

Marine Record

Cite this article: Schäfer S (2023). Expanding north: first record of the beaded sea cucumber *Euapta lappa* at Madeira Island. *Journal of the Marine Biological Association of the United Kingdom* **103**, e34, 1–3. <https://doi.org/10.1017/S002531542300019X>

Received: 29 November 2022

Accepted: 6 March 2023

Keywords:

echinoderm; Macaronesia; non-indigenous species; range expansion; tropicalization

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Expanding north: first record of the beaded sea cucumber *Euapta lappa* at Madeira Island

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Abstract

This study provides the first record of the beaded sea cucumber *Euapta lappa* at Madeira Island. A single individual was observed during a nocturnal scuba dive at 17 m depth, presumably feeding. After having its previous northern limit in the North-east Atlantic at the Selvagens Islands, this record expands the known distribution and northern limit of this tropical species by about 300 km. This new record of yet another tropical species expanding its range northwards can be seen as another indication of the ongoing tropicalization in the marine environment of Macaronesia in the North-east Atlantic.

Introduction

The genus *Euapta* belongs to the apodous holothurians and includes five species, with *Euapta lappa* (Müller, 1850) being the only species recorded in the Atlantic Ocean. The beaded sea cucumber usually occurs in the shallow subtidal up to about 20 m depth (Pérez-Ruzafa *et al.*, 2002; Wirtz, 2003) but has been recorded up to a depth of 1350 m (Martins *et al.*, 2018). *Euapta lappa* is a nocturnal species that feeds on detritus (Hammond, 1982; Wirtz, 2003; Brewin *et al.*, 2016). Their body is soft, highly flexible and can extend up to 1 m in length (Heffernan & Wainwright, 1974; Hammond, 1982). The beaded sea cucumber inhabits a wide range of habitats, including sandy bottoms, seagrass, coral reefs or rhodolith beds (Pérez-Ruzafa *et al.*, 2002; del Valle-García *et al.*, 2013; de la Cruz-Francisco *et al.*, 2017; Martins *et al.*, 2018).

Euapta lappa can be found throughout the tropics in the Atlantic Ocean. In the West Atlantic, it is known from the Gulf of Mexico and the Caribbean Sea, including the Bahamas, Barbados and Trinidad and Tobago (Deichmann, 1963; Miller & Pawson, 1984; Felder & Camp, 2009). More recently, it also has been recorded from Espírito Santo and Trindade Island, Brazil, which constitutes the most southern record of this tropical species in the Atlantic (Martins & Souto, 2020). In the East Atlantic, it has been recorded from São Tomé and Príncipe northwards to the Selvagens Islands, including the archipelagos of Cabo Verde and the Canary Islands (Pérez-Ruzafa *et al.*, 1999, 2002; Wirtz, 2003; Entrambasaguas *et al.*, 2008). In recent years an increasing number of non-indigenous species (NIS) has been recorded at Madeira Island (Castro *et al.*, 2022), with many representing northern range expansions (e.g. Wirtz & Berenger, 2017; Ribeiro *et al.*, 2019; Schäfer *et al.*, 2019; Castro *et al.*, 2021). This new record of the beaded sea cucumber, *E. lappa*, at Madeira Island adds to the growing list of tropical species recorded in the study region.

Sighting

In October 2022, a single individual of *Euapta lappa* was sighted during a scuba night dive near Caniçal on the south coast of Madeira Island (32°44′03.0″N 16°44′27.1″W; Figure 1). The animal was observed and photographed on a rocky substrate at about 17 m depth (Figure 2). It had a length of ~50 cm and appeared to be feeding.

Discussion

The first record of the beaded sea cucumber, *Euapta lappa*, at Madeira Island constitutes the northernmost record of this species in the Atlantic Ocean. While commonly found up to the north of the Gulf of Mexico and Florida in the Western Atlantic (~31°N latitude, Figure 1), in the Eastern Atlantic, the previous northern limit of the species was the record of a single specimen at the Selvagens Islands in 1999/2000 (Pérez-Ruzafa *et al.*, 2002). At the Canary Islands, about 150 km south of the Selvagens, *E. lappa* has been described as a common species in cryptic habitats (Hernández *et al.*, 2013). However, studies investigating the benthic communities at the Canary Islands describe an eastern-to-western gradient concerning the *E. lappa* abundance, with usually higher densities encountered at the western islands of the archipelago (Hernández *et al.*, 2013). In the past, this trend was also observed for other species with tropical affinities, such as the spotfin burrfish *Chilomycterus reticulatus* or ephemeral benthic algae species (Sangil *et al.*, 2012; Espino *et al.*, 2019). This imbalance in observations of certain

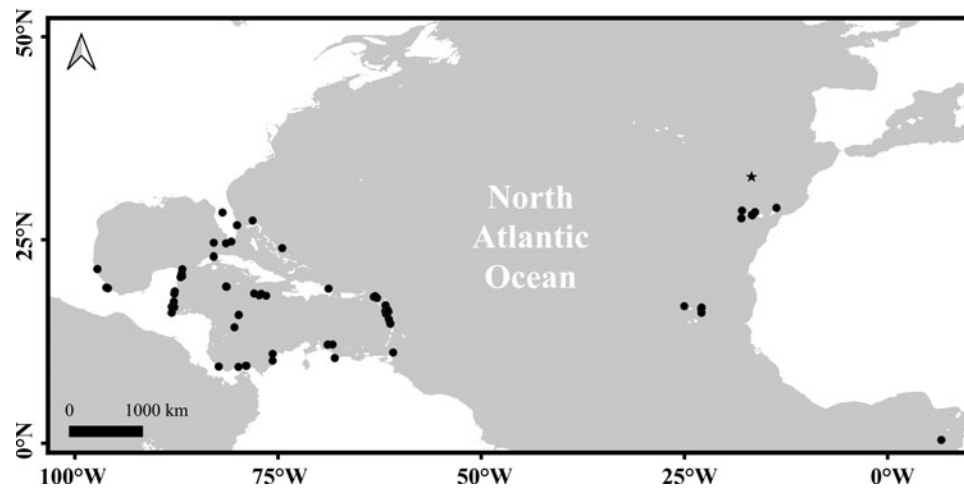


Figure 1. Distribution of *Euapta lappa* in the Atlantic Ocean downloaded from the Ocean Biodiversity Information System (OBIS; 09 March 2023) and the Global Biodiversity Information Facility (GBIF; 07 March 2023) marked as circles. The location of the record described in the present study is displayed as a star.



Figure 2. Photograph of the beaded sea cucumber (*Euapta lappa*) specimen seen during a night dive at Caniçal, Madeira Island (photographed by Eliani Rodrigues and Miguel Rodrigues).

tropical species most likely follows the prevailing temperature gradient in the Canary Islands, with western islands being slightly warmer than eastern ones (Barton *et al.*, 1998; Sangil *et al.*, 2012).

With ongoing climate change, the sea surface temperature in the NE Atlantic is increasing (Taboada & Anadón, 2012). Seawater temperatures at Madeira are currently warming at a rate of about 0.2 °C per decade, slowly shifting the current temperatures at Madeira close to values typical at the Canary Islands a few decades ago (Schäfer *et al.*, 2019). This warming promotes the progressive tropicalization of the area, with previously strictly tropical species expanding their distributional limit northwards to Madeira (e.g. Bianchi *et al.*, 1998; Wirtz & Berenger, 2017; Schäfer *et al.*, 2019; Castro *et al.*, 2021). In this context, an increasing number of tropical species has been recorded at Madeira, including crustaceans, algae and fish (Ribeiro *et al.*, 2019; Schäfer *et al.*, 2019; Castro *et al.*, 2021).

As in most of these cases, the vector for the arrival of the beaded sea cucumber to Madeira is unclear. Holothurians commonly reproduce through planktonic larvae allowing them to travel great distances (Doll *et al.*, 2022; Yu *et al.*, 2022). However, as the main current systems in Macaronesia follow a north-to-south

pattern around Madeira, the northward transport of larvae by natural means is greatly limited (Mason *et al.*, 2011; Sala *et al.*, 2016). Castro *et al.* (2020) showed that in Madeira's case, a great number of new arrivals to the archipelago could be linked to ship traffic. The location where *Euapta lappa* was observed is in close proximity (~650 m) to Madeira's main shipping harbour in Caniçal. In the case of the beaded sea cucumber, transport of larvae or juvenile stages by ships seems likely. Ultimately, the exact vector responsible for the arrival of the species remains unknown. Further studies including a genetic analysis of *Euapta lappa* at Madeira are needed to gain more insight into its origin and possible vectors of introduction. The size of the specimen observed at Madeira suggests that it is already an adult. The transport of such a large specimen by accident is quite unlikely. Given the typical nocturnal behaviour of *E. lappa*, a fast detection in a new habitat might be hindered and a single individual could have been overlooked for some time.

The present study presents the first record of *E. lappa* at Madeira Island. This new record constitutes a northward range expansion of the beaded sea cucumber in the NE Atlantic by about 300 km. Future monitoring efforts are needed to evaluate

the possible establishment and future spread of this species in the Madeira Archipelago.

Acknowledgements. Thanks to Eliani Figueira Jardim Rodrigues and Miguel Ângelo Pereira Rodrigues for providing the images, video and information about the record used in the present study. Furthermore, I would like to thank Peter Wirtz for kindly confirming the species identification based on photographs and video and comments on an early draft of the manuscript.

Financial support. This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

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