Sponges of the Red Sea

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Abstract

Sponges are found in virtually all marine habitats. The Red Sea is no exception, harboring a diverse community of sponge species. However, the state of knowledge of the Red Sea sponge fauna remains in early stages. Various taxonomic efforts have been initiated, starting with early explorers at the beginning of the nineteenth century. Subsequently, published work has focused on modern taxonomic approaches, potential bioactive molecules, microbiological associations of host sponges, and a variety of ecological topics. The majority of studies are restricted to few locations and/or small numbers of species. Overall, this collective knowledge represents a sound foundation but there remains great potential for Red Sea sponges to inform the broader context of sponge work throughout the tropics. This chapter aims to provide an overview of previous work in the region and identify fruitful areas of potential future work.

Keywords

Porifera · Biodiversity · Taxonomy · Bioactive compounds · Ecology · Microbes

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6.1 Introduction

The Red Sea has long been recognized as a region of high biodiversity (Stehli and Wells 1971) and endemism (Ormond and Edwards 1987; DiBattista et al. 2016), for example, home to well over 1000 species of fishes and over 50 genera of hermatypic corals. Few comprehensive estimates of diversity are available for other taxa, but recent attempts to compile species lists estimate 635 polychaete species, 211 echinoderm species, and 79 ascidians (DiBattista et al. 2016). However, the Red Sea and Arabian region in general have been largely understudied compared to comparably biodiverse coral reef systems (Berumen et al. 2013; Vaughan and Burt 2016), and this is especially true for sponges. Further complicating an understanding of the Red Sea ecosystem, the majority of the accessible published research originates from a relatively short (~6 km) stretch of coastline in the far northern Red Sea within the Gulf of Eilat / Aqaba (hereafter Gulf of Aqaba) (e.g., Spaet et al. 2012). The Red Sea, however, is of increasing interest to scientists working on climate change due to its relatively high and variable water temperatures (from 20 °C in spring to 35 °C in summer) and high salinity (40.0 psu in the northern Red Sea; Edwards 1987), conditions that may reflect the near-future state of oceans in other parts of the world (e.g., Voolstra et al. 2015).

Sponges are integral members of benthic communities in virtually all aqueous habitats, ranging from polar seas (McClintock et al. 2005; Peters et al. 2009; Dayton et al.

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2013) to temperate and tropical waters (for an overview, see Bell 2008). In coral reef systems, sponges are important structural components and play important functional roles. They are efficient filter feeders, play crucial roles in carbon and nitrogen cycles in coral reef ecosystems, and exert control on plankton communities (Reiswig 1974; Pile et al. 1997; Savarese et al. 1997; Peterson et al. 2006; De Goeij et al. 2013). While many sponge species provide shelter and habitat for large numbers of invertebrates and fishes (e.g., Westinga and Hoetjes 1981; Pawlik 1983; Duffy 1992; Henkel and Pawlik 2005), they are themselves aggressive competitors for space (e.g., Targett and Schmahl 1984; Suchanek et al. 1985; Aerts 1998; Loh et al. 2015) due to the most prolific production of deterrent biochemical compounds among marine organisms (see Blunt et al. (2007) and subsequent publications in that series). They host diverse communities of symbiotic microorganisms that contribute to primary productivity and nitrification (Erwin and Thacker 2007; Southwell et al. 2008a, b; Gibson 2011) and may serve as valuable models for 'holobiont' co-evolution (Ryu et al. 2016; Thomas et al. 2016). Sponges have attracted the attention of climate change researchers as sponges may be resistant to warming seawater temperatures (Simister et al. 2012). In some locations, excavating sponges are among the primary agents of carbonate bioerosion on coral reefs (Rützler and Rieger 1973; Zundelevich et al. 2007), but other sponge species may also consolidate coral rubble and thus facilitate the settlement of coral (Wulff 1984). Most of the ecological work on sponges has been conducted in the Caribbean, where sponge communities appear to have similar community composition (i.e., relative abundances are fairly consistent) within the region and community biodiversity has been well documented (van Soest et al. 2012; Pawlik and Loh 2016).

The aim of this chapter is to provide an overview on the state of sponge research that has been conducted in the Red Sea. We also attempt to highlight areas of research that are lacking or other important knowledge gaps that may serve as a guide for future work.

6.2 Red Sea Sponge Biodiversity

Little is known about Red Sea sponge biodiversity in comparison to other regional sponge communities, for example, in Oman, Seychelles, India, and East Africa (van Soest and Beglinger 2008; Berumen et al. 2013). The earliest work on Red Sea sponges was conducted by early natural historians focused primarily on cataloging the biodiversity of the region. We identified 34 papers related to taxonomy of Red Sea sponges with 12 of them focused on larger regions with only one or two species from the Red Sea. The major source of early Red Sea sponge observations began in the late nineteenth century, with Haeckel (1870, 1872), Topsent (1892) and Keller (1889, 1891). These efforts continued well into the twentieth century with important publications from Topsent (1906), Row (1909, 1911), Burton (1926, 1952, 1959), and Lévi (1958, 1965). These studies were based on work with preserved material, which poses some challenges and creates the potential for some taxonomic confusion, as discussed later. Since 2000, 23 new species (13 from the Gulf of Aqaba and 10 from the main body of the Red Sea) have been described (Vacelet et al. 2001; Klautau and Valentine 2003; Ilan et al. 2004; Helmy et al. 2004, 2005; Gugel et al. 2011; Voigt et al. 2017; van Soest and de Voogd 2018). Only a few more recent works specifically address the biodiversity of sponges in the Red Sea (e.g. Ilan et al. 2004; Helmy and van Soest 2005; Erpenbeck et al. 2016b; Voigt et al. 2017; van Soest and de Voogd 2018), and in some cases researchers had to rely on older collection material (e.g. Klautau and Valentine 2003). One of the major impediments to continued discovery of new species was the difficulty for non-regional scientists to access the region and conduct research in Red Sea for many decades (see Berumen et al. 2013; Vaughan and Burt 2015). However, for a long period, studies focused mostly on the Gulf of Suez and Gulf of Aqaba in the north, while the central and southern Red Sea remained largely understudied (Berumen et al. 2013). Although there is some anecdotal evidence that present-day sponge communities have shifted over the past century (see Vacelet et al. 2001), studies on recently-collected material of a broader geographical range in the Red Sea (e.g., Giles et al. 2015; Erpenbeck et al. 2016b; Voigt et al. 2017; van Soest and de Voogd 2018) are still scarce, which hampers the understanding of current distribution of species.

A thorough evaluation of publications and of the World Porifera Database (WPD, van Soest et al. 2018) revealed 261 valid sponge species (representing 114 genera) from the Red Sea (compiled in Table 6.1). New species of Red Sea sponges are still being described (Vacelet et al. 2001; Klautau and Valentine 2003; Helmy et al. 2004; Gugel et al. 2011; Voigt et al. 2017; van Soest and de Voogd 2018), and it can be expected that more research effort will further enhance the understanding of the biodiversity and endemism of the Red Sea sponge fauna and its relation to the biota of the adjacent regions of the Indian Ocean. The inclusion of historic material (preferably type material) in the molecular analyses in an integrative approach will greatly contribute to our understanding of biodiversity, distribution, endemism, and faunal changes of the Red Sea (see discussion in Erpenbeck et al. 2016a).

The Red Sea's recognized sponge biodiversity is mainly comprised of species from the classes Demospongiae (225 species) and Calcarea (32 species). Much less is known about Homoscleromorpha (2 species) and about the glass sponges (Hexactinellida), a generally more deep-water

Table 6.1 List of sponges reported from the Red Sea. "Species" indicates the current accepted name for the sponge species. "Citation" lists the oldest known record of the species in the Red Sea (to the best of our knowledge). Note that in some cases, the original description of the species was from another geographic location; in these cases, the citation for the original species description is included in parentheses. Because many of the sponges have had taxonomic revisions since the original records shown in the "Citation" column, the "Previous Name(s)" column indicates the name(s) used in the work cited. (For a full taxonomic history of each species / genus, see the World Porifera Database (van Soest et al. 2018)). Finally, notes are included regarding the distribution of each taxa in the "Distribution (WPD)" column. "Present" indicates that the WPD currently reflects that this species' distribution includes the Red Sea. Species listed as "Endemic" are shown in the WPD to only occur inside the Red Sea. In some cases, the publication listed in the "Citation" column has reported a species in the Red Sea although the species' distribution in the WPD does not include the Red Sea; these cases are indicated as "Unreported". This more likely reflects the ongoing work of the WPD editors and not an intentional omission. For some species, the WPD shows a distribution including the Red Sea but explicitly acknowledges that the distribution has not been reviewed by WPD editors ("Not Reviewed"). Finally, one species is indicated to occur in the Red Sea but WPD editors have flagged this as "Doubtful". Please note that Table 6.1 is available as an electronic file (Appendix) including additional taxonomic information for each species (i.e., Class and Order)

Species	Citation	Previous names	Distribution (WPD)
Class Demospongiae			
Acarnus bergquistae	Yosief et al. (1998a) (original van Soest, Hooper & Hiemstra 1991)		Unreported
Acarnus thielei	Lévi (1958)		Endemic
Acarnus wolffgangi	Keller (1889)		Present
Agelas marmarica	Lévi (1958)		Present
Agelas mauritiana	Lévi (1965) (original Carter 1879)		Present
Amphimedon chloros	Ilan et al. (2004)		Endemic
Amphimedon dinae	Helmy & van Soest (2005)		Endemic
Amphimedon hamadai	Helmy & van Soest (2005)		Endemic
Amphimedon jalae	Helmy & van Soest (2005)		Endemic
Amphimedon ochracea	Keller (1889)	*Ceraochalina ochracea*	Endemic
Antho (Jia) wunschorum	van Soest, Rützler & Sim (2016)		Endemic
Aplysilla lacunosa	Keller (1889)		Endemic
Aplysina reticulata	Burton (1926) (original Lendenfeld 1889)		Present
Arenosclera arabica	Keller (1889)	*Arenochalina arabica*	Present
Astrosclera willeyana	Karlinska-Batres & Wörheide (2015) (original Lister 1900)		Unreported
Axinella quercifolia	Keller (1889)	*Antherochalina quercifolia, Querciclona quercifolia*	Endemic
Axinyssa gravieri	Lévi (1965) (original Topsent 1906)	*Pseudaxinyssa gravieri*	Present
Batzella aurantiaca	Lévi (1958)	*Prianos aurantiaca*	Present
Biemna ehrenbergi	Keller (1889)	*Acanthella ehrenbergi*	Present
Biemna fortis	Fishelson (1971) (original Topsent 1897)		Present
Biemna trirhaphis	Lévi (1961) (Topsent 1879)		Present
Cacospongia ridleyi	Burton (1952)		Present
Callyspongia (Callyspongia) siphonella	Lévi (1965)	*Siphonochalina siphonella*	Endemic
Callyspongia (Callyspongia) tubulosa	Burton (1926) (original Esper 1797)	*Siphonochalina tubulosa*	Present
Callyspongia (Cladochalina) subarmigera	Burton (1959) (original Ridley 1884)	*Callyspongia subarmigera*	Unreported
Callyspongia (Euplacella) communis	Burton (1926) (original Carter 1881)	*Siphonochalina communis*	Present
Callyspongia (Euplacella) densa	Keller (1889)		Endemic
Callyspongia (Euplacella) paralia	Ilan et al. (2004)	*Callyspongia paralia*	Endemic
Callyspongia (Toxochalina) dendyi	Vine (1986) (original Burton 1931)		Not reviewed
Callyspongia calyx	Keller (1889)	*Cacochalina calyx*	Endemic

(continued)

Table 6.1 (continued)

Species	Citation	Previous names	Distribution (WPD)
Callyspongia clavata	Keller (1889)	*Crella cyathophora, Phylosiphonia clavata*	Endemic
Callyspongia conica	Keller (1889)	*Phylosiphonia conica*	Present
Callyspongia crassa	Keller (1889)	*Sclerochalina crassa*	Endemic
Callyspongia fistularis	Topsent (1892)	*Sclerochalina fistularis*	Endemic
Callyspongia implexa	Topsent (1892)	*Ceraochalina implexa*	Endemic
Callyspongia incrustans	Row (1911)	*Spinosella incrustans*	Endemic
Callyspongia maculata	Keller (1889)	*Cacochalina maculata*	Endemic
Callyspongia reticulata	Keller (1889)	*Siphonochalina reticulata*	Present
Callyspongia sinuosa	Topsent (1892)	*Sclerochalina sinuosa*	Endemic
Callyspongia spongionelloides	Fishelson (1971)		Endemic
Callyspongia vasseli	Keller (1889)	*Phylosiphonia vasseli*	Endemic
Carteriospongia foliascens	Lévi (1958) (original Pallas 1766)	*Phyllospongia foliascens*	Present
Chalinula saudiensis	Vacelet et al. (2001)		Endemic
Chelonaplysilla erecta	Row (1911)	*Megalopastas erectus*	Endemic
Chondrilla australiensis	Keller (1891) (original Carter 1873)	*Chondrilla globulifera*	Present
Chondrilla mixta	Lévi (1958) (original Schulze 1877)	*Chondrillastra mixta*	Present
Chondrilla nucula	El Bossery et al. (2017) (original Schmitt et al. 2012)		Unreported
Chondrilla sacciformis	Richter et al. (2001) (original Carter 1879)		Unreported
Chondrosia debilis	Lévi (1958) (original Thiele 1900)		Present
Cinachyrella albatridens	Lévi (1965) (original Lendenfeld 1907)	*Cinachyra alba tridens*	Present
Cinachyrella alloclada	Barnathan et al. (2003) (original Uliczka 1929)		Unreported
Cinachyrella eurystoma	Keller (1891)	*Cinachyra eurystoma*	Endemic
Cinachyrella ibis	Row (1911)	*Chrotella ibis*	Endemic
Cinachyrella kuekenthali	Barnathan et al. (2003) (original Uliczka 1929)		Unreported
Cinachyrella schulzei	Keller (1891)	*Cinachyra schulzei*	Present
Cinachyrella trochiformis	Keller (1891)	*Cinachyra trochiformis*	Endemic
Clathria (Clathria) arbuscula	Row (1911)	*Litaspongia arbuscula, Ophlitaspongia arbuscula*	Endemic
Clathria (Clathria) horrida	Row (1911)	*Clathria horrida, Ophlitaspongia horrida*	Endemic
Clathria (Clathria) maeandrina	Burton (1959) (original Ridley 1884)	*Clathria maeandrina*	Unreported
Clathria (Clathria) spongodes	Burton (1959) (original Dendy 1922)	*Clathria spongiosa*	Present
Clathria (Clathria) transiens	Burton (1959) (original Hallmann 1912)	*Clathria transiens*	Unreported
Clathria (Thalysias) abietina	Burton (1959) (Lamarck 1814)	*Clathria aculeata*	Present
Clathria (Thalysias) cactiformis	Hooper, Kelly & Kennedy (2000) (original Lamarck 1814)		Not reviewed
Clathria (Thalysias) fusterna	Hooper (1997)	*Clathria fusterna*	Present
Clathria (Thalysias) lambda	Lévi (1958)	*Leptoclathria lambda*	Endemic
Clathria (Thalysias) lendenfeldi	Hooper, Kelly & Kennedy (2000) (Ridley & Dendy 1886)		Not reviewed
Clathria (Thalysias) procera	Burton (1959) (original Ridley 1884)		Present

(continued)

Table 6.1 (continued)

Species	Citation	Previous names	Distribution (WPD)
Clathria (Thalysias) vulpina	Burton (1959) (original Lamarck 1814)		Present
Clathria granulata	Keller (1889)	*Ceraochalina granulata*	Endemic
Cliona orientalis	Lévi (1958) (original Thiele 1900)		Present
Crambe acuata	Lévi (1958)	*Folitispa acuata*	Present
Crella (Grayella) cyathophora	Lévi (1958) (original Carter 1869)	*Grayella cyathophora*	Present
Crella (Grayella) papillata	Lévi (1958)		Present
Dactylospongia elegans	Abdelmohsen et al. (2014a) (original Thiele 1899)		Unreported
Damiria simplex	Keller (1891)		Present
Darwinella gardineri	Lévi (1958) (original Topsent 1905)		Present
Dercitus (Halinastra) exostoticus	Keller (1891) (original Schmidt 1868)		Endemic
Diacarnus erythraeanus	Kelly-Borges & Vacelet (1995)		Present
Diplastrella gardineri	Lévi (1958) (original Topsent 1918)		Present
Discodermia stylifera	Keller (1891)		Endemic
Dragmacidon coccineum	Keller (1891)	*Hymeniacidon coccinea, Pseudaxinella coccinea, Reniera coccinea, Stylissa coccinea,*	Present
Dragmacidon durissimum	Burton (1959) (original Dendy 1905)	*Axinella durissima*	Present
Dysidea aedificanda	Row (1911)	*Spongelia aedificanda*	Endemic
Dysidea cinerea	Keller (1889)	*Spongelia cinerea*	Present
Echinoclathria digitiformis	Row (1911)	*Ophlitaspongia digitiformis*	Endemic
Echinoclathria gibbosa	Keller (1889)	*Ceraochalina gibbosa, Xestospongia gibbosa*	Endemic
Echinoclathria robusta	Keller (1889)	*Halme robusta*	Endemic
Echinodictyum flabelliforme	Keller (1889)	*Acanthella flabelliformis*	Endemic
Echinodictyum jousseaumi	Lévi (1958) (original Topsent 1892)		Present
Ecionemia arabica	Lévi (1958)	*Hezekia arabica*	Endemic
Ecionemia spinastra	Lévi (1958)		Endemic
Erylus lendenfeldi	Carmely et al. (1989) (original Sollas 1888)		Unreported
Erylus proximus	Lévi (1958) (original Dendy 1916)		Present
Eurypon calypsoi	Lévi (1958)		Present
Eurypon polyplumosum	Lévi (1958)		Endemic
Euryspongia lactea	Row (1911)		Present
Fascaplysinopsis reticulata	Helmy et al. (2004) (original Hentschel 1912)		Present
Fasciospongia cavernosa	Kashman et al. (1973) (original Schmidt 1862)		Unreported
Fasciospongia lordii	Lendenfeld (1889)	*Stelospongia lordii*	Present
Gelliodes incrustans	Lévi (1965) (original Dendy 1905)		Present
Geodia arabica	Topsent (1892) (original Carter 1869)		Present
Geodia jousseaumei	Topsent (1906)	*Isops jousseaumei*	Present
Geodia micropunctata	Row (1911)		Endemic
Guitarra indica	Burton (1959) (original Dendy 1916)	*Guitarra fimbriata*	Unreported
Halichondria (Halichondria) glabrata	Keller (1891)	*Halichondria glabrata*	Endemic
Halichondria (Halichondria) granulata	Keller (1891)	*Halichondria granulata*	Endemic
Halichondria (Halichondria) isthmica	Keller (1891) (original Keller 1883)	*Amorphina isthmica*	Endemic

(continued)

Table 6.1 (continued)

Species	Citation	Previous names	Distribution (WPD)
Halichondria (Halichondria) minuta	Keller (1891)	*Halichondria minuta*	Endemic
Haliclona (Gellius) bubastes	Row (1911)	*Halichondria bubastes*	Endemic
Haliclona (Gellius) flagellifera	Burton (1959) (original Ridley and Dendy 1886)	*Haliclona flagellifera*	Unreported
Haliclona (Gellius) toxia	Lévi (1958) (original Topsent 1897)	*Toxiclona toxius, Gellius toxius*	Present
Haliclona (Haliclona) violacea	Keller (1883)	*Lessepsia violacea*	Endemic
Haliclona (Reniera) tabernacula	Row (1911)	*Reniera tabernacula, Haliclona tabernacula*	Present
Haliclona decidua	Topsent (1906)	*Reniera decidua*	Present
Haliclona pigmentifera	Burton (1959) (original Dendy 1905)	*Adocia pigmentifera*	Present
Haliclona ramusculoides	Row (1911) (original Topsent 1893)	*Chalina minor*	Present
Haliclona spinosella	Row (1911)	*Reniera spinosella*	Endemic
Halisarca laxus	Lévi (1958) (original Lendenfeld 1889)	*Bajalus laxus*	Present
Hemimycale arabica	Ilan, Gugel & van Soest (2004)		Endemic
Higginsia arborea	Keller (1891)	*Allantella arborea, Trachytedania arborea*	Present
Higginsia higgini	Lévi (1958) (original Dendy 1922)		Present
Higginsia pumila	Keller (1889)	*Axinella pumila*	Endemic
Hyattella globosa	Lendenfeld (1889)		Endemic
Hyattella tubaria	Helmy et al. (2004) (Lendenfeld 1889)		Present
Hymedesmia (Hymedesmia) lancifera	Topsent (1906)	*Leptosia lancifera, Hymedesmia lancifera*	Present
Hymedesmia (Hymedesmia) rowi	Row (1911) (original van Soest 2017)	*Myxilla (Myxilla) tenuissima*	Endemic
Hymeniacidon calcifera	Row (1911)		Endemic
Hymeniacidon zosterae	Row (1911)		Endemic
Hyrtios communis	Row (1911) (original Carter 1885)	*Psammopemma commune*	Present
Hyrtios erectus	Keller (1889)	*Dysidea nigra, Heteronema erecta, Duriella nigra*	Present
Iotrochota baculifera	Lévi (1965) (original Ridley 1884)		Present
Ircinia atrovirens	Keller (1889)	*Hircinia atrovirens*	Endemic
Ircinia echinata	Keller (1889)	*Hircinia echinata*	Present
Ircinia ramosa	Keller (1889)	*Hircinia ramosa*	Present
Ircinia variabilis	Burton (1926) (original Schmidt 1862)	*Hircinia variabilis*	Unreported
Jaspis albescens	Row (1911)	*Coppatias albescens*	Endemic
Jaspis reptans	Lévi (1965) (original Dendy 1905)		Present
Jaspis sollasi	Burton & Rao (1932)	*Amphius sollasi*	Endemic
Jaspis virens	Lévi (1958)		Endemic
Lamellodysidea herbacea	Keller (1889)	*Carteriospongia cordifolia, Spongelia herbacea, Dysidea herbacea, Phyllospongia cordifolia, Spongelia delicatula*	Present
Levantiniella levantinensis	Tsurnamal (1969) (Vacelet, Bitar, Carteron, Zibrowius & Pérez 2007)	*Chrotella cavernosa*	Present
Lissodendoryx (Lissodendoryx) cratera	Row (1911)	*Myxilla cratera*	Endemic
Lissodendoryx (Waldoschmittia) schmidti	Lévi (1958) (original Ridley 1884)	*Damiriana schmidti*	Present
Lithoplocamia lithistoides	Burton (1959) (original Dendy 1922)		Present
Monanchora quadrangulata	Lévi (1958)	*Fasuberea quadrangulata*	Endemic

(continued)

Table 6.1 (continued)

Species	Citation	Previous names	Distribution (WPD)
Mycale (Aegogropila) sulevoidea	Burton (1959) (original Sollas 1902)	*Mycale sulevoidea*	Unreported
Mycale (Arenochalina) anomala	Burton (1952) (original Ridley & Dendy 1886)	*Esperiopsis anomala, Parisociella anomala*	Unreported
Mycale (Arenochalina) euplectellioides	Row (1911)	*Esperella euplectellioides*	Endemic
Mycale (Arenochalina) setosa	Keller (1889)	*Gelliodes setosa*	Endemic
Mycale (Carmia) erythraeana	Row (1911)	*Esperella erythraeana*	Endemic
Mycale (Carmia) fistulifera	Row (1911)	*Esperella fistulifera*	Endemic
Mycale (Carmia) suezza	Row (1911)	*Esperella suezza*	Endemic
Mycale (Mycale) dendyi	Row (1911)	*Esperella dendyi*	Endemic
Mycale (Mycale) grandis	Lévi (1958) (original Grey 1867)	*Mycale grandis*	Present
Myrmekioderma niveum	Row (1911)	*Anacanthaea nivea*	Endemic
Myrmekioderma tuberculatum	Keller (1891)	*Halichondria tuberculatum*	Endemic
Myxilla (Burtonanchora) gracilis	Lévi (1965)	*Burtonanchora gracilis*	Endemic
Negombata corticata	Carter (1879)		Present
Negombata magnifica	Keller (1889)	*Latrunculia magnifica*	Endemic
Neopetrosia contignata	Burton (1959) (original Thiele 1899)	*Haliclona contignata*	Present
Niphates furcata	Keller (1889)	*Pachychalina furcata*	Endemic
Niphates obtusispiculifera	Burton (1959) (original Dendy 1905)		Present
Niphates rowi	Ilan, Gugel & van Soest (2004)		Endemic
Oceanapia elastica	Keller (1891)	*Reniera elastica*	Present
Oceanapia incrustata	Burton (1959) (original Dendy 1922)		Present
Pachychalina alveopora	Topsent (1906)		Present
Paratetilla bacca	Row (1911) (original Selenka 1867)	*Paratetilla eccentrica*	Present
Petrosia (Petrosia) elephantotus	Ilan, Gugel & van Soest (2004)	*Petrosia elephantotus*	Endemic
Petrosia (Petrosia) nigricans	Burton (1959) (original Lindgren 1897)	*Petrosia nigricans*	Unreported
Phakellia palmata	Row (1911)		Endemic
Phakellia radiata	Burton (1959) (original Dendy 1916)		Present
Phorbas epizoaria	Lévi (1958)	*Pronax epizoaria*	Endemic
Phyllospongia lamellosa	Hassan et al. (2015) (original Esper (17940)		Unreported
Phyllospongia papyracea	Lévi (1958) (original Esper 1794)		Present
Pione mussae	Keller (1891)	*Cliona mussae, Sapline mussae*	Endemic
Pione vastifica	Ferrario et al. (2010) (original Hancock 1849)	paper says probably conspecific	Unreported
Psammoclema arenaceum	Lévi (1958)	*Psammopemma arenaceum*	Endemic
Psammoclema rubrum	Lévi (1958)	*Psammopemma*	Endemic
Pseudoceratina arabica	Keller (1889)	*Psammaplysilla arabica*	Present
Pseudoceratina purpurea	Rotem et al. (1983) (original Carter 1880)	*Psammaplysilla purpurea*	Unreported
Pseudosuberites andrewsi	Vine (1986) (original Kirkpatrick 1900)		Not reviewed
Ptilocaulis spiculifer	Rudi et al. (1999) (original Lamarck 1814)		Present
Rhabdastrella sterrastraea	Row (1911)	*Diastra sterrastraea*	Endemic

(continued)

Table 6.1 (continued)

Species	Citation	Previous names	Distribution (WPD)
Rhabderemia batatas	Ilan, Gugel & van Soest (2004)		Endemic
Rhabderemia indica	Burton (1959) (original Dendy 1905)		Present
Scalarispongia aqabaensis	Helmy, El Serehy, Mohamed & van Soest (2004)		Present
Spheciospongia inconstans	Lévi (1965) (original Dendy 1887)	*Spirastrella inconstans*	Present
Spheciospongia mastoidea	Keller (1891)	*Suberites mastoideus*	Endemic
Spheciospongia vagabunda var. *arabica*	Hooper and van Soest (2002) (original Topsent 1893)		Not reviewed
Spirastrella decumbens	Lévi (1958) (original Ridley 1884)		Present
Spirastrella pachyspira	Lévi (1958)		Present
Spongia (Spongia) arabica	Keller (1889)	*Spongia arabica, Spongia officinalis* var. *arabica*	Endemic
Spongia (Spongia) irregularis	Lévi (1965) (original Lendenfeld 1889)	*Spongia irregularis*	Present
Spongia (Spongia) lesleighae	Helmy, El Serehy, Mohamed & van Soest (2004)		Endemic
Spongia (Spongia) officinalis var. *exigua*	Lévi (1965) (original Schulze 1879)	*Spongia officinalis* f. *exigua*	Present
Spongia lacinulosa	Lamarck (1814)		Present
Stelletta parva	Row (1911)	*Pilochrota parva*	Endemic
Stelletta purpurea	Lévi (1958) (original Ridley 1884)	*Myriastra purpurea*	Present
Stelletta siemensi	Keller (1891)		Endemic
Stellettinopsis solida	Lévi (1965)		Present
Strongylacidon inaequale	Burton (1959) (original Hentschel 1911)	*Strongylacidon inaequalis*	Unreported
Stylissa carteri	Keller (1889) (original Dendy 1889)	*Acanthella aurantiaca, axinella carteri*	Present
Suberea mollis	Row (1911)	*Verongia mollis, Aplysina mollis*	Present
Suberea praetensa	Row (1911)	*Aplysina praetensa*	Present
Suberea purpureaflava	Gugel, Wagler & Brümmer (2011)		Endemic
Suberites clavatus	Keller (1891)		Endemic
Suberites kelleri	Keller (1891) (original Burton 1930)	*Suberites incrustans*	Present
Suberites tylobtusus	Lévi (1958)	*Suberites tylobtusa*	Endemic
Tedania (Tedania) anhelans	Burton (1959) (original Vio in Olivi 1792)	*Tedania nigrescens*	Unreported
Tedania (Tedania) assabensis	Keller (1891)	*Tedania assabensis, Tedania anhelans* var. *assabensis*	Present
Terpios lendenfeldi	Keller (1891)		Endemic
Terpios viridis	Keller (1891)		Endemic
Tethya japonica	Topsent (1906) (originial Sollas 1888)	*Donatia japonica*	Present
Tethya robusta	Burton (1926) (original Bowerbank 1873)	*Donatia robusta, Donatia arabica*	Present
Tethya seychellensis	Lévi (1958) (original Wright 1881)		Present
Tetilla diaenophora	Lévi (1958)		Endemic
Tetilla poculifera	Row (1911) (original Dendy 1905)		Present
Theonella conica	Lévi (1958) (original Kieschnick 1896)		Present
Theonella mirabilis	El Bossery et al. (2017) (original de Laubenfels 1954)		Unreported
Theonella swinhoei	Lévi (1958) (original Grey 1868)		Present
Timea intermedia	Lévi (1958)	*Timeopsis intermedia*	Endemic
Topsentia aqabaensis	Ilan, Gugel & van Soest (2004)	*Epipolasis aqabaensis*	Endemic
Topsentia halichondrioides	Burton (1926) (original Dendy 1905)	*Trachyopsis halichondrioides*	Present
Xestospongia ridleyi	Keller (1891)	*Reniera ridleyi*	Endemic

(continued)

Table 6.1 (continued)

Species	Citation	Previous names	Distribution (WPD)
Xestospongia testudinaria	Burton (1959) (Lamarck 1815)	Petrosia testudinaria	Present
Class Hexactinellida			
Neoaulocystis polae	Ijima (1927)	*Aulocystis polae*	Endemic
Tretocalyx polae	Schulze (1901)		Endemic
Class Homoscleromorpha			
Plakortis erythraena	Lévi (1958)		Endemic
Plakortis nigra	Lévi (1958) (original Levi 1953)		Present
Class Calcarea			
'Arturia' adusta	van Soest & de Voogd (2018) (original Wörheide & Hooper et al. 2000)	*Clathrina adusta*	Present. Genus affiliation to *Arturia* requires revision Voigt et al. (2017).
Arturia darwinii	Vine (1986) (original Haeckel 1870)	*Clathrina darwinii*	Not reviewed
Arturia sueziana	Row (1909) (original Klautau & Valentine 2003)	*Clathrina sueziana* Klautau, *Clathrina canariensis* var. *compacta*	Endemic
Arturia tenuipilosa	Burton 1952 (original Dendy 1905)	*Leucosolenia tenuipilosa*	Doubtful
Borojevia aff. aspina	Voigt et al. (2017)		Unreported
Borojevia voigti	van Soest & de Voogd (2018)		Endemic
Clathrina ceylonensis	Vine (1986) (original Dendy 1905)		Not reviewed
Clathrina maremeccae	van Soest & de Voogd (2018)		Endemic
Clathrina rotundata	Voigt et al. (2017)		Endemic
Clathrina rowi	Voigt et al. (2017)		Endemic
Clathrina sinusarabica	Klautau & Valentine (2003)		Endemic
Ernstia arabica	Voigt et al. (2017)		Endemic
Grantessa woerheidei	van Soest & de Voogd (2018)		Endemic
Grantilla quadriradiata	Row (1909)		Endemic
Kebira uteoides	Row (1909)		Endemic
Leucandra aspera	Row (1909)		Unreported
Leucandra bathybia	Lévi (1965) (original Haeckel 1869)	*Leuconia bathybia*	Present
Leucandra pulvinar	Haeckel (1872) (original Haeckel 1870)	*Mlea dohrnii Maclay*	Present
Leucandrilla intermedia	Row (1909)	*Leucilla intermedia*	Endemic
Leucetta chagosensis	Wörheide et al. (2008) (original Dendy 1913)		Present
Leucetta microraphis	Voigt et al. (2017) (original Haeckel 1872)		Unreported
Leucetta primigenia	Haeckel (1872)		Unreported
Leucetta pyriformis	van Soest & de Voogd (2018) (original Dendy 1913)		Present
Paraleucilla crosslandi	Row (1909)	*Leucilla crosslandi*	Endemic
Soleneiscus hamatus	Voigt et al. (2017)		Endemic
Sycettusa glabra	Row (1909)	*Grantessa glabra*	Endemic
Sycettusa hastifera	Row (1909)	*Grantessa hastifera, Grantilla hastifera*	Present
Sycettusa hirsutissima	van Soest & de Voogd (2018)		Endemic
Sycettusa stauridia	Row (1909) (original Haeckel 1872)	*Grantessa stauridia*	Present
Sycon ciliatum	Row (1909)	*Sycon coronatum*	Unreported
Sycon proboscideum	Haeckel (1872) (original Haeckel (1870)	*Syconella proboscideum*	Endemic 'species inquirenda van Soest & de Voogd (2018)'
Sycon raphanus	Haeckel (1872)		Unreported

affiliated class (2 species). The latter two classes likely have many more representatives in the Red Sea, but they have not yet been described.

6.2.1 Demosponge Diversity of the Red Sea

A large portion of the taxonomic work on Red Sea demosponges is based on monographs of Keller (1889, 1891), Row (1911), and Lévi (1958, 1961, 1965), subsequently complemented by other authors (e.g., Topsent 1892, 1906; Burton 1952, 1959; Kelly Borges and Vacelet 1995; Vacelet et al. 2001; Helmy et al. 2004; Ilan et al. 2004; Helmy and van Soest 2005; Gugel et al. 2011). The majority of these studies were almost entirely based on morphology. Studies on demosponges that use DNA sequencing were only recently employed to understand biodiversity patterns (e.g., Eid et al. 2011) and to apply integrative taxonomy methods (including phylogenetic analyses of DNA data, DNA barcodes and morphology).

Initial results to date on the largest molecular biodiversity survey on Red Sea demosponges (Erpenbeck et al. 2016b), summarizing the results of 1014 sponge specimens collected along the Saudi-Arabian coastline, revealed a dominance of dictyoceratid and haplosclerid operational taxonomic units (OTUs) collected from 0 m to approximately 30 m depth. Both orders constitute taxonomically challenging taxa, highlighting the need for more thorough research among those groups.

DNA sequence comparisons to other Indo-Pacific demosponge faunas indicated high endemism in the Red Sea with about 35% of the molecular sponge OTUs being shared with samples from other regions of the Indo-Pacific (Erpenbeck et al. 2016b). This study revealed several allegedly widespread Indo-Pacific species to be Red Sea endemics, such as the abundant keratose sponge *Hyrtios erectus* (Keller 1889). The Indo-Pacific "*Hyrtios erectus*" constitutes a species complex with *Hyrtios erectus* restricted to the Red Sea, and other, yet-unnamed species in other Indo-Pacific regions outside the Red Sea (Erpenbeck et al. 2017).

The results from *Hyrtios erectus* corroborated previous findings and hypotheses that the level of endemism among other marine invertebrates is underestimated (Klautau et al. 1999; Miloslavich et al. 2011): However, several Red Sea sponge species share DNA barcodes with Indonesian and other distant Indo-Pacific samples, such as *Spheciospongia vagabunda* and *Stylissa carteri* (Erpenbeck et al. 2017). *Stylissa carteri* (Fig. 6.2) has also been subject to the most extensive population genetic structure in the Red Sea at present. Giles et al. (2013a, 2015) analyzed microsatellite data of *S. carteri* samples collected from the Gulf of Aqaba to Socotra in the Arabian Sea and provided the first evidence for a latitudinal environmental gradient influencing sponge populations in the Red Sea. A gene flow barrier around the Farasan Islands, not fully explainable with the regional currents alone, separates the southern from the central and northern Red Sea *S. carteri* populations (Giles et al. 2015). In another demosponge species, *Astrosclera willeyana*, community structure and genetic diversity were explored across the species' range throughout the Indo-Pacific, with the Red Sea having its own haplotype (Wörheide 2006). Nevertheless, further studies in the Red Sea are clearly required to obtain a broader insight into Red Sea Sponge diversity and connectivity patterns.

6.2.2 Calcareous Sponge Diversity of the Red Sea

Most of the recognized species of calcareous sponges in the Red Sea were identified and described on material collected in the nineteenth and early twentieth century. Descriptions by Row (1909) are based on poorly preserved material, and often only one or very few specimens. These early reports include several species that were originally found in other oceans and climates but were considered to have a 'cosmopolitan' distribution. Newer studies have shown that some of these assumed 'cosmopolitan' species reported from the Red Sea constitute distinct species (e.g. *Clathrina sinusarabica* (Valentine and Klautau 2003), which was previously identified as the 'cosmopolitan' species *Clathrina primordialis*). Also, early reports of cold water species such as *Sycon 'coronatum'* (originally described from the North Sea) or *Sycon raphanus* (originally described from the Adriatic Sea) in the Red Sea have to be doubted. In particular, Haeckel (1872) sometimes provided relatively unspecific descriptions of species and did not specify type localities, making the identification of these species almost impossible (for example for *Leucetta primigenia,* Table 6.1). Newly collected material and the application of integrative taxonomic approaches revealed additional species (Voigt et al. 2017; van Soest and de Voogd 2018), as is the case in many other regions where such methods were applied to calcareous sponges (e.g., Imešek et al. 2014; Azevedo et al. 2015; Klautau et al. 2016).

At least 15 species of calcareous sponges are reported as Red Sea endemics (e.g., *Kebira uteoides* and *Clathrina sinusarabica* (Fig. 6.1)). However, because the calcareous sponge faunas of the adjacent Indian Ocean regions are also understudied, it is possible at least some of these typical Red Sea calcareous sponges will be found in adjacent regions in the future. Only a few Red Sea Calcarea appear to be more widespread in the Indo-Pacific, for example *Leucetta chagosensis* or *Leucetta microraphis*, but in both cases, it remains even unclear if the Red Sea specimens represent different (possibly cryptic) species (Wörheide et al. 2008; Voigt et al. 2017).

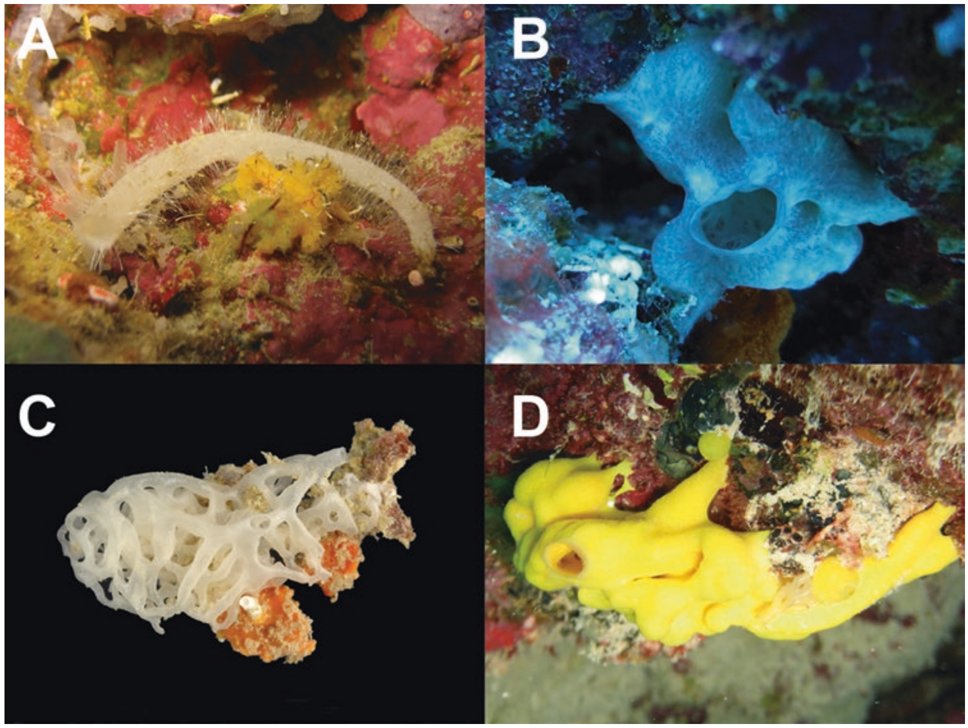

Fig. 6.1 Representative calcareous sponges (class Calcarea) of the Red Sea: (**a**) *Sycettusa hastifera* (Calcaronea, Heteropiidae); (**b**) *Kebira uteoides* (Calcaronea, Lelapiidae); (**c**) *Clathrina sinusarabica* (Calcinea, Clathrinidae); (**d**) *Leucetta chagosensis* (Calcinea, Leucettidae)

6.3 Publications on Red Sea Sponge Biology

A total of 236 publications including sponges of the Red Sea (including a handful of taxonomic papers from larger regions that only have 1 or 2 species in the Red Sea (but a first Red Sea record of a species)) were reviewed. These publications date from 1814 to early 2018 and cover 5 broad research categories: bioactive compounds, ecology, microbiology, molecular biology, and taxonomy. Red Sea sponge research increased rapidly in the last two decades with 167 of the 236 papers published since 2000. Only 51 of the pre-2000 publications were not among the reports of early taxonomy exploration. Of the 236 publications, 122 were related to bioactive compounds, 47 were ecology-focused, 27 addressed microbial aspects, 33 were taxonomy-oriented, and 7 explored molecular biology of Red Sea sponges. In publications not solely focused on taxonomy, a total of 62 sponge species were identified (i.e., at the species level and not only at a genus or higher level). Among these 62 sponge species, 29 species were noted in more than one publication and the other 33 species each appeared in only one publication.

6.3.1 Bioactive Compounds of Red Sea Sponges

A large portion of the reviewed publications describe studies of secondary metabolites of Red Sea sponges. Marine sponges are a potentially valuable source of novel natural compounds because of the diversity of secondary biological compounds they produce, most of which are not found in terrestrial organisms. Sponges are the most prolific source of new organic structures with bioactive properties; sponge-derived compounds exceed those recovered from other marine organisms by far (see Blunt et al. 2007). From the compounds extracted from Red Sea sponges to date, many have been shown to possess anti-cancer, anti-microbial, anti-inflammatory, anti-malarial, and anti-viral properties, along with other specificities as seen in Table 6.2. A multitude of studies suggests a further development of these structures towards medical applications (Faulkner 2000; Newman and Cragg 2004; Sipkema et al. 2005; Mehbub et al. 2014), such as new antibiotics for the ongoing race against antibiotic resistance. With relatively high species diversity and possibly high endemism in the Red Sea, there is a reasonable expectation that Red Sea sponges could yet yield a large number of novel compounds. Table 6.2 shows the sponges studied in the bioactive molecule publications and the associated source references.

6.3.2 Ecology of Red Sea Sponges

Although there are only 47 ecological publications on Red Sea sponges, they span a wide range of topics. Seven publications (not all exclusively focused on ecology) addressed the reproductive biology of several species (Ilan and Loya 1988, 1990, 1995; Ilan and Vacelet 1993; Meroz and Ilan

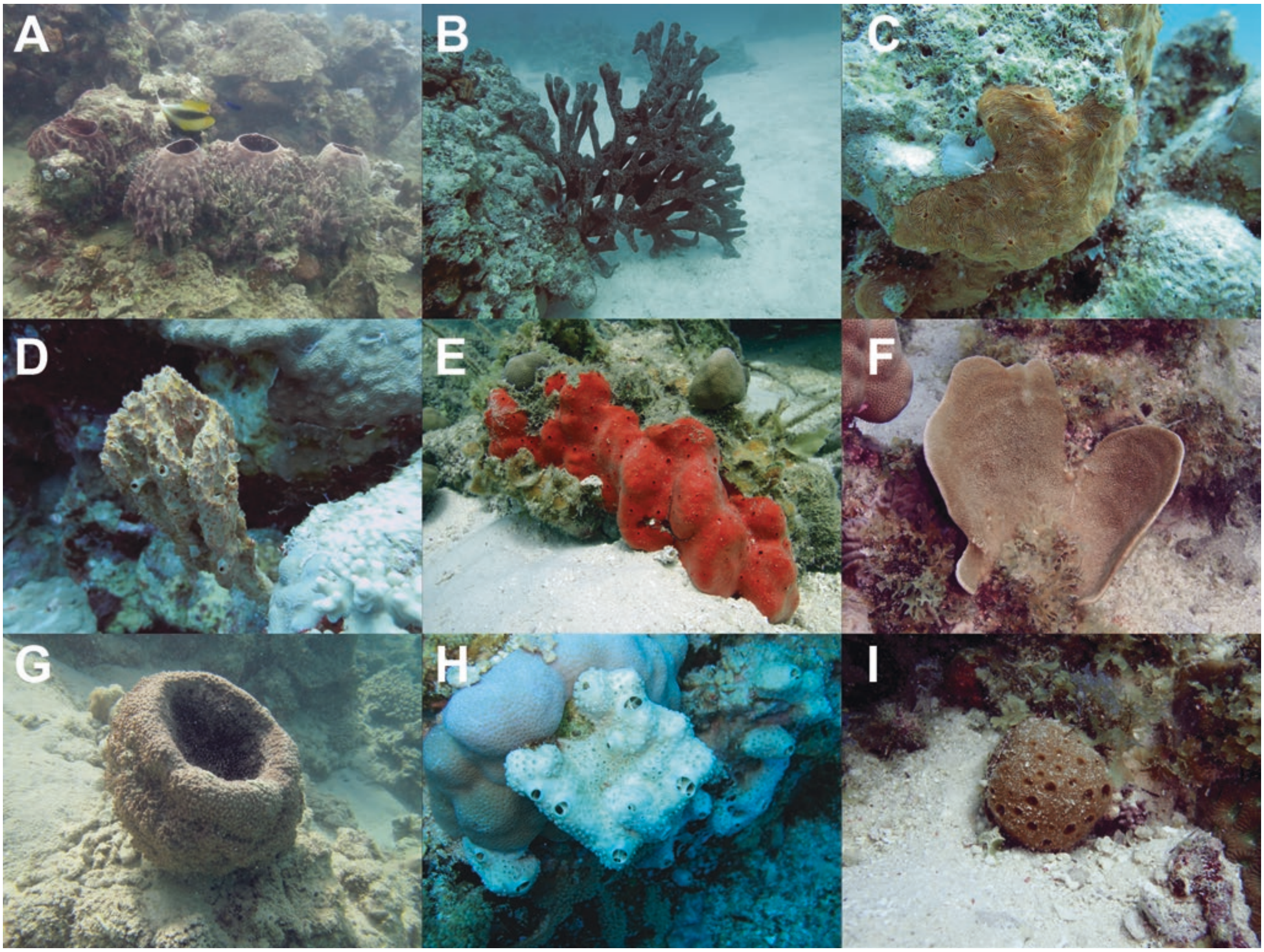

Fig. 6.2 Some common demosponges (Class Demospongiae) of the Red Sea. (**a**) *Xestospongia testudinaria* (Haplosclerida, Petrosiidae), a large massive sponge; (**b**) *Hyrtios* cf. *erectus* (Dictyoceratida, Thorectidae) with erect and branching growth form; (**c**) *Chalinula*? sp. (Haplosclerida, Chalinidae), an encrusting sponge; (**d**) *Stylissa carteri* (Scopalinida, Scopalinidae); (**e**) *Pione* cf. sp. (Clionaida, Clionaidae), a bioeroding sponge; (**f**) *Carteriospongia* sp. (Dictyoceratida, Thorectidae), a foliose sponge; (**g**) *Ircinia echinata* (Dictyoceratida, Iciniidae), a common, massive sponge; (**h**) *Crella* (*Grayella*) *cyathophora* (Poecilosclerida, Crellidae); (**i**) *Cinachyrella* sp. (Tetractinellida, Tetillidae)

1995b; Ilan et al. 2004; Oren et al. 2005). Seven publications examined feeding ecology, such as diet composition and feeding rates, including uptake of DOC, DOM, POM, viruses, and plankton (Yahel et al. 1998, 2003, 2005; Hadas et al. 2006, 2009; Genin et al. 2009). Rix et al. (2016) specifically studied the uptake of coral mucus (DOM) by encrusting sponges, which converted the DOM into detritus and thus brought it back into the food web. Rix et al. (2017) further considered DOM uptake in sponges by looking at the uptake rates of DOM from different sources (coral and algae). Rix et al. (2018) showed the transfer of organic matter from corals to sponges whose detritus was taken up by detritivores using stable isotopes. Several papers explored the symbiotic relationship between sponges and other associated macrofauna such as cirripedia, scyphozoans, mesostigmatid mites, polychaetes, barnacles, and many others (Kolbasov 1990; Meroz and Ilan 1995a; Ramadan 1997; Magnino et al. 1999; Ilan et al. 1999; Kandler 2015). A variety of other topics are addressed in some papers, such as dispersal out of the Red Sea (Tsurnamal 1969), publications identifying specific habitats and environmental conditions of sponges (Fishelson 1966; Fishelson 1971; Ilan and Vacelet 1993; Ilan and Abelson 1995; Reitner et al. 1996; Steindler et al. 2001), aspects of life history (Meroz and Ilan 1995b), the role of sponges in nitrogen cycling and primary production (Rix et al. 2015), various physical and chemical defenses employed by sponges (Burns and Ilan 2003, Burns et al. 2003, Ilan and Loya 1995), uptake of chemical defense by a spongivorous nudibranch (Mebs 1985), competition among benthic fauna (Rinkevich et al. 1993), bioerosion (Zundelevich et al. 2007), metabolism, O_2 dynamics inside the sponge, and photosynthetic responses to dim light

Table 6.2 Sponge species that have been the subject of secondary metabolite research

Species	References	Category of study
Aaptos aaptos	Rudi and Kashman (1993)	NP
Acarnus bergquistae	Yosief et al. (1998a)	NP
Amphimedon chloros	Ajabnoor et al. (1991), Kelman et al. (2009)	Blood glucose levels, AM
Amphimedon viridis	Kelman et al. (2001)	AM
Biemna ehrenbergi	Kelman et al. (2009), Youssef et al. (2015a)	AM, NP and AM
Biemna fortis	Delseth et al. (1979)	NP
Callyspongia crassa	Ibrahim et al. (2017)	(AC, AI, AM)
Callyspongia (Callyspongia) siphonella	Shmueli et al. (1981), Carmely and Kashman (1986), Kashman et al. (2001), Jain et al. (2007a), Jain et al. (2007b), Jain et al. (2009), Kelman et al. (2009), Abraham et al. (2010), Angawi et al. (2014), Foudah et al. (2014), Al-Massarani et al. (2015), Amina et al. (2016), Ibrahim et al. (2017), Ahmed A et al. (2018)	NP, NP, NP, reversal of cancer chemotherapy resistance with new NP, AC, AC multidrug resistance with new NP, AM, AC, AC with new NP, AC (new NP), AC and AM and Anti-viral), Binding properties to BSA, NP (AC and AM), new NP and inhibitationn of RANKL indused osteoclastogensis
Callyspongia aff. *implexa*	Abdelmohsen et al. (2010), Abdelmohsen et al. (2015), Elsayed et al. (2017)	AM, AM and new NP, new NP (AM and antitrypanosomal)
Callyspongia fistularis	Youssef et al. (2003a)	NP
Callyspongia spp.	Youssef et al. (2003b), Youssef et al. (2000), Abdelwahed et al. (2014), Shaala et al. (2016)	NP and AC, NP, Extract from fungus, NP and AC
Chalinula saudiensis	Al-Sofyani et al. (2011)	NP
Cinachyrella alloclada,	Barnathan et al. (2003)	NP
Cinachyrella kuekenthali	Barnathan et al. (2003)	NP
Clathria sp.	Rudi et al. (2001)	NP and anti-HIV RT
Crella (Grayella) cyathophora	El-Damhougy et al. (2017)	(AC, AM, AI)
Diacarnus erythraeanus	El Sayed et al. (2001), Lefranc et al. (2013), Youssef et al. (2001), Youssef (2004)	(Antimalarial, Antiviral, and Antitoxoplasmosis with new NP), AC with new NP, NP, NP and AC
Dragmacidon coccineum	Abou-Hussein et al. (2014)	NP and AI
Dysidea herbacea	Carmely et al. (1990)	NP
Dysidea sp.	Gebreyesusa et al. (1988)	NP
Echinoclathria gibbosa	Mohamed et al. (2014b)	(AC, AM, AI, antipyretic, and hepatoprotective activities)
Echinoclathria sp.	Abdelhameed et al. (2017)	New NP (AC and AI)
Erylus sp. (possibly *lendenfeldi*)	Goobes et al. (1996)	NP
Erylus lendenfeldi	Carmely et al. (1989), Fouad et al. (2004), Sandler et al. (2005)	Anti-tumor and AF (new NP), NP and AM and AF, NP and cytotoxicity against a yeast strain (Δrad50)
Fasciospongia cavernosa	Kashman et al. (1973)	NP
Haliclona sp.	Al-Massarani et al. (2016)	NP and AC
Hemimycale arabica	Mudit et al. (2009), Youssef et al. (2015b), Ahmed H et al. (2018)	NP and AC, NP (AM and AC), AC
Hippospongia sp.	Guo et al. (1997), Guo and Trivellone (2000)	NP
Hyrtios erectus	Youssef et al. (2002), Kashman and Rudi (1977), Youssef (2005), Youssef et al. (2005), Sauleau et al. (2006), Ashour et al. (2007), Abdelmohsen et al. (2010), Alarif et al. (2016), Elhady et al. (2016a, b), Sameh et al. (2016), Walied et al. (2016), El-Gendy et al. (2017), Hawas et al. (2018), Alahdal et al. (2018), Abd El Moneam et al. (2018)	NP and AC, NP, NP and AC, AM with new NP, NP and anti-venom, AC and AM and new NP, AM, NP and AC, NP and AC, NP and AC, AC with new NP, AC with new NP, AC and hepatitis inhibition from endophytic fungi AC with new NP, AC with (Anti Helicobacter and Antitubercular, new NP and liver toxicity
Hyrtios spp.	Youssef et al. (2004), Youssef et al. (2013), Shady et al. (2017)	NP and AM, NP and (AM, free radical scavenging and AC), NP and (AI, anti-pyretic, analgesic activities)
Lamellodysidea herbacea	Kashman and Zviely (1979), Sauleau and Bourguet-Kondracki (2005), Sauleau et al. (2005)	NP, NP and AF, NP
Latrunculia corticata	Řezanka and Dembitsky (2003)	NP and antifeeding (chemical defense)
Leucetta cf. *chagosensis*	Dunbar et al. (2000)	AF and Nitric Oxide Synthase Inhibitory with new NP
Mycale (Arenochalina) euplectellioides	Mohamed et al. (2014a). Gamal et al. (2014), Abdelhameed et al.(2016)	AI and hepato-protective, NP with (AM, AI, hepato-protective, AC), NP with anti-choline esterase activity
Negombata corticata	Ahmed et al. (2008)	Anti-epileptic with new NP

(continued)

Table 6.2 (continued)

Species	References	Category of study
Negombata magnifica	Neeman et al. (1975), Kashman et al. (1980), Spector et al. (1983), Mebs (1985), Gillor et al. (2000), Vilozny et al. (2004), Abdelmohsen et al. (2010), El-Damhougy et al. (2017), Ahmed H et al. (2018)	NP, NP, disrupt microfilament organization in cultured cells, NP and chemical defense, Immunolocalization, NP, AM, AC, AC
Niphates rowi	Gesner et al. (2005)	NP
Niphates sp.	Talpir et al. (1992)	NP
Petrosia sp.	Abdel-Lateff et al. (2014)	NP and AC
Phyllospongia lamellosa	Hassan et al. (2015)	NP and AC and AM
Prianos sp. (could be *Batzella aurantiaca*)	Kashman and Rotem (1979), Sokoloff et al. (1982)	NP, AM and AF
Pseudoceratina arabica	Badr et al. (2008), Shaala et al. (2015b), Shaala et al. (2012)	NP and parasympatholytic effects, NP and AC, NP and AC
Pseudoceratina purpurea	Rotem et al. (1983)	NP
Ptilocaulis spiculifer	Rudi et al. (1998), Rudi et al. (1999)	NP, NP
Raspailia sp.	Yosief et al. (1998b), Yosief et al. (2000)	NP, AC with NP
Siphonochalina sp.	Rotem and Kashman (1979)	NP
Spheciospongia vagabunda var. *arabica*	Abdelmohsen et al. (2010), Eltamany et al. (2014a), Eltamany et al. (2014b), Abdelmohsen et al. (2014b), Eltamany et al. (2015)	AM, AM with new NP, AC with new NP, NP and antiparasitic (from sponge associated bacterium), NP and AC
Stylissa carteri	Mancini et al. (1997), O'Rourke et al. (2016), Hamed et al. (2018)	NP, Anti-HIV, AC
Suberea mollis	Abou-Shoer et al. (2008), Shaala et al. (2011), Shaala et al. (2012), Abbas et al. (2014)	NP and AM and anti-oxidant, NP (AM, anti-oxidant, AC), NP and AC, hepatoprotective
Suberea spp.	Shaala et al. (2015a), Shaala and Almohammadi (2017)	NP and AC, new NP (AC and AM)
Theonella mirabilis	Abou-Hussein and Youssef (2016)	NP and AC
Theonella swinhoei	Youssef and Mooberry (2006), Tabares et al. (2012), Youssef et al. (2014)	NP and AC, NP, NP and AF and AC
Toxiclona toxius	Isaacs and Kashman (1992)	NP
Xestospongia testudinaria	El-Shitany et al.(2015), El-Gamal et al. (2016)	NP (AI, antioxidant, and immunomodulatory), NP and AC
Reviews	Kashman et al. (1982), Kashman et al. (1989), Kalinin et al. (2012), El-Ezz et al. (2017)	
Other	Shaaban et al. (2012), Abdelmohsen et al. (2014a), Afifi and Khabour (2017)	Inhibits oxidative stress, New Actinomycetes, AM
Undescribed sp.	Guo et al. (1996)	NP

The broad category of each study is indicated: Natural products (NP); Anti-microbial (AM); Anti-cancer (AC), Anti-fungal (AF), Anti-inflammatory (AI), etc. Where multiple studies used a given species, the categories are listed respectively for each study separated by a comma. See References section for full details of each study

(Hadas et al. 2008; Lavy et al. 2016; Beer and Ilan 1998), heavy metal accumulation (Pan et al. 2011), elemental composition of some sponge species (Mayzel et al. 2014), the discovery of chitin in skeletons of non-verongiid demosponges (Ehrlich et al. 2018; Żółtowska-Aksamitowska et al. 2018), sea ranching (Hadas et al. 2005), and effects of water movement on zonation (Sara et al. 1979). There were several publications that we placed in the ecology category which were not actually specifically focused on sponges but instead more generally assessed benthic fauna with only peripheral attention to sponges (e.g., Hoeksema et al. 2016). Many of these publications are discussed further with respect to reported distribution and density of Red Sea sponges.

Beyond biodiversity studies, there is a distinct lack of data about the abundance and coverage of sponges in the Red Sea. Benthic surveys in the Red Sea typically report very low values. For example, Benayahu and Loya (1981) found that sponges constitute about 1% of reef cover and that their space utilization is negligible. Surveys that quantify sponges on Red Sea reefs are very rare and do not exist for most parts of the Red Sea. Some publications do offer some examples of abundance of the community or at least of the study species. Meroz and Ilan (1995b) used belt transects (10 m × 0.6 m) to survey the number and percent coverage of the sponge *Mycale fistulifera* at 3, 6, 10, and 20 m depths at 2 reefs at the end of winter and summer. The number of colonies generally decreased with depth. The highest occurrence of colonies was found on one of the reefs with an average of 9 colonies at 3 m depth, but the overall density was approximately 3.7 individuals per transect at one of the sites. The highest percent coverage was ~ 33 cm^2 / m^2 at 6 m depths on one reef (see Figure 2 in Meroz and Ilan (1995b)). Yahel

(1998) used 0.25 m^2 quadrats and quantified sponges in four taxon categories: *Mycale fistulifera*, *Cliona* sp., unrecognized blue sponge, and "other sponges"; these had average densities of 0.12, 0.38, 0.91, and 0.31 individuals/quadrat, respectively, and % occurrences (i.e., presence/absence from 65 quadrats) of 9.2, 24.6, 50.8, and 18.5%, respectively. Perkol-Finkel and Benayahu (2005) followed stages of benthic community development on a purpose-planned artificial reef. They primarily focused on corals and compared the developing community to a nearby natural reef. After 10 years, the artificial reef was dominated by the sponge *Crella cyatophora*, which contributed 35% (± SE 13.38) of the living cover on the artificial reef compared to 0.08% (± 0.18 SE) on the natural reef. In another example of a temporal study, Rix et al. (2015) noted that visible sponge cover was constant throughout the year, averaging 1.2 ± 0.9% and that the non-cryptic sponge community was dominated by the abundant encrusting sponge *Mycale fistulifera*, which accounted for 65% of the visible sponge cover at 10 m depth. More recently, Ellis et al. (2017) conducted cross-shelf benthic surveys using point-count assessment of 1m^2 photo quadrats. They found a higher sponge abundance on inshore reefs (up to 5% cover).

It is important to note that standard (visual) benthic survey approaches may not fully reveal the abundance of sponges on a reef. Many species are endolithic or otherwise reside inside the reef matrix, thus masking their potential ecological importance. Richter et al. (2001) developed endoscopic techniques to explore the extensive crevices common in the physical framework of Red Sea reefs. Their approach revealed a large internal surface (2.5–7.4 m^2 per projected m^2 of reef); sponges dominated in the posterior sections of these crevices, constituting 51–73% of the coelobite cover. This highlights that sponges are more abundant than they seem because they are often living out of sight of most standard visual surveys. Pearman et al. (2016) compared various benthic diversity assessments including standard visual reef surveys, photo analysis of Autonomous Reef Monitoring Structures (ARMS) plates, and metabarcoding fauna collected from ARMS. Visual surveys found ~1% of benthic cover to be sponges, while the photo analysis of the ARMS plates had up to about 25% cover, and metabarcoding revealed slightly under 30% of the reads as sponges. Again, these results demonstrate the inadequacy of standard visual surveys for quantifying sponge abundance.

Compared with other important reef organisms, sponges have been greatly neglected in quantitative studies. The principal reasons for this are taxonomic problems, due to great variability in shape and size, and difficulties in quantification, partly because most sponge biomass is not readily visible using standard survey techniques. In the Red Sea, sponges are sometimes left out of or not reported in reef surveys because of their relatively low abundance (Benayahu and Loya 1981; Furby et al. 2013). Even in the few Red Sea studies that did attempt to include sponges, point-intercept or line-intercept transect methods were used, but these methods only provide insight to the relative rate of occurrence of individual sponge colonies (or even just morphologies) with limited further quantitative application (e.g., Roberts et al. 2016). In some cases, even when grouped into one single "sponge" category, the cover measured by these methods is typically <1% (Khalil et al. 2017). To more fully assess the ecological role of sponges, more detailed measurements, such as surface area or biomass, are needed. Methods using photographic quadrats are potentially useful for sponge surveys because percent cover can be easily derived from the photographs, and morphometric measurements can be used to calculate volume or size for more uniformly-shaped sponge species. When conducting surveys *in situ*, the use of quadrats may help to focus a researcher and enable intense investigations in crevices and the space in-between corals to search for sponges that are out of sight (and thus typically overlooked in belt transects or intercept-based methods). While there is reasonable knowledge about the diversity of sponges occurring in the Red Sea (see Table 6.1), data from a wider variety of depths and geographic locations would be helpful. Most of the published surveys conducted today to date are at a single depth (usually about 10 m) with the majority in the Gulf of Aqaba (Berumen et al. 2013).

6.3.3 Microbiology of Red Sea Sponges

Microbiology-related studies are a major area of research for sponges. Sponges can have a large proportion of their biomass comprised of bacteria and it is believed that many of the bioactive molecules from sponges are synthesized by bacterial inhabitants (Taylor et al. 2007). The 27 studies that focused on the microbial communities of the sponges from the Red Sea do not seem to have applied a systematic approach within this collective body of work, and they represent a wide range of topics that are not directly addressing questions that are specific to the Red Sea. The publications included, for example, aspects of nitrogen fixation (Wilkinson and Fay 1979), better bacterial culturing methods (Lavy et al. 2014; Keren et al. 2016), and bacterial tolerance to heavy metals (Keren et al. 2015, 2017). Several studies investigated the composition of the bacterial communities in sponges (Radwan et al. 2010; Lee et al. 2011; Schmitt et al. 2012, Karlinska-Batres and Wörheide et al. 2015), with some researchers employing phylogenetic approaches (Steindler et al. 2005). There was one phylogenetic analysis and biological evaluation of marine fungi isolated from the Red Sea *Hyrtios erectus* (El-Gendy et al. 2017). The bacterial phylum Actinobacter was sometimes specifically targeted as it includes Actinomycetes (particularly sought after for bioactive molecules) (Bergman et al. 2011; Abdelmohsen et al. 2014a, b; Kämpfer et al. 2015; Elsayed et al. 2018). One study found a novel lineage of *Marinobacter* (Lee et al. 2012) while another found a new N-Acyl homoserine lactone synthase in an uncultured symbiont (Britstein et al. 2016). Sponge species are commonly assigned either to a group that contains a high abundance of microbes (high microbial abundance (HMA)), or a group with relatively low abundances of microbes (low microbial abundance (LMA)) (Gloeckner et al. 2014). Giles et al. (2013b) specifically investigated the bacterial community of three LMA sponges. Beyond characterizations of the microbial communities, Gao et al. (2015) examined the changes in microbial communities found in healthy tissues compared to disease-like tissues; the healthy tissue hosted mostly Proteobacteria, Cyanobacteria, and Bacteroidetes, while there was a shift in the disease-like tissues that was enriched with a novel clade affiliated with the phylum Verrucomicrobia. Gao et al. (2014a) also showed shifts in bacterial communities between healthy and abnormal tissue. Oren et al. (2005) found evidence of vertical transmission of cyanobacteria from adults to larvae. Others have looked at the microbial meta-genomes and attempted to determine the functional role of the bacteria contained within the sponges (Gao et al. 2014b; Bayer et al. 2014; Moitinho-Silva et al. 2014a, b). One study found quorum sensing signal production by sponge associated bacteria (Yahia et al. 2017).

6.4 Potential Future Research Directions

Even though there has been increased interest in sponge research in the region recently, many questions remain to be answered and the Red Sea remains a poorly-understood system in many aspects. A large effort is still needed to fully document the sponge species present in the Red Sea. This knowledge gap has important consequences beyond simply cataloging biodiversity. Our present understanding of sponge diversity in the region is insufficient to recognize, for example, if there are changes to the community caused by anthropogenic disturbances, such as rapid coastal development or changes due to coral bleaching events. Although there are many gaps and important information missing, insight may be gained from reviewing the early natural history expeditions and the valuable historical records they provide. Future sponge biodiversity surveys could explicitly check to see if the same species are still present in the areas where they were originally recorded more than 100 years ago (although the fragmentary nature of the earliest data may present some challenges in such a comparison). The application of modern molecular techniques to accompany traditional morphological identifications is important ongoing work that will provide more clarity and will help to resolve some taxonomic uncertainties.

We have noted the need for a better understanding of the biodiversity, distribution, and the coverage of sponges so that a proper baseline knowledge of the Red Sea sponge community is available. Even though previous works have covered a wide range of topics, most of the topics have been addressed by only a small number of studies and there remain important topics that have yet to be investigated at all. For example, we were not able to find any studies addressing whether sponge population sizes or community composition in the Red Sea are controlled by top-down or bottom-up effects. As far as we are aware, no publication systematically examined predation on sponges in the Red Sea, nor did we find any publications discussing food or nutrient limitations impacting sponges. This type of information could provide some insight to more general questions about Red Sea sponge ecology. Are sponges in the Red Sea found more readily in crevices in shallower water because they need to be hidden from predators or is it simply because there is too much competition for space with more efficient colonizers?

The Red Sea may yet hold important insights for the ecology of coral reefs under predicted climate change scenarios (Voolstra et al. 2016). With further understanding of the biogeography and biology of the regional sponge fauna, it may be possible to ask questions about how sponges elsewhere will cope with expected environmental changes. For example, do endemic Red Sea sponges possess (or express) genetic traits or adaptations that may be latent (or unexpressed) traits in their Indian Ocean ancestors? Such traits could for the basis for the rapid emergence of heat tolerant phenotypes (e.g., Dixon et al. 2015). Very little is currently known about the biogeography or evolutionary history of Red Sea sponges, but work in other taxa suggests that the Red Sea has the potential to export biodiversity to the wider Indo-Pacific (Bowen et al. 2013; Berumen et al. 2017). There is clearly much work left to do to enhance our understanding of Red Sea sponge communities, how they interact with other organisms in the ecosystems, and the potential role they will play in Indo-Pacfic reefs under future climate scenarios.

Appendix

Electronic version of the list of sponges reported from the Red Sea. "Species" indicates the current accepted name for the sponge species. Taxonomic classification ("Class" and "Order") are provided for each species. "Citation" lists the oldest known record of the species in the Red Sea (to the best of our knowledge). Note that in some cases, the original description of the species was from another geographic location; in these cases, the citation for the original species description is included in parentheses. Because many of the sponges have had taxonomic revisions since the original records shown in the "Citation" column, the "Previous Name(s)" column indicates the name(s) used in the work cited. (For a full taxonomic history of each species / genus, see the World Porifera Database (van Soest et al. 2018)). Finally, notes are included regarding the distribution of each taxa in the "Distribution (WPD)" column. "Present" indicates that the WPD currently reflects that this species' distribution includes the Red Sea. Species listed as "Endemic" are shown in the WPD to only occur inside the Red Sea. In some cases, the publication listed in the "Citation" column has reported a species in the Red Sea although the species' distribution in the WPD does not include the Red Sea; these cases are indicated as "Unreported". This more likely reflects the ongoing work of the WPD editors and not an intentional omission. For some species, the WPD shows a distribution including the Red Sea but explicitly acknowledges that the distribution has not been reviewed by WPD editors ("Not Reviewed"). Finally, one species is indicated to occur in the Red Sea but WPD editors have flagged this as "Doubtful".

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Calcarea	Clathrinida	*'Arturia' adusta*	van Soest & de Voogd (2018) (original Wörheide & Hooper 2000)	*Clathrina adusta*	Present. Genus affiliation to Arturia requires revision (Voigt et al. 2017).
Calcarea	Clathrinida	*Arturia darwinii*	Vine (1986) (original Haeckel 1870)	*Clathrina darwinii*	Not reviewed
Calcarea	Clathrinida	*Arturia sueziana*	Row (1909) (original Klautau & Valentine 2003)	*Clathrina sueziana* Klautau, *Clathrina canariensis* var. *compacta*	Endemic
Calcarea	Clathrinida	*Arturia tenuipilosa*	Burton (1952) (original Dendy 1905)	*Leucosolenia tenuipilosa*	Doubtful
Calcarea	Clathrinida	*Borojevia aff. aspina*	Voigt et al. (2017)		Unreported
Calcarea	Clathrinida	*Borojevia voigti*	van Soest & de Voogd (2018)		Endemic
Calcarea	Clathrinida	*Clathrina ceylonensis*	Vine (1986) (original Dendy 1905)		Not reviewed
Calcarea	Clathrinida	*Clathrina maremeccae*	van Soest & de Voogd (2018)		Endemic
Calcarea	Clathrinida	*Clathrina rotundata*	Voigt et al. (2017)		Endemic
Calcarea	Clathrinida	*Clathrina rowi*	Voigt et al. (2017)		Endemic
Calcarea	Clathrinida	*Clathrina sinusarabica*	Klautau & Valentine (2003)		Endemic
Calcarea	Clathrinida	*Ernstia arabica*	Voigt et al. (2017)		Endemic
Calcarea	Clathrinida	*Leucetta chagosensis*	Wörheide et al. (2008) (original Dendy 1913)		Present
Calcarea	Clathrinida	*Leucetta microraphis*	Voigt et al. (2017) (original Haeckel 1872)	*Leucetta primigenia* var. *microraphis*	Unreported
Calcarea	Clathrinida	*Leucetta primigenia*	Haeckel (1872)		Unreported
Calcarea	Clathrinida	*Leucetta pyriformis*	van Soest & de Voogd (2018) (original Dendy 1913)		Present
Calcarea	Clathrinida	*Soleneiscus hamatus*	Voigt et al. (2017)		Endemic
Calcarea	Leucosolenida	*Grantessa woerheidei*	van Soest & de Voogd (2018)		Endemic
Calcarea	Leucosolenida	*Grantilla quadriradiata*	Row (1909)		Endemic
Calcarea	Leucosolenida	*Kebira uteoides*	Row (1909)		Endemic
Calcarea	Leucosolenida	*Leucandra aspera*	Row (1909)		Unreported
Calcarea	Leucosolenida	*Leucandra bathybia*	Lévi (1965) (original Haeckel 1869)	*Leuconia bathybia*	Present
Calcarea	Leucosolenida	*Leucandra pulvinar*	Haeckel (1872) (original Haeckel 1870)	*Mlea dohrnii* Maclay	Present
Calcarea	Leucosolenida	*Leucandrilla intermedia*	Row (1909)	*Leucilla intermedia*	Endemic

(continued)

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Calcarea	Leucosolenida	*Paraleucilla crosslandi*	Row (1909)	*Leucilla crosslandi*	Endemic
Calcarea	Leucosolenida	*Sycettusa glabra*	Row (1909)	*Grantessa glabra*	Endemic
Calcarea	Leucosolenida	*Sycettusa hastifera*	Row (1909)	*Grantessa hastifera, Grantilla hastifera*	Present
Calcarea	Leucosolenida	*Sycettusa hirsutissima*	van Soest & de Voogd (2018)		Endemic
Calcarea	Leucosolenida	*Sycettusa stauridia*	Row (1909) (original Haeckel 1872)	*Grantessa stauridia*	Present
Calcarea	Leucosolenida	*Sycon ciliatum*	Row (1909)	*Sycon coronatum*	Unreported
Calcarea	Leucosolenida	*Sycon proboscideum*	Haeckel (1872) (original Haeckel 1870)	*Syconella proboscideum*	Endemic 'species inquirenda van Soest & de Voogd 2018'
Calcarea	Leucosolenida	*Sycon raphanus*	Haeckel (1872)		Unreported
Demospongiae	Agelasida	*Agelas marmarica*	Lévi (1958)		Present
Demospongiae	Agelasida	*Agelas mauritiana*	Lévi (1965) (original Carter 1883)		Present
Demospongiae	Agelasida	*Astrosclera willeyana*	Karlinska-Batres & Wörheide (2015) (original Lister 1900)		Unreported
Demospongiae	Axinellida	*Axinella quercifolia*	Keller (1889)	*Antherochalina quercifolia, Querciclona quercifolia*	Endemic
Demospongiae	Axinellida	*Dragmacidon coccineum*	Keller (1891)	*Hymeniacidon coccinea, Pseudaxinella coccinea, Reniera coccinea, Stylissa coccinea,*	Present
Demospongiae	Axinellida	*Dragmacidon durissimum*	Burton (1959) (original Dendy 1905)	*Axinella durissima*	Present
Demospongiae	Axinellida	*Echinodictyum flabelliforme*	Keller (1889)	*Acanthella flabelliformis*	Endemic
Demospongiae	Axinellida	*Echinodictyum jousseaumi*	Lévi (1958) (original Topsent 1892)		Present
Demospongiae	Axinellida	*Eurypon calypsoi*	Lévi (1958)		Present
Demospongiae	Axinellida	*Eurypon polyplumosum*	Lévi (1958)		Endemic
Demospongiae	Axinellida	*Higginsia arborea*	Keller (1891)	*Allantella arborea, Trachytedania arborea*	Present
Demospongiae	Axinellida	*Higginsia higgini*	Lévi (1958) (original Dendy 1922)		Present
Demospongiae	Axinellida	*Higginsia pumila*	Keller (1889)	*Axinella pumila*	Endemic
Demospongiae	Axinellida	*Lithoplocamia lithistoides*	Burton (1959) (original Dendy 1922)		Present
Demospongiae	Axinellida	*Myrmekioderma niveum*	Row (1911)	*Anacanthaea nivea*	Endemic
Demospongiae	Axinellida	*Myrmekioderma tuberculatum*	Keller (1891)	*Halichondria tuberculatum*	Endemic
Demospongiae	Axinellida	*Phakellia palmata*	Row (1911)		Endemic
Demospongiae	Axinellida	*Phakellia radiata*	Burton (1959) (original Dendy 1916)		Present
Demospongiae	Axinellida	*Ptilocaulis spiculifer*	Rudi et al. (1999) (original Lamarck 1814)		Present
Demospongiae	Biemnida	*Biemna ehrenbergi*	Keller (1889)	*Acanthella ehrenbergi*	Present
Demospongiae	Biemnida	*Biemna fortis*	Fishelson (1971) (original Topsent 1897)		Present
Demospongiae	Biemnida	*Biemna trirhaphis*	Lévi (1961) (Topsent 1879)		Present
Demospongiae	Biemnida	*Rhabderemia batatas*	Ilan, Gugel & van Soest (2004)		Endemic
Demospongiae	Biemnida	*Rhabderemia indica*	Burton (1959) (original Dendy 1905)		Present

(continued)

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Demospongiae	Chondrillida	*Chondrilla australiensis*	Keller (1891) (original Carter 1873)	*Chondrilla globulifera*	Present
Demospongiae	Chondrillida	*Chondrilla mixta*	Lévi (1958) (original Schulze 1877)	*Chondrillastra mixta*	Present
Demospongiae	Chondrillida	*Chondrilla nucula*	El Bossery et al. (2017) (original Schmidt 1862)		Unreported
Demospongiae	Chondrillida	*Chondrilla sacciformis*	Richter et al. (2001) (original Carter 1879)		Unreported
Demospongiae	Chondrillida	*Halisarca laxus*	Lévi (1958) (original Lendenfeld 1889)	*Bajalus laxus*	Present
Demospongiae	Chondrosiida	*Chondrosia debilis*	Lévi (1958) (original Thiele 1900)		Present
Demospongiae	Clionaida	*Cliona orientalis*	Lévi (1958) (original Thiele 1900)		Present
Demospongiae	Clionaida	*Diplastrella gardineri*	Lévi (1958) (original Topsent 1918)		Present
Demospongiae	Clionaida	*Pione mussae*	Keller (1891)	*Cliona mussae, Sapline mussae*	Endemic
Demospongiae	Clionaida	*Pione vastifica*	Ferrario et al. (2010) (original Hancock 1849)	paper says probably conspecific	Unreported
Demospongiae	Clionaida	*Spheciospongia inconstans*	Lévi (1965) (original Dendy 1887)	*Spirastrella inconstans*	Present
Demospongiae	Clionaida	*Spheciospongia mastoidea*	Keller (1891)	*Suberites mastoideus*	Endemic
Demospongiae	Clionaida	*Spheciospongia vagabunda var. arabica*	Hooper and van Soest (2002) (original Topsent 1893)		Not reviewed
Demospongiae	Clionaida	*Spirastrella decumbens*	Lévi (1958) (original Ridley 1884)		Present
Demospongiae	Clionaida	*Spirastrella pachyspira*	Lévi (1958)		Present
Demospongiae	Dendroceratida	*Aplysilla lacunosa*	Keller (1889)		Endemic
Demospongiae	Dendroceratida	*Chelonaplysilla erecta*	Row (1911)	*Megalopastas erectus*	Endemic
Demospongiae	Dendroceratida	*Darwinella gardineri*	Lévi (1958) (original Topsent 1905)		Present
Demospongiae	Dictyoceratida	*Cacospongia ridleyi*	Burton (1952)		Present
Demospongiae	Dictyoceratida	*Carteriospongia foliascens*	Lévi (1958) (original Pallas 1766)	*Phyllospongia foliascens*	Present
Demospongiae	Dictyoceratida	*Dactylospongia elegans*	Abdelmohsen et al. (2014a) (original Thiele 1899)		Unreported
Demospongiae	Dictyoceratida	*Dysidea aedificanda*	Row (1911)	*Spongelia aedificanda*	Endemic
Demospongiae	Dictyoceratida	*Dysidea cinerea*	Keller (1889)	*Spongelia cinerea*	Present
Demospongiae	Dictyoceratida	*Euryspongia lactea*	Row (1911)		Present
Demospongiae	Dictyoceratida	*Fascaplysinopsis reticulata*	Helmy et al. (2004) (original Hentschel 1912)		Present
Demospongiae	Dictyoceratida	*Fasciospongia cavernosa*	Kashman et al. (1973) (original Schmidt 1862)		Unreported
Demospongiae	Dictyoceratida	*Fasciospongia lordii*	Lendenfeld (1889)	*Stelospongia lordii*	Present
Demospongiae	Dictyoceratida	*Hyattella globosa*	Lendenfeld (1889)		Endemic
Demospongiae	Dictyoceratida	*Hyattella tubaria*	Helmy et al. (2004) (Lendenfeld 1889)		Present
Demospongiae	Dictyoceratida	*Hyrtios communis*	Row (1911) (original Carter 1885)	*Psammopemma commune*	Present
Demospongiae	Dictyoceratida	*Hyrtios erectus*	Keller (1889)	*Dysidea nigra, Heteronema erecta, Duriella nigra*	Present
Demospongiae	Dictyoceratida	*Ircinia atrovirens*	Keller (1889)	*Hircinia atrovirens*	Endemic
Demospongiae	Dictyoceratida	*Ircinia echinata*	Keller (1889)	*Hircinia echinata*	Present
Demospongiae	Dictyoceratida	*Ircinia ramosa*	Keller (1889)	*Hircinia ramosa*	Present

(continued)

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Demospongiae	Dictyoceratida	*Ircinia variabilis*	Burton (1926) (original Schmidt 1862)	*Hircinia variabilis*	Unreported
Demospongiae	Dictyoceratida	*Lamellodysidea herbacea*	Keller (1889)	*Carteriospongia cordifolia, Spongelia herbacea, Dysidea herbacea, Phyllospongia cordifolia, Spongelia delicatula*	Present
Demospongiae	Dictyoceratida	*Phyllospongia lamellosa*	Hassan et al. (2015) (original Esper 1794)		Unreported
Demospongiae	Dictyoceratida	*Phyllospongia papyracea*	Lévi (1958) (original Esper 1794)		Present
Demospongiae	Dictyoceratida	*Scalarispongia aqabaensis*	Helmy, El Serehy, Mohamed & van Soest (2004)		Present
Demospongiae	Dictyoceratida	*Spongia (Spongia) arabica*	Keller (1889)	*Spongia arabica, Spongia officinalis* var. *arabica*	Endemic
Demospongiae	Dictyoceratida	*Spongia (Spongia) irregularis*	Lévi (1965) (original Lendenfeld 1889)	*Spongia irregularis*	Present
Demospongiae	Dictyoceratida	*Spongia (Spongia) lesleighae*	Helmy, El Serehy, Mohamed & van Soest (2004)		Endemic
Demospongiae	Dictyoceratida	*Spongia (Spongia) officinalis var. exigua*	Lévi (1965) (original Schulze 1879)	*Spongia officinalis* f. *exigua*	Present
Demospongiae	Dictyoceratida	*Spongia lacinulosa*	Lamarck (1814)		Present
Demospongiae	Haplosclerida	*Amphimedon chloros*	Ilan, Gugel & van Soest (2004)		Endemic
Demospongiae	Haplosclerida	*Amphimedon dinae*	Helmy & van Soest (2005)		Endemic
Demospongiae	Haplosclerida	*Amphimedon hamadai*	Helmy & van Soest (2005)		Endemic
Demospongiae	Haplosclerida	*Amphimedon jalae*	Helmy & van Soest (2005)		Endemic
Demospongiae	Haplosclerida	*Amphimedon ochracea*	Keller (1889)	*Ceraochalina ochracea*	Endemic
Demospongiae	Haplosclerida	*Arenosclera arabica*	Keller (1889)	*Arenochalina arabica*	Present
Demospongiae	Haplosclerida	*Callyspongia (Callyspongia) siphonella*	Lévi (1965)	*Siphonochalina siphonella*	Endemic
Demospongiae	Haplosclerida	*Callyspongia (Callyspongia) tubulosa*	Burton (1926) (original Esper 1797)	*Siphonochalina tubulosa*	Present
Demospongiae	Haplosclerida	*Callyspongia (Cladochalina) subarmigera*	Burton (1959) (original Ridley 1884)	*Callyspongia subarmigera*	Unreported
Demospongiae	Haplosclerida	*Callyspongia (Euplacella) communis*	Burton (1926) (original Carter 1881)	*Siphonochalina communis*	Present
Demospongiae	Haplosclerida	*Callyspongia (Euplacella) densa*	Keller (1889)		Endemic
Demospongiae	Haplosclerida	*Callyspongia (Euplacella) paralia*	Ilan, Gugel & van Soest (2004)	*Callyspongia paralia*	Endemic
Demospongiae	Haplosclerida	*Callyspongia (Toxochalina) dendyi*	Vine (1986) (original Burton 1931)		Not reviewed
Demospongiae	Haplosclerida	*Callyspongia calyx*	Keller (1889)	*Cacochalina calyx*	Endemic
Demospongiae	Haplosclerida	*Callyspongia clavata*	Keller (1889)	*Crella cyathophora, Phylosiphonia clavata*	Endemic
Demospongiae	Haplosclerida	*Callyspongia conica*	Keller (1889)	*Phylosiphonia conica*	Present
Demospongiae	Haplosclerida	*Callyspongia crassa*	Keller (1889)	*Sclerochalina crassa*	Endemic
Demospongiae	Haplosclerida	*Callyspongia fistularis*	Topsent (1892)	*Sclerochalina fistularis*	Endemic
Demospongiae	Haplosclerida	*Callyspongia implexa*	Topsent (1892)	*Ceraochalina implexa*	Endemic
Demospongiae	Haplosclerida	*Callyspongia incrustans*	Row (1911)	*Spinosella incrustans*	Endemic

(continued)

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Demospongiae	Haplosclerida	*Callyspongia maculata*	Keller (1889)	*Cacochalina maculata*	Endemic
Demospongiae	Haplosclerida	*Callyspongia reticulata*	Keller (1889)	*Siphonochalina reticulata*	Present
Demospongiae	Haplosclerida	*Callyspongia sinuosa*	Topsent (1892)	*Sclerochalina sinuosa*	Endemic
Demospongiae	Haplosclerida	*Callyspongia spongionelloides*	Fishelson (1971)		Endemic
Demospongiae	Haplosclerida	*Callyspongia vasseli*	Keller (1889)	*Phylosiphonia vasseli*	Endemic
Demospongiae	Haplosclerida	*Chalinula saudiensis*	Vacelet et al. (2001)		Endemic
Demospongiae	Haplosclerida	*Gelliodes incrustans*	Lévi (1965) (original Dendy 1905)		Present
Demospongiae	Haplosclerida	*Haliclona (Gellius) bubastes*	Row (1911)	*Halichondria bubastes*	Endemic
Demospongiae	Haplosclerida	*Haliclona (Gellius) flagellifera*	Burton (1959) (original Ridley and Dendy 1886)	*Haliclona flagellifera*	Unreported
Demospongiae	Haplosclerida	*Haliclona (Gellius) toxia*	Lévi (1958) (original Topsent 1897)	*Toxiclona toxius, Gellius toxius*	Present
Demospongiae	Haplosclerida	*Haliclona (Haliclona) violacea*	Keller (1883)	*Lessepsia violacea*	Endemic
Demospongiae	Haplosclerida	*Haliclona (Reniera) tabernacula*	Row (1911)	*Reniera tabernacula, Haliclona tabernacula*	Present
Demospongiae	Haplosclerida	*Haliclona decidua*	Topsent (1906)	*Reniera decidua*	Present
Demospongiae	Haplosclerida	*Haliclona pigmentifera*	Burton (1959) (original Dendy (1905)	*Adocia pigmentifera*	Present
Demospongiae	Haplosclerida	*Haliclona ramusculoides*	Row (1911) (original Topsent 1893)	*Chalina minor*	Present
Demospongiae	Haplosclerida	*Haliclona spinosella*	Row (1911)	*Reniera spinosella*	Endemic
Demospongiae	Haplosclerida	*Neopetrosia contignata*	Burton (1959) (original Thiele 1899)	*Haliclona contignata*	Present
Demospongiae	Haplosclerida	*Niphates furcata*	Keller (1889)	*Pachychalina furcata*	Endemic
Demospongiae	Haplosclerida	*Niphates obtusispiculifera*	Burton (1959) (original Dendy 1905)		Present
Demospongiae	Haplosclerida	*Niphates rowi*	Ilan, Gugel & van Soest (2004)		Endemic
Demospongiae	Haplosclerida	*Oceanapia elastica*	Keller (1891)	*Reniera elastica*	Present
Demospongiae	Haplosclerida	*Oceanapia incrustata*	Burton (1959) (original Dendy 1922)		Present
Demospongiae	Haplosclerida	*Pachychalina alveopora*	Topsent (1906)		Present
Demospongiae	Haplosclerida	*Petrosia (Petrosia) elephantotus*	Ilan, Gugel & van Soest (2004)	*Petrosia elephantotus*	Endemic
Demospongiae	Haplosclerida	*Petrosia (Petrosia) nigricans*	Burton (1959) (original Lindgren 1897)	*Petrosia nigricans*	Unreported
Demospongiae	Haplosclerida	*Xestospongia ridleyi*	Keller (1891)	*Reniera ridleyi*	Endemic
Demospongiae	Haplosclerida	*Xestospongia testudinaria*	Burton (1959) (Lamarck 1815)	*Petrosia testudinaria*	Present
Demospongiae	Poecilosclerida	*Acarnus bergquistae*	Yosief et al. (1998a) (original van Soest, Hooper & Hiemstra 1991)		Unreported
Demospongiae	Poecilosclerida	*Acarnus thielei*	Lévi (1958)		Endemic
Demospongiae	Poecilosclerida	*Acarnus wolffgangi*	Keller (1889)		Present
Demospongiae	Poecilosclerida	*Antho (Jia) wunschorum*	van Soest, Rützler & Sim (2016)		Endemic
Demospongiae	Poecilosclerida	*Batzella aurantiaca*	Lévi (1958)	*Prianos aurantiaca*	Present
Demospongiae	Poecilosclerida	*Clathria (Clathria) arbuscula*	Row (1911)	*Litaspongia arbuscula, Ophlitaspongia arbuscula*	Endemic
Demospongiae	Poecilosclerida	*Clathria (Clathria) horrida*	Row (1911)	*Clathria horrida, Ophlitaspongia horrida*	Endemic
Demospongiae	Poecilosclerida	*Clathria (Clathria) maeandrina*	Burton (1959) (original Ridley 1884)	*Clathria maeandrina*	Unreported

(continued)

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Demospongiae	Poecilosclerida	*Clathria (Clathria) spongodes*	Burton (1959) (original Dendy 1922)	*Clathria spongiosa*	Present
Demospongiae	Poecilosclerida	*Clathria (Clathria) transiens*	Burton (1959) (original Hallmann 1912)	*Clathria transiens*	Unreported
Demospongiae	Poecilosclerida	*Clathria (Thalysias) abietina*	Burton (1959) (Lamarck 1814)	*Clathria aculeata*	Present
Demospongiae	Poecilosclerida	*Clathria (Thalysias) cactiformis*	Hooper, Kelly & Kennedy (2000) (original Lamarck 1814)		Not reviewed
Demospongiae	Poecilosclerida	*Clathria (Thalysias) fusterna*	Hooper (1997)	*Clathria fusterna*	Present
Demospongiae	Poecilosclerida	*Clathria (Thalysias) lambda*	Lévi (1958)	*Leptoclathria lambda*	Endemic
Demospongiae	Poecilosclerida	*Clathria (Thalysias) lendenfeldi*	Hooper, Kelly & Kennedy (2000) (Ridley & Dendy 1886)		Not reviewed
Demospongiae	Poecilosclerida	*Clathria (Thalysias) procera*	Burton (1959) (original Ridley 1884)		Present
Demospongiae	Poecilosclerida	*Clathria (Thalysias) vulpina*	Burton (1959) (original Lamarck 1814)		Present
Demospongiae	Poecilosclerida	*Clathria granulata*	Keller (1889)	*Ceraochalina granulata*	Endemic
Demospongiae	Poecilosclerida	*Crambe acuata*	Lévi (1958)	*Folitispa acuata*	Present
Demospongiae	Poecilosclerida	*Crella (Grayella) cyathophora*	Lévi (1958) (original Carter 1869)	*Grayella cyathophora*	Present
Demospongiae	Poecilosclerida	*Crella (Grayella) papillata*	Lévi (1958)		Present
Demospongiae	Poecilosclerida	*Damiria simplex*	Keller (1891)		Present
Demospongiae	Poecilosclerida	*Diacarnus erythraeanus*	Kelly-Borges & Vacelet (1995)		Present
Demospongiae	Poecilosclerida	*Echinoclathria digitiformis*	Row (1911)	*Ophlitaspongia digitiformis*	Endemic
Demospongiae	Poecilosclerida	*Echinoclathria gibbosa*	Keller (1889)	*Ceraochalina gibbosa, Xestospongia gibbosa*	Endemic
Demospongiae	Poecilosclerida	*Echinoclathria robusta*	Keller (1889)	*Halme robusta*	Endemic
Demospongiae	Poecilosclerida	*Guitarra indica*	Burton (1959) (original Dendy 1916)	*Guitarra fimbriata*	Unreported
Demospongiae	Poecilosclerida	*Hemimycale arabica*	Ilan, Gugel & van Soest (2004)		Endemic
Demospongiae	Poecilosclerida	*Hymedesmia (Hymedesmia) lancifera*	Topsent (1906)	*Leptosia lancifera, Hymedesmia lancifera*	Present
Demospongiae	Poecilosclerida	*Hymedesmia (Hymedesmia) rowi*	Row (1911) (original van Soest 2017)	*Myxilla (Myxilla) tenuissima*	Endemic
Demospongiae	Poecilosclerida	*Iotrochota baculifera*	Lévi (1965) (original Ridley 1884)		Present
Demospongiae	Poecilosclerida	*Lissodendoryx (Lissodendoryx) cratera*	Row (1911)	*Myxilla cratera*	Endemic
Demospongiae	Poecilosclerida	*Lissodendoryx (Waldoschmittia) schmidti*	Lévi (1958) (original Ridley 1884)	*Damiriana schmidti*	Present
Demospongiae	Poecilosclerida	*Monanchora quadrangulata*	Lévi (1958)	*Fasuberea quadrangulata*	Endemic
Demospongiae	Poecilosclerida	*Mycale (Aegogropila) sulevoidea*	Burton (1959) (original Sollas 1902)	*Mycale sulevoidea*	Unreported
Demospongiae	Poecilosclerida	*Mycale (Arenochalina) anomala*	Burton (1952) (original Ridley & Dendy 1886)	*Esperiopsis anomala, Parisociella anomala*	Unreported
Demospongiae	Poecilosclerida	*Mycale (Arenochalina) euplectellioides*	Row (1911)	*Esperella euplectellioides*	Endemic
Demospongiae	Poecilosclerida	*Mycale (Arenochalina) setosa*	Keller (1889)	*Gelliodes setosa*	Endemic

(continued)

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Demospongiae	Poecilosclerida	*Mycale (Carmia) erythraeana*	Row (1911)	*Esperella erythraeana*	Endemic
Demospongiae	Poecilosclerida	*Mycale (Carmia) fistulifera*	Row (1911)	*Esperella fistulifera*	Endemic
Demospongiae	Poecilosclerida	*Mycale (Carmia) suezza*	Row (1911)	*Esperella suezza*	Endemic
Demospongiae	Poecilosclerida	*Mycale (Mycale) dendyi*	Row (1911)	*Esperella dendyi*	Endemic
Demospongiae	Poecilosclerida	*Mycale (Mycale) grandis*	Lévi (1958) (original Grey 1867)	*Mycale grandis*	Present
Demospongiae	Poecilosclerida	*Myxilla (Burtonanchora) gracilis*	Lévi (1965)	*Burtonanchora gracilis*	Endemic
Demospongiae	Poecilosclerida	*Negombata corticata*	Carter (1879)		Present
Demospongiae	Poecilosclerida	*Negombata magnifica*	Keller (1889)	*Latrunculia magnifica*	Endemic
Demospongiae	Poecilosclerida	*Phorbas epizoaria*	Lévi (1958)	*Pronax epizoaria*	Endemic
Demospongiae	Poecilosclerida	*Psammoclema arenaceum*	Lévi (1958)	*Psammopemma arenaceum*	Endemic
Demospongiae	Poecilosclerida	*Psammoclema rubrum*	Lévi (1958)	*Psammopemma*	Endemic
Demospongiae	Poecilosclerida	*Strongylacidon inaequale*	Burton (1959) (original Hentschel 1911)	*Strongylacidon inaequalis*	Unreported
Demospongiae	Poecilosclerida	*Tedania (Tedania) anhelans*	Burton (1959) (original Vio in Olivi 1792)	*Tedania nigrescens*	Unreported
Demospongiae	Poecilosclerida	*Tedania (Tedania) assabensis*	Keller (1891)	*Tedania assabensis, Tedania anhelans* var. *assabensis*	Present
Demospongiae	Scopalinida	*Stylissa carteri*	Keller (1889) (original Dendy 1889)	*Acanthella aurantiaca, axinella carteri*	Present
Demospongiae	Suberitida	*Axinyssa gravieri*	Lévi (1965) (original Topsent 1906)	*Pseudaxinyssa gravieri*	Present
Demospongiae	Suberitida	*Halichondria (Halichondria) glabrata*	Keller (1891)	*Halichondria glabrata*	Endemic
Demospongiae	Suberitida	*Halichondria (Halichondria) granulata*	Keller (1891)	*Halichondria granulata*	Endemic
Demospongiae	Suberitida	*Halichondria (Halichondria) isthmica*	Keller (1891) (original Keller 1883)	*Amorphina isthmica*	Endemic
Demospongiae	Suberitida	*Halichondria (Halichondria) minuta*	Keller (1891)	*Halichondria minuta*	Endemic
Demospongiae	Suberitida	*Hymeniacidon calcifera*	Row (1911)		Endemic
Demospongiae	Suberitida	*Hymeniacidon zosterae*	Row (1911)		Endemic
Demospongiae	Suberitida	*Pseudosuberites andrewsi*	Vine (1986) (original Kirkpatrick 1900)		Not reviewed
Demospongiae	Suberitida	*Suberites clavatus*	Keller (1891)		Endemic
Demospongiae	Suberitida	*Suberites kelleri*	Keller (1891) (original Burton 1930)	*Suberites incrustans*	Present
Demospongiae	Suberitida	*Suberites tylobtusus*	Lévi (1958)	*Suberites tylobtusa*	Endemic
Demospongiae	Suberitida	*Terpios lendenfeldi*	Keller (1891)		Endemic
Demospongiae	Suberitida	*Terpios viridis*	Keller (1891)		Endemic
Demospongiae	Suberitida	*Topsentia aqabaensis*	Ilan, Gugel & van Soest (2004)	*Epipolasis aqabaensis*	Endemic
Demospongiae	Suberitida	*Topsentia halichondrioides*	Burton (1926) (original Dendy 1905)	*Trachyopsis halichondrioides*	Present
Demospongiae	Tethyida	*Tethya japonica*	Topsent (1906) (originial Sollas 1888)	*Donatia japonica*	Present
Demospongiae	Tethyida	*Tethya robusta*	Burton (1926) (original Bowerbank 1873)	*Donatia robusta, Donatia arabica*	Present

(continued)

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Demospongiae	Tethyida	*Tethya seychellensis*	Lévi (1958) (original Wright 1881)		Present
Demospongiae	Tethyida	*Timea intermedia*	Lévi (1958)	*Timeopsis intermedia*	Endemic
Demospongiae	Tetractinellida	*Cinachyrella albatridens*	Lévi (1965) (original Lendenfeld 1907)	*Cinachyra alba tridens*	Present
Demospongiae	Tetractinellida	*Cinachyrella alloclada*	Barnathan et al. (2003) (original Uliczka 1929)		Unreported
Demospongiae	Tetractinellida	*Cinachyrella eurystoma*	Keller (1891)	*Cinachyra eurystoma*	Endemic
Demospongiae	Tetractinellida	*Cinachyrella ibis*	Row (1911)	*Chrotella ibis*	Endemic
Demospongiae	Tetractinellida	*Cinachyrella kuekenthali*	Barnathan et al. (2003) (original Uliczka (1929)		Unreported
Demospongiae	Tetractinellida	*Cinachyrella schulzei*	Keller (1891)	*Cinachyra schulzei*	Present
Demospongiae	Tetractinellida	*Cinachyrella trochiformis*	Keller (1891)	*Cinachyra trochiformis*	Endemic
Demospongiae	Tetractinellida	*Dercitus (Halinastra) exostoticus*	Keller (1891) (original Schmidt (1868)		Endemic
Demospongiae	Tetractinellida	*Discodermia stylifera*	Keller (1891)		Endemic
Demospongiae	Tetractinellida	*Ecionemia arabica*	Lévi (1958)	*Hezekia arabica*	Endemic
Demospongiae	Tetractinellida	*Ecionemia spinastra*	Lévi (1958)		Endemic
Demospongiae	Tetractinellida	*Erylus lendenfeldi*	Carmely et al. (1989) (original Sollas 1888)		Unreported
Demospongiae	Tetractinellida	*Erylus proximus*	Lévi (1958) (original Dendy 1916)		Present
Demospongiae	Tetractinellida	*Geodia arabica*	Topsent (1892) (original Carter 1869)		Present
Demospongiae	Tetractinellida	*Geodia jousseaumei*	Topsent (1906)	*Isops jousseaumei*	Present
Demospongiae	Tetractinellida	*Geodia micropunctata*	Row (1911)		Endemic
Demospongiae	Tetractinellida	*Jaspis albescens*	Row (1911)	*Coppatias albescens*	Endemic
Demospongiae	Tetractinellida	*Jaspis reptans*	Lévi (1965) (original Dendy 1905)		Present
Demospongiae	Tetractinellida	*Jaspis sollasi*	Burton & Rao (1932)	*Amphius sollasi*	Endemic
Demospongiae	Tetractinellida	*Jaspis virens*	Lévi (1958)		Endemic
Demospongiae	Tetractinellida	*Levantiniella levantinensis*	Tsurnamal (1969) (Vacelet, Bitar, Carteron, Zibrowius & Pérez 2007)	*Chrotella cavernosa*	Present
Demospongiae	Tetractinellida	*Paratetilla bacca*	Row (1911) (original Selenka 1867)	*Paratetilla eccentrica*	Present
Demospongiae	Tetractinellida	*Rhabdastrella sterrastraea*	Row (1911)	*Diastra sterrastraea*	Endemic
Demospongiae	Tetractinellida	*Stelletta parva*	Row (1911)	*Pilochrota parva*	Endemic
Demospongiae	Tetractinellida	*Stelletta purpurea*	Lévi (1958) (original Ridley 1884)	*Myriastra purpurea*	Present
Demospongiae	Tetractinellida	*Stelletta siemensi*	Keller (1891)		Endemic
Demospongiae	Tetractinellida	*Stellettinopsis solida*	Lévi (1965)		Present
Demospongiae	Tetractinellida	*Tetilla diaenophora*	Lévi (1958)		Endemic
Demospongiae	Tetractinellida	*Tetilla poculifera*	Row (1911) (original Dendy 1905)		Present
Demospongiae	Tetractinellida	*Theonella conica*	Lévi (1958) (original Kieschnick 1896)		Present
Demospongiae	Tetractinellida	*Theonella mirabilis*	El Bossery et al. (2017) (original de Laubenfels 1954)		Unreported
Demospongiae	Tetractinellida	*Theonella swinhoei*	Lévi (1958) (original Grey 1868)		Present
Demospongiae	Verongiida	*Aplysina reticulata*	Burton (1926) (original Lendenfeld 1889)		Present
Demospongiae	Verongiida	*Pseudoceratina arabica*	Keller (1889)	*Psammaplysilla arabica*	Present

(continued)

Class	Order	Species	Citation	Previous names	Distribution (WPD)
Demospongiae	Verongiida	*Pseudoceratina purpurea*	Rotem et al. (1983) (original Carter 1880)	*Psammaplysilla purpurea*	Unreported
Demospongiae	Verongiida	*Suberea mollis*	Row (1911)	*Verongia mollis, Aplysina mollis*	Present
Demospongiae	Verongiida	*Suberea praetensa*	Row (1911)	*Aplysina praetensa*	Present
Demospongiae	Verongiida	*Suberea purpureaflava*	Gugel, Wagler & Brümmer (2011)		Endemic
Hexactinellida	Lychniscosida	*Neoaulocystis polae*	Ijima (1927)	*Aulocystis polae*	Endemic
Hexactinellida	Sceptrulophora	*Tretocalyx polae*	Schulze (1901)		Endemic
Homoscleromorpha	Homosclerophorida	*Plakortis erythraena*	Lévi (1958)		Endemic
Homoscleromorpha	Homosclerophorida	*Plakortis nigra*	Lévi (1958) (original Lévi 1953)		Present

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