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Bryozoa of the Red Sea: history and current state of research

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1. History of research

Studies of the natural history of the Red Sea began with the Danish ‘Arabian’ expedition (1761–1763), headed by a disciple of Carl Linnaeus, zoologist Peter Forsskål. A variety of biological materials, including corals, were collected on the east coast of the Red Sea near Jeddah, Al-Lubbayah and Al-Mukha, but most of them were lost or deteriorated in the course of this tragic voyage (Hansen 1964, Mergner 2001).

The first bryozoans described from the Red Sea were collected during Napoleon’s campaign in Egypt (1798–1801). The technical and scientific staff of the campaign consisted of 160 experts who thoroughly documented the different aspects of life and history in Egypt, including archaeology, ethnography and also natural history. The person responsible for collecting biological samples was Étienne Geoffroy Saint-Hilaire, who became one of the leading French zoologists in the following years (d’Hondt 2006).

The closest collaborator of Saint-Hilaire was Jules-Cesar Savigny that later did a great amount of work on the materials collected. Within 15 years after his return from the expedition in 1801, he published various papers and memoirs together with his famous plates for the atlas of the “Expedition d’Egypte”. However, approaching blindness in

Table 1. List of bryozoans from the Red Sea, illustrated by Savigny (1816?), named and described by Audouin (1826), and preliminarily identified by d'Hondt (2006) [in brackets]

-
- *Cellepora Costazii* [*Celleporina costazii* (Audouin, 1826)] Pl. 7, fig. 4
 - *Cellepora Protainii* [*Cellepora protainii* (Audouin, 1826)] Pl. 7, fig. 5 (currently in *Celleporina*)
 - *Cellepora Redoutei* [*Schizmopora redoutei* (Audouin, 1826)] Pl. 7, fig. 6 (current status is unclear)
 - *Flustra Legentilii* [*Smittoidea laevis* (Harmer, 1926)] Pl. 9, fig. 1 (current status is unclear)
 - *Flustra? Dutertrei* [*Escharina dutertrei* (Audouin, 1826)] Pl. 9, fig. 2
 - *Flustra? Leperei* [*Smittoidea levis* (Kirkpatrick, 1890)] Pl. 9, fig. 3
 - *Flustra? Marcellii* [?] (current status is unclear) Pl. 9, fig. 4
 - *Flustra? Genisii* [*Microporella ciliata* (Pallas, 1766)] Pl. 9, fig. 5
 - *Flustra coronata* [*Microporella coronata* (Audouin, 1826)] Pl. 9, fig. 6
 - *Flustra umbracula* [*Microporella coronata* (Audouin, 1826)] Pl. 9, fig. 7
 - *Flustra Pouiletii* [*Cribrilaria flabellifera* (Kirkpatrick, 1888)] Pl. 9, fig. 12 (currently in *Puellina*)
 - *Flustra Bequerelii* [*Exechonella bequerelii* (Audouin, 1826)] Pl. 9, fig. 13 (current status is unclear)
 - *Flustra Montferrandi* [*Codonellina montferrandi* (Audouin, 1826)] Pl. 9, fig. 14 (currently in *Metroperiella*)
 - *Crisia Delilii* [*Scrupocellaria delillii* (Audouin, 1826)] Pl. 12, fig. 3
 - *Cellepora Boryi* [*Celleporina mangnevilleana* (Lamouroux, 1816)] Pl. 12, fig. 4
 - *Eucratea Lafontii* [*Savignyella lafontii* (Audouin, 1826)] Pl. 13, fig. 2
 - *Eucratea Cordieri* [*Chlidonia pyriformis* (Bertolani, 1810)] Pl. 13, fig. 3
-

1815, he never published any text to accompany the plates. Georges Cuvier found that this iconography was unique, and commissioned Victor Audouin who was a professor of entomology at the Muséum National d'Histoire naturelle in Paris to write an explanatory part. Two editions of "Explication sommaire des planches" were published in 1826 and 1828 correspondingly.

The text was published when Savigny was still alive. The content severely irritated him, and a number of the colleagues supported his opinion against Audouin who "he had taken all the benefits of the Savigny's work" (Bouchet and Danrigal 1982, p. 10).

A few dozens of years after the death of Savigny in 1851 all his collections have been deposited in a wet cellar of the museum of Versailles. When they had been rediscovered by the malacologist P. Pallary many years later, a great part of these collections had been damaged, and there were no Bryozoa in the list which could be saved (d'Hondt, 2006, pers. comm. 2009).

Altogether Audouin (1826) described more than 60 bryozoan species, but the precise number is uncertain since a few of them were possibly illustrated and described twice under different names (d'Hondt 2006, Harmelin *et al.*, submitted). Ten species were reported from the Mediterranean, and 17 from the Red Sea (probably, Gulf of Aqaba, d'Hondt, pers. comm. 2009, see also Table 1). The collecting sites for the rest of the species were not mentioned. In spite of this and the missing collection, the plates and descriptions of Savigny and Audouin remain a basic work until now, and seemingly

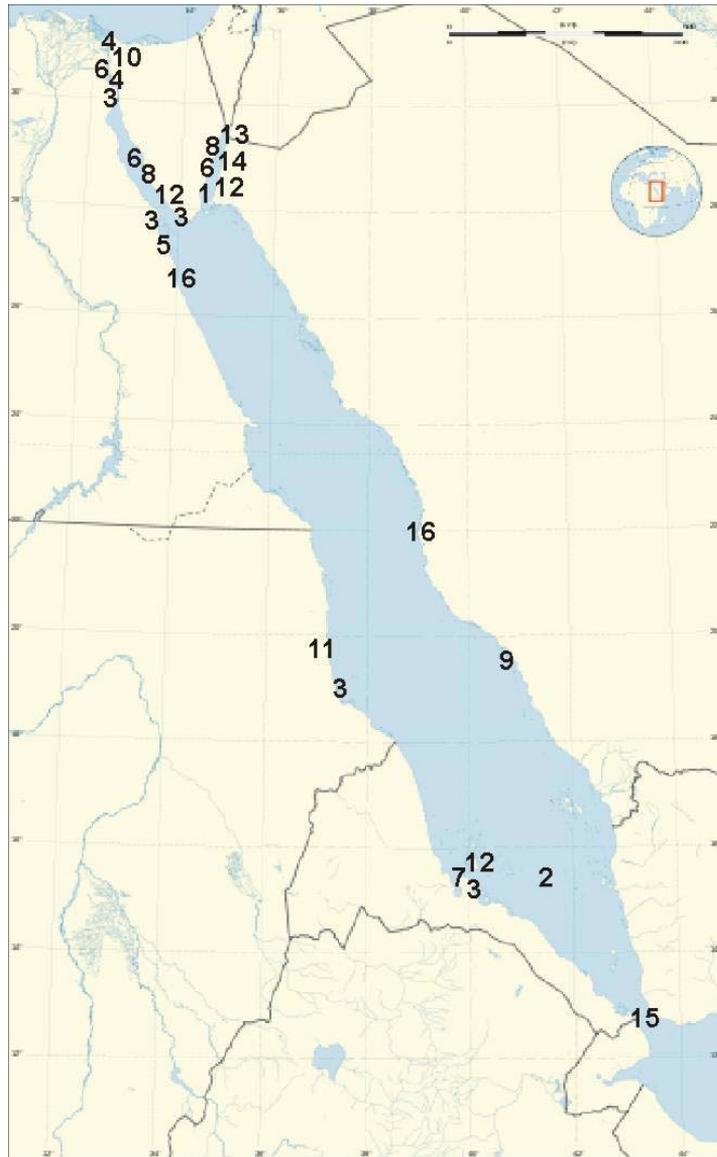


Figure 1. Map of the Red Sea showing main localities from which bryozoans were described. Subsequent numbers were given to the following major publications: (1) – Audouin (1826), (2) – Namias (1892), (3) – Waters (1909, 1910), (4) – Hastings (1927), (5) – Harmer (1926, 1957), (6) – Balavoine (1959), (7) – Powell (1967), Powell and Cook (1966, 1967), (8) – Powell (1969a), (9) – Redier (1970), (10) – Eitan (1972), (11) – Dumont (1981), (12) – d’Hondt (1988), (13) – Scholz (2000), (14) – Sternhell et al. (2002), (15) – Amui and Kaselowsky (2006), (16) – this study. For the Scilla expedition whose materials were described by Namias (1892), the location of the sampling station was approximately estimated using paper of Mergner (2001).

include a large set of common Mediterranean and tropical Indo-West Pacific species. The major problem behind this, however, is that numerous authors referred to Audouin's paper and mentioned species names for which type specimens do not exist. On one hand, the illustrations of Savigny are so clear that most of the species are (seemingly) easily recognizable. On the other hand, subtle differences between some of the closely related species, which could not be resolved prior to scanning electron microscopy (SEM), were probably a reason for the multiplication of mistakes, and the description of different species under the same names. Introduction of neotypes for the species of Savigny and Audouin is urgently needed, and this work has only just begun (Hayward and Parker 1994, Harmelin *et al.*, submitted).

Namias (1892) published a short note briefly describing seven bryozoan species collected from aboard the naval ship *Scilla* in 1891 in the southern part of the Red Sea (see Figure 1 for localities and Appendix for the species list and references). The precise sites of dredging were not mentioned, however, and it is difficult to judge species identification since the descriptions are short and illustrations are absent in this paper.

Two papers on the Red Sea bryozoans were published by Waters in 1909 and 1910, being mainly based on the collection made by Crossland in 1904–1905 on the coast of Sudan (currently kept at the Manchester Museum, UK). Additionally, Waters studied collections made by Hartmeyer (Sinai coast), and Loeffler and Siemens (Eritrea) kept in the Zoological Museum of Berlin (Germany), and some specimens from different collections (and locations) kept at the Natural History Museum, London, UK. These two papers altogether refer to 99 Red Sea bryozoan species, including descriptions and illustrations of 75 species, 15 of which were described as new. Until now this is the largest and most detailed contribution to the bryozoan taxonomy and faunistic studies of this area. It should be noted here that in contrast with the majority of taxonomists, Waters also widely used histological methods, and gave many details on the anatomy and reproductive structures of the species studied.

Hastings (1927) described 22 species collected during the Cambridge Expedition to the Suez Canal (1924), and gave some details on their reproduction: presence of embryos in the ovicells in the months of collection, as well as a list of species that had settled on experimental wood substrata. Most of the species found in the samples made in nine localities along the Canal are also known from the Red Sea. The paper is followed by a short Appendix, written by Fox, who briefly discussed the distribution of the bryozoans described from the Suez Canal. The collection is kept at the University Museum of Zoology (UMZ), Cambridge, UK.

Apart from the Indonesian and New Guinean material, the monographs of Harmer (1926, 1957) include descriptions of 35 bryozoans (four new), some of which were collected by the author during his visit to the biological station at Hurghada (Ghardaqua), northern Red Sea, in 1934. The station was established and directed by the above-mentioned Cyril Crossland (1930–1938) at the request of the Egyptian government, and Harmer had a chance to obtain both alcohol-fixed specimens from the collections of the station as well as fresh material during his own excursions. He considered these specimens

“as not unlikely to throw light on some of the species named by Audouin from Savigny’s Plates” (Harmer 1957, p. XIV). This collection is kept at the Natural History Museum, London. One species described is from the invertebrate collection of the UMZ (Hincks collection).

In 1959 Balavoine published a paper that included descriptions of 44 species, again from the northern Red Sea (Gulf of Aqaba, Gulf of Suez and Suez Canal). This material had been collected in 1928–1929 by Dollfus during his oceanographic studies in Egypt. Specimens were taken mainly by dredging from the ship *Al Sayad*, and are currently kept at the Muséum National d’Histoire Naturelle, Paris, France (MNHN). To his own collection Dollfus also added some material which had been collected by Boutan in 1891 in the same area. In the paper of Balavoine (1959) the Red Sea bryozoans (dry specimens) were for the first time illustrated using optical microphotography. Two new genera were erected.

Bryozoans of the southern part of the Red Sea were further studied by Powell (1967) who took samples in Eritrea in 1965. Some specimens during this expedition were collected by Cook who co-authored Powell in two other publications (Powell and Cook 1966, 1967). Specimens collected in the northern Red Sea by Crossland and the *Manahine* expedition were additionally studied. Altogether 32 bryozoan species, among those one new, were described, and the first faunistic analysis was made. Powell critically reevaluated species identifications made by Waters (1909, 1910), reducing the number of species described by the latter author to 58. At about the same time Powell collected additional material in the Gulf of Aqaba and Gulf of Suez, extending this biogeographical work in his following paper in which he listed 52 Indo-Pacific species (Powell 1969a). Based on his own and collated data from the literature Powell distinguished four groups of species recorded in the Red Sea: endemics, tropical Indo-West Pacific, Atlantic-Mediterranean, and Mediterranean (see also Powell 1969b). The vast majority of the specimens from Powell’s collection are kept at the Natural History Museum, London, and one specimen is in the National Museum of Canada, Ottawa.

During the winter 1951–1952 the research vessel *Calypso* (under the command of J.-J. Cousteau) visited the south-eastern (Saudi-Arabian) coast of the Red Sea, where bryozoans were collected by Cherbonnier. This material was subsequently described by Redier (1970) who identified 22 species, three of which were illustrated using SEM. The specimens are kept at the MNHN.

Eitan (1972) identified 14 species from the Suez Canal (among those 11 were new for this area), and briefly discussed the exchange of bryozoan faunas between the Red and Mediterranean seas. This small collection is kept at the Hebrew University of Jerusalem, Israel. Eitan also identified a total of 11 bryozoan species fouling asbestos panels installed in the Gulf of Aqaba (Goren 1979).

Brood (1980) identified five cyclostome species from the Gulf of Aqaba, among which he described one new. These specimens are kept in the Swedish Museum of Natural History, Stockholm, Sweden.

Dumont (1981) listed 86 species (four of them new) collected by himself along the

central Sudanese coast, and which he identified with the help of Cook. In comparison with the works of Waters (1909, 1910) and Powell (1967, 1969a) the number of species was increased by about 30 species. Apart from the taxonomic work, Dumont discussed the vertical distribution of the species in his paper. His collection is kept at the Natural History Museum, London.

Further contributions to our knowledge of the bryozoan fauna of the Red Sea area were made by d'Hondt (1988), who identified 37 species from the Gulf of Suez, Gulf of Aqaba, and the coasts and islands of Eritrea. Four species were recognized as new, while for two of them the specific names were not given. The specimens are kept in the Zoological Museum of Tel Aviv University, Israel.

Scholz (2000) listed 45 species (three supposedly new) collected in the Gulf of Aqaba in his monograph. The specimens identified are kept at the Senckenberg Museum und Forschungsinstitut, Frankfurt am Main, Germany (SMF).

Bryozoans growing on experimental aluminium panels in the Gulf of Aqaba were preliminary identified by Sternhell with co-authors (2002), who recorded 14 species.

Among bryozoans collected during the 5th expedition of the research vessel *Meteor* to the Gulf of Aden in 1987, Amui and Kaselowsky (2006) described three species (one new) from the Red Sea side of Bab el-Mandab. Together with the undescribed Red Sea collection of Ristedt, these specimens are kept at the SMF.

A few additional taxonomic and ecological papers deal with a number of bryozoan species from the Red Sea. Among others is a publication by Hastings (1939) who redescribed two known species and also described one new bugulid species based on the material of Crossland (Natural History Museum, London) and Waters (Manchester Museum, UK) from Hurghada and the surrounding area. Unfortunately, Waters's specimens collected by Crossland and kept in the Liverpool University Zoology Museum were lost in the early 1960s when the University discarded its collections (see Winston and Woollacott 2008). Cook (1966) described one species from the collection of Murray (southern Red Sea, precise locality was not given in the paper). Ghobashy and El Komy (1980) studied fouling in the southern part of the Suez Canal, recording 10 species. Ristedt (1985) described two cribrimorphs collected near Port Sudan, and studied the ecology of one species from Port Sudan and Eilat (Ristedt and Schuhmacher 1984). Soule with co-authors (1987, 1992) mentioned one cheilostome species from the Red Sea in their reviews on the evolution, systematics and biogeography of Thalamoporellidae. Hayward and Parker (1994) redescribed two of Audouin's (1826) species of smittinids. Hillmer with co-authors (1996) studied nodules of two species collected in the Gulf of Aqaba. Alvarez (1995) described one new species from the northern Red Sea, and Tilbrook (1998, 1999, 2001) described five species from the Bay of Suez, Hurghada and Massawa Harbour, Eritrea. One further species was described by Tilbrook and Cook (2005) from Hurghada, and Winston and Woollacott (2008) redescribed two more species from the northern Red Sea (Hurghada and Gulf of Suez). Recently a new species was described by Harmelin (2006) from the Gulf of Aqaba.

The list of bryozoan species based on several scientific papers was compiled by Vine

(1986) in his guide-book "Red Sea Invertebrates". With emendments this list was recently placed on-line (www.bryozoans.nl/red_sea/index.html), and includes 131 species names. Our check revealed that some of them were used erroneously. However, this recent list is the only one of its kind.

2. Safaga Bay collection

New material obtained in the course of long-term field work made in the Northern Bay of Safaga (northern Red Sea) gave us a good chance to study the bryozoan fauna of this area (Figure 1). The shallow water Bay of Safaga, with a maximum depth of 55 m (increasing up to 70 m and more on its eastern offshore slope), is situated on the west coast of the Red Sea in Egypt (33°56'–34° E, 26°37'–26°52' N), and the N–S oriented Safaga Island equally subdivides the bay into a northern and a southern part. After preliminary studies in 1984, four- to six-weeks of field work was carried out in 1986, 1987 (twice each year) and 1992 in the northern part (the Northern Bay of Safaga) by the staff of the Department of Palaeontology, University of Vienna, Austria (DPUV), in co-operation with the specialists from the Department of Geology, University of Assiut, Egypt, and the Austrian Geological Survey. The study focused on the mapping of the bottom facies and their biodiversity. Bottom sediments were collected using SCUBA diving in depths between 1 and 70 m along 55 transects with a total length of 125.8 km. Samples were subsequently sieved and sorted. The material collected was studied in respect to sedimentology, Lebensspuren, foraminiferans, corals, molluscs, including boring bivalves, and echinoids (see Piller and Pervesler 1989, Piller and Mansour 1990, Nebelsick 1992a, b, Zuschin and Oliver 2003 and references therein).

Bryozoan colonies, collected between 1 and 57 m depth, are merely the by-product of the Safaga-Expedition. They were sorted from the sediment and preliminary identified by Schmidt and Millmeyer during their Diploma-projects at the Department of Palaeontology, University of Vienna (DPUV). Nothing has been published, however, on the basis of this work. During the last four years this collection was restudied. Additional material collected from the Northern Bay of Safaga and also Jeddah, Saudi Arabia (Figure 1), was obtained from the coral collection of Dr Kleemann, kept at the DPUV. This coral collection will eventually be transferred to the Natural History Museum, Vienna (NHMV).

The bryozoan collection from the Northern Bay of Safaga is also currently kept in the DPUV but will later be stored at the SMF. Altogether it includes several thousand specimens comprising of detached fragments and colonies that encrust mollusc shells, algae, living corals and coral rubble. Unfortunately, a large part of the material taken from the sediment samples consists of highly fragmented colonies that were dead at the time of collecting. Also, many of these specimens are strongly abraded, which prevents reliable identification.

At the moment, 175 species belonging to 85 genera and 54 families from the orders Cyclostomata and Cheilostomata were identified using SEM (Table 2). Fifty-two species, 11 genera and four families are reported for the first time in the Red Sea. Twenty-three

species are supposedly new, and seven species are still considered as *incertae sedis*. Identification work is still in progress.

All the images taken (both SEM and light microscopy) are provided on-line (http://palse2.pal.univie.ac.at/Bryozoa/Safaga_Bay.html#) as part of the website of the DPUV. This virtual collection consists of more than 3000 high resolution images, allowing free access for anyone. Also, SEM-images of the paratypes for the newly described species are placed there. One great advantage of such a webpage is the possibility for permanent revision of specimen identification.

Table 2. Working list of bryozoans (orders Cheilostomata and Cyclostomata) recorded in the Safaga Bay collection (first records from the Red Sea are in bold, supposedly new species mentioned as NSP).

Order CHEILOSTOMATA Busk, 1852

Suborder INOVICELLINA Jullien, 1888

Aeteidae Smitt, 1868

Aetea truncata (Landsborough, 1852)

Suborder MALACOSTEGINA Levinsen, 1902

Electridae Stach, 1937

Conopeum lacroixii (Audouin, 1826)

Conopeum cf. *eriphorum* (Lamouroux, 1816)

Membraniporidae Busk, 1852

Biflustra savartii (Audouin, 1826)

Biflustra limosa (Waters, 1909)

Suborder NEOCHEILOSTOMINA d'Hondt, 1985

Infraorder FLUSTRINA Smitt, 1868

Calloporidae Norman, 1903

Parallesina curvirostris (Hincks, 1862)

Cranosina coronata (Hincks, 1881)

Antroporidae Vigneaux, 1949

Akatopora leucochypha (Marcus, 1937)

***Antropora typica* (Hastings, 1930)**

Antropora granulifera (Hincks, 1880)

Parantropora laguncula (Canu and Bassler, 1929)

Chaperidae Jullien, 1888

Chaperia infundibulata d'Hondt, 1988

Chaperia judex (Kirkpatrick, 1888)

Quadricellaridae Gordon, 1984
Nellia tenuis Harmer, 1926

Heliodomidae Vigneaux, 1949
Setosellina constricta Harmer, 1926

Bugulidae Gray, 1848
Bugula vectifera Harmer, 1926

Beaniidae Canu and Bassler, 1927
Beania discodermae Ortmann, 1890
Beania klugei Cook, 1968
***Beania lagenula* Tilbrook, 2006**

Epistomiidae Gregory, 1893
Synnotum aegyptiacum (Audouin, 1826)

Candidae d'Orbigny, 1851
Canda filifera Lamarck, 1816
Caberea boryi (Audouin, 1826)
Scrupocellaria maderensis Busk, 1860
Scrupocellaria spatulata (d'Orbigny, 1851)
Scrupocellaria sp.

Microporidae Gray, 1848
Mollia sp.

Onychocellidae Jullien, 1882
Onychocella angulosa (Reuss, 1847)
Smittipora cordiformis Harmer, 1926
Smittipora harmeriana (Canu and Bassler, 1929)

Monoporellidae Hincks, 1882
***Monoporella carinifera* (Canu and Bassler, 1929)**

Steginoporellidae Hincks, 1884
Steginoporella magnilabris (Busk, 1854)
Steginoporella n. sp.
Labioporella n. sp.

Thalamoporellidae Levinsen, 1902
Thalamoporella rasmuhammadi Soule, Soule and Chaney, 1999
Thalamoporella rozieri (Audouin, 1826)

Poricellariidae Harmer, 1926
***Poricellaria* cf. *ratoniensis* (Waters, 1887)**

Cellaridae Fleming, 1828
Cellaria punctata (Busk, 1852)

Infraorder ASCOPHORA Levinsen, 1909
 “Grade” ACANTHOSTEGA Levinsen, 1909

Cribrilinidae Hincks, 1879
Puellina harmeri (Ristedt, 1985)
Puellina egretta Ryland and Hayward, 1992
Puellina cf. *innominata* (Couch, 1844)
Puellina vacoleti Harmelin, 2006
Puellina cf. *voigti* (Ristedt, 1985)
Puellina n. sp.
Membraniporella aragoi (Audouin, 1826)
Distansescharella sp.

Catenicellidae Busk, 1852
Catenicella contei (Audouin, 1826)

Savignyellidae Levinsen, 1909
Savigniella lafontii (Audouin, 1826)

“Grade” HIPPOTHOOMORPHA Gordon, 1989

Hippothoidae Busk, 1859
Hippothoa calciophilia Gordon, 1984
Hippothoa flagellum Manzoni, 1870

Trypostegidae Gordon, Tilbrook and Winston, 2005
Trypostega johnsoulei Tilbrook, 2006
Trypostega sp.

Chorizoporidae Vigneaux, 1949
Chorizopora brongniartii (Audouin, 1826)

“Grade” UMBONULOMORPHA Gordon, 1989

Arachnopusidae Jullien, 1888
Poricella spathulata (Canu and Bassler, 1929)
Poricella robusta (Hincks, 1884)

Exechonellidae Harmer, 1957
Exechonella tuberculata (MacGillivray, 1883)
Exechonella brasiliensis Canu and Bassler, 1928
Exechonella n. sp. 1
Exechonella n. sp. 2
Exechonella n. sp. 3

Lepraliellidae Vigneaux, 1949

- Celleporaria labelligera* Harmer, 1957
Celleporaria aperta (Hincks, 1882)
Celleporaria pigmentaria (Waters, 1909)
Celleporaria inaudita Tilbrook, Hayward and Gordon, 2001
Celleporaria vermiformis (Waters, 1909)
Celleporaria trispiculata d'Hondt, 1988
Drepanophora indica Hayward, 1988
Drepanophora tuberculata (Osburn, 1914)

Romancheinidae Jullien, 1888

- Escharoides longirostris* Dumont, 1981

“Grade” LEPRALIOMORPHA Gordon, 1989

Smittinidae Levinsen, 1909

- Parasmittina areolata* (Canu and Bassler, 1927)
Parasmittina egyptiaca (Waters, 1909)
Parasmittina protecta (Thornely, 1905)
Parasmittina parsevalii (Audouin, 1826)
Parasmittina spondylicola Harmelin, Bitar and Zibrowius, 2009
Parasmittina raigii (Audouin, 1826)
Parasmittina serrula Soule and Soule, 1973
Parasmittina rouvillei (Calvet, 1902)
Parasmittina tropica (Waters, 1909)
Parasmittina n. sp. 1
Parasmittina n. sp. 2
Parasmittina n. sp. 3
Parasmittina sp. 1
Parasmittina sp. 2
Parasmittina sp. 3
? *Parasmittina* sp.
Smittina nitidissima (Hincks, 1880)
Smittina n. sp.
Smittoidea incucula Hayward and Ryland, 1995
Smittoidea pacifica Soule and Soule, 1973
Pleurocodonelina cf. *signata* (Waters, 1889)
Pleurocodonellina NSP

Bitectiporidae MacGillivray, 1895

- Metroperiella montferrandi* (Audouin, 1826)
Schizomavella incompta Hayward, 1988

Watersiporidae Vigneaux, 1949

- Watersipora subovoidea* (d'Orbigny, 1852)

Schizoporellidae Jullien, 1883

Schizobrachiella convergens Harmer, 1957*Schizoporella errata* (Waters, 1878)*Stylopoma* cf. *palmula* Tilbrook, 2001***Stylopoma* cf. *incomptum* Tilbrook, 2001***Stylopoma duboisii* (Audouin, 1826)

Stomachetocellidae Canu and Bassler, 1917

Cigclisula cf. *occlusa* (Busk, 1884)

Margarettidae Harmer, 1957

Margaretta tenuis Harmer, 1957*Margaretta gracilior* (Ortmann, 1892)

Hippopodinidae Levinsen, 1909

Hippopodina iririkiensis Tilbrook, 1999*Hippopodina pulcherrima* (Canu and Bassler, 1928)*Thornelya perarmata* (Harmer, 1957)*Thornelya* sp. 1*Thornelya* sp. 2

Gigantoporidae Bassler, 1935

Cosciniopsis lonchaea (Busk, 1884)*Cosciniopsis coelathus* Canu and Bassler, 1927*Gigantopora* cf. *pupa* (Jullien, 1903)

Lanceoporidae Harmer, 1957

Calyptotheca wasinensis (Waters, 1913)*Calyptotheca* sp. 1*Calyptotheca* sp. 2

Teuchoporidae Neviani, 1895

Lagenicella cylindrica (Harmer, 1957)

Insertae sedis

Robertsonidra cf. *argentea* (Hincks, 1881)*Robertsonidra* cf. *praecipua* Hayward and Ryland, 1995

Microporellidae Hincks, 1879

Microporella harmeri Hayward, 1988*Microporella geniisi* (Audouin, 1826)*Microporella* n. sp.*Fenestrulina* sp.*Calloporina* n. sp.

Petraliellidae Harmer, 1957

Mucropetraliella thenardii (Audouin, 1826)*Mucropetraliella capricornensis* Tilbrook, Hayward and Gordon, 2001

Lacernidae Jullien, 1888

Cribellopora cf. *latigastra* (David, 1949)*Cribellopora* n. sp. 1*Cribellopora* n. sp. 2*Cribellopora* n. sp. 3*Arthropoma cecillii* (Audouin, 1826)? *Arthropoma* n. sp.

Escharinidae Tilbrook, 2006

Bryopesanser serratus Dick, Tilbrook and Mawatari, 2007*Bryopesanser* 'pesanseris' (Smitt, 1873)

Crepidacanthidae Levinsen, 1909

Crepidacantha cf. *poissonii* (Audouin, 1826)

Cleidochasmatidae Cheetham and Sandberg, 1964

Characodoma fallax (Canu and Bassler, 1929)*Characodoma* n. sp. 1*Characodoma* n. sp. 2*Characodoma* n. sp. 3

Celleporidae Johnston, 1838

'*Turbicellepora*' *redoutei* (Audouin, 1826)'*Turbicellepora*' *bernardii* (Audouin, 1826)*Predanophora longiuscula* (Harmer, 1957)*Celleporina tropica* Hayward, 1988'*Celleporina*' *perplexa* (Harmer, 1957)*Celleporina* n. sp.

Hippoporidridae Vigneaux, 1949

Odontoporella costulata (Canu and Bassler, 1929)*Trematooecia* cf. *turrita* (Smitt, 1873)

Phidolophoridae Gabb and Horn, 1862

Fodinella spinifera (Philipps, 1900)*Lifuella multidentata* (Thornely, 1905)*Metacleidochasma* cf. *planulata* (Canu and Bassler, 1929)*Plesiocleidochasma laterale* (Harmer, 1957)*Rhynchozoon ferocula* Hayward, 1988*Rhynchozoon splendens* Hayward, 1988***Rhynchozoon* cf. *verruculatum* (Smitt, 1873)***Rhynchozoon* n. sp. 1*Rhynchozoon* n. sp. 2*Rhynchozoon* n. sp. 3*Reteporella* sp. 1*Reteporella* sp. 2*Reteporellina* sp. 1*Reteporellina* sp. 2

Schedocleidochasma porcellaniforme Soule, Soule and Chaney, 1991
Schedocleidochasma n. sp.
Schedocleidochasma sp.

Order CYCLOSTOMATA Busk, 1852
 Suborder ARTICULINA Busk, 1852

Crisiidae Johnston, 1838
Crisia cf. *bifurcata* Brood, 1976
Crisia sp.

Suborder TUBULIPORINA Milne-Edwards, 1838

Tubuliporidae Johnston, 1838
Tubulipora sp. 1
Tubulipora sp. 2

Entalophoridae Reuss, 1869
Entalophorecia sp.
 ? *Entalophorecia* sp.

Terviidae Canu and Bassler, 1920
 ? *Tervia* sp.

Suborder RECTANGULINA Waters, 1887
 Lichenoporidae Smitt, 1867
Disporella boutani (Audouin, 1826) [Alvarez 1995 as *Disporella boutani*]

INCERTAE SEDIS

It is as yet impossible to identify specimens belonging to seven more ascophoran cheilostomes because of their small size and/or insufficient preservation.

3. Discussion

Our survey showed that there has never been a comprehensive faunal study on Bryozoa from the Red Sea despite it being more thoroughly sampled than any other part of the tropical seas (see Mergner 2001). Also, whereas bryozoans were identified numerous times in the northern Red Sea, its eastern coast is practically unstudied (apart from Redier 1970) as well as most of the western coast (Figure 1). Bryozoans from deep-water habitats are not studied at all.

Detailed analysis of the literature revealed that the number of bryozoan species names ever referred to in connection with the Red Sea is 292. Altogether they belong to 125 genera and 68 families (see Appendix). Considering the 52 species found during our work, which represent new records, the total number of species in the Red Sea is 344. This number (while very approximate) is comparable with the total diversity known in some

other tropical areas, for instance in Brazil (346 species listed in Vieira *et al.* 2008), although the recently known species numbers in the local faunas are clearly underestimated (Tilbrook 2006). Also, this is about one third of the preliminarily estimated bryozoan biodiversity of the Indian Ocean including both shallow- and deep-water records - currently 1017 species (Ostrovsky and Cáceres-Chamizo, unpublished). Of them 199 species (19%) also inhabit the shallow waters of the Red Sea. Finally, the number of new species (23) found in the Northern Bay of Safaga, whose size is less than 100 km², suggests that the true biodiversity of bryozoans in the Red Sea is greatly underestimated.

Altogether, study of the bryozoan collection of the Northern Bay of Safaga confirmed the presence of 70 species previously mentioned in the Red Sea. However, absence of the type specimens of many species described in the 18th century, and poor or often missing photographic and descriptive documentation of the identified specimens, makes this estimation rather uncertain and allows us to judge the exact species numbers only approximately.

4. Conclusions

Our survey of the literature showed that despite the long research history and a rather substantial number of published papers our knowledge about bryozoan diversity of the Red Sea is very incomplete. This is partially because a majority of the studies were done in pre-SEM times and species identifications require thorough re-examination. Also, most of the recent studies were published as species lists, and can be used only with great caution. In such a situation revision is badly needed, although the distribution of bryozoan collections throughout different museums, together with great difficulties of yielding financial support for taxonomic research, strongly hamper any further progress. Another problem is difficulties in getting specimens on loan from the museums that (unofficially) do not encourage loans or have no curators for the specific collections, in concert with the absence of modern low-vacuum SEMs in many museums.

As a future work, apart from the description of new species, the status of many species should be re-evaluated using type specimens from the museum collections, accompanied by the redescription of many "common" species and establishment of neotypes. The creation of websites presenting the SEM-images of the available specimens should be promoted, thus greatly facilitating the work of specialists that have no access to the specimens. The collection from the Northern Bay of Safaga and its webpage are useful and provide an important background for such a revision. Since many specimens from this collection are unfortunately abraded, the Ristedt collection, kept at the SMF, and including many specimens from the Red Sea, would greatly boost future work. An additional source of bryozoan material are the coral collections kept in a number of zoological and university museums in Germany (Berlin, Stuttgart, Darmstadt, Stralsund, Jena, Hamburg), Austria (Vienna, Salzburg), France (Paris), Britain (London, Manchester, Cambridge), Italy (Genova) and Israel (Tel-Aviv, Jerusalem) (H. Schuhmacher, pers. comm. 2008).

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Appendix

List of all bryozoan taxa recorded from the Red Sea [references in brackets].
Current taxonomic position of the species given according to www.bryozoa.net and Gordon (2009)

Order CTENOSTOMATA Busk, 1852

Suborder VICTORELLINA Jebram, 1973

Nolellidae

- *Nolella dilatata* Hincks, 1860 [Waters 1910 as *Cylindroecium*]
- *Nolella gigantea* Busk, 1856 [Waters 1910 as *Cylindroecium*]
- *Nolella papuensis* (Busk, 1886) [Hastings 1927; Powell 1969]

Suborder STOLONIFERINA Ehlers, 1876

Walkeriiidae

- *Walkeria uva* (Linnaeus, 1758) [Waters 1910 as *Valkeria*]

Aeverrilliidae

- *Aeverrillia setigera* (Hincks, 1887) [Hastings 1927 and Powell 1969 as *Buskia*]

Suborder VESICULARINA Johnston, 1838

Vesiculariidae

- *Amathia ? braziliensis* Busk, 1886 [Hastings 1927]
- *Amathia tortuosa* Tenison-Woods, 1880 [Waters 1910]
- *Bowerbankia imbricata* (Adams, 1800) [Waters 1910]
- *Bowerbankia* sp. [Ghobashy and El Komy 1980]
- *Zoobotryon verticellatum* (della Chiaje, 1822) [Waters 1910 and Hastings 1927 as *Z. pellucidum*]

Buskiidae

- *Buskia socialis* Hincks, 1887 [Hastings 1927]

Order CHEILOSTOMATA Busk, 1852

Suborder INOVICELLINA Jullien, 1888

Aetiidae

- *Aetea ligulata* Busk, 1852 [d'Hondt 1988]
- *Aetea crosslandi* Waters, 1910 [Powell 1969]
- *Aetea* sp. [Scholz 2000 as *Aetea* aff. *longicollis*]
- *Aetea recta* Hincks, 1880 [Waters 1909]
- *Aetea truncata* (Landsborough, 1852) [Scholz 2000; Sternhell, Taylor and Itzhak 2002]

Suborder MALACOSTEGINA Levinsen, 1902

Electridae

- *Electra bellula* (Hincks, 1882) [Water 1909 and Powell 1967 as *Membranipora*]
- *Conopeum lacroixii* (Audouin, 1826) [Namias 1892 as *Membranipora*; Balavoine 1959]

Membraniporidae

- *Biflustra savartii* (Audouin, 1826) [Waters 1909, Hastings 1927, Powell 1967 and d'Hondt 1988 as *Membranipora*; Balavoine 1959 as *Acanthodesia*]
- *Biflustra limosa* (Waters, 1909) [Waters 1909 as *Membranipora*; Balavoine 1959 and Powell 1967, 1969 as *Acanthodesia*]
- *Membranipora commensale* (Kirkpatrick and Metzelaar, 1922) [Powell 1967 as *Conopeum*]
- *Membranipora tenuis* (Desor, 1848) [Eitan 1972]
- *Membranipora tehuelcha* (d'Orbigny, 1839) [Hastings 1927]
- *Membranipora tuberculata* (Bosc, 1802) [Balavoine 1959; Powell 1967; Eitan 1972]
- *Membranipora membranacea* (Linnaeus, 1767) [Balavoine 1959]

Suborder NEOCHEILOSTOMINA d'Hondt, 1985

Infraorder FLUSTRINA Smitt, 1868

Calloporidae

- *Amphiblestrum bursarium* (MacGillivray, 1887) [Waters 1909 as *Membranipora*]
- ? *Callopora aurita* (Hincks, 1877) [d'Hondt 1988]
- *Cranosina coronata* (Hincks, 1881) [Dumont 1981 as *Setosellina*]

Antroporidae

- *Antropora granulifera* (Hincks, 1880) [Dumont 1981]
- *Antropora minor* (Hincks, 1880) [Waters 1909 as *Membranipora trifolium* var *minor*; Powell 1967, 1969 and Dumont 1981 as *A. marginella*; Tilbrook 1998]
- *Antropora tinca* (Hastings, 1930) [Tilbrook 1998]

Chaperiidae

- *Chaperia infundibulata* d'Hondt, 1988 [d'Hondt 1988]
- *Chaperiopsis tropica* (Waters, 1909) [Waters 1909 and Powell 1969 as *Chaperia*; Balavoine 1959 as *Chaperina*]

Quadricellariidae

- *Nellia oculata* Busk, 1852 [Waters 1909 as *Farcimia*; Balavoine 1959]
- *Nellia tenuis* Harmer, 1926 [Dumont 1981]

Heliodomidae

- *Setosellina constricta* Harmer, 1926 [d'Hondt 1988]

Cupuladriidae

- *Cupuladria* sp. [d'Hondt, 1988]
- *Vibracellina viator* Canu and Bassler, 1929 [Balavoine 1959; Powell 1969]

Bugulidae

- *Bugula avicularia* (Linnaeus, 1758) [Waters 1909; Hastings 1927]
- *Bugula fulva* Ryland, 1960 [Redier 1970]
- *Bugula minima* (Waters, 1909) [Waters 1909 as *B. neritina* var. *minima* (in part, see Winston and Woollacott 2008); Hastings 1939 (in part, see Winston and Woollacott 2008); Winston and Woollacott 2008]
- *Bugula neritina* (Linnaeus, 1758) [Waters 1909; Hastings 1927; Balavoine 1959; Eitan 1972;

- Goren 1979; Ghobashy and El Komy 1980; d'Hondt 1988]
- *Bugula plumosa* (Pallas, 1766) [Scholz 2000]
 - *Bugula robusta* MacGillivray, 1869 [Powell 1969; Dumont 1981; d'Hondt 1988]
 - *Bugula vectifera* Harmer, 1926 [Sternhell, Taylor and Itzhak 2002]
 - *Bugula crosslandi* Hastings, 1939 [Waters 1909 as *B. neritina* var. *minima* (in part, see Winston and Woollacott 2008); Hastings 1939 (in part., see Winston and Woollacott 2008); Winston and Woollacott 2008]
 - *Bugula turbinata* Alder, 1857 [Ghobashy and El Komy 1980]
 - *Bugula stolonifera* Ryland, 1960 [Ghobashy and El Komy 1980]
 - *Bugula scaphoides* Kirkpatrick, 1890 [Hastings 1939]
 - *Caulibugula* sp. [Scholz 2000 as *Caulibugula* cf. *dendrograpta*]
 - *Bicellariella ciliata* (Linnaeus, 1758) [Waters 1909 as *Bicellaria*]

Beaniidae

- *Beania cupulariensis* Osburn, 1914 [Dumont 1981]
- *Beania discodermiae* (Ortmann, 1890) [Redier 1970; Dumont 1981]
- *Beania intermedia* (Hincks, 1882) [Waters 1909; Hastings 1927]
- *Beania mirabilis* Johnston, 1840 [Eitan 1972; Dumont 1981]

Epistomiidae

- *Synnotum aegyptiacum* (Audouin, 1826) [Waters 1909 and Hastings 1927 as *S. aviculare*]

Candidae

- ?*Canda arachnoides* Lamouroux, 1816 [Waters 1909; Dumont 1981]
- *Canda filifera* Lamarck, 1816 [d'Hondt 1988]
- *Scrupocellaria bertholletii* (Audouin, 1826) [Waters 1909; Hastings 1927; Balavoine 1959]
- *Scrupocellaria diadema* Busk, 1852 [Redier 1970; Dumont 1981]
- *Scrupocellaria longispinosa* Harmer, 1926 [Dumont 1981]
- *Scrupocellaria mansueta* Waters, 1909 [Waters 1909; Redier 1970]
- *Scrupocellaria delilii* (Audouin, 1826) [Audouin 1826 as *Crisia Delilii*; d'Hondt 2006]
- *Scrupocellaria jolloisii* (Audouin, 1826) [Waters 1909; Hastings 1927; Balavoine 1959; Powell 1969]
- *Scrupocellaria obtecta* Haswell, 1880 [Powell 1969]
- *Scrupocellaria serrata* Waters, 1909 [Waters 1909; Powell 1969]
- *Scrupocellaria spatulata* (d'Orbigny, 1851) [Balavoine 1959; Powell 1969; Scholz 2000; Sternhell, Taylor and Itzhak 2002]
- *Scrupocellaria dongolensis* (Waters, 1909) [Waters 1909 as *S. scrupea* var. *dongolensis*]
- *Scrupocellaria cervicornis* Busk, 1852 [Waters 1909]
- *Scrupocellaria scruposa* (Linnaeus, 1758) [Ghobashy and El Komy 1980]
- *Eupaxia quadrata* (Busk, 1884) [Namias 1892 as *Cellularia*]

Microporidae

- *Micropora coriacea* (Esper, 1791) [Waters 1909]

Onychocellidae

- *Smittipora cordiformis* Harmer, 1926 [Dumont 1981]

Steginoporellidae

- *Labioporella crenulata* (Levinsen, 1909) [Dumont 1981]
- *Steginoporella magnilabris* (Busk, 1854) [Redier 1970 as *Steganoporella*]
- *Steginoporella simplex* (Harmer, 1900) [Powell 1967, 1969 and Dumont 1981 as *Steganoporella*]
- *Steginoporella triangularis* Amui and Kaselowsky, 2006 [Amui and Kaselowsky 2006]

Thalamoporellidae

- *Thalamoporella indica* (Hincks, 1880) [Powell 1969 as *T. gothica* var. *indica*]
- *Thalamoporella cookae* Soule, Soule and Chaney, 1992 [Soule, Soule and Chaney 1992]
- *Thalamoporella rozieri* (Audouin, 1826) [Waters 1909; Powell 1967; Redier 1970; Eitan 1972; Dumont 1981; Soule, Soule and Chaney 1987; d'Hondt 1988; Soule, Soule and Chaney 1992]
- *Thaiopora mamillaris* (Lamouroux, 1816) [Waters 1909]

Cellaridae

- *Cellaria salicornioides* Lamouroux, 1816 [Balavoine 1959]
- *Cellaria* sp. [Scholz 2000 as *Cellaria* n.sp. aff. *salicornioides*]
- *Cellaria* sp. [Namias 1892 as *Salicornaria farciminoides*]

Chlidoniidae

- *Chlidonia pyriformis* (Bertolani, 1810) [Audouin 1826 as *Eucratea Cordieri*; d'Hondt 2006]

Infraorder ASCOPHORA Levinsen, 1909

'Grade' ACANTHOSTEGA Levinsen, 1909

Cribrilinidae

- *Membraniporella aragoi* (Audouin, 1826) [Waters, 1909 as *Membranipora*; Redier 1970; Dumont 1981]
- *Puellina harmeri* (Ristedt, 1985) [Scholz 2000]
- *Puellina innominata* (Couch, 1844) [Ristedt 1985 as *Cribrilaria*; d'Hondt 1988; Scholz 2000]
- ? *Puellina flabellifera* (Kirkpatrick, 1888) [Audouin 1826 as *Flustra Pouilletii*; Ristedt 1985 and d'Hondt 2006 as *Cribrilaria*]
- *Puellina gattyae* (Landsborough, 1852) [Waters 1909 as *Cribrilina*]
- *Puellina radiata* (Moll, 1803) [Waters 1909, Balavoine 1959 and Dumont 1981 as *Cribrilina*]
- *Puellina vacoleti* Harmelin, 2006 [Harmelin 2006]
- *Reginella floridana* (Smitt, 1873) [Dumont 1981]

Catenicellidae

- *Catenicella contei* (Audouin, 1826) [Waters 1909 as *Vittaticella*; Redier 1970]
- *Vasignyella otophora* (Kirkpatrick, 1890) [Dumont 1981 as *Savignyella*]

Savignyellidae

- *Savignyella lafontii* (Audouin, 1826) [Audouin 1826 as *Eucratea Lafontii*; Waters 1909 and Hastings 1927 as *Catenaria*; Harmer 1957; Balavoine 1959; Goren 1979; Scholz 2000; Sternhell, Taylor and Itzhak 2002]

'Grade' HIPPOTHOOMORPHA Gordon, 1989

Hippothoidae

- *Hippothoa distans* (MacGillivray, 1869) [Harmer 1957]

- *Hippothoa divaricata* Lamouroux, 1821 [Balavoine 1959]
- *Hippothoa* sp. [Goren 1979]

Haplopomidae

- *Haplopoma impressum* (Audouin, 1826) [Waters 1909 as *Microporella*]

Trypostegidae

- *Trypostega venusta* (Norman, 1864) [Harmer 1957; Dumont 1981; d'Hondt 1988]

Chorizoporidae

- *Chorizopora brongniartii* (Audouin, 1826) [Dumont 1981; Scholz 2000]

'Grade' UMBONULOMORPHA Gordon, 1989

Arachnopusiidae

- *Poricella* sp. [d'Hondt 1988 as *Tremogasterina* sp. aff. *brancoensis*]
- *Poricella robusta* (Hincks, 1884) [Waters 1909 as *Lepralia*; Powell and Cook 1967, Powell 1967, 1969 and Dumont 1981 as *Tremogasterina*; d'Hondt 1988]
- *Poricella spathulata* (Canu and Bassler, 1929) [Harmer 1957 as *Arachnopusia*; Powell and Cook 1967, Powell 1969 and Dumont 1981 as *Tremogasterina*]

Exechonellidae

- *Exechonella antillea* (Osburn, 1927) [Dumont 1981]
- *Exechonella discoidea* Canu and Bassler, 1929 [Dumont 1981]
- *Exechonella tuberculata* (MacGillivray, 1883) [Waters 1909 as *Lagenipora*; Balavoine 1959; Powell 1967, 1969; Dumont 1981]
- ? *Exechonella bequerelii* (Audouin, 1826) [Audouin 1826 as *Flustra Bequerelii*; d'Hondt 2006]

Adeonellidae

- ? *Laminopora contorta* Michelin, 1842 [Harmer 1957; Cook 1982, locality is doubtful]
- *Reptadeonella* sp. [Dumont 1981]

Lepraliellidae

- *Celleporaria aperta* (Hincks, 1882) [Waters 1909 and Hastings 1927 as *Holoporella*; Harmer 1957; Powell 1967, 1969; Dumont 1981; d'Hondt 1988; Scholz 2000]
- *Celleporaria* aff. *bicornis* (Busk, 1884) [d'Hondt 1988]
- *Celleporaria columnaris* (Busk, 1881) [Goren 1979; Dumont 1981; d'Hondt 1988]
- *Celleporaria decostilsii* (Audouin, 1826) [Waters 1909 as *Holoporella*]
- *Celleporaria fusca* (Busk, 1854) [Redier 1970; Hillmer, Scholz and Dullo 1996]
- *Celleporaria granulosa* (Haswell, 1880) [Dumont 1981]
- *Celleporaria labelligera* Harmer, 1957 [Balavoine 1959; Redier 1970; Powell 1967, 1969; Dumont 1981; Harmer 1957]
- *Celleporaria pertusa* (Smitt, 1873) [Waters 1909]
- *Celleporaria pigmentaria* (Waters, 1909) [Waters 1909 as *Holoporella*; Harmer 1957; Powell 1967, 1969; d'Hondt 1988]
- *Celleporaria pilaefera* (Canu and Bassler, 1929) [Harmer 1957; Dumont 1981]
- *Celleporaria sibogae* Winston and Heimberg, 1986 [Scholz 2000]
- *Celleporaria tridenticulata* (Busk, 1881) [Scholz 2000]

- *Celleporaria trispiculata* d'Hondt, 1988 [d'Hondt 1988]
- *Celleporaria vermiformis* (Waters, 1909) [Waters 1909 as *Holoporella*; Powell 1969]
- *Celleporaria* sp. [Scholz 2000]
- *Drepanophora birbira* Powell, 1967 [Powell 1967, 1969]
- *Drepanophora incisor* (Thornely, 1905) [Dumont 1981]
- *Drepanophora* sp. [Scholz 2000 as *Drepanophora* cf. *indica*]

Romancheinidae

- *Bathosella aspera* (Ulrich, 1901) [Redier 1970]

Umbonulidae

- *Rhamphostomella* sp. [Goren 1979]

Exochellidae

- *Escharoides coccinea* (Abildgaard, 1806) [Balavoine 1959; Scholz 2000 as *Escharoides* aff. *coccinea*]
- *Escharoides longirostris* Dumont, 1981 [Dumont 1981]

'Grade' LEPRALIOMORPHA Gordon, 1989

Smittinidae

- *Parasmittina egyptiaca* (Waters, 1909) [Waters 1909 as *Smittia egyptiaca* and ?*S. egyptiaca* var. *heteropolita* (see Harmer 1957 for discussion); Hastings 1927 as *Smittia*; Harmer 1957 as *Smittina*; not Balavoine 1959; Redier 1970; Powell 1967, 1969; Ghobashy and El Komy 1980 as *Mucronella*; Dumont 1981]
- *Parasmittina glomerata* (Thornely, 1912) [Harmer 1957 as *Smittina*; Powell 1967, 1969; Dumont 1981]
- *Parasmittina* sp. [Scholz 2000 as *Parasmittina* n.sp. aff. *glomerata*]
- *Parasmittina nitida* (Verrill, 1875) [Waters 1909 as *Smittia*; Balavoine 1959 as *Smittina*]
- *Parasmittina parsevalii* (Audouin, 1826) [Harmer 1957 as *Smittina* (in part. see Hayward and Parker 1994); Powell 1967; Dumont 1981; Hayward and Parker 1994; Scholz 2000]
- *Parasmittina protecta* (Thornely, 1905) [Waters 1909 and Hastings 1927 as *Smittia*; Harmer 1957 as *Smittina*; Powell 1967, 1969; d'Hondt 1988]
- *Parasmittina raigii* (Audouin, 1826) [Harmer 1957 as *Smittina* (in part. see Hayward and Parker 1994); Dumont 1981; Hayward and Parker 1994]
- *Parasmittina serrula* Soule and Soule, 1973 [Scholz 2000]
- *Parasmittina tropica* (Waters, 1909) [Waters 1909 as *Smittia*; Harmer 1957 as *Smittina*; Powell 1967, 1969; Dumont 1981; d'Hondt 1988; Scholz 2000]
- *Parasmittina delicatula* (Busk, 1884) [Namias 1892 as *Mucronella*]
- *Parasmittina* sp. [d'Hondt 1988]
- *Parasmittina* sp. 1 [Sternhell, Taylor and Itzhak 2002]
- *Parasmittina* sp. 2 [Sternhell, Taylor and Itzhak 2002]
- *Pleurocodonellina signata* (Waters, 1899) [Waters 1909 as *Smittia marmorea* (see Harmer 1957 for discussion); Powell 1969 and d'Hondt 1988 as *Parasmittina*; Goren 1979 as *Smittina*]
- *Smittina baccata* Canu and Bassler, 1930 [Redier 1970]
- *Smittina* sp. [Scholz 2000 as *Smittina* cf. *crystallina*]
- *Smittina nitidissima* (Hincks, 1880) [Powell 1967 as *Smittina malleolus*; Balavoine 1959 as *Smittina egyptiaca* (see Harmelin, Bitar and Zibrovius 2009); Dumont 1981]

- *Smittina mucronata* (Smitt, 1868) [Waters 1909 as *Schizoporella*]
- *Smittoidea ophidiana* (Waters, 1879) [Waters 1909 as *Smittia*; Balavoine 1959 as *Smittina*]
- *Smittoidea levis* (Kirkpatrick, 1890) [Audouin 1826 as *Flustra? Leperei*; Waters 1909; Dumont 1981]
- ? *Smittoidea laevis* [Audouin 1826 as *Flustra Legentilii*; d'Hondt 2006]
- *Smittoidea* sp. [Scholz 2000 as *Smittoidea* n.sp.1 cf. *pacifica*]
- *Smittoidea* sp. [Scholz 2000 as *Smittoidea* n.sp. 2 aff. *hyalina*]
- *Smittoidea* sp. [Eitan 1972]
- *Prenantia cheilostomata* (Manzoni, 1869) [Redier 1970 as *Porella*]

Bitectiporidae

- *Hippoporina pertusa* (Esper, 1796) [Redier 1970 as *Hippodiplosia*; Balavoine 1959]
- *Schizomavella australis* (Haswell, 1880) [Powell 1967]
- *Schizomavella inclusa* (Thornely, 1906) [Harmer 1957; Powell 1969]
- *Schizomavella punctigera* (MacGillivray, 1883) [Scholz 2000]
- *Schizomavella sinapiformis* Harmer, 1957 [Dumont 1981]
- *Metroperiella montferrandi* (Audouin, 1826) [Audouin 1826 as *Flustra Montferrandi*; Waters 1909 as *Lepralia*; Harmer 1957, Powell 1967 and Dumont 1981 as *Codonellina*]
- *Pentapora ottomulleriana* (Moll, 1803) [Redier 1970 as *Hippodiplosia*]
- *Pentapora* ? sp. [d'Hondt 1988]

Watersiporidae

- *Watersipora cucullata* Busk, 1854 [Waters 1909 and Hastings 1927 as *Lepralia*; Ghobashy and El Komy 1980]
- *Watersipora subovoidea* (d'Orbigny, 1852) [Waters 1909; Harmer 1957 and Balavoine 1959 as *Dakaria*; Eitan 1972; Goren 1979; Dumont 1981]
- *Watersipora subtorquata* (d'Orbigny, 1852) [d'Hondt 1988; Scholz 2000; Sternhell, Taylor and Itzhak 2002]

Schizoporellidae

- *Stylopoma duboisii* (Audouin, 1826) [Harmer 1957; Powell 1967, 1969; Redier 1970; Dumont 1981; Tilbrook 2001]
- *Stylopoma parviporosa* Canu and Bassler, 1929 [Hillmer, Scholz and Dullo 1996]
- *Stylopoma viride* (Thornely, 1905) [Waters 1909 as *Schizoporella*; Powell 1967, 1969; Dumont 1981; Tilbrook 2001]
- *Schizobrachiella convergens* Harmer, 1957 [Dumont 1981]
- *Schizoporella errata* (Waters, 1878) [Eitan 1972; Ghobashy and El Komy 1980; d'Hondt 1988]
- *Schizoporella unicornis* (Johnston, 1847) [Waters 1909; Balavoine 1959; Hastings 1927; Ghobashy and El Komy 1980]
- *Schizoporella pungens* Canu and Bassler, 1928 [Balavoine 1959]
- *Schizoporella ansata* (Johnston, 1847) [Waters 1909 as *Schizoporella unicornis* var. *ansata*]
- *Schizoporella* sp. [Sternhell, Taylor and Itzhak 2002]

Stomachetosellidae

- *Cigclisula occlusa* (Busk, 1884) [Waters 1909 as *Lepralia occlusa*; Powell 1967, 1969; Dumont 1981]

Margarettidae

- *Margaretta cereoides* (Ellis and Solander, 1786) [Waters 1909 as *Tubucellaria*; Harmer 1957]
- *Margaretta gracilior* (Ortmann, 1892) [Harmer 1957; Powell 1969; Dumont 1981]
- *Margaretta tenuis* Harmer, 1957 [Harmer 1957; Powell 1969; Dumont 1981]
- *Margaretta mediterranea* (Canu, 1917) [Redier 1970 as *Tubucellaria*]

Hippopodinidae

- *Hippopodina feegenensis* (Busk, 1884) [Harmer 1957; Powell 1967, 1969; Dumont 1981; Tilbrook 1999]
- *Hippopodina pulcherrima* (Canu and Bassler, 1928) [Tilbrook 1999]
- *Thornelya ceylonica* (Thornely, 1905) [Dumont 1981]

Gigantoporidae

- *Cosciniopsis lonchaea* (Busk, 1884) [Waters 1909 as *Lepralia*; Harmer 1957; Redier 1970; Powell 1967; Dumont 1981]
- *Cosciniopsis globosa* Harmer, 1957 [Dumont 1981]
- ? *Cosciniopsis* sp [Scholz 2000]
- *Gigantopora pupa* (Jullien, 1903) [Balavoine 1959; Powell 1969; Dumont 1981]
- *Stenopsella fenestrata* (Smitt, 1873) [Waters 1909 and Dumont 1981 as *Gigantopora*]

Lanceoporidae

- *Calyptotheca wasinensis* (Waters, 1913) [Powell 1967, 1969; Dumont 1981; Amui and Kaselowsky 2006]
- *Calyptotheca nivea* (Busk, 1884) [Waters 1909 as *Schizoporella*; Balavoine 1959]
- *Calyptotheca heteroavicularia* Dumont, 1981 [Dumont 1981]
- *Calyptotheca nigra* Dumont, 1981 [Dumont 1981]
- *Calyptotheca sudanensis* Dumont, 1981 [Dumont 1981]
- *Emballothecha quadrata* (MacGillivray, 1880) [Waters 1909 as *Lepralia*]

Cryptosulidae

- *Cryptosula pallasiana* (Moll, 1803) [Waters 1909 as *Lepralia*; Ghobashy and El Komy 1980]

Insertae sedis

- *Robertsonidra argentea* (Hincks, 1881) [Waters 1909 as *Schizoporella*; Harmer 1957 as *Rhamphostomella*; Powell 1967; Dumont 1981]

Microporellidae

- *Microporella ciliata* (Pallas, 1766) [Waters 1909; Balavoine 1959; d'Hondt 1988, 2006; Sternhell, Taylor and Itzhak 2002]
- *Microporella coronata* (Audouin, 1826) [Audouin 1826 as *Flustra coronata* and *Flustra ombracula*; Waters 1909; Hastings 1927 as *M. ciliata* var. *coronata*; d'Hondt 2006]
- *Microporella genisii* (Audouin, 1826) [Audouin 1826 as *Flustra? Genisii*; d'Hondt 2006 as *M. ciliata*]
- *Microporella harmeri* Hayward, 1988 [Harmer 1957 as *M. orientalis* var.]
- *Microporella lunulifera* (Haswell, 1880) [Eitan 1972]
- *Microporella orientalis* Harmer, 1957 [Harmer 1957; Powell 1967; Dumont 1981; d'Hondt 1988; Scholz 2000; Sternhell, Taylor and Itzhak 2002]
- *Microporella personata* (Busk, 1854) [Waters 1909]

- *Fenestrulina malusii* (Audouin, 1826) [Waters 1909 as *Microporella*; Scholz 2000]

Petraliellidae

- *Mucropetraliella thenardii* (Audouin, 1826) [Balavoine 1959; Powell 1969; Dumont 1981; Scholz 2000 as *Mucropetraliella* cf. *thenardii*]
- *Mucropetraliella echinata* (Canu and Bassler, 1929) [Dumont 1981]
- *Mucropetraliella phillipinensis* (Canu and Bassler, 1929) [Dumont 1981]
- *Mucropetraliella robusta* (Canu and Bassler, 1929) [Dumont 1981]
- *Petraliella magna* (d'Orbigny, 1852) [Waters 1909 as *Lepralia japonica*; Harmer 1957, Powell 1967, 1969 and Dumont 1981 as *Hippopetraliella*; Tilbrook and Cook 2005]
- *Sinupetraliella* sp. [d'Hondt 1988]

Lacernidae

- *Arthropoma ceciliae* (Audouin, 1826) [Harmer 1957; Balavoine 1959; Redier 1970; Eitan 1972; Goren 1979; Dumont 1981; d'Hondt 1988; Scholz 2000 as *Arthropoma* cf. *ceciliae*]
- *Cribellopora trichotoma* (Waters, 1918) [Dumont 1981]
- *Phonicosia circinata* (MacGillivray, 1869) [Dumont 1981 as *Arthropoma*; Scholz 2000]

Escharinidae

- *Bryopesanser pesansensis* (Smitt, 1873) [Waters 1909 as *Schizoporella*; Harmer 1957, Dumont 1981, d'Hondt 1988 and Scholz 2000 as *Escharina*]
- *Escharina dutertrei* (Audouin, 1826) [Audouin 1826 as *Flustra? Dutertrei*; Waters 1909 as *Schizoporella*; Balavoine 1959 as *Mastigophorella*; d'Hondt 2006]

Crepidacanthidae

- *Crepidacantha poissonii* (Audouin, 1826) [Harmer 1957; Balavoine 1959; Dumont 1981; Scholz 2000]

Cleidochasmatidae

- *Characodoma protrusum* (Thornely, 1905) [Dumont 1981]

Celleporidae

- '*Turbicellepora*' *bernardii* (Audouin, 1826) [Waters 1909 as *Schizoporella*; Harmer 1957 as *Stephanosella*; not pl. 6, fig. 1 in Balavoine 1959; Powell 1967, 1969; Dumont 1981; d'Hondt 2006]
- '*Turbicellepora*' *redoutei* (Audouin, 1826) [Audouin 1826 as *Cellepora Redoutei*; Balavoine 1959 as *Celleporina*; Powell 1969 as *Schismopora*; d'Hondt 2006 as *Schizmopora*]
- ? *Turbicellepora tubigera* (Busk, 1859) [Namias 1892 as *Cellepora*]
- *Celleporina caminata* (Waters, 1879) [Redier 1970 as *Costazia*]
- *Celleporina costazii* (Audouin, 1826) [Audouin 1826 as *Cellepora Costazii*; Balavoine 1959; Dumont 1981; d'Hondt 1988, 2006]
- *Celleporina globulosa* (d'Orbigny, 1852) [d'Hondt 1988]
- *Celleporina lucida* (Hincks, 1880) [Scholz 2000]
- *Celleporina mangnevilleana* (Lamouroux, 1816) [Audouin 1826 as *Cellepora Boryi*; d'Hondt 2006]
- *Celleporina spatula* (MacGillivray, 1887) [Waters 1909 as *Lagenipora costazii* var. *spathulata*]
- *Celleporina protainii* (Audouin, 1826) [Audouin 1826 as *Cellepora Protainii*; d'Hondt 2006 as *Cellepora*]

- ? *Celleporina* sp. [Sternhell, Taylor and Itzhak 2002]
- *Lagenipora* sp. [Scholz 2000 as *Lagenipora* cf. *pinnacula*]
- *Predanophora longiuscula* (Harmer, 1957) [Waters 1909 as *Rhynchozoon corrugatum*; Harmer, 1957, Powell 1967, 1969 and Dumont 1981 as *Drepanophora*; Balavoine 1959 as *Microporella umbracula*]

Hippoporidridae

- *Odontoporella adpressa* (Busk, 1854) [Powell 1967 as *Hippopodinella*; Dumont 1981]
- '*Odontoporella*' ? *costulata* (Canu and Bassler, 1929) [Balavoine 1959 as *Scorpidinipora bernardii*]
- *Trematoecia turrata* (Smitt, 1873) [Dumont 1981]

Hippaliosinidae

- *Hippaliosina acutirostris* Canu and Bassler, 1929 [Powell 1967, 1969]

Phidoloporidae

- *Fodinella spinigera* (Philipps, 1900) [Dumont 1981 as *Hippoporella*]
- *Lifuella multidentata* (Thornely, 1905) [Dumont 1981 and Scholz 2000 as *Hippoporella*]
- *Rhynchozoon detectum* Harmer, 1957 [Dumont 1981; Scholz 2000 as *Rhynchozoon* cf. *detectum*]
- *Rhynchozoon haha* Hayward, 1988 [Scholz 2000 as *Rhynchozoon* cf. *haha*; Amui and Kaselowsky 2006]
- *Rhynchozoon incrassatum* (Hincks, 1882) [Hastings 1927 as *Schizoporella*; Powell 1969]
- *Rhynchozoon globosum* Harmer, 1957 [Powell 1967; Dumont 1981]
- *Rhynchozoon larreyi* (Audouin, 1826) [Balavoine 1959 as *Cellepora*; Harmer 1957; Powell 1969; Dumont 1981; Ristedt and Schuhmacher 1985; d'Hondt 1988]
- *Rhynchozoon tubulosum* (Hincks, 1880) [? Harmer 1957; Powell 1969; Dumont 1981]
- *Rhynchozoon* sp. [Sternhell, Taylor and Itzhak 2002]
- *Reteporella abyssinica* (Waters, 1909) [Waters 1909 as *Retepora*]
- ? *Reteporella expansa* (Waters, 1910) [Waters 1910 as *Retepora abyssinica* var. *expansa*]
- *Reteporella jermanensis* (Waters, 1909) [Waters 1909; Powell 1969 as *Retepora*; d'Hondt 1988]
- *Reteporella praetenuis* (Hincks, 1878) [Waters 1909 as *Retepora*; Powell 1969 as *Sertella*]
- *Reteporella cellulosa* (Linnaeus, 1758) [Waters 1909 as *Retepora*]
- *Reteporellina denticulata* (Busk, 1884) [Powell 1969 synonymized with *Reteporella abyssinica*; Scholz 2000 as *Reteporellina* cf. *denticulata*]
- *Plesiocleidochasma laterale* Harmer, 1957 [Powell 1967, 1969 and Dumont 1981 as *Cleidochasma*]
- *Schedocleidochasma porcellanum* (Busk, 1860) [Redier 1970 and Dumont 1981 as *Cleidochasma*]
- *Schizotheca serratimargo* (Hincks, 1886) [Waters 1909]
- *Triphyllozoon hirsutum* (Busk, 1884) [Waters 1909 as *Retepora*; Powell 1969]
- *Triphyllozoon tenue* (Kirkpatrick, 1888) [Amui and Kaselowsky 2006]

Mamilloporidae

- *Anoteropora latirostris* Silén, 1947 [Powell 1969; Cook 1966]
- *Anoteropora magnicapitata* Canu and Bassler, 1927 [Balavoine 1959]

ORDER CYCLOSTOMATA Busk, 1852

Suborder ARTICULINA Busk, 1852

Crisiidae

- *Filicrisia geniculata* (Milne-Edwards, 1838) [Hastings 1927 as *Crisia*]
- *Crisiella producta* (Smitt, 1865) [Waters 1910 as *Crisia*]
- *Crisia cylindrica* Busk, 1886 [Waters 1910]
- *Crisia cuneata* Maplestone, 1905 [Scholz 2000]
- *Crisia denticulata* (Lamarck, 1816) [Balavoine 1959; Waters 1910]
- *Crisia ramosa* Harmer, 1891 [Waters 1910]
- *Crisia kerguelensis* Busk, 1876 [Scholz 2000]
- *Crisia elongata* Milne Edward, 1838 [Goren 1979; Harmer 1926]
- *Crisia* sp. [Sternhell, Taylor and Itzhak 2002]
- *Crisia* sp. [Brood 1980]

Suborder TUBULIPORINA Milne-Edwards, 1838

Tubuliporidae

- *Idmidronea atlantica* (Forbes, 1838) [Balavoine 1959]
- *Tubulipora concinna* MacGillivray, 1885 [Goren 1979; Scholz 2000 as *Tubulipora* cf. *concinna*]
- *Tubulipora samuelsoni* Brood, 1980 [Brood 1980]

Pustuloporidae

- *Pustulopora danziensis* Brood, 1976 [Scholz 2000]
- *Pustulopora delicatula* Busk, 1875 [Brood 1980]

Entalophoridae

- *Entalophorecia deflexa* (Couch, 1844) [Namias 1892]

Diaperoeciidae

- *Diaperoecia major* (Johnston, 1847) [d'Hondt 1988]
- *Nevianipora pulcherrima* (Kirkpatrick, 1890) [Brood 1980]

Stomatoporidae

- ? *Proboscina incrassata* Smitt, 1865 [Balavoine 1959 *Stomatopora incrassata*]
- *Stomatopora* sp. [Scholz 2000]

Annectocymidae

- *Annectocyma tubulosa* (Busk, 1875) [Waters 1910 as *Filisarsa*]

Suborder RECTANGULINA Waters, 1887

Lichenoporidae

- *Lichenopora* sp. [Goren 1979]
- *Disporella boutani* Álvarez, 1995 [Waters 1910 and Balavoine 1959 as *Lichenopora radiata*; Álvarez 1995]
- *Disporella sibogae* Borg, 1944 [Brood 1980]
- *Disporella* sp. [Scholz 2000 as *Disporella* cf. *hispida*]

- ? *Disporella* sp. [Sternhell, Taylor and Itzhak 2002]

Insertae sedis

- ? *Biflustra delicatula* Busk, 1859 [Namias 1892; synonymized to *B. savartii* by Harmer, 1926]

- ? *Cellepora* sp. [Namias 1892]

- ? *flustra?* *Marcelii* (Audouin, 1826) [Audouin 1826; Waters 1909 as *Lepralia*]

- ? '*Smittia*' *spathulata* MacGillivray, 1883 [Waters 1909]

- ? *Retepora fissilabris* Busk [Waters 1909]

- ? *Retepora ? plana* [Waters 1909]

- ? *Lepralia* sp. [Waters 1909]

