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Cheilostome bryozoan diversity from the southwest Atlantic region: Is Antarctica really isolated?

Blanca Figuerola [a,*], Dennis P. Gordon [b], Virginia Polonio [c], Javier Cristobo [c], Conxita Avila [a]

[a] Animal Biology Department (Invertebrates) and Biodiversity Research Institute (IrBIO), Faculty of Biology, University of Barcelona, Av. Diagonal 643, 08028 Barcelona, Catalunya Spain
[b] National Institute of Water and Atmospheric Research, Private Bag 14901, Kilbirnie, Wellington 6021, New Zealand
[c] Oceanographic Centre of Gijón, Spanish Institute of Oceanography (IEO), Av. Príncipe de Asturias, 70 bis, 33212, Gijón, Asturias, Spain

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ABSTRACT

During the Cenozoic, the break-up of Gondwana was accompanied by a gradual separation of its components and the subsequent establishment of the Antarctic Circumpolar Current, leading to a relative thermal and biogeographic isolation of the Antarctic fauna. However, the zoogeographical affinities of several taxa from South America and Antarctica have been subject to debate, bringing into question the extent of Antarctic isolation. Here we present new data on bryozoan species and their spatial distribution in the Argentine Patagonian (AP) region, as well as an analysis of the bryozoological similarities between deep ranges from Argentina and neighboring regions. A total of 108 species of cheilostome bryozoans (378 samples), belonging to 59 genera was found. Five new genera and 36 new species were found in the AP region, while 71 species were reported for the first time from Argentina. The bathymetric ranges of 94 species (87%) were expanded and a high proportion of the identified species (44.4%) also had an Antarctic distribution. The bryozoological affinities found in the current study between the nearest geographical neighbors are in agreement with the hypothesis of the sequential separation of Gondwana during the Cenozoic. Moreover, a high number of shared species, mainly from the slope, were found in this study between the AP region and Antarctica, thus supporting the idea that the Southern Ocean may have been less isolated over geological time than once thought.

1. Introduction

The Patagonian continental shelf and slope, one of the most productive Large Marine Ecosystems (LMEs) of the Southern Hemisphere, extends for about 5649 km along the Atlantic coast of South America (Acha et al., 2004; Miloslavich et al., 2011). There, two major wind-driven currents coexist: the cold nutrient-rich Falkland/Malvinas and the warm Brazil currents. The Malvinas Current is a branch of the ACC (Antarctic Circumpolar Current), flowing northward along the continental shelf of Argentina to about latitude 30° to 40° S, where it is deflected eastward after meeting the warm southward-flowing Brazil Current (Legeckis and Gordon, 1982). At the confluence of these currents, there is high biological production on the continental shelf and slope, promoting elevated biomass of benthic invertebrates (Acha et al., 2004). Thus, this region is inhabited by particular species with a wide range of distributions and adaptations to fluctuating conditions resulting from the influence of these subtropical and subantarctic waters (Miloslavich et al., 2011).

In recent years, several exotic species have been recorded in the Patagonian region, making it increasingly difficult to establish the original composition of coastal communities, considering that the biodiversity of the southwestern Atlantic is poorly known (Orensanz et al., 2002). Since the mid-1700s, the number of new species from South America has increased exponentially and particularly high numbers have been found in Argentina, although marine-invertebrate diversity has not been well studied and even less so in the deep-sea. In particular, the best-known benthic invertebrates in this region are molluscs, echinoderms and cnidarians (Miloslavich et al., 2011). In contrast, considering the high bryozoan diversity found with little sampling effort in different areas of the coast, shelf and slope, bryozoan species richness, mainly in northern shelf areas, is still largely underestimated (López Gappa, 2000; Moyano, 1999). Thus, more studies are needed for this region, mainly at slope and abyssal depths, to evaluate the connectivity of bryozoan populations between the Southern Ocean and South America (Arntz et al., 2005; Barnes and De Grave, 2001; Figuerola et al., 2012; Hastings, 1943; Moyano, 1982, 1999). In fact, the assessment of biodiversity and biogeography is of particular importance in the conservation and sustainable management of species, especially in Antarctica (Brandt et al., 2004). From this perspective, studies of comparative diversity in the deep sea between Antarctica and the last separated fragments of Gondwana are key to understanding the evolution of regional communities and their relationships with the fauna outside the Polar Front (Clarke, 2008; Clarke et al., 2005a). Therefore, the abundance and

* Corresponding author. Tel.: +34934020161.
E-mail address: bfiguerola@gmail.com (B. Figuerola).

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