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Polar marine biology science in Portugal and Spain: Recent advances and future perspectives

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ABSTRACT

Polar marine ecosystems have global ecological and economic importance because of their unique biodiversity and their major role in climate processes and commercial fisheries, among others. Portugal and Spain have been highly active in a wide range of disciplines in marine biology of the Antarctic and the Arctic. The main aim of this paper is to provide a synopsis of some of the results and initiatives undertaken by Portuguese and Spanish polar teams within the field of marine sciences, particularly on benthic and pelagic biodiversity (species diversity and abundance, including microbial, molecular, physiological and chemical mechanisms

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in polar organisms), conservation and ecology of top predators (particularly penguins, albatrosses and seals), and pollutants and evolution of marine organisms associated with major issues such as climate change, ocean acidification and UV radiation effects. Both countries have focused their polar research more in the Antarctic than in the Arctic. Portugal and Spain should encourage research groups to continue increasing their collaborations with other countries and develop multi-disciplinary research projects, as well as to maintain highly active memberships within major organizations, such as the Scientific Committee for Antarctic Research (SCAR), the International Arctic Science Council (IASC) and the Association of Polar Early Career Scientists (APECS), and in international research projects.

Contents

1. Introduction

Major scientific investigations have been carried out in the polar regions, including those related to marine sciences on which this review is centered, by scientists from more than 60 countries worldwide, in the last 200 years (Krupnik et al., 2011). The Southern Ocean and the Arctic Ocean play unique and critical roles for both the physical Earth system and its overall ecology by both strongly influencing the climate and harboring unique and diverse biological communities (ACIA, 2005; Turner et al., 2009). Portugal and Spain have been very active in carrying out studies related to polar science in the last two to three decades, particularly in the Antarctic region (Xavier et al., 2006b).

As a new country carrying out polar research, Portugal was highlighted as a successful example of a recent emergent polar nation during the International Polar Year (Schiermeier, 2009). Portuguese researchers have been regularly involved in polar science, mainly in the Antarctic, through other countries' national programs (Xavier et al., 2006b). In the last 10 years, the number of Portuguese researchers has increased considerably, especially due to the impetus of the International Polar Year. Portugal defined a strategy for polar science in 2006 (Xavier et al., 2006b) and established a successful scientific research program, PROPOLAR, and an educational program, LATITUDE60! (Kaiser et al., 2010). Portugal also joined several major polar organizations, including the Scientific Committee for Antarctic Research (SCAR) in 2006, the Association of Polar Early Career Scientists (APECS) and the European Polar Board (EPB) in 2007, signed the Antarctic Treaty in 2010 and has been involved in major polar research and outreach outputs (Baeseman et al., 2011; Zicus et al., 2011). Portuguese scientists have been awarded some of the most important polar research awards nationally and internationally (e.g. Marta T. Muse prize from the Tinker Foundation).

Marine biology research by Portuguese scientists in the polar regions started with Luiz Saldanha in the 1970s/1980s via collaboration with the French Antarctic program (Ré et al., 2001; Saldanha, 1983, 1991; Saldanha et al., 1990a,b). This pioneering example was followed by Antarctic research from teams from the University of the Azores, ISPA — Instituto Universitário, the Centre of Marine Sciences of the University of Algarve (Xavier et al., 2006b), IPMA and the Institute of Marine Research of the University of Coimbra, among others, working particularly with UK, France, Norway and Canada (see below).

Marine biology research could also potentially be considered as the origin of the Spanish polar research activity. In the austral summer of 1986–1987, the first scientific expedition in Antarctica was organized by the Spanish Institute of Oceanography (IEO) using two fishing vessels, the Nuevo Alcocero and the Pescapuerta IV, to study marine Antarctic species and their potential for commercial fisheries. In 1986, the first field camp was also established on Livingston Island to preliminary map where the future Spanish Antarctic base Juan Carlos I would be located. At the same time, several marine biology studies were carried out. These activities were the result of previous scientific work carried out sporadically by some researchers, which contributed to Spain being integrated into different international organizations (see below). Dr. A. Ballester and Dr. J. Castellvi from the Marine Fisheries Institute (Spanish Research Council) played a key role in this initiative. In 1982, Spain became an observer member of the Antarctic Treaty, integrating its consultative board in 1988. In 1987, Spain became an associate member of the Scientific Committee on Antarctic Research (SCAR) and was admitted as a full member in 1990. Spain has also recently been admitted as an observer member of the Arctic Council (in 2006) and of the International Arctic Science Council (IASC, in 2009).

More than twenty years later, Spanish polar research, specifically polar marine biology, has matured and expanded as evidenced by Spain's

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