Marine Biodiversity Records, page 1 of 3. © Marine Biological Association of the United Kingdom, 2015
doi:10.1017/S1755267214001481; Vol. 8; e19; 2015 Published online

First record of Nanozoanthidae from the Red Sea

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Here we report on the first finding of Nanozoanthidae (Anthozoa: Hexacorallia: Zoantharia) in the Red Sea and the first record west of Western Australia. A single specimen of Nanozoanthus *sp. was found at a depth of 13 m off Dumsuq Island, the Farasan Islands, Saudi Arabia (16°33.846′N 42°03.510′E) during SCUBA surveys. Previous research had hypothesized that the genus could potentially be widespread in the Indo-Pacific and was simply undetected due to its small and cryptic nature, and the current specimen provides support for this idea. Such findings demonstrate the importance of biodiversity surveys by taxonomic specialists in understudied marine regions.*

Keywords: Zoantharia, zooxanthellae, *Nanozoanthus*, Saudi Arabia, Farasan Islands

Submitted 12 November 2014; accepted 20 December 2014

INTRODUCTION

Many Zoantharia (Anthozoa: Hexacorallia) are zooxanthellate and such species are distributed in tropical and sub-tropical waters of the world. Most well-known species belong to the genera *Palythoa* (family Sphenopidae) and *Zoanthus* (family Zoanthidae) in suborder Brachycnemina, not only owing to their wide distribution and commonness on coral reefs, including intertidal and shallow waters, but also due to their often vivid and varied oral disk coloration (Burnett *et al.*, 1997). However, many other zoantharian species are zooxanthellate, including some Caribbean *Parazoanthus* spp. (Swain & Wulff, 2007), *Isozoanthus sulcatus* from European waters (Williams, 2000) in suborder Macrocnemina and species of the brachycnemic genera *Acrozoanthus*, *Isaurus* and *Neozoanthus*.

The newest described zooxanthellate genus is the monospecific *Nanozoanthus* in the family Nanozoanthidae, described from specimens from Okinawa in the north-west Pacific and from Western Australia (Fujii & Reimer, 2013). Based on DNA phylogeny, Nanozoanthidae is clearly divergent from all other known Zoantharia, distinguishable in the field from other zooxanthellate species by its very small polyps (<2 mm diameter) and is found in pockets of sand on coral reefs. The recent discovery and description of this and other zoantharian genera from both shallow (Fujii & Reimer, 2011) and deep-sea ecosystems (Sinniger *et al.*, 2013) demonstrate that our understanding of Zoantharia diversity and distribution is far from complete.

Zoantharia research in the Red Sea, despite having a long taxonomic history (e.g. Audouin, 1826; Klunzinger, 1877; Pax & Muller, 1956), has lagged behind the research in other marine regions, similar to the situation with other marine invertebrate taxa (Berumen *et al.*, 2013). Here, as part of a marine biodiversity survey project, we report on the first finding of a *Nanozoanthus* sp. specimen from the Red Sea.

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MATERIALS, METHODS AND RESULTS

A single zooxanthellate zoantharian colony with very diminutive polyps was found at a depth of 13 m during SCUBA surveys at Dumsuq Island, the Farasan Islands, Saudi Arabia (16°33.846′N 42°03.510′E) on 26 October 2014 (Figure 1A). Detailed image analyses and examination identified the specimen as belonging to *Nanozoanthus* due to the following characters; zooxanthellate, with relatively long transparent tentacles (~same length as oral disk diameter) arranged in two cycles, very small polyps (diameter of closed polyps <2 mm) connected by stolons, with a zig-zag white outline along the edge of the oral disk (Figure 1B, compare with Fujii & Reimer, 2013). Similar to the single previously described species, *Nanozoanthus haraneceus* Fujii & Reimer (2013), this specimen was attached to carbonate substrate and partially buried in sand, with only the upper tips of polyps extending out of the sediment (Figure 1A).

Specimens are housed at the King Abdullah University of Science and Technology's marine biodiversity collection in Thuwal, Saudi Arabia, with the specimen number SAZ-RS801.

DISCUSSION

In their description of *Nanozoanthus haraneceus,* Fujii & Reimer (2013) hypothesized that:

> ... the transparent and sandy body colour make *N. harenaceus* sp. nov. very cryptic, in

contrast to the bright body colours of many sponge-associated zoanthids. Therefore, this small and cryptic zoanthid is likely to have a wider distribution in the Indo-Pacific than is described here.

The finding of the single specimen in this study seems to confirm this hypothesis, as the location in the southern Red Sea is almost 9000 km west of the previously known closest record from Ningaloo, Western Australia. While it is not yet clear if the specimen here is *N. haraneceus* or another, undescribed species (see below), it may be that this genus is widely distributed throughout the Indo-Pacific. Interestingly, *Nanozoanthus* was not detected in a previous survey of reefs in the central and northern Red Sea (including the Gulf of Aqaba) (Reimer *et al.*, 2014). Again, this could be due to its easily-overlooked appearance or it could be related to a distribution restricted to the southern Red Sea. The Farasan Islands contain habitats and environmental conditions typical of the southern Red Sea and quite different from the central and northern Red Sea, with much higher productivity in the south (e.g. Raitsos *et al.*, 2013). Additionally, reefs in the south experience more turbid conditions, generally do not extend as deep as reefs in the north and are thought to be distinct from central and northern Red Sea coral communities (Sheppard & Sheppard, 1991). At least for some fishes, this habitat seems to present a demographic or evolutionary barrier to dispersal and gene flow (e.g. DiBattista *et al.*, 2013; Nanninga *et al.*, 2014). The effect of this environmental gradient on the biogeography of zoantharians and other invertebrates has yet to be fully documented.

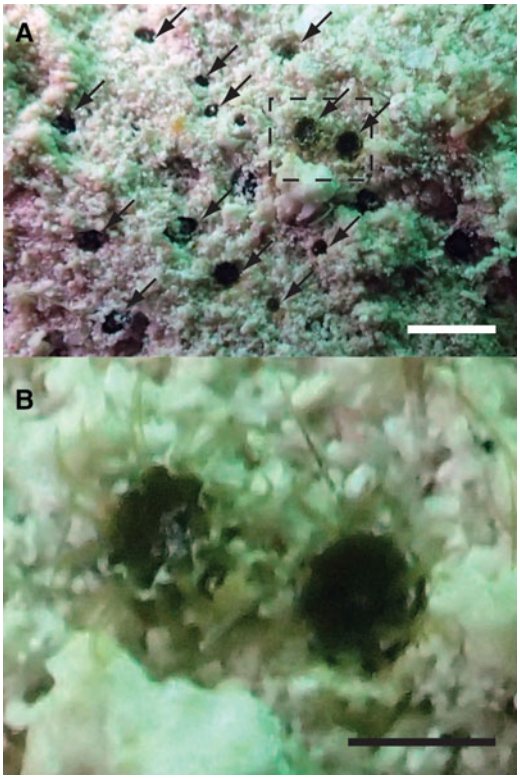

Fig. 1. (A) *In situ* image of *Nanozoanthus* sp. colony from 13 m depth at Dumsuq Island, the Farasan Islands, Saudi Arabia, in the Red Sea, with inset (B) of two polyps. Scale bars: A, approximately 5 mm; B, approximately 2 mm. Black arrows in (A) indicate individual polyps. Image taken October 26 2014.

In Fujii & Reimer (2013), two specimens of *Nanozoanthus* from Ningaloo, Australia, in the eastern Indian Ocean were preliminarily classified as a different, undescribed species based on slightly divergent mitochondrial 16S ribosomal DNA sequences, and were not formally described as a species based on the lack of a specimen of more than a few polyps in size. The current specimen from the Red Sea is larger than the Australian specimens, with approximately 20 polyps, and pending the results of future molecular and morphological analyses, it may be possible to describe an Indian Ocean *Nanozoanthus* sp. in the near future.

ACKNOWLEDGEMENTS

This research was supported by award no. 1389-CRG1 from the King Abdullah University of Science and Technology (KAUST) to M.L. Berumen. The following people are thanked for logistical support: J. Bouwmeester, L. Chen, D. Coker, J. DiBattista, A. Gusti, C. Nelson and T. Sinclair-Taylor of KAUST and the crew of the MY 'Dream Master'. Two anonymous reviewers' comments improved the manuscript.

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