

Biodiversity Record: Upside-down medusa of the genus *Cassiopea* in Singapore

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Recommended citation. Iesa I, Yap NWL, Ng L, Tun K & Chou LM (2021) Biodiversity Record: Upside-down medusa of the genus *Cassiopea* in Singapore. *Nature in Singapore*, 14: e2021117. DOI: 10.26107/NIS-2021-0117

Subjects: Upside-down medusa, *Cassiopea* sp. (Cnidaria: Scyphozoa: Rhizostomeae).

Subjects identified by: Iffah Iesa, Karenne Tun, Nicholas W. L. Yap, Lionel Ng and Loke Ming Chou.

Locations and dates: Singapore Strait at two locations —

- 1) Sentosa Island, Sentosa Cove; 2008–2009
- 2) Semakau Landfill, northern and southern sides of the island; 2008–2017

Habitat: Marine. At Sentosa Cove, in eutrophic body of water of about 2.5 m depth in an enclosed boat canal. At Semakau Landfill, in shallow open water of over 1 m depth along the shore with mangrove vegetation.

Observers: Iffah Iesa, Karenne Tun, Nicholas W. L. Yap, Lionel Ng and Loke Ming Chou.

Observations: At Sentosa Cove, blooms of *Cassiopea* were encountered from 2008 to 2009 (Fig. 1). Along a 30-m transect, counts ranging from 34 to 120 individuals were made between the months of January and March in 2009; with more individuals encountered in March. The animals encountered varied from 2 to 19 cm in bell diameter, and were seen typically pulsating on the benthos. When disturbed, they would rise up and swim about before quickly settling on the substrate again. These medusae were not observed to interact with other organisms. Some individuals seemed to lack photosynthetic zooxanthellae and appeared bleached (Fig. 2).

At Semakau Landfill, individuals were often encountered in sparse numbers (less than 10 individuals each time) on the benthos of mangrove areas. These individuals were observed pulsating alone on the benthos (Fig. 3). No bleached specimens were seen there. Some individuals, collected over eight years between 2008 and 2017 from Semakau Landfill, were preserved and deposited at the Lee Kong Chian Natural History Museum, National University of Singapore, as material for scientific reference and future genetic work.

Remarks: At least two species of *Cassiopea* were previously reported from the Malayan Archipelago. These include *Cassiopea andromeda* (Forskål & Niebuhr, 1775) and *Cassiopea ornata* Haeckel, 1880 (see Kramp, 1961, for a full list). *Cassiopea andromeda* and *Cassiopea ornata* share the same size range (10–12 cm) and flat exumbrella shape. They differ in the number of lappets in each paramere, rhopalia and branches in the mouth arms (see Ohdera et al., 2018, for comparison of species of *Cassiopea*). While the presence of *Cassiopea* has been documented in Singapore (Yeo et al., 2011; Yap & Ong, 2012), the species that occur there have not been identified.

Like many other Rhizostomeae medusae, *Cassiopea* is symbiotic with photosynthetic zooxanthellae. This relationship has been inferred to supplement both partners with nutrients. Bleached individuals were likely a result of the zooxanthellae having been expelled from the medusa. The cause of the bleaching in some *Cassiopea* in Sentosa Cove is unclear. The bleaching could have been induced by various environmental stresses, such as an increase in temperature in the habitat.



Fig 1. Blooms of *Cassiopea* at Sentosa Cove on 17 May 2008. Note individuals drifting about at the water surface and many more, deeper down. (Photograph by: Lionel Ng).

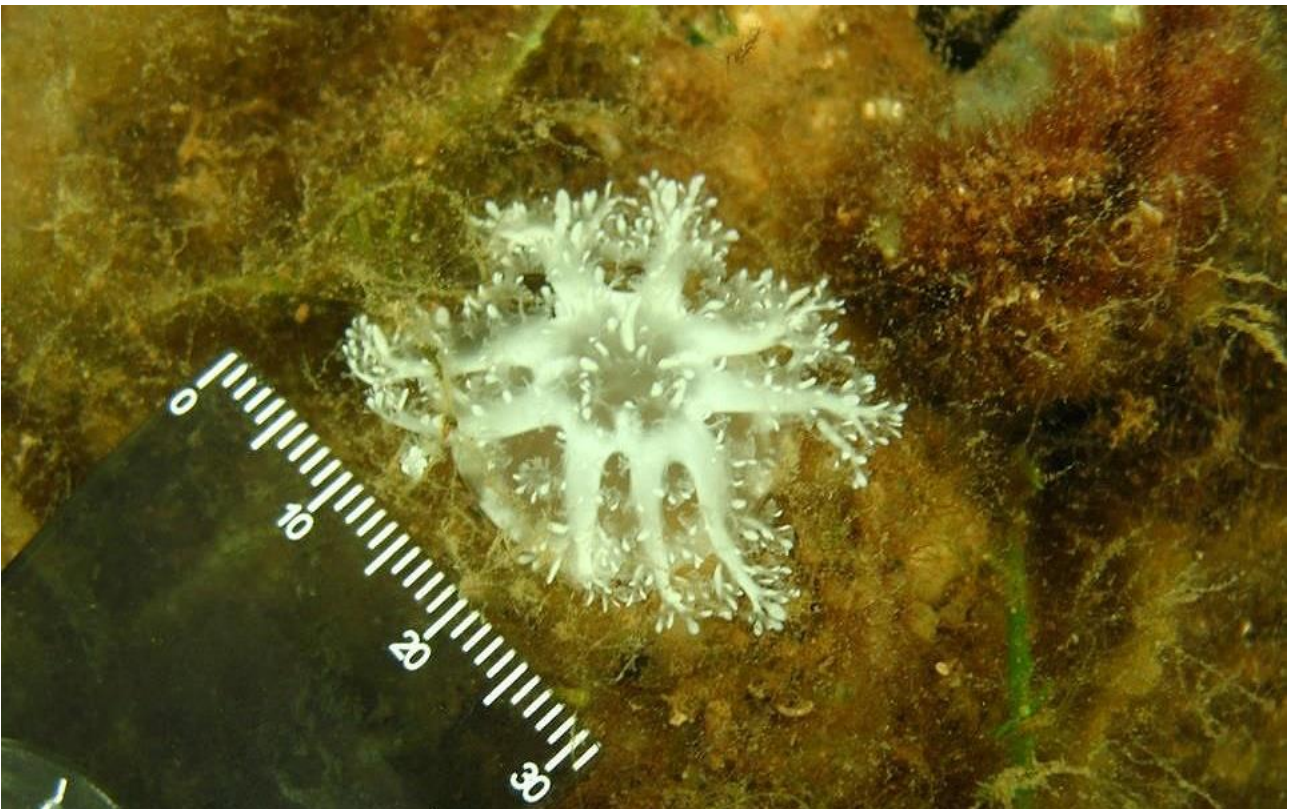


Fig. 2. A bleached *Cassiopea* individual with bell diameter of about 2.8 cm at rest in an upside-down position on the algae-covered substrate at Sentosa Cove on 8 May 2008. (Photograph by: Karenne Tun).



Fig. 3. In situ view of a *Cassiopea* of approximately 15 cm bell diameter at rest, with the surface of its bell facing upwards, in shallow water at Semakau Landfill on 4 November 2017. (Photograph by: Nicholas W. L. Yap).

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