



First description of seagrass distribution and abundance in São Tomé and Príncipe



Ana Alexandre*, João Silva, Rogério Ferreira, Diogo Paulo, Ester A. Serrão, Rui Santos

Centre of Marine Sciences (CCMAR), University of Algarve, Gambelas, 8005-139 Faro, Portugal

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ABSTRACT

Seagrass meadows in São Tomé and Príncipe, eastern Atlantic Ocean, are described here for the first time. Specifically, we quantified the biomass and density of seagrasses, characterized the plant morphology and measure their nutrient content as a proxy of the nutrient environmental conditions where the meadows develop. The seagrass *Halodule wrightii* was found in two locations of the northeastern coast of the island of São Tomé: 1) developing throughout an estimated area of 1500 ha surrounding Cabras islet, at a depth range of 4–10 m, on sandy bottom; and 2) at Santana bay with an area of 1500 m² at 5–10 m depth, on sandy bottom. A highly morphologically different population of *Halodule wrightii* was found on the northeastern coast of the island of Príncipe, off Abade beach, covering an area of 135 m² at 4 m depth. Further research is needed to assess if this is a different species. Shoot biomass and density was 10 and 4-fold higher in São Tomé than in Príncipe, respectively. CN ratios of above and belowground tissues of plants collected in São Tomé were also significantly higher than in Príncipe. The carbon content of *Halodule* leaves from São Tomé and Príncipe (41%) was much higher than that reported for other *Halodule* species, suggesting that meadows may have an important ecological role for carbon fixation. The presence of *H. wrightii* in São Tomé and Príncipe raises ecological and evolutionary questions that warrant further research.

1. Introduction

Seagrasses are marine flowering plants widely distributed along temperate and tropical coastlines of the world. To facilitate a global assessment of their distribution, seagrass species have been grouped into six bioregions (Short et al., 2007). The Tropical Atlantic seagrass Bioregion 2 (Caribbean Sea, Gulf of Mexico, Bermuda, the Bahamas, and both tropical coasts of the Atlantic) is one of the regions with greatest diversity. Tropical seagrass species of the genera *Halophila*, *Syringodium*, *Thalassia* and *Halodule* are described for this region, but only on the western side of the Atlantic. On the tropical coast of Africa only the genus *Halodule* has been reported. Despite the general knowledge of the global distribution of seagrasses (Green and Short, 2003; Short, 2007), many regions of the world remain poorly described, such as the West African seas. The potential for the occurrence of seagrass species in São Tomé and Príncipe has been reported by those authors but there are no scientific references of specific locations and no quantitative description of the populations.

São Tomé and Príncipe is a volcanic archipelago of two islands with a total area of 1001 km² (S. Tomé = 852 km²; Príncipe = 142 km²), located at the Equator in the Gulf of Guinea (0°25'N; 6°20'E) at 380 km

off the continental African coast (Fig. 1a and b). The country lies within the Tropical Atlantic Bioregion and has a total coastline extension of 240 km. On both islands, dominant oceanic currents from southwest render these coasts too hydrodynamic and unsuitable for seagrasses to develop, restricting to half the total extension of coastline where seagrasses can potentially occur. Considering a depth distribution of 10 m, we estimate a total potential area for seagrasses to occur of 1200 km². São Tomé and Príncipe has been designated a marine biodiversity hotspot and a priority for conservation for its high level of endemic species (Roberts et al., 2002). The region is particularly relevant for marine turtles as all the five cosmopolitan species nest here (Schneider, 1992; Castroviejo et al., 1994). Seagrass habitats may be locally relevant as feeding grounds for the green turtle *Chelonia mydas*.

Here we describe for the first time the location and extent of seagrass meadows in São Tomé and Príncipe, quantify their biomass and density, characterize their morphology and measure their nutrient content as a proxy of the nutrient environmental conditions where the meadows develop.

* Corresponding author.

E-mail address: aalexandre@ualg.pt (A. Alexandre).

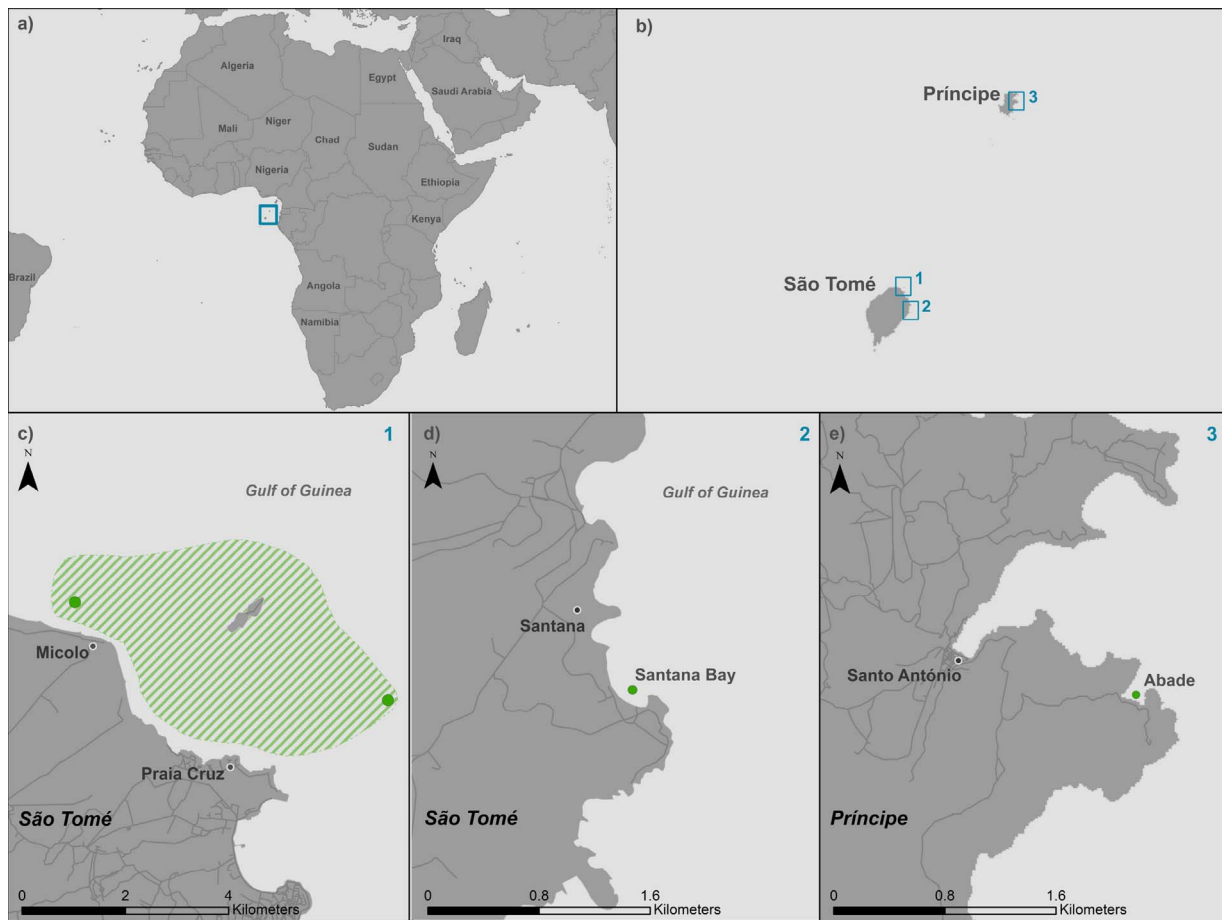


Fig. 1. Maps of the geographical location of São Tomé and Príncipe and the sites where *Halodule* species were found: (a) location of the archipelago in the Gulf of Guinea, (b) detail of the islands showing the areas where the seagrass was found, (c) estimated distribution area of *H. wrightii* around Cabras islet in the island of São Tomé and sampling sites (green dots), (d) location of the meadow at Santana Bay in the island of São Tomé (green dot), (e) location and sampling site of *H. wrightii* off Abade beach in the island of Príncipe (green dot). (For interpretation of the references to colour in this figure legend and text, the reader is referred to the web version of this article.)

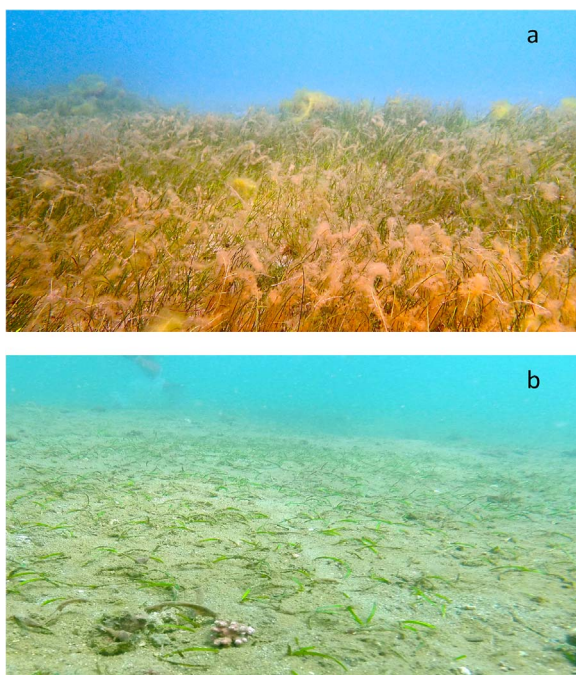


Fig. 2. Aspect of the *Halodule* meadows in São Tomé and Príncipe: (a) dense meadow of *H. wrightii* with epiphytes around Cabras islet, in the island of São Tomé; (b) sparse meadow of *H. wrightii* off Abade beach, in the island of Príncipe.

2. Methods

An underwater survey for seagrasses was conducted in both islands, São Tomé and Príncipe, in January 2017. On both islands, dominant oceanic currents from southwest render these coasts too hydrodynamic and unsuitable for seagrasses to develop, restricting to half the total extension of coastline where seagrasses can potentially occur. Consequently, southwest coasts of both islands were excluded from this survey. Considering a depth distribution of 10 m, the estimated potential area for seagrasses to occur is 1200 km². Satellite images of Google Earth were used to pre-select potential sites for seagrass development (sheltered bays and beaches with weak currents). Information from local fishermen and previous knowledge of turtle feeding grounds were also used to select the most probable sites for the occurrence of seagrasses. Divers were towed by an outboard motor boat to cover large areas of the nearshore subtidal zone down to 10 m depth. When spotted, seagrass meadows were sampled at a depth of ~ 5 cm using a 12 cm diameter core to determine the seagrass biomass and density. Samples were collected in two different points around Cabras islet, in São Tomé (Fig. 1c, green dots) (total n = 11), and in one point at Abade beach, in Príncipe (Fig. 1e) (n = 6). Seagrasses were also sighted in Santana, in the island of São Tomé, but no samples were collected here. After collection, plant samples were kept in cool seawater until analysis. Leaf length and width, and rhizome diameter were measured, and above and belowground biomass were determined after drying the samples at 60 °C for 48 h. The carbon (C) and nitrogen (N) content was determined in leaves and roots in a Vario EL III elemental analyser (Elementar).

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