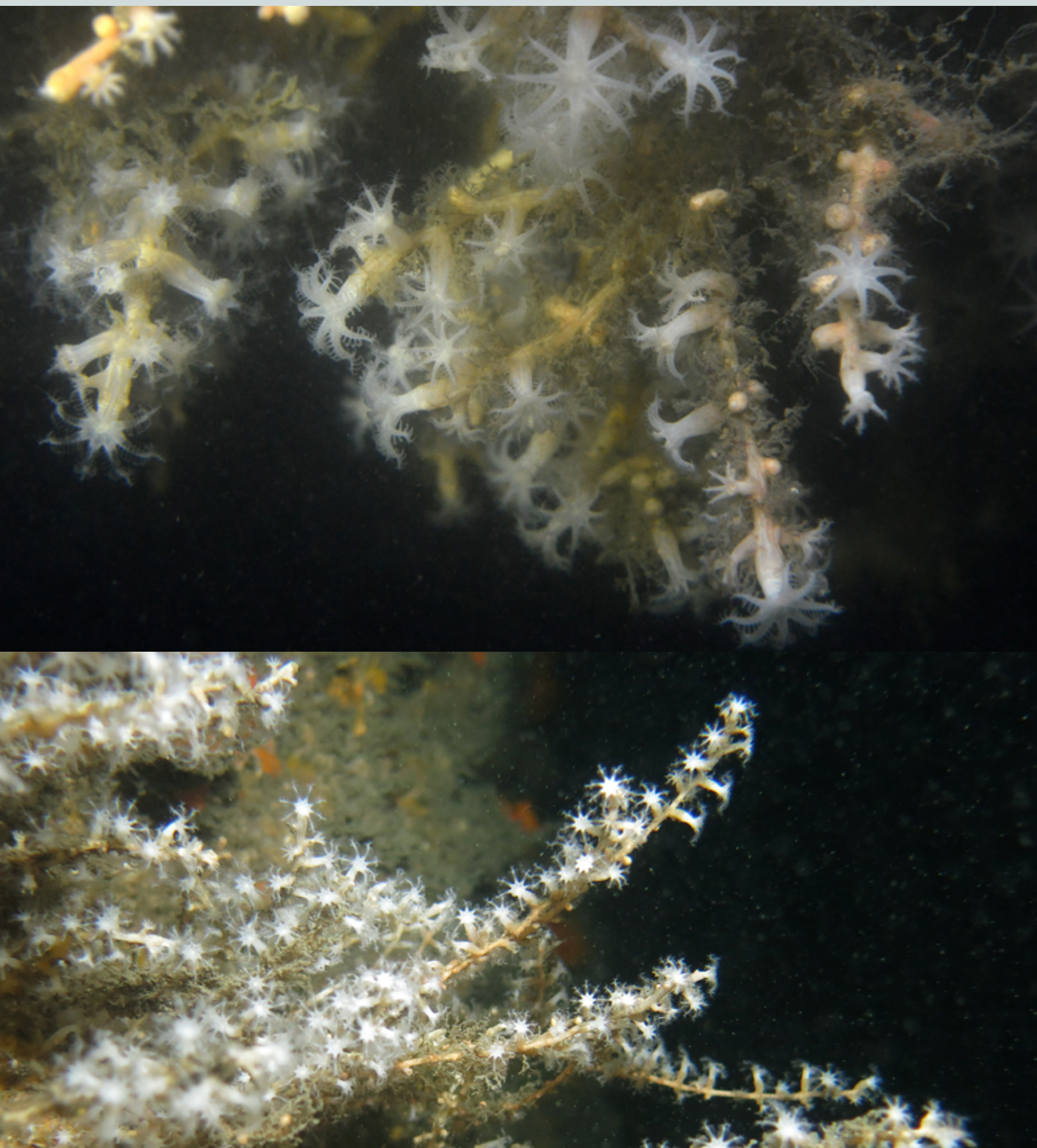
Bacterial mat with *Zoothamnium* feathers (photo Peter Wirtz)

- CNIDARIA OCTORALLIA

Carijoa riisei (Duchassaing and Michelotti, 1860)

This circumtropical species has already been recorded from an oil platform off Gabon by Friedlander et al. (2014). We here record it from the Gabon mainland coast, where we found it to be common at the edges of rocky overhangs in about 8 m depth, reaching sizes of up to 20 cm length. The species is known to harbour many symbionts (e.g. Galvan-Villa & Rios-Jara 2018) and indeed we collected shrimps from it (see below).





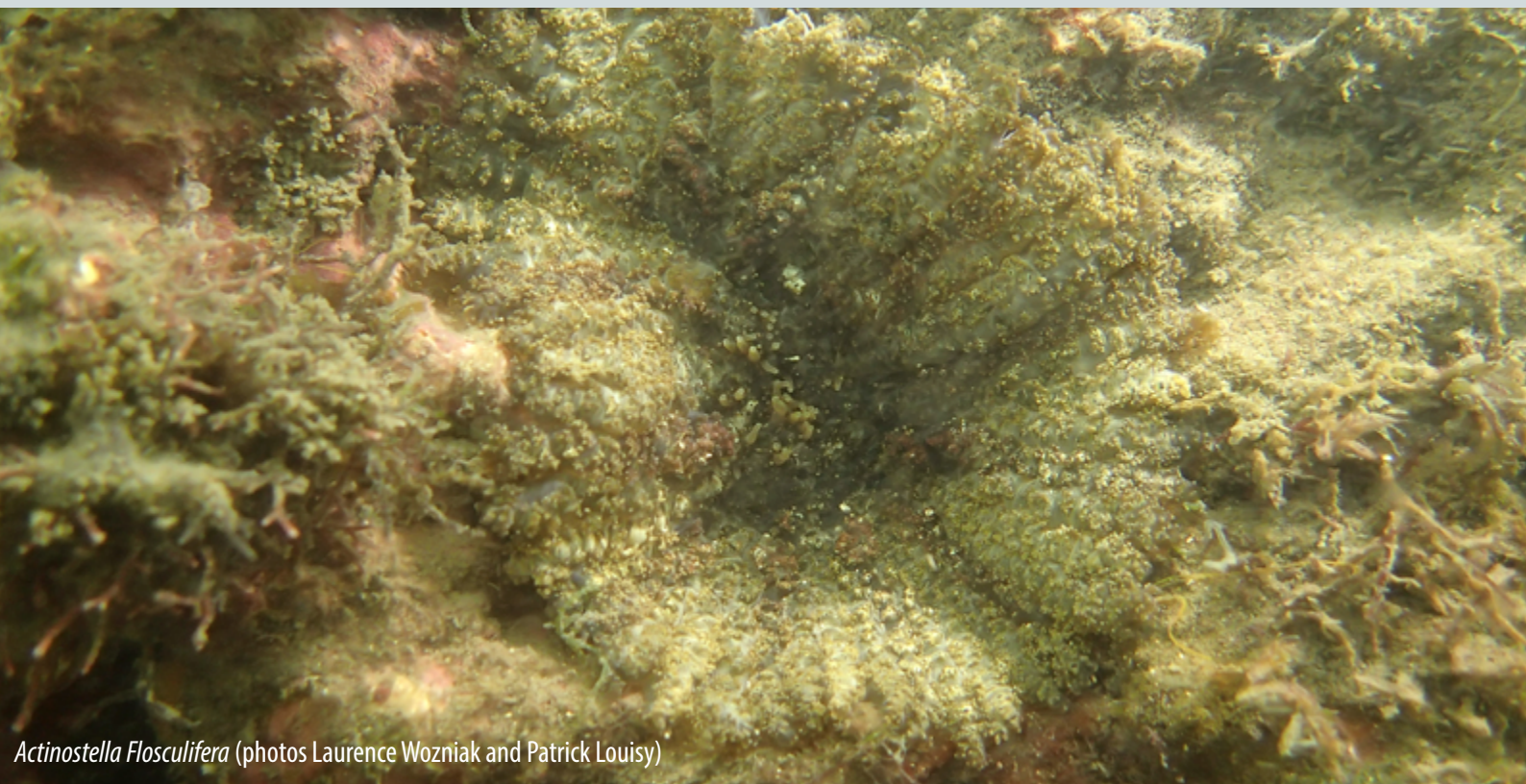


The snowflake coral *Carijoa riisei* (photos Lucas Bérenger (2), Thomas Menut and Patrick Louisy)

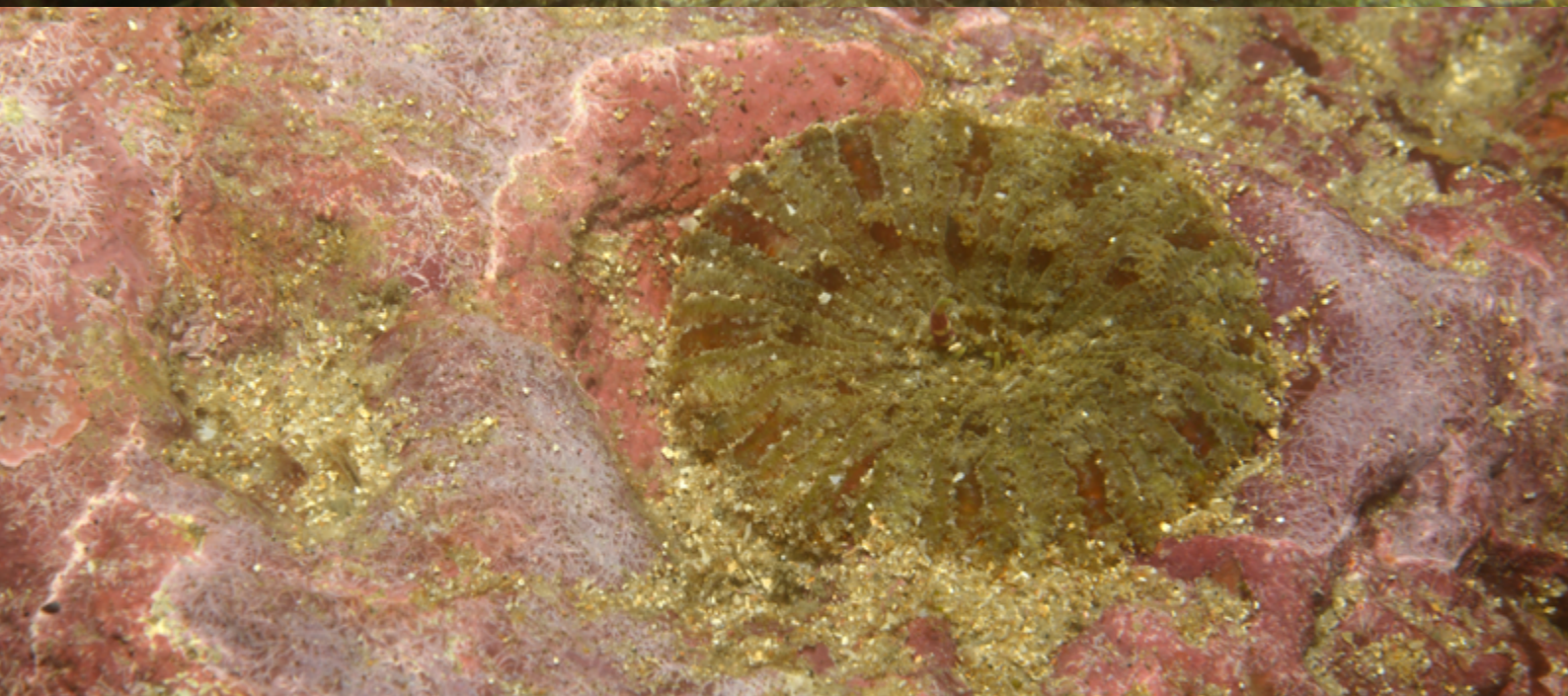
• CNIDARIA ANTHOZOA

Actinostella flosculifera (Lesueur, 1817)

Several individuals of this sea anemone were encountered in shallow water at (0°36'64''N, 9°18'43''E). This amphi-Atlantic sea anemone, reaching sizes of about 8 cm diameter, is known from the Canary Islands to São Tomé Island in the Eastern Atlantic (Wirtz 2003, Ocaña et al 2015) but has not yet been recorded from the coast of Gabon.



Actinostella Flosculifera (photos Laurence Wozniak and Patrick Louisy)



• PLATHELMINTHES

Pseudobiceros wirtzi (Bahia and Schroedl, 2016)

The species *Pseudobiceros wirtzi* was described by Bahia and Schroedl (2016) from Madeira to Senegal, including the Cape Verde Islands. When turning over a stone in 8 m depth at (0°30'27''N, 9°17'92''E), an individual of *P. wirtzi* about 3 cm long was seen, corresponding in colour with a specimen from the Cape Verde Islands. The known range of the species is thus extended considerably to the south.



Pseudobiceros wirtzi (photo Thomas Menut)

• MOLLUSCA «OPISTHOBRANCHIA»

A - *Navanax orbignyana* (Rochebrune, 1881)

This cephalaspid seaslug is known from the Cape Verde Islands to Ghana (Ortea et al. 2012). We encountered several individuals up to 4 cm long in shallow water (about 1-2 m depth) when snorkeling at (0°36'64''N, 9°18'43''E).



Navanax orbignyana (photos Mathias Prat and Peter Wirtz)

B-Oxynoe olivacea (Rafinesque, 1814)

This sacoglossan seaslug is known from the Mediterranean Sea and in the Eastern Atlantic from southern Portugal to the Cape Verde Island (Segers et al. 2009) and was recently also recorded at Príncipe Island (Aketza Herrero pers. comm. to PW). We found several individuals of this species, up to 4 cm long, on *Caulerpa* sp. in shallow water at (0°36'64''N, 9°18'43''E).



Oxynoe olivacea (photos Laurence Wozniak)

C-Felimare cf. francoisae (Bouchet, 1980)

Felimare francoisae has been recorded from Senegal and from the Cape Verde Islands (Ortigosa et al. 2017). We photographed an individual of about 1 cm length of what almost certainly is this species at (0°40'47''N, 9°16'24''E).



Felimare cf. francoisae (photo Cathy Roquefort)

D-Felimida luteorosea (Rapp, 1827)

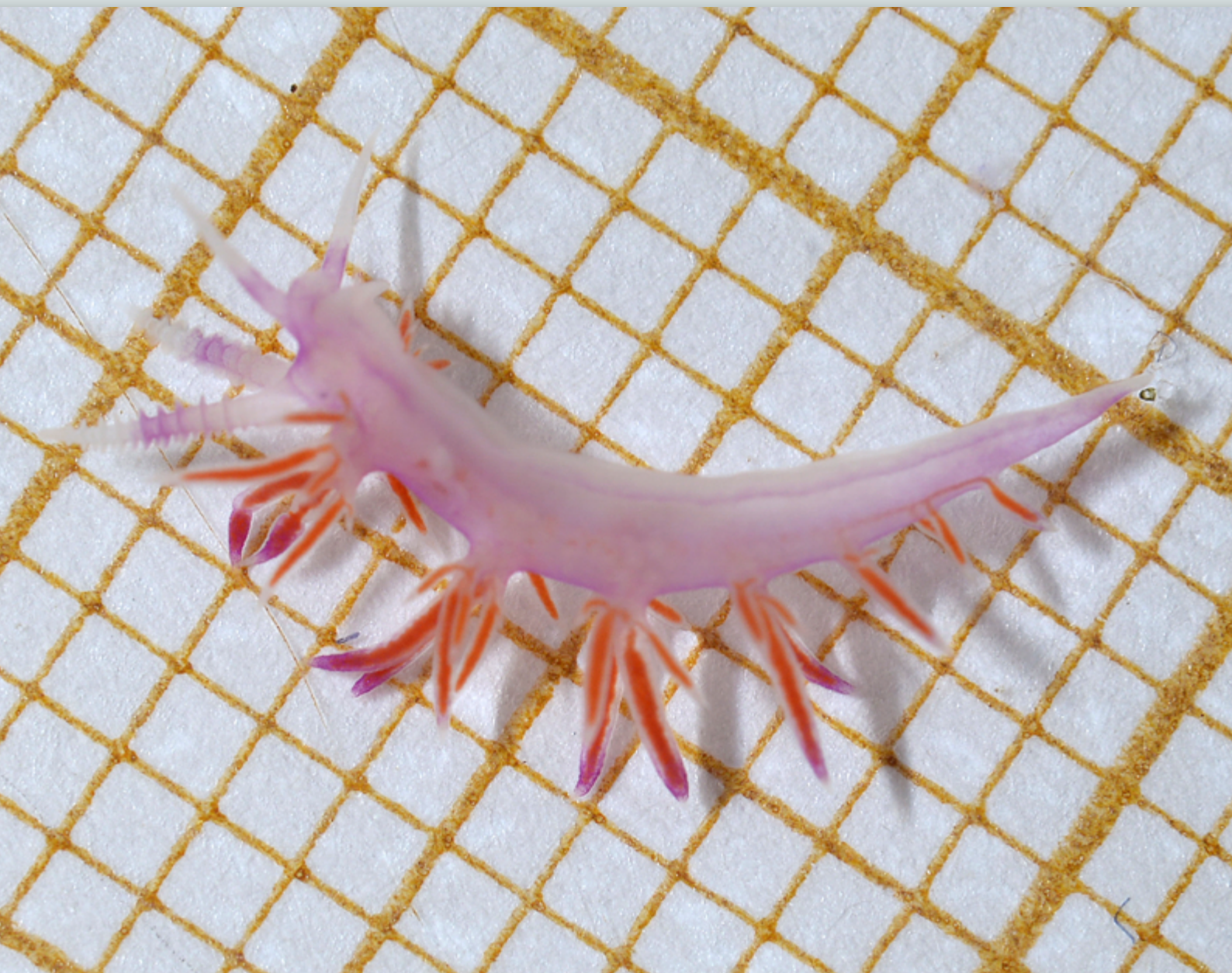
Felimida luteorosea has been recorded from the Mediterranean Sea and from Morocco to Namibia (Ortea et al. 2018, L. Moro Abad pers. comm to PW). We collected a specimen of about 1 cm length at (0°30'28''N, 9°17'92''E) in about 8 m depth.



Felimida luteorosea (photos Lucas Bérenger and Patrick Louisy)

E-Paraflabellina ischitana (Hirano and Thompson, 1990)

Paraflabellina ischitana has been recorded from the Mediterranean Sea, the Atlantic coast of Portugal, and Ceuta (Ortea et al. 2018). We photographed an individual of about 1 cm length of this species at (0°34'74''N, 9°17'85''E), which is a very large extension of the known distribution of this species.



Paraflabellina ischitana (photo Patrick Louisy)

F-Luisella babai (Schmekel, 1972)

This species is known from the Mediterranean Sea and in the eastern the Atlantic from the coasts of Spain and Portugal and Senegal (Calado et al 2005). We collected an individual of about 1 cm length at (0°34'74''N, 9°17'85''E).

*Luisella babai* (photo Lucas Bérenger)

G-Three unidentified species

We collected three additional nudibranch species :

- *Felimare* sp., about 2 cm long, at (0°31'88''N, 9°17'22''E) in about 10 m depth,
- *Edmundsella* sp., about 1 cm long, at (0°32'71''N, 9°17'60''E) in about 8 m depth,
- *Dolabrifera* sp., up to 4 cm long, from tide pools at (0°36'22''N, 9°19'03''E). These can only be identified after extensive anatomical and genetic study; unfortunately, our export permit does not allow this.

The first two species could be still undescribed, the third one most likely is *Dolabrifera edmundsi* Valdés et al., 2017, as this species has been recorded from Príncipe Island (Valdés et al. 2017).



Felimare sp. (photos Thomas Menut and Patrick Louisy)



Edmundsella sp. (photos Patrick Louisy and Thomas Menut)



Dolabrifera sp. (photo Peter Wirtz)

• ANNELIDA POLYCHAETA

Eurythoe sp.

A polychaete of the genus *Eurythoe* was commonly encountered when turning over stones in shallow water at (0°36'64''N, 9°18'43''E). Two species are known from the Eastern Atlantic : *Eurythoe laevisetis* Fauvel, 1914 is differentiated from *E. complanata* (Pallas, 1766) by the lack of harpoon notochaetae (Barroso et al. 2010). We did not collect specimens and therefore cannot identify the species. The type locality of *E. laevisetis* is São Tomé Island, and thus the species at the coast of Gabon is probably this one.





Eurythoe sp. (photos Patrick Louisy and Peter Wirtz (2))

• CRUSTACEA AXIIDEA

Neaxius mclaughlinae (Ngoc-Ho, 2006)

This mudshrimp, up to 6 cm long, was common in shallow water, occupying burrows in the bottom, at (0°36'64''N, 9°18'43''E). The species was previously only known from Príncipe (Ngoc-Ho 2006) and São Tomé Islands (Wirtz unpublished). Photo below provides the first colour photo of this species.

*Neaxius mclaughlinae* (photo Peter Wirtz)

• CRUSTACEA CARIDEA

A- *Alpheus rugimanus* (A- Milne-Edwards, 1878)

Alpheus rugimanus has been recorded from St Helena Island and from the Cape Verde Islands to the Gulf of Guinea (Anker et al. 2016) but apparently not yet from the coast of Gabon. We encountered an individual of about 4 cm length when turning over stones at (0°36'64''N, 9°18'43''E).



Alpheus rugimanus from São Tomé (photo Arthur Anker)

B- *Athanas nitescens* (Leach, 1813)

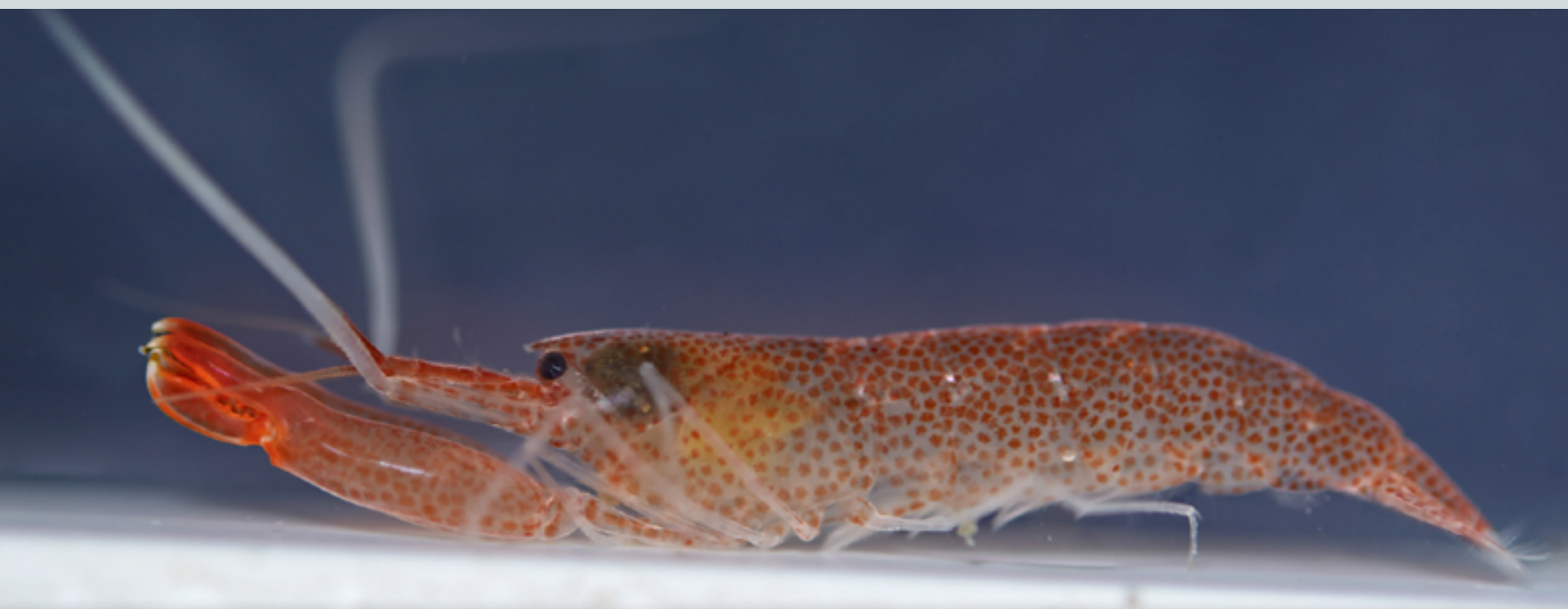
This species has been recorded from many places in the Eastern Atlantic, including the Cape Verde Islands and Annobon Island in the Gulf of Guinea (Udekem D'Acoz 1999) but apparently not yet from the coast of Gabon. We encountered an individual of about 2 cm length when turning over stones at (0°36'64''N, 9°18'43''E).



Athanas nitescens from São Tomé (photos Peter Wirtz and Arthur Anker)

C- Nennalpheus gabonensis (Anker, 2019)

When turning over a stone at (0°40'47''N, 9°16'24''E) in 11 m depth, an alpheid shrimp of the genus *Nennalpheus* was encountered. This genus has only been reported from the western Pacific ! Based on our collected specimen, Anker (2019) has now described it as the first *Nennalpheus* species from the Atlantic Ocean.



Nennalpheus gabonensis and its habitat (photos Patrick Louisy and Thomas Menut)

D- Cinetorhynchus gabonensis (Duris, Sobanova and Wirtz, 2019)

When turning over a large stone in 10 m depth at (0°33'49''N, 9°17'75''E), three individuals of a shrimp species obviously belonging to the genus *Cinetorhynchus* were encountered. One of them was an ovigerous female of about 2 cm length. The specimens are morphologically very similar to the Western Atlantic *Cinetorhynchus manningi* Okuno, 1996 (De Garve pers. comm to PW) but are much smaller and differ in colour. Colour is a diagnostic feature in this genus (Baeza et al. 2014). A genetic analysis has confirmed that this was an undescribed species. The species has now been described by Duris, Sobanova & Wirtz (2019), and named in honour of Gabon.



Cinetorhynchus gabonensis, new species found during the mission (photos Thomas Menut)

E- Palaemon vicinus (Ashelby, 2009)

Holthuis (1951) recorded *Palaemon elegans* Rathke 1837 from Gabon. Since then, however, the species *Palaemon vicinus* Ashelby 2009 has been described from the area of the Cape Verde Islands to Cameroon (Ashelby 2009). The Gabon specimens of *Palaemon*, which were common in tide pools at (0°36'22''N, 9°19'03''E) and up to 2 cm long, turned out to be *P. vicinus*.



Palaemon vicinus, lower photo from Cape Verde Island (photos Peter Wirtz)

F- Periclimenes cf. scriptus

The eastern Atlantic tropical species similar to *Periclimenes scriptus* (e.g. Holthuis 1951) is an undescribed species currently being investigated by Zdenek Duris. We found numerous specimens, up to 2 cm length, at the edge of an overhang covered with *Carijoa riisei* and *Aglaophenia* sp., in about 10 m depth at (0°36'01''N, 9°18'55''E).

G- Pseudocoutierea wirtzi (Udekem d'Acoz, 2001)

This species has previously been recorded from Antipatharia and Gorgonaria at the Cape Verde Islands, Senegal, and São Tomé Island (Wirtz and De Grave 2010). We found several specimens, up to 2 cm length, on gorgonians in about 10 m depth at (0°31'88''N, 9°17'22''E).



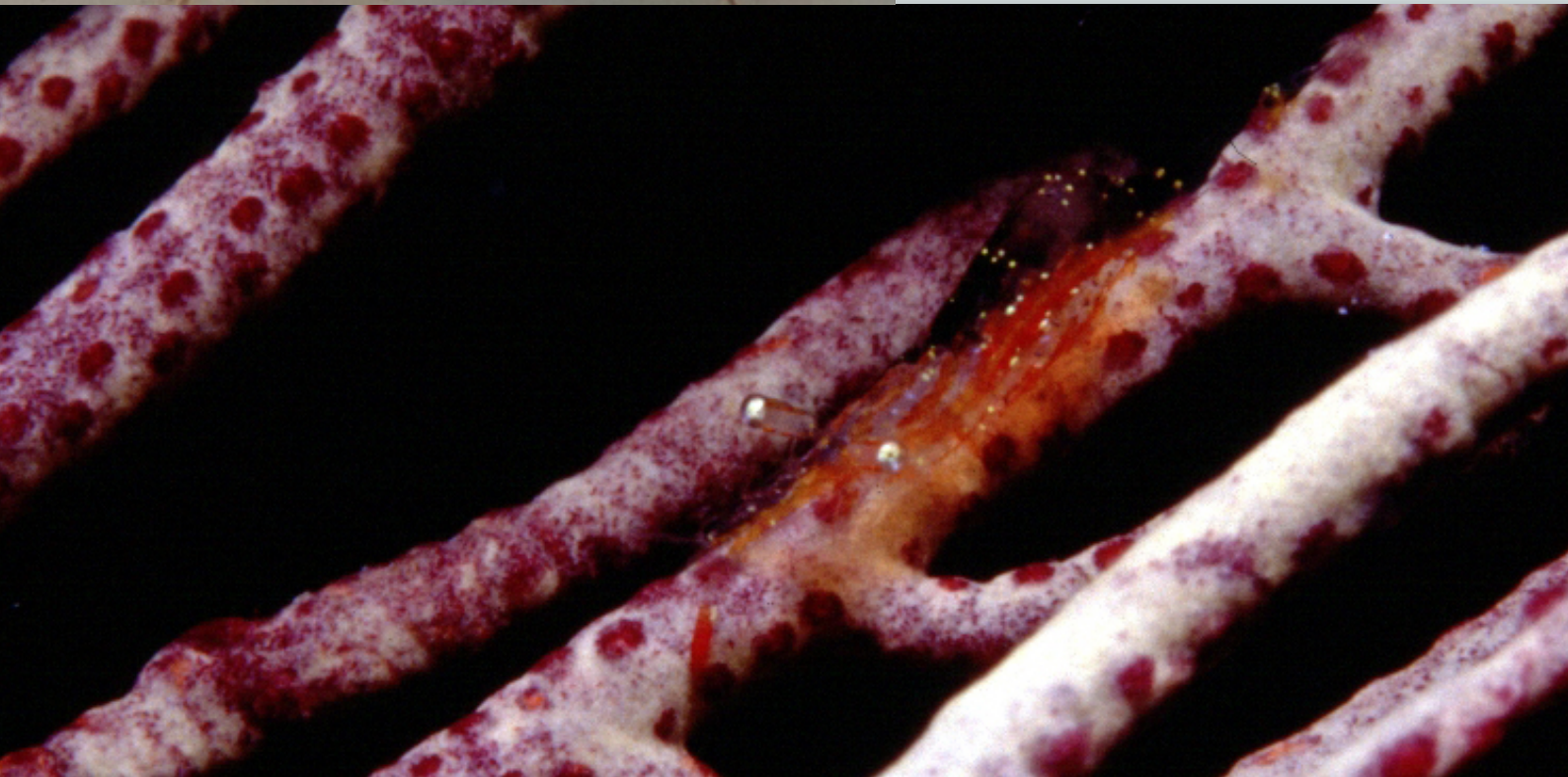
Pseudocoutierea wirtzi (photos Patrick Louisy and Laurence Wozniak)

H- Rapipontonia platalea (Holthuis, 1951)



This amphi-Atlantic shrimp has been recorded from the Cape Verde Islands, Senegal, Guinea and São Tomé and Príncipe, in association with Gorgonaria and Antipatharia (Wirtz and De Grave 2010). We collected several specimens, up to 2 cm length, from gorgonians in about 10 m depth at (0°31'88''N, 9°17'22''E).

Rapipontonia platalea at São Tomé Island (photos Peter Wirtz)



I- Thoralus cranchii (Leach, 1817)

This species has been recorded from southern Norway to Annobon Island in the Gulf of Guinea (Udekem D'Acoz 1999). We found an individual of about 1 cm length in about 10 m depth at (0°31'88''N, 9°17'22''E).



Thorulus cranchii, from the Algarv and from Atlantic France (photos Peter Wirtz and Marc Cochu)

• CRUSTACEA ANOMURA

A beautiful little hermit crab of the family Paguridae (genus *Paguristes* or *Clibanarius*?) was collected in shallow water at (0°36'64''N, 9°18'43''E). This species will be studied by Cédric d'Udekem d'Acoz.

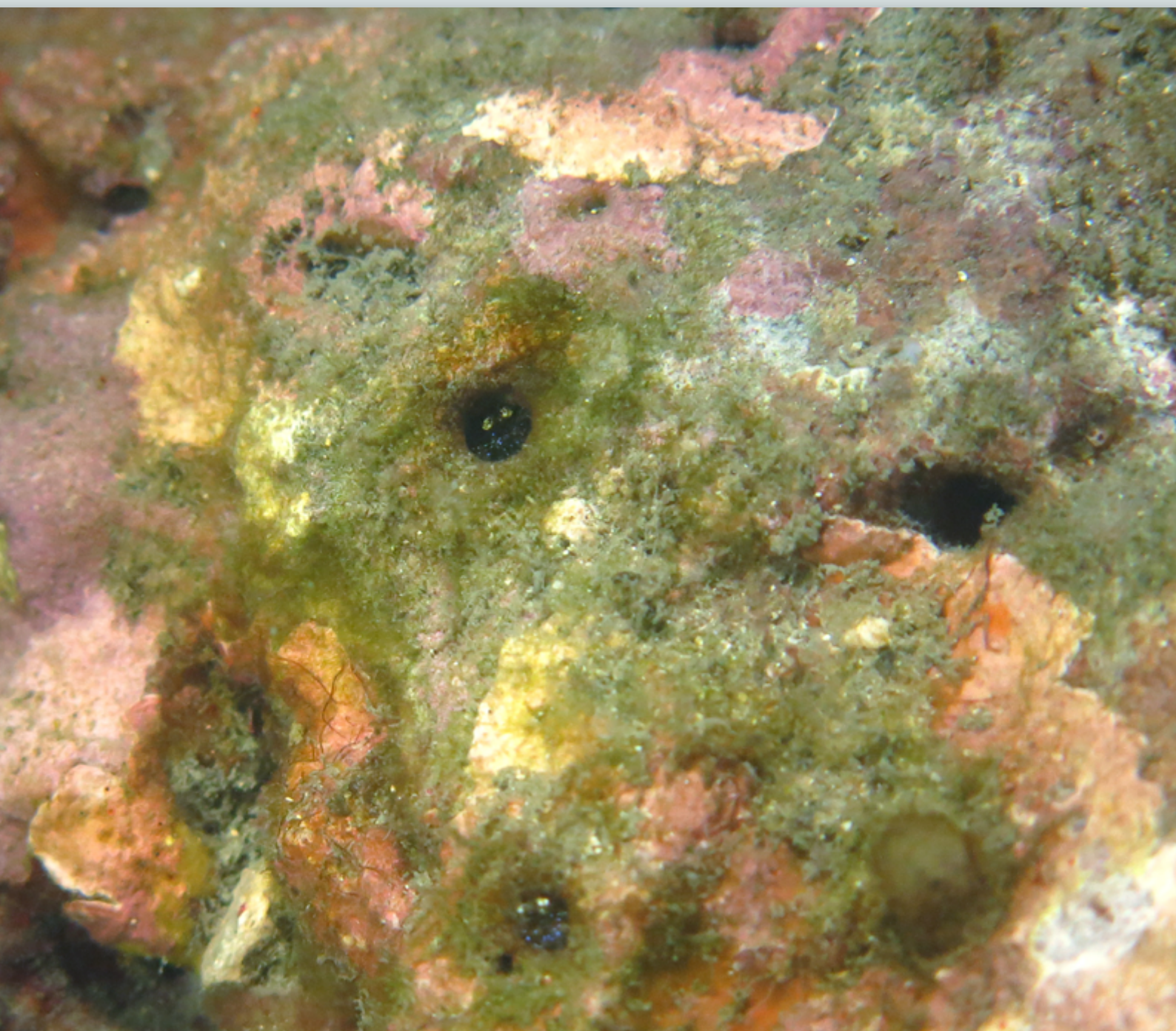


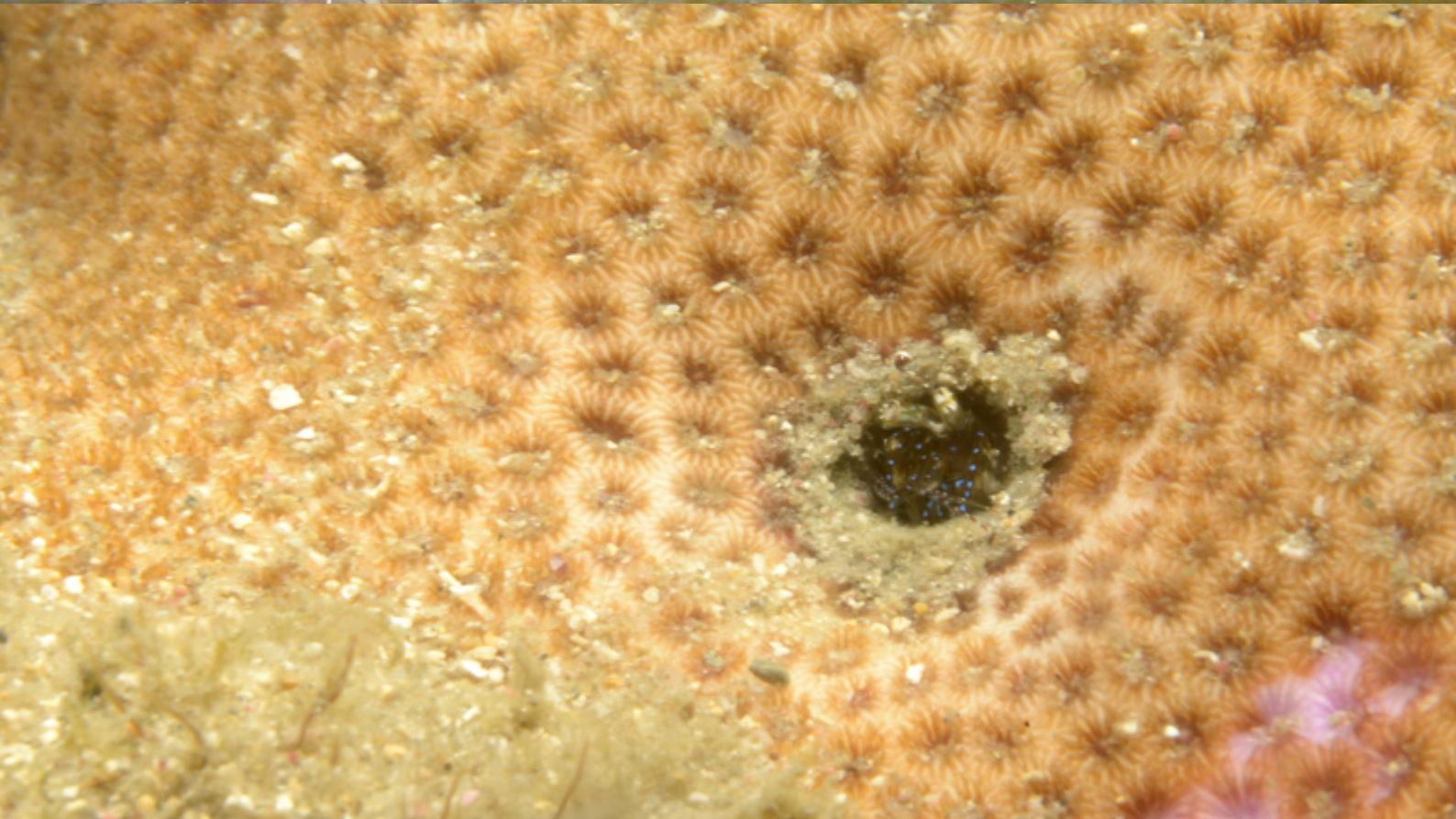
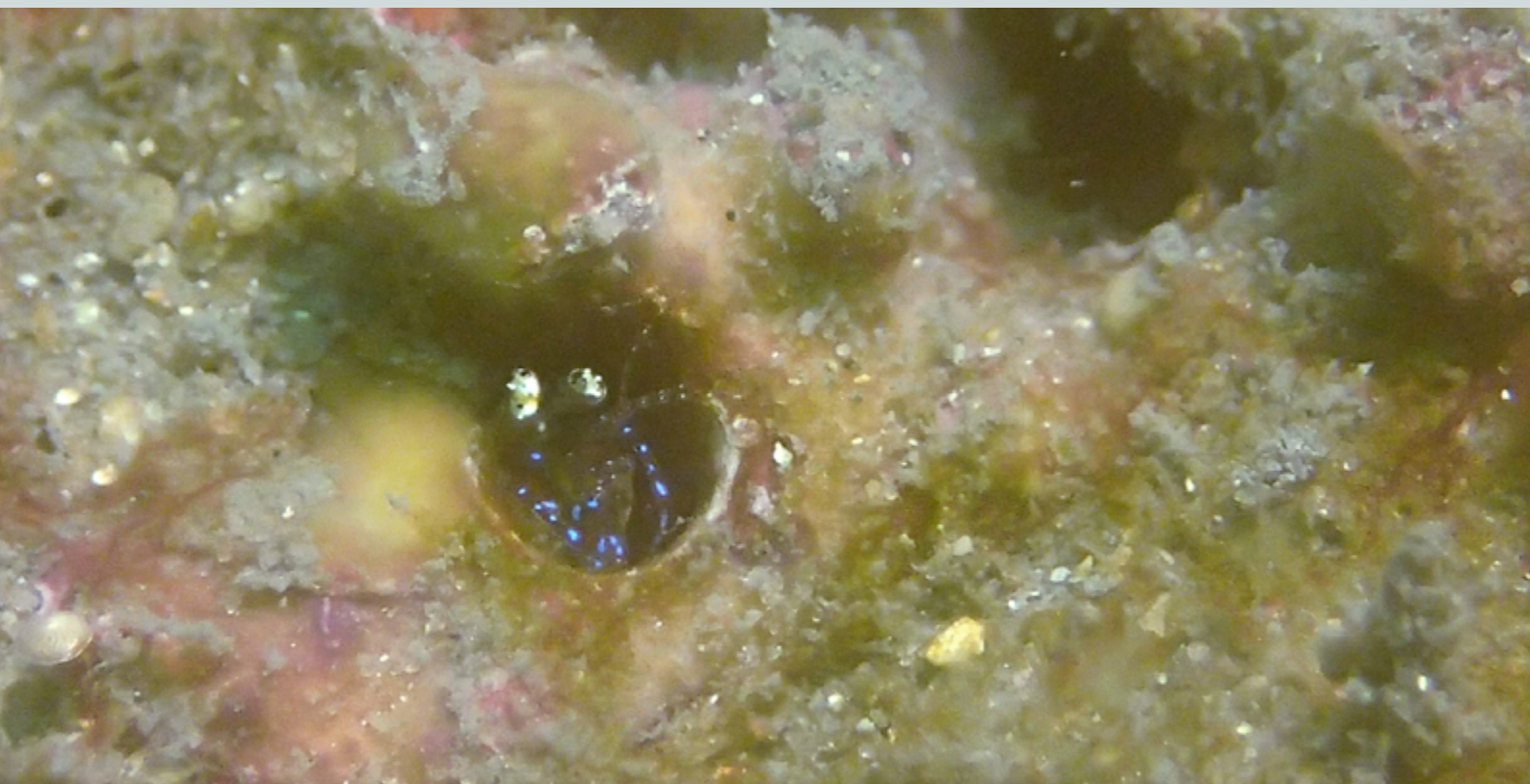
Unidentified hermit crab (photos Patrick Louisy)

• CRUSTACEA STOMATOPODA

Protosquilla sp.

A small stomatopod was common in bore holes in *Siderastrea* corals in shallow water (0°36'64''N, 9°18'43''E). It could be either *Protosquilla folini* (A. Milne-Edwards, 1867), recorded from the Cape Verde Islands, Senegal, Ghana and Congo, or *P. calypso* Manning 1974 recorded from Annobon, São Tomé, Príncipe, and Bioko (Manning 1977). The two species are similar in colour but differ in small morphological details. We did not collect specimens and therefore cannot identify the species.





Protosquilla sp. (photos Lucas Béranger, Laurence Wozniak and Patrick Louisy)

- CRUSTACEA CIRRIPIEDIA

Conopea saotomensis (Carrison-Stone et al., 2013)

Carrison-Stone et al. (2013) described two new species of *Conopea* from gorgonians at São Tomé and Príncipe. Gorgonians were common at the rocky coast of Gabon explored there by us and several different species of them were colonized by *Conopea* sp.. We collected several *Conopea*, up to 2 cm length from only one species of gorgonian, an unidentified species of *Eunicella*. Bob van Syoc at the California Academy of Sciences identified them as *C. saotomensis* Carrison-Stone et al, 2013. This is the first record of the species from the continental coast of Africa.



Conopea saotomensis, one of the collected individuals (photo Peter Wirtz)

- ECHINODERMATA HOLOTHUROIDEA

Isostichopus cf badionotus (Selenka, 1867)

Several individuals of this species were encountered in shallow water at (0°36'64''N, 9°18'43''E). This seacucumber looks like *Isostichopus badionotus* but there are cryptic, undescribed species quite similar to *badionotus* in the Atlantic Ocean (Giomar Borrero pers. comm. to PW).



Isostichopus cf badionotus (photo Lucas Bérenger)

DISCUSSION

We have listed 23 species of marine invertebrates that had not yet been recorded from the coast of Gabon. Two additional species were undescribed when we collected them, and have now been described already (*Cinetorhynchus gabonensis* and *Nennalpheus gabonensis*). Two nudibranchs and a hermit crab are also likely to be undescribed species. Twelve of these species are widespread in the Eastern Atlantic. Two of them were previously only known as far south as Senegal and the Cape Verde Islands. For *Paraflabellina ischitana* the record from the coast of Gabon represents a very large extensions of the know distribution ranges (from the coast of Portugal and Ceuta). Two species, *Neaxius mclaughlinae* and *Conopea saotomensis* were only known from the islands of São Tomé and Príncipe; to find them at the nearby coast of mainland Africa was to be expected. Additional undescribed species and new records are among the corals, alpheid shrimps, and fishes that will be dealt with in separate publications by experts for these groups. In general, the marine fauna of the rocky coast of Gabon appears to be quite typical of the Gulf of Guinea but apparently contains many still unexplored riches.

ACKNOWLEDGEMENTS

The expedition to the rocky coast of Gabon was organized by the Gabonese National Parks Agency (ANPN) – in particular Mathieu Ducrocq and Malgloire-Désiré MOUNGANGA - in collaboration with Fondation BIOTOPE and financed by the French Development Agency (AFD), as part of the project Arc Emeraude, in collaboration with the program Gabon Bleu. We are particularly grateful to Laurence Wozniak, director of diving, and the crew of the ship «Vagabond», for making our dives possible and safe.

Bob van Syoc at the California Academy of Sciences identified *Conopea saotomensis*. Peter Dworschak at Vienna Natural History Museum identified *Neaxius mclaughlinae*. Sammy De Grave at Oxford Natural History Museum identified the shrimp species. Leopoldo Moro Abad at Servicio de Biodiversidad, Las Palmas de Gran Canaria, identified *Felimida luteorosea*. Vinicius Padula at Universidade Federal da Bahia and Michael Schrödl at Zoologische Staatssammlung München identified the other opisthobranchs. Many thanks to all of them.

The first author is grateful to Centro de Ciências do Mar (CCMAR) at the University of Faro, Portugal, for financial support. This study received Portuguese national funds through project FCT - UID/Multi/04326/2013.

Remerciements :

La Fondation Biotope souhaite en premier lieu remercier très chaleureusement l'Agence Française de Développement et en particulier Jean-François Cornu, pour le soutien financier essentiel à l'existence même d'un tel projet. Ses remerciements les plus sincères vont aussi à l'équipe administrative et technique de l'ANPN pour lui avoir confié cette mission et avoir permis sa réussite. Nous remercions tout particulièrement Gaëlle Valérie NGOUWA, Magloir Désiré MOUNGANGA, Mathieu DUCROCQ et Laurence WOZNIACK pour leur travail préparatif important et minutieux et leur implication globale, sans lesquels cette mission n'aurait pu avoir lieu.

Nous tenons aussi à exprimer notre vive gratitude à l'adresse de l'équipage du Vagabond, le navire de recherche qui a servi de base logistique pour toutes les plongées. Merci à Laurence WOZNIACK, Directrice de plongée, qui a veillé à l'organisation de toute la mission en mer, au respect des procédures de plongée et des règles de sécurité. Sans sa présence et sa compétence professionnelle vis-à-vis de cette activité qui peut être dangereuse, sans la mise à disposition de l'ensemble de l'équipage pour la logistique très chronophage de cette mission, sans l'existence sur place du matériel de plongée lourd et impossible à faire voyager en avion, cette mission aurait tout simplement été impossible.

Merci à l'équipe du projet Arc d'Emeraude, pour sa complète disponibilité et l'appui logistique et administratif à terre. Merci encore à Magloir Désiré MOUNGANGA, Gaëlle Valérie NGOUWA et Flore Koumba PAMBO pour avoir facilité auprès du CENAREST l'obtention des permis d'exportation des échantillons biologiques. Merci à Armand CASTELLON, digne représentant des pêcheurs Benga du Cap Esterias, pour son appui comme guide local et son application à veiller sur la sécurité des plongeurs, ainsi qu'à Jean- Charles IKENDJE, piroguier. Merci enfin à tout le personnel de l'hôtel Akounago Village qui a accueilli l'équipe pendant la durée de la mission.

Et enfin merci à Julien Cordier de BIOTOPE pour avoir participé à l'initiation de ce projet et à Nicolas Verdon pour sa très belle mise en page.



REFERENCES

- Anker, A. 2019.** The alpheid shrimp genus *Nennalpheus* Banner & Banner, 1981 in the tropical eastern Atlantic, with description of a new species from Gabon and new records of *N. sibogae* (De Man, 1910) in the Indo-West Pacific (Malacostraca: Decapoda: Caridea). *Zootaxa*, 4646 (1), 87-100
- Anker A, Tavares M, Mendonca JB 2016.** Alpheid shrimps (Decapoda : Caridea) of the Trindade & Martin Vaz Archipelago, off Brazil, with new records, description of a new species of *Synalpheus* and remarks on zoogeographical patterns in the oceanic islands of the tropical southern Atlantic. *Zootaxa* 4138 (1) : 1-58
- Ashelby CW 2009.** *Palaemon vicinus* spec. nov. (Crustacea: Decapoda: Palaemonidae), a new species of caridean shrimp from the tropical eastern Atlantic. *Zool Meded Leiden* 83 /2: 825-839
- Baeza JA., Bauer RV, Okuno J, Thiel M 2014.** Molecular phylogeny of hinge-beak shrimps (Decapoda: Caridea: *Rhynchocinetes* and *Cinetorhynchus*) and allies : a formal test of familiar and generic monophyly using a multilocus phylogeny. *Zool J Linn Soc Lond* 172 : 426-450.
- Bahia J, Schrödl M 2016.** *Pseudobiceros wirtzi* sp. nov. (Polycladida : Cotylea) from Senegal with revision of valid species of the genus. *Zootaxa* 4097/1 : 101-117.
- Barroso R, Klautau M, Solé-Cava AM, Paiva PC 2010.** *Eurythoe complanata* (Polychaeta : Amphinomidae), the 'cosmopolitan' fireworm, consists of at least three cryptic species. *Mar Biol* 157 : 69-80
- Bernard PA 1984.** Coquillages du Gabon. P. Bernard, Libreville. 140 pp.
- Bianchi G 1992. Study of the demersal assemblages of the continental shelf and upper slope off Congo and Gabon, based on the trawl surveys of the RV 'Dr Fridtjof Nansen'. *Mar Ecol Prog Ser* 85 : 9-23.
- Bright M, Espada-Hinjosa S, Lagkouvardos I, Volland JM 2014.** The giant ciliate *Zoothamnium niveum* and its thiotrophic epibiont *Candidatus Thiobios zoothamnicoli* : a model system to study interspecific cooperation. *Front Microbiol* 5, Article 145. DOI : 10.3389/fmicb.2014.00145
- Calado G, Ortea J, Caballer M 2005.** A new species of the genus *Flabellina* Voigt, 1834 (Mollusca : Nudibranchia) from the Cape Verde Islands. *J Conchol* 38/6 : 663.671.
- Carrison-Stone D, Syoc RV, Williams G, Simison WB 2013.** Two new species of the gorgonian inhabiting barnacle, *Conopea* (Crustacea, Cirripedia, Thoracica), from the Gulf of Guinea. *ZooKeys* 270 : 1-20.
- De Bruyne G 2013.** Guide d'identification des ressources halieutiques marines présentes dans les eaux Gabonaises. Wildlife Conservation Society. 40 pp.
- Duris Z, Sobanova A, Wirtz P 2019.** *Cinetorhynchus gabonensis*, a new species of hinge-beak shrimp (Crustacea: Decapoda: Rhynchocinetidae) from the eastern Atlantic. *Zootaxa* 4664 (2), 191-205
- Friedlander AM, Ballesteros E, Fay M, Sala E 2014.** Marine Communities on Oil Platforms in Gabon, West Africa : High Biodiversity Oases in a Low Biodiversity Environment. *PLoS ONE* 9(8) : e103709. doi :10.1371/journal.pone.0103709
- Galvan-Villa CM, Rios-Jara E 2018.** First detection of the alien snowflake coral *Carijoa riisei* (Duchassaing and Michelotti, 1860) (Cnidaria : Alcyonacea) in the port of Manzanillo in the Mexican Pacific. *BiolInvasions Records* · March 2018 DOI : 10.3391/bir.2018.7.1.01
- Gonzalez JA 2018.** Checklists of Crustacea Decapoda from the Canary and Cape Verde Islands, with an assessment of Macaronesian and Cape Verde biogeographic marine ecoregions. *Zootaxa* 4413/3 : 401-448
- Holthuis LB 1951.** The caridean Crustacea of tropical West Africa. *Atlantide Report* 2 : 7-187.
- John D.M & Lawson G.W. 1974.** Observations on the marine algal ecology of Gabon. *Bot Mar* 17 : 249-254.
- Laborel J 1974.** West African reef corals. Am hypothesis on their origin. *Proceedings of the Second international coral reef symposium* 1 : 425-443.
- Langer MR, Mouanga GH, Fajemila OT 2016.** Shallow-water nearshore benthic foraminifera assemblages from Gabon. *Micropaleontology* 62/1, 69-80.
- Lawson GW 1966.** The littoral ecology of West Africa. *OceanogrMar Biol An Rev* 4 : 405-448.
- Le Loeuff P, van Cosel R 1998.** Biodiversity patterns of the marine benthic fauna on the Atlantic coast of tropical Africa in relation to hydroclimatic conditions and paleogeographic events. *Acta Oecol* 19/3 : 309-321.
- Manning RB 1977.** A monograph of the West African stomatopod Crustacea. *Atlantide Report* 12 : 27-181.



- Mc Glade JM , Cury P , Koranteng K A, Hardman-Mountford N J 2002.** The Gulf of Guinea, Large Marine Ecosystem : environmental forcing and sustainable development of marine resources. Amsterdam : Elsevier Science, 428 pp.
- Menut T, Bérenger L, Wirtz P, Prat M, Roquefort C, Ducrocq M, Louisy P 2018.** Exploration naturaliste sous-marine des petits fonds rocheux du Cap Santa Clara au Cap Esterias, Province de l'Estuaire, Gabon : les poissons marins. Les cahiers de la fondation Biotope 21 : 1- 51 + Annexes ; freely available from https://www.biotope.fr/wp-content/uploads/2018/07/Plongee_Gabon_Cahier_n21.pdf
- Ngoc-Ho N 2006.** A new species of *Neaxius* Borradaile, 1903 from the Gulf of Guinea (Crustacea, Decapoda, Thalassinidea, Strahlaxiidae). *Zoosystema* 28/2 : 409-415
- Ocaña O, Hartog JC, Brito A, Moro L, Herrera R, Martín J, Ramos A, Ballesteros E, Bacallado JJ 2015.** A survey on Anthozoa and its habitats along the Northwest African coast and some islands. *Rev Acad Canar Cienc* 27 : 9-66.
- Ortea J, Caballer M, Moro L, Espinosa J 2012.** Notas en Opisthobranchia (Mollusca, Gastropoda) I. Sobre la Validez de la especie *Posterobranchus orbignyianus* Rochebrune, 1881 (Cephalaspidea, Aglajidae). *Rev Acad Canar Cienc* 23/3 : 39-44.
- Ortea J, Moro L, Benhamú C, Bacallado JJ, Ocana O 2018.** Babosas marinas de la región de Ceuta. Fundación Museu del Mar de Ceuta, 187 pp.
- Ortigosa D, Pola M, Cervera JL 2017.** A new *Felimare* (Mollusca : Heterobranchia : Nudibranchia) of the Atlantic blue chromodorid chromatic group from Cape Verde. *Scientia Marina* 81/3 : 387-394.
- Rolan E 2005.** Columbellidae (Gastropoda, Neogastropoda) of the gulf of Guinea with the description of eight new species. *Iberus*, 23 (2) : 119-156.
- Rossignol, M. 1957.** Crustacés décapodes marins de la région Pointe Noire. In : Collignon Jean, Rossignol Martial, Roux Charles. Mollusques, crustacés, poissons marins des côtes d'A.E.F en collection au Centre d'Océanographie de l'Institut d'Etudes Centrafricaines de Pointe-Noire. Paris : ORSTOM, 71-136.
- Rossignol, M. 1962.** Catalogue des crustacés décapodes brachyours, anomours et macrours littoraux en collection au centre d'oceanographie de Pointe-Noire. *Cahiers ORSTOM.Série Océanographie*, (2), 111-138.
- Seger W, Swinnen F, de Prins R 2009.** Marine molluscs of Madeira. Snoeck Publishers, 612 pp.
- Udekem D'Acoz CD´ 1999.** Inventaire et distribution des crustacés décapodes de l'Atlantique oriental, de la Méditerranée et des eaux continentales au nord de 25° N. Collection Patrimoines Naturels, 40 : i-x + 1-383 (Service du Patrimoine Naturel, Muséum National d'Histoire Naturelle, Paris).
- Valdés A, Breslau E, Padula V, Schrödl M et al. 2017.** Molecular and morphological systematics of *Dolabrifera* Gray, 1847 (Mollusca : Gastropoda : Heterobranchia : Aplysiomorpha). *Zool J Linn Soc Lond* 20 : 1–35.
- Weir CR, MacLeod CD, Pierce G.J 2012 a.** Habitat preferences and evidence for niche partitioning amongst cetaceans in the waters between Gabon and Angola, eastern tropical Atlantic. *J Mar Biol Ass UK* 92 : 1735-1749. doi :10.1017/S0025315412000148
- Weir CR., Macena BCL, Notarbartolo di Sciara G 2012b.** Records of rays of the genus *Mobula* (Chondrichthyes : Myliobatiformes : Myliobatidae) from the waters between Gabon and Angola (eastern tropical Atlantic). *Mar Biodivers Records* 5 : 1-6.
- Wirtz P 2003.** New records of marine invertebrates from São Tomé Island. *J Mar Biol Ass UK* 83 : 735-736.
- Wirtz P 2008.** New records of the giant ciliate *Zoothamnium niveum* (Protozoa, Peritrichia). *Arquipelago Life and Marine Sciences* 25 : 89-91.
- Wirtz P 2018.** New records of marine invertebrates from São Tomé and Príncipe (Eastern Atlantic Ocean). *Arquipelago Life and Marine Sciences* 35 : 41-46.
- Wirtz P, De Grave S 2010.** Shrimps (Crustacea Decapoda Caridea) associated with gorgonians at the coast of Senegal. *Arquipelago Life and Marine Sciences* 27 : 69-71.