

Range extension of pyrosomes in oligotrophic waters of the Indian Ocean

Tunicates are known to exhibit fast growth rate by consuming phytoplankton during their unusual blooming period¹. Hence their position in the food web is vital for the environment. During our regular faunal exploration under the 'Fauna of Lakshadweep: Echinoderms' survey on 5 February 2018, we have noticed a pyrosome swarm at the subtidal environment of Bangaram Island of Lakshadweep Archipelago (Figure 1 a and b). It was identified as the giant pyrosome, *Pyrostremma spinosum* (Herdman, 1888), which is found as groups of colonial organisms with thousands of individual zooids, drifted in the sub-tidal regions at depths between 8 and 15 m. Many pyrosome species are known to migrate diurnally and are found mainly in deep waters². Their distribution pattern has been reported from Northeast Pacific to North and South Atlantic Ocean through the Indian Ocean (Northwest Australia), Celebes Sea, Red Sea and the Southern Ocean³. To interpret their unusual occurrence to coincide with the plankton bloom, the corresponding chlorophyll *a* concentration was assessed from the respective study site by downloading the satellite image.

The cloud-free image of 6 February 2018 for the respective study site was available from Sentinel-3 Ocean and Land Colour Instrument (OLCI)⁴ with the spatial resolution of 300 m. Sentinel-3 Tool kit module in Sentinel Application Platform 6.0.10 was used for processing the data and the respective study area was extracted from the Sentinel-3 data with a swath width of 1270 km (User Guide – Sentinel-3 OLCI). Case-2 Regional Coast Colour (C2RCC) module (Sentinel-3 Toolbox|STEP)⁵ was used to determine the chlorophyll *a* concentration based on inverse relation between inherent optical properties (IOPs) and the reflectance values, thus allowing retrieval of chlorophyll *a* concentration⁶. Further, the concentration of chlorophyll *a* has been exported as a map (Figure 1 c). The spatial pattern of chlorophyll *a* in and around the Bangaram Island waters is clearly seen. It was observed that the maximum chlorophyll *a* concentration inside the selected subset was 28.47 mg m⁻³ (near the northwestern side of Bangaram Island). Moreover, it has been estimated that as much as about 22.05 km² area under the selected subset of this regional water has

above 15 mg m⁻³ of chlorophyll *a* concentration. The location of the reported species (10.9266 N and 72.3141 E) shows the corresponding value of chlorophyll *a* concentration that was calculated as 17.03 mg m⁻³ according to the pixel value. Hence, the chlorophyll *a* concentration was observed to be more for oligotrophic waters, which corresponds to and confirms the unusual occurrence of phytoplankton bloom that occurred during this period.

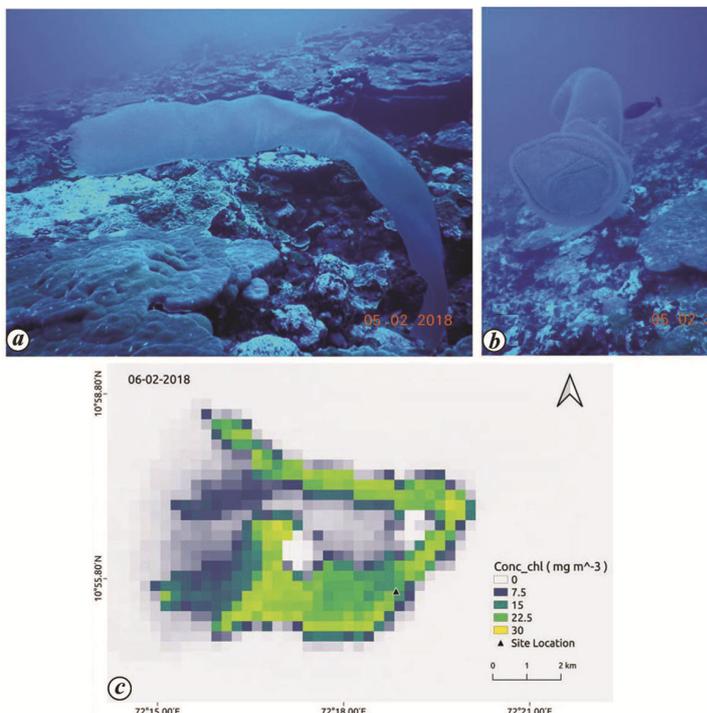


Figure 1. Giant pyrosome, *Pyrostremma spinosum* from the Lakshadweep Archipelago. **a, b**, Giant pyrosome. **c**, Chlorophyll data from Sentinel-3 OLCI.

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