Occurrence of marine sponge *Chelonaplysilla delicata* Pulitzer-Finali & Pronzato, 1999 (Porifera: Demospongiae: Darwinellidae) from the Andaman Islands and the Indian Ocean with a baseline information of epifauna on a mesophotic shipwreck

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Abstract

During a biodiversity assessment on an upper mesophotic artificial reef of Andaman and Nicobar Islands (Shipwreck: HMIS Sophie Marie/HMIS SM), a single specimen of sponge *Chelonaplysilla delicata* was recorded. Our finding confirms the species taxonomy and highlights the current observation as a first report from the Andaman and Nicobar Islands and the Indian Ocean. The baseline diversity of epifaunal assemblage is further reported in this study.

Keywords: *Chelonaplysilla delicata*, Indian Ocean, Biodiversity, Porifera, Epifauna, Andaman and Nicobar Islands

Introduction

The Andaman and Nicobar Islands (ANI) (Figure 1) is an archipelago that lies in the eastern side of Bay of Bengal, bounded by the Andaman Sea on the west¹. These islands support a diverse

coral reef ecosystem that harbours a plethora of marine organisms². Most faunal groups that have been studied extensively in these waters are large-sized, conspicuous and are of economic importance³ however, areas in the mesophotic depths remain poorly explored. Further, the study of sponge distribution in the islands, though have existed since the early 19th century⁴⁻¹¹, recent works have revealed many undocumented and new species¹²⁻¹⁹ indicating its high diversity. Consisting of several shipwrecks both in the shallow and mesophotic zones. These sunken structures act as an artificial reef providing space for growth and establishment of various sessile marine communities creating a habitat intricacy²⁰⁻²². Being a dominant group in shipwreck driven ecosystem, poriferans are capable of colonizing in a relatively short period^{20, 23-27} along with which the substratum allows the growth of other invasive and non-native fauna²⁸. It is Interesting to note that these habitats remain less studied in the mesophotic zones (F. Sinniger pers comm) thus a baseline assessment remains necessary, however recent attempts to explore shallow wrecks in the area has revealed interesting results^{22, 29-32}.

Our findings document the presence of the marine sponge *Chelonaplysilla delicata* from the Andaman and Nicobar Islands and the Indian Ocean along with providing baseline information relating to the epifaunal assemblage on a mesophotic shipwreck.

Materials and Methods

The sponge *C.delicata* (Figure 2), collected from the shipwreck HMIS SM (Figure 2, 3) during a survey conducted for documenting epifaunal diversity from February to March 2014. The shipwreck is a 70m long Royal Indian navy minesweeper that sank in the year of 1942 (Figure 3). At a depth of ≈ 33 meters, the wreck lies at the edge of the Macpherson strait near Chidiyatapu (11°28'38.02"N 92°42'12.20"E), the southernmost tip of South Andaman Island (Fig. 1). Water transparency and temperature were recorded with Secchi disc and dive calculator. Within 2 hours after collection, the specimen was preserved in 100% ethanol. A surface peel of the easily separable cortex

of the specimen was removed and placed in xylene for 24 hours after which a permanent slide of the peel was mounted with DPX. A single fibre with its base and branches intact was removed from the sponge for species-level identification under a stereo microscope. (Figure 2B - D). The specimen was identified following Finali and Pronzato³³. The preserved specimen is deposited in the National Zoological Collections (NZC) of the Andaman and Nicobar Regional Centre (ANRC), Zoological Survey of India (ZSI), Port Blair. Study maps were created using QGIS.

Results

Taxonomy and Description

Phylum: Porifera

Class: Demospongiae

Subclass: Keratosa

Order: Dendroceratida

Family: Darwinellidae

Genus: *Chelonaplysilla*

Species: *C. delicata* Pulitzer-Finali & Pronzato, 1999

Materials Examined: 1 ex (Paratype), ZSI/ANRC – 14321, India: Andaman Island: South Andaman: Chidiyatapu (11°28'38.02"N 92°42'12.20"E). Coll. RRD, 2014

Description: *C. delicata* predominantly thickly encrusting (< 10 mm) but has erect lobes that are about 4 - 5 cm high. The sponge surface is conulose, and the acute conules separated from each other

by 2 - 5 mm. Oscules 1 - 3 mm in diameter, flush with the surface and unevenly distributed all over on sponge surface. The texture is soft collapsible and feeble. The fresh specimen was dark violet or purple in colour and retained its colour even in the preserved condition. Sponge surface covered by structured regular reticulation of sand and spicule detritus, which forms regular roundish or oval meshes of 90 - 155 μ m. This reticulation is typical of the genus. Regular rounded fibrous pores, inhalant in nature are enclosed within these rounded meshes (Figure 2D). The skeleton is dendritic, made up of pigmented fibres fragile in nature with repeated branching that originate from a basal spongin plate (Fig. 4B and 4C) and extends towards the boundary. The primary fibre measured to be around 0.4 mm at its thickest. Spicules are absent.

Distribution: India: ANI (South Andman, Present study). Elsewhere: Bismark Sea (Papua New Guinea)³³, Indonesia (Sulawesi)³⁴, Palau³⁵, French Polynesia³⁶.

Similar Species: *C.delicata* is very similar to *C.erecta*³⁷; however, the latter has fibres anastomosing in nature whereas the thickness of fibres in *C.delicata* fades in diameter. Our specimen was initially identified as *C.erecta*³⁰.

Remarks: The specimen mentioned in Finali and Pronzato³³ is gray whereas our specimen in dark maroon in live condition.

Comments: The family Darwinellidae possesses sponging fibres with proper skeleton and fibrous spicules^{38,39}. It consists of four recognized genus and forty-seven accepted species (one under “nomen nudum” status). *Chelonaplysilla* is the only genus, which is devoid of spicules but consists of a fibrous dendritic skeleton that possesses distinct laminated bark surrounding a central pith region. A structured and separable cortex that is reinforced by a delicate reticulation of sand grains³⁸ distinguishes this genus.

Wreck Biodiversity: The surface of the wreck surveyed consisted of various sessile communities³², revised identification of which revealed the presence of encrusting Sponges, Tunicates, Bryozoans, and Hydroids. Ahermatypic corals of family Dendrophylliidae (*Tubastrea*) were common and easily visible (Figure 3). Solitary corals (*Heterocyathus*) were scattered in few vertical areas. Reef-building corals were relatively less in abundance. The observed corals include *Favia*, *Symphyllia*, *Podabacia crustacea*, and *Leptoseris*. A Gastropod (*Chicoreus* sp.) and few Crinoids were also present. Poriferan families which were identified during the survey include Irciniidae (*Ircinia*), Chalinidae (*Haliclona* (*Reniera*)); Thorectidae (*Hyrtios*), Iotrochotidae (*Iotrochota baculifera*), Thorectidae (*Dactylospongia*). Tunicates comprised of Didemnidae (*Didemnum*), Perophoridae (*Perophora*) and other unidentified sp. Macroalgae were absent however areas covered with a mix of turf algae and encrusting crustose algae (ECA). The mean temperature in the area was 26.5° C.

Discussion

The Faunal organisms that thrives in Artificial Reefs (Shipwrecks) is an important part of the marine community^{27,40}. With increasing anthropogenic impacts on natural coral reef habitats, artificial reefs are regarded as a successful alternative²⁵. As a result, it becomes important to understand the biological communities growing on these habitats²⁶. Since a stable structural feature can lead a centennial shipwreck to mimic a natural coral reef ecosystem^{39,40}, the necessity to investigate pre-existing shipwrecks in a mesophotic zone can provide insights on these complex ecosystems. The faunal assemblages in shipwrecks vary with horizontal and vertical orientation³⁹. Such assemblages enhance food resources for fishes, increasing its abundance thus improving diversity²⁰. Sponges which naturally occupy shipwrecks are one of the dominant organisms in such habitat, as evidenced by many studies^{20,21,26,27,41,42}. Their presence in large numbers also signifies advance stages of community succession^{20,43}. Sponges are known to play an important role in ecological recycling, habitat formation

for other organisms, acting as functional connectors between the benthic community and ocean productivity and are also known to replace corals^{44,45}.

Environmental parameters like depth and light penetration play an important role in the distribution and presence of communities in a shipwreck^{20,39}. Lower light intensity in the study area can contribute towards the abundance of poriferans and ahermatypic corals (*Tubastrea* sp.) (Figure 1), by limiting macroalgal growth^{32,40}. Yogesh-Kumar et al.³¹ reported high sponge cover when studying other wrecks in the region; however, the live coral coverage remains contrasting, indicating the role of regional stressors and geolocation. Sponges that inhabit mesophotic areas mainly rely on plankton feeding rather than photosymbionts and have higher growth rates due to the limited light intensity^{46,47}. In the Caribbean's, sponge density seems to be directly proportional to depth⁴⁵. Moreover, the difference in current velocities affects the growth and development of filter feeders like sponges present in the shipwrecks⁴⁰. Higher current velocities through the Macpherson strait (Figure 1) can effectively determine the faunal assemblage of HMIS SM but a long-term monitoring is necessary in this regard.

The occurrence of a sponge from the deepest (Upper mesophotic region) and oldest wreck (WWII) studied in the area sheds light on the vast and rich biodiversity that thrives on such habitats and awaits much-needed attention from the scientific community. Technical gaps have always been a hurdle to study mesophotic ecosystems but with the advancement of time, technologies like automated underwater vehicle (AUV), remotely operated underwater vehicle (ROV), submersible's etc. can be well utilized for the exploration of shipwrecks in such depths. It should be noted that the recent use of ROV in ANI (see. Ramesh et al.⁴⁸) and the documentation of Mesophotic reefs off Puducherry coast⁴⁹ is an important step that will further lead towards the exploration of deeper ecosystems in the region. Further, as only certain areas of the wreck were assessed, long-term repeated sampling, taking

150 structural heterogeneity, hydrodynamics, and other environmental parameters into account will possibly
151 give a detailed picture of the faunal assemblages.

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Figure 1. Location of the study area (HMIS SM). (A) ANI, (B) South Andaman

Figure 2. *Chelonaplysilla delicata* [ZSI/ANRC-14321]: (A) Freshly collected specimen, (B) Branching fibres and basal sponging plate, (C) Closer view of pigmented, branching, dendritic spongin fibre, (D) Inhalant pores surrounded by rounded meshes reinforced by sand grains . Scale (A) 5mm (B) 2 mm, (C) 2 mm, (D) 155 μ m.

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289 **Figure 3.** A part of the wreck HMIS SM. (Arrow: high abundance of invasive *Tubastrea* cf.
290 *micranthus*)

Figure 4. Global distribution of *C. delicata* Pulitzer-Finali & Pronzato, 1999

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Table 1. Shipwrecks assessed in ANI

Wreck Name	Co-ordinates	Location	Date of Sinking	Depth (m)	Current Activities	Reference
SS Inchkeith	12°00'23.69"N 92°46'08.34"E	Kyd Island (South Andaman)	1955	14	Diving*	28,29,31
HMIS Sophie Marie	11°28'38.02"N 92°42'12.20"E	Chidiyatapu (South Andaman)	1942	30 - 33	Diving*	29,31, Current Study
MV Mars	11°55'54.98"N 92°57'24.12"E	Havelock (Ritchie's Archipelago)	2006	10 - 16	Diving*	31
North Bay Wreck	11°43'00.56"N 92°45'60.60"E	Port Blair (South Andaman)	30 – 40 (yrs)	10	Diving* and Fishing	22,30
Peel Wreck	12°03'84.20"N 92°57'81.10"E	Havelock (Ritchie's Archipelago)	8 - 10	9 - 12.	Diving*	22,30

Japan Wreck	09°10'88.30"N 92°50'12.30"E	Car Nicobar (Nicobar Islands)	40 - 50	28	Fishing ground	22,30
Sinclair Bay	11°39'873"N	Near Ross Island (South Andaman)	-	8		22
Shipwreck	92°45'488"E					

296 *Recreational/Water Tourism

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