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BIODIVERSITY AND DISTRIBUTION OF OCTOCORALS OF MINICOY ATOLL, LAKSHADWEEP

ANITA G. MARY¹ and ROBERT D. SLUKA²

ABSTRACT

A survey of the distribution of octocorals of Minicoy Atoll, Lakshadweep found 53 species representing 44 alcyoniids (7 genera) and 9 gorgonians (6 genera). Specimens were from 7 families: Alcyoniidae, Neptheidae, Nidallidae of the Alcyoniina group, Melithaeidae of the Scleraxonia group and Acanthogorgiidae, Plexauridae of the suborder Holaxonia and Ellisellidae of the suborder Calcaxonia. All species are new records to the study area. Based on the species collected and their importance, an outlook on the future possibilities of working in this area is suggested.

INTRODUCTION

There are four main coral reef areas in India: Lakshadweep (Laccadives; Figure 1), Andaman and Nicobar Islands, the Gulf of Mannar, and the Gulf of Kutch.

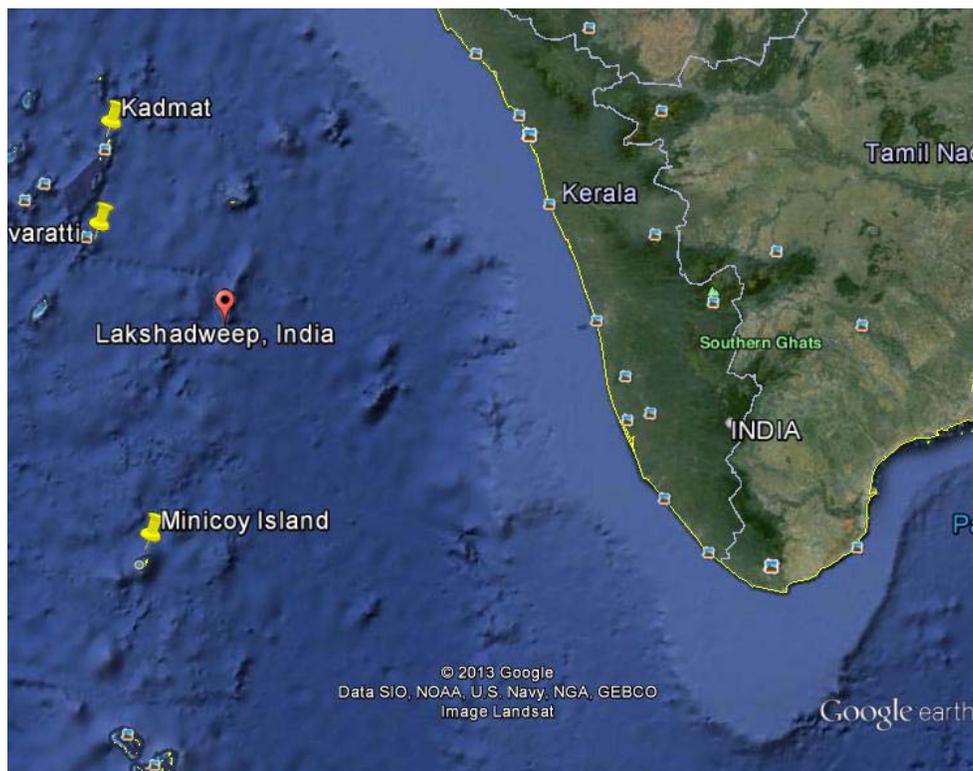


Figure 1. Map of India showing atoll reefs and fringing reefs.

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The Lakshadweep Archipelago (8° 27-30' N, 71°-74° E) consists of 12 coral atolls with 36 islands and 5 submerged banks situated at the northern end of the Laccadive-Chagos ridge, 225-450 km west of the Kerala coast (Figure 2). These islands vary in size from 0.1 km² (Bitra) to 4.8 km² (Androth) and are surrounded by 4,200 km² of lagoon, raised reefs and banks (Muley et al., 2000). The entire 132 km (Wafar, 1999) coastline of Lakshadweep islands is protected by an outer reef which encloses a shallow lagoon, with the exception of Androth, which is exposed on all sides (Jones and Kumaran, 1980).

Minicoy (8° 27' N, 73° 05' E) is the southernmost island in Lakshadweep and is located just north of the Maldives Archipelago. Its large lagoon area has undergone visible changes in the last decade due to natural causes like *El Nino* and other anthropogenic interferences (Viner and Agnew, 1999). Generally information on octocoral fauna from the Maldives, Lakshadweep and south west coast of Indian Territory is very limited. Gardiner (1903) made a broad survey of the fauna and geography of the Maldives and Laccadive Archipelago during an expedition conducted in 1899 and 1900. Apart from the 'Investigator Expedition' collections (Thomson and Henderson, 1906 and Thomson and Simpson, 1909), the taxonomic reports on Lakshadweep soft corals are found in the publications of Pratt (1903, 1905), Hickson (1903, 1905), Ofwegen and Vennam (1991), Alderslade and Shirwaiker (1991) and Vennam and Ofwegen (1996).

There are fundamental gaps in the basic distribution and status information for much of the reef fauna of Lakshadweep islands. No octocorals have been recorded in the Minicoy Island reefs. The present paper reports on a survey of Minicoy Island reef sites to record biodiversity and distribution of octocorals. We present a preliminary systematic list of octocorals as well as information on their abundance and distributional patterns on the reefs.

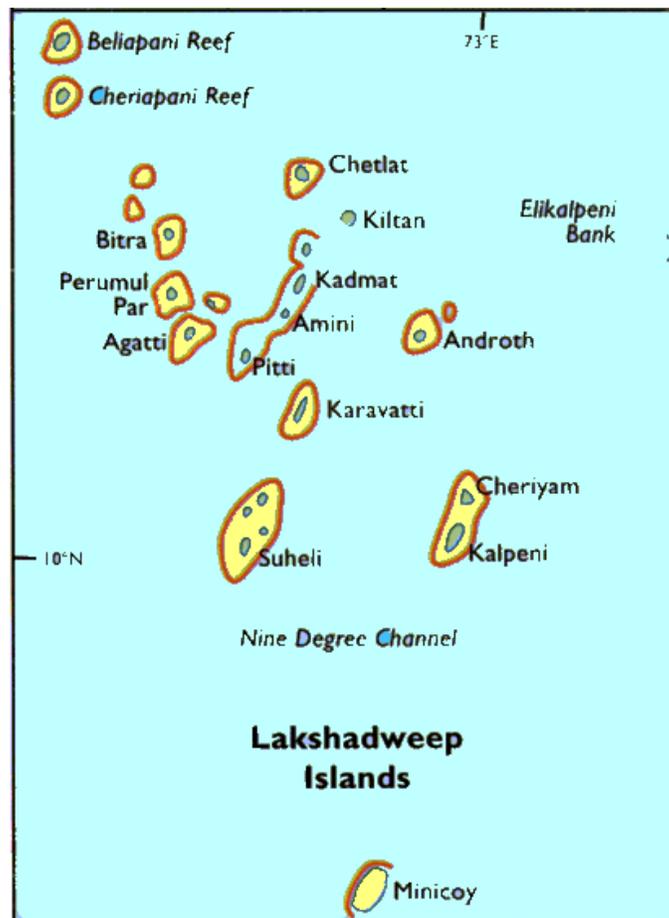


Figure 2. Map showing Lakshadweep islands and Minicoy Atoll.

METHODOLOGY

Field observations were made and octocoral samples were collected in December 2005 and January 2006 at three sites: one within the lagoon (Site A; Figure 3) at a depth range of 5-10m and two locations (Site B and C; Figure 3) outside the lagoon crest at a depth of <40m. The three sites were selected along the windward reefs with one near the western boat channel (Site A: 8°31'N; 55°03'E) and two at shipwreck sites (Site B: 8°31'N; 55°07'E and Site C: 8°29'N; 55°07'E) in the northeastern region (Figure 3). At each site, the details of habitat and other field conditions were recorded. The reefs were reached mainly by boat and the collections were made using SCUBA. Most of the photographic records were collected *ex situ* as strong currents didn't support quality *in situ* pictures.

The octocorals treated in this paper were collected from Minicoy by the first author. All specimens apart from the dry fragments of *Acabaria variabilis* are preserved in 70% alcohol. All specimens were deposited in the Northern Territory Museum (NTM), Darwin, Australia. The underwater abundance estimates of the genera were made visually and divided into four categories: Rare, Sporadic, Abundant and Dominant.

Identifications were made by examining sclerite preparations which were dissolved in 10% sodium hypochlorite following Fabricius and Alderslade (2001) and the subsequent confirmation by Dr. Phil Alderslade, NTM, Darwin, Australia.



Figure 3. Map showing the survey sites in Minicoy atoll, Lakshadweep.

RESULTS

Fifty six collections yielded 53 species of which 44 were alcyoniids and 9 gorgonids. All were new biogeographical records for Minicoy Atoll. Identifications were made based on the variations in sclerites within each genus. Ten of these species were new records to Lakshadweep islands and six are new to India. The complete classification list with Museum inventory numbers and previous references from Lakshadweep and Maldives are given in Table 1. The present collection comprises 13 genera dominated by seven genera of three soft coral families *viz.* Alcyoniidae, Nepthidae and Nidallidae of the Alcyonina group, followed by six genera of four gorgonian families Melithaeidae of the Scleraxonia group, Acanthogorgiidae, Plexauridae of suborder Holaxonia, and Ellisellidae of suborder Calcaxonia.

Soft corals dominated in distribution and diversity. We recorded 16 species of *Sinularia* (Plates 11 to 16) followed by 13 species of *Lobophytum* (Plates 7 to 10), 7 species of *Dendronephthya* (Plates 1 to 4), 6 species of *Sarcophyton* (Plates 17 to 22) and one species each of *Klyxum* (Plates 23 and 24), *Scleronephthya* (Plates 5 and 6) and *Siphonogorgia* (Plates 25 and 26). The gorgonian distribution was dominated by *Wrightella sp.1* (Plates 27 and 28), *Wrightella sp.2* (Plate 29) and *Acanthogorgia sp.1* (Plate 34) and *Acanthogorgia sp.2* (Plate 35) with 2 species each, followed by one species each of *Verucella* (Plates 37 and 38), *Astrogorgia* (Plates 32 and 33), *Echinogorgia* (Plate 36) and *Acabaria variabilis* (Plates 30 and 31). All species except *Acabaria variabilis* require extensive taxonomic revision to identify beyond the genus level. Of the genera recorded, all are new records to Lakshadweep islands except *Lobophytum*, *Sinularia* and *Sarcophyton*. The genera *Klyxum*, *Scleronephthya*, *Siphonogorgia*, *Wrightella*, *Astrogorgia* and *Acanthogorgia* are new records to India

Minicoy is a typical atoll with an outer reef close to shore stretching from a shallow reef-flat and dropping to hundreds of meters deep very steeply. Site B and C encompass shipwrecks with corals growing on the stern, wheel, ladders etc. of each sunken ship. Abundant reef fishes were observed among the shipwreck sites. All three sites (A, B and C) showed rich and diverse coral coverage with an abundance of soft corals. *Sinularia*, *Lobophytum*, *Sarcophyton* and *Dendronephthya* are highly abundant in the shallow reef habitats (5-12m) and were found even in habitats exposed to strong tidal currents and wave actions. Usually *Sarcophyton*, *Lobophytum*, *Sinularia* created a monospecific carpet composed of numerous colonies locally covering several meters. They are dense in the shipwreck areas, occupying niches along the stern of the ship. Widely scattered sporadic colonies of gorgonians were observed from 7 to 36m depth along the northeastern reef crest of the atoll. Below 22m, *Sinularia* and *Lobophytum* became scarcer while *Dendronephthya* and *Sarcophyton* were abundant in the shallows but sporadic at depth. *Klyxum* and *Scleronephthya* were generally rare.

Gorgonians such as *Acabaria variabilis* and *Wrightella* were mostly found overhanging in the niches below the reef edge and in shipwreck crevices shielded from direct sunlight. It is interesting to note that octocorals survive in both calm, deeper waters with excellent visibility (to 18m) and at depths less than 6m where they endure heavy wave action near the reef crest.

DISCUSSION

Only a few papers have been published on the octocorals of Lakshadweep Island and so far no records from Minicoy atoll. Hence no comparisons can be made concerning the diversity or distribution patterns of octocorals other than the comparison with other island records of Lakshadweep and neighboring islands of Maldives. It is noted that alcyoniids show a widespread distributional pattern, indicating a need for further octocoral surveys to determine the true range of distribution of various soft coral taxa.

Hickson (1903, 1905) and Pratt (1903, 1905) worked more on the Maldivian specimens. The “*Investigator*” collections recorded only six alcyonaceans and few gorgonians (<4) from the littoral area of Lakshadweep islands, while eight gorgonians and three sea pens were collected from a depth of more than 1286m. The present collections were from shallow (5–40 m) depth and none of the octocorals were

present amongst their material. Thompson and Simpson (1909) described four species of gorgonians from Lakshadweep viz: *Subergorgia ornata*, *Nicella reticulata*, *N. pustulosa* and *Echinomuricea uliginosa*. Three additional gorgonians were reported by Ofwegen and Vennam (1991). From the 1985 to 1989 and 1992 collections by National Institute of Oceanography, Goa, India, the soft coral fauna of Lakshadweep was reported by Ofwegen and Vennam (1991) (19 species), Alderslade and Shirwaiker (1991) (17 species) and Vennam and Ofwegen (1996) (11 species). All soft coral fauna from Lakshadweep are also collected from various other islands such as Kavaratti, Kadmat, Bangaarum, Agatti and Androth. The present inclusion of 53 species of octocorals with 44 Alcyoniids (4 new genera) and 9 gorgonids (6 new genera) increase the Lakshadweep octocoral list to 97 soft corals and 26 gorgonians known to date. Among the 13 listed genera, 10 form first records for the Lakshadweep islands i.e., *Klyxum*, *Dendronephthya*, *Scleronephthya*, *Siphonogorgia*, *Acabaria*, *Wrightella*, *Acanthogorgia*, *Echinogorgia*, *Astrogorgia* and *Verucella*. In addition, collections made at Kavaratti, Kadmat and Agatti islands by the first author (*Unpublished*) yielded other new records and will increase the species list for Lakshadweep.

From the present overall objective of the survey to investigate the octocoral fauna of Minicoy atoll, the results indicate that octocorals are abundant both in the shallow lagoon and the deep outer crest. Current observation shows that Minicoy has a greater diversity compared to the available information from other islands of Lakshadweep (53 species of soft corals and 17 gorgonids) and neighboring islands of Maldives (3 species). Also there is close resemblance between respective faunas in terms of generic composition (3% overlap). Out of the total 56 materials collected, 80.4% were soft corals and 14.3% were gorgonians.

Our observations confirmed previous findings (Hickson 1903, 1905; Pratt 1903, 1905) that family Alcyoniidae is dominant in the Lakshadweep islands, and that in particular reef areas of Minicoy live coverage of this family can account for more than 70 to 75% of the total surface area. These colonies propagate asexually which is known to cause monospecific aggregations (Benayahu and Loya 1984). With their less abundant sclerites and flexibility, these intertidal soft corals can withstand high wave action and currents. It is also understood from the previous Maldivian soft coral reports (Hickson, 1903 and Pratt, 1903, 1905) that *Sinularia*, *Sarcophyton* and *Lobophytum* are the only widely distributed genera. A striking feature of many alcyonaceans is their patchy distribution (Benayahu and Loya, 1977, 1981; Tursch and Tursch 1982) and this feature may promote varied species composition and abundance in different localities. In deeper areas, the important limiting factor for alcyonacean distribution is the availability of firm substratum suitable for the larvae to settle. Competitive interactions with other reef organisms clearly play an important role in determining the distribution of soft corals (Benayahu and Loya 1981, 1982; Sammarco et al 1983) and it is also suggested that the abundance of alcyonaceans could be regulated by difference in life history parameters, mainly reproductive stages. It was also reported that the rare occurrence of nephtheids is due to their reproductive potential and short distance dispersal of planulae (Benayahu 1985). Life history studies on these soft corals would provide additional explanation for the distributional patterns of the various species.

The associated assemblages observed in the present survey reveal that there were almost no branching corals, and the sites appear to be overgrown by brown and green algae and the sea grass *Thalassia* sp. Some massive corals were found, including a colony of *Favites* of approximately 4m in diameter. It is reported in general that when there are more living scleractinians, there will be less alcyonaceans and *vice versa* (Fishelson 1970). This selective occurrence seems to be controlled by environmental factors or by competition. Scleractinians are more adapted to withstand wave actions; whereas alcyonaceans may be less sensitive to sedimentation. The important factors that affect the coral growth at these islands include wave action, sedimentation, extreme low tides, coastal erosion and anthropogenic destructions, such as coral mining by dredging (for building construction), pollution by agricultural runoff, unmanaged and destructive fishing, coastal development and the production of lime.

CONCLUSIONS

The preliminary survey leaves no doubt about the rich and highly diverse soft coral fauna of Minicoy Island. Species of *Lobophytum*, *Sinularia* and *Sarcophyton* show different morphometric characters such as colony, colour and sclerite structures. Identification to species level of these specimens awaits future research. A detailed descriptive study of those specimens should be carried out to determine if there are any new species. It is suggested that further exploration would help yield many new alcyonacean records. The current abundant diversity of octocorals emphasizes the need to implement effective conservation policies and management programs to promote conservation of this unique reef ecosystem.

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Table 1. List of new records of Octocorallia (Anthozoa) from Minicoy Atoll, Lakshadweep, along with its abundance and comparison with previous records from other Lakshadweep islands, India.

| Classification | Genus and species recorded from Minicoy Island | Museum ID | No. of Sp. | Abundance | Previous records of genus from other Lakshadweep islands and Indian coast | Previous records of genus from Maldives |
|-------------------------------------|--|-----------|------------|-----------|--|---|
| Suborder Alcyoniina: Alcyoniidae | <i>Sinularia</i> sp.1 | C015310 | 16 | Dominant | Ofwegen and Vennam (1991); Alderslade and Shirwaiker (1991); Vennam and Ofwegen (1996) | Hickson (1903, 1905); Pratt (1903, 1905); Gardiner (1903) |
| | <i>Sinularia</i> sp.2 | C015311 | | | | |
| | <i>Sinularia</i> sp.3 | C015315 | | | | |
| | <i>Sinularia</i> sp.4 | C015317 | | | | |
| | <i>Sinularia</i> sp.5 | C015319 | | | | |
| | <i>Sinularia</i> sp.6 | C015322 | | | | |
| | <i>Sinularia</i> sp.7 | C015323 | | | | |
| | <i>Sinularia</i> sp.8 | C015326 | | | | |
| | <i>Sinularia</i> sp.9 | C015327 | | | | |
| | <i>Sinularia</i> sp.10 | C015328 | | | | |
| | <i>Sinularia</i> sp.11 | C015329 | | | | |
| | <i>Sinularia</i> sp.12 | C015330 | | | | |
| | <i>Sinularia</i> sp.13 | C015332 | | | | |
| | <i>Sinularia?</i> sp.14 | C015333 | | | | |
| | <i>Sinularia</i> sp.15 | C015335 | | | | |
| | <i>Sinularia</i> sp.16 | C015348 | | | | |
| | <i>Lobophytum</i> sp.1 | C015309 | 13 | Dominant | Ofwegen and Vennam (1991); Alderslade and Shirwaiker (1991); Vennam and Ofwegen (1996) | Hickson (1903,1905); Pratt (1903, 1905); Gardiner (1903) |
| | <i>Lobophytum</i> sp.2 | C015318 | | | | |
| | <i>Lobophytum</i> sp.3 | C015321 | | | | |
| | <i>Lobophytum</i> sp.4 | C015324 | | | | |
| | <i>Lobophytum</i> sp.5 | C015325 | | | | |
| | <i>Lobophytum</i> sp.6 | C015331 | | | | |
| | <i>Lobophytum</i> sp.7 | C015334 | | | | |
| | <i>Lobophytum</i> sp.8 | C015336 | | | | |
| | <i>Lobophytum</i> sp.9 | C015337 | | | | |
| | <i>Lobophytum</i> sp.10 | C015340 | | | | |
| | <i>Lobophytum</i> sp.11 | C015341 | | | | |
| | <i>Lobophytum</i> sp.12 | C015342 | | | | |
| | <i>Lobophytum</i> sp.13 | C015343 | | | | |
| | <i>Klyxum</i> sp. | C015313 | 1 | Rare | -No Record- | -No Record- |

| | | | | | | |
|--|----------------------------|---------|---|-------------------|---|---|
| Suborder Alcyoniina: Alcyoniidae (continued) | <i>Sarcophyton</i> sp.1 | C015312 | 6 | Abundant | Ofwegen and Vennam (1991); Alderslade and Shirwaiker (1991); Vennam and Ofwegen (1996) | Hickson (1903, 1905); Pratt (1903, 1905); Gardiner (1903) |
| | <i>Sarcophyton</i> sp.2 | C015314 | | | | |
| | <i>Sarcophyton</i> sp.3 | C015316 | | | | |
| | <i>Sarcophyton</i> sp.4 | C015320 | | | | |
| | <i>Sarcophyton</i> sp.5 | C015338 | | | | |
| | <i>Sarcophyton</i> sp.6 | C015339 | | | | |
| Suborder Alcyoniina: Nidaliidae | <i>Siphonogorgia</i> sp. | C015357 | 1 | Rare | -No Record- | Hickson (1903, 1905); Pratt (1903, 1905); Gardiner (1903) |
| Suborder Alcyoniina: Nephtheidae | <i>Dendronephthya</i> sp.1 | C015352 | 7 | Abundant | Mary et al. (2011) | -No Record- |
| | <i>Dendronephthya</i> sp.2 | C015353 | | | | |
| | <i>Dendronephthya</i> sp.3 | C015344 | | | | |
| | <i>Dendronephthya</i> sp.4 | C015346 | | | | |
| | <i>Dendronephthya</i> sp.5 | C015347 | | | | |
| | <i>Dendronephthya</i> sp.6 | C015351 | | | | |
| | <i>Dendronephthya</i> sp.7 | C015354 | | | | |
| | <i>Scleronephthya</i> sp. | C015345 | 1 | Rare | -No Record- | -No Record- |
| Suborder Scleraxonia: Melithaeidae | <i>Wrightella</i> sp.1 | C015349 | 2 | Sporadic | -No Record- | -No Record- |
| | <i>Wrightella</i> sp.2 | C015498 | | | | |
| | <i>Acabaria variabilis</i> | C015493 | 1 | Sporadic | Mary et al. (2011) | -No Record- |
| Suborder Holaxonia: Acanthogorgiidae | <i>Acanthogorgia</i> sp.1 | C015350 | 2 | Sporadic | -No Record- | -No Record- |
| | <i>Acanthogorgia</i> sp.2 | C015358 | | | | |
| Suborder Holaxonia: Plexauridae | <i>Astrogorgia</i> sp. | C015356 | 1 | Sporadic | -No Record- | -No Record- |
| | <i>Echinogorgia</i> sp. | | 1 | Sporadic | -No Record- | -No Record- |
| Suborder Calcaxonia: Ellisellidae | <i>Verrucella</i> sp. | C015355 | 1 | Sporadic | Mary et al. (2011) | -No Record- |
| TOTALS | 13 genera | | | 53 species | | |

PLATE 1



5cm

a. *Dendronephthya* sp. 1



b. *Dendronephthya* sp. 4



c. *Dendronephthya* sp. 5



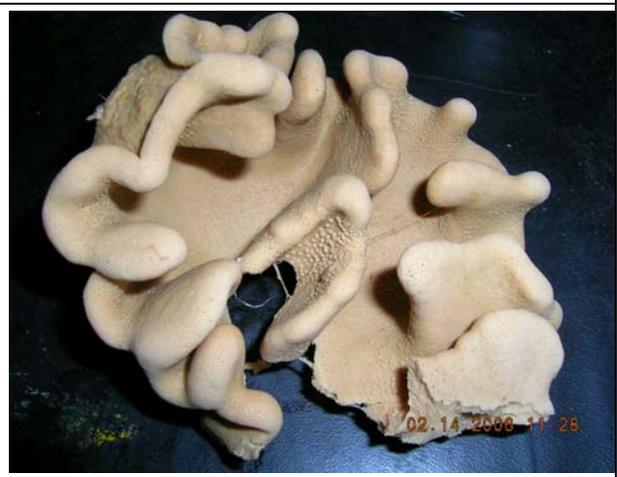
5cm

d. *Dendronephthya* sp. 6

PLATE 2



a. *Scleronephytha* sp.



b. *Lobophytum* sp. 2

c. *Lobophytum* sp. 4



d. *Lobophytum* sp. 8

e. *Lobophytum* sp. 12

PLATE 3



a. *Sinularia* sp. 2



b. *Sinularia* sp. 5



c. *Sinularia* sp. 9



d. *Sinularia* sp. 11



e. *Sinularia* sp. 12



f. *Sinularia* sp. 15

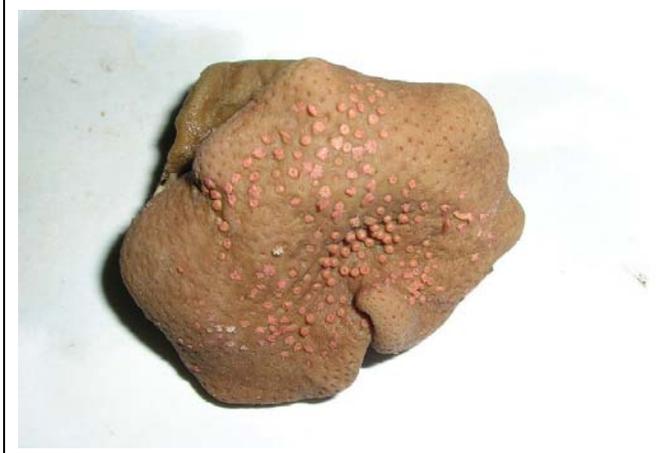
PLATE 4



a. *Sarcophyton* sp. 1



b. *Sarcophyton* sp. 2



c. *Sarcophyton* sp. 3



d. *Sarcophyton* sp. 4



e. *Sarcophyton* sp. 5



f. *Sarcophyton* sp. 6

PLATE 5



a. *Klyxum* sp. A



b. *Klyxum* sp. B



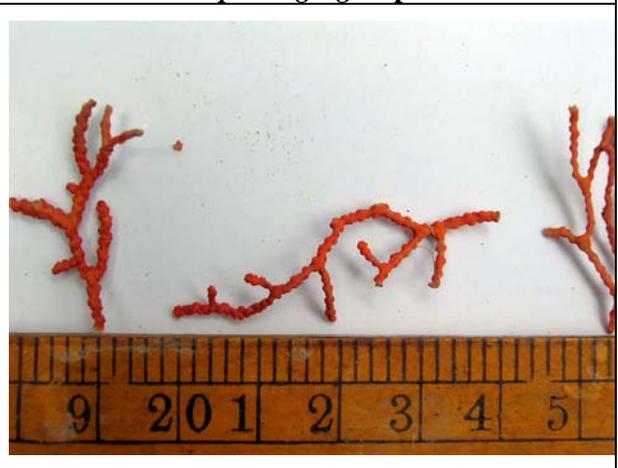
c. *Siphonogorgia* sp. A



d. *Siphonogorgia* sp. B



e. *Wrightella* sp. 1A



f. *Wrightella* sp. 1B

PLATE 6



a. *Wrightella* sp. 2



b. *Acabaria* variabilis



c. *Astrogorgia* sp. 1A



d. *Astrogorgia* sp. 1B



e. *Acanthogorgia* sp. 1



f. *Acanthogorgia* sp. 2

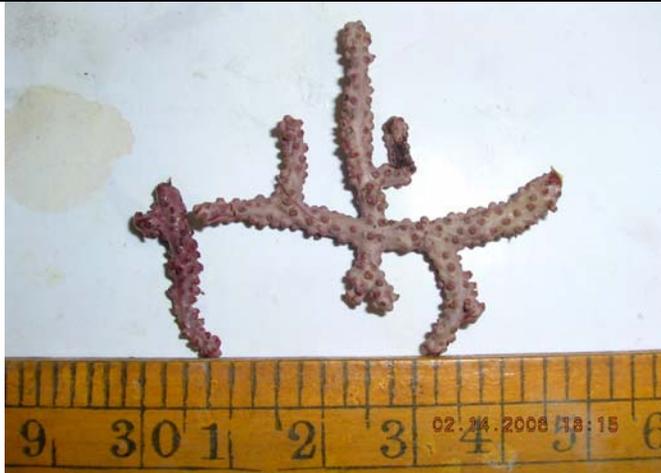
PLATE 7



a. *Echinogorgia* sp.



b. *Verrucella* sp. A



c. *Verrucella* sp. B

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