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The Strait of Gibraltar as a metaphor for the upcoming IBS meeting

The next IBS meeting will take place near the Strait of Gibraltar, one of the main biogeographical crossroads in the Western Palearctic. The biogeographical function of this strait, both as a boundary and as a pathway, for marine and terrestrial biota, is represented in the images of the IBS conference logo (see Fig. 1). This is so because the Strait of Gibraltar could serve as a metaphor for the aims of the IBS meeting, and of Biogeography itself. At the Strait of Gibraltar, two continents and two seas intersect. Biogeography is also an intersection, of Biology and Geography. It studies the distribution of living beings in space and in time. Biogeographers analyse the marine and the terrestrial environments, both animals and plants, and microorganisms. There are boundaries between these and many other aspects of Biogeography, boundaries that developed over time, which help to define the identity of each subdiscipline.

A complex geological history of the area and a critical geographical location have established the Strait of Gibraltar as a crucial biogeographical boundary at the crossroads between the Atlantic Ocean and the Mediterranean Sea, and between Africa and Europe (Harzhauser et al. 2007). The Strait of Gibraltar is also a pathway that connects Mediterranean and Atlantic waters and Europe and Africa, all of which modify local and regional populations. This transition

zone is thus a significant area for monitoring marine biological invasions of species of tropical Atlantic origin into the Mediterranean, as well as modification in distribution of plant and animal species and changes in migration habits of terrestrial animals, mainly birds and insects, due to climate change (Altamirano et al. 2008, Chamorro et al. 2017).

For most of its geologic history, the ancient Mediterranean Sea communicated with the Atlantic by two straits: the Betic Strait and the Rifian Strait to the north and to the south, respectively, of the Betic-Rif mountain arc, which separated Europe from Africa (Martín et al. 2014). The biotic composition of this Paleomediterranean Sea was quite different from nowadays, with most of the biota inherited from the Tethys Sea. Tectonic compression and sedimentary infilling generated the closure of these straits in the Messinian (upper Miocene, ~6 Mya), isolating the Paleomediterranean Sea from the Atlantic, but connecting Southern Europe with North Africa. The Mediterranean Sea was then isolated as a concentration basin, as the contributions of rivers and precipitation did not balance evaporation. A process of rapid and almost entire desiccation of the Mediterranean basin followed in less than a thousand years in the “Messinian Salinity Crisis”, dated 5.97-5.33 My BP (Krigman et al. 1999). There

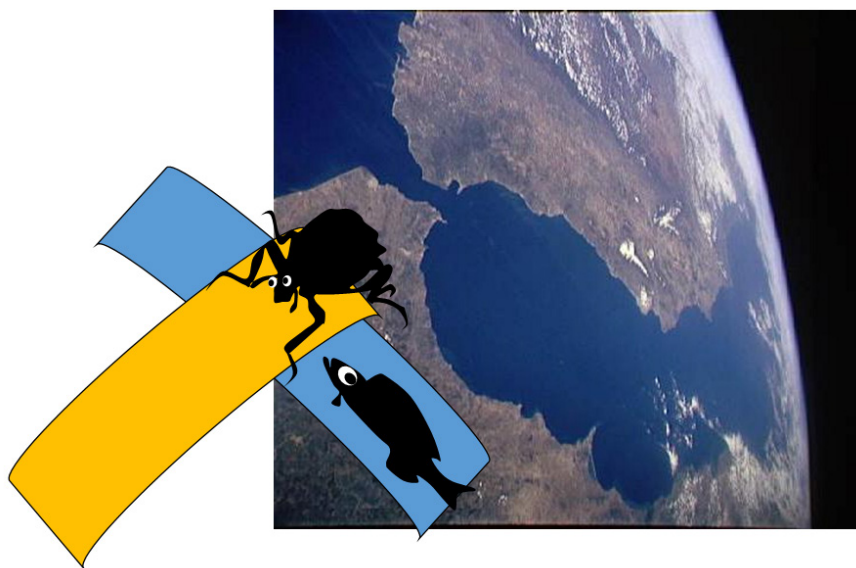


Figure 1. The images in the logo of the 9th Biennial Conference of the International Biogeography Society rotated, and a satellite image of the Strait of Gibraltar. Satellite Image Photograph by Nasavrs, available at <https://pixels.com/featured/strait-of-gibraltar-satellite-image-nasavrs.html>, under a creative commons license.

is no agreement as to whether the entire basin dried out. However, evaporite deposits from this time are extensive and the impact on the biota nearly wiped out the Tethyan heritage (Hsü et al. 1973). Some authors mention, however, that a relic Paleomediterranean population persisted, adapted and participated in the subsequent repopulation of the Mediterranean (Pérès and Picard 1964). Two hundred thousand years later, at the beginning of the Pliocene, 5.3 My BP, the Strait of Gibraltar was established as presently known, in what is called the Zanclean flood, originated from an eastwards flowing stream to the Mediterranean basin (Blanc 2002). This connected the Atlantic with the Mediterranean, and separated again Europe from Africa triggering the evolution of vicariant biota at both terrestrial sides of the Strait.

The Strait of Gibraltar is known to be a barrier for certain species, both marine and terrestrial, and a transition zone for many others (Fredj and Maurin 1987). The depth of the Strait, only 320 m, turns it into an effective barrier to deep marine fishes, for example. The Strait sometimes works as a semipermeable frontier, hindering more effectively the passage from east to west than *vice versa*, especially for species that make use of the surficial water, which flows eastwards. Loggerhead turtle youngsters, for example, easily enter the Mediterranean but are unable to return through the Strait until they reach adult size and have the strength to overcome the incoming current of Atlantic water (Revelles et al. 2007). For non-volant terrestrial animals the Strait of Gibraltar is a formidable frontier, and even migrant birds have to wait for favourable winds to risk crossing it during their biannual migrations. In any case, this frontier is permeable, and the Strait of Gibraltar constitutes an important transition zone, particularly for highly migratory fish species and air-breathing marine and terrestrial vertebrates (Bellido et al. 2010). These species periodically and systematically cross through a narrow sea pathway and also narrow land elongations at the south of the Iberian Peninsula and the north of Morocco. This implies predictable and spectacular concentrations and aggregations of populations crossing the area latitudinally and longitudinally, by air and by sea.

I see our biennial meetings as concentrations of biogeographers coming from different backgrounds and focused on diverse aspects of biodiversity distribution. Like the Strait of Gibraltar, disciplinary boundaries are also permeable frontiers and passing pathways that invite us to aggregate at the border and risk the crossing to the other side to increase and better articulate our knowledge. January 8-12 2019 is migration time for biogeographers in Málaga.

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