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Areas of endemism in the Southwestern Atlantic Ocean based on the distribution of benthic hydroids (Cnidaria: Hydrozoa)

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Abstract

Geographic distributions of 130 species of benthic hydroids were used to infer areas of endemism in the Southwestern Atlantic Ocean (SWAO, between 22°S and 55°S). Endemicity Analysis (EA) was carried out with the software NDM VNDM, using a 2° x 2° grid with different values of F (F = 0.5 and F = 1.0) for inferred presence. Hypothesized areas of endemism (16 with F = 0.5 and 13 with F = 1.0) formed three generalized patterns: (1) Tropical, (2) Subtropical, and (3) disjunctions along Tropical and Subtropical areas. Areas of endemism estimated here were compared with provinces, ecoregions and areas of endemism previously defined (but not based on algorithmic analysis) in the literature. Ecological and historical aspects that are potentially relevant for the SWAO realm were contrasted, related and discussed to areas of endemism. This is the first study to apply NDM VNDM to the marine realm and one of the few that focuses on the SWAO.

Key words: polyps, marine realm, Endemicity Analysis, NDM VNDM, Tropical, Subtropical, disjunctions, biogeography

Introduction

The Southwestern Atlantic Ocean (SWAO) comprises Brazilian, Uruguayan and Argentinean waters, from 22°S to 55°S and from 35°W to 70°W. In terms of oceanography, SWAO has two main and opposing currents: the warm, southbound, Brazil Current that dominates the coast of Brazil (*cf.* Castro & Miranda 1998), and the cold, northbound, Falklands/Malvinas Current that dominates the coast of Argentina (*cf.* Boltovskoy 1981). Where these currents converge, the cold South Atlantic Central Water (SACW) is formed. It flows northward beneath the Brazil Current, and can cause intense thermoclines on the continental shelf of the SWAO (Acha *et al.* 2004). Variable temperatures, wind patterns and shelf topography contribute to the frequent coastal upwellings, and consequent increase in nutrients and recruitment in regional superficial waters (Matsuura 1986; Acha *et al.* 2004). Sea bottoms of the southern Brazilian continental shelf are comprised of varying amounts of sand, mud and gravel that together allow a diverse marine benthic fauna (Amaral *et al.* 2004). Benthic hydroids are a common component of this fauna as epibionts (Genzano & Rodriguez 1998; Migotto *et al.* 2001; Campos *et al.* 2012).

To the south, the mixture of sub-Antarctic waters and the Falklands/Malvinas Current also results in an oceanic front that flows along the continental shelf of Argentina, and brings nutrient-rich waters, allowing a diverse benthic fauna to develop (Acha *et al.* 2004; Acha & Mianzan 2006). In Argentina, dense banks of mussels are common in shallow waters, and dense banks of scallops occur above the 100m isobath (Acha *et al.* 2004; Bremec *et al.* 2008; Genzano *et al.* 2009). As in Brazil, this diversity of benthic species is correlated with loose gravel, rocky outcrops and hard bottoms (Genzano *et al.* 2009), associated with increased recruitment of hydroids on many consolidated substrates of natural or artificial origin.

The SWAO has traditionally been divided into several biogeographical regions and provinces depending upon the number of endemic species, and aspects of oceanography and ecology. Briggs (1974, p. 144) described basic

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