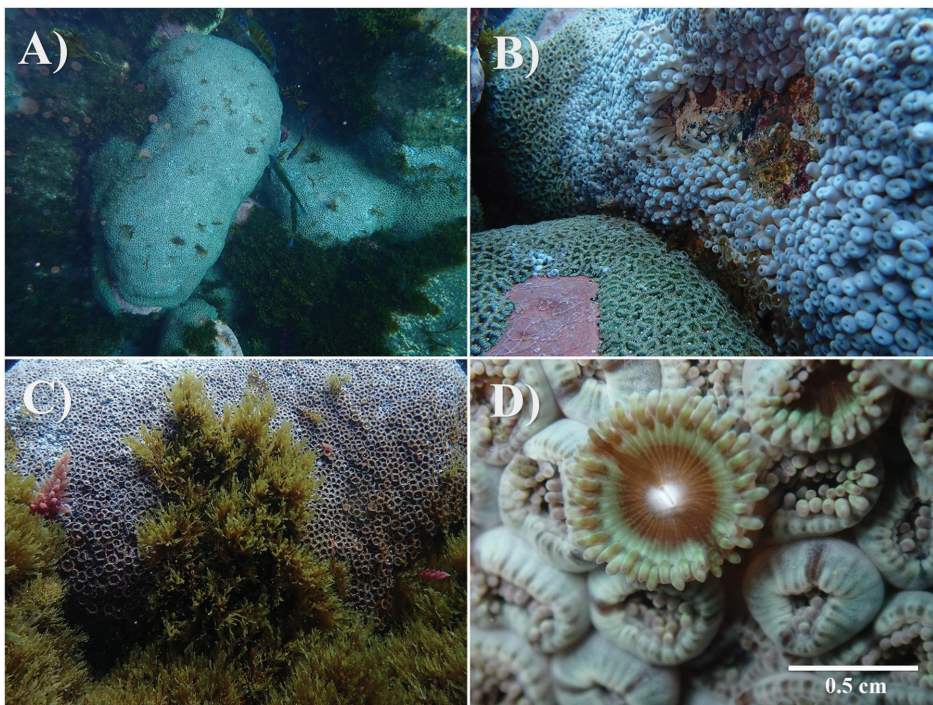


## Tropicalization alert: new species of mat-forming zoantharian (*Zoanthus pulchellus*) arrives on Madeira Island (NE Atlantic)

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Zoantharians are colonial cnidarians (Anthozoa: Hexacorallia) that inhabit tropical and subtropical rocky ecosystems worldwide from intertidal to mesophotic depths. Species of the genera *Palythoa* and *Zoanthus* can cover large areas and proliferate in a broad range of environmental conditions, including degraded regions (López et al. 2019, Reimer et al. 2021, Moreno-Borges et al. 2022).

The mat-forming zoantharian, *Zoanthus pulchellus*, customary distribution includes the Caribbean Sea, SW Atlantic, NE Atlantic, up to the archipelagos of Cape Verde and the Canary Islands (López et al. 2019). In January 2023, *Z. pulchellus* was observed during an underwater visual census survey at the Madeira Archipelago, located in the NE Atlantic, within Macaronesia ecoregion together with the Azores and Canary archipelagos (Schäfer et al. 2019). Two boulders colonized by the zoantharian were found 10 m apart, with an area of approximately 1 m<sup>2</sup> each (Panel A). The figure above shows one of the colonized boulders by

*Z. pulchellus* at 4–6 m depth, 100 m from the Machico local marina. This observation reports the first record of *Z. pulchellus* at Madeira Island and the first evidence that the invasive macroalga *Rugulopteryx okamurae* is growing within the zoantharian colony (Panel C). Two months later, another colony was observed in Funchal (32.633139, -16.943372). The *Z. pulchellus* polyps (Panel B) and the tentacular crown and oral disk (Panel D; close view) from the Machico colony were collected for the Natural History Museum of Funchal collection (MMF049844).

Before this discovery, *Z. pulchellus* in the eastern Atlantic was limited to the Canary Islands (López et al. 2019), where it negatively affected native reef fish and local benthic communities by reducing macroalgae coverage (Moreno-Borges et al. 2022). The introduction of non-indigenous species to oceanic islands (Castro et al. 2021) has been increasing due to globalization, climate change, and international maritime traffic. Moreover, the increase in seawater temperatures has promoted the process of “tropicalization,” i.e., tropical species advancing into subtropical and temperate latitudes (Schäfer et al. 2019, Castro et al. 2021).

The recent discovery of *Z. pulchellus* in Madeira may represent a potentially invasive species that can form an extensive mat on the subtidal rocky substrate, which could directly affect the local food web and lead to phase-shift events (Moreno-Borges et al. 2022). This early detection also represents an opportunity for the scientific community to evaluate the potential impacts of zoantharian colonies in a new ecosystem. For that, a seasonal monitoring program of the zoantharian spreading is suggested, evaluating which measures might be applied to mitigate a potential phase-shift event from macroalgae cover to the dominance of *Z. pulchellus* on the shallow rocky substrate on an oceanic island.

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