

# The Sponges (Porifera) of the Southern Islands, Singapore

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**ABSTRACT.** Singapore has high levels of marine biodiversity. Sponges were included in a survey of intertidal habitats fringing the Southern Islands of Singapore in 2020–2022, resulting in a checklist of all recorded and recognized species of sponge from the Southern Islands Biodiversity Survey, from published literature and other internal and unpublished records. These yielded 178 species in the Southern Islands out of approximately 200 species known nationally. The factors influencing species richness at each site are unclear but may include substrate quality, water quality and currents that facilitate or hinder dispersal. Reef area and length of coastline are not correlated with species numbers. Further research will be needed on species ecology in order to reap the conservation value, ecological services and biomedical potential of the sponges in the Southern Islands.

**Keywords.** Porifera, biodiversity, conservation.

## Introduction

Sponges are aquatic invertebrates classified under the phylum Porifera (Hooper & Soest, 2012). Typically, in their mature stage, they are sessile organisms that come in diverse shapes, sizes, and colours (Ng et al., 2011), some growing on the seafloor or intertidal reefs alone or in clusters of vase-like tubes or branches, or as encrusting layers on the surfaces of rocks, buoys, jetties and ship hulls (Soest et al., 2012). Most species are marine and grow asymmetrically although some species are radially symmetrical (Bergquist, 1978). Many are brightly coloured, and the bright pigments are thought to help protect them from damaging ultraviolet rays in sunlight (Bandaranayake, 2006).

About 8,500 to 9,500 species of sponges are known globally, within the four classes Demospongiae, Hexactinellida, Calcarea and Homoscleromorpha (de Voogd et al., 2023; NOAA, 2023). Demospongiae contains about 80% of all living sponges (de Voogd et al., 2023). They are the most common in Singapore, comprising almost 200 species (Ng et al., 2011). Demospongiae are characterized by silica or spongin spicules (Uriz et al., 2003). Calcarea contains the calcareous sponges that typically grow in shallow waters where calcium carbonate production is ideal (Soest et al., 2012). Only five species of Calcarea have been documented in Singapore waters (Ng et al., 2011). They are characterized by calcium-magnesium spicules (Sethmann & Wörheide, 2008).

Marine sponges perform many functional roles (Bell, 2008). Through filter feeding, sponges help to improve the water quality (Ng et al., 2011). Many sponges are important components of coral reef communities, forming substrate, structural complexity and shelter for various marine species (de Voogd & Cleary, 2009). While certain boring sponges are involved in the bioerosion of coral reefs (Schönberg & Lim, 2019), others are important in reef creation, consolidation and accretion, adhering loose coral substrate (Bell, 2008). The occurrence of boring sponges and reef building sponges appears to be related to the water column's nutrient content, with more boring sponges in waters with higher eutrophication levels, implying that human-generated eutrophication can be a factor in reef loss (Ward-Paige et al., 2005). Sponges also contribute to nutrient cycling and connect the pelagic and benthic

layers of the sea. As suspension feeders, sponges feed on planktonic biomass, dissolved organic matter and in certain species even viruses, assimilating carbon, silica, nitrogen, and other nutrients (Bell, 2008). Sponges are a food source for other marine species such as the hawksbill turtle, some species of nudibranchs and tropical fish (Wulff, 2006). Sponges have value in biomedical research as they have evolved elaborate chemical defences to make themselves unpalatable to predators. These defensive secondary compounds have potential in development of antimicrobial, anti-fungal, anti-viral, anti-cancer and other pharmaceutical drugs (Laport et al., 2009; Anjum et al., 2016).

Singapore is the type locality for the iconic Neptune's Cup sponge, *Cliona patera*, which can grow to one metre in length and one metre in height (DHI, 2011). Since its discovery in the early part of the nineteenth century, research on sponges in Singapore waters had been intermittent until Lim S.C. et al. (2008, 2009, 2012a) began a resurgence of interest. Lim S.C. et al. (2016) catalogued 388 sponges named to species level from the South China Sea, from Singapore to Taiwan. However, the most detailed and widespread surveys conducted under the Comprehensive Marine Biodiversity Survey (CMBS) did not cover the Southern Islands fully. Therefore, intertidal surveys under the Southern Islands Biodiversity Survey, SIBS (Tan & Leong, 2025) were used as an opportunity to better fill a gap in knowledge of sponge species diversity and distribution.

### Materials and Methods

Intertidal surveys were conducted at 16 sites at Pulau Biola, Pulau Berkas, Sentosa (formerly Pulau Blakang Mati), Pulau Hantu, Pulau Jong, Pulau Salu, Pulau Satumu (Raffles Lighthouse), Pulau Sakijang Bendera (Saint John's Island), Pulau Sakijang Pelepah (Lazarus Island), Pulau Semakau, Pulau Seringat (now merged with Lazarus Island), Pulau Subar Darat (Small Sister's Island), Pulau Tembakul (Kusu Island), Pulau Tekukor, and Terumbu Pandan (Cyrene Reef). The surveys were conducted between August 2020 and March 2022 during low spring tides, typically during early morning hours (6:00am to 10:00am) or during the evening (4:00pm to 8:00pm). Intertidal surveys were not conducted at Keppel Island, Pulau Brani, and Pulau Subar Laut (Big Sister's Island), although other aspects of biodiversity at those islands were included in the SIBS study (Tan et al., 2025).

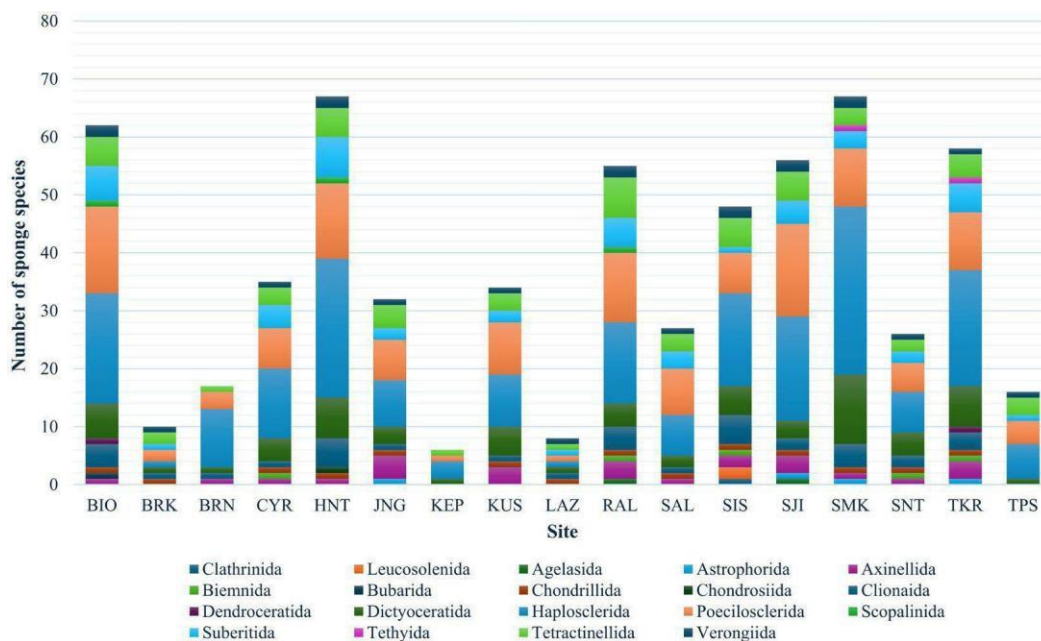
A reconnaissance trip was organised for each site to identify suitable areas for laying out transects that would encompass a wide diversity of intertidal habitat types and maximise species encounters. During the actual survey, a 30m line perpendicular to the shoreline was laid across the intertidal zone, and three sets of 25 m line transects were placed parallel to the shore. There was one set each within the zones 0–10m, 10–20m and 20–30m from the shoreline, so as to ensure sampling covered the upper, middle, and lower shore. Each transect set/shore level was surveyed by a team of 3-5 surveyors, and for each transect five quadrats (50cm by 50cm) were placed along either side of the transect tape at intervals determined via a random number generator. Tan et al. (2025) provides an illustration of the layout of transects and quadrats. All living morphospecies in the quadrat were photographed for record keeping and identification to the lowest possible taxonomic level. Another team of 5-10 surveyors separately patrolled the intertidal zone beyond the vicinity of the transects to take photographs of as many morphospecies as possible for later identification.

Poriferan biodiversity records from published literature and NParks internal records were also compiled. The earliest published literature on Southern Island sponges included in the database was published in 2007, although there may be older literature in unpublished records, and the latest literature included was published in 2022. Scientific names were standardised according to the Singapore Red Data Book (Lim S.C., 2024).

## Results

There are 188 morphospecies of sponge recorded in the Southern Islands from at least 79 genera, of which 105 were identified to species level. Three species belong to Order Clathrinidae and Order Jenkinidae within Class Calcarea, all of which are identified to species level. 180 of the remaining morphospecies, of which 102 were identified to species level, belong to Class Demospongiae (Table 1), while five morphospecies are of unknown class. Sites with relatively high sponge species richness include Pulau Hantu and Pulau Semakau with 67 species respectively, and Pulau Biola with 62 species (Figure 1). Sites with relatively low sponge species richness include Keppel Island with 6 species, Pulau Sakijang Pelepah with 8 species and Pulau Brani with 10 species. The patterns of diversity are generally similar when morphospecies richness is considered.

Employing topographical data from Tan & Leong (2025: Table 1), there was no significant correlation between sponge species diversity and either the area of intertidal habitat (Spearman Rank  $\chi^2 = 0.1697$ ,  $n=17$ ,  $\Sigma d^2 = 677.5$ ,  $p>0.1$ ) or the length of coastline of the respective islands (Spearman Rank  $\chi^2 = 0.2249$ ,  $n=17$ ,  $\Sigma d^2 = 632.5$ ,  $p>0.1$ ). Lazarus had an oddly low total of only eight species, yet St John's Island which is adjacent and has a very similar extent of intertidal habitat had 56 species. Such anomalies may have been exaggerated by differing intensities of recent historical collection (post-2000) as St John's Island supports a marine research laboratory.



**Figure 1.** Record of poriferan species richness of the Southern Islands by site. BIO = Pulau Biola, BRK = Pulau Berkas, BRN = Pulau Brani, CYR = Terumbu Pandan (Cyrene Reef), HNT = Pulau Hantu, JNG = Pulau Jong, KEP = Keppel Island, KUS = Pulau Tembakul (Kusu Island), LAZ = Pulau Sakijang Pelepah (Lazarus Island), RAL = Pulau Satumu (Raffles Lighthouse), SAL = Pulau Salu, SIS = Pulau Subar Laut (Sisters' Islands), SJI = Pulau Sakijang Bendera (St John's Island), SMK = Pulau Semakau, SNT = Pulau Blakang Mati (Sentosa), TKR = Pulau Tekukor, TPS = Terumbu Pempang.

Of the Calcarea found in Singapore, three species from two families and two orders were recorded in the Southern Islands (Table 1). All three were recorded at Pulau Subar Darat and Pulau Subar Laut (Sister's Islands) alone, emphasising the importance of these islands and suggesting that calcareous sponges have a limited range in Singapore waters. In contrast, Demospongiae are widely recorded across all survey sites. 180 morphospecies of demosponge were recorded from 73 genera, 43 families and 17 orders, including 102 identified species across 17 survey sites. The most widespread demosponge morphospecies include *Spheciospongia* cf *vagabunda*, *Xestospongia testudinaria*, *Rhabdastrella globostellata*, *Cinachyrella australiensis* and *Pseudoceratina purpurea*, which were all recorded across 15 out of the 17 sites surveyed (Table 1). Another ten demosponge species and two morphospecies were recorded in more than ten sites, including *Chondrilla australiensis*, *Spheciospongia* sp "yellow cones", *Lamellodysidea herbacea*, *Lendenfeldia chondrodes*, *Callyspongia* (*Cladochalina*) *diffusa*, *Neopetrosia exigua*, *Neopetrosia* sp "blue", *Oceanapia sagittaria*, *Lissodendoryx* (*Waldoschmittia*) cf *schmidtii*, *Biemna fortis*, *Coelocarteria singaporensis*, *Clathria* (*Thalysias*) *reinwardti*. The remaining 160 demosponge species have each been recorded in fewer than ten sites.

Within Demospongiae, the Order Haplosclerida has the most recorded species of all sponges in the Southern Islands, with 60 species including morphospecies (Figure 1). Order Poecilosclerida has the second most recorded species, with 37 species including morphospecies. Other demosponge Orders that were relatively frequently recorded include Order Dictyoceratida (19 morphospecies) and Order Suberitida (21 morphospecies). There were also 12 morphospecies recorded for Order Clionaida and 11 for Order Tetractinellida. Order Axinellida was represented by seven morphospecies, and the remaining ten demosponge Orders were each represented by only one to three morphospecies.

**Table 1.** Locations of sponge taxa found in Southern Island waters from published, unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates taxa was observed during Southern Islands Biodiversity Survey 2019-2022. Year corresponds to most recent publication or NParks internal record with taxa observation. RDB3 = Singapore Red Data Book 3 Status, IUCN = International Union for Conservation of Nature Status, BIO = Pulau Biola, BRK = Pulau Berkas, BRN = Pulau Brani, CYR = Cyrene Reef, HNT = Pulau Hantu, JNG = Pulau Jong, KEP = Keppel Island, KUS = Kusu Island, LAZ = Lazarus Island, RAL = Raffles Lighthouse, SAL = Pulau Salu, SIS = Sisters' Islands, SJI = St John's Island, SMK = Pulau Semakau, SNT = Sentosa Island, TKR = Pulau Tekukor, TPS = Terumbu Pempangs. Acronyms for RDB3/IUCN: EX = Globally Extinct, NEx = Presumed Nationally Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, DD = Data Deficient, NE = Not Evaluated, NL = Not Listed, NA = Not Assessed.

| Taxa                                     | RDB3 | IUCN | BIO | BRK | BRN | CYR | HNT | JNG  | KEP | KUS  | LAZ | RAL  | SAL | SIS  | SJI  | SMK  | SNT | TKR  | TPS |
|------------------------------------------|------|------|-----|-----|-----|-----|-----|------|-----|------|-----|------|-----|------|------|------|-----|------|-----|
| <b>Class Calcarea</b>                    |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <b>Order Clathrinida</b>                 |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <b>Family Clathrinidae</b>               |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <i>Clathrina sororcula</i>               | LC   | NE   |     |     |     |     |     |      |     |      |     |      |     | 2015 |      |      |     |      |     |
| <b>Order Leucosolenida</b>               |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <b>Family Jenkinidae</b>                 |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <i>Anamixilla singaporensis</i>          | LC   | NE   |     |     |     |     |     |      |     |      |     |      |     | 2015 |      |      |     |      |     |
| <i>Uteopsis argentea</i>                 | LC   | NE   |     |     |     |     |     |      |     |      |     |      |     | 2015 |      |      |     |      |     |
| <b>Class Demospongiae</b>                |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <b>Order Agelasida</b>                   |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <b>Family Agelasidae</b>                 |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <i>Agelas cavernosa</i>                  | LC   | NE   |     |     |     |     |     |      |     |      |     | 2012 |     |      | 2012 |      |     |      |     |
| <b>Order Astrophorida</b>                |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <b>Family Geodiidae</b>                  |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <i>Geodia</i> sp “off white, encrusting” | NA   | NL   |     |     |     |     |     | 2012 |     |      |     |      |     |      | 2012 | 2012 |     | 2012 |     |
| <b>Order Axinellida</b>                  |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <b>Family Axinellidae</b>                |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <i>Axinella carteri</i>                  | NA   | NE   |     |     |     |     |     | 2012 |     |      |     | 2012 |     |      |      |      |     |      |     |
| <b>Family Raspailiidae</b>               |      |      |     |     |     |     |     |      |     |      |     |      |     |      |      |      |     |      |     |
| <i>Echinodictyum asperum</i>             | LC   | NE   |     |     |     |     |     | 2012 |     | 2012 |     |      |     |      | 2012 |      |     |      |     |

**Table 1 continued.** Locations of sponge taxa found in Southern Island waters from published, unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates taxa was observed during Southern Islands Biodiversity Survey 2019–2022. Year corresponds to most recent publication or NParks internal record with taxa observation.

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| Taxa                                            | RDB3 | IUCN | BIO        | BRK  | BRN  | CYR        | HNT        | JNG        | KEP | KUS        | LAZ  | RAL        | SAL        | SIS  | SJI        | SMK        | SNT        | TKR        | TPS  |
|-------------------------------------------------|------|------|------------|------|------|------------|------------|------------|-----|------------|------|------------|------------|------|------------|------------|------------|------------|------|
| <b>Family Clionaidae</b>                        |      |      |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <i>Cliona patera</i>                            | CR   | NE   |            |      |      |            |            |            |     |            | (1)  |            |            | 2018 | 2017       | (1)        |            |            |      |
| <i>Cliona</i> sp “orange, encrusting”           | NA   | NL   |            |      |      |            | 2012       |            |     |            |      |            |            |      |            | 2012       |            |            |      |
| <i>Cliona utricularis</i>                       | LC   | NE   |            |      |      |            |            |            |     |            |      |            |            |      |            | 2012       |            |            |      |
| <i>Speciospongia</i> cf <i>inconstans</i>       | NA   | NA   | 2013       |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <i>Spheciospongia lacunosa</i>                  | DD   | NE   |            |      | 1905 |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <i>Spheciospongia</i> sp “yellow cones/volcano” | NA   | NL   | 2012       |      |      | 2020       | SIBS; 2020 | 2020       |     | 2020       |      | 2012       | SIBS; 2012 | 2020 | 2020       | 2020       | 2020       | 2020       | 2020 |
| <i>Spheciospongia</i> cf <i>vagabunda</i>       | LC   | NE   | SIBS; 2012 | SIBS |      | SIBS; 2020 | SIBS; 2020 | SIBS; 2020 |     | SIBS; 2020 | 2020 | 2012       | SIBS       | 2020 | SIBS; 2020 | SIBS; 2020 | SIBS; 2020 | SIBS; 2020 | 2020 |
| <b>Family Placospongiidae</b>                   |      |      |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <i>Placospongia carinata</i>                    | LC   | NE   | 2012       |      |      |            |            |            |     |            |      | 2012       |            | 2012 |            |            |            | 2012       |      |
| <b>Family Spirastrellidae</b>                   |      |      |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <i>Spirastrella decumbens</i>                   | LC   | NE   |            |      |      |            | 2012       |            |     |            |      | 2012       |            |      |            |            |            |            |      |
| <i>Spirastrella</i> sp “grey”                   | NA   | NL   | 2012       |      |      |            |            |            |     |            |      | 2012       |            |      |            |            |            |            |      |
| <b>Order Dendroceratida</b>                     |      |      |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <b>Family Darwinellidae</b>                     |      |      |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <i>Aphysilla rosea</i>                          | NA   | NE   |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            | 2012       |      |
| <b>Family Dictyodendrillidae</b>                |      |      |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <i>Dictyodendrilla</i> sp “2”                   | NA   | NL   | 2013       |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <b>Order Dictyoceratida</b>                     |      |      |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <b>Family Dysideidae</b>                        |      |      |            |      |      |            |            |            |     |            |      |            |            |      |            |            |            |            |      |
| <i>Dysidea frondosa</i>                         | LC   | NE   | 2012       |      |      |            | 2012       |            |     |            |      |            |            |      |            | 2012       |            |            |      |
| <i>Dysidea</i> cf <i>ramoglomera</i>            | NA   | NA   |            |      |      |            |            |            |     |            |      |            |            |      | 2012       |            |            |            |      |
| <i>Lamellodysidea herbacea</i>                  | LC   | NE   | 2012       |      |      | SIBS; 2020 | 2020       | 2020       |     | 2020       | 2020 | SIBS; 2012 |            | 2020 | SIBS; 2012 | SIBS; 2020 | SIBS; 2020 | SIBS; 2020 | 2020 |

(1) pers. obs. during the SIBS survey period

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| Taxa                                                      | RDB3 | IUCN | BIO           | BRK  | BRN  | CYR           | HNT           | JNG           | KEP  | KUS           | LAZ  | RAL           | SAL  | SIS  | SJI           | SMK           | SNT           | TKR  | TPS |
|-----------------------------------------------------------|------|------|---------------|------|------|---------------|---------------|---------------|------|---------------|------|---------------|------|------|---------------|---------------|---------------|------|-----|
| <b>Family Irciniidae</b>                                  |      |      |               |      |      |               |               |               |      |               |      |               |      |      |               |               |               |      |     |
| <i>Ircinia cf anomala</i>                                 | NA   | NA   | 2012          |      |      |               |               |               |      |               |      |               |      |      |               |               |               |      |     |
| <i>Ircinia irregularis</i>                                | LC   | NE   |               |      |      |               | 2018          |               |      |               |      |               |      | 2018 |               |               |               |      |     |
| <i>Ircinia ramosa</i>                                     | LC   | NE   | 2012          |      |      |               | 2012          | 2012          |      |               |      | 2012          |      |      |               | 2012          |               | 2012 |     |
| <i>Ircinia</i> sp “with Vulsella”                         | NA   | NL   |               |      |      |               |               |               |      |               |      |               |      |      |               | 2012          |               |      |     |
| <b>Family Spongiidae</b>                                  |      |      |               |      |      |               |               |               |      |               |      |               |      |      |               |               |               |      |     |
| <i>Coscinoderma mathewsi</i>                              | LC   | NE   |               |      |      |               |               |               |      | 2012          |      |               |      | 2012 |               |               | 2012          | 2012 |     |
| <i>Hippospongia mollissima</i>                            | LC   | NE   |               |      | 1905 |               |               |               |      |               |      |               |      |      |               |               |               |      |     |
| <i>Hippospongia</i> sp “black, massive”                   | NA   | NL   |               |      |      |               |               |               |      |               |      |               |      |      |               | 2012          |               |      |     |
| <i>Hyattella intestinalis</i>                             | LC   | NE   |               |      |      |               | 2012          |               |      |               |      |               |      |      |               |               | 2012          |      |     |
| <i>Hyattella tubaria</i>                                  | LC   | NE   |               |      |      |               |               |               |      |               |      |               |      |      |               | 2020          |               |      |     |
| <i>Spongia (Spongia) ceylonensis</i>                      | LC   | NE   |               |      |      | 2012          |               |               |      | 2012          |      |               |      |      | 2012          | 2012          |               | 2012 |     |
| <i>Spongia</i> sp “with broken shells and sand”           | NA   | NL   | 2012          |      |      | 2012          |               |               |      |               |      | 2012          |      |      |               |               |               |      |     |
| <i>Spongia</i> sp “yellow, encrusting”                    | NA   | NL   |               |      |      |               |               |               |      |               |      |               |      |      |               | 2012          |               |      |     |
| <b>Family Thorectidae</b>                                 |      |      |               |      |      |               |               |               |      |               |      |               |      |      |               |               |               |      |     |
| <i>Dactylospongia elegans</i>                             | LC   | NE   |               |      |      | 2020          | SIBS;<br>2020 |               |      |               |      |               |      |      |               | SIBS;<br>2020 | 2020          |      |     |
| Family Thorectidae sp “black, massive, strongly conulose” | NA   | NL   |               |      |      |               |               |               |      |               |      |               |      |      |               |               |               | 2012 |     |
| <i>Hyrrios erectus</i>                                    | LC   | NE   | 2013          |      |      |               |               |               |      | 2012          |      |               | 2012 | 2012 |               |               |               | 2012 |     |
| <i>Lendenfeldia chondrodes</i>                            | LC   | NE   | SIBS;<br>2012 | SIBS |      | SIBS;<br>2020 | SIBS;<br>2012 | SIBS;<br>2012 | 2020 | SIBS;<br>2020 | 2020 | SIBS;<br>2020 | 2012 | 2020 | SIBS;<br>2020 | 2012          | SIBS;<br>2020 | 2020 |     |

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| Taxa                                                             | RDB3 | IUCN | BIO  | BRK  | BRN  | CYR           | HNT           | JNG  | KEP  | KU | LAZ | RAL | SAL  | SIS  | SJI           | SMK  | SNT           | TKR  | TPS  |
|------------------------------------------------------------------|------|------|------|------|------|---------------|---------------|------|------|----|-----|-----|------|------|---------------|------|---------------|------|------|
| <b>Order Haplosclerida</b>                                       |      |      |      |      |      |               |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <b>Family Callyspongiidae</b>                                    |      |      |      |      |      |               |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <i>Callyspongia</i><br>( <i>Cladochalina</i> ) <i>fibrosa</i>    | DD   | NE   |      |      | 1905 |               |               |      |      |    |     |     |      | 2012 |               |      |               |      |      |
| <i>Callyspongia</i><br>( <i>Callyspongia</i> ) <i>ramosa</i>     | DD   | NE   |      |      | 1905 |               |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <i>Callyspongia</i><br>( <i>Callyspongia</i> ) <i>serpentina</i> | DD   | NE   |      |      | 1905 |               |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <i>Callyspongia</i><br>( <i>Cladochalina</i> ) <i>diffusa</i>    | LC   | NE   |      | SIBS |      | SIBS;<br>2020 | SIBS;<br>2020 |      | 2020 |    |     |     | SIBS | 2020 | SIBS;<br>2012 | 2020 | SIBS;<br>2020 | 2020 | 2020 |
| <i>Callyspongia</i><br>( <i>Cladochalina</i> ) <i>samarensis</i> | LC   | NE   |      |      |      |               | SIBS;<br>2020 |      |      |    |     |     |      |      |               | 2020 |               |      |      |
| <i>Callyspongia aurantiaca</i>                                   | DD   | NE   |      |      | 1905 |               |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <i>Callyspongia euplax</i>                                       | DD   | NE   |      |      | 1905 |               |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <i>Callyspongia</i> sp “pale<br>yellow, massive branching”       | NA   | NL   |      |      |      |               | 2012          | 2012 |      |    |     |     |      |      |               | 2012 |               |      |      |
| <i>Callyspongia</i> sp “purple,<br>lobate”                       | NA   | NL   |      |      |      |               |               |      |      |    |     |     |      |      |               | 2012 |               |      |      |
| <i>Callyspongia</i> sp “purple,<br>long, slender branches”       | NA   | NL   |      |      |      | 2012          |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <i>Callyspongia</i> sp” yellow,<br>spiny”                        | NA   | NL   | 2012 |      |      |               |               |      |      |    |     |     |      |      |               | 2012 |               | 2012 |      |
| <i>Callyspongia spinulosa</i>                                    | DD   | NE   |      |      | 1905 |               |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <b>Family Chalinidae</b>                                         |      |      |      |      |      |               |               |      |      |    |     |     |      |      |               |      |               |      |      |
| <i>Cladocroce</i> aff <i>burapha</i>                             | NA   | NA   |      |      |      |               |               |      |      |    |     |     |      |      |               | 2012 |               |      |      |
| <i>Cladocroce</i> sp “dark<br>green, branching, repent”          | NA   | NL   |      |      |      |               |               |      |      |    |     |     |      |      |               | 2012 |               |      |      |

**Table 1 continued.** Locations of sponge taxa found in Southern Island waters from published, unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates taxa was observed during Southern Islands Biodiversity Survey 2019-2022. Year corresponds to most recent publication or NParks internal record with taxa observation.

| Taxa                                              | RDB3 | IUCN | BIO  | BRK | BRN | CYR        | HNT        | JNG  | KEP | KUS  | LAZ | RAL  | SAL | SIS  | SJI  | SMK        | SNT        | TKR  | TPS  |
|---------------------------------------------------|------|------|------|-----|-----|------------|------------|------|-----|------|-----|------|-----|------|------|------------|------------|------|------|
| <b>Family Chalinidae</b>                          |      |      |      |     |     |            |            |      |     |      |     |      |     |      |      |            |            |      |      |
| <i>Haliclona (Gellius) amboinensis</i>            | LC   | NL   |      |     |     |            |            |      |     |      |     |      |     |      | 2012 |            |            |      |      |
| <i>Haliclona cf baeri</i>                         | NA   | NA   |      |     |     | 2020       | SIBS; 2020 | SIBS |     | 2020 |     |      |     |      | 2020 | SIBS; 2020 | SIBS; 2020 |      | 2020 |
| <i>Haliclona (Gellius) cymaeformis</i>            | LC   | NE   | 2012 |     |     | SIBS; 2012 | SIBS; 2012 | SIBS |     |      |     |      |     | 2012 |      | 2012       |            | 2012 | 2013 |
| <i>Haliclona (Reniera) fascigera</i>              | NL   | NL   |      |     |     |            | 2013       |      |     |      |     |      |     |      |      |            |            |      |      |
| <i>Haliclona (Rhizoniera) australis</i>           | DD   | NL   |      |     | 190 |            |            |      |     |      |     |      |     |      |      |            |            |      |      |
| <i>Haliclona koremella</i>                        | DD   | NL   |      |     |     |            |            |      |     |      |     |      |     |      |      |            |            | 2012 |      |
| <i>Haliclona</i> sp “black antler”                | NA   | NA   |      |     |     |            |            |      |     |      |     |      |     |      |      | 2020       |            |      |      |
| <i>Haliclona</i> sp “black encrusting”            | NA   | NA   |      |     |     |            |            |      |     |      |     |      |     |      | 2012 |            |            |      |      |
| <i>Haliclona</i> sp “brown, stout fistules”       | NA   | NA   | 2012 |     |     | 2012       | 2012       |      |     | 2012 |     | 2012 |     |      | 2012 | 2012       |            | 2012 |      |
| <i>Haliclona</i> sp “elegant branching”           | NA   | NA   |      |     |     | SIBS       | SIBS       |      |     |      |     |      |     |      |      |            |            |      |      |
| <i>Haliclona</i> sp “irregularly tubular”         | NA   | NA   |      |     |     |            | 2012       |      |     |      |     |      |     |      |      | 2012       |            |      |      |
| <i>Haliclona</i> sp “lumpy green”                 | NA   | NA   |      |     |     |            |            |      |     |      |     |      |     |      | SIBS |            |            | 2020 |      |
| <i>Haliclona</i> sp “lumpy purple”                | NA   | NA   |      |     |     | 2020       | 2020       |      |     |      |     |      |     |      |      | 2020       |            | 2020 |      |
| <i>Haliclona</i> sp “maroon, repent, thin branch” | NA   | NA   |      |     |     |            |            |      |     |      |     |      |     | 2012 |      |            |            |      |      |

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| Taxa                                                                | RDB3 | IUCN | BIO  | BRK | BRN  | CYR  | HNT  | JNG | KEP  | KUS  | LAZ | RAL  | SAL  | SIS  | SJI  | SMK  | SNT  | TKR  | TPS  |
|---------------------------------------------------------------------|------|------|------|-----|------|------|------|-----|------|------|-----|------|------|------|------|------|------|------|------|
| <b>Family Chalinidae</b>                                            |      |      |      |     |      |      |      |     |      |      |     |      |      |      |      |      |      |      |      |
| <i>Haliclona</i> sp “purple,                                        | NA   | NL   | 2012 |     |      |      | 2012 |     |      | 2012 |     | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 |      |      |
| <i>Haliclona</i> sp “transparent,                                   | NA   | NL   | 2012 |     |      |      | 2012 |     |      |      |     |      |      | 2012 |      |      |      |      |      |
| <i>Haliclona</i> sp “tubular”                                       | NA   | NL   |      |     |      |      | 2020 |     |      |      |     |      |      |      |      | 2020 | 2020 |      |      |
| <i>Haliclona</i> sp “violet,                                        | NA   | NL   | 2012 |     |      |      |      |     |      |      |     |      |      | 2012 | 2012 | 2012 |      |      |      |
| <i>Haliclona</i> sp “white                                          | NA   | NL   | 2012 |     |      |      |      |     |      |      |     |      |      |      |      |      |      |      |      |
| <i>Haliclona</i> sp nov                                             | NA   | NL   | 2012 |     |      |      | 2012 |     |      |      |     |      |      |      |      |      |      | 2012 |      |
| <b>Family Niphatidae</b>                                            |      |      |      |     |      |      |      |     |      |      |     |      |      |      |      |      |      |      |      |
| <i>Gelliodes fibulata</i>                                           | LC   | NE   |      |     |      |      | 2020 |     | 2020 | 2020 |     |      |      | 2018 |      | 2020 | 2020 |      | 2018 |
| <i>Gelliodes</i> sp “massive, spiny”                                | NA   | NL   |      |     |      |      |      |     |      |      |     |      |      |      |      | 2012 |      | 2012 |      |
| <i>Gelliodes</i> sp “pale violet,<br>stout anastomosed<br>branches” | NA   | NL   | 2012 |     |      | 2012 | 2012 |     |      | 2012 |     | 2012 |      |      | 2012 | 2012 |      | 2012 |      |
| <i>Gelliodes spinosella</i>                                         | DD   | NE   |      |     | 1905 |      |      |     |      |      |     |      |      |      |      |      |      |      |      |
| <i>Niphatas</i> sp “greyish-black,                                  | NA   | NL   |      |     |      |      |      |     |      |      |     |      |      |      |      | 2012 |      |      |      |
| <i>Niphatas</i> sp “reddish-pink,<br>massive”                       | NA   | NL   |      |     |      |      |      |     |      |      |     | 2012 |      | 2012 |      |      |      |      |      |
| <b>Family Petrosiidae</b>                                           |      |      |      |     |      |      |      |     |      |      |     |      |      |      |      |      |      |      |      |
| <i>Acanthostrongylophora<br/>ingens</i>                             | LC   | NE   | 2012 |     |      |      | 2012 |     |      |      |     |      |      |      |      | 2012 |      |      |      |
| <i>Neopetrosia carbonaria</i>                                       | LC   | NE   |      |     |      |      |      |     |      |      |     | 2012 |      |      | 2012 | 2012 |      | 2012 |      |

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| Taxa                                                         | RDB3 | IUCN | BIO           | BRK  | BRN  | CYR           | HNT  | JNG           | KEP  | KUS           | LAZ  | RAL  | SAL           | SIS  | SJI  | SMK           | SNT           | TKR  | TPS  |
|--------------------------------------------------------------|------|------|---------------|------|------|---------------|------|---------------|------|---------------|------|------|---------------|------|------|---------------|---------------|------|------|
| <b>Family Petrosiidae</b>                                    |      |      |               |      |      |               |      |               |      |               |      |      |               |      |      |               |               |      |      |
| <i>Neopetrosia compacta</i>                                  | DD   | NE   |               |      | 1905 |               |      |               |      |               |      |      |               |      |      |               |               |      |      |
| <i>Neopetrosia exigua</i>                                    | NA   | NE   | SIBS;<br>2012 |      |      | SIBS;<br>2020 | 2018 | SIBS;<br>2020 |      | SIBS;         |      |      |               |      |      |               |               |      | 2020 |
| <i>Neopetrosia similis</i>                                   | DD   | NE   |               |      | 1905 |               |      |               |      |               |      |      |               |      |      |               |               |      |      |
| <i>Neopetrosia</i> sp "blue"                                 | NA   | NL   | 2012          | SIBS |      | SIBS;<br>2020 |      | SIBS;<br>20   |      | 2012          |      |      |               |      |      |               |               |      | 2020 |
| <i>Petrosia (Petrosia)</i><br><i>hoeksemai</i>               | LC   | NE   |               |      |      |               |      |               |      |               |      |      |               |      |      |               |               | 2012 |      |
| <i>Petrosia</i> sp "massive, stout<br>fistules"              | NA   | NL   |               |      |      |               |      |               |      |               |      |      |               |      |      |               |               | 2012 |      |
| <i>Petrosia</i> sp "white,<br>ectosomal, reticulation"       | NA   | NL   | 2012          |      |      |               | 2012 | 20            | 2    |               |      |      |               |      |      |               | 2012          |      |      |
| <i>Xestospongia</i> sp "black,<br>boring"                    | NA   | NL   | 2012          |      |      |               | 2012 |               |      |               |      | 2012 |               | 20   | 2    |               | 2012          |      |      |
| <i>Xestospongia</i> sp "brown,<br>numerous oscules"          | NA   | NL   |               |      |      |               |      |               |      |               |      | 2012 |               |      |      |               |               |      |      |
| <i>Xestospongia</i> sp "white"                               | NA   | NL   |               |      |      |               |      | 20            | 2    |               |      | 2012 |               |      |      | 2012          |               |      |      |
| <i>Xestospongia</i> sp "reddish-<br>pink, irregular"         | NA   | NL   | 2012          |      |      |               | 2012 |               |      | 2012          |      | 2012 |               |      |      |               |               |      |      |
| <i>Xestospongia testudinaria</i>                             | LC   | NE   | 2012          |      |      | 2020          | 2020 | 2020          | 2020 | SIBS;<br>2020 | SIBS | 2012 | 2012          | 2020 | 2020 | 2020          | SIBS;<br>2020 | 2020 | 2020 |
| <i>Xestospongia vansoesti</i>                                | LC   | NE   |               |      |      |               |      |               |      |               |      |      | 2012          |      | 2012 | 2012          |               | 2012 |      |
| <b>Family Phloeodictyidae</b>                                |      |      |               |      |      |               |      |               |      |               |      |      |               |      |      |               |               |      |      |
| <i>Oceanapia sagittaria</i>                                  | LC   | NE   | 2012          |      |      | SIBS;<br>2020 | 2020 | SIBS;<br>2012 |      | 2020          |      | 2020 | SIBS;<br>2012 | 2020 | 2020 | SIBS;<br>2012 | 2020          | 2020 | 2020 |
| <i>Oceanapia</i> sp "white<br>fistules, 1cm crust body"      | NA   | NL   |               |      |      |               |      |               |      |               |      |      |               |      |      | 2012          |               |      |      |
| <i>Oceanapia</i> sp "yellow<br>fistules, calcareous grains " | NA   | NL   |               |      |      | 2012          |      |               |      |               |      |      |               | 2012 |      | 2012          |               | 2012 |      |

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|--------------------------------------|------|------|------|-----|-----|------|------|------|-----|------|------|------|------|------|------|------|------|------|------|
| <b>Family Phloeodictyidae</b>        |      |      |      |     |     |      |      |      |     |      |      |      |      |      |      |      |      |      |      |
| <i>Siphonodictyon maldiviense</i>    | LC   | NE   | 2012 |     |     | 2012 | 2013 |      |     |      |      |      |      | 2012 |      | 2012 |      | 2012 |      |
| <i>Siphonodictyon mucosum</i>        | LC   | NE   | 2012 |     |     |      |      |      |     | 2012 |      | 2012 |      |      |      |      |      |      |      |
| <b>Order Poecilosclerida</b>         |      |      |      |     |     |      |      |      |     |      |      |      |      |      |      |      |      |      |      |
| <b>Family Acarnidae</b>              |      |      |      |     |     |      |      |      |     |      |      |      |      |      |      |      |      |      |      |
| <i>Acarnus primigenius</i>           | LC   | NE   | 2012 |     |     |      | 2012 | 2012 |     |      |      |      |      |      |      | 2012 |      |      |      |
| <i>Acarnus ternatus</i>              | LC   | NE   | 2012 |     |     |      |      |      |     |      |      |      |      |      |      | 2012 |      |      |      |
| <i>Damiria simplex</i>               | LC   | NE   |      |     |     |      | 2012 |      |     |      |      |      |      |      |      | 2012 |      |      |      |
| <b>Family Coelosphaeridae</b>        |      |      |      |     |     |      |      |      |     |      |      |      |      |      |      |      |      |      |      |
| <i>Forcepia (Forcepia) vansoesti</i> | LC   | NE   | 2012 |     |     |      |      |      |     | 2012 |      |      | 2012 |      | 2012 |      |      |      |      |
| <i>Monanchora clathrata</i>          | LC   | NE   | 2012 |     |     |      |      |      |     |      |      | 2012 |      |      |      | 2012 |      |      |      |
| <i>Lissodendoryx cf schimdti</i>     | NA   | NE   | 2012 |     |     |      | 2012 | 2012 |     | 2012 |      | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 | 2012 |      |
| <b>Family Crambeidae</b>             |      |      |      |     |     |      |      |      |     |      |      |      |      |      |      |      |      |      |      |
| <i>Monanchora unguiculata</i>        | LC   | NE   |      |     |     |      |      |      |     |      |      |      |      |      |      |      | 2012 |      |      |
| <b>Family Desmacellidae</b>          |      |      |      |     |     |      |      |      |     |      |      |      |      |      |      |      |      |      |      |
| <i>Biemna fortis</i>                 | LC   | NE   | 2012 |     |     | 2012 | 2013 | 2012 |     | 2012 | 2012 | 2012 |      | 2012 | 2012 | 2012 | 2012 | 2012 | 2013 |
| <b>Family Guitarridae</b>            |      |      |      |     |     |      |      |      |     |      |      |      |      |      |      |      |      |      |      |
| <i>Tetrapocillon patbergquistae</i>  | LC   | NE   |      |     |     |      |      |      |     |      |      | 2012 |      |      |      |      |      |      |      |
| <b>Family Iotrochotidae</b>          |      |      |      |     |     |      |      |      |     |      |      |      |      |      |      |      |      |      |      |
| <i>Iotrochota baculifera</i>         | LC   | NE   |      |     |     | 2012 |      |      |     |      |      |      |      |      |      | 2013 |      |      | 2013 |
| <i>Iotrochota purpurea</i>           | LC   | NE   |      |     |     |      |      |      |     |      |      |      | 2012 |      |      | 2012 |      |      |      |

[illegible]

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|--------------------------------------------------------------------|------|------|------|-----|------|------|------|------|-----|------|-----|------|------|------|------|------|-----|------|-----|
| <b>Family Mycalidae</b>                                            |      |      |      |     |      |      |      |      |     |      |     |      |      |      |      |      |     |      |     |
| <i>Mycale (Aegogropila)</i> sp<br>“orange, thin branch”            | NA   | NL   |      |     |      |      | 2012 |      |     |      |     |      |      | 2012 |      |      |     |      |     |
| <i>Mycale (Aegogropila)</i> sp<br>“yellow encrusting”              | NA   | NL   |      |     |      |      | 2012 |      |     | 2012 |     |      |      |      |      |      |     |      |     |
| <i>Mycale (Aegogropila)</i><br>sp “yellow, large<br>mycalostyles ” | NA   | NL   |      |     |      | 2012 |      | 2012 |     |      |     |      | 2012 |      | 2012 |      |     |      |     |
| <i>Mycale(Aegogropila)</i><br><i>sulevoidea</i>                    | LC   | NE   | 2012 |     |      | 2012 | 2012 |      |     | 2012 |     | 2012 |      |      |      | 2012 |     |      |     |
| <i>Mycale (Carmia) murrayi</i>                                     | DD   | NE   |      |     | 1905 |      |      |      |     |      |     |      |      |      |      |      |     |      |     |
| <i>Mycale (Carmia)</i> sp<br>“purple, encrusting”                  | NA   | NL   |      |     |      |      |      |      |     |      |     |      |      | 2012 |      |      |     |      |     |
| <i>Mycale (Mycale) grandis</i>                                     | LC   | NE   |      |     |      |      |      |      |     |      |     |      |      |      |      | 2013 |     | 2012 |     |
| <i>Mycale (Mycale)</i> sp<br>“orange, thin branch”                 | NA   | NL   | 2012 |     |      |      |      |      |     |      |     |      |      |      |      |      |     |      |     |
| <i>Mycale(Mycale)</i> sp nov<br>“orange, thin branch”              | NA   | NL   |      |     |      |      | 2012 |      |     |      |     |      |      |      |      |      |     |      |     |
| <i>Mycale (Mycale) sulcata</i>                                     | LC   | NE   | 2012 |     |      |      |      |      |     |      |     |      |      |      |      |      |     | 2012 |     |
| <i>Mycale(Zygomycale)</i><br><i>parishii</i>                       | LC   | NE   | 2012 |     |      |      |      | 2012 |     | 2012 |     | 2012 | 2012 |      | 2012 | 2012 |     | 2012 |     |
| <b>Family Myxillidae</b>                                           |      |      |      |     |      |      |      |      |     |      |     |      |      |      |      |      |     |      |     |
| <i>Psammochela psammodes</i>                                       | LC   | NE   |      |     |      |      |      |      |     |      |     | 2012 |      |      |      |      |     |      |     |
| <b>Order Scopalina</b>                                             |      |      |      |     |      |      |      |      |     |      |     |      |      |      |      |      |     |      |     |
| <b>Family Scopaliniidae</b>                                        |      |      |      |     |      |      |      |      |     |      |     |      |      |      |      |      |     |      |     |
| <i>Scopalina</i> sp nov “yellow,<br>encrusting”                    | NA   | NL   | 2012 |     |      |      | 2012 |      |     |      |     | 2012 |      |      |      |      |     |      |     |

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|--------------------------------------------------------------------|------|------|------|------|-----|---------------|------|------|-----|------|------|------|------|------|------|------|---------------|---------------|------|
| <b>Order Suberitida</b>                                            |      |      |      |      |     |               |      |      |     |      |      |      |      |      |      |      |               |               |      |
| <b>Family Halichondriidae</b>                                      |      |      |      |      |     |               |      |      |     |      |      |      |      |      |      |      |               |               |      |
| <i>Amorpinopsis excavans</i>                                       | LC   | NE   |      |      |     | SIBS          |      |      |     |      | 2020 | SIBS |      |      |      |      |               | SIBS;<br>2012 |      |
| <i>Axinyssa</i> sp “cushion-shaped<br>shaped”                      | NA   | NL   |      |      |     |               | 2012 |      |     |      |      | 2012 |      |      | 2012 |      |               |               |      |
| <i>Axinyssa</i> sp “orange, bushy”                                 | NA   | NL   |      |      |     |               |      |      |     |      |      |      |      |      |      |      |               | 2012          |      |
| <i>Axinyssa</i> sp “orange, cone-<br>like fistules”                | NA   | NL   | 2012 |      |     |               |      |      |     |      |      | 2012 |      |      |      |      |               |               |      |
| <i>Ciocalyptra</i> cf <i>tyleri</i>                                | NA   | NA   |      |      |     |               |      |      |     |      |      |      |      |      |      |      | 2012          |               |      |
| <i>Epipolasis suluensis</i>                                        | LC   | NE   |      |      |     |               |      |      |     |      |      |      | 2012 |      |      |      |               |               |      |
| <i>Halichondria</i><br>( <i>Halichondria</i> ) <i>cartilaginea</i> | LC   | NE   |      | SIBS |     | SIBS;<br>2013 |      | SIBS |     | 2012 |      |      | SIBS |      | SIBS |      | SIBS;<br>2013 |               |      |
| <i>Halichondria</i> sp “green,<br>lobate”                          | NA   | NL   |      |      |     |               | 2012 | 2012 |     |      |      |      |      |      |      |      |               |               |      |
| <i>Halichondria</i> sp “orange”                                    | NA   | NL   | 2012 |      |     |               |      |      |     |      |      |      |      |      |      |      |               |               |      |
| <i>Halichondria</i> sp “pale<br>orange, encrusting”                | NA   | NL   |      |      |     |               |      |      |     |      |      |      |      |      |      |      |               | 2012          |      |
| <i>Halichondria</i> sp “purple,<br>massive”                        | NA   | NL   |      |      |     |               | 2012 |      |     |      |      |      |      |      |      |      |               |               |      |
| <i>Halichondria</i> sp “white<br>fistules, burrowing”              | NA   | NL   |      |      |     |               | 2012 |      |     |      |      | 2012 |      |      |      |      |               |               |      |
| <i>Halichondria</i> sp “thin wall,<br>brown”                       | NA   | NL   | 2012 |      |     |               | 2012 | 2012 |     |      |      | 2012 |      | 2012 | 2012 | 2012 |               |               |      |
| <i>Halichondria</i> sp “yellow<br>fistules”                        | NA   | NL   |      |      |     |               |      |      |     |      |      |      |      | 2012 | 2012 |      |               | 2012          |      |
| <i>Halichondria</i> sp “yellow-<br>green, burrowing”               | NA   | NL   |      |      |     |               |      |      |     |      |      |      |      | 2012 | 2012 |      |               |               |      |
| <b>Family Suberitidae</b>                                          |      |      |      |      |     |               |      |      |     |      |      |      |      |      |      |      |               |               |      |
| <i>Aaptos suberitoides</i>                                         | LC   | NE   | 2013 |      |     |               | 2012 |      |     | 2020 |      |      |      |      | 2018 | 2020 | 2020          | 2012          | 2020 |
| <i>Prosuberites oleteira</i>                                       | LC   | NE   | 2012 |      |     |               |      |      |     |      |      | 2012 |      |      | 2012 |      |               | 2012          |      |

**Table 1 continued.** Locations of sponge taxa found in Southern Island waters from published, unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates taxa was observed during Southern Islands Biodiversity Survey 2019-2022. Year corresponds to most recent publication or NParks internal record with taxa observation.

| Taxa                                                 | RDB3 | IUCN | BIO        | BRK  | BRN  | CYR        | HNT        | JNG        | KEP  | KUS        | LAZ        | RAL  | SAL        | SIS  | SJI  | SMK        | SNT        | TKR        | TPS  |
|------------------------------------------------------|------|------|------------|------|------|------------|------------|------------|------|------------|------------|------|------------|------|------|------------|------------|------------|------|
| <b>Family Suberitidae</b>                            |      |      |            |      |      |            |            |            |      |            |            |      |            |      |      |            |            |            |      |
| <i>Protosuberites</i> sp “yellow, thinly encrusting” | NA   | NL   | 2012       |      |      |            |            |            |      |            |            |      |            |      |      |            |            | 2012       |      |
| <i>Pseudosuberites cava</i>                          | LC   | NE   |            |      |      | 2012       | 2012       |            |      |            |            |      |            |      |      |            |            |            |      |
| <i>Suberites diversicolor</i>                        | LC   | NE   |            |      |      |            |            |            |      |            |            |      |            |      | 2012 |            |            |            |      |
| <i>Terpios granulosus</i>                            | LC   | NE   | 2012       |      |      |            | 2012       |            |      |            |            |      | 2012       |      |      |            |            |            |      |
| <b>Order Tethyida</b>                                |      |      |            |      |      |            |            |            |      |            |            |      |            |      |      |            |            |            |      |
| <b>Family Tethyidae</b>                              |      |      |            |      |      |            |            |            |      |            |            |      |            |      |      |            |            |            |      |
| <i>Tethya robusta</i>                                | LC   | NE   |            |      |      |            |            |            |      |            |            |      |            |      |      | 2020       |            | 2020       |      |
| <b>Order Tetractinellida</b>                         |      |      |            |      |      |            |            |            |      |            |            |      |            |      |      |            |            |            |      |
| <b>Family Ancorinidae</b>                            |      |      |            |      |      |            |            |            |      |            |            |      |            |      |      |            |            |            |      |
| <i>Ancorina</i> sp “yellow, green encrusting”        | NA   | NL   |            |      |      |            |            |            |      |            |            |      |            |      | 2012 |            |            |            |      |
| <i>Jaspis splendens</i>                              | LC   | NE   | 2012       |      |      |            | 2012       | 2012       |      |            |            | 2012 |            | 2012 | 2012 |            |            |            |      |
| <i>Rhabdastrella globostellata</i>                   | LC   | NE   | SIBS; 2012 | SIBS |      | SIBS; 2020 | SIBS; 2020 | SIBS; 2020 | 2015 | 2012       |            | 2012 | SIBS; 2012 | 2020 | 2020 | SIBS; 2020 | SIBS; 2020 | SIBS; 2020 | 2020 |
| <i>Stelletta clavosa</i>                             | LC   | NE   |            |      |      | SIBS; 2020 | SIBS; 2020 | SIBS; 2012 |      |            |            |      | SIBS       |      |      | 2020       |            | 2012       | 2020 |
| <b>Family Tetillidae</b>                             |      |      |            |      |      |            |            |            |      |            |            |      |            |      |      |            |            |            |      |
| <i>Cinachyrella arabica</i>                          | DD   | NE   |            |      | 1905 |            |            |            |      |            |            |      |            |      |      |            |            |            |      |
| <i>Cinachyrella australiensis</i>                    | LC   | NE   | 2012       | SIBS |      | SIBS; 2020 | SIBS; 2020 | SIBS; 2020 |      | SIBS; 2020 | SIBS; 2020 | 2012 | SIBS; 2012 | 2020 | 2020 | 2020       | SIBS; 2020 | SIBS; 2020 | 2020 |
| <i>Cinachyrella</i> sp “white”                       | NA   | NL   | 2012       |      |      |            |            |            |      |            |            | 2012 |            | 2012 |      |            |            |            |      |
| <i>Craniella abracadabra</i>                         | LC   | NE   |            |      |      |            |            |            |      |            |            | 2012 |            |      |      |            |            |            |      |
| <i>Paratetilla bacca</i>                             | LC   | NE   | 2012       |      |      |            | 2018       |            |      | 2012       |            |      |            | 2018 | 2012 |            |            | 2012       |      |
| <i>Paratetilla</i> sp “yellow”                       | NA   | NL   |            |      |      |            |            |            |      |            |            | 2012 |            |      |      |            |            |            |      |

**Table 1 continued.** Locations of sponge taxa found in Southern Island waters from published, unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates taxa was observed during Southern Islands Biodiversity Survey 2019-2022. Year corresponds to most recent publication or NParks internal record with taxa observation.

| Taxa                                         | RDB3 | IUCN | BIO  | BRK  | BRN | CYR           | HNT           | JNG           | KEP | KUS           | LAZ           | RAL  | SAL  | SIS  | SJI           | SMK           | SNT           | TKR  | TPS  |
|----------------------------------------------|------|------|------|------|-----|---------------|---------------|---------------|-----|---------------|---------------|------|------|------|---------------|---------------|---------------|------|------|
| <b>Family Theonellidae</b>                   |      |      |      |      |     |               |               |               |     |               |               |      |      |      |               |               |               |      |      |
| <i>Theonella laena</i>                       | LC   | NE   |      |      |     |               |               |               |     |               |               | 2016 |      |      |               |               |               |      |      |
| <b>Order Verongiida</b>                      |      |      |      |      |     |               |               |               |     |               |               |      |      |      |               |               |               |      |      |
| <b>Family Aplysiniellidae</b>                |      |      |      |      |     |               |               |               |     |               |               |      |      |      |               |               |               |      |      |
| <i>Aplysinella strongylata</i>               | NA   | NE   |      |      |     |               |               |               |     |               |               |      |      |      |               | 2013          |               |      |      |
| <b>Family Ianthellidae</b>                   |      |      |      |      |     |               |               |               |     |               |               |      |      |      |               |               |               |      |      |
| <i>Hexadella indica</i>                      | LC   | NE   | 2012 |      |     |               | 2018          |               |     |               |               | 2012 |      | 2018 | 2012          |               |               |      |      |
| <b>Family Pseudoceratinidae</b>              |      |      |      |      |     |               |               |               |     |               |               |      |      |      |               |               |               |      |      |
| <i>Pseudoceratina purpurea</i>               | LC   | NE   | 2012 | SIBS |     | SIBS;<br>2020 | SIBS;<br>2020 | SIBS;<br>2020 |     | SIBS;<br>2020 | SIBS;<br>2020 | 2012 | SIBS | 2020 | SIBS;<br>2020 | 2020          | SIBS;<br>2020 | 2020 | 2020 |
| <b>Class Unknown</b>                         |      |      |      |      |     |               |               |               |     |               |               |      |      |      |               |               |               |      |      |
| Phylum Porifera sp "blue encrusting prickly" | NA   | NA   |      |      |     |               | SIBS;<br>2020 |               |     |               | 2020          | 2020 | SIBS | SIBS | 2020          | SIBS;<br>2020 | SIBS;<br>2020 |      | 2020 |
| Phylum Porifera sp "milo"                    | NA   | NA   |      |      |     |               | SIBS          |               |     | 2020          |               |      |      |      |               |               |               |      |      |
| Phylum Porifera sp "smooth green"            | NA   | NA   | SIBS |      |     | SIBS;<br>2020 | SIBS;<br>2020 |               |     | SIBS          | 2020          |      | SIBS | 2020 |               | SIBS;<br>2020 | 2020          | 2020 | 2020 |
| Phylum Porifera sp "straw"                   | NA   | NA   |      |      |     |               | SIBS          | SIBS          |     | 2020          |               |      |      |      |               | 2020          |               |      | 2020 |
| Phylum Porifera sp "yellow bumpy"            | NA   | NA   |      |      |     | SIBS          | 2020          |               |     | 2020          |               |      |      |      |               | 2020          | 2020          |      |      |

## Discussion

With approximately 9,000 extant species of Porifera globally, 188 morphospecies of sponges have been recorded by us in the Southern Islands of Singapore, of which 105 have been identified to species level. While this may not be a large proportion of all sponge species, the totals in the Southern Islands are nationally significant and represent between a quarter and a half of those recorded in the western part of the South China Sea (Lim et al., 2016). But the necessity of relying on morphospecies is a significant drawback. 12 of the morphospecies (not identified to species level) listed here could not be found in Lim et al. (2012), and some could be hidden or duplicated within inconsistent morpho-names. A more limited study by Lim et al. (2023; data not included in our study) identified 28 morphospecies in total at Pulau Hantu, Big Sisters Island (Pulau Subar Laut) and the western tip of Sentosa (i.e., three of the sites covered in the present paper) plus Labrador on the adjacent mainland coast. The SIBS exercise has helped to clarify the distribution of species and their numbers, but has not answered some of the underlying reasons. As the area of intertidal habitat and the length of island coastline are not obviously correlated with diversity, other factors may be in play such as the water quality around each island, amount of sediment, quality of the substrate for the settlement of larvae, or source populations from which larvae can disperse via currents.

In the Singapore Red Data Book (Lim, 2024), 83 of the 105 sponges (including the three calcareous sponges) identified here to species level were listed as being of Least Concern, and 17 species as Data Deficient. The Neptune Cup's sponge *Cliona patera* was a lone exception and is considered Critically Endangered (Table 1). The National Parks Board has managed relocation efforts for imperilled sponges like *Cliona patera* in efforts to conserve and potentially restore wild living populations. Although most of these sponges are not highlighted as being of conservation concern, all sponges, like other marine species, are susceptible to the pressures of pollution and habitat loss due to dredging, land reclamation and coastal development. About half of the listed sponges (including morphospecies) do not have an assigned conservation status and present a knowledge gap for future research.

*Cliona patera* was considered globally extinct after 1908 due to overharvesting (Platt, 2011), but it was rediscovered in Singapore waters in 2011 (Lim et al., 2012b). Efforts are in place to protect and conserve these magnificent sponges in Singapore, for instance, through successful relocation programmes which ensure survival of corals and sponges impacted by coastal modification and land reclamation projects (Khamid, 2015). While compiling records for SIBS, we found that *Cliona patera* was recorded off Pulau Seringat (grouped here under Lazarus Island), Sisters' Islands, (Pulau Subar Darat and Pulau Subar Laut), Pulau Sakijang Bendera (St John's Island), and Pulau Semakau. Some of these critically endangered sponges have been relocated to the waters of Sisters' Islands Marine Park as part of a species recovery effort, following reclamation and coastal development works at Pulau Semakau. While relocating these sponges prevented their immediate destruction, experts have raised concerns that aggregating these sponge individuals make them more susceptible to disease and predation (Quek et al., 2022). For instance, natural predators such as the Hawksbill Turtle *Eretmochelys imbricata* could find these aggregations, feed on them, and consequently extirpate the rare sponges. Thus, the sponges are regularly monitored by NParks through dive surveys to check their health and overall condition to ensure their continued survival.

Although sponges are now well studied and documented in Singapore taxonomically, there is a major knowledge gap on their ecology. Preliminary studies on *Cliona patera* continue to surprise, as their regenerative ability and rate of growth was higher than expected. Knowledge gaps of this sort, including substrate preferences, reproductive needs, interspecific competition, settlement rates and dispersal can all impede conservation efforts.

Two examples illustrate the importance of conservation. *Xestospongia testudinaria*, the giant barrel sponge, is a maroon to pink coloured sponge which was recorded in 15 Southern Island sites. In the intertidal zone, it grows to about 10–20 cm in width and height (Tan, 2019), but members of the *Xestospongia* species complex can reach more than a 100 years old and grow over 1 m in height and diameter (McMurray et al., 2008). With a distribution that spans from Australia to the Indian Ocean (de Voogd et al., 2023), it is a target for bioprospecting for active pharmaceutical compounds and a subject for many biomedical research reports. Some individuals can live for a long time, and the large amount of water that they filter over their lifetime is important for maintaining water quality and controlling algae populations. These sponges are also one of the most common sponge species in Singapore (de Voogd & Cleary 2009; Lim, de Voogd & Cleary, 2012), forming habitats for certain marine species such as sponge worms, sea cucumbers and benthic fish (Tan, 2019). Unpublished data from dredge surveys of the Comprehensive Marine Biodiversity Survey (2010 - 2015) of Singapore suggest that these may form species-rich sponge beds on otherwise soft-sediment seabed areas. The barrel sponge thus serves important ecological functions across the Southern Islands marine ecosystem.

*Pseudoceratina purpurea*, the yellow prickly branching sponge, is another widely recorded species, and has a variable shape, forming knobs, lobes, branching stems from an encrusting base (Tan, 2016). This widely distributed sponge has potentially powerful biomedical applications, as it contains a chemical called psammaplin A, which strongly inhibits cancer cell growth and proliferation (Matthias, 2011).

While sponges may not have garnered the same level of research interest as other charismatic marine taxa, there is evidence that they serve important ecosystem services such as improving water quality through filter feeding and have impressive potential for biomedical and pharmaceutical applications. The exciting re-emergence of the critically endangered Neptune's Cup Sponge in recent years, also highlights the Southern Island's marine habitats as a small but surprising treasure trove for marine biodiversity. As such, the Southern Islands, and the surrounding marine range, are an essential part of Singapore's natural heritage. The potential challenges of climate change, coral bleaching (loss of substrate and nutrient supply), shipping, physical damage such as anchoring, land reclamation, and pollution including oil spills should not be overlooked.

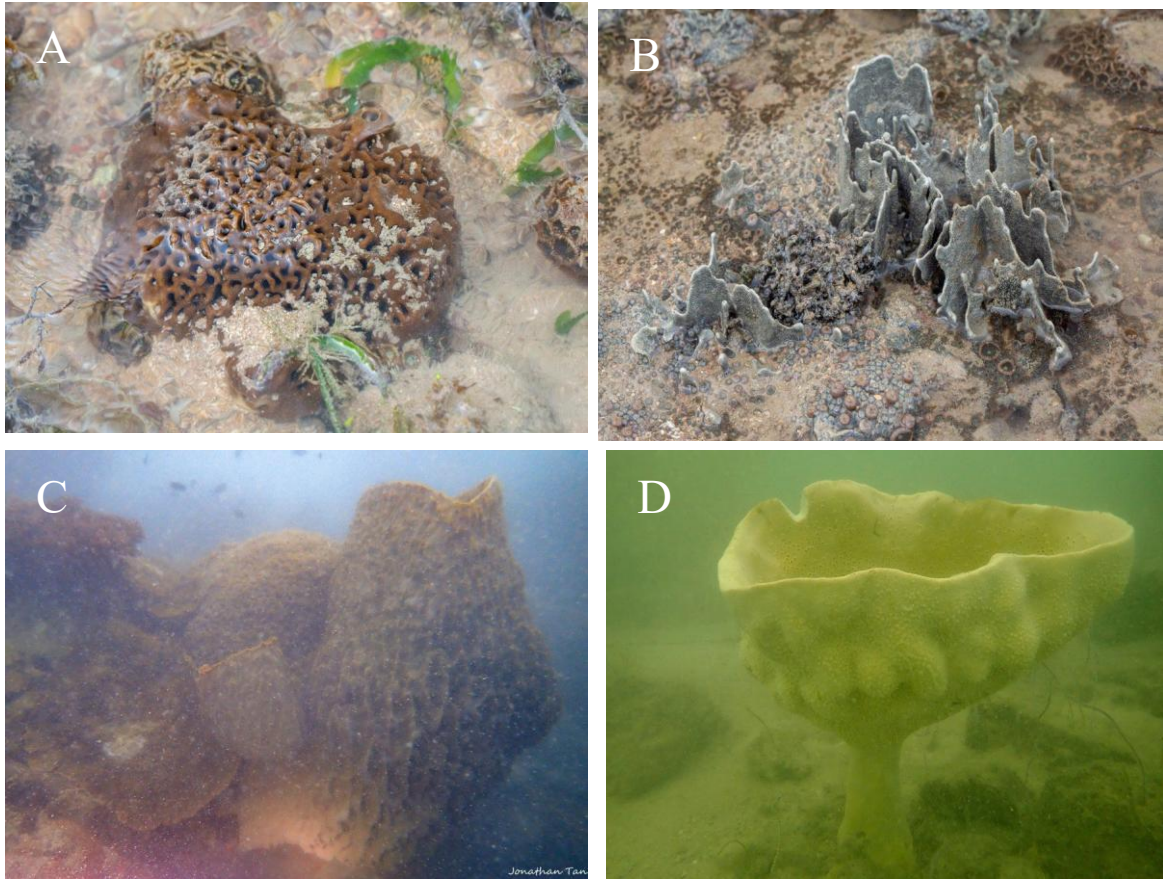
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**Appendix 1** (A) Chocolate Sponge (*Spheciospongia vagabunda*) at Pulau Tekukor, credits: Marcus Ng. (B) Silvery Blue Sponge (*Lamellodysidea herbacea*) at Pulau Tekukor, credits: Marcus Ng. (C) Barrel Sponge (*Xestospongia testudinaria*) forming habitat on a coral reef, Raffles Lighthouse, credits: Jonathan Tan. (D) Neptune's Cup Sponge (*Cliona patera*), Sisters Islands, credits: Jonathan Tan.