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Cover: A digital art of water birds of Noyyal River and its wetlands in Coimbatore District by Megha A. Kashyap.

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COMMUNICATION

Bits and fragments: documenting an unreported coral genus *Heterocyathus* Milne Edwards & Haime, 1848 from northwestern Bay of Bengal (Odisha coast) and a call for further assessment

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Abstract: The collection of a dead specimen of the coral *Heterocyathus* cf. *sulcatus* on a sandy beach in southern Odisha highlights the importance of exploring offshore waters along this coast. The specimen was identified based on prominent taxonomic characters and association with coral boring worm. This genus was previously known to occur along the eastern coast of India, from the Gulf of Mannar/ Palk Bay and off the Chennai coast. The presence of rocky offshore outcrops and a sandy substratum in the vicinity suggests that the specimen likely originated from that location.

Keywords: Caryophillidae, coral reefs, habitat, new record, rocky offshore, sandy beach, taxonomic characters.

Abbreviations: EBRC—The Estuarine Biology Regional Centre | ZSI—Zoological Survey of India.

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Author contributions: DPB: Writing, reviewing and editing, Specimen collection, Validation, Conceptualization; RRD: Writing original draft, reviewing and editing; Conceptualization, Validation.

Competing interests: The authors declare no competing interests.

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INTRODUCTION

The family Caryophylliidae Dana, 1846 under which *Heterocyathus* originates has the highest diversity of species (>300) worldwide (Cairns 1999a,b; Reyes 2009). This azooxanthellate/apozooxanthellate genus is free-living, preferring a sandy substratum (Hoeksema & Best 1991; DeVantier et al. 2006) and occurs near offshore patchy reefs as seen in Sulawesi (Hoeksema 1990; Hoeksema & Best 1991). Found at a depth ranging from 0 to around 320 m (FAO 2011), it has also been reported beyond 500 m (Cairns 1999b). The genus consists of seven valid species: *H. aequicostatus* Milne Edwards & Haime, 1848; *H. alternatus* Verrill, 1865; *H. antoniae* Reyes, Santodomingo & Cairns, 2009; *H. hemisphaericus* Gray, 1849; *H. japonicus* Verill, 1866; *H. monileseptatum* Filander & Kitahara, 2021; and *H. sulcatus* Verrill, 1866. *H. sulcatus*, *H. aequicostatus*, and *H. alternatus* have been reported from Indian waters (Alcock 1893; CMFRI 1970; Pillai 1983; Venkataraman 2007). Unique characters for species level distinction include the arrangement and lateral projection of septa, and coloration patterns (Reyes et al. 2009). The genus can be seen associated with the polychaete worm *Aspidosiphon muelleri* Diesing, 1851 (Hoeksema & Best 1991; Stolarski et al. 2001). It is important to note that all the three species reported from Indian waters are under the 'Least Concern' category of the IUCN Red List of Threatened Species (2018).

In this paper our main objectives are to: (1) report the observation of an unreported coral genus (*Heterocyathus*) from the northwestern coast of Bay of Bengal (Odisha) and (2) emphasize the need to explore the offshore waters of the coast.

MATERIAL AND METHODS

The Gopalpur coast (Figure 1), the point of origin for this specimen is located within the southern part of Odisha State. It is known for its tourism and fishing activities involving trawlers and small fishing boats

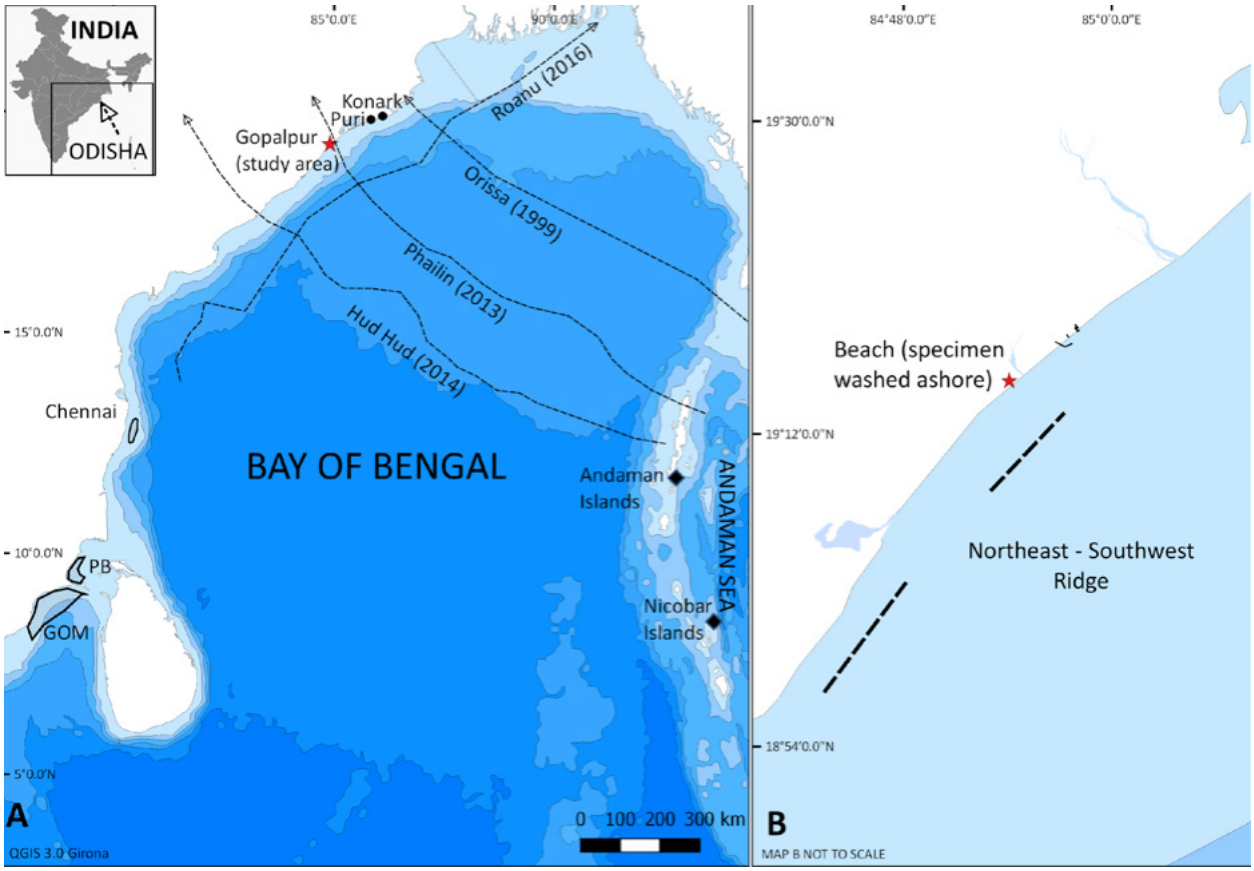

Figure 1. Study map: A—Various cyclones affecting the area of observation, triangular dots and polygons are previously reported areas and circular dots indicating locality having possible patchy reefs offshore. PB: Palk Bay; GOM: Gulf of Mannar | B —The NE-SW ridge, known to harbour various corals and other associated organisms. [Cyclone track obtained from NASA, RAMMB and JAXA, Base map source: Free vector and raster map data @ naturalearthdata.com.]

(Mahapatro et al. 2015; Behera et al. 2017a,b). The area comprises of various creeks, rivers, and the Chilika lagoon in its vicinity. Off the coast lies a submerged ridge which runs parallel to the Gopalpur coast extending further till Andhra Pradesh (see Bapuji et al. 1999; Rao et al. 2001). The area is also highly exposed to tropical cyclones that originate from the Bay of Bengal and the Andaman Sea (Figure 1).

During a regular field visit, a single dead specimen of the non-reef building Indo-pacific scleractinian genus *Heterocyathus* was observed on the sandy beach. The specimen was documented for further taxonomic identification. The specimen was identified based on its morphological characters following Stolarski et al. (2001), Reyes et al. (2009), and Cairns & Kitahara (2012). Morphological measurements were taken in the field with a digital Vernier caliper and were later reassessed with ImageJ v1.51. Study map was created using QGis 3.0. The stacked bar chart was created using R programming software version 4.0.5 (2021-03-31), using the packages "ggplot2" and "tidyverse" (Wickham 2016; Wickham et al. 2019).

RESULTS AND DISCUSSION

Systematics

Phylum Cnidaria Verrill, 1865
Class Anthozoa Ehrenberg, 1834
Order Scleractinia Bourne, 1900
Family Caryophylliidae Dana, 1846
Genus *Heterocyathus* Milne Edwards & Haime, 1848
Heterocyathus cf. *sulcatus*
(Image 1)

Material Examined: One dead specimen washed ashore observed on 25 February 2016, Gopalpur coast (19.2506N, 85.9013E), southern Odisha, obs. by: Durga Prasad Behera. Deposited at EBRC/ZSI/Cn – 11146.

Description: Corallum solitary, unattached, globular with commensal sipunculid derived pores (polyporous type of corallum modification), theca non-porous, imperforate. Calicular Diameter 7.21 mm, height 5.81 mm with a base diameter of 7.43 x 6.93 mm. Dark brownish to blackish colour prominent in the central region of calices. Four sipunculid derived basal holes present: two in the center and one each on the left and right respectively. The right most hole is the main orifice (diameter 0.99 mm) (Image 1C). A thin and smooth layer observed on the interior surface of the main orifice. Three additional holes are in the intercostal furrows of the theca (Image 1B). The base consists of uneven granules resulting in an uneven texture. Coastae prominent, extends till the base with height significantly reduced. Accurate description of lateral septal projection not possible as the specimen is worn out.

Remarks: The genus *Heterocyathus* has close similarity with genus *Heteropsammia* Milne Edwards & Haime, 1848; however, the latter bears a perforated theca with prominent coastae absent**.** Our specimen is believed to be *H. sulcatus* (Verrill 1866) due to the similar colouration pattern in the central portion of the calices. The height of our specimen also closely correlates with the original description of *H. sulcatus* which was initially described as *Stephanoseris sulcata* Verrill, 1866 from Sri Lanka (see. Verill 1866).

Distribution: Indian waters – The genus is reported from Andaman & Nicobar Islands (Alcock 1893; Pillai 1983; GBIF 2023); off Chennai coast (Tamil Nadu) (Venkataraman 2007), Gulf of Mannar and Palk Bay (CMFRI 1970; Pillai 1983), and off the coast of Mumbai (Maharashtra), Gujarat, and Kerala (GBIF 2023). Elsewhere – Pacific and Indian Ocean (Vanuatu and Wallis & Futuna, Tuscarora bank, Waterwitch bank, Tanna, Erromango, Efate, southeastern Espiritu Santo, northeastern Espiritu Santo, Anatom) (Cairns 1999b), Great Barrier Reef (Devantier et al. 2006), Japan (Until Northern Honshu), Taiwan (Yabe & Eguchi 1932; Zibrowius 1998), Indonesia (Hoeksema & Best 1991), South China Sea (Renlin & Xilian 1983), Gulf of Thailand (Hoeksema & Matthews 2015), Sri Lanka (MOE 2012), Pakistan (Moazzam & Moazzam 2016), Persian Gulf (Maghsoudlou 2010), Seychelles, Coast of Africa (GBIF 2023), Gulf of California, western coast of Mexico (Zibrowius 1998; Reyes-Bonilla & Cruz-Piñón 2000), and northeastern Caribbean coast (Reyes 2009).

A review of the literature indicates that there are few published papers which have tried to explore the coral reef or its associated faunal diversity off the coast of Odisha (Bapuji et al. 1999; Rao et al. 2001; Jayaprakash & Radhakrishnan 2014), it has not been highlighted in most of the coral reef literature present due to this limited knowledge (e.g., Pillai 1996; Muley et al. 2000; Rajasuriya et al. 2000; Venkataraman & Wafar 2005; Tamelander & Rajasuriya et al. 2008). Recent observation of coral reef indicating fishes and coral fragments off Konark coast (Figure 1b) and the report of the presence of *Gorgonia ventalina* Linnaeus, 1758 (a protected species) off Puri coast (Figure 1b) (Odishatv 2016; De et al. 2017) have created much interest among the coral reef researchers in the country. This indicates that coastal waters of southern Odisha might not be the only place with the presence of a patchy reef. Therefore,

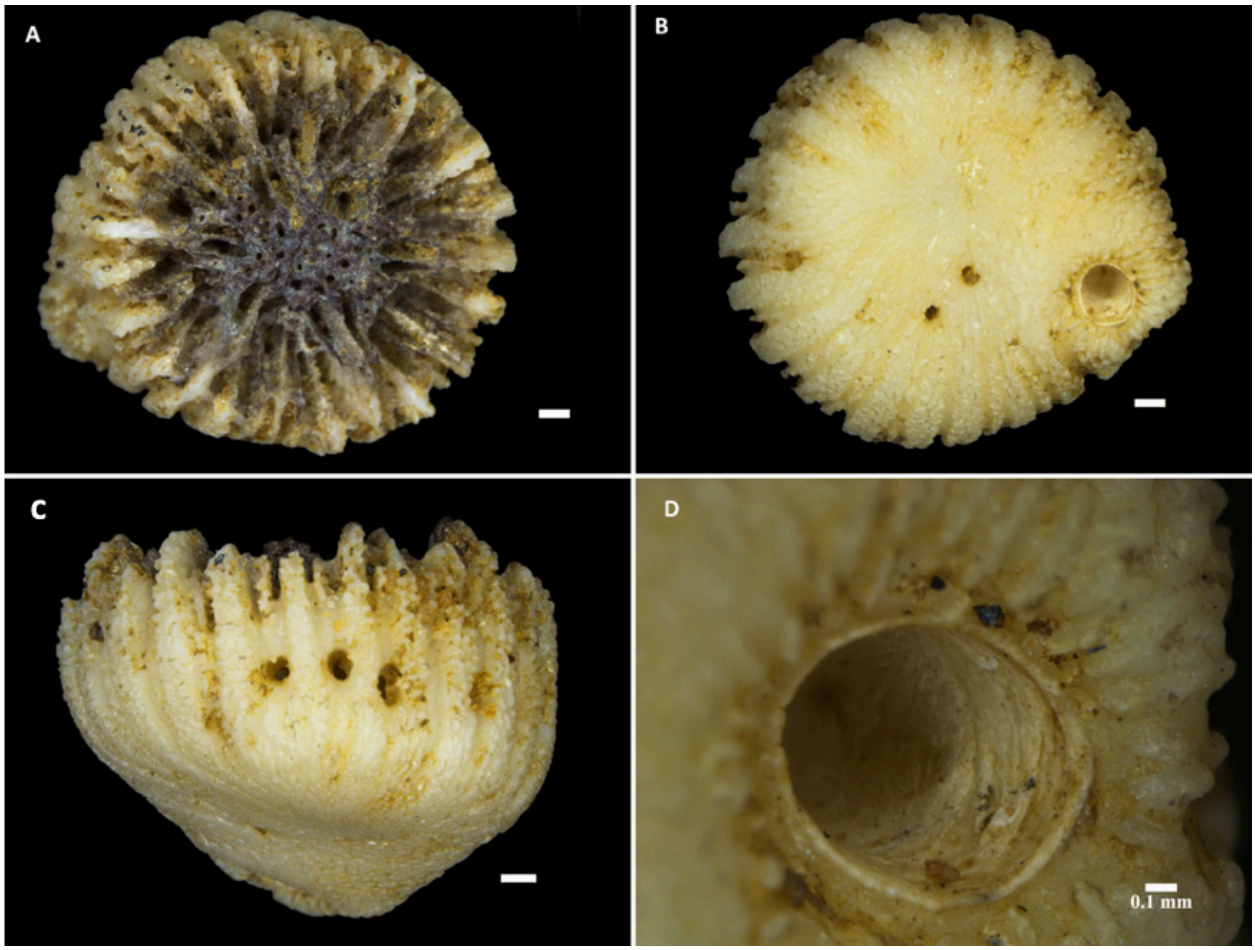

Image 1. *Heterocyathus* cf. *sulcatus*: A—Calicular view: center of calices dark in colour | B—Basal view | C—Lateral view: additional sipunculid holes in the intercoastal furrows | D—Zoomed in basal view: porous holes associated with sipunculid and main orifice. ©Rocktim Ramen Das.

more focus on the lack of survey efforts to explore the ecology of the submerged ridge should be stressed upon.

Our observation lies perpendicular to the rocky outcrop, which is divided into two segments. The rocky outcrop with a length of approximately 14 km extends from Gopalpur to further south with an elevation of 3–5 km spread across 150–250 m (Bapuji et al. 1999; Rao et al. 2001). The faunal diversity of both the segments has been highlighted in Figure 2. Though regarded as a preliminary observation by the authors, follow-up studies do not exist. Recent reports indicate the presence of reefs off Konark and Puri (~100+ km) is also limited to non-scientific reports. Recently, Behera et al. (2017a), mentioned these rocky outcrops and their fauna based on previous literature, but the author's finding was more related to fish rather than corals. Based on our knowledge on the region, we can hypothesize that the north-west–south-east ridge and the sandy substratum in its vicinity can act as a good habitat for solitary coral species and might contain more undocumented aggregation of free-living corals which can in fact be the original source of our present observation. The vulnerability of the coast to frequent cyclones could also be the cause of the specimen being washed ashore as observed in other Indian reefs affected by cyclones (Krishnan et al. 2012).

CONCLUSION

Till recently, the ahermatypic/apozooxanthellate corals have received less attention in this part of the world (Venkataraman et al. 2003; Venkataraman & Wafar 2005) but various recent reports indicate the possibility of undocumented species (see. Venkataraman 2007; Raghuraman & Raghunathan 2015; Tenjing et al. 2019). Our observation indicates that we know very little about the offshore waters of Odisha and builds further evidence that many corals, reef-associated sedentary or mobile species remain undocumented in the region.

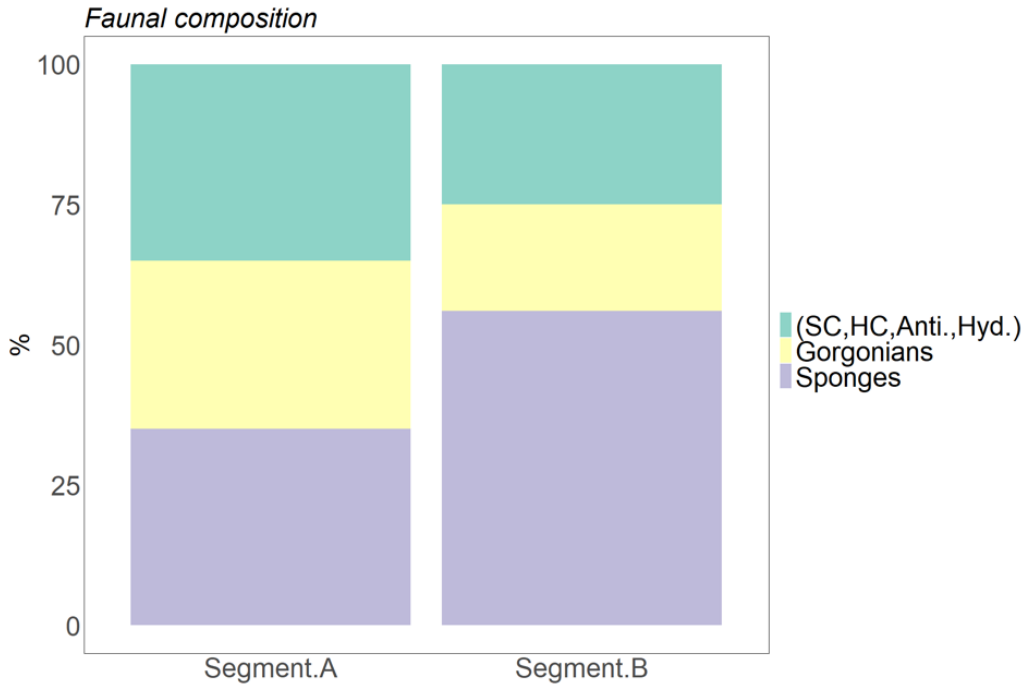

Figure 2. Faunal composition as reported from the rocky outcrops off the coast of Gopalpur (Odisha/ NW Bay of Bengal). SC—Soft Coral | HC—Hard Coral | Anti.—Antipatharian | Hyd.—Hydroids. Data obtained from Rao et al. (2001).

Reporting a genus or a species significantly improves our knowledge regarding its distribution and range. Still, our observation will remain a mere testimony if its habitat and surrounding ecosystem is not studied further. Thus, we communicate our findings to stimulate interest and motivate future scientific endeavors.

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