

## PhD Thesis

### THE ANTARCTIC-MAGELLAN CONNECTION: DIVERSITY AND BIOGEOGRAPHY OF INTERSTITIAL TURBELLARIANS IN THE SCOTIA ARC

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#### INTRODUCTION:

The study of systematics and distribution of Antarctic organisms is very important, not only for a few specialists, but also for all biologists involved in biogeography (Dell, 1972, *sensu* Karling, 1977). Despite the relevance of the relation between the Antarctic and Magellanic biotas, its study has proven difficult because of substantial problems that make the biogeographical evaluations rest on incomplete data (Arntz, 1999; Convey, 2007). Main problems include (i) the lack of specialists, because of which in many works the determinations do not reach species level; (ii) the lack of studies in the Scotia Arc region, that results in that many works compare the Magellanic Region with the Weddell Sea, because the latter has been better investigated, and (iii) the low biodiversity in the Antarctic (Clarke *et al.*, 2007). Furthermore, in recent years it has become clear that studies based on different groups of organisms can yield contradictory results (Griffiths *et al.*, 2009), especially when comparing distributions of taxa with dispersive phases (for example, see Brandt *et al.*, 1999; Liuzzi and Zelaya, 2004; Schrödl, 1999, and Zelaya, 2005 for mollusk distributions).

The study of turbellarians can overcome the latter difficulty. Because of their adaptations to the interstitial environment, these animals have a practically null dispersal potential, which makes vicariance processes the most likely to explain their current distribution. There are three examples of the use of these organisms in large-scale biogeographical studies, and all three have led to consistent results: (i) the work of Sterrer (1973), where trans-allopatric sister species of many interstitial phyla, including turbellarians, were found on both sides of the Atlantic; (ii) two complementary works by Sluys (1989, 1995), who found evidence of trans-Pacific tracks using marine and terrestrial planarians, and (iii) two complementary works by Ax and Armonies (1987, 1990), who found evidence of an ancient boreal circumpolar distribution of brackish water turbellarians.

This study will provide significant data on the diversity and distribution of a group of organisms that has been overlooked in most studies of the benthic fauna of the Antarctic Region, and it will also attempt to provide clues for the evolution of the Antarctic biota in a region of key importance for biogeographical studies. With the Antarctic Peninsula being one of the most rapidly changing environments in the world, it is imperative to undertake these kind of analysis as soon as possible, in order to get reliable data before both human impact and climatic change alter the biogeographic signals provided by the biota.

**OBJECTIVES:**

The general objective of this proposal is to carry out a Historical Biogeography study to reconstruct the history of the biota of marine interstitial turbellarians in the Scotia Arc. In order to do so, four specific objectives have been defined: (i) to describe the biota of interstitial turbellarians in the Scotia Arc area, based on sampling in the Antarctic Peninsula, King George Island, Tierra del Fuego and the Magellan Strait, and on reports from the South Georgia, South Orkney and the Falkland/Malvinas Islands; (ii) to make a panbiogeographic analysis using this fauna, to test the processes of vicariance suggested for the area by the available geological information; (iii) to carry out an analysis of predictive modelling of species distribution to complement the biogeographical analysis, and (iv) to evaluate the results in the context of available literature.

**RELEVANCE:**

This proposal falls within the goals of the Evolution and Biodiversity in the Antarctic (EBA) Scientific Research Programme.

**METHODOLOGY:**

*Sampling.* The Uruguayan Antarctic Institute will facilitate sampling in the Antarctic Peninsula, King George Island, Tierra del Fuego and the Magellan Strait. Samples will be processed mainly in the Uruguayan Base Científica Antártica Artigas (King George Island), and also in the Uruguayan Estación Científica Antártica T/N Ruperto Elichiribehety (Hope Bay, Antarctic Peninsula).

*Taxonomical study.* Species will be identified using standard techniques for the study of microinvertebrates, including the observation of live animals, and morphometrical and histological analyses.

*Biogeographical analysis.* A panbiogeographical analysis will be carried out under a vicariance paradigm. Individual tracks will be drawn at species and genus level. Orientation of tracks will be performed with the baseline and main massing criteria. Generalized tracks will be obtained, and nodes identified. A complementary analysis of predictive modelling of species distribution will be carried out with informatic tools.

*Interpretation of results.* The results will be analyzed in the context of (i) the distribution of species and genera of interstitial turbellarians at a global level, (ii) the proposed evolution of the Scotia Arc area, and (iii) other biogeographical analyses performed in the area.

**EXPECTED RESULTS:**

*Internal deliverables* include a Collection of specimens identified at the species level, which will be deposited in the Helminthological Collection of the Faculty of Sciences, Montevideo, Uruguay, a taxonomic database of anatomy and morphometry of the species, and internal reports.

*External deliverables* include a set of specimens that will be deposited in an external Collection, a list of the species of marine interstitial turbellarians in different localities along the Scotia Arc, taxonomic publications describing taxa, a report and a publication of the results of the biogeographical study, and recommendations for the delimitation of protected areas.

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