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Marine sponges as biological indicator of oligotrophic Andaman waters

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Surveys on marine sponges conducted vide SCUBA at South Andaman (North Bay, Chidiyatapu, Havelock and Neil Island) at three different depth zones (5, 10 and 15m) using randomly placed quadrants(1x1m^2). Marine sponge recorded in the surveys showed *Carteriospongia foliascens,* a phototrophic species, which mainly relies on the translocation of nutrients from their symbiotic cyanobacteria was observed in all depths and is well known as biological indicator of oligotrophic waters.

[**Key words:** Porifera, pollution, depth, phototrophic, Oligotrophy]

Introduction

The phylum Porifera (from latin *Porus*-pore and *fero*- to bear) includes the simplest and primitive metazoans[1]. They are pore bearing filter-feeding sessile invertebrates inhabits in both marine and freshwater environments. Of the approximately 9000 sponge species described till date, 99% were found to occur in marine environment and the rest inhabits in freshwater[2]. Andaman and Nicobar group of Islands is located about 1200 km away from the peninsular mainland in the Bay of Bengal (92°12' to 93°57' E and 6°45' to 13°41' N) in the Indian Ocean. Total reported sponge diversity of Andaman and Nicobar group of Islands is 114 species of which 109 are found in Andaman and 12 species were found in Nicobar Islands whereas Gulf of Mannar (318 species), Gulf of kutch (82 species) and Lakshadweep (45 species) are the other areas where marine sponges are documented[3]. Oligotrophic waters are areas with low nutrient levels with chlorophyll a (mg m^{-3}) range of 0.06 to 0.1, whereas mesotrophic is moderate (0.1-0.3) and eutrophic (0.3-1) and hypertrophic (>1) are nutrient over enriched waters[4]. Sponges are filter feeders which filters large quantities of water. This enables them to inhabit nutrient-poor environments like tropical reef habitats, where they are the dominant group of suspension feeders[5], hence, they can be used as a biological indicator of oligotrophy.

Materials and Methods

Sponge surveys were conducted in South Andaman (North Bay, Chidiyatapu, Havelock and Neil Island) at three different depth zones *viz.,* 0-5m (Shallow), 6-10m (Medium) and 11-15m (Deep). Along every depth contour, sponges were documented by randomly placed fifty quadrants (1×1 m^2) in the study sites, and distribution of the marine sponges was documented. Sponges were photographed *in situ* using Canon G11 underwater camera with housing. Sponges collected were preserved in ethanol within two hours of collection. The collected samples were then transferred to laboratory for identification using standard references[6, 7, 8.]

Results and Discussion

Sponges are strongly associated with the abiotic environment and are therefore very sensitive to environmental stress so it has been as a tool for environmental monitoring programs[9-10]. Presence of particular species in either pristine or environmentally perturbed habitats permits us to deduce their importance as biological indicators[11]. The distribution of sponges in four sites of South Andaman is shown in Table 1. *Carteriospongia foliascens*, *Oceanapia saggitaria* and *Neopetrosia exigua* were observed along all depths in quadrants (Plate 1).

Table 1—Presence/Absence of Marine sponges in sites of South Andaman

Sponge species	North Bay			Chidiyatapu			Havelock			Neil		
	Depth strata (m)											
	5	10	15	5	10	15	5	10	15	5	10	15
Lamellodysidea herbacea (Keller, 1889)	+	+	+	+	+	+	+	+	+			
Liosina paradoxa (Thiele, 1899)	+	+	+	+	+	+	+	+	+	+	+	+
Monanchora unguiculata (Dendy, 1922)							+	+	+	+	+	+
Oceanapia sagittaria (Sollas, 1902)	+	+	+	+	+	+	+	+	+	+	+	+
Neopetrosia exigua (Kirkpatrick, 1900)	+	+	+	+	+	+	+	+	+	+	+	+
Neopterosia carbonaria (Lamarck, 1814)	+	+	+	+	+	+		+	+			
Paratetilla bacca (Selenka, 1867)	+							+	+	+	+	+
Paschetrella sp.		+	+	+	+	+	+	+	+	+	+	+
Plakortis simplex (Schluze, 1880)		+	+	+	+	+	+	+	+			
Pseudoceratina purpurea (Carter, 1880)						+	+	+				
Rhabdastrella globostellata (Carter, 1883)	+	+	+				+	+				
Spheciospongia vagabunda (Ridley, 1884)										+	+	+
Spirastrella cunctatrix(Schmidt, 1868)				+	+	+	+	+	+			
Stylissa carteri (Dendy, 1889)	+	+	+	+	+	+		+	+			
Stylissa massa (Carter, 1887)	+	+	+			+	+	+	+	+	+	+
Tethya diploderma (Schmidt, 1870)				+								
Xestospongia testidunaria (Lamarck, 1815)		+	+					+	+		+	+
*Agelas axifera (*Hentschel, 1911)				+	+	+						
Aplysilla rosea (Barrois, 1876)	+	+	+	+	+	+						
Callyspongia (Euplacella) australis (Lendenfeld, 1887)										+	+	+
Carteriospongia foliascens (Pallas, 1766)	+	+	+	+	+	+	+	+	+	+	+	+
Clathria (Thalysias) cervicornis (Thiele, 1903)	+	+	+				+	+	+			
*Cliona ensifera (*Sollas, 1878)	+	+		+	+		+	+		+		
Cliona varians (Duchassaing&Michelotti, 1864)	+	+	+	+	+	+		+	+			
Coelocarteria singaporensis (Carter, 1883)	+	+	+							+	+	+
*Ecionemia acervus*Bowerbank, 1846						+	+	+	+			
Gelliodes fibulata (Carter, 1881)				+	+	+		+	+	+	+	+
Haliclona (Gellius) cymaeformis (Esper, 1794)				+	+	+						
Hyrtios erectus (Keller, 1889)	+	+	+	+	+		+	+	+	+	+	+
Iotrochota baculifera Ridley, 1884	+	+	+				+		+			
Ircinia strobilina (Lamarck, 1816)	+	+	+				+	+	+	+	+	+

Plate 1−A: *Neopetrosia exigua;* B: *Carteriospongia foliascens;* C: *Oceanapia sagittaria*

Marine sponge *C. foliascens,* is a phototrophic species, which mainly relies on the translocation of nutrients from their symbiotic cyanobacteria and is believed to be favoured in oligotrophic waters[11]. Their absence from many of the studied sites in Indonesia, West Java may be an indication of adverse environmental conditions.*C. foliascens* has been reported as a biological indicator of pollution free waters from Indonesian waters[12]. The wide distribution of phototrophic marine sponge, *C. foliascens* recorded through this study in Andaman waters lead us to state that *C. foliascens* could be deduced as a biological indicator for the oligotrophic waters of Andaman Islands and are bestowed with pollution free pristine environment. In addition, the presence of other sponges *O.sagittaria* and *N.exigua* could also possibly be biological indicator of pollution free waters.

Mycale micracanthoxea described in several localities in the Dutch delta[11] is a very common in harbour poles and pontoons[10] and thus described as indicator of port environment. *M.microsigmata* is considered as a control species due to their tolerance demonstrated in the polluted areas of Southeastern Brazil[13.] Another species of the genus, *M. crassissima* was observed in Andaman at Pongibalu, Havelock, Wilson, Nicholson, South Button, and Craggy Island[14], however its distribution is not close to any port or harbour. *Clathria venosa* reported to serve as a most reliable indicator of sites affected by urban pollution in Cuba[15.]

Corals are highly sensitive to environmental changes like sea surface temperature, which influence the survival of corals[16]. It must be interesting to know whether sponges also respond to such environmental stress or temperature change as most of the sponges also occupy shallow waters in Andaman and they rely on the photosynthetic activity of the associated algae for translocation of nutrients. As sponges host several several ecological functional roles[17], their distribution and abundance could be an important indicator of status of environment.

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