

**Occurrence of marine sponge *Chelonaplysilla delicata* Pulitzer-Finali & Pronzato, 1999 (Porifera: Demospongiae: Darwinellidae) from the Andaman Islands and the Indian Ocean: An indication of unexplored sessile habitat on mesophotic shipwrecks**

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# **Occurrence of marine sponge *Chelonaplysilla delicata* Pulitzer-Finali & Pronzato, 1999 (Porifera: Demospongiae: Darwinellidae) from the Andaman Islands and the Indian Ocean: An indication of unexplored sessile habitat on mesophotic shipwrecks**

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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. Further indicating the significance of old sunken structures surrounding the islands.

**Keywords:** *Chelonaplysilla delicata*, Indian Ocean, Biodiversity, Porifera, 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 west<sup>1</sup>. These islands support a diverse

coral reef ecosystem that harbours a plethora of marine organisms<sup>2</sup>. Most faunal groups that have been studied extensively in these waters are large-sized, conspicuous and are of economic importance<sup>3</sup> however, areas in the mesophotic depths remain poorly explored. The study of sponge distribution in the islands, though have existed since the early 19<sup>th</sup> century<sup>4-11</sup>, numerous recent works have revealed many undocumented and new species<sup>12-19</sup> indicating its high diversity.

The coastal and offshore waters of ANI consist of a number of 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 intricacy<sup>20-22</sup>. Being a dominant group in shipwreck driven ecosystem, poriferans are capable of colonizing in a relatively short period<sup>20, 23-27</sup>. Although globally numerous studies have been conducted on these environments, shipwrecks remain less studied in the mesophotic zones (F. Sinniger pers comm). However, recent attempts to explore shallow wrecks has revealed interesting results<sup>22, 28-31</sup>.

Our findings document the presence of the marine sponge *Chelonaplysilla delicata* from the Andaman and Nicobar Islands and the Indian Ocean and highlights the need to explore the rich unexplored fauna of mesophotic shipwrecks.

## 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  $\approx 33$  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 Pronzato<sup>32</sup>. 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 µm. 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)<sup>32</sup>, Indonesia (Sulawesi)<sup>33</sup>, Palau<sup>34</sup>, French Polynesia<sup>35</sup>.

Similar Species: *C.delicata* is very similar to *C.erecta*<sup>36</sup>; 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*<sup>29</sup>.

Remarks: The specimen mentioned in Finali and Pronzato<sup>32</sup> is gray whereas our specimen in dark maroon in live condition.

Comments: The family Darwinellidae possesses sponging fibres with proper skeleton and fibrous spicules<sup>37,38</sup>. 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

103 structured and separable cortex that is reinforced by a delicate reticulation of sand grains<sup>38</sup>  
104 distinguishes this genus.

105 Wreck Biodiversity: The surface of the wreck surveyed consisted of various sessile  
106 communities<sup>31</sup>, revised identification of which revealed the presence of encrusting Sponges, Tunicates,  
107 Bryozoans, and Hydroids. Ahermatypic corals of family Dendrophylliidae (*Tubastrea*) were common  
108 and easily visible (Figure 3). Solitary corals (*Heterocyathus*) were scattered in few vertical areas. Reef-  
109 building corals were relatively less in abundance. The observed corals include *Favia*, *Symphyllia*,  
110 *Podabacia crustacea*, and *Leptoseris*. A Gastropod (*Chicoreus* sp.) and few Crinoids were also present.  
111 Poriferan families which were identified during the survey include Irciniidae (*Ircinia*), Chalinidae  
112 (*Haliclona* (*Reniera*)); Thorectidae (*Hyrtios*), Iotrochotidae (*Iotrochota baculifera*), Thorectidae  
113 (*Dactylospongia*). Tunicates comprised of Didemnidae (*Didemnum*), Perophoridae (*Perophora*) and  
114 other unidentified sp. Macroalgae were absent however areas covered with a mix of turf algae and  
115 encrusting crustose algae (ECA). The mean temperature in the area was 26.5° C.

## 116 Discussion

117 The Faunal organisms that thrives in Artificial Reefs (Shipwrecks) is an important part of the  
118 marine community<sup>27,39</sup>. With increasing anthropogenic impacts on natural coral reef habitats, artificial  
119 reefs are regarded as a successful alternative<sup>25</sup>. As a result, it becomes important to understand the  
120 biological communities growing on these habitats<sup>26</sup>. Since a stable structural feature can lead a  
121 centennial shipwreck to mimic a natural coral reef ecosystem<sup>39,40</sup>, the necessity to investigate pre-  
122 existing shipwrecks in a mesophotic zone can provide insights on these complex ecosystems. The  
123 faunal assemblages in shipwrecks vary with horizontal and vertical orientation<sup>39</sup>. Such assemblages  
124 enhance food resources for fishes, increasing its abundance thus improving diversity<sup>20</sup>. Sponges which  
125 naturally occupy shipwrecks are one of the dominant organisms in such habitat, as evidenced by many

126 studies<sup>20,21,26,27,41,42</sup>. Their presence in large numbers also signifies advance stages of community  
 127 succession<sup>20,43</sup>. Sponges are known to play an important role in ecological recycling, habitat formation  
 128 for other organisms, acting as functional connectors between the benthic community and ocean  
 129 productivity and are also known to replace corals<sup>44,45</sup>.

130 Environmental parameters like depth and light penetration play an important role in the  
 131 distribution and presence of communities in a shipwreck<sup>20,39</sup>. Lower light intensity in the study area can  
 132 contribute towards the abundance of poriferans and ahermatypic corals (*Tubastrea* sp.) (Figure 1), by  
 133 limiting macroalgal growth<sup>31,39</sup>. Yogesh-Kumar et al.<sup>30</sup> reported high sponge cover when studying  
 134 other wrecks in the region; however, the live coral coverage remains contrasting, indicating the role of  
 135 regional stressors and geolocation. Sponges that inhabit mesophotic areas mainly rely on plankton  
 136 feeding rather than photosymbionts and have higher growth rates due to the limited light intensity<sup>45,46</sup>.  
 137 In the Caribbean's, sponge density seems to be directly proportional to depth<sup>44</sup>. Moreover, the  
 138 difference in current velocities affects the growth and development of filter feeders like sponges  
 139 present in the shipwrecks<sup>39</sup>. Higher current velocities through the Macpherson strait (Figure 1) can  
 140 effectively determine the faunal assemblage of HMIS SM but a long-term monitoring is necessary in  
 141 this regard.

142 The occurrence of a sponge from the deepest (Upper mesophotic region) and oldest wreck  
 143 (WWII) studied in the area sheds light on the vast and rich biodiversity that thrives on such habitats  
 144 and awaits much-needed attention from the scientific community. Technical gaps have always been a  
 145 hurdle to study mesophotic ecosystems but with the advancement of time, technologies like automated  
 146 underwater vehicle (AUV), remotely operated underwater vehicle (ROV), submersible's etc. can be  
 147 well utilized for the exploration of shipwrecks in such depths. It should be noted that the recent use of  
 148 ROV in ANI (see. Ramesh et al.<sup>47</sup>) and the documentation of Mesophotic reefs off Puducherry coast<sup>48</sup>

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

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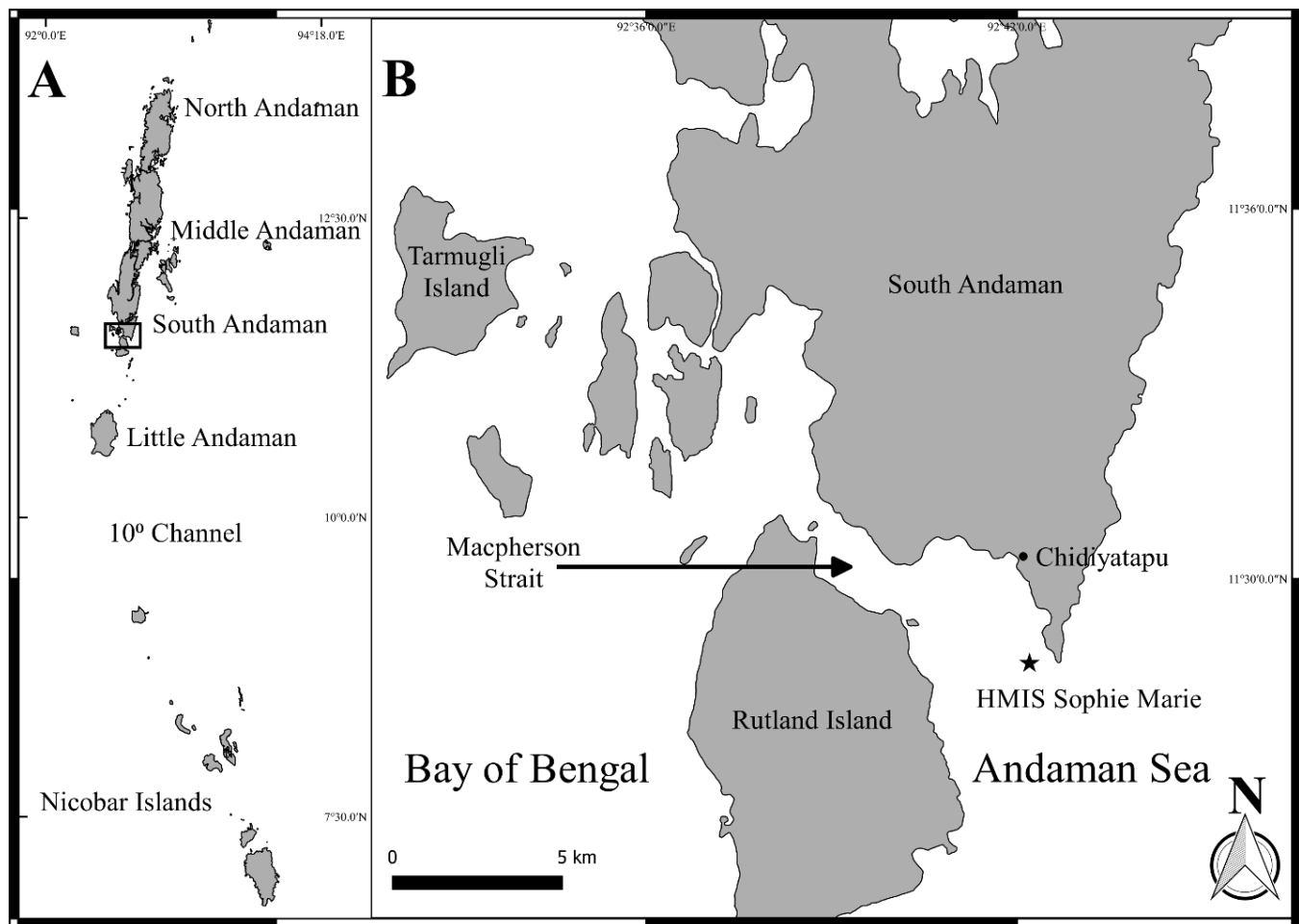
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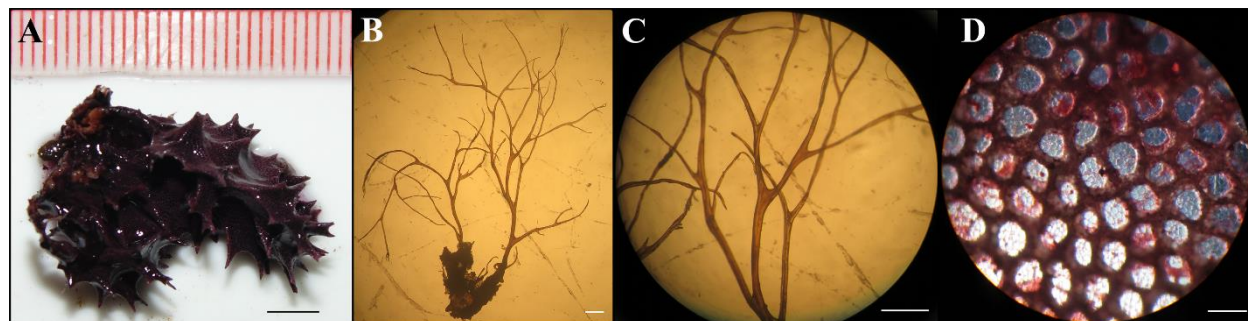
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**Figure 1.** Location of the study area (HMIS SM). (A) ANI, (B) South Andaman



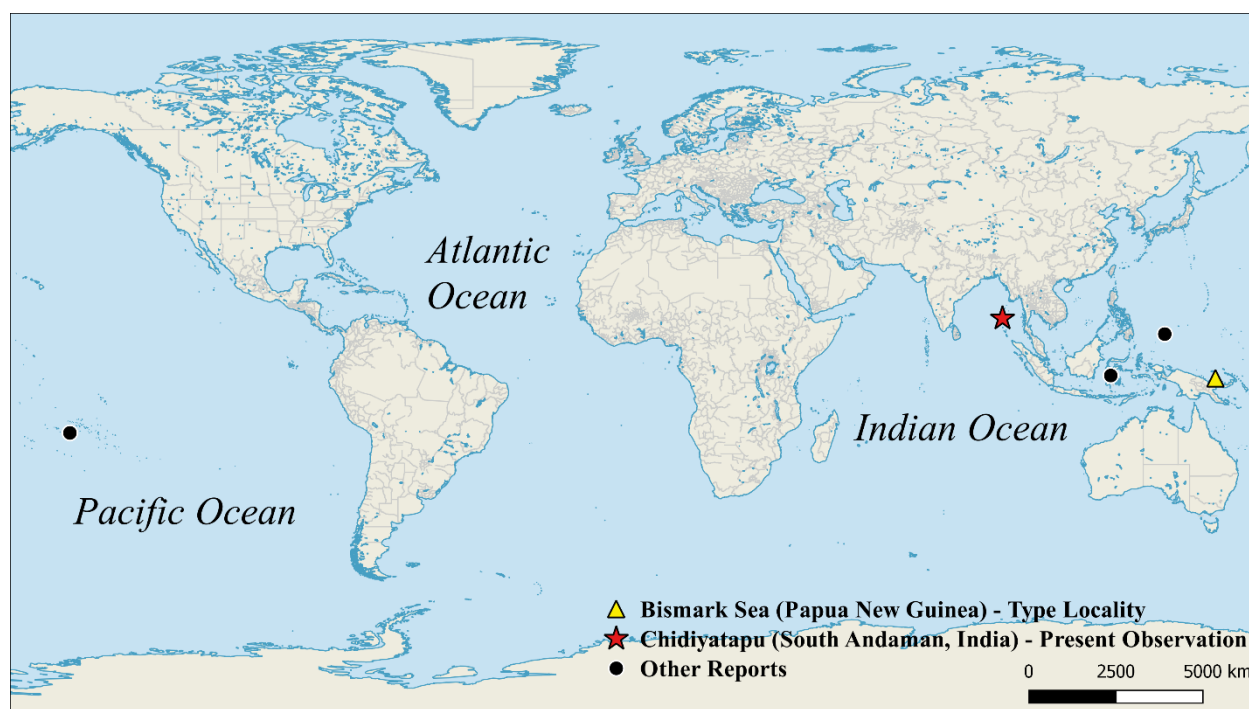
**Figure 2.** *Chelonaplysilla delicata* [ZSI/ANRC-14321]: (A) Freshly collected specimen, (B) Branching fibres and basal sponging plate, (C) Closer view of pigmented, branching, dendritic spongin fibre, (D) Inhalant pores surrounded by rounded meshes reinforced by sand grains . Scale (A) 5mm (B) 2 mm,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



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





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



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<br>92°46'08.34"E               | Kyd Island (South Andaman)         | 1955            | 14             | Diving*             | 28,29,31                       |
| <b>HMIS Sophie Marie</b> | <b>11°28'38.02"N</b><br><b>92°42'12.20"E</b> | <b>Chidiyatapu (South Andaman)</b> | <b>1942</b>     | <b>30 - 33</b> | <b>Diving*</b>      | 29,31,<br><b>Current Study</b> |
| MV Mars                  | 11°55'54.98"N<br>92°57'24.12"E               | Havelock (Ritchie's Archipelago)   | 2006            | 10 - 16        | Diving*             | 31                             |
| North Bay Wreck          | 11°43'00.56"N<br>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<br>92°57'81.10"E               | Havelock (Ritchie's Archipelago)   | 8 - 10          | 9 - 12.        | Diving*             | 22,30                          |

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

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291 \*Recreational/Water Tourism

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