The Shallow Water Marine Sponges (Porifera) of Cebu, Philippines

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ABSTRACT

Thirty-three (33) species of marine sponge were identified in this study. Four were identified as possibly new to science; a short description of these species is given here. In addition, one species has potential for bath sponge culture. Percent similarity of species is low between stations suggesting a highly diverse sponge assemblage around the island. Clustering of the stations appears to be related to distance between stations.

Keywords: sponges, Cebu, percentage similarity, number of species

INTRODUCTION

The coastline of the island of Cebu has wide shallow water areas and reef flats. While many studies have been conducted on the island, few studies on sponges have been reported or published. So far, there are only the works of Ruelo (1964), Esmero (1978) and Bakus and Nishiyama (2000) that reported on the sponges in the collection of the University of San Carlos, sponge fauna on artificial substrates in Cebu Harbor and the three species of toxic sponges, respectively. No comprehensive study on the sponge fauna of Cebu has been completed, nor for the entire Philippine regions, although many probate collections are known.

Ecologically, sponges are important components of coral reefs since their biomass and ecological tolerance frequently exceed that of the reef-building corals (Ruetzler, 1978). They have unique symbiotic relationships with cyanobacteria or blue-green algae (Hooper, 2000), with their own kind and with other marine organisms. They are also effective filters, filtering up to four to five times their own volume every minute (Allen, 2000). They are capable of bioeroding as well as consolidating reef structures (Hooper, 2000).

Economically, the growing preference for natural products has reinforced the market position of sponges (Josupeit, 1990) as good sources of bath sponges for the cosmetic industry. Some sponges (i.e. *Aplysina fulva* and *Mycale microsigmatosa*) showed potential to prevent marine biofouling (Periera et al., 2002).

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Sponges have become the focus of many medical and biochemical studies due to the presence of novel compounds and bioactive secondary metabolites which are hoped to inhibit cancerous growths and other diseases.

There are about 7,000 recognized species worldwide however, it is believed that there are at least 15,000 living species (Hooper, 2000). The Indo-Malay archipelago and South China sea have approximately 1,200 described species with the Philippines having less than 500 species documented pers. com. Caberoy. This region is thought to harbor high diversity of sponges estimated to range from 4,000 to 6,000 species. The many types of habitats (i.e. coral reefs, mangrove, muddy, sandy and rubble) in this region support such diverse fauna.

This study aims to identify the sponges found in the shallow waters of Cebu Island, Philippines focusing on the demosponge fauna of the intertidal and shallow subtidal (0-18 m). Sponges that are possibly new to science will be described preliminarily awaiting more detailed study and specimens to finally allocate a new species name.

MATERIALS AND METHODS

Six sampling stations were established around Cebu (Fig. 1). In establishing the sampling stations, it was considered that all the bodies of water surrounding the island were represented. Table 1 shows the six (6) sampling stations and the bodies of water that the stations represent. The station at San Francisco (Station 2) included a separate intertidal area (zone 1) due to observed abundance of sponges in one particular area. This is located about 2 km from the sampling area of the three deeper zones. The station inside a Marine Protected Area of Badian (Station 4) was also included as a reference station for sponge distribution for MPAs

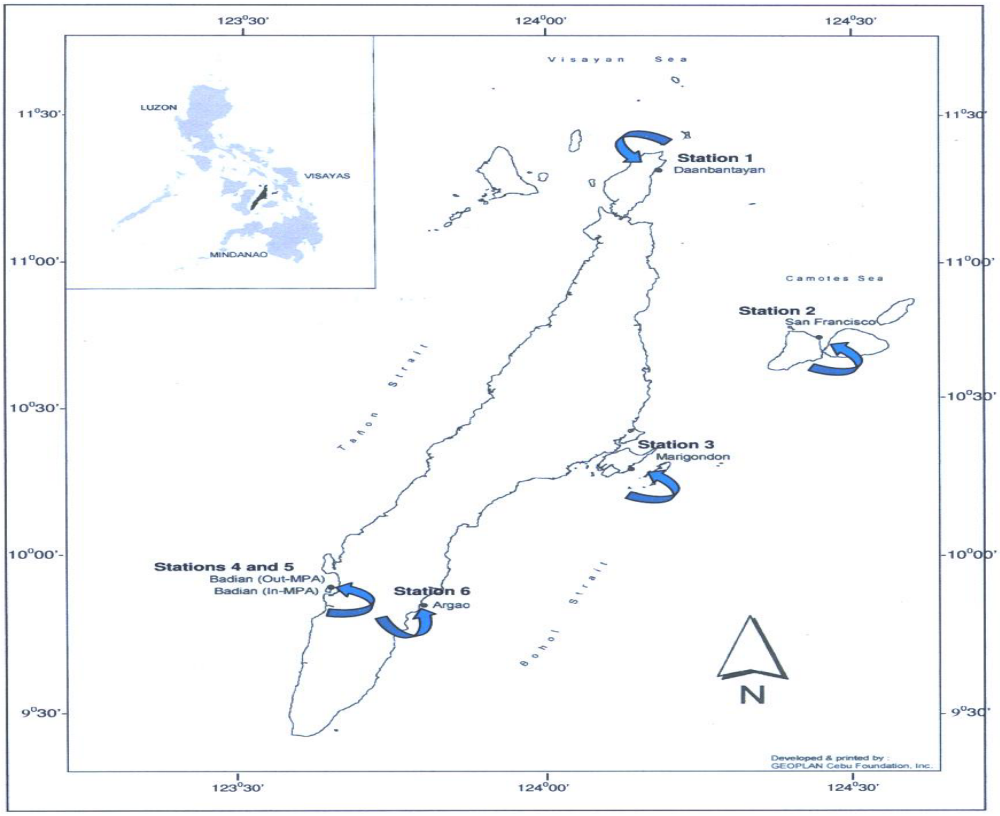


Fig. 1. Map of Cebu showing the six sampling stations of the study.

Table 1. The six (6) sampling stations with their respective location.

Station No.	Location	Position		Remarks
		ºN Latitude	ºE Longitude	
1	Daanbantayan	11º13'25.8"	124º03'23.5"	The station represents the shallow waters of the Visayan Sea and Camotes Sea
2	San Francisco	10º41'23.2"	124º22'31.9"	Bound by Camotes Sea
3	Marigondon	10º16'10.2"	123º59'30.1"	Located at Hilutungan Channel
4	Badian (Inside MPA)	9º51'43"	123º23'55"	Bound by Tanon Strait
5	Badian (Outside MPA)	09º53'38.8"	123º22'51.8"	Bound by Tanon Strait
6	Argao	09º50'02.7"	123º34'08.0"	Bound by Bohol Strait

and at the same time as a comparison to the station outside an MPA (Station 5).

Sponge specimens were collected from the six sampling stations from April to May 2003. Collection of sponges for taxonomy was done together with the samplings for the distribution study thus the depth specification of the latter was used. Four depth zones were considered for the six stations: depth zone 1 (0-2m); depth zone 2 (3-9m); depth zone 3 (10-12m) and depth zone 4 (13-18m). A 50-m transect line was laid parallel to the shore at every depth zone. Quadrat sampling was then carried-out at 5-m interval using a 1-m^2 quadrat. All the samples collected were coded (for later identification) and recorded. Sponges were collected by SCUBA diving and snorkeling at a distance ranging from 80 m to 1,000 m from the shore.

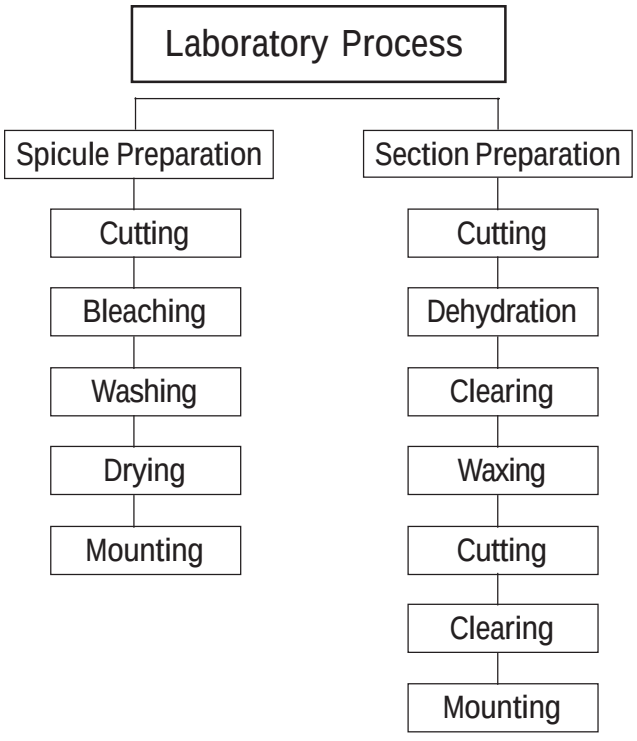


Fig. 2. Schematic diagram of the laboratory process in the preparation of permanent slides used in the microscopic analysis of sponges collected in the different stations of Cebu, from April to May 2003.

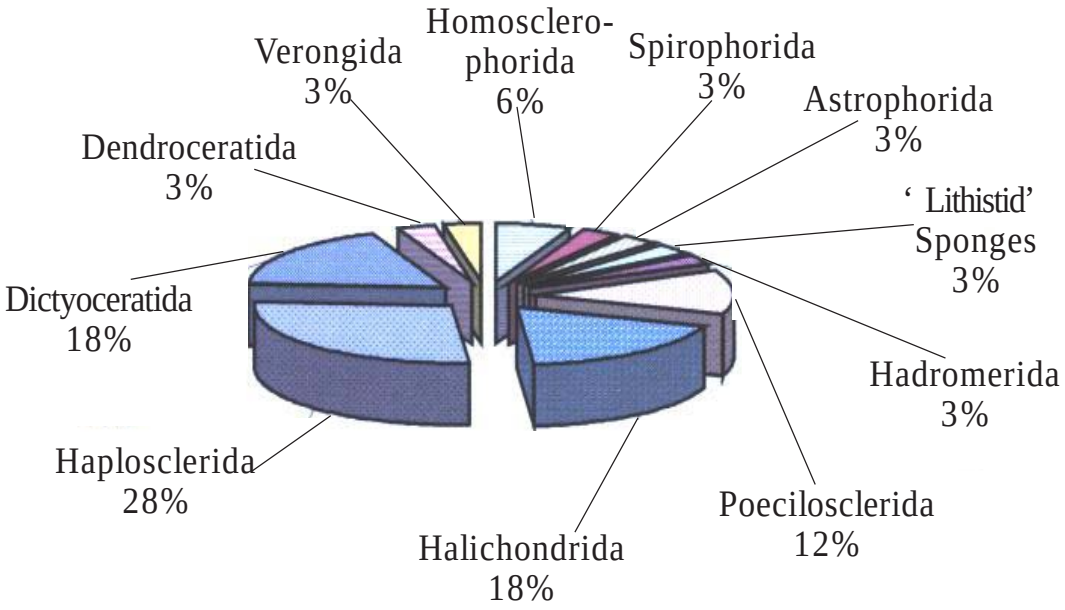
Species richness, which is the total number of sponge species, is determined for each station and zone. Jaccard's Index of Similarity and Dissimilarity (Bakus, 1990) was calculated to process clustering of stations using Statistica, 2000. The formula used to compute this index is given below:

$$\text{Jaccard } C_J = j/(a+b-j)$$

where: j = number of species found in both stations; a = the number of species in station A; b = the number of species in station B

Figure 2 shows the schematic diagram of the laboratory process that was used to identify the sponges. Spicule forms, sizes and their architecture together with some morphological characters (i.e. color, shape, texture, surface, sizes of pores and others) were used in the identification.

Only part of the sponge collection (those identified to the species level and the four sponges preliminarily identified as new species) is presented in this work. Comparisons of biological data gathered will be presented in another paper.



RESULTS AND DISCUSSION

A total of thirty-three (33) species belonging to 29 genera, 22 families and 11 orders were identified in this study. Sixteen (16) species are new to the Philippines and four (4) species are possibly new to science, only a short description is given here, as the primary purpose of the paper is to provide an overall description of the fauna of Cebu Island. These will be described formally in a later publication. Similarly, previous studies of sponges in the Philippines reported several new species. Wilson (1925) discovered 37 new sponge species of the 90 species he identified from the collection of the Albatross Expedition to the Philippines in 1907-10. In 1935, de Laubenfels also reported 2 new species out of the eight (8) species identified. In 1989, Lèvi and Lèvi reported 16 new species out of the 68 identified sponges of the South China Sea with the majority collected in Manila.

The percentage distribution (by order) of sponges of Cebu Island, Philippines (Fig. 3) showed that the haplosclerids had the highest percentage composition at 28% followed by halichondrids and dictyoceratids at 18%. Twenty-five percent (25%) of the haplosclerids were found in San Francisco and Marigondon, thirty-three percent (33%) of the halichondrids were recorded outside the marine protected area in Badian, Cebu and forty-five percent (45%) of the dictyoceratids were found in San Francisco.

The dominance of the haplosclerid sponges of Cebu is comparable to what is reported for Ilocos Region (Caberoy, 1997) which is 24% and the sponges of West Central Pacific (de Laubenfels, 1954) which is 22%. This is lower compared to what was reported for the Motupore Island, Papua New Guinea sponge fauna (Kelly-Borges and Bergquist, 1988) which is 40% (10 species out of 25 species).

Genus *Haliclona* contains the most number of species within the Order Haplosclerida (4 *Haliclona* species out of the 9 haplosclerid species). It has always been assumed that the observed habitat specialization of adult individuals results from selective mortality following unselective settlement. The combination of swimming or crawling behavior, duration of free life and phototactic response displayed by larvae such as *Haliclona* sp., combined with unspecific requirements as to settlement surface, works to minimize the dispersion of the larvae into unsuitable habitats (Bergquist, 1978), thus ensuring higher survival compared to the other genus.

A synoptic list of the sponge species found in Cebu, Philippines is presented below followed by the description of each species.

Synoptic List of the Sponge Species Found in Six (6) Stations Around Cebu Island, Philippines

Phylum Porifera Grant, 1836
- Class Demospongiae Sollas, 1885
  - Subclass Homoscleromorpha Bergquist, 1978
    - Order Homosclerophorida Dendy, 1905
      - Family Plakinidae Schulze, 1880
        - Genus *Corticium* Schmidt, 1862
          - ***Corticium* sp. nov.**
        - Genus *Plakortis* Schulze, 1880
          - ***Plakortis lita*** de Laubenfels, 1954
  - Subclass Tetractinomorpha Lèvi, 1953
    - Order Spirophorida Bergquist and Hogg, 1969
      - Family Tetillidae Sollas, 1886
        - Genus *Paratetilla* Dendy, 1905
          - ***Paratetilla bacca*** (Selenka, 1867)
    - Order Astrophorida Sollas, 1888
      - Family Ancorinidae Schmidt, 1870
        - Genus *Rhabdastrella* Thiele, 1903
          - ***Rhabdastrella sp. nov.***
    - Order Hadromerida Topsent, 1894
      - Family Clionaidae D'Orbigny, 1851
        - Genus *Spheciospongia* Marshall, 1892
          - ***Spheciospongia vagabunda*** (Ridley, 1884)
    - 'Lithistid' Demospongiae
      - Family Theonellidae Lendenfeld, 1903
        - Genus *Siliquariaspongia* Hoshino, 1981
          - ***Siliquariaspongia cf. mirabilis*** (de Laubenfels,1954)
    - Order Poecilosclerida Topsent, 1928
      - Suborder Microcionina Hadju, Van Soest and Hooper, 1994
        - Family Microcionidae Carter, 1875
          - Subfamily Microcioninae Carter, 1875
            - Genus *Clathria* Schmidt, 1862
              - Subgenus *Thalysias* Duchassaing and Michelotti, 1864
                - ***Clathria (Thalysias) reinwardti*** Vosmaer, 1880
        - Family Raspailiidae Hentschel, 1923
          - Subfamily Echinodictyinae Hooper and Van Soest, 2002
            - Genus *Echinodictyum* Ridley,1881
              - ***Echinodictyum cf. conulosum*** Kieschnick, 1900
      - Suborder Myxillina Hadju, Van Soest and Hooper, 1994
        - Family Iotrochotidae Dendy, 1922
          - Genus *Iotrochota* Ridley, 1884
            - ***Iotrochota baculifera*** Ridley, 1884
      - Suborder Mycalina Hadju, Van Soest and Hooper, 1994
        - Family Desmacellidae Ridley and Dendy, 1886
          - Genus *Biemna* Gray, 1867
            - ***Biemna fortis*** (Topsent, 1897)
    - Order Halichondrida Gray, 1867
      - Family Axinellidae Carter, 1875
        - Genus *Axinella* Schmidt, 1862
          - ***Axinella carteri*** (Dendy, 1889)
        - Genus *Phakellia* Bowerbank, 1862
          - ***Phakellia cavernosa*** (Dendy, 1922)
      - Family Desmoxyidae Hallman, 1917
        - Genus *Higginsia* Higgin, 1877
          - ***Higginsia cf. mixta*** (Hentschel, 1912)
      - Family Dictyonellidae Van Soest, Diaz and Pomponi, 1990
        - Genus *Liosina* Thiele, 1899
          - ***Liosina paradoxa*** Thiele, 1899
        - Genus *Stylissa* Hallmann, 1914
          - ***Stylissa massa*** (Carter, 1889)
      - Family Halichondriidae Gray, 1867
        - Genus *Axinyssa* Lendenfeld, 1897
          - ***Axinyssa cf. topsenti*** Lendenfeld, 1897
    - Order Haplosclerida Topsent, 1928
      - Suborder Haplosclerina Topsent, 1928
        - Family Callyspongiidae de Laubenfels, 1936
          - Genus *Callyspongia* Duchassaing and Michelotti, 1864
            - Subgenus *Callyspongia* Duchassaing and Michelotti, 1864

Callyspongia (Callyspongia) aerizusa Desqueyroux-Faundez, 1984
Callyspongia (Callyspongia) muricina (Lamarck, 1813)
Family Chalinidae Gray, 1867
Genus *Dendroxea* Griessinger, 1971
***Dendroxea* sp. nov.**
Genus *Haliclona* Grant, 1836
Haliclona amboinensis (Lèvi, 1961)
Haliclona cymiformis (Esper, 1794)
Haliclona poseidon (de Laubenfels, 1954)
***Haliclona* sp. nov.**
Family Niphatidae Van Soest, 1980
Genus *Cribrochalina* Schmidt, 1870
Cribrochalina olemda de Laubenfels, 1954
Suborder Petrosina Boury-Esnault and Van Beveren, 1982
Family Petrosiidae Van Soest, 1980
Genus *Xestospongia* de Laubenfels, 1932
Xestospongia testudinaria (Wilson, 1925)
Order Dictyoceratida Minchin, 1900
Family Thorectidae Bergquist, 1978
Subfamily Thorectinae Bergquist, 1978
Genus *Hyrtios* Duchassaing and Michelotti, 1864
Hyrtios erecta (Keller, 1889)
Genus *Luffariella* Thiele, 1899
Luffariella cf. variabilis Polejaeff, 1884
Genus *Dactylospongia* Bergquist, 1965
Dactylospongia cf. elegans Thiele, 1899
SubFamily Phyllospongiinae Bergquist, Sorokin and Karuso, 1999
Genus *Carteriospongia* Hyatt, 1877
Carteriospongia flabellifera (Bowerbank, 1877)
Family Spongiidae Gray, 1867
Genus *Spongia* Linnaeus, 1759
Spongia zimocca sensu de Laubenfels, 1954
Family Dysideidae Gray, 1867
Genus *Dysidea* Johnston, 1842
Dysidea cf. arenaria Bergquist, 1965
Order Dendroceratida Minchin, 1900
Family Dictyodendrillidae Bergquist, 1980
Genus *Igernella* Topsent, 1905
Igernella mirabilis Lèvi, 1961
Order Verongida Bergquist, 1978
Family Pseudoceratinidae Carter, 1885
Genus *Pseudoceratina* Carter, 1885
Pseudoceratina verrucosa Bergquist, 1995

Description of the Sponges of Cebu Island, Philippines

Phylum Porifera Grant, 1836
Class Demospongiae Sollas, 1885
Subclass Homoscleromorpha Bergquist,1978
Order Homosclerophorida Dendy, 1905
Family Plakinidae Schulze, 1880
Genus *Corticium* Schmidt, 1862
Corticium sp. nov. (Plate 1, Fig. 1)

DESCRIPTION: Encrusting sponge with round edges (38 mm at the longest portion, 28 mm wide and 10 mm thick); surface is smooth but granular to the touch; texture is firm, cartilaginous and difficult to tear. External color in life and in alcohol is shiny jet black, interior is grayish to light brown. Mesoscleres are calthrops, irregular non-lophose (non-branching) in one size category (range: 38.4-76.8 µm; mean: 60.5 µm); and candelabrum, with three basal equally ramified actines and the fourth actine ramifies basally in 4-10 longer and thinner microspined rays (range: 24 - 36 µm; mean: 0.5 µm). The ectosome is well-defined, the choanosome is composed of spicules scattered between choanocyte chambers; candelabra are more concentrated at the surface and edges of canals. Found encrusting on a rock at 9 m.

REMARKS: *Corticium* sp. nov. is closely related to *C. candelabrum* Schmidt, 1862 in terms of the size of spicules but differ in color, the former is pale yellow or

brown in life while the latter is black on the external and grayish on the internal. Further specimens are required before a final species allocation can be made. DISTRIBUTION: Philippines: Cebu - Badian (present study)

Genus *Plakortis* Schulze, 1880
***Plakortis lita de* Laubenfels, 1954** (Plate 1, Fig. 8)

DESCRIPTION: Thickly encrusting sponge (51 mm long, 25 mm wide and 20 mm thick); surface is smooth with contractile oscules that are hard to detect when the sponge is taken out of the water; texture is soft and compressible, fleshy and easy to tear. In life, the sponge is reddishbrown that is a little brighter and darker at the ectosome than the endosome. In alcohol, its color is brown with the ectosome darker than the endosome. Mesoscleres are diods, with straight and sinuous rays (range: 99-120 x 2.9-3.5 µm; mean: 108 x 3.2 µm); triods are occasionally present. Spicules are densely packed all throughout, without differential location of spicules. Encrusting on empty bivalve shells and coral rubbles at depths 5-17 m.

REMARKS: Bakus and Nishiyama, 1999 reported this sponge as one of the toxic sponges found in Cebu. This is quite a common sponge in the island, present in three of the six stations.

DISTRIBUTION: West-Central Pacific (de Laubenfels, 1954); South Korea (Sim, 1985); Vanuatu (NIWA Collection); Indonesia (NIWA Collection); Fiji (NIWA Collection); Philippines: Cebu - Mactan Island (Bakus and Nishiyama, 1999); San Francisco, Daanbantayan and Maribago (present study)

Subclass Tetractinomorpha Lèvi, 1953
Order Spirophorida Bergquist and Hogg, 1969
Family Tetillidae Sollas, 1886
Genus *Paratetilla* Dendy, 1905
***Paratetilla bacca* (Selenka, 1867)** (Plate 1, Fig. 9)

DESCRIPTION: Globular sponge (fragment: 110 mm at longest portion and 62 mm wide) with numerous porocalices 7-12 mm in diameter; surface is uniformly hispid caused by protruding spicules; texture is firm and slightly compressible. Color of live specimen is bright yellow for the endosome and greenish to brown at the ectosome caused by either the epiphytic algae or the accumulated sand, mud or detritus trapped at the protruding spicules. In alcohol, the color of the endosome is light brown and the ectosome is dark brown. Megascleres are protriaenes (only few were observed), with three straight clads and long, straight shaft anatriaenes, with sharply curved clads and long and thick shaft (range: 4,925-5,801 x 4.8-7.2 µm; mean: 5,363 x 6 µm), orthotriaenes, with shaft shorter than the clads resembling calthrops (range of shaft: 40-119 x 12-19.2 µm; mean, 83 x 16 µm; range of clad: 99-218 x 9.6-19.2 µm; mean: 155 x 15.5 µm), oxeas, huge and very long (range: 1,725 - 4,473 x 19.8-50 µm; mean: 2,841 x 28.4 µm); microscleres are sigmas, finely spined (range: 14-17 x 1 µm; mean: 16 x 1 µm). Radial arrangement is very evident with bundles of oxea radiating from a central focus; a specialized dermal layer of modified triaenes, resembling calthrops is present. Found at a depth of 18 m among coral rubbles.

DISTRIBUTION: Indo-West Pacific: Samoa, Mayanmar, NE Australia, Sri Lanka (Van Soest and Hooper, 2002); Mauritius (NIWA Collection); Indonesia (Van Soest and Hooper, 2002; NIWA Collection); Maldives (NIWA Collection); Philippines: La Union, Ilocos Sur, Ilocos Norte (Caberoy, 1997); Cebu - Argao (present study)

Order Astrophorida Sollas, 1888
Family Ancorinidae Schmidt, 1870
Genus *Rhabdastrella* Thiele, 1903
***Rhabdastrella* sp.nov.** (Plate 1, Fig. 2)

DESCRIPTION: Encrusting sponge (130 mm, 63 mm wide and 20-30 mm thick); surface is microscopically hispid with micropores evident at the portion in contact with *Haliclona amboinensis* (Lèvi, 1961), oscula (2-5 mm in diameter) are located at portions free of any attachments; texture is fleshy, slightly compressible, rubbery and difficult to tear. Out of water and in preservative, the color is grayish black. Spicules are oxeas (range: 239-873 x 7.1-28.6 µm; mean: 660.3 x 14.3 µm), spherasters (range: 16.8-40.8 µm; mean: 31.9 µm), spheroxyasters (range: 16.8-38.4 µm; mean: 27.7 µm), and oxyasters (range: 43.2-60 µm; mean: 53.3 µm). Oxeas are radially arranged forming bundles that run perpendicular to the surface while the euasters are randomly scattered at the innermost zone, spherasters

and spheroxyasters are mostly found at the cortex. Found at 10-16 m in a coral reef area.

REMARKS: *Rhabdastrella* sp. nov. is found to be in close association (always appearing as the underside) with *Haliclona amboinensis* (Lèvi, 1961). This is closely related to *Rhabdastrella disctincta* (Thiele, 1900) from Indonesia however there was no mention of any close association with another sponge. Further specimens are required before a final species allocation can be made.

DISTRIBUTION: Indonesia (NIWA Collection); Phillipines - Cebu: Mactan Island (NIWA Collection); Badian (present study)

Order Hadromerida Topsent, 1894
Family Clionaidae D'Orbigny, 1851
Genus *Spheciospongia* Marshall,1892
***Spheciospongia vagabunda* (Ridley, 1884)** (Plate 1, Fig. 10)

DESCRIPTION: Irregular in shape (105 mm long, 60 mm wide and 15-30 mm thick); surface is hispid and has steep-sided conical projections (8-12 mm high and 5-9 mm wide), grooves filled with calcitic materials, ostia are not visible while the oscula located at the apex of the conules could not be easily seen out of water; texture is hard, corky, not readily compressible and difficult to tear. Its color in life and in preservative, is brown with the top of conules darker than the other parts of the sponge due to heavy concentration of pigments. Megascleres are tylostyles of two size categories, with terminal or sub-terminal heads slightly curve at the anterior half and pointed sharply (I. range: 429-600 x 7.1-14.2 µm; mean: 522.6 x 9.7 µm, II. range: 143-329 x 2.8-8.1 µm; mean: 222 x 5.0 µm); microscleres are finely spined spirasters (range: 10.3-13.7 µm; mean : 11.3 µm). Spicules are tightly packed and confused, crisscrossing each other with some protruding to the surface. Found at 6 m depth in an area with coral rubbles and sandy substrate.

REMARKS: As described by Kelly-Borges and Bergquist (1988), the sponge specimen collected form Cebu is a juvenile.

DISTRIBUTION: Indonesia (Van Soest, 1989); Indo-West Pacific, Fiji Islands (Tendal, 1969); Palau (Bergquist, 1965); Papua New Guinea (Kelly-Borges and Bergquist, 1988); Philippines: Cebu - Mindoro (de Laubenfels, 1935); La Union, Ilocos Norte, Ilocos Sur (Caberoy, 1997); San Francisco (present study)

'Lithistid' Demospongiae
Family Theonellidae Lendenfeld, 1903
Genus *Siliquariaspongia* Hoshino, 1981
***Siliquariaspongia cf. mirabilis* (de Laubenfels, 1954)**

DESCRIPTION: Irregularly encrusting (105 mm long and 43 mm wide) with short tubular projections (7-12 mm high, 10-11 mm wide) distributed 14-20 mm apart; surface is wrinkly and uneven but the tubes are smooth, ostia are not visible but the oscula are terminal located at each tube (4 mm in diameter); texture is spongy, crumbly and easy to tear. In life, ectosome is reddish brown and endosome is yellowish brown; in alcohol, the color is orange brown. Spicules are strongyles, long and smooth (range: 393.6-556.8 x 4.8-10.8 µm; mean: 442.6 x 7.8 µm), desmas are non-articulated tetraclone (range: 268.8-374.4 µm; mean: 306 µm), microrhabds, are straight to slightly curved and spiny (range: 7.2-12 x 1.2 µm; mean: 10.6 x 1.2 µm). Ectosome seems to be devoid of desmas or may be present sparsely but it has high concentration of rhabds; in areas with conules, ascending tracts of strongyles (55-82 µmnin diameter) are present terminating at its crest; desmas are present in great number at the choanosome or at the area below the conules, arranged in random. Attached to a reef at 10 m.

REMARKS: *Siliquariaspongia cf mirabilis* (de Laubenfels, 1954) is somewhat related to *Placinolopha mirabilis* however, it is not a true member of the homosclerophorid genus due to the presence of non-articulated desmas and a skeleton highly reminiscent of the lithistid genus. The sponge differs from *Siliquariaspongia japonica* Hoshino, 1981 in the absence of discotriaenes.

DISTRIBUTION: Palau (de Laubenfels, 1954; NIWA Collection); Papua New Guinea (NIWA Collection); Indonesia (NIWA Collection); Philippines: Davao (NIWA Collection); Panglao, Bohol (NIWA Collection);

Sulu Sea, North Tubbataha Reef (NIWA Collection); Cebu - Mactan Island (NIWA Collection); Marigondon (present study)

Order Poecilosclerida Topsent, 1928
Suborder Microcionina Hadju, Van Soest and Hooper, 1994
Family Microcionidae Carter, 1875
Subfamily Microcioninae Carter, 1875
Genus *Clathria* Schmidt, 1862
Subgenus *Thalysias* Duchassaing and Michelotti, 1864
***Clathria (Thalysias) reinwardti* Vosmaer, 1880**

DESCRIPTION: Massive, elongate and ramose (ramose: 87 mm long, 50 mm wide and 5-10 mm thick; elongate: 132 mm long and 10 mm wide) with primary branch giving rise to cylindrical fingers growing or rising just above the ground clinging into branching corals, some have as many as 5 branches growing at different directions forming a mass of branching network attached to the substrate through several points while others have only single elongate branch. Surface is rough and hispid due to protruding spicules with oscula (1-2 mm in diameter) irregularly dispersed throughout the 'body'; texture is semi-elastic and difficult to tear. In life, ectosome is bright orange and endosome is brick brown; in alcohol, color is light orange. Megascleres are styles with three size categories: principal style, smooth and slightly curved at the anterior third (range: 210-263 x 10-11.3 µm; mean: 243 x 10.4 µm), accessory style, generally straight with faintly microspined bases (I. range: 88-168 x 2.5-3.8 µm; mean: 115 x 2.9 µm, II. range: 125-228 x 6.3-10 µm; mean: 174 x 7.5 µm), and acanthostyles, heavily spined towards the distal end (range: 53-70 x 4.3-5.5 µm; mean: 63 x 5 µm); microscleres are palmate isochela (range: 10-14 µm; mean: 11 µm), toxas (range: 55-129 x 2.3-4.6 µm; mean: 93 x 2.8 µm). Ectosomal skeleton is made- up of a thin layer of smaller microspined styles that form discrete brushes erect on surface in a continuous palisade; choanosomal skeleton is irregularly reticulate with spongin fibers fully cored by principal styles forming oval, triangular or rectangular meshes with dense echinating acanthostyles at the surface. Found attached to some dead coral (5-11m) at an area with sandy substrate and patches of corals.

DISTRIBUTION: Australia (Bergquist et al. 1971; Hooper, 1996); Caroline Islands (Hooper, 1996); Vietnam (Hooper, 1996); Indonesia (Van Soest, 1989; Hooper, 1996; NIWA Collection); Motupore Island, Papua New Guinea (Kelly-Borges and Bergquist, 1988; Hooper, 1996); Solomon Island (Bergquist et al., 1971); Zanzibar (NIWA Collection); Philippines: Bohol (NIWA Collection); Negros Oriental (Hooper, 1996); Cebu - Daanbantayan, Marigondon and San Francisco (present study)

Family Raspailiidae Hentschel, 1923
Subfamily Echinodictyinae Hooper and Van Soest, 2002
Genus *Echinodictyum* Ridley, 1881
***Echinodictyum cf. conulosum* Kieschnick, 1900**

DESCRIPTION: Anastomosing small branches forming an irregularly round to oval mass (105 mm long and 54 mm wide); surface is rugged with many projecting branches (4-7 mm long) and numerous interstitial holes covered with a thin membranous sheath that easily disintegrates upon preservation; texture is stiff, firm and brittle. In life and in preservative, the color is jet black with purple tinge due to dense deposit of pigment granules. Megascleres are oxeas, straight to slightly curved (range: 78-243 x 4.2-14.3 µm; mean: 364 x 8.8 µm), acanthostyles are straight and tapering and with blunt ends (range: 86-157 x 4.2-7.1 µm; mean: 127 x 6.1 µm); microscleres are absent. The ectosome is membranous with protruding tips of extra-axial styles while the choanosome is differentiated into primary ascending fibers and secondary transverse connecting tracts, fully cored with oxeas and echinated by acanthostyles; pigment granules are embedded in the membrane. Occurs at depths 15-18 m, in a coral reef area.

REMARKS: Pigment granules are only found in shallow water specimen (Hooper, 1991).

DISTRIBUTION: Australia (Hooper, 1991); Philippines: Cebu - Marigondon

Suborder Myxillina Hadju, Van Soest and Hooper, 1994
Family Iotrochotidae Dendy, 1922
Genus *Iotrochota* Ridley, 1884
Iotrochota baculifera Ridley, 1884

DESCRIPTION: Irregularly thick encrusting sponge (fragment: 200 mm long, 87 mm wide and 20-30 mm thick), accumulates a lot of foreign materials into its 'body' which emits a purplish mucus that stains the hand when handled; surface is uneven and rough with no visible pores; texture is firm and barely compressible. Color is purplish-black in life and in preserved state. Megascleres are styles, smooth and slightly curved at the anterior portion (range: 153.6-172.8 x 4.8-6 µm; mean : 163.9 x 6 µm), strongyles are straight and thin (range: 204-249.6 x 3.6 µm; 12 mean : 225.3 x 3.6 µm); microscleres are birotula (range: 12-14.4 µm; mean : 13.7 µm). The skeleton is fibrous with irregular reticulate tracts of curved styles; strongyles are randomly arranged at the dermal membrane. Found at 0-2 m in an area with muddy substrate.

DISTRIBUTION: Palau (de Laubenfels, 1954; Bergquist, 1965); Papua New Guinea (Kelly-Borges and Bergquist, 1988); India (Dendy, 1922); Aru Island (Hentschel, 1912); Philippines: Cebu - San Francisco (present study)

Suborder Mycalina Hadju, Van Soest and Hooper, 1994
Family Desmacellidae Ridley and Dendy,1886
Genus *Biemna* Gray, 1867
***Biemna fortis* (Topsent, 1897)**

DESCRIPTION: Massive sponge (150 mm long and 90 mm in diameter), with chimney-like projections, base is buried in the substrate sometimes with only the tubular projections visible at the surface; the sponge is rugged and hispidous, ostia are not visible while the oscula (3-8 mm) are terminally located at each projection; texture is woody and cork-like. In live specimen and in preserved state, the portion buried to the ground is yellowish-green to yellowish-brown while the top of the projection is dark green to gray; variations in color is due to accumulated debris. Megascleres are styles, smooth and slightly curved upwards (range: 929-1,283 x 16.2-36.5 µm; mean : 1,121 x 28.6 µm); microscleres are sigmas, robust with pointed ends (range: 71-93 x 3.1-5.3 µm; mean : 85 µm x 4.3 µm). Ectosomal skeleton is a mass of tangentially arranged spicules; choanosome occasionally contains fiber tracts but is mostly composed of abundant felted spicules interspersed with numerous sigmas. Found at 9-10 m in two habitats (coral reef and sandy substrate with coral patches).

REMARKS: Thrives well in areas with high siltation.

DISTRIBUTION: Papua New Guinea (Kelly-Borges and Bergquist, 1988); Straight of Malacca, Dead Sea (Hentschel, 1912); Indonesia (Van Soest, 1989); Palau and Ponapé (de Laubenfels, 1954); Philippines: Cebu - San Francisco and Badian (present study)

Order Halichondrida Gray, 1867
Family Axinellidae Carter, 1875
Genus *Axinella* Schmidt, 1862
***Axinella carteri* (Dendy, 1889)**

DESCRIPTION: Flabellate sponge (94 mm long, 42 mm wide and 12 mm thick) with relatively thick buttressed lamellae having irregular margin, attached to the substrate by a small basal stalk; surface is hispid and rugged with ridges (5 mm high) and conules all throughout, only one osculum (1 mm in diameter) is found; texture is rubbery, compressible and easy to tear. The color is bright orange-brown in life and pale orange-brown in alcohol. Megascleres are styles, relatively long, either slender or robust and slightly curved (range: 347 - 504 x 4.8-16.8 µm; mean: 448.5 x 9.8 µm); microscleres are absent. The ectosome is membranous with sparsely 13 protruding extra-axial spicules; choanosome is composed of multispicular bundles fully cored with styles running longitudinally through the lamellae interconnected by vaguely plumose, ascending paucispicular extra-axial tracts or individual spicules; fiber reticulation formed is relatively close-meshed. Found at 15-18 m attached to a coral stone.

DISTRIBUTION: Indonesia (Van Soest, 1989; NIWA Collection); Papua New Guinea and the Great Barrier Reef (Hooper and Lévi, 1993); New Caledonia (Hooper and Lévi, 1993; Laboute *et al.*, 1995); Red Sea, Saudi Arabia (NIWA Collection); Zanzibar (NIWA Collection); Philippines: Cebu - Badian (present study)

Genus *Phakellia* Bowerbank, 1862
***Phakellia cavernosa* (Dendy, 1922)**

DESCRIPTION: Rounded and clathrate-cavernous (90 mm long and 50 mm wide) consisting of intertwined

taberculae forming small branches (2 mm in diameter) with blunt tips uniformly protruding to the outside forming rounded cavities between which is stretched a thin dermal membrane; surface of the branch is smooth and even while the entire mass is perforated; texture of the whole mass is compressible but not the individual branch, the membrane is very soft. Its color is orange, darker in life than in alcohol. Megascleres are strongyles, long and sinuous (range: 282-943 x 1.7-11.3 µm; mean: 603 x 5.7 µm), styles, straight to sinuous (range: 243-500 x 5.3-17.7 µm; mean : 332 x 9.2 µm), and anisoxeas (range: 239-521 x 4.2-9.9 µm; mean : 348 x 7.6 µm); microscleres are absent. Individual branch is partially cored with dense spicules terminating to the surface; some are arranged perpendicular to the spicule tracts fully enclosed within the spongin fiber. Found at 17 m in an area with sandy substrate and coral patches.

DISTRIBUTION. Indonesia (Van Soest, 1989); Indian Ocean (Dendy, 1922); Philippines: Cebu- San Francisco (present study)

Family Desmoxyidae Hallmann, 1917
Genus *Higginsia* Higgin, 1877
***Higginsia cf. mixta* (Hentschel, 1912)**

DESCRIPTION: Thickly encrusting (fragment: 82 mm long, 50 mm wide and 10 mm thick); surface is rough with broken ridges (thin and tapering 3-10 mm high), the underside is smoother with no ridges but with holes, ostia are not visible but the oscula (2-4 mm in diameter) are irregularly distributed; the sponge is stiff, compact and resilient. The color is dark orange in life and light brown in alcohol. Spicules are oxeas with two size categories: dominant stout oxeas and thinner centrangulate oxeas (I. range: 1,015-1,143 x 25.7-42.9 µm; mean: 1,078 x 30.2 µm: II. range: 757-1,115 x 5.3-15.7 µm; mean: 889 x 9.7 µm), styles are very long and sinuous (range: 1,802-2,574 x 9.6-16.8 µm; mean: 2,117 x 14.2 µm), acanthoxeas are finely spined and centrangulate (range: 81-191 x 3.5-6 µm; mean : 154 x 4.6 µm). Skeleton is a regular arrangement of ascending tracts formed by long and stout oxeas concentrated towards the center of vertical processes; spongin is present along spicule tracts but no actual spongin encased in fibers occur; acanthoxeas are present all over but mostly concentrated at the ectosomal area; long styles and thin oxeas protrude to the surface. Found at 5-6 m deep in a coral reef area.

DISTRIBUTION: Palau (Bergquist, 1965); Philippines: Cebu - Badian (present study)

Family Dictyonellidae Van Soest, Diaz and Pomponi, 1990
Genus *Liosina* Thiele, 1899
***Liosina paradoxa* Thiele, 1899**

DESCRIPTION: Massive encrusting sponge (fragment 174 mm long and 72 mm in diameter); surface is conulose with raised and irregularly distributed oscules (5 mm in diameter); texture is spongy and slightly compressible. In life, the sponge is whitish while pale brown in alcohol. Megascleres are oxeas (range: 287-921 x 2.4-14.4 µm; mean: 468 x 7.1 µm), and strongyles (range: 337-970 x 3.6-12 µm; mean: 571.7 x 7.9 µm); microscleres are absent. Spicule tracts are weakly developed and are widely separated by tangentially distributed small group of megascleres; pigment granules are distributed sparsely on the choanosome and dense at the surface and canal lining. Habitat. Found at 5-11 m deep in a coral reef area.

DISTRIBUTION: Indonesia (Van Soest, 1989); Mauritius (NIWA Collection); New Caledonia (Laboute et al., 1998); Solomon Islands (Bergquist et al., 1971); Vanuatu (NIWA Collection); Zanzibar (NIWA Collection); Philippines: Cebu-Pescador Island (NIWA Collection); Buyong, Mactan Island (NIWA Collection); Badian (present study); Argao (present study).

Genus *Stylissa* Hallmann, 1914
***Stylissa massa* (Carter, 1889)** Plate 1, Fig. 5

DESCRIPTION: Massive, erect, lamellate or globular (fragment: 100 mm long, 46 mm wide and 15 mm thick) attached to the ground through a narrow portion (10 mm diameter) or may grow laterally at the ground; surface is rugged and microhispid, ostia (1-2 mm in diameter) and oscula (3-4 mm in diameter) are plenty and randomly scattered; texture is very soft, compressible, firm and soggy. Color is bright yellow in life and dull yellow in alcohol; it turns orange when exposed. Megascleres are styles, straight to slightly curved (range: 443 - 572 x 7.1 - 19.5 µm; mean: 493 x

13.5 µm); microsleres are absent. Spicules are arranged in a loosely plumoreticulate structure, each tract ends with projecting spicules to the surface; other areas are devoid of spicules. Found at 1 m deep among soft corals in a coral reef.

DISTRIBUTION: Palau, Papua New Guinea (Kelly-Shanks and Bergquist, 1988); Philippines -Zamboanga, Batangas, Davao del Norte, Mindoro Occidental, Marinduque, Quezon, La Union, Ilocos Sur, Ilocos Norte (Caberoy, 1981); Cebu, Badian (present study)

Family Halichondriidae Gray, 1867
Genus *Axinyssa* Lendenfeld, 1897
***Axinyssa cf. topsenti* Lendenfeld, 1897**

DESCRIPTION: Massive (140 mm long and 84 mm wide), attached to the substrate by a narrow peduncle-like structure; surface is hispid and with many irregular depressions formed by raised portions at the surface, many of these are ostia but some are superficial pores without distinct channels to the interior, oscula (3-6 mm in diameter) are few and somewhat raised; the sponge is compressible but firm and easy to tear. Its color is reddish brown or purplish in life, brownish in alcohol. Megascleres are oxeas, straight and smooth (range: 364.8-710.4 x 3.6-14.4 µm; mean: 502.7 x 9.2 µm); microscleres are absent. The ectosome is a thick organic skeleton with sparsely scattered spicules; choanosome is made up of spicules scattered in confusion with regular tracts separated at regular intervals, giving rise to the raised portions at the surface. Found at 17 m deep in a coral reef area.

DISTRIBUTION: Central Atlantic (Diaz et al., 1991); Philippines: Cebu - Marigondon (present study)

Order Haplosclerida Topsent, 1928
Suborder Haplosclerina Topsent, 1928
Family *Callyspongiidae* de Laubenfels, 1936
Genus *Callyspongia* Duchassaing and Michelotti, 1864
Subgenus *Callyspongia* Duchassaing and Michelotti, 1864
***Callyspongia (Callyspongia) aerizusa* Desqueyroux-Faundez, 1984**

DESCRIPTION: Tubular and erect (178 mm long, 17.5 mm wide and walls at 2.5 mm thick), form clusters attached to the substrate by a common base. Internal surface of tubes is smooth with plenty of small pores while the external surface is laden with tapering and distally directed spine-like projections (3-10 mm high and 2-5 mm wide), ostia are not visible but the oscula1(5 mm in diameter) are terminally located at each tube. Texture is soft, spongy, compressible and easy to tear; The color is blue-green to green in life and fawn in alcohol. Megascleres are oxeas, small and thin, straight to slightly curved (range: 79.2-96 x 2.4 µm; mean: 87.8 x 2.4 µm); microscleres are absent. Ectosomal and choanosomal skeleton is ladder-like with fully cored primary fibers (28 µm in diameter) branching out to secondary fibers (7-10 µm in diameter) and unispicular tertiary fibers; meshes formed have oval or round shapes (69-183 µm wide), spongin is always present, fully or partially cored with spicules; primary fiber makes-up the skeletal support of the spine-like projections. Found attached to a reef at 10 m.

DISTRIBUTION: Great Barrier Reef, Australia (Fromont, 1993); Indonesia (NIWA Collection); New Caledonia (Laboute *et al.*, 1998); Tanzania (NIWA Collection); Papua New Guinea (NIWA Collection); Palau (NIWA Collection); Philippines: Cebu - Badian (present study)

***Callyspongia (Callyspongia) muricina* (Lamarck, 1813)**

DESCRIPTION: Thin and long solid tubes with spine-like projections (210 mm long and 10 mm in diameter); surface is micropunctipore with spinelike projections (4-7 mm high) distributed at 3-5 mm apart; ostia are not visible but the oscula (2.5-5 mm in diameter) are distributed 6-10 mm apart at the surface of the sponge; texture is soft, compressible and a little difficult to tear; Its color is greenish brown in life, light brown in alcohol. Megascleres are oxeas, small and thin (range: 56-83 x 1-3 µm; mean: 77 x 2 µm); microscleres are absent. Ectosomal skeleton is a tangential reticulation of sparsely cored primary and secondary fibers; choanosomal skeleton is a reticulation of fully cored primary fibers (34-59 µm in diameter), partially cored secondary fibers (14 µm in diameter) and unispicular tertiary fibers (7 µm in diameter) forming round to oval meshes, 55-247 µm wide; primary fibers support the spine-like projection. Found at a depth of 13 m attached to a coral stone in an area with sandy substrate and coral patches.

DISTRIBUTION: Great Barrier Reef (Fromont, 1993); Philippines: Cebu - Daanbantayan (present study)

Family Chalinidae Gray, 1867
Genus *Dendroxea* Griessinger, 1971
***Dendroxea* sp. nov.** (Plate 1, Fig. 3)

DESCRIPTION: Thinly encrusting (fully encrusting a coral fragment 64 mm long and 10 mm in diameter); surface is velvety and hispid; texture is soft and compressible. In life, color is olive to dark green while in preservative it is greenish brown. Megascleres are oxeas, small and almost uniform, straight to slightly curved (range: 91.2-103.2 x 2.4-4.8 µm; mean: 96 x 4 µm); microscleres are absent. Reticulate base gives rise to multispicular, plumose, branching spicular tracts that thin out to the surface; primary tracts (7.2-14 µm in diameter) are partially to fully cored with spicules; secondary tracts (4.8 µm in diameter) are partially cored with 2 or more spicules. Found encrusting in coral fragments at coral reefs.

REMARKS: Morphologically this is different from the lone species of *Dendroxea, Dendroxea lenis* (Topsent), 1892, which has smooth, even surface and grayish color. Further specimens are required before a final species allocation can be made.

DISTRIBUTION: Philippines: Cebu - Argao, Daanbantayan, Marigondon, San Francisco (present study)

Genus *Haliclona* Grant, 1836
***Haliclona amboinensis* (Lèvi, 1961)** (Plate 1, Fig. 11)

DESCRIPTION: Encrusting sponge (140 mm long, 63 mm wide and 20-30 mm wide) spreading like a thick mat above *Rhabdastrella* sp. nov.; surface is rough to the touch with no visible ostia, oscula (2-4 mm in diameter) are slightly raised and are irregularly distributed at the upper side of the sponge; texture is brittle, crumbly and easy to tear. In life, color is light blue and fawn in alcohol. Megascleres are oxeas, curved at center, occasionally straight (range: 168-288 x 2.4-19.6 µm; mean: 238.9 x 10 µm); microscleres are sigmas, small and c-shaped (range: 12-14.4 µm; mean: 14.2 µm). Choanosomal skeleton is confused isotropic to sub-isotropic reticulation of spicules; ectosome is an extension of the choanosomal skeleton forming a single layer of spicules parallel to the surface with occasional erect spicules extending beyond the parallel layer; sigmas occur throughout the membrane and around internal pores. Found at 10 m deep in a coral reef.

DISTRIBUTION: Moluccas (Kelly-Borges and Bergquist, 1988); Great Barrier Reef, Australia (Fromont, 1993); Philippines: Cebu - Badian (present study).

***Haliclona cymiformis* (Esper, 1794)** (Plate 1, Fig. 12)

DESCRIPTION: Thinly encrusting that completely surrounds the red algae *Ceratodictyon spongiosum;* in general, it appears erect with bifurcate branches interconnected to form large spreading mass (140 mm long, 120 mm wide and 20-30 mm high) with branches (up to 2-8 mm in diameter and 8-11 mm high); surface is even and unornamented, porous and microscopically hispid with oscules (1-2 mm in diameter) that are irregularly scattered; texture is firm, incompressible, tough and a bit difficult to tear. In life, its color is green to greenish-brown; the one with the greenish color is observed to be robust with full tips while that of the greenishbrown coloration looks like it is being grazed on by other organisms with the tips broken; in alcohol, the color is fawn. Megascleres are oxeas, slim and slightly curved at the center (range: 132-165.6 x 2.4-4.8 µm; mean: 146.2 x 3.6 µm); microscleres are sigmas (range: 16.8-21.6 µm; mean: 19.7 µm). A spongin-fiber reticulation is observed between anastomosing networks of thalli; surface skeleton has isodictyal reticulation. The sponge is relatively abundant in an intertidal area with muddy substrate, attached to a hard substrate by a narrow portion at the base that is sometimes burrowed in the mud.

DISTRIBUTION: Indonesia (Van Soest, 1989); Papua New Guinea (Laboute et al., 1998); Great Barrier Reef, Australia (Laboute et al., 1998); Philippines - Ilocos Sur, Ilocos Norte, La Union (Caberoy, 1997); Cebu - San Francisco (present study)

***Haliclona poseidon* (de Laubenfels, 1954)**

DESCRIPTION: Tubular to flabellate forms with very thin walls (long and thin tubes: height 115-172 mm and width 10 mm; wall thickness 1.5 mm; oscular opening 6-8 mm in diameter; short and stout tubes: height 115 mm and width 72 mm; flabellate form fragment: 254 mm long and 185 mm wide), some tubular forms have long and slender tubes that connect with each other at the base with narrow openings while others have shorter and larger tubes with wide openings, the tubes branch-out at some point, usually at the middle. Surface is generally smooth and micropunctipore but the stouter forms have some folds, oscula are sometimes visible (1-2 mm in diameter) but ostia are not; texture is very soft, compressible and easy to tear. Color is highly variable; in water, it is faint blue-grey to light violet; out of the water, it turns to greenish brown, pink, dark rose, lavender or purple; in alcohol, it is light brown to cream. Megascleres are oxeas, straight and thin (range: 67-112.8 x 2.4-4.8 µm; mean : 85.6 x 3.8 µm); microscleres are absent. Spicular arrangement is isotropic reticulation of unispicular fiber tracts devoid of spongin forming triangular and polygonal meshes (45-80 x 60-70 µm); ascending tracts of fibers (20 µm in diameter) containing small amount of spongin enclosing one or more spicules are present, arranged 233-644 µm apart; pigments are scattered between spicule tracts. Found at 12-17 m deep, attached to a branching coral.

DISTRIBUTION: Indonesia (NIWA Collection); Palau (de Laubenfels, 1954); Tanzania (NIWA Collection); Philippines-Camiguin (NIWA Collection); Cebu: Marigondon (present study)

Haliclona sp. nov. (Plate 1, Fig. 4)

DESCRIPTION: Encrusting sponge with variable thickness and shape (fragment: 50 mm long, 42 mm wide and 10-20 mm thick); surface is slightly conulose (conules are 2 mm high) and micropunctipore, ostia are not visible but oscula are common (1-2 mm in diameter); texture is very soft, crumbly and compressible. Its color is orange in life and light brown or cream in alcohol. Megascleres are oxeas, almost uniform, straight to slightly curved, pointed, sometimes strongylote (range: 110-156 x 2.5-5 µm; mean: 131.8 x 3.88 µm); microscleres are absent. Skeleton is isotropic reticulation that is unispicular all throughout with spicules not enclosed by spongin; meshes formed are irregular in sizes with some spicules protruding to the surface; organic content (brownish pigment) is scattered all throughout. Found at 15-17 m encrusting in coral stones, the area is dominantly sandy with coral patches.

REMARKS: The sponge shows high degree of plasticity; the specimens collected range from a thin encrusting sponge, encrusting with low tubular protrusions to encrusting forms with pronounced tubules; could be easily distinguished by the brightness of its color. Further specimens are required before a final species allocation can be made.

DISTRIBUTION. Philippines - Cebu: San Francisco and Marigondon

Family Niphatidae Van Soest, 1980
Genus *Cribrochalina* Schmidt, 1870
***Cribrochalina olemda* de Laubenfels, 1954**

DESCRIPTION: Fan shaped, thicker at the point of attachment than at the edges (32 mm long, 46 mm wide and 3-5 mm at its thickest portion); surface is rugged with protruding fiber tracts forming subdermal cavities while the underside is smoother, ostia are not visible but the oscula (5 mm in diameter) are distributed 8-15 mm apart; texture is soft, compressible and difficult to tear. Color is brown with bluish tint when out of water while in preservative, it is light brown. Megascleres are oxeas (range: 120-139.2 x 2.4-4.8 µm; mean: 126.2 x 3.6 µm); microscleres are absent. The skeleton is fibro-reticulate with cored spongin fibers (12-25 µm in diameter) forming irregular meshes; ascending fibers terminate at the protrusions at the surface of the sponge. Found at 5 m in a coral reef area.

DISTRIBUTION: Palau (Bergquist, 1965; de Laubenfels, 1954); Philippines: Cebu - Badian (present study)

Suborder Petrosina Boury-Esnault and Van Beveren, 1982
Family Petrosiidae Van Soest, 1980
Genus *Xestospongia* de Laubenfels, 1932
***Xestospongia testudinaria* (Wilson, 1925)**

DESCRIPTION: Encrusting (fragment: 46 mm long, 22 mm wide and 15 mm thick) with ridges (7-15 mm high and 1-2 mm thick) arranged laterally forming deep canals; surface is micropunctipore, hispid and conulose (conules are 1 mm high and 3 mm wide); ostia and oscula are not visible; texture is hard, stiff and crumbly. In life, its color is light brown, darker at the endosome than the ectosome; in alcohol, it is fawn. Megascleres are oxeas, slightly bent with blunt to pointed ends (range: 328.8-465.8 x 13.7-17.8 µm; mean: 387.7 x 14.8 µm); microsleres are absent. Ectosomal and choanosomal skeleton are isotropic reticulation of spicules forming thick tracts (151-178 µm wide) with meshes (233-699 µm wide); many spicules are scattered in confusion obscuring the skeletal network; spongin is absent. Attach to rubbles in an area with sandy substrate and patches of corals at a depth of 17 m.

REMARKS: The specimen collected is a young sponge that has not fully attained its characteristic barrel shape.

DISTRIBUTION: Philippines (Lévi and Lévi, 1989; Ruelo, 1964, Wilson, 1925): Cebu-San Francisco (present study)

Order Dictyoceratida Minchin, 1900
Family Thorectidae Bergquist, 1978
Subfamily Thorectinae Bergquist, 1978
Genus *Hyrtios* Duchassaing and Michelotti, 1864
***Hyrtios erecta* (Keller, 1889)** (Plate 1, Fig. 7)

DESCRIPTION: Elongate to massive (105 mm long, 60 mm wide and 15-20 mm thick); surface is conulose (conules are 2 mm high and 3 mm wide); sponge is compressible and a bit difficult to tear. In life, the color of the ectosome ranges from brown to black while the endosome is light to dark brown; little change in the color is observed in alcohol. Siliceous spicules are absent. Skeleton is made up of primary (terminates at the conules) and secondary fibers, fully cored with detritus; the surface is darkly pigmented. Found at 9-13 m deep in areas with patches of hard and soft corals.
DISTRIBUTION: Palau (de Laubenfels, 1954; Bergquist, 1965); Philippines: Cebu-Daanbantayan, Marigondon and San Francisco (present study)

Genus *Luffariella* Thiele, 1899
***Luffariella cf. variabilis* Polejaeff, 1884**

DESCRIPTION: Massive forming a shallow caliculate form (fragment: 130 mm wide, 80 mm and 5-10 mm thick); surface has many depressions formed by four protruding tracts (4-8 mm in diameter and 9 mm deep) distributed close to each other and connected by a membrane; the sponge is moderately firm and less compressible. Out of water, the sponge is yellowish-brown to reddish-brown, in alcohol the external color is blackish brown while the internal is brown. Siliceous spicules are absent. Skeleton in irregular formed by branching primary (cored with foreign debris and almost fasciculate near the surface) and uncored secondary and tertiary spongin fibers. Found at 10-18 m deep in a coral reef.

DISTRIBUTION: Philippines: Cebu - Argao, Badian (present study)

Genus *Dactylospongia* Bergquist, 1965
***Dactylospongia* cf. elegans (Thiele, 1889)**

DESCRIPTION: Repent sponge (fragment: 210 mm long, 38 mm wide and 5-10 mm thick) with irregular branches; the upper surface is rugged and irregularly conulose (with conules, 1-4 mm high) while the bottom is smoother, ostia are not visible but the oscula (2-6 mm in diameter) are irregularly distributed along the depressions; texture is rubbery, not readily compressible and difficult to tear. The color is reddish-brown, both out of water and in preservative. Siliceous spicules are absent. Skeleton is a reticulation of yellowish-brown spongin fibers made-up of primary fibers (27-41 µm in diameter), secondary fibers (10-14 µm in diameter) and fine tertiary fibers (3 µm in diameter), the resulting pattern is a beautiful and neat intricately woven fibers forming round to oval meshes (41-315 µm wide). Attached to a coral stone at 11 m deep in an area with sandy substrate and coral patches.

DISTRIBUTION: Phillippines: Cebu - San Francisco (present study)
Subfamily Phyllospongiinae Bergquist, Sorokin and Karuso, 1999
Genus *Carteriospongia* Hyatt, 1877
***Carteriospongia flabellifera* (Bowerbank, 1877)**

DESCRIPTION: Foliose (fragment: 130 mm wide, 56 mm long and 2 mm thick) with a single and short

attachment stalk; surface displays a characteristic pattern of low regularly aligned ridges and hispidous; texture is firm, flexible and granular. In life, color is beige; out of water and in preservative, it is brown. Siliceous spicules are absent. Irregular reticulation of primary and secondary spongin fibers cored with foreign materials; long, thin and vermiform tertiary fibers intertwined along the columns to form complex fiber tresses. Found at 15-18 m deep in a coral reef.

DISTRIBUTION. Philippines: Cebu - Marigondon, Argao (present study)

Family Spongiidae Gray, 1867
Genus *Spongia* Linnaeus, 1759
***Spongia zimocca sensu* de Laubenfels, 1954** (Plate 1, Fig. 6)

DESCRIPTION: Massive (fragment: 70 mm high and 82 mm wide); surface is rugged with projections (7-10 mm high) found at the upper surface bearing the oscules (4-8 mm in diameter); texture is soft and spongy. In life and in preservative, ectosome is black and endosome is orange to rusty red with brownish tinge. Siliceous spicules are absent. The skeleton is a fibroreticulate arrangement of fibers (20 µm in diameter) forming irregular sizes of polygonal meshes (about 100-133 µm across); ectosome of the sponge is thin and darkly pigmented. The specimen was found on some hard substrate in an intertidal area with generally muddy substrate.

REMARKS: This is one of the sponges traded as bath sponge, often referred to as "yellow" sponge because the macerated fibers exhibit a somewhat yellowish or almost orange color (de Laubenfels, 1954).

DISTRIBUTION: Eastern Ponapè and Palau (de Laubenfels, 1954), Philippines (Wilson, 1925; Ruelo, 1964): Cebu - San Francisco (present study)

Family Dysideidae Gray, 1867
Genus *Dysidea* Johnston, 1842
***Dysidea cf. arenaria* Bergquist, 1965**

DESCRIPTION: Irregular, roughly conulose (fragment: 65 mm long, 16 mm wide and 2 mm thick); surface is conulose, with conules measuring 1-5 mm high and 20-50 mm apart (Bergquist, 1965) separated by deep pits; texture is rubbery and less compressible. Its color in life is light brown while grayish white in alcohol. Fibers are not differentiated into primary and secondary fibers (93.3-133.4 µm in diameter); arranged in a reticulate pattern forming irregular meshes; all fibers are fully cored with detritus. Found at depth zone 15-18 m in an area with sandy substrate and coral patches.

DISTRIBUTION: Indonesia (Van Soest, 1989); Palau (Bergquist, 1965); New Caledonia (Laboute et al., 1998); Philippines: Cebu-San Francisco (present study)

Order Dendroceratida Minchin, 1900
Family Dictyodendrillidae Bergquist, 1980
Genus *Igernella* Topsent, 1905
Igernella mirabilis Lèvi, 1961

DESCRIPTION: Massive (fragment: 154 mm long, 88 mm wide and 15-38 mm thick), accumulates a lot of shells and small stones in the body; round depressions (5-7 mm in diameter) are irregularly distributed at the surface with pores not visible on the outside but when sliced, a lot of them can be seen; texture is very soft but difficult to tear. The external color is dark brown in life and become lighter in alcohol while the internal is light brown in life and in alcohol. Siliceous spicules are absent, replaced instead by spiculoids, which are yellowish-brown fibers taking the form of triactines and diactines; skeletal arrangement is reticulate forming regular to slightly irregular meshes. Found at 9-12 m in a coral reef area.

DISTRIBUTION: Philippines: Cebu - Marigondon (present study)

Order Verongida Bergquist, 1978
Family Pseudoceratinidae Carter, 1885
Genus *Pseudoceratina* Carter, 1885
***Pseudoceratina verrucosa* Bergquist, 1995**

DESCRIPTION: Massive and repent (fragment: 64 mm long, 32 mm wide and 30 mm thick) with thick branches; surface is generally uneven, verrucose containing small rounded projections (1-2 mm high); texture is hard, incompressible and difficult to tear. Its color is yellowish-brown with greenish patches when out of water while in preservative it is deep purple

almost black. Dendritic arrangement of irregular fibers composed of pith elements; a large portion of the deeper region of the choanosome is devoid of skeleton; bark is absent and the ectosome contains a layer of collagen. Found at depths of 15-18 m in a steep reef front with abundant corals.

DISTRIBUTION: New Caledonia (Bergquist, 1995); Philippines: Cebu - Marigondon (present study)

Of the thirty-three (33) species identified in this study, four (4) have medical and economic potentials (Plate 1, Figs. 5-8). The sponge *Stylissa massa* (Carter, 1889) contains eight (8) known alkaloids in which two showed significant enzyme inhibitory activity and inhibited the growth of human tumor LoVo cells (Tasdemir et al., 2002). *Hyrtios erecta* (Keller, 1889), one of the most common sponges in the island, has some associated bacteria (alpha proteobacteria SpeI-7) which are potential sources of bioactive metabolites (Rodriguez et al., 2005). *Plakortis lita* de Laubenfels, 1954 has been reported to release allelochemicals toxic to hard corals (Bakus and Nishiyama, 1999; 2000). Furthermore, *Spongia zimocca* sensu de Laubenfels, 1954 is considered as one of those traded as bath sponges commercially referred to as the "yellow sponge" because of the color of its fibers (de Laubenfels, 1954).

Sponges can enter into complex epizoic relationships, growing over, upon or even inside one another without hampering their pumping and filtering activities on which they depend (Bergquist, 1978). Four (4) species of sponges in this study (Plate 1, Figs. 9-12) were found growing in symbiotic relationship with another sponge or other marine organisms. *Haliclona cymiformis* (Esper, 1794) had been known in association with red algae *(Ceratodictyon spongiosum)* thinly but fully encrusting the algae (Fromont, 1993). *Paratetilla bacca* (Selenka, 1867) have greenish tinge caused by cyanobacteria, *Symploca* sp. (Caberoy, 1997). Sponge to sponge association is exhibited by *Haliclona amboinensis* (Lèvi, 1961) and *Rhabdastrella* sp. nov. in all the specimens collected for this study. *Haliclona amboinensis* (Lèvi, 1961) grow on top of *Rhabdastrella* sp. nov. with the latter attached to the substrate. Fromont (1993) reported another sponge, *Niphates nitida* Fromont, 1993 in association with these two sponges however, this association is not well established in this study. Kelly-Borges and Bergquist (1988) reported another sponge in association with *H. amboinensis* (Lèvi, 1961), *Psammaplysilla purpurea* Carter, 1880 but such association was not observed in this study.

Percentage Similarity

Figure 4 shows the species richness of the six stations. The station in San Francisco (Station 2) recorded the highest number of species (15 species) while Daanbantayan (Station 1) recorded the lowest (5 species). The highest number of species recorded at

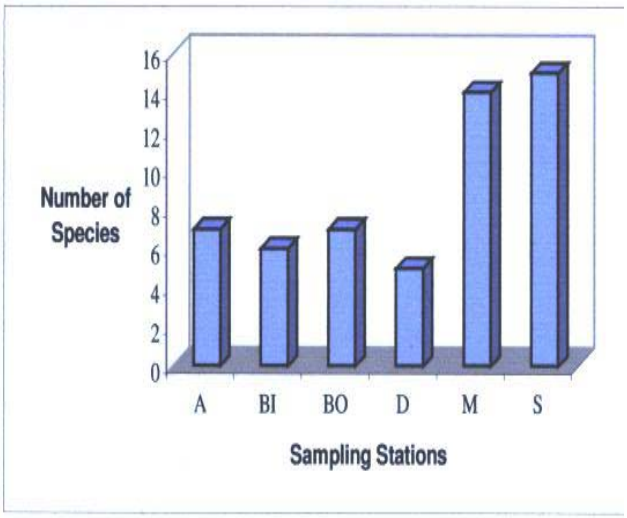


Fig. 4. Species richness of the six sampling stations of Cebu, Philippines. A, Argao; BI, Badian In-MPA; BO, Badian Out-MPA; D, Daanbantayan; M. Marigondon; S, San Francisco.

San Francisco station is due to the presence of several sponge species in the intertidal zone, which is unusual for this zone. The study of Diaz *et al.* (1985) revealed that sponges are generally absent in the intertidal zone of open reef habitats. Sponges are not the major occupants in this zone, frequently occurring in pools, shades, under boulders, in crevices and on top of organisms (Bergquist, 1978). Light and wave action may play an important role affecting sponge distribution in this zone. Wave stress may limit the colonization and growth of sponges by generating substrate instability, high turbidity and turbulence (Diaz *et al.*, 1985). Unlike the other intertidal zones, a dike that runs

perpendicular to the shore is protecting the intertidal area of San Francisco making it suitable for sponge growth and survival.

Species richness increases with depth as observed in this study (Fig. 5). The highest number, 22 species was recorded at depth zone 4 (13-18 m) while the lowest number, 6 species, was at depth zone 1 (0-2 m). Schmahl (1985) noted similar observations in his study of the four Southern Florida coral reefs. Distribution of sponges along the depth gradient is indicative of their ecological tolerance in which species widely distributed are more tolerant than those restricted at certain depths (Alvarez *et al.*, 1985). Ecological factors that vary with

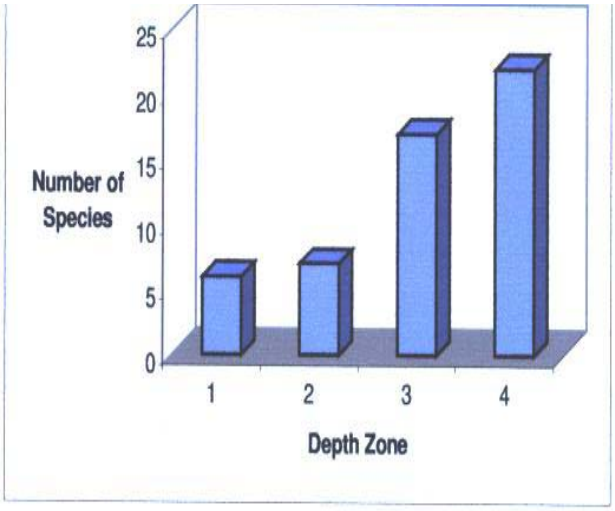


Fig.5. Species richness of the four depth zones of Cebu, Philippines, 1. 0-2m; 2, 3-9m; 3, 10-12m; 4, 13-18m.

depth appear to be responsible for the observed distributions. One such factor is turbulence or physical disturbance due to wave action, which decreases substantially with depth (Schmahl, 1985).
Species richness inside and outside the marine protected areas has almost the same values (6 and 7 species, respectively), which could mean that these marine organisms are not being harvested or utilized in the area.

Table 2 shows the species occurrence at the six stations of Cebu. Not a single sponge species was present in all of the six sampling stations. Only three (3) species or nine percent (9%) occurred in four of the six stations, two of which are new to science, *Dendroxea* sp. nov. and *Haliclona* sp. nov. The other most common species is *Hyrtios erecta* (Keller, 1889). Three (3) species or nine percent (9%) were present in three stations and these include *Plakortis lita* de Laubenfels, 1954; *Clathria (Thalysias) reinwardti* Vosmaer, 1880; and *Liosina paradoxa* Thiele, 1899. Six (6) species or eighteen percent (18%) were present in two stations and twenty-one (21) species or sixty-seven percent (67%) of the thirty-three (33) known sponges were recorded only once. This trend is lower than the one recorded by Raymundo and Harper (1995) in their study of the sponges in Central Visayas. In their study, only fifty-three percent (53%) of the 85 sponges collected were present at one site, twenty-four percent (24%) were found in more than one site and thirty-three percent (33%) were found in more than five stations. A fairly large number of their genera has widespread distribution in Central Visayas. However, it was not mentioned from which bodies of water the sponges were collected.

The cluster results using Jaccard's Index of Similarity and Dissimilarity is shown in Fig. 6. Two major groupings were formed as if distance between stations is the major criteria. The first cluster is composed of the closest stations, inside and outside the Marine Protected Area of Badian, Cebu (Stations 4 and 5) situated at the shallow waters of Tanon Strait at the western portion of the island. The second cluster is composed of stations in Daanbantayan, San Francisco,

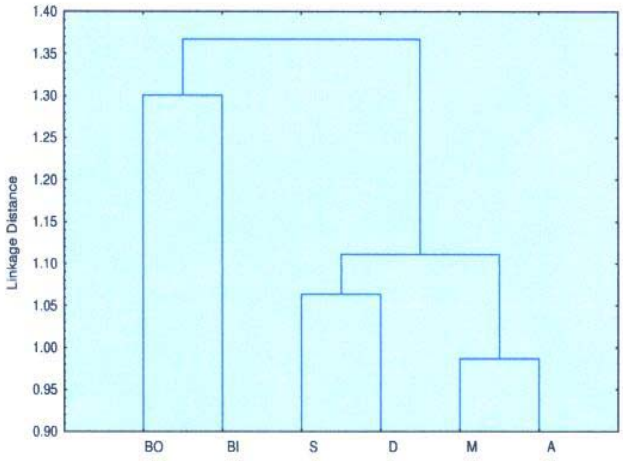


Fig. 6. Cluster analysis of the different sampling stations of Cebu, Philippines using percentage similarity and weighted pair-group average. A, Argao; BI, Badian In-MPA; BO, Badian Out-MPA; D, Daanbantayan; M, Marigondon; S, San Francisco.

Table 2. Occurrence of sponges at the six (6) sampling stations of Cebu Island, Philippines (A, Argao; BI, Badian Inside MPA, BO, Badian Outside MPA; D, Daanbantayan; M. Marigondon; S, San Francisco).

Species	A	BI	BO	D	M	S
1. *Corticium* sp. nov.		+				
2. *Plakortis lita* de Laubenfels, 1954				+	+	+
3. *Paratetilla bacca* (Selenka, 1867)	+					
4. *Rhabdastrella* sp. nov.			+			
5. *Spheciospongia vagabunda* (Ridley, 1884)						+
6. *Siliquariaspongia cf. mirabilis* (de Laubenfels, 1954)					+	
7. *Clathria (Thalysias) reinwardt*i Vosmaer, 1880				+	+	+
8. *Echinodictyum cf. conulosum* Kieschnick, 1900					+	
9. *Iotrochota baculifera* Ridley, 1884					+	
10. *Biemna fortis* (Topsent, 1897)			+			+
11. *Axinella carter*i (Dendy, 1889)			+			
12. *Phakellia cavernosa* (Dendy, 1922)						+
13. *Higginsia cf. mixta* (Hentschel, 1912)		+	+			
14. *Liosina paradoxa* Thiele, 1899	+		+		+	
15. *Stylissa massa* (Carter, 1889)		+				
16. *Axynissa cf. topsenti* Lendenfeld, 1897					+	
17. *Callyspongia (Callyspongia) aerizusa* Desqueyroux-Faundez, 1984		+				
18. *Callyspongia (Callyspongia) muricina* (Lamarck, 1813)				+		
19. *Dendroxea* sp. nov.	+			+	+	+
20. *Haliclona cf. amboinensis* (Lèvi, 1961)			+			
21. *Haliclona cymiformis* (Esper, 1794)						+
22. *Haliclona poseidon* (de Laubenfels, 1954)					+	
23. *Haliclona* sp. nov.	+	+			+	+
24. *Cribrochalina olemda* de Laubenfels, 1954		+			+	
25. *Xestospongia testudinaria* (Wilson, 1925)						+
26. *Hyrtios erecta*(Keller, 1889)	+			+	+	+
27. *Luffariella cf. variabilis* Polejaeff, 1884	+		+			
28. *Dactylospongia cf. elegans* (Thiele, 1889)					+	
29. *Carteriospongia flabellifera* (Bowerbank, 1877)					+	+
30. *Spongia zimocca sensu* de Laubenfels, 1954						+
31. *Dysidea cf. arenaria* Bergquist, 1965						+
32. *Igernella mirabilis* Lèvi, 1961					+	
33. *Pseudoceratina verrucosa* Bergquist, 1995	+				+	

Marigondon and Argao located at the eastern part of the island.

Other closely related stations are Stations 1 and 2 (Daanbantayan and San Francisco). Though the distance between Marigondon and San Francisco is relatively shorter than San Francisco and Daanbantayan, the sampling site being located at the back of the island may have favored the flow towards Daanbantayan than towards Marigondon. The station in Daanbantayan is still within the northern tip of Camotes Sea where San Francisco is situated. Marigondon and Argao are closer to each other and are found in the same cluster with San Francisco and Daanbantayan.

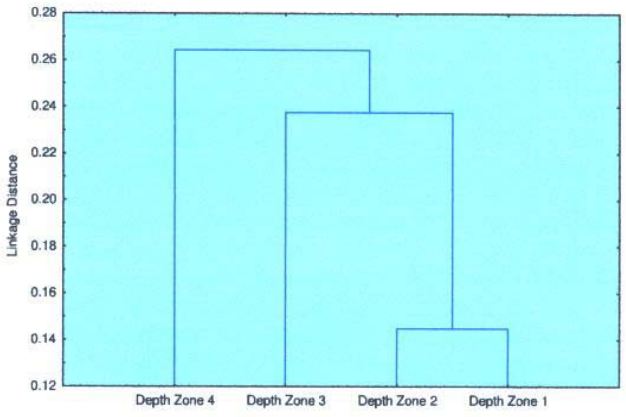


Fig. 7. Cluster analysis of the four depth zones of Cebu, Philippines using percentage similarity and weighted pair-group average, Depth Zone 1, 0-2m; Depth Zone 2, 3-9m; Depth Zone 3, 10-12m; Depth Zone 4, 13-18m.

Plate 1. Figs. 1-12. Habit of sponges. Figs. 1-4, sponges preliminarily identified as new species, figs. 5-8, those with economic, medical and ecological potentials; figs. 9-12, those with association to its kind or with other marine organisms.

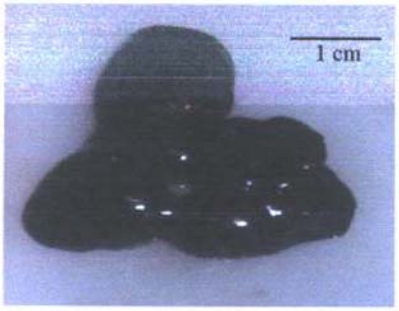


Figure 1. ***Corticium*** sp. nov.

Figure 2. ***Rhabdastrella*** sp. nov.

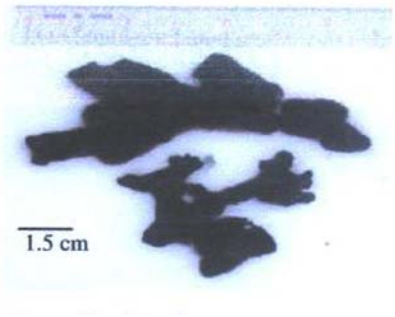


Figure 3. ***Dendroxea*** sp. nov.

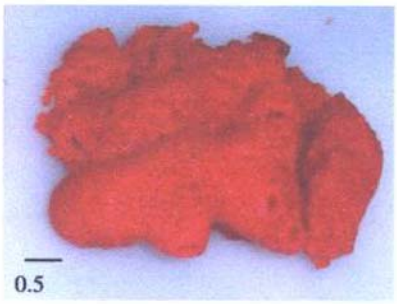


Figure 4. ***Haliclona*** sp. nov.

Figure 5. ***Stylissa massa*** (Carter, 1889), in situ.

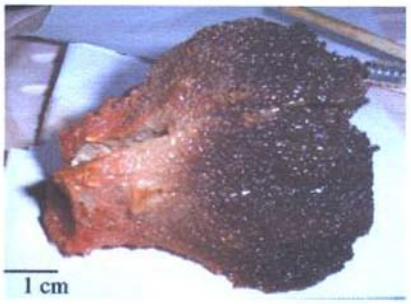


Figure 6. ***Spongia zimocca sensu*** de Laubenfels, 1954

Figure 7. ***Hyrtios erecta*** (Keller, 1889)

Figure 8. ***Plakotis lita*** de Laubenfels, 1954

Figure 9. ***Paratetilla bacca*** (Selenka, 1867)

Figure 10. ***Spheciospongia vagabunda*** (Ridley, 1884)

Figure 11. ***Haliclona, cf. amboinensis*** (Levi, 1961)

Figure 12. ***Haliclona cymiformis*** (Esper, 1794)

For depth zones (Fig. 7), the two shallowest zones (zones 1 and 2) are clustered together while the two deepest zones are not. These two, however have high linkage distance than depth zones 1 and 2.

CONCLUSION

The shallow marine areas of Cebu are inhabited by a wide variety of sponge species. The low percentages of similarity among stations clearly showed that the bodies of water surrounding the island support different species of sponges. Clustering of these areas occurred between nearest neighboring waters.

The discovery of four possible new species shows that there are probably more undescribed species in Philippine waters and that more taxonomic research is needed. The discovery of the species of bath sponges, *Spongia zimocca sensu* de Laubenfels, 1954, proves promising for aquaculture.

Protecting the coral reef from anthropogenic factors does not have big impact on sponge richness as shown by the sampling results of stations inside and outside a marine protected area.

RECOMMENDATIONS

This study showed that there are still a lot of sponges yet to be discovered in Philippine waters, hence the need to conduct similar study in other areas of the country, possibly using the advancements in molecular biology.

Since only few sponge species were found common among the different bodies of water surrounding Cebu, it is recommended that studies related to current system of these waters be conducted to explain this pattern of distribution.

Spongia zimocca sensu de Laubenfels, 1954, one of the commercial sponges, has potential for mariculture in the shallow waters of Cebu. Thus studies on growth, survival and culture methods of this sponge and other species with importance to economy, ecology and medicine should be conducted for these may provide livelihood opportunities for marginal fishermen.

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