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First sightings of mimic octopus *Thaumoctopus mimicus* (Cephalopoda: Octopodidia) from the Southwest Indian Ocean with photographic records from the Inhambane Province of southern Mozambique

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Abstract

Two separate sightings, two years apart, of the mimic octopus *Thaumoctopus mimicus* Norman & Hochberg, 2005 are reported from the Inhambane Province of southern Mozambique within the protected waters of the Vilanculos Coastal Wildlife Sanctuary. Individuals were encountered in May 2020 and 2022 in shallow waters, at a depth of less than 30 cm. Both individuals were fully exposed moving along a sandy substrate at the water's edge in a tidal flat. These represent the first documented sightings of *T. mimicus* in Mozambique, confirming the occurrence of the species along the eastern coast of Africa and extending this species' known range west from the Arabian Sea and south from the Red Sea.

Introduction

Thaumoctopus mimicus Norman & Hochberg, 2005 was first encountered in the 1980s in Sulawesi, Indonesia and was subsequently nicknamed the 'mimic octopus' because of its ability to dynamically impersonate the shape, colour, and behaviours of other species found in its habitat (Norman *et al.*, 2001). In 2005, *T. mimicus* was taxonomically described within a monotypic genus (Norman and Hochberg, 2005). It was initially, and is still currently, described as a rare, infrequently encountered species of octopus occupying shallow coral reefs and soft sand and mud flat environments in depths up to 37 m (Norman and Hochberg, 2005; Sajikumar *et al.*, 2020). *T. mimicus* is often confused with another recently described species, *Wunderpus photogenicus* (Hochberg *et al.*, 2006), due to its similar colouration and preferred habitat.

Subsequent to its discovery, *T. mimicus* was found to occur throughout the Indo-Malayan archipelago (Norman and Hochberg, 2005) northward to the Gulf of Thailand (Nabhitabhata and Sukhsangchan, 2007) and southward to the Great Barrier Reef in Australia (Coker, 2013). In 2017, Nabhitabhata and Mitranont (2017) presented the first photographic evidence of the species occurring in the eastern Indian Ocean, with sightings off Phuket, Thailand in the East Andaman Sea. Subsequently in 2020, a further range extension of approximately 1400 nautical miles was reported with supporting photographic and genetic evidence, extending the known distribution of *T. mimicus* to the Arabian Sea (Sajikumar *et al.*, 2020). Considering the rarity of *T. mimicus* and the vastness of its potential coastal habitats, additional records are needed to expand knowledge of its distribution, particularly from areas within the Indian Ocean that have not been adequately surveyed.

The Vilanculos Coastal Wildlife Sanctuary (VCWS) is a terrestrial and marine reserve spanning 439 km² within the greater Bazaruto seascape of southern Mozambique. Marine habitats within the Sanctuary range from mangrove forests to seagrass beds, tidal bays to shallow sandy estuarine habitats, and rocky reefs to open ocean environments (Bruton, 2003). Fishing and harvesting of marine resources are permitted within certain areas of the reserve while other areas are designated no-take zones. Here, we report two sightings of live *T. mimicus* from within the VCWS of southern Mozambique.

Methods

Two separate *T. mimicus* were opportunistically encountered and photographically documented within the boundaries of the VCWS (Figure 1). On neither occasion was the den of the individual observed.

On 17 May 2020, at approximately 11 am, a single individual was encountered in less than 30 cm of water by researchers on a boat-based survey within the Inhambane Estuary (−22.1147° S, 35.5321° E). The individual was photographed (Figure 2a) and then captured in a small bucket for closer examination. At this time the individual's mantle was approximately measured with a pliable measuring tape. The individual was then released and was

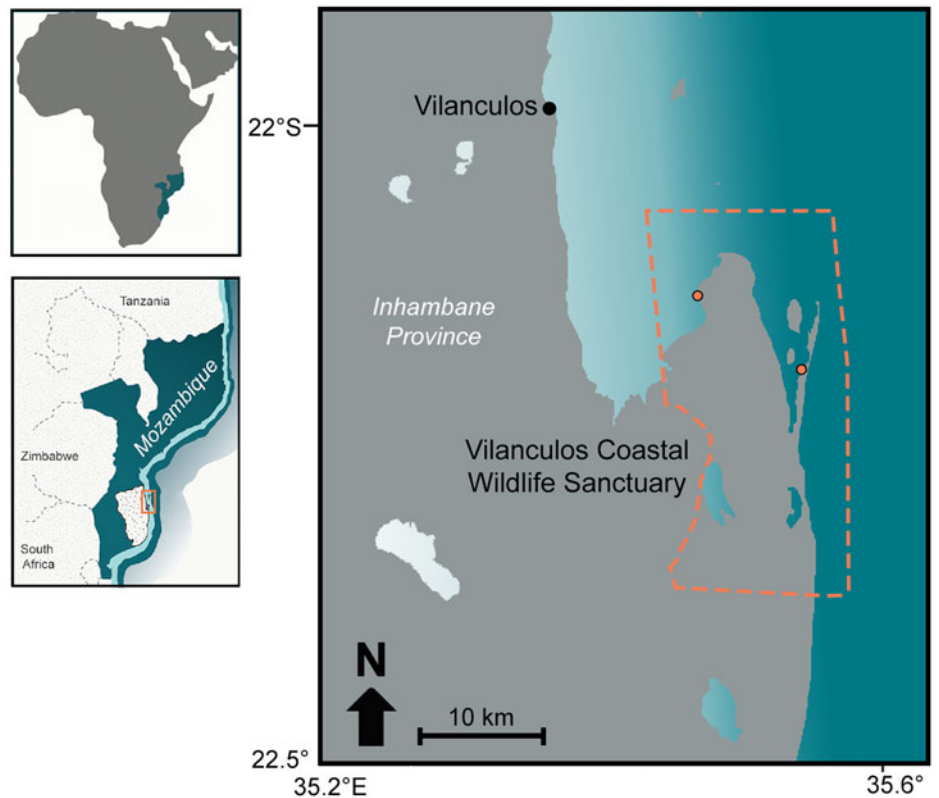


Figure 1. Map of the Bazaruto Seascape with *Thaumoctopus mimicus*, Norman & Hochberg, 2005, sighting locations indicated within the Vilanculos Coastal Wildlife Sanctuary of southern Mozambique.

photographed extensively upon return to its habitat (Figure 2b–f). The individual's behaviour was observed at this time for approximately 20 min.

Two years later, in May 2022 a second solitary individual was documented 11.6 km away in the Chicucacua area of the VCWS (-22.1345° S, 35.4435° E) by the managers of the Sanctuary during a beach walking survey. This individual was encountered at 11:25 am on 31st May in extremely shallow water of less than 20 cm at the water's edge. On this occasion photographs of the individual were taken only through the water (Figure 2g). The individual was not disturbed and the mantle length was not measured.

Post encounter, images of individuals were examined in detail and compared to the description and photographs in the original diagnosis (Norman and Hochberg, 2005) as well as photographs and descriptions in other publications, keys, and guidebooks (Norman *et al.*, 2001, 2016; Human and Deloach, 2014).

Results

Two opportunistic sightings of octopus moving across flat, sandy bottoms near the high-tide waterline within the tidal flats of the VCWS of southern Mozambique were later confirmed as *T. mimicus* due to prominent and unique markings known to be diagnostic to the species. Generally, both individuals possessed a dark brown mantle with mottled white markings. They both also possessed white banding along the arms with an uninterrupted white border at the base of each arm running along the entire length. A teardrop-shaped white ring with a connecting u-shaped mark posterior to it was present on the dorsal surface of the mantle (Figure 2b, g). Notably, both individuals lacked the distinct white circular patch on the posterior tip of the mantle present in *W. photogenicus*. A large and elongated supraocular papilla was present as well as 1–2 antero-ocular papillae on each eye (Figure 2c, d). In addition, each eye had a characteristic brown stripe running laterally across the eye. The mantle length (ML),

of the individual examined and measured in the field, was approximately 45 mm. Both individual's arms were long, with well-developed arm webs and bi-serial suckers (Figure 2e). The individual that was handled changed the colour and texture of its skin on multiple occasions during its capture and subsequent release (Figure 2a–g). Upon its release it displayed evasive behaviours, attempting to avoid and even flee from the photographer and fish species present in the area. During this period it displayed rapid colour and posture changes to camouflage itself or mimic other species, including a rapidly moving flatfish travelling across the sand, a static anemone and slow-moving lionfish (Figure 2b, g, h).

Discussion

The first sightings of *T. mimicus* along the east African coastline have been reported from the Inhambane Province of Mozambique significantly extending the range of this species to the Western Indian Ocean, southward by approximately 4700 km from presumed records in the Red Sea (Norman *et al.*, 2016) and approximately 5600 km from confirmed records in the Arabian Sea (Sajikumar *et al.*, 2020). Additionally, these new records confirm a southern latitudinal range of this species to 22° S in the Southwest Indian Ocean.

Sightings of this species remain relatively rare outside of the coral triangle and northeastern Australia, with few confirmed records to date in the Indian Ocean (Norman *et al.*, 2016; Sajikumar *et al.*, 2020). These recent sightings in southern Mozambique represent the first photographically confirmed records in the southwestern Indian Ocean. These records combined with recent records from the Arabian Sea (Sajikumar *et al.*, 2020) and presumed records from the southern Red Sea (Norman and Hochberg, 2005) indicate that this species might be more widespread in the Indian Ocean than previously expected. These records also now represent the most southern distribution records of this species in the Indian Ocean, closely



Figure 2. Photographic records of *Thaumoctopus mimicus*. (A–F) an individual sighted in the Inhamambane Estuary of the Vilanculos Coastal Wildlife Sanctuary (VCWS) in southern Mozambique in May 2020 showing: (A) frontal; (B) superior; (C, D) lateral; and (E) ventral angles, as well as colouration patterns and behaviours: (F) anemone mimicry; (G) flat fish mimicry and an individual sighted during an opportunistic beach-walking survey in the Chicucacuana area of the VCWS in May 2022 showing: (H) lionfish mimicry.

matching the latitudes of their most southerly distribution records in the Southeastern Pacific (Norman *et al.*, 2016).

Individuals encountered in southern Mozambique were sighted within the protected waters of the Vilanculos Coastal Wildlife Sanctuary in areas where no fishing or harvesting is permitted.

Consistent with descriptions of their preferred habitat in other parts of their range (Norman *et al.*, 2016), *T. mimicus* individuals were encountered in extremely shallow water, completely exposed as they walked across the sandy bottom of a tidal flat within a large estuary system.

Many of the behaviours exhibited by the two observed individuals resembled those previously documented for *T. mimicus* (Human and Deloach, 2014). Individuals were observed and photographed presenting similar rapid colouration changes, posturing, and mimicry behaviour to individuals photographed in the Indo-Malayan archipelago (detailed in Norman *et al.*, 2001; Norman and Hochberg, 2005; Human and Deloach, 2014).

As a rare and cryptic species, each sighting record can add to our knowledge of the geographical range and distribution of *T. mimicus* and tell us more about its preferred habitat type and general behaviour. Despite a recent influx of scuba diving

operations along the Mozambican coastline, these are the first reported records of the species from the region. Authors have also been conducting marine field research in the immediate region for over a decade without previously encountering this species, indicating that *T. mimicus* may be rare. However, given the type of diving tourism (e.g. reef diving and marine megafauna tours) and marine research (e.g. marine megafauna, coral, etc.) that is predominantly conducted in the region, it is also possible that the preferred habitats of this species are not currently being adequately surveyed.

Given the significant extension in its range, genetic confirmation would further support these visual sighting records. Additional surveys in the shallow tidal flats of the VCWS along with similar habitats within the Inhambane Province are recommended to better determine the extent of the species range in the region. The directed capture of cephalopods including octopus for local consumption and limited export has been documented in this region (authors' personal observation). Aggressive seine netting along the tidal flats of the greater Bazaruto seascape may also contribute to anthropogenic pressures potentially affecting this shallow water species.

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Ethical Standards. Permission to conduct work within the Vilanculos Wildlife Sanctuary was granted by the management of Santuario Bravio de Vilanculos Lda under Permit Number TPZSS_0621MMF.

Consent for Publication. Not applicable.

Availability of Data and Materials. All data generated or images used during this study are included in this published article.

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